Economic and Social Impact Evaluation Study of the Rural Electrification Program in Bangladesh

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HDRC Human Development Research Centre

NRECA International Ltd.
Partners with the Rural Electrification Board of Bangladesh and USAID
for the Rural Power for Poverty Reduction (RPPR) Program
(USAID CA 388-A-00-97-00040-00)

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UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
Dhaka, Bangladesh

Forward

The United States Agency for International Development (USAID) has had a long association with the Bangladesh Rural Electrification (RE) Program, which actually evolved from the findings of a 1976 USAID-funded Feasibility Study. The Rural Electrification Board (REB), which was established by the Presidential Ordinance of 29th, October 1977, is the agency responsible for directing this large development program. Today 67 Palli Bidyut Samities (PBSs) are functioning as rural electric cooperatives and provide electric service to more than 4.2 million connections throughout rural Bangladesh. The Program's progress and achievements are certainly noteworthy. This recognized success has resulted in its becoming a model for other countries to see how a rural electric program can be successfully implemented. Over the years other development partners have joined with USAID in providing financial assistance and support for the Program's ongoing development. The active participation of these development partners has been facilitated through the positive cooperation of the Government of Bangladesh, as well as its commitment to providing its own financial resources.

Given that rural electrification is a costly development effort, all stakeholders have particular interest in being able to identify the "impacts" of such an intervention on those identified as the targeted beneficiaries. It has been long believed that electricity brought many positive impacts, however this belief has not always been very well substantiated. Given the interest of USAID and other development partners in more effectively determining the social and economic impacts, this *Economic and Social Impact Evaluation of the Bangladesh Rural Electrification (RE) Program* was undertaken as one of the components of the Rural Power for Poverty Reduction (RPPR) Program (Project No. 388-0093), which was implemented by NRECA International Ltd. in partnership with USAID and the REB/PBSs. This new study serves as a follow-up to a similar study whose findings were published in 1996.

NRECA, in collaboration with REB, selected the Human Development Research Centre (HDRC) as the local firm to conduct the actual study. NRECA worked with REB and HDRC in directing the development of all aspects of the study. USAID was particularly gratified to see the active involvement of the REB and the PBSs throughout the entire study period. This participation helped to promote an environment that provided the HDRC teams open access to any and all information that was needed in order to successfully implement this type of study.

USAID Bangladesh is pleased with this report that carefully identifies many of the development contributions of the Bangladesh Rural Electrification Program. The analysis of the data shows both direct and indirect benefits of having access to electricity, as well as various linkages to other rural development programs. The Mission is optimistic that the stated findings on the economic and social impacts and the recommendations will be useful to all stakeholders and that the information will be relevant for future policy decisions being made with regard to RE and other development programs in Bangladesh.

USAID extends thanks to all of the contributing members of HDRC, in particular to Dr. Abul Barkat-leader of the study team, for their dedicated efforts, as well as to the members of NRECA's Socio-economic Team for their contributions. USAID also acknowledges the participation and support of the REB Board Members and other concerned officers of REB and the PBSs for their interest and cooperation throughout the preparation of this important study.

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Partners with the Rural Electrification Board
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Preface

The Bangladesh Rural Electrification (RE) Program was founded with a Presidential Ordinance in October 1977 that established the Rural Electrification Board (REB) as the semi-autonomous government agency reporting to the Ministry of Energy and Mineral Resources, which was responsible for electrifying rural Bangladesh. A USAID-funded Feasibility Study in 1976 provided options for the development of the program and decisions were taken at that time to development the program using the rural electric cooperative concept that had been successfully used to electrify rural America. Since its inception, the purpose of the program has been to use electricity as a means of creating opportunities for improving agricultural production and enhancing socio-economic development in the rural areas, whereby there would be improvements in the standard of living and quality of life for the rural people

The RE Program was developed in phases under its initial Master Plan. Today there are 67 operating rural electric cooperatives called Palli Bidyut Samiti (PBS), which bring service to approximately 4.2 million meters across Bangladesh through a distribution network of more than 140,000 kms of distribution line. The growth of the Program is substantial with approximately 400,000 new connections being made and more than 10,000 kms of line being constructed each year.

Enormous changes have occurred in areas all across rural Bangladesh due to people having access to electricity. The magnitude of changes and the impact of the RE Program is vast and diversified and information documenting these have become more acute in recent years. All stakeholders, particularly the Government of Bangladesh and the development partners need documentation that supports the large funding requirements that are needed to expand the program further. Given these circumstances, decisions were taken to have this *"Economic and Social Impact Evaluation Study of the Bangladesh Rural Electrification Program"* completed under the USAID-funded Rural Power for Poverty Reduction (RPPR) Program that was being implemented by NRECA International Ltd. in partnership with USAID and REB. This Study was begun in March 2002 with the selection of the Human Development Research Centre (HDRC), an established Bangladeshi consulting firm working under the leadership of Dr. Abul Barkat of Dhaka University. This Report is a result of that effort and provides an enormous amount of information about direct and indirect impacts of electricity, as well as the related impacts on other rural development programs and projects.

This eight-month Study involved more than 100 male and female qualified enumerators, as well as a number of data quality controllers, working to collect quantitative and qualitative data through the completion of questionnaires during the interview of 3,718 cases in more than 70 villages/thanas in both electrified and non-electrified areas of 23 different PBSs dispersed across the country. In addition, the fieldwork also included 27 "focus group discussions" and nine "group discussions with the PBS Board Members". The four major categories of consumers namely domestic, commercial, irrigation, and industry were included when preparing the sampling sizes for both experimental and control groups. Fourteen different instruments were designed, field tested, and used for the information collection phase of the Study.

The Report itself is a single volume divided into two main parts, namely “Text” and “Tables”, with each divided into the four categories of connections namely Domestic, Industry, Irrigated Agriculture and Commercial. The Report presents findings on both the direct and indirect impact of the RE program. Besides presenting information on a number of important issues, the quantitative expression of the qualitative issues is one of the strengths of this Report. In some cases, the Report compared the Study findings with the countrywide statistics available in some national and international secondary sources. A “draft” of the study findings was shared with a number of key members of NRECA International Ltd. (Dhaka), REB, USAID and with representatives of some donor agencies in Bangladesh. However, it is fair to state that any study is confined by its purpose, methodology, time allocation and other resource limitations and thus may not be able to answer all queries that a user-reader desires. For this NRECA extends its sincerest apology for any unintended omissions or mistakes in the Report. It is hoped that the Study findings will be useful to all stakeholders in making decisions on future policies and strategies regarding rural electrification in Bangladesh. Lastly it is also desired that this Report will be of benefit to those involved with future impact assessment(s) of the RE program and also to interested socio-economic development researchers.

NRECA International Ltd. acknowledges the cooperation extended from its RPPR partners for completing this Study. REB exhibited keen interest in this Study with particular support provided from Mr. Ziaul Islam Chowdhury, Chairman; Mr. Tauhidul Islam, Member, PBS-Training; Mr. Ahsan Habib, Executive Director; and Mr. ABM Ali Hossain, Director (PBS-MO-South). In addition, we also would like to express our gratitude to the concerned PBS officers and staff and Board Members who extended significant cooperation to the members of the HDRC study teams during the field implementation of the Study. The members of NRECA’s Socio-economic Section also made significant contributions.

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Acknowledgements

A daunting task of this magnitude and complexity involves collective performance of a variety of activities from the most heightened levels of intellectualism to the relatively mechanical chores of supply and logistics. The appropriate designing and successful administration of this study would not have been possible without the commitment and dedication of all those who were involved in this process.

On behalf of the whole team, I am particularly grateful to Mr. James M Ford, Chief of Party, NRECA International Ltd., for his intellectually stimulating input, constant care and help, unstinted support, and constructive advice at all the stages of this challenging and innovative research work. We will never forget humaneness of James.

I am highly indebted to Mr. Ziaul Islam Chowdhury, Chairman of REB, for his high-level concern and commitment towards this research study of highest national developmental significance. Mr. Chowdhury's accomplished participation in the training sessions of 150 trainee field staff at REB gave a real boost to the study and changed the mind-set of the field personnel, to a large extent.

We express our indebtedness to all the participants of the consensus-building meeting with RPPR program partners who, of course, bear no responsibility for the final product but whom we must thank for their intellectual stimulation**:** Md. Tauhidul Islam, Mr. NC Sarkar, Md. Khalilur Rahman, Md. Abdul Halim, Mr. Mahfuzur Rahman, Mr. Ahsan Habib, Mr. Anwarul Kabir Chowdhury, Mr. ABM Ali Hossain, Mr. Latifur Rahman, Mr. Sk. Ahmed Ali, Mr. Ashraful Islam, to mention only a few.

I am particularly grateful to Mr. Charles Uphaus, Mr. Bruce McMullan, Mr. John Rifenfork, and Mr. Md. Kamaruzzaman of USAID - for their invaluable contribution to the study through joint meeting of the RPPR partners - USAID, NRECA and REB.

We are especially indebted to Mr. Ahsan Habib, Executive Director of REB for his unflinching support and advice throughout the study. Mr. Ahsan Habib's commitment towards rural electricity and the Program made our organizational life in the field a lot easier.

We will remain ever grateful to Mr. ABM Ali Hossain, Director, PBS, Development and Operations (South) of REB for his most informed advice on the methodology and other relevant intellectual support at all stages of this research endeavour.

We gratefully acknowledge Mr. AIM Latiful Azam, Deputy Director, REB for his providing useful back-up support at the initial crucial stages of the study including organizing familiarization visits to PBSs, setting-up training venues, informing the PBSs about the field data collection teams, organizing flow of data about industrial connection from all 67 PBSs.

We are profoundly indebted to Mr. Krishna Kamal Dey, Socio-economist, NRECA for his playing the key role as local professional in ensuring the quality of our work at all the stages. We are grateful to Mr. Md. Ayub Ali and Mr. A M Rasheduzzaman Khan - NRECA staff members. All of the NRECA socio-economic team members were forever gracious and forthright, and helped us instantenously at all stages of the study. We will ever remain grateful to them for their interest and enthusiasm in the study.

We are grateful to the GMs and their staff in all the 67 PBSs for providing us with detailed information support on industrial connections, and particularly to the GMs of 23 sample PBSs for their very kind help and cordial assistance to our teams in the field, even in the late hours.

I would be failing in my ethical responsibility if I do not express our gratitude to all the 14,000 persons - the respondents and their family members, who provided us with information, at times, during their busy hours, to materialize the difficult data collection activities. We will remain ever grateful to them and to those field staff who have worked very hard in the process of data collection.

I am truly grateful to Mr. Muzammel Hoque, our friend and colleague, for his kindness in helping us in editing the draft report, within the shortest possible time.

Finally, we are grateful to all the reviewers of the draft report for their interest on the study methodology and findings, constructive critique and useful suggestions to improve upon the Report. We are highly indebted to all the participants who were present at the Study Findings Dissemination Meetings with USAID (3 October 2002) and that with REB (17 October 2002) for their keen interest, understanding of limitations, acceptance and ownership of the study, well-knitted suggestions, and finally, for displayed respect for serious and well-grounded research work.

I simply can not conclude without acknowledging my profound debt to all HDRC staff members for their hard work and sleepless nights. To all of these lovely and uncomplaining souls, my grateful thanks.

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Acronyms

AIDS	Acquired Immune Deficiency Syndrome
AGM	Assistant General Manager
ARI	Acute Respiratory Infection
AVP	Annual Volume of Production
BBS	Bangladesh Bureau of Statistics
BCC	Behavior Change Communication
BDHS	Bangladesh Demographic and Health Survey
CI	Cropping Intensity
CMI	Census of manufacturing Industries
CRR	Cost Return Ratio
CPR	Contraceptive Prevalence Rate
CU	Commercial Unit
CUIS	Commercial Unit Interview Schedule
DCI	Data Collection Instruments
DoE	Directorate of Environment
DTW	Deep Tubewell
EMF	Emitting Electromagnetic Fields
ENT	Ear, Nose and Throat
EOC	Emergency Obstetric Care
EPA	Environmental Protection Agency
ESIES	Economic and Social Impact Evaluation Study
FE	Field Enumerator
FGD	Focus Group Discussion
FP	Family Planning
FS	Field Supervisor
FWV	Family Welfare Visitor
GAD	Gender and Development
GD	Group Discussion
GM	General Manger
GoB	Government of Bangladesh
HDI	Human Development Index
HDRC	Human Development Research Centre
HE	Households with Electricity
HH	Household
HHIS	Household Interview Schedule
HIV	Human Immune-deficiency Virus
HP	Horse Power
HQ	Head Quarters
HYV	High Yield Variety
IE	Irrigation Equipment
IEAIS	Irrigation Equipment and Agriculture Interview Schedule
IGA	Income Generating Activities
IMR	Infant Mortality Rate
IS	Interview Schedule

IU	Industrial Unit
IUIS	Industrial Unit Interview Schedule
LLP	Low Lift Pump
MA	Medical Assistant
MCP	Medically Competent Person
MIS	Management Information System
MOHFW	Ministry of Health and Family Welfare
MPCA	Minnesota Pollution Control Agency
MTP	Medically Trained Person
MV	Means of Verification
MWH	Mega Watt Hour
NGO	Non-Governmental Organization
NIPORT	National Institute of Population Research and Training
NRECA	National Rural Electrification Cooperative Association
OMU	Observation Measurement Unit
ORS	Oral Rehydration Saline
PBS	Palli Bidyut Samity
PNC	Post-natal Care
PPS	Probability Proportionate to Size
PRSP	Poverty Reduction Strategy Papers
QCO	Quality Control Officer
RE	Rural Electrification
REB	Rural Electrification Board
REP	Rural Electrification Program
RPI	Relative Productivity Index
RPPR	Rural Power for Poverty Reduction
SACMO	Sub-Assistant Community Medical Officer
SDCF	Secondary Data Collection Format
STD	Sexually Transmitted Disease
STW	Shallow Tubewell
TB	Tuberculosis
ToR	Terms of Reference
TQM	Total Quality Management
TSCA	Toxic Substances Control Act
TT	Tetanus Toxoid
UN	United Nations
USAID	United States Agency for International Development
VAC	Vitamin A Capsule
VCP	Video Cassette Player
WID	Women in Development
WE-EV	Without Electricity in Electrified Village
WE-NEV	Without Electricity in Non-electrified Village
WHO	World Health Organization

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EXECUTIVE SUMMARY

INTRODUCTION

Rural Electrification Program in Bangladesh started its journey in 1978, primarily with the technical assistance of National Rural Electrification Cooperative Association (NRECA)of United States of America with an aim to provide the electricity outside the urban strata. The program is based on the concept of member-owned, *Palli Bidyut Samities* (PBSs) similar to the rural electric cooperatives that exist in the United States. Sixty-seven PBSs have been organized to date in Bangladesh.

REP aimed initially at electrification of irrigation pumps and tube-wells, agro-based industries and serving domestic and commercial loads of only those villages, which fall right alongside the electrical distribution facilities built for irrigation purposes. To date, electricity made available through PBS areas, is intended to use for all possible applications that serve the purpose of improved living conditions of rural populace. Rural electrification has also been identified as one of the four priority areas in order to ensure increasing growth and bringing of pro-poor orientation in the growth process, as has been mentioned in the National Poverty Reduction Strategy Report, 2002. Introducing electricity into different consumers - domestic/household, industrial, irrigation equipment, commercial, street light and office use, provides the necessary infrastructure for accelerated economic activities as well as creating environment for realizing human capabilities. Since 1978 more than a thousand-fold increase (1237times) in terms of number of services connected reveals an annual average growth rate of 40%. The development of rural electrification in Bangladesh is one of the major success stories of external development assistance to a developing nation.

OBJECTIVES OF THE STUDY: BROAD AND SPECIFIC

The **broad objective** of the study was to make an **assessment of economic and social impacts of Rural Electrification Program in Bangladesh**.

In line with the Terms of Reference and the broad objective, the **specific objectives** of the study were:

- To design the economic and social impact evaluation study of the Rural Electrification Program that includes reconfirmation of direct (intended) objectives and identification of broader (indirect) impacts of REP, defining impact indicators, identification of relevant testable hypotheses, and development of appropriate methodology.
- To determine impact of Rural Electrification Program on the various dimensions of human development focussing on standard of living, poverty reduction and gender development.
- To evaluate the impact of Rural Electrification Program on industrial development.
- To assess the impact of Rural Electrification Program on the development of commercial activities.
- To evaluate the impact of Rural Electrification Program on the various dimensions of irrigation and agriculture.
- To put forward logically sound recommendations based on scientifically rigorous impact evaluation in line with the above objectives and the Government's Energy Policy, especially for accelerated development and poverty reduction in a sustainable way through rural electrification.

METHODOLOGY

The first step of designing appropriate methodology was to formulate the study design followed by definition of impact indicators and identification of testable hypotheses. In the process of finalizing of key technical issues, the core team had two meetings with RPPR program partners– USAID, NRECA, REB and reached a consensus on all key issues methodologically crucial for the study.

In line with the objectives of the study, **absence of baseline** (pre-test) measurement observation necessitated adoption of **Posttest-only Control Group Operations Research Design.** ESIES was thus designed to evaluate impact(s) using ***`with-without'*** (electricity) scenario to gauze the impact of REP on different categories of customers–households, irrigation equipment (pump owners and plot owners), industry, and commercial units. Customers using rural electrification was treated as experimental and those not-using electricity as control variable. An additional sample category for households - the households without electricity in the electrified villages, was included in the study design to evaluate the spillover effect of REP. Data collection techniques applied, include both *quantitative* and *qualitative* methods.

The key features of sampling strategy, finalized after the consensus-building meeting include:

- Selection of PBSs as primary sampling unit, for which *probabilistic sampling strategy* was adopted to ensure desired level of confidence with *probability proportionate to size* (PPS) according to the number of villages electrified.
- Considering age-length of PBSs as the stratification criterion, 23 sample PBSs were selected following *Stratified Random Sampling* procedure. Age-length for three strata are: those- < 6 years, 6 years to <18 years, and 18 years and above.
- Selection of sample sizes for FOUR observation measurement unit–Household (2491), Irrigation equipment (523), Industry (176) and Commercial (528), following appropriate statistical formula. The total sample for quantitative survey was 3718. Based on MIS data of REB (January 2002), the distribution of sample sizes across the sample PBSs followed the PPS method for all the observation measurement unit.

In addition to the quantitative survey following the above mentioned sampling procedure, qualitative information were collected through 27 Focus Group Discussions (FGD) with respective respondents of each observation measurement unit and 9 Group Discussions (GD) with members of Board of Directors, General Manager and other officials of PBSs. A number of Secondary Data Collection Formats (SDCF) were designed to portray an overall community scenario at different levels-Villages, Unions and Upazilas as well as sample PBSs. SDCFs, for information on industries connected, were sent to all 67 PBSs (through REB) to grasp the overall status of industrial connection of REB and provided further insight in analyzing the field data for industrial units.

Impact indicators for each observation measurement units were identified on the basis of review of relevant literature, rigorous brainstorming sessions among the core team members and their familiarization visit vis-à-vis idea-generation visit to two PBSs- Sirajgonj and Gopalganj. For *households* , impact indicators were analysed under three broad categories of variables or measurable objects–Economic, Social and Cultural, and Demographics. The relevant variables for *irrigation* include productivity, cost of production, employment, command area, operational cost, maintenance cost, and others. The broad categories of variables for *industries* include productivity, cost of production, efficiency, diversification, forward and backward linkages, clusters, development of support-service system, and environmental. The concerned variables for *commercial* units were categorized as business turnover, market expansion, employment and quality.

Hypotheses developed for all observation measurement unit were tested and analysed for respective broad categories of variables for each observation measurement unit, incorporating 54 tests for households, 6 for irrigation, 9 for industry and 4 for commercial units. Apart from hypothesis testing, several statistical methods have been applied to incorporate different dimensions of study objectives and the variability of data set. The methods include factor analysis, cluster analysis, income determination model and TOBIT model analysis.

A total of 14 data collection instruments were administered in the survey. These included 4 quantitative survey instruments, 4 FGD checklists, 5 secondary data collection formats, and one set of group discussion guidelines. Apart from regular exercises relating to developing DCIs, the process of DCI development involved repeated field tests and field orientation with the trainees.

As part of the field implementation, the field functionaries of all categories– *Field Enumerators (56), Field Supervisors (23), Quality Control Officer(12), FGD moderators(11), Note-takers (11), Recorded Data Transcriber (6)*– were selected at the first place after multi-phased screening. The training session for field staff began on 18 May, 2002 at the REB Auditorium. The experiences of familiarization visits by the team members and the experiences gained in the pre-test were used to prepare the training schedule for 10 days. In the training session the trainees were segregated for each observation measurement unit to ensure better understanding of the DCIs and thereby ensuring accuracy in data collection.

On their arrival at the PBSs, in consultation with the General Manager, field supervisors collected list of consuming units from each PBS. On the basis of which the primary samples were selected. The selection of *sample villages* was somewhat different from other observation measurement unit. From each PBS, names of electrified villages (2 near and 2 far) were obtained from GM, and then visits were made to those villages. The selection was made on the basis of distance–one not too far, and one far. The sample households were drawn from the list of connection holders from those selected 2 villages. Similarly, names of 2 non-electrified villages were obtained from GM/PBS, and finally one village for HH interview was selected. In selecting Irrigation Equipment priority was given to the village selected for HH interviews. Electricity driven as well as non-electricity driven large, medium, small and cottage industrial units were included as sampling unit for industry. Commercial Units were mostly drawn as sample from the village selected for HH interviews. In order to complete Focus Group Discussions/Group Discussions, six teams were deployed.

Each of the FEs conducted 2 interviews a day for household, commercial and irrigation units. On the other hand, one working day was assumed optimal to conduct one interview with industrial unit owners. In the total survey, a total of 3,718 interviews were conducted in the stipulated time period.

In order to ensure high quality output in the data collection a quality assurance system was instituted which took care of all systematic arrangements and activities directed towards safeguarding, maintenance and promotion of quality throughout the study period. Quality Control Officers (QCOs) were deployed for each of the 12 quality control clusters. They constantly moved around the sample spots, and thereby ensured quality data through (i) field checking, and (ii) data monitoring.

In order to ensure accuracy and validity of such information, concerted efforts were made by way of the following steps e.g. designing instruments to facilitate information gathering, provisions for cross-checking and consistency in the instruments, regular evening meetings to share team experience of the day and resolving problems jointly.

Data management activities were comprised of registration of questionnaires, data processing and computerization of data. It also included detailed transcription and analysis of the FGD/GD information. For the purpose of data management, 2 Registration Assistants, 8 Coder and Code Verifiers and 8 Editor and Edit Verifiers were employed.

FINDINGS, IMPLICATIONS AND RECOMMENDATIONS

> This economic and social impact evaluation study was aimed at assessing the multidimensional aspects of the direct and indirect, tangible and intangible benefits of Rural Electrification Program of Bangladesh. Such impact was assessed for four observation measurement units, namely household, irrigation, industry and commercial activities. Impact by these units were evaluated separately and then attempts were made to synthesise the impact, which are interrelated and interdependent, and produces synergy.

ECONOMIC AND SOCIAL IMPACTS – HOUSEHOLD LEVEL

The economic and social impacts of rural electrification at the household level are multidimensional, and both tangible and intangible. The approximate number of persons who now derive direct benefit of household (domestic) connections of REB would be 20.5 million. The household level impacts are mediated through availability of electricity in the household as well as outside the household (agriculture, fisheries, commercial activities—shops and establishments, and industry). In the later event, the benefits go not only to the 20.5 million people who are connected through domestic connections, but also to those not having domestic connections.

During the last 20 years (1983-2002), the total number of domestic consumers of RE has increased almost 1200 times, from 2852 in 1983 to 3,413,825 in 2002. The estimated average annual growth rate (cumulative of domestic connections) is 42.53%.

The multifaceted impacts and benefits are either direct or indirect. The direct impacts are mostly economic, and reflected in enhanced income, and employment, and optimized expenditure pattern, surpluses, savings, and asset building. Most indirect impacts are related to the social and cultural aspects of life, which include, among others, such areas as education, health, women's status, modernization etc. These direct and indirect benefits together produce synergy in economic growth, poverty reduction, and human development.

ECONOMIC IMPACT

Impact on Income

The average annual income of households with electricity (HE) is 64.5% higher than that in the households of non-electrified villages (WE-NEV), and 126.1% higher than that in the households without electricity of electrified villages (WE-EV). The last year's average household income of HE was Tk. 92,963, and the same for WE-EV was Tk. 41,110 and that for WE-NEV was Tk. 56,524.

In terms of broad categories of sources of income, the households with electricity show a relatively higher share on account of non-agricultural sources (66.8% of annual income) than that of the same for non-electrified households (WE-EV and WE-NEV, 57.9% and 51.5% respectively).

The distribution of income by income groups shows a much better-off situation of the electrified households compared to that of their counterparts – non-electrified households. The gini-coefficient of income distribution is 0.53 for electrified households, 0.43 for non-electrified households in electrified villages (WE-EV), and 0.45 for households in the non-electrified villages (WE-NEV). As compared to the non-electrified households, the electrified households show a higher income inequality but with higher income in the comparable groups. This means, the electrified households can be characterized as being relatively high income inequality with relatively high income.

Estimates show that 16.4% of the annual income of the electrified households can be attributed to electricity. As for non-electrified households in the electrified villages (WE-EV), 12% of the annual income can be attributed to electricity, and it is only 3.6% for the households in the non-electrified villages (WE-NEV).

Extrapolated estimates show that (a) 9.3 percent of the annual income of the total rural households (19.1 million) in Bangladesh can be attributed to electricity, and (b) assuming "all rural households have electricity" the total annual household income – at current market price – will increase to Tk. 1,775 billion from the present Tk. 1,105 billion, i.e., the annual net gain in income will be Tk. 671 billion more than today, of which Tk. 290.8 billion or 43.3% of the increment will be due to electricity. This net gain in annual income due to 100% electrification of rural households is equivalent to 26% of the current GDP (Tk. 2,580.6 billion at current market price) of Bangladesh.

Impact on Employment

Electricity generates employment. The impact on employment was both direct and indirect. In agriculture, an estimated 1.1 million persons are directly involved in farmlands using rural-electricity connected irrigation equipments. Currently, 63,220 industries using rural electricity employ 983,829 persons; and electrified industries, on average, generate 11 times more employment than the non-electrified industries. Rural and wholesale shops using rural electricity employ 848,630 persons. There has been direct employment of 16,223 persons in the PBSs. More so, women in the electrified compared to those in the non-electrified households are involved more in household level income-generation activities and depict better re-allocation of time for remunerative employment; unemployment rate is relatively low in the electrified households; and relatively higher share of non-agricultural employment in the electrified households indicates modernization effect of electricity on occupation. On the top of all these, there has been an enormous spill-over effect of rural electrification on employment in various support-services.

Impact on Expenditure

The overall average annual (last year's) expenditure in the electrified households was Tk.94,552. The corresponding figure for the non-electrified households in electrified villages was Tk.61,327, and for households in the non-electrified villages was Tk.68,282. As compared to the differences in the relative income of these three sample categories, the differences in relative expenditure is less pronounced implying that the electrified households spend relatively more than the other two categories.

The food-non food expenditure pattern in electrified resembled close-to-the national urban pattern and that in the non-electrified close-to-the national rural pattern. Thus, electrification has acted as a factor in urbanizing the consumption pattern of the rural people having electricity in their households.

The distribution of expenditure by recurrent-capital depicts a much progressive pattern in the electrified households as compared to the non-electrified households. The annual average recurrent expenses in the electrified households (Tk.72,676) was 29% higher than that of the households in non-electrified villages (Tk.56,285). The same for capital expenses was as much as 82% higher in the electrified households compared to that in the households of non-electrified villages. More importantly, while share of capital expenses to overall expenditure was 23.1% in the electrified households, it was 17.7% in the households of non-electrified villages. This pattern of distribution of recurrent-capital indicates relatively more stable and stronger domestic economy and better quality of life of the electrified households as compared to their counterparts in the non-electrified ones. Thus, electricity influences strengthening of the domestic economy of households having access to electricity.

The relatively higher standard of living as well as quality of life of the members in the electrified households as compared to the members in the non-electrified households are evident from higher annual per capita expenditure on all items of expenditure. The annual per capita expenditure on food in the electrified households (Tk.7,418.6) was 16% higher than that of the households in non-electrified villages.

The analysis of per capita daily intake of food by the members of households with and without electricity shows the following:

First: In terms of quantity of food consumption, the members of the electrified households are much better off than their counterparts in the non-electrified villages. The members in the electrified households, on average, consume daily 46 gms (4.8%) more than their counterparts in the non-electrified villages. In terms of intake of energy (kilo calories), it was 60 K.Cal (2.6%) more.

Second: In terms of quality of food the differences in food intake were significant. The average daily **protein** intake of the members in the electrified households (182.2 gm) was 34% higher than that of the members in the non-electrified villages. The higher quality is also evident in the fact that while the average K. calorie for the members in the electrified households was only 2.6% higher than that in the non-electrified villages, the money value of food in the electrified household exceeded 15.3%, the money value of food in the non-electrified households.

The average annual household expenses for education incurred by the electrified households was Tk.3,260 – an about 87% higher expenditure than that in the households of the non-electrified villages, and 135% higher than the non-electrified villages.

The average annual healthcare expenditure reported by the electrified households was Tk. 4,325, which is 44% higher than their non-electrified counterparts (Tk. 3,012 and Tk. 2,999). The annual health care expenses for the females of electrified (Tk.1,948) was 85% higher than those in the households of the non-electrified villages and 104% higher than those in the non-electrified households of electrified villages.

The average monthly expenses on fuel reported by the electrified households was Tk.545 and the corresponding amounts for the non-electrified households in electrified villages was Tk.362, and in non electrified villages Tk.385. Spending on kerosene was much higher in the non-electrified than in the electrified households. Electrified households monthly expenses on kerosene was only Tk. 28.3, while it was around Tk.65 in the non-electrified households. On average, the volume of kerosene used as fuel was 1.6 litres per month in the electrified households, 3.3 litres per month in the non-electrified households of electrified villages, and 4.1 litre per month in the households of the non-electrified villages. Nationally speaking, this has significant financial implications on the imports in Bangladesh. Currently, all rural households in Bangladesh annually consume 775.53 million litres of kerosene as fuel for domestic use. If 100% rural households are connected with electricity, the annual volume of consumption will drop down to 366.58 million litres i.e; the projected annual savings will be about 410 million litres. This amount of projected annual savings equals to Tk.7361.1 million, which is equivalent to about 53% of the present rural households expenditure on kerosene, or equivalent to 2.15% of the current annual valuation of national imports (CIF) of Bangladesh. Thus, ensuring 100% electrification of rural households will have major impact not only in reducing the dependency on kerosene, which is purchased in the context of fragile foreign currency reserve situation, but also will have high positive impact on the overall economy of Bangladesh and contribute towards macroeconomic stability (to certain extent). In addition, this will have major sustainability implications in terms of accelerating the process of ensuring an environment-friendly society in Bangladesh.

Impact on Surpluses and Savings

On an average, an electrified household had surplus amounting to Tk.20,287 which is 85 times of the households in non-electrified villages (Tk. 238.4 only) . The situation of households by landownership categories was also better in the electrified households than the comparable households in the non-electrified villages. The rich-poor gap (landless versus large landowner) was much less pronounced in the electrified households (gap of Tk 74,312) than that in the households of non-electrified villages (gap of Tk 9,2791). On average, an electrified households had savings amounting to Tk 28,893, non-electrified in electrified households Tk 9,918, and households in the non-electrified village, Tk 14,007. The influence of electricity on household savings is evident from the higher average propensity to savings in the electrified households which is due mainly to the relatively high income and less proportion of recurrent expenses. Electricity contributes significantly in enhancing the savings rate of the poor in the electrified households, and reduces the rich-poor gaps in savings (by income groups such gap was 6.4 times in electrified households and 18 times in the non-electrified villages).

Impact on Credit

Since both asset and income were found to be higher in the electrified households than in the non-electrified ones, the former has relatively high creditworthiness. The average amount of credit taken in the last year by electrified households was Tk. 9,153, and that by non-electrified households in the electrified villages was Tk. 4,685, and the same for the households in non-electrified villages was Tk. 5,339.

Impact on Ownership and Assets

A higher proportion of the electrified households own cultivable land, as compared to their counterpart non-electrified households. About 79% of the electrified households (HE) reported ownership of cultivable land. The corresponding reporting was 59% for non-electrified households in the electrified villages and 73% for the households in the villages without electricity.

The average amount of own cultivable land of the electrified households is 178.2 decimals, that of WE-EV 74.2 decimals, and WE-NEV, 147.8 decimals.

During the last five years, the inequality situation of cultivable landownership has improved in the electrified households compared to that in the households of non-electrified villages. The relative share of ownership in the total cultivable land of the bottom 40% of the electrified households has gone up at a higher rate during the last five years, as compared to that in households of the non-electrified villages. The distribution of ownership of cultivable land in the electrified households, although skewed, is still better than that in the non-electrified households. The gini concentration ratio for ownership of cultivable land for the electrified households has dropped slightly from 0.62 in 1997 to 0.61 in 2002 (a decline of 1.6%); the same for non-electrified households in the electrified villages has dropped from 0.69 in 1997 to 0.68 in 2002 (a decline of 1.4%); but for the households in the non-electrified villages this has remained same at 0.67 in 1997 and 2002.

In terms of the absolute size of ownership and the increment, the higher increase in homestead, pond and kitchen garden in the electrified households compared to the others should be treated as a distinct sign of improvements in the standard of living in the electrified households.

During the last five years, in terms of dwelling and non-dwelling rooms, the increase in the electrified households was higher than that in the households of non-electrified villages. The average space of dwelling rooms in the electrified households has gone up to 635 sq. ft. in 2002 from 513 sq. ft. in 1997, and that for households in the non-electrified villages has gone up to 440 sq. ft. in 2002 from 367 sq. ft. in 1997.

During the last five years, ownership of average number of livestock (cow, goat, sheep) and poultry has increased in the electrified households, whereas the ownership of livestock declined in the non-electrified households.

In terms of some household assets, there has been a major change in the electrified households. A high proportion of electrified households reported ownership of electrical appliances such as fan, TV, cassette player, iron, which are almost non-existent in the households of the non-electrified villages.

During the last five years, the asset strength of the electrified households has improved by a much higher rate than that in the two other categories: five-year increase for HE was 19.4%, for WE-NEV 10%, and for WE-EV 2.4%.

With all the fluctuations in the movement of households from one asset group to another, as compared to the non-electrified households, the electrified households have shown a much progressive trend in their economic strengths measured through upward movement of the household asset situation. This was evident in relatively less proportion of households in the low asset group, higher rate in the upward movement of the original (1997) low and medium asset groups (during 1997-2002), and relatively less pronounced downward trend of all the three asset groups.

SOCIAL AND CULTURAL IMPACT

Impact on Education

The overall literacy rate was found much higher at 70.8% in the electrified households, compared to that in the non-electrified with 54.3% in the electrified villages and 56.4% in the non-electrified villages. Compared to the non-electrified households, the overall literacy rates for both male and female in the electrified were significantly higher, especially due to the household's access to electricity which has contributed much both in economic terms as well as in raising awareness about value of education. The rich-poor divide in literacy was also less pronounced in the electrified than that in the non-electrified households.

The adult literacy rates for electrified households as compared to non-electrified ones is characterized by relatively high rate for both male and female, relatively less gender disparity, and relatively less rich-poor divide. Therefore, of literacy, it can be forcefully argued that ensuring access to electricity in the households should be seen as a major strategy to reduce the knowledge-poverty (in terms of both raising overall literacy and adult literacy) in rural Bangladesh.

The gross enrolment ratio – one of the major indicators of educational attainment –– was high at 64% in the electrified villages, and around 55% in the non-electrified households.

The quality of education measured in terms of household expenditure on education, marks (grades) obtained in the last final examinations, school drop-outs, school attendance rate, and time spent for study by students at night – all found much improved in the electrified than in the non-electrified household. Electricity matters in improving the quality of education. This quality improvement in the electrified households works through vary many channels: more time available for study after the sunset, the quality of that time due to sufficient light and fan for comfort, strengthening the knowledge-base due to access to TV (which in turn increases the appetite for learning), parents (especially mothers/other elder female members) devote more time in assisting children's education compared to before electricity etc.

Impact on Health, Hygiene and Sanitation

In terms of knowledge about the crucial public health issues respondents in the electrified households were reported to be much more aware than those in the non-electrified households. Out of 20 public health issues, on average, the respondents in the electrified households reported awareness about 12.8 issues, those representing WE-EV 8.8 issues, and those in WE-NEV 8.2 issues.

The (poor) landless in the electrified households was found more knowledgeable (61%) about the public health issues than even the rich (large landowner) in the non-electrified villages (59%). This also means, in terms of knowledge-poverty, the economically poor people become knowledge-rich if access to electricity is ensured.

Electricity has contributed spectacularly to the knowledge building about crucial public health issues. Overall, as high as 56% of those having knowledge in the electrified households reported TV as the main source of knowledge, the corresponding figure for TV was 28%in the non-electrified households in electrified villages, and 17% in the non-electrified villages. TV played an immense role as the major source of such enhanced knowledge on health issues.

Although the pattern of sickness did not show any variation by sample categories, the distinctions were pronounced when it came to the question of treating sickness by medically competent persons (MCP). Availing treatment from the MCP was much more pronounced in the electrified households (57%) compared to that in the non-electrified households (43%). The gender disparity in seeking treatment from MCP exists. However, it is much less pronounced in the electrified than that in the non-electrified households. Also, the rich-poor gap between utilization of MCP in sickness was 9.3% points in the electrified households, and as high as 21.8% points in the households of the non-electrified villages. Thus, health poverty reduction— both in terms of awareness on public health issues and utilization of medically competent persons while sick— is possible with ensuring access to electricity in the non-electrified households.

A much higher proportion of child delivery (last birth) in the electrified households were assisted by medically trained persons (36%) as compared to that in the non-electrified households in electrified villages 23.1%. In terms of assistance in child delivery by medically trained persons, the electrified households show a much better situation – both overall, as well as by landownership categories.

The situation of availing of antenatal care (ANC) check-up during pregnancy by medically trained provider, receipt of tetanus toxoid injections during pregnancy, and post natal (PNC**)** check-up after delivery – all reported by a much higher proportions in the electrified households compared to those in the non-electrified households. All these imply that having electricity in the households positively influences the utilization of ANC and PNC services, and also acts as a health-mediated poverty reduction factor by motivating poor people (through radio/TV) to use ANC and PNC services in need.

Maternal morbidity during pregnancy, delivery, and within 42 days of delivery (postpartum period) is a serious public health concern in Bangladesh. Reduction in the burden of maternal morbidity by ensuring treatment by medically competent person is a major health-mediated poverty reduction strategy of the Government of Bangladesh which has worked much better in the households having electricity compared to those in the non-electrified villages.

One of the most spectacular influences of electricity was found on the infant mortality rate. The infant mortality rate in the electrified households is 42.7/1000 live births, in the non-electrified households in electrified villages 53.8/1000 live births, and in the non-electrified villages 57.8/1000 live births. IMR in the electrified households is 25% less than the national average (57/1000 LB) and 35% less than the national rural average (66/1000 LB). Estimates show that **if access to electricity is 100% ensured in the rural households, and those electrified households maintain the same IMR as the current electrified households, the annual number of infant deaths that could be saved will be around 36,818, i.e., a savings of 101 infant deaths everyday**.

The full immunization coverage among children 12-23 months was significantly higher in the electrified households (60.7%) than that in the households of non-electrified villages (36.5%).

About 68% of the currently married women in the electrified households reported their use of a contraceptive method. The contraceptive prevalence rate is 62.8% in the non-electrified households of electrified villages, and 61.7% in the non-electrified villages. Thus, in terms of attaining the national goal of NRR=1 by 2005 (which is equivalent to TFR= 2.1 by 2005), the electrified households appear to be more close-to-goal than the non- electrified households.

Access to electricity influences significantly in raising CPR among the poor-landless. CPR among electrified poor-households (65.7%) was found 19.5% higher than that among the poor in the non-electrified villages (CPR being 55%). These imply that ensuring access of the poor to electricity will have far reaching impact in the whole demographic future, as well as human development in Bangladesh.

The indication that electricity provides a great impetus in accelerating the process of attainment of the demographic goal of Bangladesh is clearly evident from the fact that a large share of FP use was contributed by the television. As for 22.5% of the family planning users in the electrified household, TV was mentioned as the most influential factor prompted FP use. Thus, electricity and TV together can contribute significantly in expediting the process of reaching the national demographic goals of Bangladesh.

One of the most notable findings in the study is related to the use of hygienic latrines. Sixty one percent of the electrified households reported use of hygienic latrines (sanitary, sealed closed), while the corresponding figures for non-electrified households in electrified villages was 29% and for non-electrified villages, 31.7%. Another significant finding was related to the proportion reporting `open space' for defecation: it was only 5.2% for the electrified, and around 20% for the others. Moreover, 50% of the poor households having electricity use hygienic latrine, while it was only 27.3% among their counterpart poor in the non-electrified villages. More spectacularly, while only 6.8% of the electrified poor-households reported use of open place for defection, it was as high as 29.2% for the poor in the non-electrified villages.

There has been distinct cultural changes in the hygienic practices due to household electrification. The use of soap after defecation was reported by 66% of the electrified households and only 33% of the households in the non-electrified villages. Besides, use of nothing (not even ash/mud) was reported by only 4.7% of the electrified and as high as 17% of the non-electrified households. Electricity has contributed significantly in promoting the use of soap/ash(mud) as hand-washing materials after defecation (which is televised frequently). In terms of all hygienic behavior and practices, the electrified households depict a much higher standard than the non-electrified households, and that especially as compared to the non-electrified villages.

IMPACT ON GENDER DIMENSIONS: WOMEN'S EMPOWERMENT, CHANGING STATUS AND MODERNIZATION EFFECTS

Electrification has contributed to the positive development on women's socio-economic status. Electricity has left a profound impact on women's mobility, participation in IGAs, decision-making, freedom in using income and savings, better utilization of credit, knowledge about gender inequality issues, household work plan according to convenience, changes in attitude in terms of reducing healthcare disparities, increase in overall years of schooling for both boys and girls, preference to send girls to schools, awareness of legal issues (as for example, marriage for girls at 18 and boys at 21), and awareness about negative impact of dowry.

Although, women in the non-electrified villages are working inside and outside home, they have less control over utilization of their earnings, decision-making; and their level of awareness of fundamental rights is low. One of the significant facts that, emerged is that if electricity is provided to them these women can benefit substantially with more power or status.

Against this context, it is important to enhance women's role in the decision-making bodies. Women do not have direct access to informal power structure and to many local committees. As for instance, in PBS's committees, only that person can participate against whose name the electricity connection has been taken; and it is always men who take electricity as their main breadwinner of the household. Although women are the *defacto* managers of the households, they are usually bypassed from membership in various committees. Three women are usually taken as the advisers in the committees, but other women from electrified households are not taken in as general members. There is a scope to include women in the PBS committees in a meaningful manner and to strengthen women's role in the decision-making institutions. Therefore, it is required to involve more women in the top-level management, and in the implementation stage, to formulate more gender-sensitive policies. It is against this context that REP should aim at changing rural women's overall living standard.

Electricity enables all members in electrified households to avail more time after sunset, in comparison with those in WE-EV and WE-NEV. The daily average time from sunset to sleeping is higher for all categories of household members in HE.

Socio-cultural development is the most prominent activity after sunset for household of their electrification status. Watching TV/listening radio is the major activity for senior members both male and female in HE followed by socialization. Both the activities facilitated through electricity also signifies spillover effect of electrification for female members in non-electrified households in the electrified villages as the study results revealed less difference with WE-EV (40.7%) in terms of time allocation for socio-cultural development in comparison with WE-NEV (47.5%).

Male household heads/senior male member in the electrified household spent more time, after sunset, in income generating activities (56.4 mins) as compared to those in WE-EV (50 mins) and WE-NEV (37.3 mins).

Business, emerging as the most prominent activity signifies increased economic activities in the region as has been reflected with higher time spent by WE-EV in comparison with WE-NEV.

Considering income-generating activities for female household heads/senior female members sewing appeared as the one entirely attributable to electricity. The difference in terms of average time spent for sewing in HE is 564.8% and 978.6% higher than WE-EV and WE-NEV respectively. Even for senior female students in HE, sewing can be treated as future source of income which is completely absent in WE-EV and WE-NEV.

Electricity plays the role of a catalyst in having a quality education both by extended time period and by creating comfortable environment through electrical appliances.

For landless electrified household, longer study hours for students and more time spent for socio-cultural development by the female household heads, acted as a catalyst for reducing human poverty. Higher allocation of time by the male household heads, the principal earner of the family in most cases, can contribute in reducing income poverty in an indirect fashion. The interplay of all those, actually create the environment for new opportunities to overcome the hardship of poverty

Providing electricity at the household level is crucial to ensure better standard of living as the effective use of time shapes up the life style for each individual concerned. Given the study results, the better use of additional time attributed to electricity, has facilitated the electrified household members to explore new range of activities as well as extended time period for the old ones. Comparing the pre and post electrification time allocation pattern for electrified household members, the study results revealed increased time allocation for activities like income generating activities or watching TV, which address income as well as human poverty. In the electrified household, reduced household chore for female members and reduced gender gap in terms of daily average time for studying is clearly indicative of improved gender status.

Thus, it can be recommended that to ensure better use of time after sunset by efficient allocation across different activities, it will be important to provide electricity at the household level. Electricity available at the household level should be a priority from the perspective of poverty reduction and women empowerment too, as the study revealed improved gender status in HE in the post - electrification period. Dominant spillover effect reported by higher difference in terms of time allocation between HE and WE-NEV, also rationalise the provision of electricity at the community level to ensure environment conducive to economic growth and higher standard of living.

Impact on Social Environment and Protective Security

Irrespective of availability of electricity in the households, almost all (96%) have said that electricity created significant employment opportunities. The most pronounced among those were creation of scopes for work at night (reported by 63% respondents), expansion of local trade and business activities (54%), generation of employment opportunities for unemployed youth (54%), broadening of scopes for employment in crop agriculture (53%), establishment of small and cottage industries (29%), increase in the opportunities for poultry raising (29%), and increase in the scopes for earning from multiple sources (27%).

Almost everyone (98%), irrespective of access to household electricity, agreed that protective security has increased due to electrification at the household level. The fact that security of mobility at night has increased due to electricity was confirmed by all respondents, irrespective of availability of electricity in their households.

IMPACT ON DEMOGRAPHICS

The reported mean number of children ever born to women was 4.3 in both the electrified households and households in the non-electrified villages. However, the mean number of deaths was relatively less in the electrified households with 50 (ever) deaths per every 100 households, which was high in the non-electrified villages with 62 deaths per every 100 households, and 59 deaths per 100 non-electrified households in the electrified villages. In the electrified households, not only the mean number ever died was relatively low, but also both the incidences of death and severity of death (measured in terms of death of 3 or more members) were less pronounced. As a result, the demographic consequences are distinct: the proportion of ever born still surviving is higher in the electrified households (88.4%) than that in the households of non-electrified villages (85.8%).

In the electrified households there are 912 females for every 1000 males i.e; 88 females are 'missing' against 1000 males. The corresponding missing number of females was lower at 54 in the non-electrified households in the electrified villages, and even higher at 102 in the non-electrified villages. Thus, the estimated missing number of females in the households of the non-electrified villages was about 16% higher than that in the electrified households. This issue of "missing females" has high gender, demographic and human development implications. Estimates done for the whole of rural Bangladesh show a total of 942, 215 missing females in the electrified households, 966,937 missing females in the non-electrified households of electrified villages, and a disproportionately high 2,857,404 missing females in the households of non-electrified villages. The inferences which can be drawn as to the positive influence of electricity in reducing the missing female population are as follows:

First: The number of missing females is disproportionately high in those villages where there is no electricity. Although the non-electrified villages constitute 49% of the rural population, they represent about 60% of the missing females of rural Bangladesh.

Second: Had there been no-electricity in the electrified households, the approximate number of missing females could have been 163,865 more than today (current number is 942,215), i.e, among other determinants, electricity has contributed in reducing the missing females by 163,865 persons. This implies that access to electricity has been instrumental in reducing the number of missing females in the electrified households by 17.4%.

Third: Had there been electricity in the households of the non-electrified villages the approximate number of missing females could have been reduced by 423,320 persons (i.e, from current 2,857,404 to 2,434,084).

The mean age of the household members was 26 years in electrified, 24.8 years in the non-electrified villages, and 24 years in the non-electrified households in electrified villages. Two important inter-related findings having significant demographic implications are as follows: (a) The mean age of the female members of the electrified households is 1.3 years less than the male members, 25.3 and 26.6 years, respectively. In the non-electrified villages the female mean age is 1.6 years less than their counterpart male members (24 and 25.6 years respectively). This relatively low female age in the non-electrified villages can be explained through relatively high proportion of women in the younger age group and relatively low proportion in the older age group. (b) The proportion of both male and female in the higher age group (45+ including the older age 60+) was relatively high in the electrified compared to those in the non-electrified. As for the younger age group (up to 14 years of age), the proportions of both male and female in the electrified were lower than those in the non-electrified households. Thus, young age structure was more pronounced for the non-electrified than the electrified households.

The average household size of the electrified households is slightly higher (6 person per household) than that in the non-electrified households (5.4 and 5.7respectively for those in the electrified and non-electrified villages). It is most likely that, this slightly high average household size of the electrified household is due to less poverty-induced out-migration of family members, higher incidence of joint-family structure, and job opportunities in the electrified areas.

The dependency ratio is lowest (0.64) in the electrified households, highest (0.73) in the non-electrified households of electrified villages and in-between (0.68) in the households of non-electrified villages. Thus, compared to the non-electrified, the same number of active population supports a smaller number of dependent population in the electrified households.

Estimates show that availability of electricity in the household contributes 15.7% in the reduction in overall total fertility rate (TFR) (comparison of TFRs in two extreme samples), but availability of electricity in the village but not in the household contributes only 2% in the reduction in TFR.

The TFR of poor in the electrified (2.7) was 26% less than that of the poor in the non-electrified villages, and it was even 7.5% less than that of the rich in the non-electrified villages (2.9). Thus, electricity not only contributes to declining overall TFR, but also contributes significantly to reduction in TFR among the poor.

The survey provided a number of indications about the urbanization of rural life in the electrified areas, as evident from the analysis of the pattern of household expenditure, and asset situation of the electrified households. The qualitative survey gave positive indications about high incidence of in-migration in the electrified areas.

During the last five years, a total of 966 persons have migrated-out from 2491 sample study households. Most out-migration was associated with marriage (ranging between 61% in HE and 72% in WE-NEV), followed by job (22% in WE-NEV and 33% in WE-EV), and education (4.3% in WE-EV, and 6.1% in HE and WE-NEV each).

A new phenomenon of in-migration into the electrified village has been reported. Many have said that, because of electricity, new economic activities have emerged, which has created more employment opportunities, and that, in turn, gave impetus for people in the non-electrified villages toward electrified villages for work. The occupational pattern has changed in the electrified villages. In addition, due to the availability of improved educational and health facilities people are also attracted toward electrified villages. Electrified villages have better agricultural facilities due to electricity-driven equipments for land preparations, irrigation, threshing, husking and demand for labour during harvesting has increased. All these have been instrumental in reducing out-migration for job from electrified villages, and in increasing in-migration (both temporary/seasonal and permanent) to electrified from non-electrified villages. Because of the combined effect of all these factors mediated through rural electrification a tendency has been developed among people to shift their residence from non-electrified to electrified villages. As a result, the price of land in the electrified villages has increased.

IMPACT ON DIRECT USERS OF DOMESTIC ELECTRICITY: CONSUMER PREFERENCES, DEMAND, BENEFITS, PROBLEMS OF SUPPLY INTERRUPTIONS, AND WILLINGNESS-TO-PAY MORE

The average amount of expenses incurred for domestic connections was Tk.1,480 per household with Tk. 253 to the PBS (as membership fee and guarantee deposit), Tk.953 for purchase of wiring materials, Tk. 218 for wiring charges (to technician), and Tk. 55 for 'other' purposes. Thus, the one-time capital expenditure required to get domestic connection is about US$26, with 64% for wiring materials and only 17% to the PBS. Thus, as capital expenditure for domestic connections, rich spent 48% more than the poor, and the most part (73%) of the increased expenditure was due to the wiring materials and related charges. The policy makers should note that this amount of one time cost of connection, equivalent to just 4.2% of the annual net income of the landless non-electrified households in the electrified villages, is relatively low.

As a means of household lighting, all the consumers prefer electricity to any other means. Before having electricity, as means of lighting, 51% had the habit of using lantern and 49% *kupee*. They used to light the lanterns/*kuppes*, on average, for 3.05 hours per night. Now, with the electricity in households, they use electricity, on an average, 4.6 hours per night for lighting. This means, on average, electrified households now have 1 hour 33 minutes additional lighting hours available for leisure and/or for income generation activities. Thus, compared to before electricity, they now have 51% more time for lighting per night. Among all the economic (landowning) categories, the landless households reported highest extent of change: 55% more lighting-time now than before electricity.

Consumers of electricity reported use of both tungsten bulbs and fluorescent tubes. **Considering a total of 3,413,825 domestic RE connections, the approximate number of**

total tungsten bulbs in use would be 12.6 million and the number of fluorescent bulbs 1.54 million.

The estimated average number of various electrical appliances purchased per 100 households was as follows: 168 fans, 53 TVs, 46 cassette players, 30 irons, 5 refrigerators, 4.3 mobile phones, and 2.4 juice machine. **Estimates show that nation-wide, due to REB (with 3413825 domestic connections as on June 2002), the total number of various electrical equipments sold (indication about the market) would be 5,735,226 fans, 1,795,672 TV, 1,570,356 cassette players, 1,010,492 irons, 170,691 refrigerators, 146,794 mobile phones, 81,500 juice machines, and 9,900 toasters**.

The future market for electrical appliances would be a huge one: the market for refrigerator would be 6 times higher than now, the market for charger lights will increase by 4.2 times, the market for TV will increase by 61%. Increase in the number of domestic connections will further expand the market for electrical appliances, and thereby, will have enhanced impact on people's standard of living and quality of life, by way of increased latent demand for modernization of rural life.

The source(s) of purchase or procurement of the electrical appliances now possessed by the households indicate development of relevant market close-to-consumers. This also indicates an expansion of employment opportunities in the commercial establishments selling and repairing electrical appliances.

The consumers prefer electricity for seven different reasons/purposes (proportion of reporting being different): for the quality of light, comfort, more time for household chores, watch TV, listen radio, and iron cloths and generate more income. Another prominent benefit of electricity was the availability of longer work hours and leisure due to lighting.

Changes in habits mediated through electricity have taken place. The pattern of favorable changes in habit and in leisure activities have direct positive impact in improving the quality of life and changing mind-set of people towards better life. This can be denoted as electricity-driven demand creation for improved standard of living.

Eighty seven per cent of the consumers (domestic) never faced problem of disconnection associated with the non-payment of bills. About 13% had experienced a disconnection for non-payment of bills. Further probing has shown that, 23% of the respondents ever faced trouble in paying the bill. Three reasons were mentioned: 67% could not pay due to want of money, 14% each did not get the bill in time and got incorrect bill. Thus, two notable issues are in order:

First: A 28% of those having had trouble in paying bills (6.5% of all consumers) were due to the causes associated with PBS management (incorrect bill or disbursement of bill not in time). This implies that, at least 28% of the problems associated with bill payment or delayed payment can be resolved by improving the relevant management parts of the PBSs.

Second: A 67% of those ever experienced trouble in paying bills (15.6% of all consumers) were associated with the non-availability of cash at the time of bill payment. Compared to the rich segment of the consumers, a higher proportion of the poor has mentioned so. However, based on this findings, it would be difficult to draw any firm conclusion about what can be done by PBS to resolve the issue. This is at least because of two reasons: (a) the average amount of bill is not so high as compared to the income (for landless category, monthly bill would be at best 4% of monthly income), (b) uninterrupted or irregular cash flow is a reality among many in the rural areas. Cash-flow has a seasonal characteristics in the rural areas, and that especially among the poor.

Irregularity of power supply and load shedding are acute problems in REP. About 85% of the customers have said, power supply irregular. Of these, 72% said that such irregular power supply is almost a daily affair. Irregular power supply mostly takes place in the summer and the 6-10 PM is the time of most irregular supply. These findings are sufficient enough to raise the question of quality of electricity supply through REP in the PBSs. The policy implications are straight forward: regularity in power supply needs to be ensured (or frequency of irregularity needs to be minimized); power supply during prime time, 6-10 PM should be made regular; and all mitigation efforts should be directed to address the problem of irregular supply during the summer season. It is most likely that more generation of is the most important route to resolve the issue of irregular power supply, because of the increasing population size and increasing demand for electricity in the rural households.

A large number of the domestic consumers are willing-to-pay more for electricity than now providing better quality is ensured. About 45% of the consumers have expressed their willingness-to-pay more for electricity providing their is no power fluctuations and round-the-clock availability of electricity is ensured. On average, the customers are willing to pay 7.42% more amount than now if better quality of services are guaranteed

An average household pays Tk. 147.22 per month as electricity bill. Assuming this rate to be true for overall REPs domestic connections, the estimated annual revenue comes to Tk.5,007 million (for 3,413,825 domestic connections, June 2002). If better quality of services are ensured (i.e, no power fluctuation and round-the-clock availability of electricity) and people pay as per their willingness-to-pay more, then the estimated amount of annual revenue from domestic connections would be Tk. 5,378.5 million, i.e; an annual increment of Tk. 371.5 million. It is most likely, if quality of electricity supply is really ensured, the actual extent of increment in the revenue will be much higher than the estimated Tk. 371.5 million.

DEMAND FOR ELECTRICITY AND REASONS FOR NOT HAVING ELECTRICITY

Around 94% of the non-electrified households have expressed their willingness to have electricity in their households. Respondents showing willingness to have electricity at their households reported multifarious reasons for such willingness. A close scrutiny of the reasons shows that people’s demand for electricity at their households is primarily determined by both the socio-cultural and economic needs associated with desire for enhanced quality of life.

According to our estimates, 17.88% of the rural households in Bangladesh have electricity connections, and 65% of the households in the villages with electricity do not have access to electricity. What are the reasons for households' inaccess to electricity even in the electrified villages? The reasons reported include financial insolvency, hassles to get connection, non-inclusion in PBS master plan, paid membership fee long ago but not yet connected, paid money but not yet connected, hassles of regular payment of bill, and completed wiring awaiting connection. The reported reasons show a pattern worth further analysis: Some will get the connection soon (those who paid money and completed wiring); many will not get connection because of their financial insolvency and because of non-inclusion in the master plan; and many are less interested due to the hassles in getting connection as well as hassles of paying the bill on a regular basis. Thus, two categories of problems can be resolved with PBS management intervention, and thereby, increase the number of direct beneficiaries of electricity: those who paid money and completed wiring, and those who have reported various forms of hassles associated with getting connection and paying the bills.

In general, people in the non-electrified households are not adequately aware about the costs associated with household electricity. About 50% of the respondents in non-electrified household are fully unaware about the one time amount of money (investment) required to get electricity connection. About two-fifths of the respondents in the non-electrified households are unaware about the approximate amount of monthly bill to be paid for domestic use of electricity. About 91% were found unaware about the per unit tariff for domestic use of electricity. The extent of unawareness about the unit tariff was more pronounced among the poor than among the rich landowner categories. **Thus, inadequate knowledge about one time investment, approximate monthly bill and unit tariff were highly pronounced among the respondents in the non-electrified households, implying that dissemination of these information would be necessary to make activities more transparent, which, in turn, will facilitate people's informed decision-making in having electricity connections at their households.**

IMPACT ON POVERTY REDUCTION AND HUMAN DEVELOPMENT

About 40% of the population in the electrified households are below **absolute poverty line**. The corresponding figures for the population in non-electrified households of electrified villages is 51%, and that for the population of non-electrified villages is 43.4%. Compared to the national level of absolute poverty (44.3%) the electrified household's level is 11% less implying that electricity has contribution in poverty reduction.

Like absolute poverty, the **hard core poverty** was also most prominent among population in the non-electrified households in the electrified villages (27.1%). In the electrified households, 21.8% of the population were found below the hard core poverty line. The corresponding value for the population in the non-electrified villages was 23.1%.

The incidence of cost-of-basic needs (CBN) poverty shows that both the lower and upper poverty lines are much less pronounced for the electrified households than the non-electrified households. The high incidence of both lower and upper poverty among the population of non-electrified households, and high gaps in those incidences between the electrified and non-electrified households with electrified households showing the least incidences (51% less in lower poverty line and 37% less in upper poverty line) signify that access to electricity in the poor households (not in the villages only) had much impact in poverty reduction. **Thus, ensuring poor people's (households) access to electricity should be assigned with high priority in any future poverty reduction strategy for the rural Bangladesh.**

In terms of incidence of poverty, one of the most interesting findings was the positive relationship between the age length of electricity in the household and the declining incidence of absolute poverty. 42.4% population in the households with 3 years of age-length of electrification are poor (below absolute poverty line), which drops down to 37.1% if the household age-length of electrification is 4-5 years, and further falls down to 33.9% if households electrification age is 6 years. This is quite a revealing finding, which shows show that electricity influences poverty reduction, overtime, with a gestation period.

Human Development Index (HDI) values obtained for electrified household is 0.642, for non-electrified households in the electrified villages is 0.440, and for non-electrified households in the non-electrified villages is 0.436. Based on the analysis of HDI of 3 categories of sample households, the following inferences are in order:

First : The HDI for electrified households (HE) 0.642 is substantially higher than the overall HDI of Bangladesh (0.478). The electrified households' HDI corresponds to the lower-mid-level index for medium HDI countries. This implies that, by ensuring 100% access to household electricity in the rural areas, Bangladesh may raise its HDI ranking substantially from current 145th position to a position of around 100 (corresponding to the ranking of such countries as Egypt, Bolivia, Indonesia, Honduras). **Thus, electricity's potential impact on enhancement of national HDI could be very significant.**

Second: Even the non-electrified households in the electrified villages (WE-EV), which are predominantly poor, represents an HDI almost similar to that of the Bangladesh country average. The former category's HDI value is even higher than the households in the non-electrified villages (which are economically better off than the non-electrified households in electrified villages). This imply that, HDI increases with the village level electrification even when household's access to electricity is denied. This, as found in the survey, is most likely influenced by the relatively low infant mortality rates and higher combined gross enrolment.

Third: The differences in HDI values between the electrified HHs and the non-electrified households in the electrified villages is 45.9%; between the non-electrified households in the electrified villages and the non-electrified villages is less than 1%, and that between the electrified households and the households in the non-electrified villages is 47.2%. This implies that, provisioning of access to electricity for the non-electrified households will have spectacular impact in raising HDI in Bangladesh. **Thus, village electrification without electrifying the households will have not much effect on improving human development and increasing HDI values. Or, in other words, universal rural household electrification will have spectacular impact on human development in rural Bangladesh.**

To recapitulate, electricity at the household level impacts upon almost all economic variable, improves living standard and quality of life, and reduces poverty.

1) Both absolute poverty and hard-core poverty are significantly less pronounced in the electrified than those in the non-electrified households.

2) Electricity contributes to income-poverty reduction. The average annual income (last year’s) of the electrified households (Tk.92,963) is much higher (65%) than that in the households of non-electrified villages. The annual income of the poor (landless category) in the electrified (Tk.58,864) was around 50% higher than that in the non-electrified households.

3) Electricity has income-enhancing effect. 16.4% of the income of electrified households can be attributed to electricity. The corresponding figures for the non-electrified households in electrified villages was 12% and for those in the non-electrified villages only 3.6%. Other things being the same, 100% electrification of rural households (currently 17.88% of rural households are electrified) might increase the annual rural income by Tk.671 billion (which is equivalent to the 26% of the current GDP), and as high as 43% of this incremental income can be attributed to electricity.

4) The electrified households are much better-off than the non-electrified ones in terms of all human development indicators, namely human longevity (measured using infant mortality rate as proxy), human knowledge, and per capita real income. Bangladesh is a low HDI country (ranks 145 out of 173 countries) but the HDI value for electrified village-segment corresponds to the medium HDI countries such as Egypt, Indonesia, Honduras, Bolivia.

Thus, ensuring household access to electricity alone can be seen as a necessary precondition to significantly improve human development scenario of Bangladesh.

5) Electricity contributes significantly in asset-building of the poor. The cultivable landownership distribution is less skewed in the electrified than in the non-electrified – the bottom 40% of the electrified households own 3.7% of total cultivable land, whereas the bottom 40%of the households in non-electrified villages own only 1.6% of the total land. During the last five years, changes in the land ownership of the bottom 40% was more progressive in the electrified households than in the households of the non-electrified villages. The gini-concentration ratio of cultivable land ownership was 0.61 for electrified and 0.67 for non-electrified segments. Similar changes (during the last five years) in favor of the poor in the electrified households as compared to the poor in the households of non-electrified villages were evident in the ownership of other capital assets–dwelling/non-dwelling rooms, livestock and poultry, agricultural equipments and household durable.

6) Electricity has had significant impact is strengthening the socio-economic foundation and in improving the quality and living standards of the people in the electrified households. This has been amply reflected in the dynamics of self-assessed poverty status by the respondents.

7) Electricity has major demographic impacts. The population growth rate in the electrified household segment is less than that in the non-electrified. This is evident from the relatively low total fertility rate (TFR) as compared to the non-electrified segment. Young age structure and dependency ratios were relatively less pronounced in the electrified than those in the non-electrified household. Electricity in the household contributed 16% of the reduction in TFR. The TFR of the poor in the electrified household is 26% less than that of the poor in the non-electrified villages. As compared to the non-electrified villages, in-migration was much more pronounced in electrified villages mainly due to access to electricity and other associated modern amenities. Population survival rate is higher in the electrified than in the non-electrified villages. Among others, this is evident from the relative low infant mortality rates in the electrified, 42.7/1000 live births against 57.8/1000 live births in the non-electrified villages.

8) Electricity has played an immense role in improving people's overall health status, especially for those in the electrified households, and more so for the poor, women and children. The electrified households are much better endowed than the non-electrified households in the electrified villages and significantly better-off than the households in the non-electrified households in terms of the following heath indicators: awareness of crucial public health issue, seeking treatment by medically competent person while sick, use of medically trained persons in child delivery, accessing ANC and PNC check-ups, use of TT immunization, seeking treatment of medically competent persons in maternal morbidity, rate of full immunization of children (vaccines against 6 diseases), aversion of infant deaths, intake of Vit-A capsule to prevent nightblindness among children, use of family planning methods, use of higienic latrines, use of hand washing materials after defecation. In all these indicators, not only that the rich-poor divide was less pronounced in the electrified compared to the non-electrified households, but also the poor (landless) in the electrified have shown much better health outcomes than their counterparts in the non-electrified households, especially than those in the non-electrified villages.

9) Electricity has significant influence on education, especially on quality of education. This influence is much more pronounced among the poor and girls in the electrified households than the poor and girls in the non-electrified households. Compared to the non-electrified, the electrified households fare much better in terms of overall literacy rate; adult literacy rate; enrollment ratio; expenditure on education; performances in terms of examination results, attendance rate, dropout, and average time spent on study (after sunset, 6 PM). The overall literacy rate in the electrified (70.8%) is 26% higher than that in the non-electrified households. The same for the female is 31% higher: the rates being 65% in the electrified and around 49% in the non-electrified. The rich-poor gap in literacy is 20% in the electrified households, but it is as high as 60% in the households of non-electrified villages. The literacy rate among the poor in the electrified (66%) is about 41% higher than that of the poor in the non-electrified villages. The similar pattern holds true for adult literacy. In addition, the average annual household expenditure on education was 87% higher in the electrified (Tk.3,260) compared to that in the non-electrified villages (Tk.1,746).

IMPACT ON IRRIGATION AND AGRICULTURAL PRODUCTION

In agriculture, REP has contributed significantly in attaining food self-sufficiency through use of productive and efficient irrigation equipments, and generated stable employment opportunities.

Electricity powered irrigation equipments, on average, cover 10 acres more net area, 12 acres more total area, and 3 acres more new-to-irrigation area as compared to the diesel operated irrigation equipments.

Average number of days of irrigation in last year for DTW-E was 130 days, for DTW-D 128 days, STW-E 114 days, STW-D 117 days, LLP-E 112 days and LLP-D 82 days.[*>]

Land use intensity under irrigation of electricity powered equipment is higher in comparison with diesel operated ones' except for STW.

94 % of total cropped area of the sample plots under electrified irrigation is engaged in cereal cultivation. Of all cropped areas under DTW-E, the largest part is used for cereal production. Similarly, 94% of total cropped area under STW-E are engaged in growing cereals. Potato is also being grown in areas under STW-E. Jute, Masur, Mustard, Cauliflower, Tomato, Melon are being grown in 2% of the total area under the same type of irrigation equipment. 100% of total cropped area under LLP-E is being used for cultivation of rice. Rice is being cultivated in 96% cropped area under DTW-D. Potato being grown in 3% of cropped area and Bean in 1% area under DTW-D. In the total cropped area under STW-E, 94% of area are being used for cereal production, 5% for Potato, and 1% for Chilly. 80% of total cropped area under LLP-D deals with Boro, and for Aman.

The above reveals that with the development of irrigation facilities, Boro cultivation has grown up significantly and it pushed out other variety of rice. **The commendable achievement of the country towards relative food self sufficiency have been made possible because of shift towards HYV and especially high yielding Boro followed by HYV Aman at a massive scale. The contribution of REP in attaining the same can be attributed to the facts that REB has ensured uninterrupted supply of water through more than 103 thousands of**

[*>] DTW= Deep tubewell, STW= Shallow tubewell, LLP= Low lift pump, E= Electricity powered machine, D= Diesel operated machine, HYV= High yielding variety, WTO= World Trade Organization.

electricity operated irrigation equipment to approximately 2.3 million of acres of land under HYV Boro and HYV Aman.

Average, yield per acre (productivity) under electricity powered irrigation is 24 % higher than that of diesel operated ones.

Cropping intensity in plots using electrically powered irrigation is 193, the corresponding figure for plots irrigated by diesel is 191 and for plots with no irrigation or rain-fed is 181. It implies that electrified irrigation intensifies the land use by 12% points more than rain-fed/no irrigated land, while diesel powered irrigated land intensifies by 10% points.

Electrified irrigation equipment in general are more dependable compared to diesel operated. Both operational cost and energy cost of electrified equipment, on average, three-fourths as compared to those of diesel operated ones. Maintenance cost ranges between 7-10 % of operational cost, cost of repairing for an average electricity operated equipment is almost one and a half less than that of diesel operated one.

Electrified irrigation equipment creates employment for two persons for almost half of the year and with the electrification of irrigation equipment, more than one hundred thousand additional employment have been created through out the year in rural areas of the country.

As land use intensity and cropping intensity through electrified equipment is higher and cost of operation of the same is lower (including breakdown and associated problems) - in comparison with diesel equipment, electrified irrigation has got distinct advantages over other types of irrigation. It is once again established that HYV crops and HYV Boro has been greatly facilitated by Rural Electrification contributing to spectacular growth in food production and thereby growth of Gross Domestic Product in the country. Therefore, in order to secure further growth in food production, particularly in the backdrop of WTO considerations, where countries are supposed to capitalize on their competitive advantage-electricity as a source of power needs to be made widely available in the rural areas of the country.

As the contribution of electricity is evidentially clear in the agriculture sector of Bangladesh, therefore, more generation of electricity, on the one hand, and better distribution of the same, on the other, is recommended. The REB needs to entertain its initial mission of connecting all irrigation pumps and think its mission/goal about engaging itself into generation of electricity too.

IMPACT ON INDUSTRIAL DEVELOPMENT

Industry is the second highest consumer of rural electricity using 42.3%of the total MWH. During the last twenty years (1983-2002), the total number of industrial consumer of rural electricity has increased 3210 times and the average number of industrial connections per PBS has increased 550 times.

A substantial growth in industrial output (both in terms of volume and value) has been identified in the study. During last five years, the growth in value was about 295% in electrified industries. The total volume of output (in terms of ton) has increased by 78 percent, while the same growth was only 8 percent in non-electrified industry. The volume of output in terms of piece unit (other than ton and maund) grew up by 121% in electrified households, and it was –0.44 percent (negative) in non-electrified industries during the last five years.

The total employment in 63,220 industries in 67 PBSs is 983,829. Electrified industries, on average, generate 11 times more employment than the non-electrified. During the last five year, the overall growth in employment in electrified industries was 52.8% with 41% for male and 121% for female. But the growth of skilled labour force was 78.6% with 55% for male and 417% for female labors. The total growth in employment in non-electrified industries during this period was 28.6% with 16.2% for male and 56.3% for female. The increase in the number of skilled labor was 41% with 11% for male and 170% female. The male labour force of electrified industry (last year) shares 79% of total working hours, and the same was 70% in case of non-electrified industries.

Electrified industries are both cost-efficient and productive. The average cost of production is Tk. 0.65 to produce output of one Tk. for electrified industries while the same was Tk.0.84 for non-electrified industries. Similarly the productivity in electrified industries isTk.131.07 per hour and in non-electrified industries Tk. 45.38 per hour. The low cost of production and high productivity have also reflected in the net revenue of the electrified industry which amounted to Tk. 302.4 billon, last year. All these indicators – productivity, low cost of production and high profit, indicate the efficient performance of electrified industries over the non-electrified industries.

RE connected industries have strengthen the local industrial base by promoting backward and forward linkages and diversification which later forms agglomeration by attracting and generating diversified services. The study shows that 3 industries were expanded through backward and forward linkages, another 13 went for diversification, and 9 expanded through sub-contracted arrangements. The shares of these industries are not much pronounced compared to the total RE connected industries. But once this process has started, it would be intensified in the future.

All these highlight the significant contribution of RE connected industries and underscore the need for further expansion of rural electrification for a rapid growth of industries. In view of the above stated, the following suggestions can be forwarded for policy-scrutiny:

1) The rural electrification should be expedited to cover more villages and areas.

2) The local bazar or village market should be brought under rural electrification with utmost priority to provide incentives for establishing small and cottage industries, which, *inter alia*, will act as a powerful factor to stop or minimize the rural-push migration.

3) The quality of supply should be improved and load shedding should be brought under minimum levels without increasing the tariff, initially.

4) Those people who have successfully expanded their industries with the RE- connection should be encouraged to contribute to the Board of Management.

5) In the north and southwest region, expansion of many RE connected industries are inhibited due to the absence of gas supply. REB may take initiative to speed up the process of gas-based electricity production and distribution in the north and southwest regions for accelerated industrialization.

6) Local agro-based industries should be encouraged to generate more income and employment in the country, and thereby facilitate the process of minimizing forced rural-to-urban migration.

7) More security measures should be adopted to save the rural consumers from accidents caused by electricity.

Rural electrified industries have been playing a pivotal role in changing the living condition of the rural people whose fortune was tied-up with subsistence agriculture till the coming of rural electrification. More and more people have been shifting their traditional stereotype business to the more dynamic industrial venture. Development of agglomeration resulting from industrial concentration in many rural areas, generated income and urban facilities and thus contribute in reducing the rural-urban gap.

Modernization of agriculture has taken place during the last twenty years. Such modernization has augmented the output, in one hand, but ousted many small and marginal farmers, on the other. This process of uprooting has been accelerated and aggravated by population pressure, river erosion and many other natural calamities and man made reasons. Rural electrification has, to some extent been able to absorb these ousted people in their concerned areas. But the most striking feature in this process is the participation of many female labors of both skilled and unskilled, who otherwise have been confined to household work.

IMPACT ON COMMERCIAL ACTIVITIES

Rural electricity has acted as a leap-forward in the development of commercial activities in rural Bangladesh. Out of the total shops in Bangladesh an estimated 24% are using rural electricity.

Electrified shops are more attached to market and wholesale shops are all the more attached to marketplace. In some cases availability of electricity has given rise to constellation of shops, on other cases already existing constellation of shops have been served with electricity.

Quite a number of electrical appliances are used in the shops and they are found to be profitable. Fridge is spectacular in its contribution both financially and emotionally.

Business turnover be it daily, weekly or monthly for electrified retail shops are more than double than that of non-electrified**.** For wholesale electrified it is eleven-fold. Similar is true for volume of business, business hours, volume of customers, employment of electrified shops then non-electrified. Generally, the traders of electrified areas appear more vibrant than those of non-electrified. Sometime electricity appear as world-view, as an outlook, as status symbol and all pervasive 'source of power'. More professional approach toward business is visible among electrified traders than non-electrified.

Those traders who are yet to get the benefit of electricity are ready to invest for electricity as they think it worth from the business point of view.

Estimates pertaining to the contribution of rural electricity on sales turnover of retail and wholesale shops reveal the following:

1) In case of electrified retail shops, rural electricity's contribution to the additional sales turnover is 34.51% and the same to the overall sales turnover is 17.26%.

2) In case of electrified whole sale shops, rural electricity's contribution to the additional sales turnover is 15.08% and the same to the overall sales turnover is 11.23%.

3) For overall Bangladesh, the total annual (2001) sales turnover of retail and wholesale shops is Tk.1274.1 billion of which RE connected shops' share is Tk.301.2 billion i.e; RE connected shops contribute 23.64% of the total annual sales turnover of all shops in Bangladesh.

4) Most importantly, out of the total annual (2001) sales turnover of retail and wholesale shops in Bangladesh (Tk.1274.1 billion) rural electricity's share is Tk.174.9 billion, i.e.; rural electricity's contribution (through commercial connections) to the national overall annual sales turnover of retail and wholesale establishments is 13.72%.

As there is clear impact of electricity on trade and business with presumable multiplier effect, electricity should be made widely available in rural areas.

Cost-benefit considerations at a given point in time may not be encouraging but given the longer benefit with multiplier effect - investment in generation and distribution of electricity is strongly recommended.

Although complain resolution rate at PBS is commendable (97%), customer care on the part of REB-PBS is not much praiseworthy. The whole approach of REB should be more customer-oriented and toward that, the PBSs need to be activated further.

Those who are yet to get electricity have been found to use diesel generators for lighting and other purposes. REB can think of better-options, other than electricity, for them.

Need for electricity is there but demand is yet to emerge. REB can think of networking with local organizations, associations to translate those needs into effective demand.

PBS: IMPACT ON LOCAL GOVERNANCE AND DEMOCRATIZATION

PBS members elect the Board of Directors by direct voting which creates an opportunity to build a social network among the users and to have control over the mechanisms that allow their voices at the PBS management level. Since electricity created congenial environment for political and social gathering, community and courtyard meeting, people spend longer period in union council, clubs, cooperatives and *samities* and strongly participate in local level decision making.

Less than one-third of the PBS members (29.6%) were found to know the eligibility criteria to be a Director, about one-fourth (23.9%) of the PBS members reported to attend the last AGM and majority of the PBS members (65%) never casted their vote. Mentioned reasons for not participating in PBS election were – distance of PBS election centers from the household, lack of time and transport fare etc. Majority of the PBS members (60.3%) appeared to be ignorant about the roles of the elected directors in PBS management. The rate of attendance in last AGM by the PBS members of the electrified villages is low (23.9%).

Majority of the respondents (70%) in electrified villages reported that PBS played useful role for members. The average number of complains were 7199.81 per PBS in 2000 and the number of complains resolved were 6987.85 (97.1%). The number of complains per PBS and the percentage of those resolved proves the nature of accountability to the PBS members and level of efficiency.

Local governance contributes to the required scaling up of the rate of poverty reduction through enhancing the developmental choices available at the local level and a better inclusion of all social groups in these choices. PBS system is one of the best existing models of local governance and decentralization in Bangladesh. The model of PBS can be replicated in other sectors of development and resource management for the better future of Bangladesh.

To achieve the objective of rural power supply for poverty reduction, governance system of PBSs should be improved and democratization should be the norm of implementing the PBSs' activities. The following recommendations are advanced to improve good governance of PBS and to strengthen democratic practices in PBS management:

1) To strengthen local governance and to ensure transparency and accountability, the "Best Actors" of human governance should be involved for development of PBS.

2) The motivational and awareness activities for the PBSs members to make them aware of the rights and obligation should be strengthened.

3) Since the poor have weak social networks and they are excluded from mechanisms that allow their voices to be heard, PBS can play an important role in building trust and norms for coordinated actions to extend people's freedom and to exercise choice by creating institutional structures that in turn create capabilities.

4) All the electricity users should be the members of PBS for better participation in local level planning, decision-making and implementation.

5) Constraints of participation in PBS election faced by the PBS members should be eliminated.

RECOMMENDATIONS

1. Based on the empirical findings of this Study it would be pertinent to conclude that rural electricity has profound and far-reaching economic, socio-cultural and demographic impacts on life and living of the rural people in Bangladesh. Access to rural electricity has significant and sustained impact on the reduction of both income-poverty and all dimensions of human poverty (health, education, women empowerment). The Study's findings also indicate that rural access to this commodity has deep-rooted impact on agricultural development, industrialization, and business and commercial activities. In addition, it has impact on human capital formation through knowledge building mediated through electricity-driven media exposure. Thus, in order to accelerate the process of economic growth, strengthening pro-poor orientation in growth process and to further human development in Bangladesh, access to electricity of the households and social and economic institutions should be expanded within shortest possible time.

2. Vigorous efforts are needed to devise appropriate strategies (means and ways) to increase the coverage of the non-electrified households in the electrified villages (65% households in the electrified villages, which is equivalent to 33.5% of all rural households in Bangladesh) in to the scheme of the rural electrification program. This will contribute to both increasing socio-economic impacts as well as improving the financial viability of the PBSs.

3. Special policies and strategies should be designed and implemented to accelerate the process of poor peoples' access to electricity.

4. Analyses of numerous and diverse impacts of rural electrification provide adequate logical basis to argue that rural electrification should be given top most priority as a catalyst for ensuring accelerated human development, poverty reduction and economic growth in Bangladesh. Therefore, rural electrification should be viewed as the cornerstone of national poverty reduction strategy.

5. Due to the richness in content and diversity, and potential high knowledge-building and policy utility (for almost all economic and social sectors) of the Study, the findings should be widely disseminated for both awareness raising amongst the masses of people and for policy advocacy purposes among both the development partners and high level policy makers, including those amongst the people's elected representatives. To expedite this dissemination process to these different target populations, the production of relevant materials in the form of short films, documentary, booklets would be useful.

6. It is due to the innovative nature of the study design that the methodology used in the Study should be disseminated among the relevant research community — both at home and abroad. An in-depth understanding of the study methodology will be of high utility for the capacity building of REB staff members who are involved in the designing and evaluation of socio-economic impacts of rural electrification. The dissemination of this innovative study design would be useful for all RPPR partners and other stakeholders in their quest for developing the system for measuring impacts under the RPPR Program.

7. The production and publication of research-based books – one in Bangla and the other in English – on the subject "Economic and Social Impact of Rural Electrification Program in Bangladesh" would be useful for a broader audience. This would be the first of its kind in Bangladesh and perhaps elsewhere as well.

8. The empirical data-base produced in this Study is huge, and of high quality in terms of accuracy and depth. This database should be profitably used in the future as a baseline and/or as a benchmark for all subsequent socio-economic impact evaluation studies of rural electrification in Bangladesh.

9. Considering the availability of a wealth of data produced in this research and prepared in a working database, it is highly recommended that all possible secondary analyses be conducted for better understanding of many dimensions of relevant impact to expedite the process of informed policy and decision making by the concerned authorities. Secondary analyses are also suggested to strengthen and generate a new knowledge-base on the subject.

10. The knowledge gap of all stakeholders about various relevant dimensions of the impact of rural electrification is still considered to be high. Thus, in order to minimize this knowledge gap, further more focused and in-depth studies should be launched on areas of specific interest, such as migration and rural electrification, the relationship between poverty reduction and age-length of domestic connections, the relationship between willingness-to-pay and quality services, electricity's role in improving people's health, relationship between electricity and mortality and morbidity, electrification's role in empowerment of women, and the PBS as a good governance model. These studies should be conducted on a priority basis, in which poverty reduction, production, and human development areas should be assigned as the top priorities.

11. The development needs of the entire Bangladesh Rural Electrification Program and the probable requirements of the donors and development partners will likely require similar large-scale impact assessment studies to be conducted in the future on a periodic basis with the recommended interval being a minimum five years.

12. In order to expand the concept of sharing best practice experiences worldwide and to lend support to the partner-countries, all members of the donor community and other development partners involved in rural electrification, such as NRECA, could gainfully utilize the innovative design and methodology of this research to study economic and social impact of rural electricity programs in other countries such as Costa Rica, Bolivia, Philippines, India, Indonesia, Vietnam, Nicaragua, Ecuador, Panama, Ghana, El Salvador, etc. The national research and policy partners in these partner countries can be trained on this Bangladesh Methodology, which will also contribute to their own national capacity building efforts.

CHAPTER 1

RURAL ELECTRIFICATION PROGRAM IN BANGLADESH: AN OVERVIEW

1.1. INTRODUCTION

Electricity entails enlightenment – enlightenment having physical and metaphysical connotations. Metaphysically, electricity provides a world-view, while physically electricity provides energy. The combination of these two connotations allows transition from the state of deprivation to that of opportunities and choices; from being powerless and voiceless to be a person with an identity. Apart from being the vital infrastructure for income-generating activities, electricity acts as catalyst for a decent standard of living for all by opening up the avenues for development of human potentials so as to incorporate them in the mainstream of socioeconomic activities. Providing electricity, particularly in the rural areas, becomes crucial now-a-days not only because of its burgeoning role in the present globalized economy, but also to synchronize the development patterns between rural and urban areas as well as among different regions within countries. All these are adequately reflected in the Article 16 of the Constitution of Bangladesh, which states, "The state shall adopt effective measures to bring about a radical transformation in the rural areas through the promotion of an agricultural revolution, the provision of **rural electrification,** the development of cottage and other industries, and the improvement of education, communications and public health, in those areas, so as progressively to remove the disparity in the standards of living between the urban and the rural areas"[1>].

The National Poverty Reduction Strategy Report-2002[2>] identified rural electrification as one of the four priority areas in order to ensure increasing growth and bringing a pro-poor orientation in the growth process.

In a country like Bangladesh, where a significant part of the rural populace is yet to be brought under electrification, turning on a switch means much more than an end to the state of darkness and deprivation *per se.* If we define human development as ensuring opportunities for a full life to people, especially to poor, women and deprived[3>], Rural Electrification Program (REP) provides the necessary infrastructure (economic, socio-cultural and political) for achieving real freedom – freedom from servitude to Nature, ignorance, poverty, dogmatic beliefs and even from other people[4>].

1.2. RURAL ELECTRIFICATION PROGRAM IN BANGLADESH

The Rural Electrification Program in Bangladesh began in 1978. Primarily with the technical assistance of National Rural Electrification Cooperative Association (NRECA), Rural Electrification Board started their journey in 1976 with an aim to provide electricity outside the urban strata *(http://international.nreca.org/limited/banglaesh_climate.html)*. The program is based on the concept of member-owned *Palli Bidyut Samities* (PBSs) similar to the rural electric cooperatives that exist in the United States. PBSs as the model of local governance act as nucleus of REP. Sixty-seven PBSs have been organized to date in Bangladesh.

[1>] The Constitution of the People's Republic of Bangladesh. Article16 under "Fundamental Principles of State Policy".

[2>] A National Strategy for Economic Growth and Poverty Reduction, Economic Relations Division, Ministry of Finance, September 2002. This report is popularly known as PRSP (Poverty Reduction Strategy Papers).

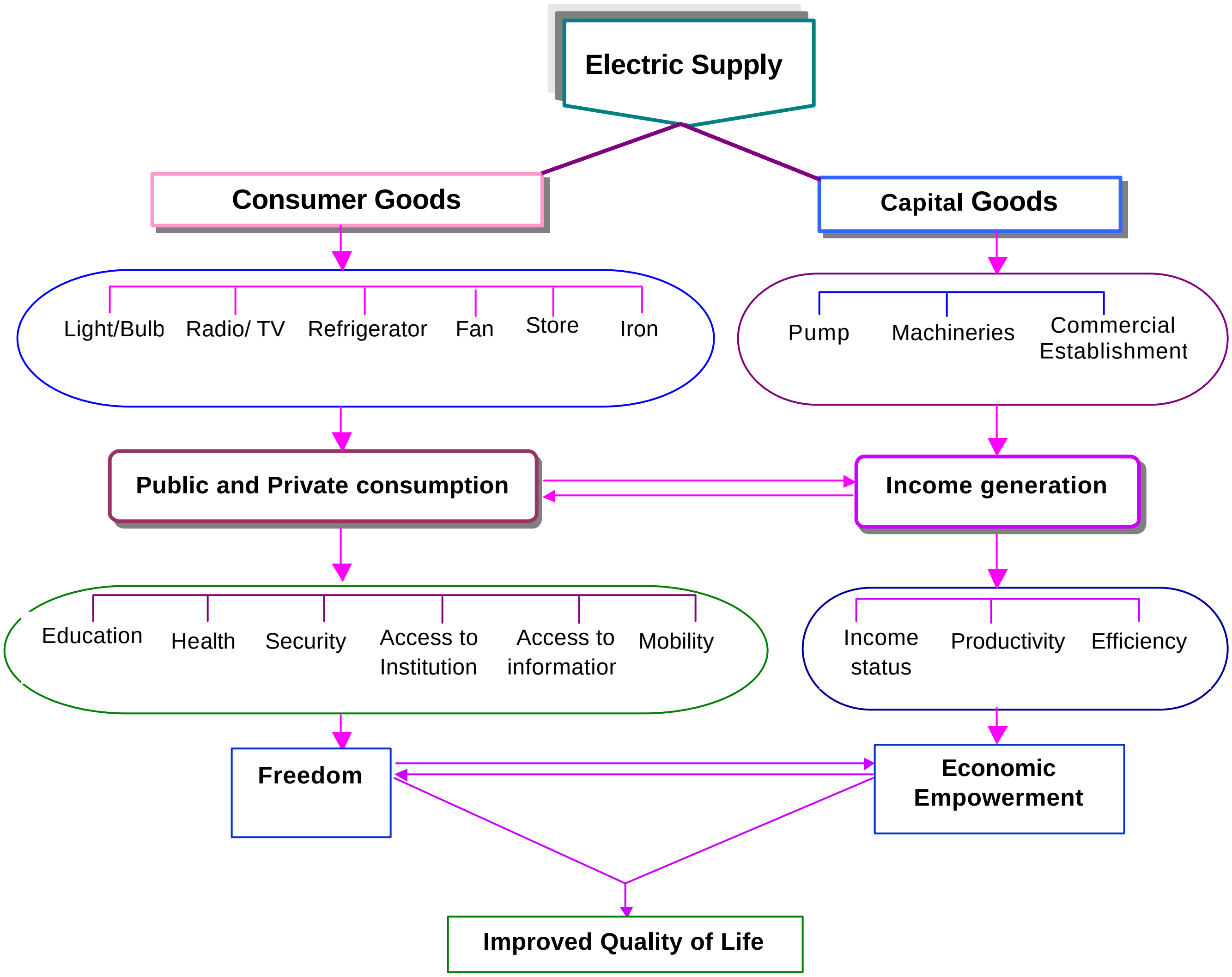
[3>] Barkat, A. (2001), "Development-Freedom-Empowerment in the Context of Poverty and Deprivation in Bangladesh".

[4>] Todaro, M. (1994), Economic Development in the Third World.

REP aimed initially at electrification of irrigation pumps and tube-wells, agro-based industries and serving domestic and commercial loads of only those villages, which fall right alongside the electrical distribution facilities built for irrigation purposes. To date, electricity made available through PBS areas, is intended to be used for all possible applications that serve the purpose of improved living conditions of the rural people. This can be achieved and has been achieved to a large extent (present research findings substantiate this) by introducing electricity into households (e.g., for lighting and domestic appliances), into rural industry (e.g., for powering tools), and into agriculture (e.g., for water pumping in irrigation systems, raising farm yields), in to market places, and into public (street lighting, power and cooling of medicines or vaccines in medical centers) to ensure improved health facilities, lighting in schools, offices and other institutions.

Rural Electrification Program has been aimed at accelerating the process of human development in Bangladesh. Focusing on the human face of development, REP has played a profound role in enabling the rural people to meet all the pre-requisites for sustainable human development and thus to ensure a better quality of life. REP's linkages with accelerated human development can be conceptualized as shown in Figure 1.1.

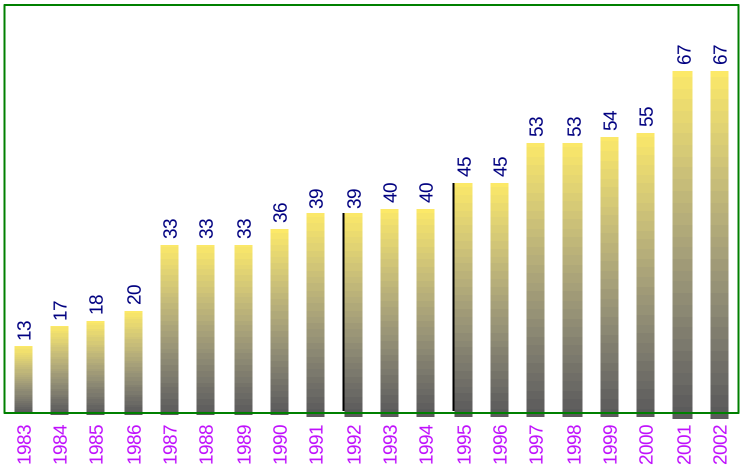
Figure 1.1: Electrification and Human Development



The development of Rural Electrification (RE) in Bangladesh is one of the success stories of external development assistance to a developing nation. It is a story of assistance from concerned donor agencies, of democratic principles in action, and people-to-people involvement. The most recent Mid-Term Review of the Fifth Five-Year Plan (1997-2002) of the Government of Bangladesh has termed this as "a marked success towards expansion of electricity in rural areas".[5>]

Since its inception in 1978, REP has been able to achieve laudable growth as far as coverage is concerned. Given the MIS data on REP for the last 20 years – from June 1983 to June 2002, the uprising trend is portrayed in Figure 1.2.

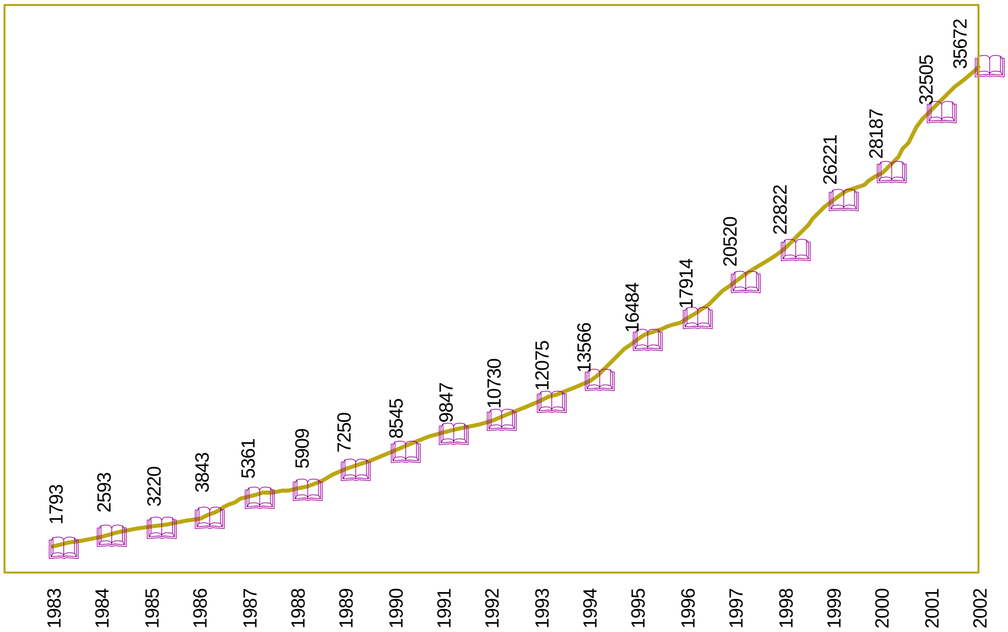
Figure 1.2: Trend in the number of PBS: 1983-2002



Source: Compiled by the authors based on last twenty years' (1983 - 2002) MIS Reports obtained from REB(all data relate to the month of June of the relevant year)

Over the last 20 years, the number of PBS established has increased over five folds with notable expansion during 1986-1987, 1994-1995, 1995-1996 and 1999–2000 (Figure 1.2). Up to June 2002, REP has covered 35,672 villages (Figure 1.3) and constructed a length of 141,736 km. of distribution line (Figure 1.4), a significant increase as far as coverage in concerned. During the past twenty years, the annual average growth rate of villages electrified was 17%, and that of length of lines energized was 17.8%.

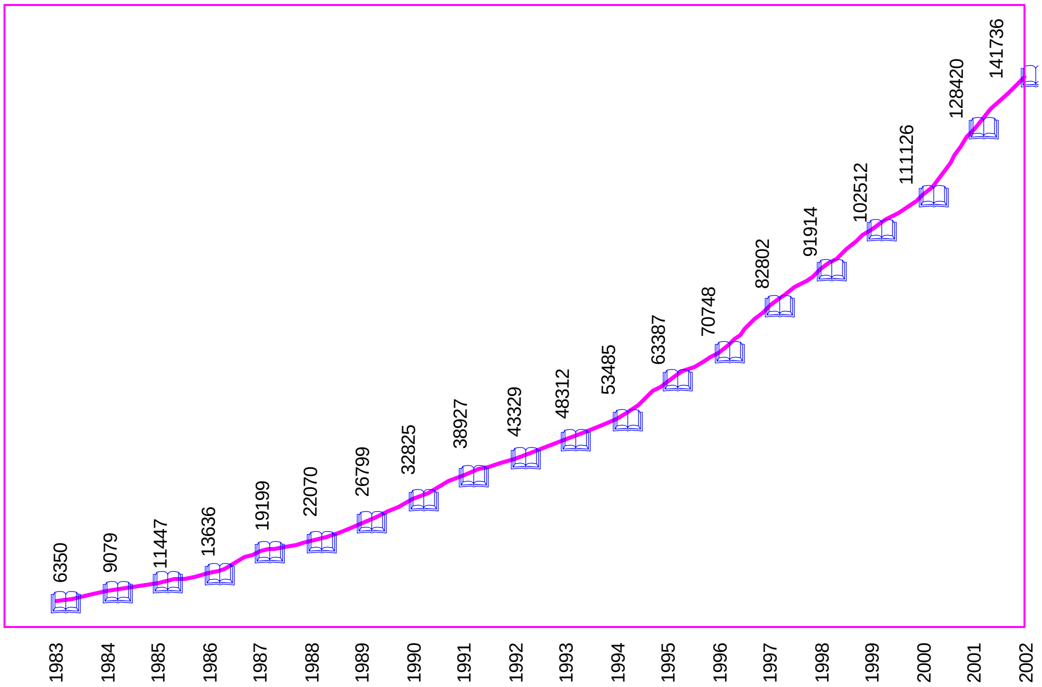
Figure 1.3: Trend in the number of villages electrified: 1983-2002



Source: Compiled by the authors based on last twenty years' (1983 - 2002) MIS Reports obtained from REB (all data relate to the month of June of the relevant year)

[5>] Government of Bangladesh (2000), Mid Term Review of the Fifth Five Year Plan – 1997-2002, Ministry of Planning, December 2000:136.

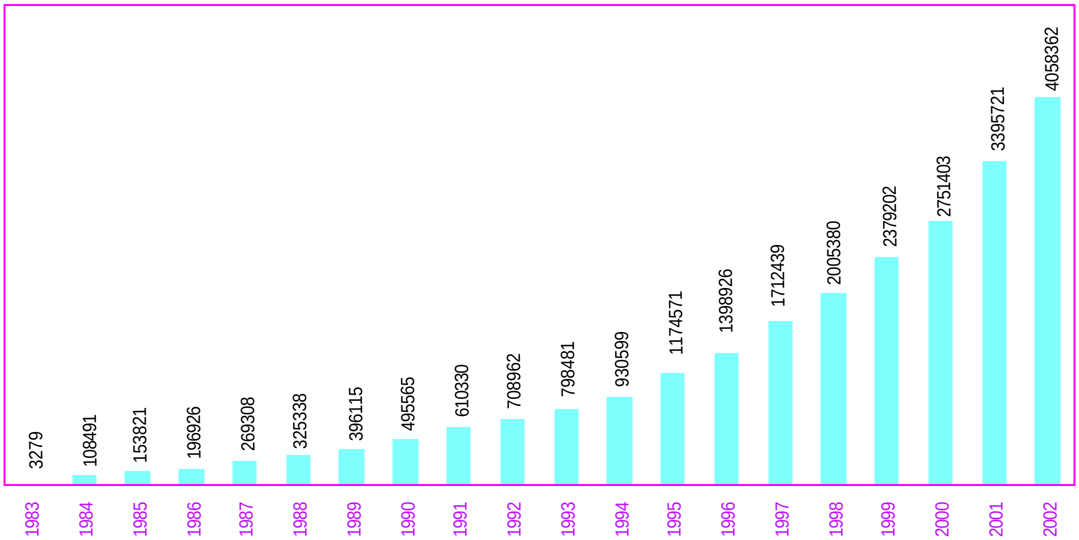
Figure 1.4: Trend in the number of Km. lines energized: 1983-2002



Source: Compiled by the authors based on last twenty years' (1983 - 2002) MIS Reports obtained from REB (all data relate to the month of June of the relevant year)

More than a thousand-fold increase (1237.63 times) in terms of number of services connected, revealing an annual average growth rate of 42.8% is shown in Fig. 1.5. As has been mentioned before, the categories of connection include – domestic/household, industrial, irrigation equipment, commercial and street light. All categories of connection are distributed in different proportions over the years, which will be discussed in details in the relevant sections for each observation measurement unit.

Figure 1.5: Trend in the number of total connections: 1983-2002

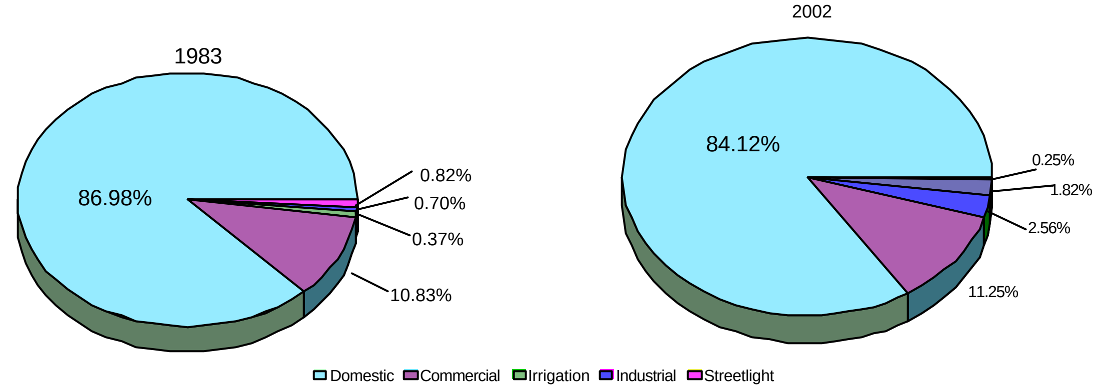


Source: Compiled by the authors based on last twenty years' (1983 - 2002) MIS Reports obtained from REB (all data relate to the month of June of the relevant year)

The changes in the pattern of consumer connection, i.e, consumer mix, has been depicted in Figure 1.6, in which comparisons have been made for 1983 and 2002. As for both the years, domestic connection ranks first and commercial connection ranked second, in terms of relative shares of the total consumer connection.

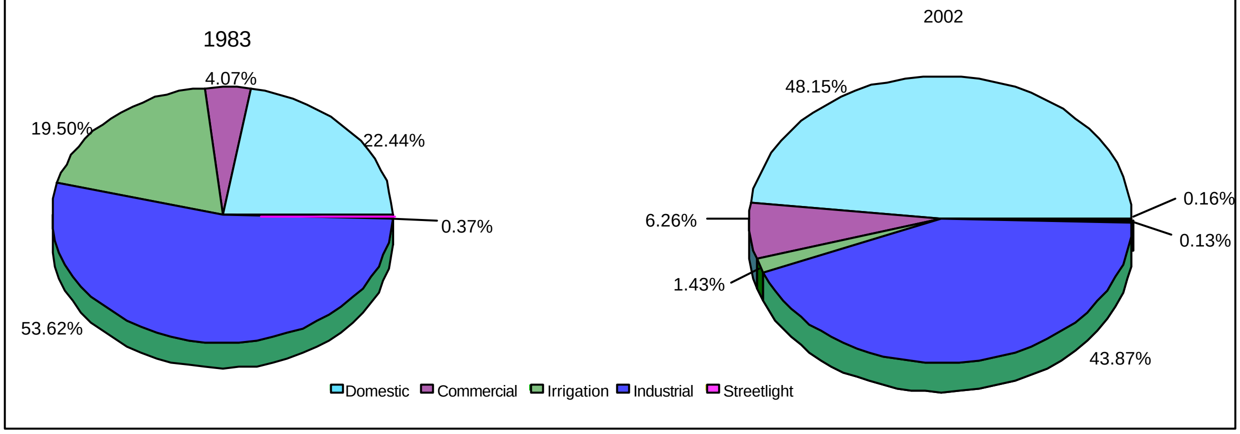
Irrigation and industrial connections have shown significant positive growth over the time period, revealing REP's objective of enhancing productivity and efficiency in agricultural production and industrial units (Figure 1.6). It is however, interesting to note that the relative share of street light connections has reduced from 0.82% in 1983 to 0.25% (Figure 1.6) in 2002.

Figure 1.6: Changes in consumer – mix. (1983 and 2002): percentage share of total consumers connected by type



Changes in the pattern of consumption in terms of MWH for one month (denoted as *this month* in MIS, REB) is shown in Figure 1.7. In 2002, office use emerges as a new category of connection. Providing electricity for social institutions (for public consumption as shown in Figure 1.1) like schools, hospitals and law-and-order institutions from 1996 signifies a qualitative change in REP intervention. This addresses major issues like public health, public education and social security and actually provides services to a lager population enabling them to avail the benefits of electrification.

Figure 1.7: Changes in consumption - mix: Percentage share of total consumption (MWH: for one month denoted as this month in MIS) (1983 and 2002)



In terms of MWH, the consumption pattern has changed significantly for all types of connection. The relative share of domestic consumption in the consumption-mix, has shown more than a two fold increase (in relative terms of total consumption) with decrease in irrigation consumption (Figure 1.7).

Given the extent of mechanization in industrial units, the consumption for industrial units (as % of total consumption) can be revealed as a steady one comparing 1983 (53.62%) with 2002 (43.87%).

1.3. EXPLICIT AND IMPLICIT GOALS OF REP

Based on a review of the available relevant documents, the primary objective of Rural Electrification Program can be stated as *to ensure a stable and reliable supply of power to the rural areas at reasonable price.* The first step toward implementation was to establish *Palli Bidyut Samities (PBSs),* a unique model of local governance in Bangladesh. The members of the PBSs, i.e., the users have successfully practiced this type of democracy at the grassroots and proved it as one of the promising models of local governance in Bangladesh (See Chapter 8).

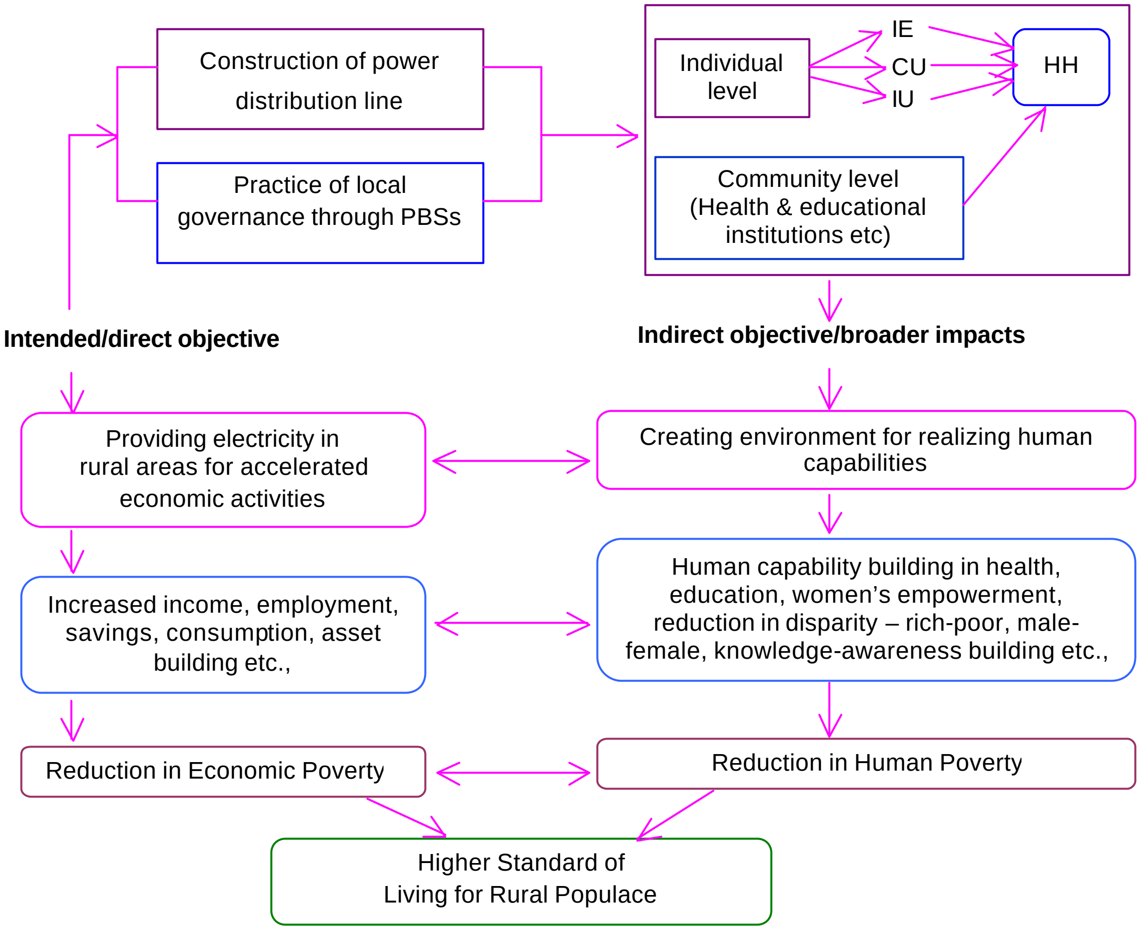
Electricity, as one of the most precious gift, of civilization, can do wonders should the economy use it in a proper way and, therefore, the objective of rural electrification is dependent on this as it is widely known that rural electrification is not an end in itself, but is a means to a number of ends. Electricity helps the people to enjoy real freedom[6>], influencing their day-to-day life directly (through *intended or direct objectives* like increase in agricultural production) by expanding the resource base and indirectly (through *indirect objectives* or *broader impacts* like greater control in household decision-making by female members) resulting to establishment of the socio-cultural infrastructure to ensure freedom of choice[7>].

As the deprivation of human capabilities far exceeds the deprivation of income alone, the interplay of intended (direct) and indirect objectives (Annex A1) is crucial for human development. Their impact in the process of accelerated human development has been portrayed in Figure 1.8.

[6>] Sen, A.K. (1999)

[7>] The objectives of REP (in ToR objective B.1, See Annex D) was termed as “intended” and “unintended”. Later on, a meeting was held between the Core-team and NRECA (on 31st march 2002) to review the draft Report 1. After much brainstorming about the essence/contents of the two categories, namely “intended” and “unintended” objectives, it was resolved that from now on, the “unintended” objective will be terned synonymously as “direct” objective; and the term “unintended” objective will be replaced by “indirect objective” or “broader impacts”.

Figure 1.8: Objectives of Rural Electrification Program



IE = Irrigation Equipment, CU = Commercial Units, IU = Industrial Units, HH= Household

Considering the activities and output of REP, the explicit and implicit goals of REP has been ascertained and purposes identified on the basis of direct and indirect objectives of REP as revealed in glimpses of relevant studies (Annex A2). The purposes and goals are presented below in Table 1.1, following a conceptual framework[8>].

Table 1.1: Purposes and Goals of REP

Purposes	Goals
1. Increased farm yields and non-farm production 2. Enhanced productivity and efficiency in agricultural production 3. Greater job opportunities 4. Improved environment and enhanced willingness for education. 5. Greater awareness about health issues 6. Better health care facilities 7. Increased access to information through electronic media 8. Local level democratization in PBSs 9. Expansion of local markets 10. Increased social security and mobility 11. More effective use of working hours.	***Explicit*** 1. Poverty reduction 2. Reduced migration from rural areas 3. Local governance ***Implicit*** 1. Improved living standard 2. Gender development and women empowerment 3. Changed world view.

[8>] The conceptual framework is a set of inter-linked notions wherein ***goal*** (e.g. income - poverty reduction) is defined as higher level objective while ***purpose*** (e.g. increased farm and non-farm production) is supposed to contribute in achieving the higher level objective. Again ***output*** (e.g. electrical connection household, to irrigation equipments and industrial units) is that which a project must achieve and sustain in order to ensure the purpose, and ***activity*** (e.g. construction of power distribution line) is action towards output.

CHAPTER 2

OBJECTIVE OF THE STUDY

The **broad objective** of the study was to make an **assessment of Economic and Social Impacts of Rural Electrification Program in Bangladesh.**

In line with the Terms of Reference (see Annex E) and the broad objective, the **specific objectives** of the study were:

i. To design the economic and social impact evaluation study of the **Rural Electrification Program** that includes reconfirmation of intended objectives and identification of indirect or broader impacts of REP, defining impact indicators, identification of relevant testable hypotheses, and development of an appropriate methodology.

ii. To determine impact of REP on various dimensions of human development focussed on

    a. standard of living
    b. poverty reduction
    c. gender development.

b) To evaluate the impact of REP on industrial development: This objective focuses on employment generation, production, wages, investment, market expansion, agro-industrialization, environment, development of support services, and changes in life-pattern to poverty reduction.

c) To assess the impact of REP on the development of commercial activities: This objective concentrates, among others, on expansion of economic activities and growth centers, employment, business turnover, savings and investment.

d) To evaluate the impact of REP on various dimensions of irrigation: This objective deals with two major dimensions of impact**:** (a) the irrigation pump owners, and (b) the effect on production. Areas of focus of this objective include the following variables: coverage of irrigation, production, employment, investment, savings, cost of production, crop diversification, adoption of modern varieties, environment, and poverty reduction as a result of expansion of irrigation facilities associated with rural electrification.

e) To put forward logically sound recommendations based on scientifically rigorous impact evaluation in line with the above objectives, the goal and purpose of REB, and the Government's Energy Policy, especially on accelerated development of Bangladesh economy and poverty reduction in a sustainable way through rural electrification.

It would be appropriate to note that the study objectives presented above had been formulated based on the research team's understanding of the Terms of Reference, knowledge about the Rural Electrification Program and REB, essence of the Government's Energy Policy, evaluative findings of the Mid-term Review of Fifth Five Year Plan (published in December 2000), and the team's review of relevant literature and meetings with the stakeholders– USAID, NRECA, REB, PBS, focussing on impact of electrification on economic and social development.

CHAPTER 3

METHODOLOGY

3.1. INTRODUCTION

Designing of the appropriate methodology, being one of the most crucial task to accomplish, was multi-phased and rigorous. The first phase was to formulate the study design, followed by definition of impact indicators and identification of testable hypotheses linking REP and project interventions with explicit and implicit goals established.

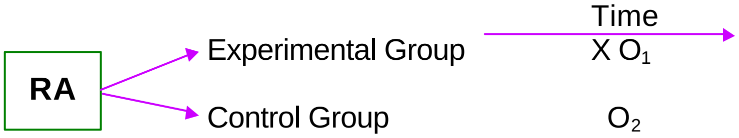
In the process of finalization of key technical issues pertaining to this impact evaluation study,[1] the study team had two meetings with RPPR program partners– USAID, NRECA and REB:

a. Consensus-building meeting held on 9 May, 2002 at REB Headquarters, Dhaka
b. Joint meeting held on 15 May, 2002 at USAID, U.S. Embassy, Dhaka.

The technical issues discussed include, among others, objectives of REP and the study, explicit and implicit goals of REP, impact indicators, testable hypotheses, universe and sample, and field implementation. After threadbare discussion among the participants, the study team and the stakeholders reached a consensus on all key issues methodologically crucial for the study.

3.2. STUDY DESIGN

In line with the objectives of the study, **absence of baseline** (pre-test) measurement observation necessitated adoption of **Posttest-only Control Group Operations Research Design,** which is depicted as.



Where, RA = Random assignment of cases to the experimental group and the control group
X = Program intervention/experimental intervention (rural electrification)
O_1 = Observation measurement for HHs with electricity
O_2 = Observation measurement for HHs without electricity

ESIES was designed to evaluate impact(s) using ***`with-without'*** (electricity) scenario to gauze the impact of REP. In addition to the observation measurements O_1 and O_2, an additional sample category – the households without electricity in the electrified villages (Observation measurement O_3) – was thus included in the study design to evaluate the spill-over effect of REP. However, in the process of designing the actual study and pre-test of the household survey instruments, it was decided to collect retrospective information on some specific indicators like ownership, property and assets for households which suffers less memory recall problems. Data validity, therefore, is adequate enough to gauze inter-temporal variations and changes for respective variables, which is important for ESIES (details see section 4.3.7.1).

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[1] The title of the study is Economic and Social Impact Evaluation Study (ESIES) of the Rural Electrification Program in Bangladesh. Henceforth, the acronym for the present study will be denoted as **ESIES**.

At the level of household, the study proposed three types of observation measurement:

O_1 = Observation measurement for households **with** electricity **(HE)***

O_3 = Observation measurement for households **without** electricity ***in electrified villages (WE-EV*).***

O_2 = Observation measurement for households **without** electricity ***in non-electrified villages (WE-NEV)*.***

* Throughout this report three acronyms, namely, **HE, WE-EV,** and **WE-NEV** have been used consistently to denote households with electricity, households without electricity in electrified villages, and households in non-electrified villages, respectively.

In order to capture all the dimensions of impact of REP, all categories of customers (consumers) were considered. In addition to the households, observation measurement was made on irrigation (pump owners and plot owners), industry, and commercial units using rural electrification (experimental) and not-using electricity (control). The survey technique included both qualitative and quantitative methods, as discussed in details in the rest of the chapter.

3.3. SAMPLE DESIGN

Given the importance of representativeness of data, sampling strategy was detailed out by the study team before the consensus-building meeting with RPPR program partners (held on 9 May, 2002) and was unanimously accepted by all the RPPR program partners.

3.3.1. PBS as Primary Sampling Unit

PBSs have been taken as primary sampling unit. In lieu of purposive selection, *probabilistic sampling strategy* was adopted to ensure desired level of confidence with *probability proportionate to size* (PPS) according to the number of villages electrified. As for this purpose, the following statistical formula was used:

$$n = \frac{NZ^2PQ}{(N-1)\,C^2 + Z^2PQ}$$

Where,

n = Sample size

P = a dichotomous probability

Q = 1 – P

N = Size of the universe

Z= Standard normal variate

C = Precision level.

An approximate conservative value of P=50% has been used with a confidence level of 95% and precision level 10%. Choice of P=50% leads to a better approximation to normality which is needed for the above formulation. Choice of precision level = 10% is allowable in social science studies in order to minimize costs related to trade-off between Type I and Type II errors. Thus, an workable sample size of PBS has been determined to be **N**=37. However, the impact of sample size relative to universe size needed to be considered as well. We notice that n/N exceeds 5%. Thus, n has to be adjusted downward by n/N (see Cochrane, 1999). Thus, the revised final sample size of PBS units is, **n = 23**.

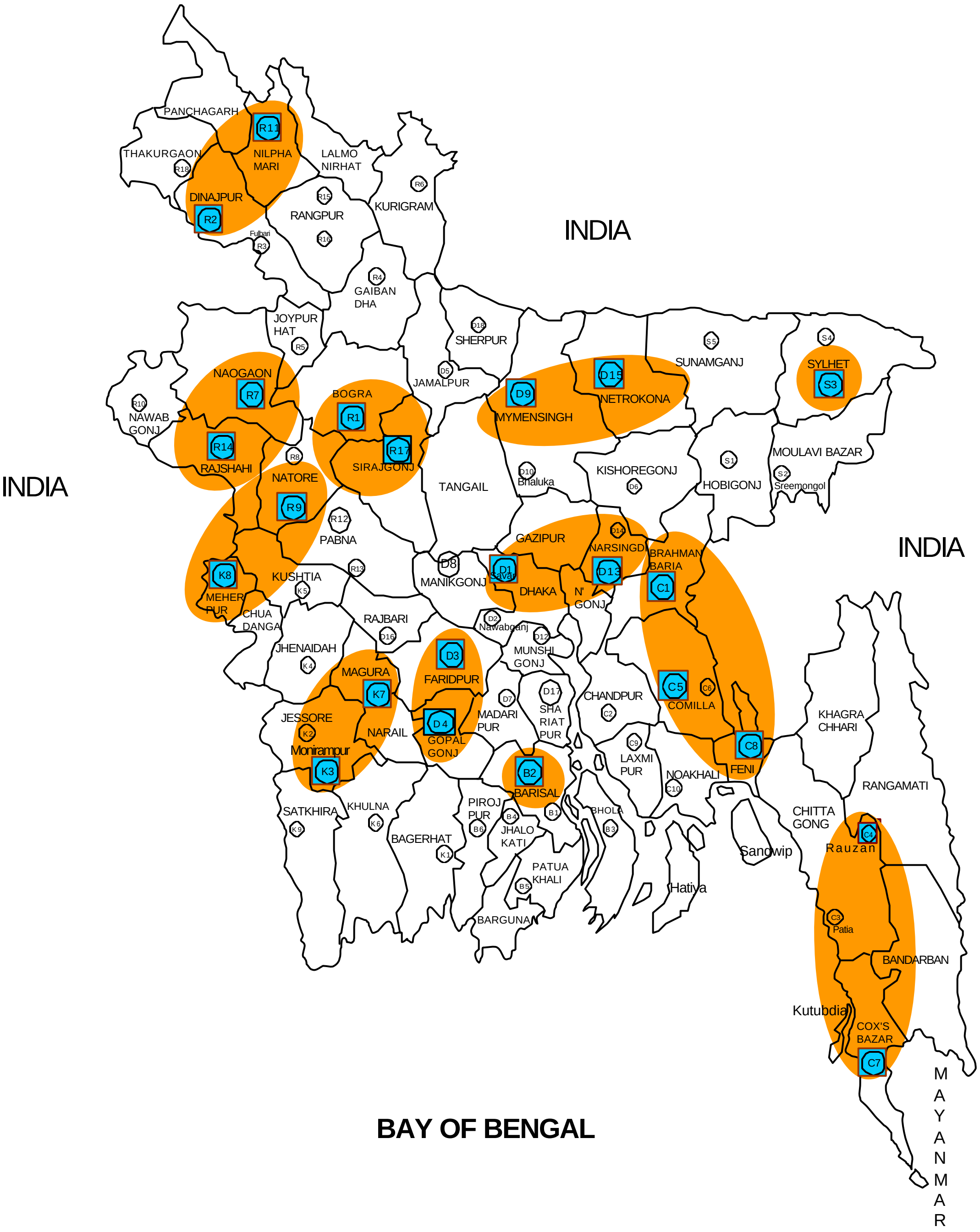
In order to ensure representativeness of twenty-three (23) sample PBSs, stratified random sampling procedure has been adopted. The age-length of PBSs has been used as the criteria for such stratification. The three strata are as follows:

Stratum 1: Age group Q1 and below;
Stratum 2: Age group above Q1 and upto Q3; and
Stratum 3 : Age group Q3 and above.

The selected sample PBSs according to age group is shown in Annex A3, and the locations of all 61 PBSs and those of 23 sample PBSs is shown on the Map-3.1. The map also identifies 12 quality control clusters, which have been worked out on the basis of proximity and communication network among the sample sites. The issues pertaining to quality control have been discussed in details in Section 3.6.3.

Map 3.1: Sample PBSs and *Quality Control Clusters*

Legends: ○=PBS ●=Sample PBS



3.3.2. Sample Sizes for Observation Measurement Unit

The survey respondents of FOUR broad observation measurement units – Household, Irrigation Equipment, Industry, and Commercial Unit were:

	Beneficiary category	**Respondent**
1.	Household	Household head (male and/or female)
2.	Industry	Owner, Manager
3.	Commerce	Owner, Manager
4.	Irrigation sector	Pump owner, farmer (owner of plot)

The final sample sizes by observation measurement units for the survey is thus presented in Table 3.1.

Table 3.1: Sample sizes by observation measurement units

Electrification Status	Household	Industry	Commercial	Irrigation	Total *
Village/area with electricity:					
Unit with electricity (experimental)	1380	117	400	383	2278
Unit without electricity (control)	421	59	128	73[1>]	1438
Village/area without electricity (control)	690			67[2>]	
Total	2491	176	528	523	3718

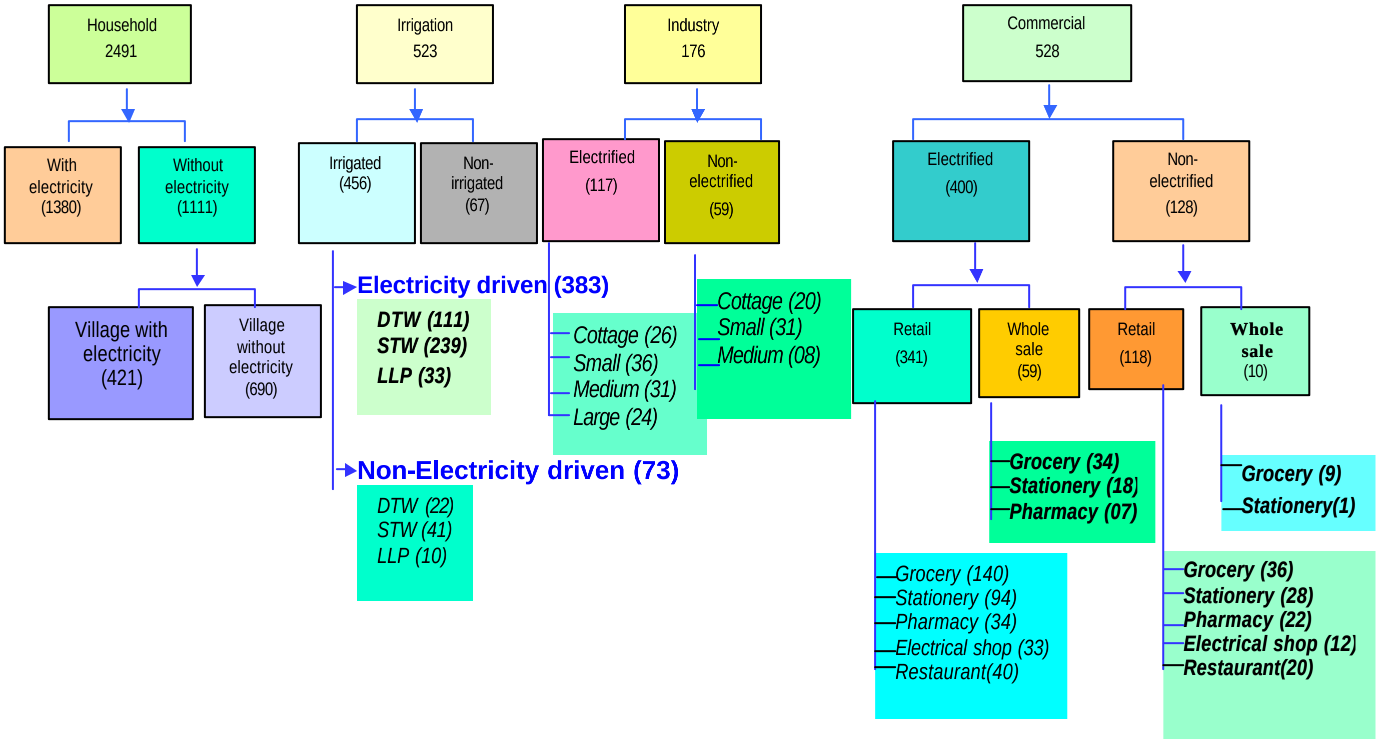
* *Strictly speaking these are not additive; however, in order to give a feeling about the magnitude of coverage, addition has been made.*

[1>] *User of non-electricity driven irrigation equipment;* [2>] *No-irrigation*

The rationale for sample size of experimental units for each observation measurement unit is discussed in the following section in details in the rest of the chapter. The statistical formula used to select the control sampling units have been discussed in Annex A3.

A schematic view of distribution of sample sizes by observation measurement units and by categories under each unit is depicted in Figure 3.1.

Figure 3.1: Schematic view of distribution of sampling units by categories



3.3.2.1. Distribution of Sample Size for Villages and Households

Within a particular PBS, three villages were selected for survey– two with and one without electricity. Within the PBS area two dispersed villages and 30 households having electricity (WE) from each such village were chosen as the sampling unit. From each of the two selected villages, 9 to 10 households without electricity (WE-EV) were chosen randomly (as per statistical rationale mentioned in Annex A3). From each selected village without electricity (within the sample PBS), 30 households (WE-NEV) were chosen randomly.

3.3.2.2. Distribution of Sample Size for Irrigation Equipment

As for each PBS, the total sample for electrified irrigation equipment was distributed following the PPS method using PBS wise information in MIS of REB. According to MIS June 2001, there were 89,647 (in 61 PBSs) irrigation connections. For such a huge universe, a random sampling of 383 irrigation connections at 95% confidence level with 5% margin of error is enough with a dichotomous probability of 50%. The same procedure was followed in distributing samples by types of irrigation equipment (*DTW, STW, LLP*) per PBS. As for non-electrified samples, since there was no list available with PBS on the total number of irrigation equipment, the above procedure has been followed and has been discussed in details in Annex A3.

3.3.2.3. Distribution of Sample Size for Industrial Units

As for each PBS, the total sample for electrified industrial units was distributed following the PPS method using PBS-wise information in MIS of REB (January 2002). The list of industrial connections for each of the 117 industrial units were brought under survey. Such a number conforms to 95% confidence level with 10% precision level for a population of over 65,831 services already connected across 61 PBSs having a dichotomous probability of 50%. Due to the unavailability of national data on the distribution of industries by types – *cottage, small, medium, large* – expert judgment was applied in distributing the samples by types for each sample PBS. Types of industries have been defined following Census of Manufacturing Industries (CMI)[2>]. As for non-electrified samples, a similar procedure has been followed. It may be mentioned here that of 59 industrial units using power other than electricity is treated as control units for comparison purposes (Annex A3). Such comparison, most likely, was possible only in case of the cottage and small industries. The large and medium-scale industrial units having no counterpart comparison units, is compared with their own performance over time using retrospective information on some crucial variables.

3.3.2.4. Distribution of Sample Size for Commercial Units

According to REB's MIS, there are over 370 thousand commercial connections provided by 61 PBSs. Thus, following the same strategy as with industrial units, a sample of 400 commercial units is enough at 95% confidence level with 5% margin of error and 50% dichotomous probability. As for each PBS, the total sample for electrified commercial units was distributed following the PPS method using PBS-wise information in MIS of REB (January 2002). Due to the unavailability of national data on the distribution of commercial units by types – retail (*grocery, stationery, pharmacy, saloon, restaurant*) and wholesale (*grocery, stationery*) – expert judgment was applied in distributing the samples by types for each sample PBS. As for non-electrified samples, a similar procedure has been followed (Annex A3).

3.3.3. Qualitative Survey

To complement quantitative information obtained through interview schedules, qualitative information were collected through focus group discussions (FGDs) for each observation measurement unit and group discussions (GDs) with members of Board of Directors, General Manager and other officials of PBSs (Table 3.2). Keeping geographical coverage in mind, nine group discussions with members of Board of Directors, General Manager and other officials of PBSs were conducted by the core team members during their field visits in respective PBSs.

[2>] *Cottage: With family member, Small: 1-10 workers, Medium: 11-49 workers, Large: 50+ workers*

Table 3.2: Number of FGDs and GDs by category of participants.

Electrification status	FGD				GDs
	Household head/Women	Owner/ Manager of IU	Owner/ Manager of CU	Owner/ Manager of IE	Member/ Board of Directors
Village/area (within PBS)	-	-	-	-	9
Unit with electricity	3	3	3	3	
Unit without electricity	3	3	3	3	
Village/area (Non-PBS)	3				
Total	9	6	6	6	9

Note: *FGD = Focus Group Discussion, GD= Group Discussion, IE= Irrigation Equipment, IU= Industrial Unit, CU= Commercial Unit.*

3.3.4. Secondary Data Collection Format

The primary objective in formulating Secondary Data Collection Format (SDCF) was to gather additional information for PBS and the community in which the survey was conducted, all of which has been presented in Annex B. SDCF for PBS (Annex B10) encompasses information on electrification and consumer status as well as organizational, technical, financial and employment status. SDCFs for community level information were developed for three levels: *Upazilas (Annex B13), Unions (Annex B12),* and *Villages (Annex B11)*. All those were formulated in such a way that the information collected would help understanding the overall community scenario at diverse level as the filed staff were asked to survey all the sample villages and the unions and upazilas under which the sample villages were situated. SDCFs, for information on industries connected *(Annex B14)*, were sent to all 67 PBSs (through REB) to grasp the overall status of industrial connection of REB and provided further insight in analyzing the field data for industrial units.

3.4. MEASURABLE OBJECTS/VARIABLES, IMPACT INDICATORS AND STATISTICAL INFERENTIAL ANALYSIS

At first, the relevant impact indicators have been discussed followed by formulation of testable hypotheses for each of the sample categories – **Households Units, Irrigation Units, Industrial Units,** and **Commercial Units.** Different methods for statistical inferential analysis are briefly mentioned in section 3.4.2.2.

3.4.1. Impact Indicators

3.4.1.1. Household

The impact indicators for household units have been applied to analyse three broad groups of variables/measurable objects– Economic, Social and Cultural, and Demographic. As for each group of variable/measurable objects, the corresponding impact indicators and means of verification (sources of data/information) were as presented in Table 3.3.

Table 3.3: Variable(s)/measurable objects, measurable indicators and means of verification for households.

Variable(s) measurable objects	Measurable indicators (MI)	Means of verification (MV)/ source(s) of data/ information
Economic	**Income** (gross, net, sources, by male-female); source-wise income's share of electricity (in household and/or outside household); **occupation** and **employment** (primary and secondary by male-female); **expenditure** (by all items; food and non-food; recurrent and capital; health, education and clothing by male-female); **credit** (by sources); **surplus** and **savings;** possession/ownership of **assets** – land, non-land (including dwelling, livestock-poultry, agricultural equipments and household durables); **self assessment** of household economic status (for last five years) interms of availability of food, bearing/meeting health and educational expenses, crisis, crisis coping strategies/ mechanisms, and distress sale; **willingness to pay more** for electricity; **spending** on electricity connections and payment of bills; and **purchase** of electrical appliances and future intention to purchase.	IS,FGD
Social and cultural	**Education:** literacy – overall and adult, gross enrollment, years of schooling, quality of education (spending, attendance, exam. performance, study hours at night, dropout) – all by male-female.	IS,FGD
	Health-Hygiene-Sanitation: Knowledge on crucial public health issues (twenty issues including ORS, ARI, PNC, safe delivery; EOC, STD, HIV/AIDS, Arsenic, TB, Leprosy etc); health care practices including disease pattern and treatment by medically competent persons (MCP) while sick; child delivery, ANC and PNC check-ups by MCP, TT immunization status, child vaccination status (against 6 diseases), intake of vitamin A capsule to prevent night-blindness in children; source of drinking water; availability of latrine facilities; use of hand washing materials after defecation; use of soap for bathing; infant mortality; maternal morbidity and related treatment; contraceptive use (by method)	IS,FGD

Variable(s) measurable objects	Measurable indicators (MI)	Means of verification (MV)/ source(s) of data/ information
Social and cultural (contd...)	**Access to information, awareness and knowledge:** Availability of and access to TV and radio; time spent in watching TV and listening radio; programs most frequently watched and listened; subjects, issues and areas of awareness-building through radio and TV; changes in habits due to TV/radio; knowledge gained through radio listening and watching TV; women's knowledge about gender equality issues and source of knowledge; knowledge about amount of one-time investment needed for electricity, monthly bill and tariff; knowledge about eligibility criteria for PBS board directorship, their role, AGM and lady advisors; reasons for not having electricity; reasons for willingness to have electricity; knowledge of and experience about dis-benefits of irregular electricity supply; knowledge about problems associated with electricity disconnections.	IS,FGD
	Women's perception: towards years and place of education, ideal age-at marriage, arrangement of marriage, ideal family size, ideal birth spacing, need to consult for consent in marriage, young women's jobs outside village, dowry.	IS,FGD
	Women empowerment: (in addition to those already mentioned) participation in income generation activities; decision making in spending wage discrimination; membership of credit groups; ability to visit various community places (alone/not alone); work/activities outside home; security of mobility at night; husband's consultation on major decision issues; male-female divide in health care and educational spending; equipments/in use for cooking, husking and grinding of spices; workload; pattern of spending leisure.	IS,FGD
	Allocation of time (after sunset) by elders and older students**:** by specific activities, activities new after electricity in household, activities not new but more time available after electricity, income generation activities.	IS,FGD
Demo-graphics	Children even born and died, age-sex structure, household size, total fertility rates, migration (out and in), reasons for migration.	IS,FGD

Note: ***IS = Interview Schedule, FGD = Focus Group Discussion***

For all the indicators mentioned above quantitative data in the survey were collected. However, FGD dealt with those issues for which adequate quantitative data were not available or for which more in-depth qualitative data/information were deemed necessary. The relevant data collection instruments are appended. See Annex B1 and B5.

3.4.1.2. Irrigation Units

The relevant variables for irrigation units, their corresponding indicators and means of verifications were as stated in Table 3.4.

Table 3.4: Variable(s), measurable indicators and means of verification for irrigation unit

Variable(s)/ measurable objects	Measurable indicators (MI)	Means of verification (MV)/ source(s) of data/ information
Productivity	Yield of different crops using various irrigation equipment (DTW, STW, LLP), Cropping Intensity	IS
Cost of Production	Cost of inputs per acre (by crop)	IS, FGD
	Cost of inputs by unit production (by crops)	IS
	Cost of irrigation	IS
Employment	Labor power (person days) by stages of agricultural production: - Seed bed preparation - Land preparation - Sowing - Weeding/Thinning - Pesticide - Fertilizer - Irrigation - Harvesting - Carrying/Transporting - Threshing - Drying/Weaning	IS
	Labor power for operating equipment/pump (regular/casual)	
Command area	Net irrigated area	IS
	Total irrigated area	
	New area under irrigation	
Operational cost	Cost of energy	IS
	Cost of lubricant	
	Wages	
Maintenance cost	Cost of servicing (lubrication, change in filters etc.)	IS,FGD
	Cost of breakdown	
	Cost associated with hazards/mental tension.	
Others	Tenancy pattern of plots	IS
	Income by crop	
	Income by type of pump	
	Duration of installation	
	Duration of electrification	
	Capacity of equipment	
	Depth of well	
	Cost of equipment	
	Installation cost	
	Reasons for switching	
	Reasons for not switching	
	Future intention of non-electrified pump owners	
	Irrigated land of pump owner	

Note: *IS=Interview schedule, FGD=Focus Group Discussion, DTW=Deep Tubewell, STW=Shallow Tubewell, LLP= Lowlift Pump*

3.4.1.3. Industrial Unit

The relevant variables for industrial units, their corresponding impact indicators and means of verifications were as presented in Table 3.5.

Table 3.5: Variable(s), measurable indicators and means of verification for industrial units

Variable(s)/measu-rable objects	Measurable indicators (MI)	Means of verification (MV)/ source(s) of data/ information
Productivity	Volume of production	IS
	Working hours per day	
	No. of workers (skilled-unskilled, part time-full time, male-female)	
	Market Value of output	
	Value Addition	
	Profit	
	Investment	
Cost of production	Cost of inputs (including wage for male and female workers)	IS
	Cost of power supply/fuel cost	
	Depreciation	
	Cost of capital	
	Transportation cost	
Efficiency (Production/ worker) (Average cost/ production)	Volume of production	IS
	No. of workers	
	Cost of production	
Diversification	Type of goods	IS
	Value of output	
	Market value of fixed capital	
	No. of workers	
Forward and backward linkages	Type of goods	IS, FGD
	Value of output	
	Market value of fixed capital	
	No. of workers	
Clusters	No. of units concentrated (by type)	IS, FGD
	No. of inter-linked industries(by type)	
	No. of auxiliary firms(by type)	
	No. of subcontracting firms (by type)	
Development of support-service sector	Credit Institutions	IS, FGD
	Transport Linkage	
	Service sector	
Environmental (Pollution)	Nature of waste (chemicals, smoke)	IS, FGD
	Method of waste disposal (air, water)	

Note: IS=Interview Schedule, FGD=Focus Group Discussion

3.4.1.4. Commercial Units

The concerned variables for commercial units, their corresponding impact indicators and means of verifications were as stated in Table 3.6.

Table 3.6: Variable(s), measurable indicators and means of verification for commercial units.

Variable(s)/ measurable objects	Measurable indicators (MI)	Means of verification (MV)/ source(s) of data/ information
Market expansion	Duration of business hour (day and night)	IS, FGD
	Number of customers	
	Turnover	
	Stock in hand	
	Overhead expenses	
	Business Diversification	
Employment	No. of employees (part time, full time, self employment, and by sex)	IS
Quality	Variety of electrical gadgets	FGD
	Use of electrical gadgets	
	Statement of owners about: i. Advantages and disadvantages ii. Sources of supply iii. Risks	

Note: IS=Interview Schedule, FGD=Focus Group Discussion

3.4.2. Statistical Inferential Analysis: Testable hypotheses, factor analysis, cluster analysis, income determination model, and TOBIT Model Analysis

The nature of this study required a number of hypotheses to be tested on the basis of information collected in the survey. Each group of hypotheses contain rationale followed by formulation of *Null* ***(H_0)*** as well as *Alternative* ***(H_1)*** hypotheses for crucial variables[3>].

3.4.2.1. Testable Hypotheses

Hypotheses developed for different categories of observation measurement units (e.g. Household, Industry, Commercial and Agriculture) were tested. The number of hypotheses by categories and key areas, tested are presented in Table 3.7.

[3>] The objective of hypothesis testing is precisely to find out whether a given observation of finding is compatible with the stated hypothesis. In the language of statistics, the stated hypothesis is known as **"Null Hypothesis"** which is usually tested against an **"Alternative Hypothesis",** also known as "Maintained Hypothesis". The theory of hypothesis testing is concerned with developing rules or procedures for deciding whether to reject or not reject the null hypothesis. The two mutually complementary approaches for devising such rules – confidence interval and test of significance; predicate that the variable under consideration has a distribution and that hypothesis testing involves making statements or assertions about the values of the parameter(s) of such distribution. (Gujrati, D.N.; 1995. Basic Econometrics, McGraw Hill Inc). In this study, the testing strategy is divided into two parts: (1) Test of difference and (2) Test of Association (in applicable cases).

Table 3.7: Number of hypotheses by categories and key areas for which statistical tests were carried out

Categories	Key areas	Hypotheses tested for		
		Test of association	Test of differences	All
Household	Economic	5	16	21
	Social and Cultural	9	24	33
	All	14	40	54
Irrigation	Productivity	-	3	3
	Cost of irrigation	-	2	2
	Cost of maintenance	-	1	1
	All	-	6	6
Industry	Production and sales	-	1	1
	Cost of production	-	1	1
	Diversification	-	1	1
	Backward and Forward Linkages	-	2	2
	Industrial cluster	-	1	1
	Development of support-service System	-	3	3
	All	-	9	9
Commercial	Market Expansion	-	1	1
	Employment	-	4	4
	All	-	5	5
TOTAL		14	59	73

All test results are discussed and analysed in Chapter 9. The following subsection presents testable hypotheses for each of the four units with key variables and rational behind the hypothesis. While only one example of each is presented below, details are available in Chapter 9.

A. Testable Hypotheses for Household

All testable hypotheses with 21 for economic and 33 for social-cultural related to economic aspects of households have been presented in Chapter 9. Only one example against each broad variable has been provided here.

A1. ECONOMIC

(Income, Employment, Expenditure, Surplus, Savings and Asset Generation)

- **INCOME AND EMPLOYMENT**

Rationale

Electricity provides the necessary infrastructure for a broader range of income-generating activities, in terms of accessing new ventures (e.g. poultry) as well as the better operation of the old ones (like electricity-operated irrigation equipment). The extended working hours in the evening enables the households, especially women, engaging themselves in home-based income-generating activities like sewing, handicrafts etc. Due to the expansion of local markets in the electrified villages, the households in the vicinity (even without electricity) are exposed to increased employment opportunities compared to the households in the non-electrified villages. The same applies to the expansion of industrial base.

Hypothesis (one of the examples, while other examples are available in Chapter 9)

H_0 = Households with and without electricity do not differ in terms of net income.
H_1= Households with electricity have higher net income compared to those of households without electricity.

A2. SOCIAL and CULTURAL

(Education, health, hygiene, sanitation, access to information and awareness, mobility and security: A total of 33 hypotheses have been tested; See Chapter 9)

- **EDUCATION**

Rationale

Electricity enables the school-going children to study in a more productive way due to the extended study hours in the evening as well as due to the comfort offered by electrical appliances (e.g., fans). Thus, electricity facilitates literacy, enrolment and attainment. Along with their affordability, the enlightened outlook towards education due to media exposure contributes to their willingness in pursuing higher studies for their children, especially girls. The operation of night schools in the electrified villages can also contribute in rejuvenating the thirst for education for adult and female members as well.

Hypothesis

H_0 = Electrified and non-electrified areas do not differ in terms of literacy rate (both male and female).
H_1 = Electrified areas have higher literacy rate (both male and female) than non-electrified areas.

- **HEALTH, HYGIENE AND SANITATION**

Rationale

Electricity enables the electrified households to enjoy improved health status as a result of more knowledge on issues related to health, hygiene and sanitation (through electronic media, especially TV); and also because of better healthcare facilitated by electrical appliances like fans, refrigerators etc. The health providers can also contribute more effectively with modern appliances (machines conducting various diagnostic tests, e.g., X-ray machines) and extended working hours in the evening. Thus, it can be rationally postulated that electricity contributes to knowledge, practice and services pertaining to health, hygiene and nutrition.

Hypothesis

H_0 = Women in households with and without electricity do not differ in terms of knowledge about crucial public health issues.
H_1 = Women in electrified households have more knowledge on crucial public health issues than those in the non-electrified households.

- **ACCESS TO INFORMATION AND AWARENESS**

Rationale

The electronic media has been instrumental in building awareness (social, economic and cultural) among the rural people. Apart from a widened vision towards education, health rights, security and other socio-cultural issues, better access to information through electronic media enables the households (especially the women) in the electrified villages to be aware of their fundamental human rights.

Hypothesis

H_0 = Women in electrified and non-electrified areas do not differ in terms of time allocation for watching TV.

H_1 = Women in electrified areas spend more time in watching TV compared to that of non-electrified areas.

- **MOBILITY AND SECURITY**

Rationale

The electrification at the household level, by providing light in the courtyard, helps the people, especially women, to move freely with a greater sense of security after sunset. Electricity accelerates market expansion, which, in turn, enhances mobility of the rural population.

Hypothesis

H_0 = Households in the electrified and non-electrified areas do not differ in terms of security for mobility at night.

H_1 = Households in electrified area have higher security for mobility at night compared to households in the non-electrified areas.

B. Testable Hypotheses for Irrigation Unit

(A total of 16 hypotheses were tested; See Chapter 9)

- **PRODUCTIVITY**

Rationale

Uninterrupted water supply is vital for a specific duration of production for each crop. In addition to timely and adequate supply of water facilitated by irrigation equipment, electricity-driven irrigation equipment are ensure higher crop yields as a result of uninterrupted water supply.

Hypothesis

H_0 = Yield per acre using electricity-driven irrigation equipment do not differ from that of non-electrified irrigation equipment.

H_1= Yield per acre is higher with electricity-driven irrigation equipment compared to non-electrified irrigation equipment.

C. Testable Hypotheses for Industrial Unit

(A total of 9 hypotheses were tested; See Chapter 9)

- **PRODUCTIVITY**

Rationale

Electricity has created an atmosphere, which facilitates higher production, productivity (production per unit of time), value addition, market value of output, and profit.

Hypothesis

H_0 = Annual volume of production (AVP) does not differ between electrified and non-electrified industries.

H_1 = AVP is higher in electrified industries than that of non-electrified industries.

D. Testable Hypotheses for Commercial Unit

(A total of 4 hypotheses were tested; See Chapter 9)

- **Market Expansion**

Rationale

Electricity is useful in providing necessary environment for accelerated commercial activities. By providing lighting facilities, electricity lengthens working hours for business people. Among others, hours of businesses for commercial establishments (hats, bazars, shops and stores) in the rural areas is dependent on the availability of customers, environment and others. Electricity begets a new work culture where people of electrified areas have got a different life-style than that of non-electrified areas. Therefore, it can be reasonably expected that productive activities in general and commercial activities in particular, are more in electrified areas and thus contribute to higher business turnover and greater assortment of products in the electrified commercial establishments.

Hypothesis

H_0 = Electrified and non-electrified commercial units do not differ in terms of business turnover.

H_1 = Business turnover in the commercial units with electricity is higher than in the units without electricity.

3.4.2.2. Factor Analysis, Cluster Analysis, Income Determination Model, and TOBIT Model Analysis

Apart from hypothesis testing, several statistical methods have been applied to incorporate different dimensions of the study objectives and the variability of data set. These exercises, detailed out in Chapter 9, seem crucial for the quantification of impact of Rural Electrification. Relevantly we briefly highlight those specific tools.

1. **Factor Analysis:** Such a tool enables us to identify the crucial set of factors to be retained for analysing the present scenario.

2. **Cluster Analysis:** This is an elegant tool to form homogenous groups of observation for gaining better insight into the phenomenon. Thus, models like Income Determination Model can be more meaningfully adopted and interpreted.

3. **TOBIT Model:** This is a very novel approach enunciated by Nobel Laureate James Tobin in 1958 for analysing situations whenever dependent variable (under variable consideration to be analysed) can take zero values. We have several dependent variables in our study, which conform to such framework very well. Such approach enables us to incorporate those Zero observations into analysis instead of discarding them altogether.

3.4.3. Goals of REP

As for each goal (both explicit and implicit) the important assumptions, measurable indicators and means of verification were as presented in Tables 3.8 and 3.9 consecutively. Given that the implicit and explicit goals are interwoven, many indicators were repeated for the sake of analyses.

Table 3.8: Quantification of Explicit Goals of REP.

Narrative summary	Measurable Indicators	Means of verification
1. Poverty reduction Electrification enables expansion and diversification of income generating activities in all spheres of rural life, resulting into increased farm and non-farm production and home based economic activities. More employment opportunities ensure more income and thereby contributing to reduction of income poverty.	Land ownership	IS
	Asset (other than land)	IS
	Income	IS
	Food consumption (in terms of kilo-calorie per day)	IS
	Economic vulnerability	IS
	Distress sale	IS, FGD
	Clothing	IS
	Poverty incidence	IS
2. Reduced migration from rural areas Increased employment in agriculture, industry, trade and business and greater self employment opportunities in the electrified areas reduce the incentives for rural push – migration. Exposures to modern amenities facilitating urbanization in rural areas also act as a catalyst in this process.	Migration out (No. of migrated family members)	IS, FGD
	Occupation of migrants skilled, unskilled) at destination	IS, FGD
	Reasons for migration (both out and in)	IS, FGD
1. Practice of local governance through PBS PBS initiative contributes in building individual as well as institutional capacity. PBS membership ensures democratic participation, and promotes resource mobilization at local level.	1. PBS staffs trained 2. Locals trained for support service system 3. Variety of REP functions contracted out 4. Participation in the governance, knowledge about election and functioning of PBS Board of Advisors. 5. Transparency and accountability of PBS 6. Involvement of lady advisors in policy planning of PBSs. 7. One stop service	PBS and REB documents, GD

Note: *IS = Interview Schedule, FGD = Focus Group Discussion, GD = Group Discussion*

Table 3.9: Quantification of Implicit Goals of REP

Narrative summary	Measurable Indicators	Means of verification
Improved standard of living for rural people Economic growth due to higher possibilities in farm yields and non-farm production coupled with social and cultural development mediated through electricity (both as power and as source of lighting) accelerates crystallization of all factors attributable to human development.	1. Human Development Index (HDI) • Educational attainment (combination of adult literacy and gross enrolment) • Infant Mortality (a proxy measure for life expectancy). • Income	IS
	2. Asset	IS
	3. Food intake pattern	IS
	4. Household expenditure in social priority sectors: health, education.	IS
	5. Dwelling (sq.ft. per person)	IS
	6. Time allocation for the period between sunset and sleep (by activities)	IS, FGD
	7. Knowledge about crucial public health issues.	IS
	8. Health practices.	IS
	9. Self reported economic status (over time)	IS
Gender development; women's employment Income generation opportunities for women has broadened. Because of availability of more hours, women has been able to enjoy greater freedom of choice in terms of time allocation by activities. Radio and TV facilitates awareness building for women about their rights and responsibilities. Increased household income makes possible increased investment on health and education for females. All these contribute to strengthening the process of effective decision making by women both at household and community levels.	1. Women's Income (by sources)	IS
	2. Saving (Share in total household income)	IS, FGD
	3. Decision making in spending money	IS, FGD
	4. Participation in major decisions of the family	IS, FGD
	5. Equipments used for: cooking rice husking, spice grinding	IS
	6. Allocation of time (for an average day): watching TV, listening Radio, cooking, leisure time, production activities	IS
	7. Education i) Literacy rate (including adult, male and female)	IS
	ii) Gross enrolment ratio (male , female	IS
	ii) Drop out rate (Boys and Girls)	IS, FGD
	iv) Attendance rate (Boys and Girls)	IS
	v) Marks Obtained (Boys and girls)	IS
	8. Health Knowledge on public health issues (ORS, ARI. ANC, PNC, STD, HIV/AIDS, TB, Leprosy, etc)	IS, FGD
	Health Practices	IS, FGD
	Male – female disparity in medical treatment (while sick).	IS, FGD
	9. Mobility and Security Ability to visit various community places (alone/not alone), work/activities out-side home, security of mobility at night	IS, FGD
	10. Awareness regarding fundamental rights	IS, FGD

Narrative summary	Measurable Indicators	Means of verification
Changed Worldview Electricity as power (to run machines) and as a source of lighting, generates synergistic effect in terms of enlightenment. Use of electricity both in production and in household accelerates the process of changing outlook for rural people. This results, among others, in transforming the society through driving away various harmful practices like superstition, illusion, taboo and misconception.	1. Awareness about equality of men and women in terms of : Access to resources, employment, wage, fundamental human rights, voting rights, participation in election	IS, FGD
	2. Awareness about punishable criminal offences: Women trafficking, child trafficking, acid throwing	IS, FGD
	3. Changes of habits: Reading, watching TV, listening radio, cultural programs	IS, FGD
	Perception towards: Education (boys and girls), ideal age at marriage, ideal family size, birth spacing, young women's jobs outside village, prohibition of dowry superstition, taboo, misbeliefs, misconceptions etc	IS, FGD

3.5. DATA COLLECTION INSTRUMENTS

Data Collection Instruments (DCIs), being one of the most crucial components of the study, were developed after a rigorous and careful exercise by all the core team members. In line with the objective of the study, variables, measurable indicators, explicit and implicit goals of REP and the feedback obtained from the participants of *Consensus-building Meeting* with the RPPR Program Partners (held on 9 May, 2002), the core team had developed the draft data collection instruments further. The first round of pre-testing was conducted during the *familiarization visits* by the core team in Sirajgonj and Gopalgonj. Long before the originally planned time period for preparing DCIs (as per ToR), the core team decided to develop the first draft of interview schedule for each sampling unit.

The key features of the process of designing of DCIs were:

- The team members were separately assigned to four observation measurement units and secondary data compilation formats for PBS and community levels (Upazila, Union and Village), based on their comparative advantage in expertise. After rigorous brain-storming sessions among the team members, DCIs for each observation measurement unit and SDCFs were made available to all members of the study team for comments and suggestions. All the core team members then negotiated the DCIs after consecutive brainstorming sessions among the team members. The ISs, FGD guidelines and SDCFs were finalized after repeat pre-testing. Along with the DCIs, data collection manuals containing key instructions to fill-in the questionnaires and clarifications regarding the questions were developed to prepare interview schedule for households (Annex B15).

- The major purpose of the pre-testing was to assess relevance, sequence and appropriateness of the questions in IS, as well as to gauze the level of communicating skills required of the field team in actual data collection. The pre-testing was conducted at two stages – *before* and *after* the formal training of field functionaries and was followed by necessary adjustment before the training session based on feedback from the enumerators. As for HHIS and IEAIS, the required changes were also substantiated with the computerization of the data and subsequent consistency check by the team members and the Systems Analyst as well.

- At the last stage of finalization of DCIs, the core team made the necessary adjustments overnight given the feedback from the field, followed by a daylong role-playing session for each unit. After reviewing the role-playing exercise, the interview schedule for each observation measurement unit was finalized for field survey and was printed in Bangla for the field survey.

A total of 14 data collection instruments were prepared and administered in the survey. These included 4 quantitative survey instruments, 4 FGD checklists, 5 secondary data collection formats, and one set of group discussion guidelines. All these 14 DCIs have been presented in Annex B.

3.6. STUDY IMPLEMENTATION

3.6.1. Field Functionaries

Field functionaries of all categories– *Field Enumerators, Field Supervisors, Quality Control Officers (QCOs), FGD moderators, Note-takers, Recorded Data Transcribers*– were selected, and then trained after multi-phased screening. Both the recruitment procedure and the training, led by the Project Director, were taken into serious consideration by the core team, given the importance of quality of data and competency of the field functionaries in terms of handling likely adverse situations at the field level.

The training session for field staff began on 18 May, 2002 at the REB Auditorium. The detailed outline for training session is available in Annex A4. Given the importance of required training for ensuring quality of data, the training schedule for field staff (Table A4) was developed and revised repetitively by the core team (Section 3.5). The experiences of familiarization visits by the team members and the experiences during the pre-test were used to prepare the training schedule for 10 days (although a five-day training was proposed in the technical proposal).

The key aspects of the training session for field functionaries were as follows:

Based on the experiences during familiarization visits and pre-test, the study team felt the need for **segregation of trainees for each observation measurement unit** to ensure better understanding of the DCIs and thereby ensuring accuracy in data collection. The study team observed that given the number and size of interview schedules, the required competency level of the field enumerators would only be achievable by **specialization**.

Table 3.10: Distribution of field data collection staff in groups by observation measurement unit

GROUP (s)	Participants	Area of Specialization
FSG 1	36 Female	Household Unit
	10 Male	
FSG 2	23 Male	Irrigation Equipment and Agricultural Unit
FSG 3	33 Male	Industrial Unit & Commercial Unit

Note: FSG= Field Staff Group

The criteria for specialization included the nature of and sensitivity attached to different ISs, synonymity among ISs, the topics for FGDs and the experiences of pre-testing during familiarization visits by the core team as well as the first stage of pre-test before the formal training session.

The training sessions were conducted at two venues:

a. REB Auditorium (dated 18 May, 2002 – 27 May, 2002)
b. HDRC Office Premise (dated 29 May, 2002-30 May, 2002)

Team composition was declared on 27 May, 2002, and the teams were asked to report at HDRC on 29 May, 2002 at different time periods. Given the divergent time schedule, the size of a group was not too large for accommodating all of them at HDRC to conduct the training sessions in an efficient manner.

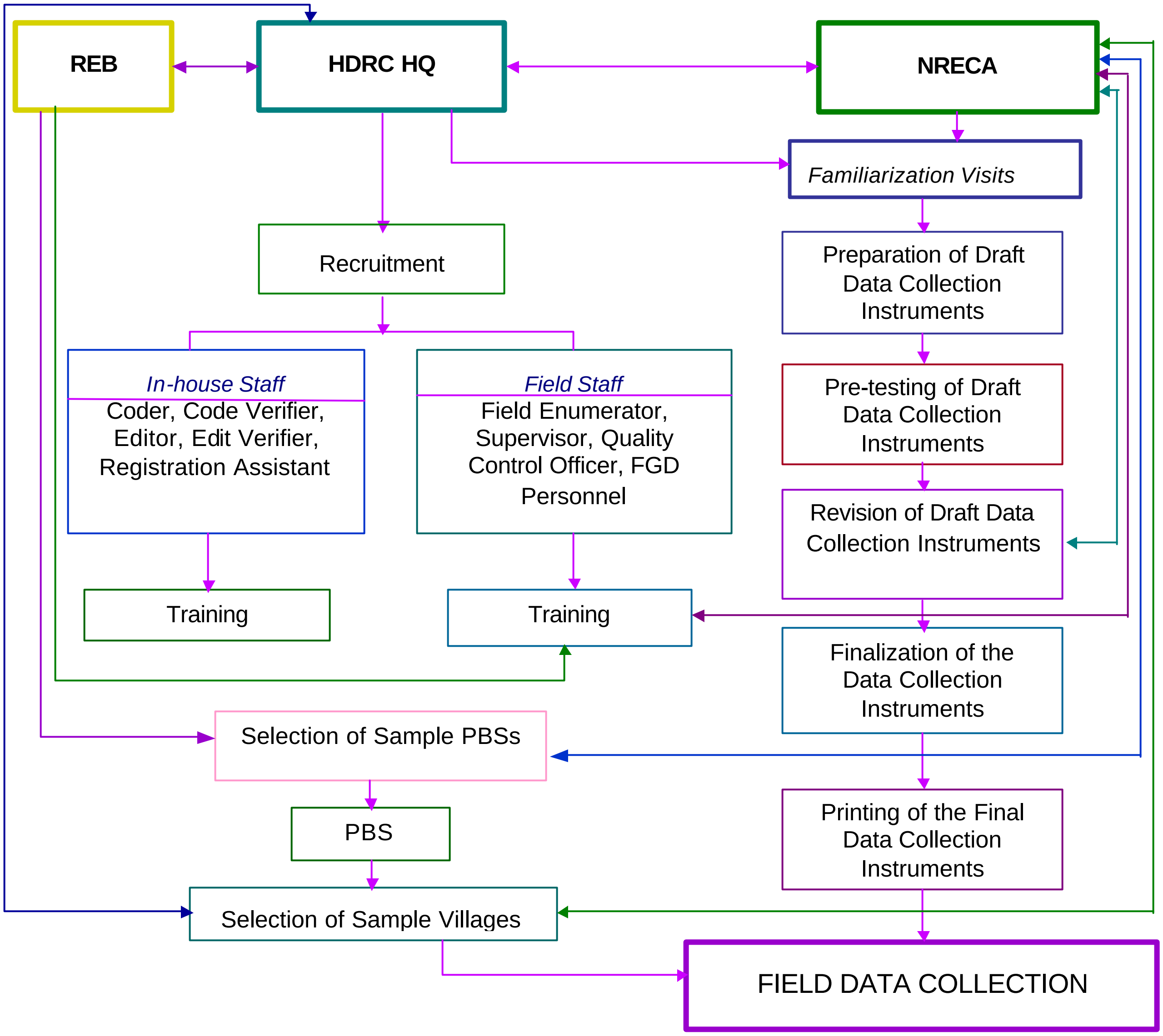
Though their activities began after the field level data collection, to have a proper understanding of the study objective, all the required in-house staff attended the training sessions along with the field staff from 18 May 2002 to 22 May 2002. The length of training, thereafter was different depending on the nature of job (Annex A4).

3.6.2. Field Data Collection

The field staff, especially the FSs and QCOs had a one-day training especially on field data collection, in addition to their regular training session (Day-11, Annex A4). They were provided with detailed instructions for appropriate field implementation, presented in a diagrammatic fashion in this section. The field data collection activities were carried out during June and July 2002.

The major activities relating to field data collection has been shown in Figure 3.2.

Figure 3.2: Major Activities for Field data Collection



3.6.2.1. Field Implementation for Quantitative Survey

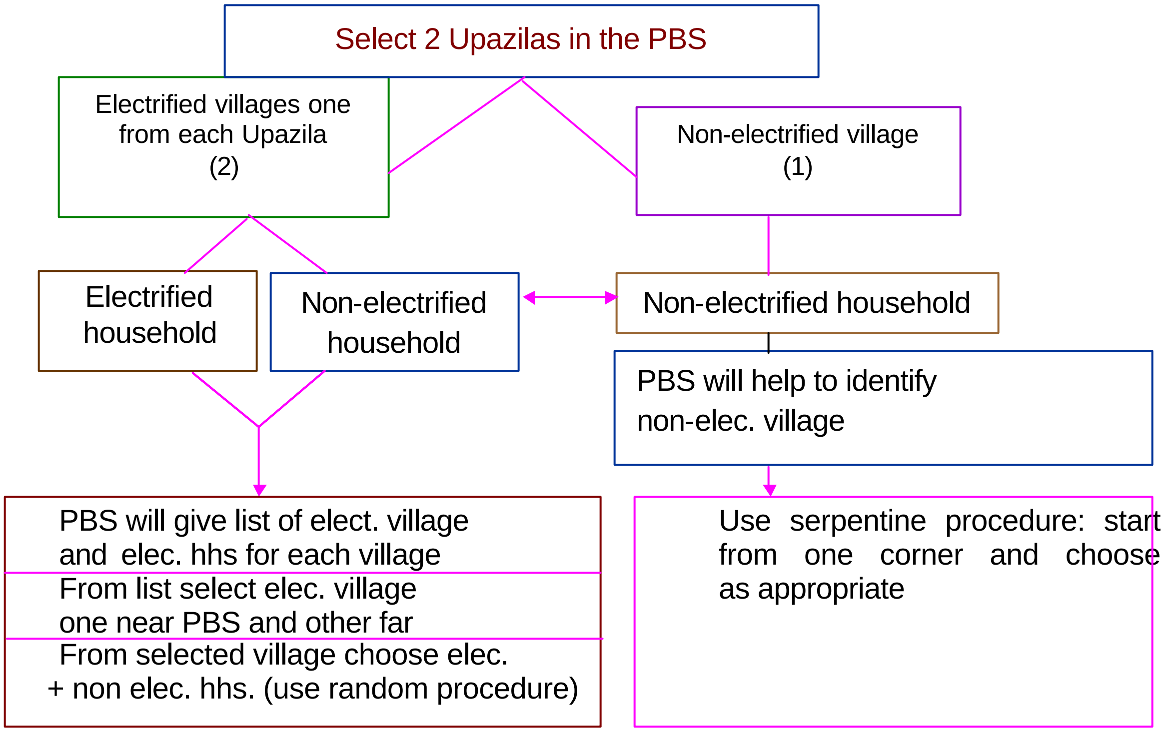
On their arrival at the PBS, the FSs were advised to organize an introductory meeting with the General Manager of the respective PBSs. Other than being briefed about the PBSs, they collected list of consuming units from each PBSs, on the basis of which they made the primary sample selection.

Each of the FEs conducted 2 interviews a day for household, commercial and irrigation equipment units. While preparing the technical proposal, the core team thought that it would be possible to conduct 3 interviews per day. However, based on the experiences during familiarization visits, the core team decided that 2 interviewees per day would be optimal to ensure quality of data in terms of accuracy. On the other hand, given the IUIS, one working day was assumed optimal to conduct one interview with industrial unit owners. In the total survey, a total of 3,718 interviews were conducted in the stipulated time period. The field implementation method followed for each observation measurement unit was as presented below:

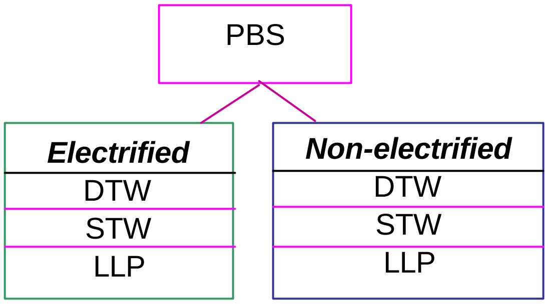
A. Selection of villages for HH survey and selection of HH

As shown in the figure below, from each PBS, names of electrified villages (2 near and 2 far) were obtained from GM, and then visits were made to those villages and selection was made : one not too far, and one far. Then, the list of connection holder households was obtained from PBS for those selected 2 villages.

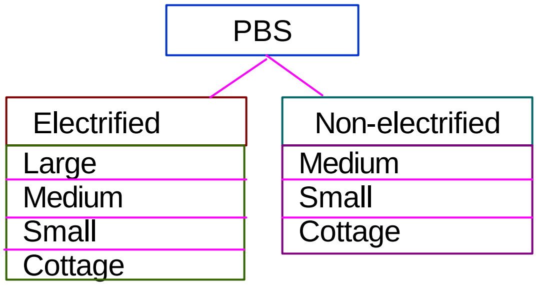
Similarly, names of 2 non-electrified villages was obtained from GM/PBS, visits made, and finally one village for HH interview was selected.



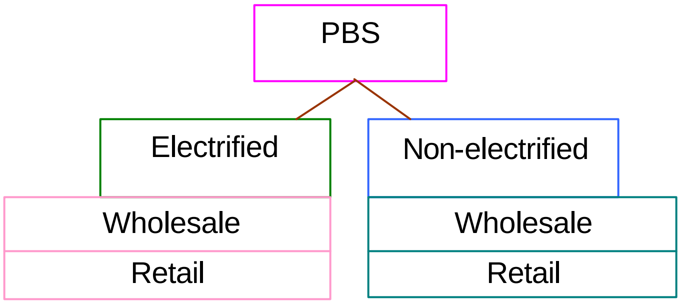
B. **Selection Criteria for Irrigation Equipment :** *Priority was given to the village selected for HH interviews, if needed expansion to the neighboring villages was considered.*



C. Selection Criteria for Industry: *Priority was given to the 2 selected Upazilas; expansion of the geographic area viz, other upazila, district – HQs under selected PBS was permitted, if needed.*



D. Selection Criteria for Commercial Unit : *Concentration was given to the village selected for HH interviews; expansion was permitted to the union HQ; and in case of need further expansion was permitted to the selected upazila HQs.*



E. Selection Criteria for No Irrigation: *Either from electrified or non-electrified village or both.*

3.6.2.2. Field implementation for Qualitative Survey

In order to complete Focus Group Discussions/Group Discussions, six teams were deployed. Each team consisted of one Facilitator, one FGD Organizer-cum-Note Taker and one Data Recorder-cum-Transcriber. It was estimated that each team would be able to organize, conduct and transcribe the recorded data within 3 days. Although it was not planned during the formulation of technical proposal, the consultants preferred to conduct some of the FGDs themselves while visiting the survey field.

3.6.3. Quality Control

As production of high quality output in the study was contingent upon the quality assurance system, a system of TQM (Total Quality Management) was instituted which took care of all systematic arrangements and activities directed towards safeguarding, maintenance and promotion of quality throughout the study period. The TQM framework deployed involved, among others, the following:

a. Ensuring full and effective coordination among the key personnel.
b. Instituting division of labor by assigning specific and time-bound job responsibility to each member of the key personnel.

c. Recruitment of support staff having appropriate qualification, skills and motivation.
d. Working out well-defined job responsibilities for each member of the support team and implementing those.
e. Imparting adequate appropriate training to the support staff.
f. Instituting timely reporting and efficient communication mechanism with NRECA.
g. Adopting mechanisms for appropriate selection of study area in consultation with REB and PBS.
h. Field checking to monitor survey data collection.
i. Quality control checks of data management.
j. Developing necessary management arrangements for timely coping with unforeseen situations.
k. Instituting time and cost optimization mechanisms in the study.

Twelve Quality Control Officers (QCOs) were deployed– one in each quality control cluster shown in Map-3.1. They constantly moved around the sample spots, and thereby ensured quality data through (i) field checking, and (ii) data monitoring, as detailed out in Annex A5.

3.6.4. Problems in Data Collection and their Innovative Solutions

In any large scale data collection involving different categories of observation measurement units, various types of data collection instruments and huge number of data collection staff it is usual that, in spite of excellent pre-field preparation and design, problems do still occur. In order to minimize the possibilities of problems or to minimize the extent of such problems in data collection, the following were accomplished before and during field data collection:

1. Appropriate designing of the data collection instruments (including repeat pre-tests before finalizing the same).
2. Appropriate selection of field data collection staff with special emphasis on commitment and competence of those staff.
3. Instituting total quality management approach in data collection.
4. Deployment of knowledgeable persons as quality control officers by quality clusters.
5. Designing all possible guidelines to ensure homogeneity in understanding (Annex B15).
6. Appropriate mix of field data collection team by PBS considering the workload as per sample size and accessibility status.
7. Development of expertise among the field data collection staff to conduct interviews on specific observation measurement units.
8. In-depth training to the field staff on data collection instruments (including field testing, and post-field experience sharing).
9. Consultants' visit to the field at the initial stage of data collection.
10. Regular and living contacts (day-to-day) with the field (especially by way of evening telephone discussion).

A number of issues covered in the household schedule demanded more than two hours time (if agriculture part was applicable) from the sample respondents. The same was the case of industrial schedules for large and medium scale industries. In such cases, rapport building was seen as a major technique for successful interviewing. This had been a major area on which the field staff were trained and the sample respondents had given their time without hesitation in most of the cases. In some instances due to unavoidable reasons, the respondents deferred the interviews, but gave time afterwards. Experience in this study also shows that once the purpose of the study was explained, rapport build-up and ethical codes (e.g., non-divulgence of information for other than study purposes) were well maintained, and the respondents became eager to participate and give adequate time.

Obtaining accurate concrete information, such as those on income, expenditure, business turnover, investment etc., is not easy and is time-consuming. In order to ensure accuracy and validity of such information, concerted efforts were made by way of the following steps:

a) Designing instruments to facilitate information gathering. In accomplishing that, all possible sub-items (e.g. for income, expenditure etc.) were mentioned and prompted (to ensure memory recall in all possible issues); and provisions for cross-checking and consistency were incorporated in the instruments.
b) In all possible cases, assistance of knowledgeable informants were sought.
c) Regular evening meetings were organized to share team experience of the day, and to resolve problems jointly.
d) Quality control checks were instituted for certain specific measurement objects/variables.

In case of non-availability of sample respondents, repeat visits were made. In some cases, the relevant respondents were visited thrice to complete the interview successfully. Experienced and devoted field staff made all-out sincerest efforts to overcome all possible expected and un-expected real life situations in the field.

In some instances, compliance with the sample by category– in case of industrial and irrigation units– was problematic due to non-availability of sample category in the PBSs. As for example, large industry was not available in *Meherpur; and* DTW with electricity was not available in *Barisal*. In these cases, thorough checking and re-cehcking were made in consultation with PBS. Thereafter, other size/type-categories were added to ensure the total sample size of the PBSs in tact, and additional sample sizes were taken from other locations (PBS) where those size/type-categories were available. Almost all the field staff reported that the interviewing of larger units required greater persuasion, not because of non-cooperative attitude, but because of their pre-occupation, while the smaller units and the household level respondents were reported to be relatively more cordial and cooperative.

Collection of PBS level data (from PBSs) was the least problematic area in the survey. All the PBSs were found research-friendly in providing accurate data on time. This is a lesson learnt that a huge undertaking can be successfully completed if the people at the policy and higher implementation levels (REB officials) are committed and have ownership from the very beginning. This sensitization worked and transpires throughout the chain of command.

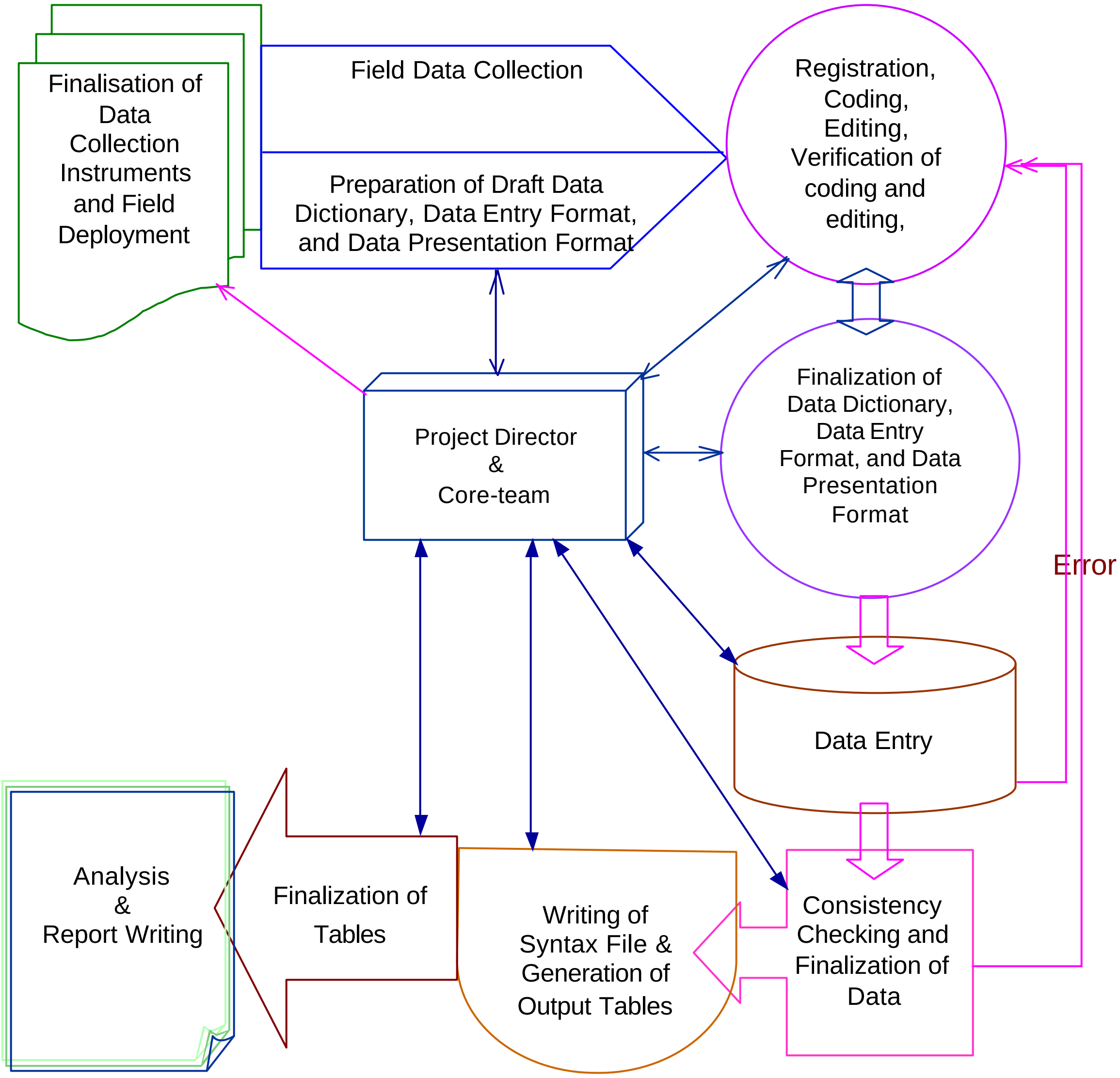
Community-level data collection for upazila, union, and village levels were found problematic in the sense that many data were not updated. As for example, whenever data on population size and related areas were sought, in almost all situations, 1991 – census was mentioned (i.e.,10 years old data). As for some indicators, it was found difficult to find out the person who was (were) actually responsible for provision of such data/information (e.g., amount of agricultural land by irrigation status in the upazila, Union, Village).

The focus group discussion (FGD) teams did not face significant problems in organizing the discussion meetings to obtain qualitative information. In some cases, FGDs were conducted by the consultants.

3.6.5. Data Management

Data management comprised the following activities: (a) Registration of Questionnaires, (b) Data Processing, and (c) computerization of data. It also included detailed transcription of the FGD/GD information recorded in the cassettes by the transcriber, taking active assistance from the proposed experts in qualitative assessments and analyses. The detailed discussion of the activities has been presented in Annex A5. The process of data management has been shown in Figure 3.3.

Figure 3.3: Flow Chart of Data Management.



↔ ***Information receiving & undertaking necessary action***
→ **Start Field Data Collection**

3.7. ORGANIZATION OF THE REPORT

In line with the purpose and the objectives delineated in Chapters 1 and 2, this report presents ten chapters including the current one dealing with all methodological issues. The basic principle followed in outlining the chapters was to present the whole research output separately by **observation measurement units,** namely, Household, Irrigation, Industry, and Commercial Activities. The **Chapter 4** provides thorough analyses of the household level impact of rural electrification in Bangladesh. The household level economic and social impacts have been analysed in terms of income, expenditure, consumption, savings, surpluses, employment, assets, education, health, women's empowerment, modernization and media exposure, allocation of time, sense of protective security, demand for electricity and electrical appliances, consumer preferences, willingness to pay for electricity. Almost in all relevant cases, analysis has been provided on electricity's role in addressing economic-poverty, human poverty, gender-divide, and equity issues. **Chapters 5, 6 and 7** give analysis of the impact of REP on irrigation and agricultural production, industrial development, and commercial activities respectively. All these chapters present vivid analysis and implications of electricity's impact on production, business turnover, employment, productivity, cost of production, efficiency, development of linked-services – all strictly in compliance with the specific objectives set for the respective observation measurement unit. **Chapter 8** purports to provide pertinent analysis showing PBS as a model of local governance and democratization. All statistical inferential analyses have been presented separately in **Chapter 9.** Finally, the key findings with some feasible recommendations for future actions are presented in **Chapter 10.**

This research report is an outcome of thorough team work will fullest possible commitment and devotion of each members of the team including the field and support staff. All the experts of the core-team members have contributed in drafting the report in line with their respective areas of expertise.[4>] The draft report was submitted to NRECA International Ltd on 15th September 2002. The Report has been finalized through a rigorous process of review by the NRECA Socio-economic team including by the Team Leader, and review and suggestions by the relevant REB officials. In the process of finalization of the report, two "Study Findings Dissemination Meetings" were held, one with the USAID on 3rd October 2002, and the other with the REB High Officials including the RPPR Partners on 27th October 2002 (see Annex A6 for list of participants). The participants of these dissemination meetings provided useful inputs, which were duly considered in the finalization of the report.

As part of the overall design and presentation of the report, it is worthwhile to mention the following at the outset:

1. In order to facilitate better understanding of the essence of the huge and complex data and information obtained in the survey, and to show impact visually, graphic presentation (as per the original technical proposal) has been maximally used.

[4>] Contribution by authors was as follows: A. Barkat (Executive Summary; Chapter 10; Chapter 4, except Sections 4.3.3, 4.4.4; Sub-section 4.4.2.2 and 4.4.2.3 with support from M. Majid; and Chapters 1, 2, 3 with support from NN Ratna and regular inputs from other core team members), SH Khan (Chapter 7, with contribution by A. Barkat for Sections 7.2 and 7.11), S. Zaman (Chapter 6, except 6.2 and 6.11 contributed by A. Barkat, and 6.10 contributed by A. Karim), A. Poddar (Chapter 5, except Sections 5.2 contributed by A. Barkat), M Rahman (Chapter 9 in collaboration with A. Barkat), S Halim (Section 4.4.3 with support from A. Barkat on quantitative analysis), NN Ratna (Sections 4.3.3 and 4.4.4), AKM Maksud (Chapter 8 in collaboration with A. Barkat), A. Karim (Sections 5.12, 6.10 and Annex D), and S Islam contributed to the discussion of the relevant engineering aspects. The overall technical guidance throughout the study was provided by the Team Leader, A. Barkat.

2. All Tables have been Annexed, exception being a few estimates done to show the REP's impact on national scale (extrapolation and projections) having significant policy implications.

3. All data collection instruments, some of the methodological issues, a write-up on environmental issues, the Terms of References, and list of study personnel are presented in Annexes.

4. Throughout the report acronyms **HE, WE-EV** and **WE-NEV** have been used to denote households with electricity, households without electricity in electrified villages, and households in the non-electrified villages, respectively.

5. In all possible cases, cross-references have been made to show linkages within the observation measurement units, variables and indicators, as well as comparison with relevant national statistics (e.g., poverty situation, human development indicators, irrigation and productivity, share of industrial output and commercial activities, etc).

6. Throughout the report *%* sign has been used instead of writing percent/percentage etc.

CHAPTER 4

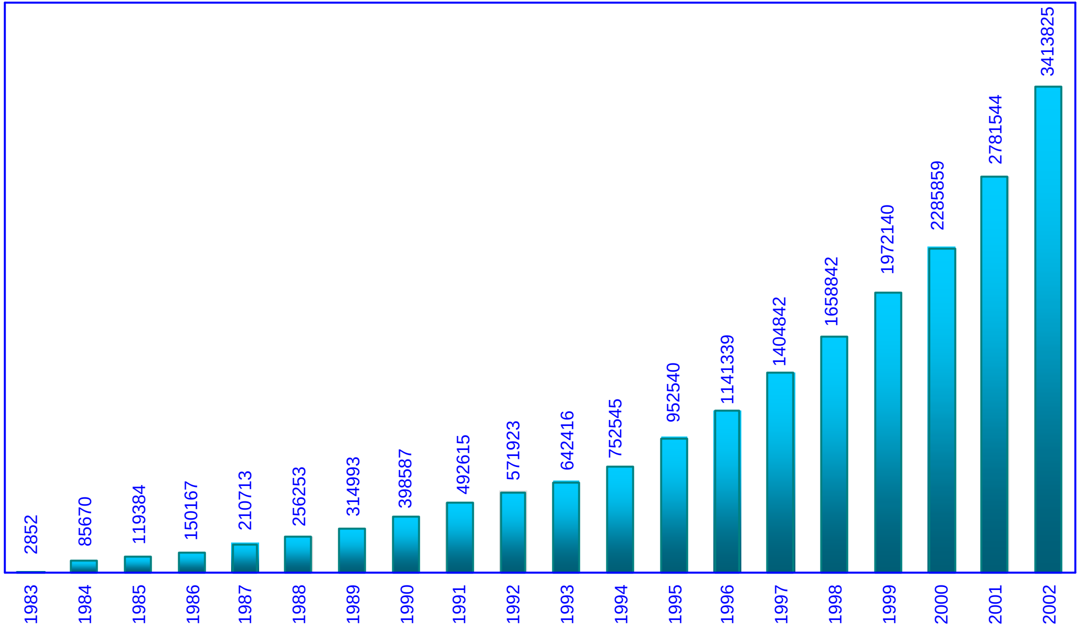
ECONOMIC AND SOCIAL IMPACTS — HOUSEHOLD LEVEL

4.1. INTRODUCTION

The economic and social impacts of rural electrification at the household level are multidimensional, and both tangible and intangible. The approximate number of persons who are now deriving direct benefit of household (domestic) connections of REB would be 20.5 million[13>].

Before presenting the multifarious impacts of electricity at the level of the households with or without electricity, it would be pertinent to provide a brief analysis of the growth of consumers and consumption of electricity during the last twenty years — 1983-2002[14>]. During the last 20 years, as shown in Figure 4.1, the total number of domestic consumers (connections) of RE has increased almost 1200 times, from 2852 in 1983 to 3,413,825 in 2002 (as on June 2002). The estimated average annual growth rate (cumulative of domestic connections) is 42.53%. During the same 20 years, the domestic consumption of electricity (MWH in a comparable month) has increased 131 times, from 1214 MWH in 1983 to 159077— MWH in 2002. The number of villages electrified has increased by 67 times, from 1793 in 1983 to 35,672 in 2002. Thus, estimation based on these figures show that, during the last twenty years, there has been not

Figure 4.1: Twenty years' growth in the number of domestic consumers: 1983-2002



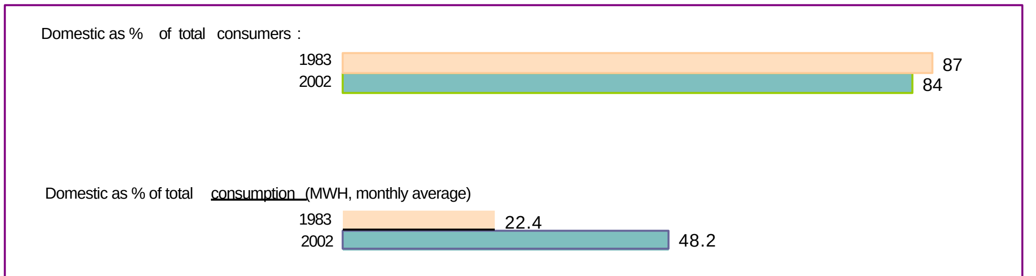
Source: Compiled by the authors based on last twenty years' (1983 - 2002) MIS Reports obtained from REB (all data relate to the month of June of the relevant year)

[13>] The average household size of households with electricity is 6, and the total number of domestic connections is 3,413,825 (as on June 2002, REB/MIS) (see Figure 4.1)

[14>] Last twenty year's time was chosen because data from REB/MIS were available for that period; and twenty years is a sufficient time period to draw inferences on growth trends.

only an astronomical rise (1200 times) in the number of domestic consumers, but also the number of domestic users per PBS. On average, the number of domestic users per PBS has increased 233 times (from 219 domestic consumers in 1983 to 50,953 in 2002). Secondly, there has been a qualitative change in terms of increasing relative share of domestic use in the overall RE power supply. Although the share of domestic consumers in total consumers has declined to 84% in 2002 from 87% in 1983 (absolute number has increased 1200 times) the share of power consumption by them (MWH) has gone up to 48% in 2002 from 22% in 1983 (Figure 4.2). Thus, there has been drastic changes in the number of domestic users as well as remarkable qualitative changes in the domestic consumption of rural electricity during the last 20 years.

Figure 4.2: Relative changes in the domestic use of rural electricity during the last twenty years : 1983 and 2002



Source: Prepared based on information obtained from MIS Reports/REB

The household level impacts are mediated through availability of electricity in the household as well as outside the household (agriculture, fisheries, commercial activities— shops and establishments, industry). In the later event, the benefits go not only to the 20.5 million people who are connected through domestic connections, but also to those not having domestic connections.

The multifaceted impacts and benefits are either direct or indirect. The direct impacts are mostly economic, and reflected in enhanced income, and employment, and optimized expenditure pattern, surpluses, savings, and asset building. The indirect impacts are those which are mediated through electricity. Most indirect impacts are related to the social and cultural aspects of life, which include, among others, such areas as education, health, women's status, modernization etc. These direct and indirect benefits together produce synergy in economic growth, poverty reduction, and human development. This chapter provides an analysis of these dimensions of social and economic impact of rural electrification.

4.2. SAMPLE CHARACTERISTICS

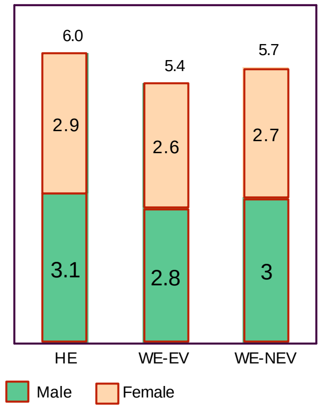
The next two sub-sections describe the key features of the sample households and the villages from where the samples were drawn and data obtained. The later community characteristics are important at least to evaluate the extent of homogeneity/non-homogeneity of the communities (villages with and without electricity).

4.2.1. Characteristics of Sample Households

As per the study design, three types of households were considered – households with electricity, households without electricity in electrified villages, and households in non-electrified villages. These three types have been categorized throughout the report using abbreviations HE, WE-EV, and WE-NEV respectively. The sample sizes of households in the three categories were 1380 for HE, 421 for WE-EV, and 690 for WE-NEV.

It would be pertinent to present some of the salient demographic, social and economic characteristics of the sample households. The profiles presented below are also indicative of impacts of electrification, and, therefore, are elaborately analysed further in the relevant sections and sub-sections.

Figure 4.3: Average household size by sex by household electrification status



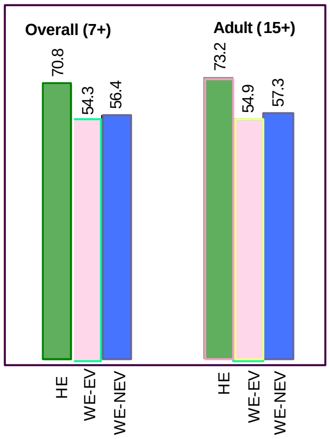
Source: Table 4.2.1

4.2.1.1. Demographic

The average household size of HE is 6 (with 3.1 males and 2.9 females). Such size for WE-EV is 5.4 (2.8 males and 2.6 females), and for WE-NEV is 5.7 (3 males and 2.7 females) (Figure 4.3). Thus, the average household size of HE is slightly higher than that of both WE-EV and WE-NEV. The reasons for slightly higher household size of HE compared to the two other sample categories (explained through less migration, more job opportunities, relatively high proportion of joint/extended families) along with other relevant demographics have been explained in Chapter 4.5 (impact on demographics).

4.2.1.2. Social

Figure 4.4: Literacy rates by household electrification status



Source: Tables 4.4.2, 4.4.3(b) (Literacy rate: Class 3 and above)

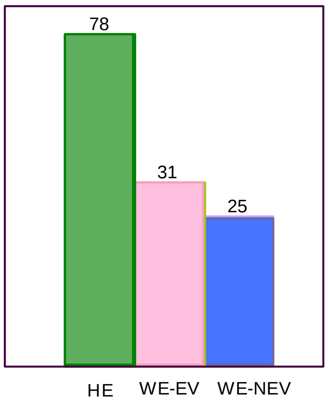
In terms of both overall (age 7 years and above) and adult (age 15 years and above) literacy, the rates are higher in the HE compared to those in the WE-EV and WE-NEV. The overall literacy rates in HE, WE-EV and WE-NEV are 70.8%, 54.3%, and 56.4% respectively. The respective adult literacy rates are 73.2%, 54.9%, and 57.3% (Figure 4.4). The impact of electricity on literacy and quality education is analysed in Section 4.4.1.

The respondents in the electrified households (HE) reported higher awareness about crucial public health issues than the two other categories of HHs. Awareness about at least ten out of the total of 20 public health issues was reported by 78% respondents in HE, 31% in WE-EV and 25% in WE-NEV (Figure 4.5). Not only health awareness, but also in terms of health practices the

HE were reported to be in a better-off situation. Such practices include treatment while sick by medically competent persons, child delivery attended by trained persons, use of medically competent persons for ANC and PNC check-ups and maternal morbidity, use of family planning methods, child immunization, and use of vitamin-A capsules to prevent nightblindness. All these health-related vital quality of life and human development aspects along with electricity's role in those have been analysed in Section 4.2.2.

Women in the electrified households were found more empowered than those in the two other sample categories (WE-EV and WE-NEV). Such enhanced empowerment were evident in the following aspects: independence in spending, spatial mobility, and participation in household decision-making. Detailed analyses of the gender aspects of contribution of electricity have been presented in the Sections 4.4.3, 4.4.4, 4.4.5, 4.5, 4.6 and 4.8.

Figure 4.5: Awareness about crucial public health issues: % respondents reported awareness about more than 10 out of 20 issues

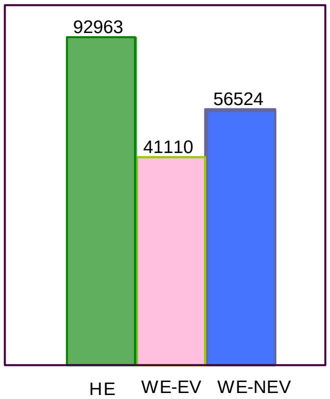


Source: Table 4.4.14

4.2.1.3. Economic

The economic profiles of the three categories of sample households are distinctly different showing impact of electricity on household economy. Various dimensions of such impact are analysed in Sections 4.3 and 4.8. In the last year (2001), average income in the electrified households was Tk. 92,963, and that in the WE-EV and WE-NEV were Tk. 41,110 and Tk. 56,524 respectively (Figure 4.6). Section 4.3.2 presents detailed analysis about the approximate share of the above incomes (of all three categories of households) which could be attributed to electricity.

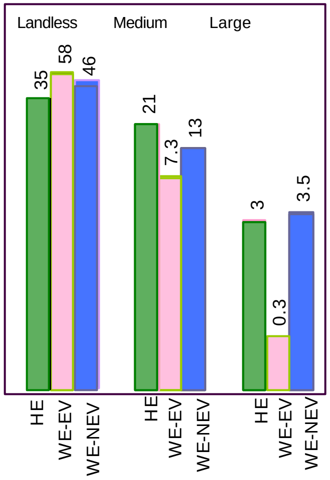
Figure 4.6: Average annual (last year) household net income (in Tk.)



Source: Table 4.3.2

In terms of landownership status, the three sample categories were found much different. The differences were higher pronounced in three groups— landless, medium and large. In the HE sample, 35% were landless, it was 58% in the WE-EV, and 46% in the WE-EV samples. 21% of HE samples were medium farmers. It was 7.3% in WE-EV and 13% in WE-NEV samples (Figure 4.7). The large landowners constituted 3% of HE sample, only 0.3% in WE-EV sample, and 3.5% of WE-NEV sample. Two inferences can be drawn at this stage: (i) the electrified and non-electrified households (in non-electrified villages) are more or less comparable with slightly higher concentration of landlessness in the later category, and (ii) a large share of non-electrified households in the electrified villages are relatively land-poor. They are also income-poor. Landless in this group earn 40% less income than the landless in the electrified households (estimated based on information in Table 4.3.6).

Figure 4.7: % distribution of sample households by selected landownership groups



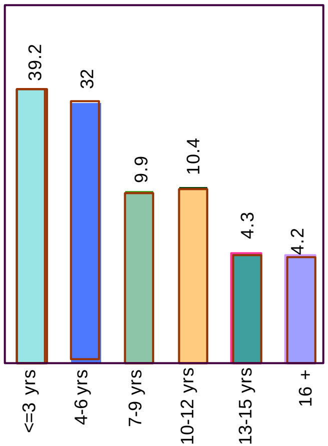
Source: Table 4.3.36

Various economic aspects of sample households including employment, expenditure, surplus, savings, and asset-building are analysed in the following six Sections 4.3.2-4.3.7; and economic aspects of poverty and human development have been discussed in Section 4.8.

4.2.1.4. Timing of electricity connections

The average time since electricity was connected in the sample electrified households (HE) was 5.54 years, the mode being 3 years. A 39.2% of the sample electrified households took connection during the last three years (preceding the interview), another 32% between 4 and 6 years, and the remaining 19% took connection 10 years or more ago (Figure 4.8). The first connection in the sample dates back to 1979 (Table 4.2).

Figure 4.8: % distribution of sample households by timing of (age-length) electricity connection



Source: Table 4.2.

4.2.2. Profile of Sample Villages

Information about the community characteristics of all the 69 villages under the study (46 electrified and 23 non-electrified) were obtained using a secondary data collection format (instrument is appended). The community profile of an average electrified and non-electrified village presented in Table 4.2.8 depict the following:

1. The population size of electrified village is 3796 persons, 69% higher than that of non-electrified village (2241 persons).
2. The area of electrified village is 7.73 sq.km. and that of non-electrified one 2.33 sq. km.
3. In terms of absolute number of schools, colleges, night schools, cooperative societies, *haats* and bazars— the electrified villages were found slightly better-off than the non-electrified villages. However, in terms of population per some of these institutions, the variation between electrified and non-electrified ones was not much pronounced. As for example, there were one school for 1622 population in electrified and 1 school for 1310 population in non-electrified. However, in terms of some other facilities such as colleges, night schools, cooperative societies, and banks, both absolute and relative status (population per facility)— the electrified villages were found better endowed than the non-electrified ones.
4. An average electrified village has about 39 electrified shops.
5. The number of mosques in both the types of villages was equal, 4.4 each. Similar was the case with temples, about 2 each.
6. In terms of one of the most important infrastructures— road, the non-electrified villages were found to be better endowed than the electrified villages. The average pucca road in electrified is 2 km. and that in the non-electrified, 3.25 km. In terms of total length of roads (all types combined: pucca, semi-pucca, and kutcha), number of bridges and culverts, the electrified villages are better endowed. However, if compared with population size, the differences are negligible.
7. The average distance of the upazila health complex from the electrified villages is 6 km., and that from non-electrified ones 4 km.

8. Electrified villages are much better endowed with employment in the NGOs. In the electrified villages, 17 persons are employed in NGOs and the corresponding figure for non-electrified villages is about 7.

4.3. ECONOMIC IMPACT

4.3.1. Introduction

Economic impact of rural electrification in this study has been measured for all three broad sample categories of households in terms of income, employment, expenditure, surplus, savings, credit, and assets. Comparison has been made between households with and without electricity. Although not envisaged, in the original study design, data on assets namely, land, homestead (including dwelling and non-dwelling rooms), household and agricultural capital assets, and livestock and poultry were obtained for two points in time— survey year (2002) and five years ago (1997). Thus, the before-after situation could be ascertained for these assets.

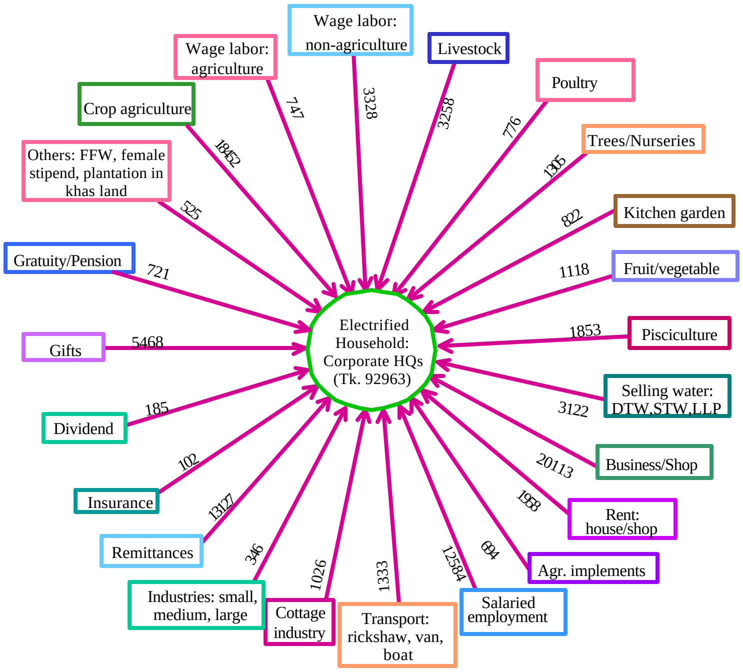
4.3.2. Impact on Income

4.3.2.1. Annual income and sources

Income to the households flows from various sources. A total of 23 such sources were identified (Figure 4.9). The average number of sources of income reported by the electrified households (HE) was 3.9 compared to 3.3 by the non-electrified households in electrified villages (WE-EV) and 3.8 by the households in the non-electrified villages (WE-NEV). Irrespective of sample categories, the relatively more frequently cited sources were crop agriculture (73% to 84%), followed by poultry (38% to 43%), small business and shops (25% to 35%), livestock (27% to 29%) (Table 4.3.1). Compared to the non-electrified households, a higher proportion of the electrified households reported salaried employment and remittances as sources of income. Similarly, compared to the electrified households, a higher proportion of non-electrified households reported wage labor (both agricultural and non-agricultural) as source of income. However, the frequency of reporting of sources of income and the actual income are not synonymous. This is evident from the fact that although, on average, almost a similar number of sources of income were reported by the HE and WE-NEV (3.8 and 3.9 respectively), the difference in income was significant— HE 1.65 times higher than WE-NEV (Table 4.3.3).

It would be important here to note that although four different measurement objects using electricity from the Palli Biddyut Samities (PBSs), namely, domestic, commercial, irrigation and industry have been studied, the **households** have been treated as the core or corporate HQs. This is because of the fact that income, irrespective of its source of origin, ultimately flows to the household or, in other words, the benefits of earning flows to the household. Thus, the household being the corporate HQs, the individual sources constitute operating unit of the HHHQs. As such, a total of 23 sources of income (operating units) were identified with different sources contributing different amounts into the income-basket of the corporate body— the household. Figure 4.9 below shows the scenario of last year's (average per household) income flow to the electrified households by 23 sources.

Figure 4.9: Last year's average income of electrified households by 23 sources of income (in Tk.)



Source: Prepared based on information in Table 4.3.2

The average annual income[15>] **of households with electricity (HE) is 64.5% higher than that in the households of non-electrified villages (WE-NEV), and 126.1% higher than that in the households without electricity of electrified villages (WE-EV). The last year's average household income of HE was Tk. 92,963, and the same for WE-EV was Tk. 41,110, and that for WE-NEV was Tk. 56,524 (Figure 4.10).** Three issues are important at this stage, which are vividly explained in Section 4.3.2.3:

1. Having electricity in the household has contributed to the increased income of electrified households (Table 4.3.8).

2. Electricity has contributed to the income of <u>all households,</u> in varying degrees, irrespective of access/non-access to electricity in terms of benefits from the use of electricity-driven irrigation equipment, commercial connections, and industrial connection (i.e., access to electricity-mediated income outside household connections) (Table 4.3.8).

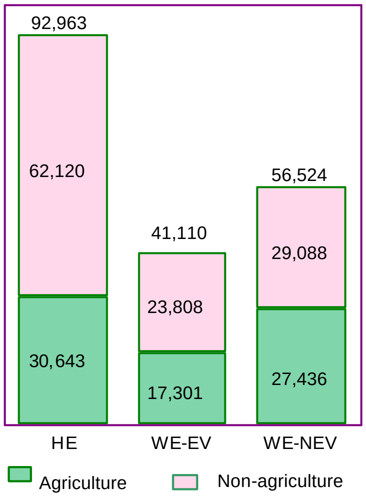
3. Not all of the differences in income of three categories of sample households are attributable to the independent effect of the presence of electricity.

[15>] Income here refers to net income i.e; gross income minus cost of earning (of gross income). Household income refers to last year's income and the duration considered was between April 14, 2001 and April 13, 2002 or Bangla last calendar year.

In terms of broad categories of sources of income, the households with electricity show a relatively higher share on account of non-agricultural sources (66.8% of annual income) than that of the same for non-electrified households (WE-EV and WE-NEV, 57.9% and 51.5% respectively) (Table 4.3.3). In other words, the share of agricultural sources in total income was relatively higher for WE-NEV (48.5%) and WE-EV (42.1%) than that of HE (33.2%).

As for electrified households, the four major sources which have contributed about 70% of the total income include small businesses/shops (21.64%), crop agriculture (19.85%), remittances (14.12%), and salaried employment (13.54%) (Table 4.3.2). These four sources together contributed 56% of the total income of WE-EV, and about 66% of the total income of WE-NEV. However, excluding the crop agriculture, the three other sources (all non-agricultural) contributed 50% of the total income of electrified households, and 33% of the total income of each of the two categories of non-electrified households.

Figure 4.10: Average annual income (net) of household and share of agriculture and non-agriculture (last year : April 2001 to April 2002) by household electrification status (in Tk.)



Source: Table 4.3.3

4.3.2.2. Distribution of income

Income distribution of the three categories of sample households has been analysed keeping in view the distribution by income groups, by land ownership status, and by decile households. In addition, in order to show the distribution, the lorenz curves and gini coefficients have been constructed. The income-poverty dimensions are presented in Section 4.8.

The distribution of income by income groups shows a much better-off situation of the electrified households compared to their counterparts— non-electrified households. Considering the lowest income group of Tk.24,000 per household per year, while only 19.3% of the electrified households fall in this group, the corresponding proportion of households in the WE-EV and WE-NEV were as high as 39.2% and 27.4% respectively (Table 4.3.5). Similarly, if we consider the highest income group of Tk.104,001 and above, 22% electrified households represented this group as compared to only 5.5% of WE-EV and 11.7% of WE-NEV.

The distribution of annual household income by landownership categories indicates a much better-off situation for all five-landowner groups[16>] in the electrified households compared to their counterpart non-electrified households. The average annual income of landless (poor) households having electricity connection was Tk.58,864, and that in their two counterparts was Tk. 35,104 (WE-EV) and Tk. 38,982 (WE-NEV) i.e., landless in the electrified households earn, on an average, 68% more than the landless in the non-electrified households in electrified villages and 51% more than the landless in the non-electrified villages (Table 4.3.6). Almost similar was the pattern in all other landownership groups.

The income accrued from the first 3 deciles (bottom 30% households or poorest 30%) was 6.5% of the total income in HE, 48.7% in WE-EV, and 52.3% in WE-NEV. The top 10% of the electrified households had 44.8% of the total income compared to 32.4% possessed by the

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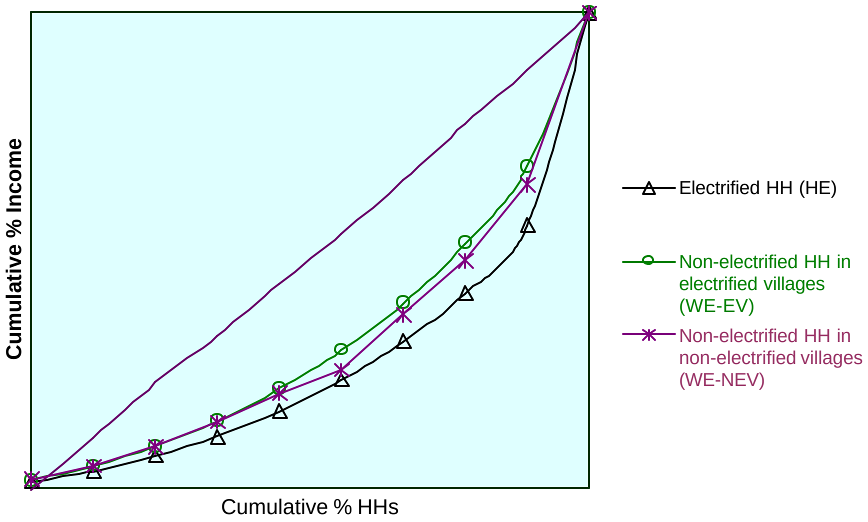
[16>] The five landowner groups are landless, marginal, small, medium and large. These categorization was made using official classification which is as follows: landless includes functional landless owning less than 50 decimals of cultivable land, marginal owns 50-149 decimal, small owns 150-249 decimals, medium owns 250-749 decimals, and large owns 750 decimals and more (Sources: Census of Agriculture 1996, vol.1:71, BBS 1999; Statistical Pocketbook of Bangladesh 1997: 184-185).

corresponding decile among the WE-EV households, and 36.2% among the WE-NEV households (Table 4.3.7). The poorest 50% electrified households earned 16% of the total income, and this was 21% for the WE-EV and 20% for the WE-NEV households.

The distribution pattern of annual income by three sample categories of households is shown in the Lorenz curve below (Figure 4.11). The gini-coefficient[17>] of income distribution is 0.53 for electrified households (HE), 0.43 for non-electrified households in electrified villages (WE-EV), and 0.45 for households in the non-electrified villages (WE-NEV). The gini-values show that the income distribution in the electrified households is slightly more skewed than that of the non-electrified households. Although the relative income inequality is more pronounced in the electrified household compared to the non-electrified households, the average absolute income of all the landownership groups in the electrified households is much higher than the comparable groups in the non-electrified households (Table 4.3.6). Thus, as compared to the non-electrified households, the electrified households show a higher income inequality but with higher income in the comparable groups. This means, the electrified households can be characterized as being relatively high income inequality with relatively high income.

Figure 4.11: Lorenz curves showing pattern of income distribution of sample HHs: electrified (HE) and non-electrified (WE-EV, WE-NEV)



4.3.2.3. Share of income attributable to availability of electricity

In order to systematically estimate the source-wise share of income which can be attributable to electricity, each respondent household, irrespective of availability of electricity in the household, was enquired about the following for each of the 23 possible sources[18>] of income:

[17>] Gini coefficient or gini concentration ratio is the ratio of the area between the 45° line and the Lorenz Curve to the total area beneath the 45° line. It shows the distributional equality/inequality status in the indicator (income, landownership, consumption etc). The value of gini-coefficient ranges between 0 and 1, where '0' means absolute equality and '1' means total inequality. Progressive shift in the curve, away from 45° line (and towards the origin) indicate increases in inequality.

[18>] All these 23 sources are shown in Figure 4.9 and in Table 4.3.1, and income by sources in Table 4.3.2

First: For each of the 23 possible sources of income the source(s) applicable for the individual household's last year income was (were) ascertained.

Second: For electrified household, it was ascertained whether or not the income from the relevant source has any relationship with the availability of electricity in the household.

Third: For all households, electrified and non electrified, it was enquired whether or not the income from the relevant source has any relationship with the availability of electricity in the area i.e., outside the household (agriculture, industry, commercial shops and establishments etc).

Fourth: For all households, electrified and non-electrified, it was ascertained whether or not the specific source of income is a new source of income for the household which has emerged only with electricity in the household and/or in the area.

Fifth: For all households, electrified and non-electrified, it was enquired whether or not the specific source of income is not a new source of income for the household, but electricity gave impetus for enhanced income from that source.

Once these logical steps were passed in the interview, for all applicable sources, the approximate share of net income from the source which can be attributed to electricity was estimated. This estimation was based on the following methods (one or a combination): direct financial, amount of land, multiple use of same land, person days/working days/working hours, amount of production (non-crop), km/number of passengers etc (Table 4.3.11). As for example, in the case of estimating electricity's contribution to the income from crop agriculture, the following factors were considered (single factor or a combination as appropriate): increased production due to electrified irrigation, increased cropping intensity, amount of previously fallow land which is now cultivated due to availability of electrified irrigation equipment and changes in production etc. In the case of estimating electricity's contribution to the income from livestock (and poultry), the following were considered: stealing/theft of cattle/poultry birds stopped (reduced) due to electricity which gave impetus/incentive for cattle breeding and poultry rearing; more production of high breed cow/poultry due to security, availability of vaccines, feed and fodder, fan and lighting; demand for and price of milk increased after electricity; increased selling/production of cattle, milk, poultry birds, eggs after electricity etc. In case of shops and businesses, the factors considered were increased business hour (after sunset), increased customer-flow due to electrified market place, income increase due to refrigerator, business diversification etc. All the factors, by sources, which have contributed in electricity-mediated income enhancement are presented in the box below:

Source(s)	**Factors considered in estimating the contribution of electricity in enhanced/incremental income**
1. Crop Agriculture:	1. Increased production due to electrified irrigation. 2. Cropping intensity increased. 3. Become possible to cultivate now previously fallow land. 4. Less expenditure due to electrified irrigation. 5. Income increased due to electrified irrigation compared to before electricity.
2.Wage Labour Agriculture:	1. Demand increased due to increase cropping intensity. 2. Wage income increased compared to before electricity. 3. Price of wage labour increased due to establishment of new industrial and commercial units.
3. Wage Labor: Non-Agri:	1. Increased due to expansion of market places and economic activities after electrification. 2. More time for work (days & hours) is available after electricity. 3. Increased income of wage labour due to over time at night (eg Mason, industries, shops and establishment) 4. Absolutely new type of work has emerged with electricity (electrician, poultry raising, Pisciculture, job in PBS etc.).
4. Livestock:	1. Stealing cattle stopped due to electricity, which gave incentive for livestock raising. 2. More production of high breed cow (Australian) and milk due to security, availability of vaccine, feed, fodder, fan and lighting; and demand for & price of milk increased after electricity. 3. Increased selling/production of cattle after connection of electricity.
5. Poultry :	1. Income increased due to increased poultry selling after electricity. 2. Increased poultry rearing/production rate due to electricity. 3. Stealing of poultry stopped due to electricity in HH which gave impetus for increased protection. 4. Income increased by selling of eggs after electricity. 5. Did not rearing of poultry because of death and stealing before electrification of HH, Absolutely new to the HH & emerged with electricity. 6. Attack of poultry birds by dog/ fox stopped after electricity. 7. Death of poultry stopped (reduced) due to vaccination facilities. 8. Emergence of new poultry farm after electricity.
6. Trees/ Nurseries:	1. Absolutely new to the HH and emerged with electricity. 2. Stealing of trees/nurseries stopped due to lighting. 3. Selling increased of trees/nurseries after electricity.
7. Kitchen/home gardening:	1. Stealing of vegetable stopped after electrification of the HH. 2. Income increased from selling of vegetables after electricity. 3. Awareness about benefits home/kitchen gardening in applying of modern cultivation methods learned from TV/radio.
8.Fruits/vegetables:	1. Increased production of fruits/vegetables due to less attacks by birds for lighting. 2. Stealing fruits/vegetables stopped due to electricity in HH. 3. Production of vegetables increased due to electricity–powered irrigation.
9. Pisciculture/ Fisheries:	1. Income increased due to round- the – year availability of water in the pond using electrified pump. 2. Stealing of fish stopped due to lighting at night (electricity). 3. Income and production from fisheries increased due to awareness through Radio & TV. 4. Insect killed due to lighting in the pond, as a result less food expenditure to cultivate fish. 5. Price of fish increased due to good communication after electricity.
10. Selling water :	1. Income increased from selling water using electrified pumps. 2. Absolutely new to the HH and emerged with electricity (DTW, STW & LLP).
11. Business/ Shops	1. Increased business hours at night after electrification. 2. Income increased due to electricity powered Refrigerator. 3. Increased selling and customer at night after electricity. 4. Market expansion has taken place after electrification of the market place and surroundings. 5. New business enterprises emerged after electrification (eg Photocopy, rice husking mill, potato stock business by cold storage, establishment of new shops etc.). 6. Increased business days and hours after electrification. 7. Selling goods increased due to availability of fan, light, cassette player etc. after electrification.
12. Rent:House, Shop	1. Increased rents of shop / house after electrification.
13. Agri. Implement:	1. Increased demand for agricultural implement due to electricity irrigation and thereby increased income. 2. Increased use of agri. implements at night due to electricity.
15. Transport:(Van, Rickshaw, Boat, Motorcycle, Cycle)	1. Increased income after electricity as compared to before electricity. 2. Driving more path (increased km of movement) after evening due to electrification of villages. 3. Increased passengers, passenger hours after electricity.
16.Cottage industries:	1. Increased income of handicrafts at night due to electricity. 2. Working time increased after electricity. 3. New cottage industries emerged in many households.
17. Industry/ Factory:	1. New industry/factory established. 2. Diesel driven industries switched over to electricity, which generated more employment and earning. 3. Expenditure saving in rice husking due to switch over to electricity from diesel machine.
18. Remittances:	-------
19. Insurance:	-------
20. Dividend:	---------
21. Gifts:	1. Visiting of relatives with gifts increased due to facilities improved of electrification of HH.
22. Gratuity/ Pension :	1. Due to the development of good communication after electricity of this village, some people save expenditure to withdraw their pension
23. Others	1. Private tuition at night (100%), new after electricity.

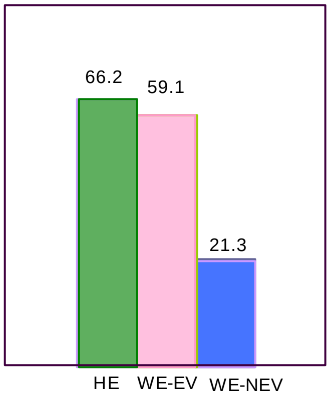
Source: Prepared based on review of relevant parts of all 2491 household interview schedules

Before presenting the estimates of share of income attributable to electricity, it would be appropriate to briefly know about the household's reporting about relationship between enhanced income and availability of electricity. The main findings on this aspect, in line with the steps mentioned above, are presented below:

1. Overall 40.8% of the households with electricity reported that having electricity <u>in the household</u> has somehow influenced the increase in income (Table 4.3.8).

2. Income's relationship with the <u>availability of electricity outside household</u> was reported by 66.2% of the households with electricity, and 59.1% of the households without electricity in electrified villages (WE-EV), and 21.3% of the households in non-electrified villages (WE-NEV) (Figure 4.12). These are indicative enough to show that electricity benefits all— irrespective of availability of electricity in the household.

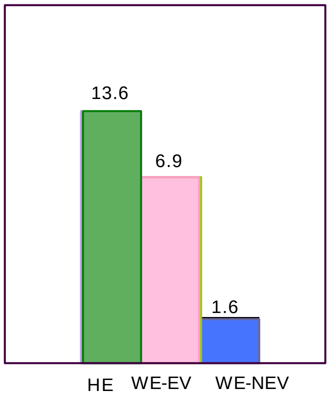
Figure 4.12: % hhs reported income's relationship with the availability of outside household by household electrification Status



Source: Table 4.3.8

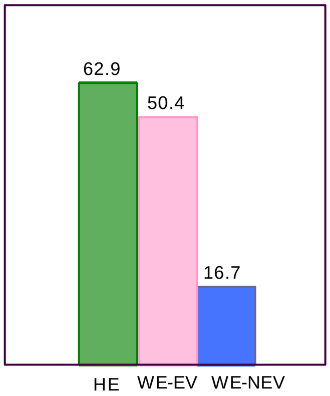
3. Many households have reported that some sources of income are <u>absolutely new</u> to the household which emerged with electricity. Such absolutely new sources of income were reported by 13.6% HE, 6.9% WE-EV, and 1.6% WE-NEV (Figure 4.13).

Figure 4.13 : % hhs reported the source of income as absolutely new to the hh which emerged with electricity



Source: Table 4.3.8

Figure 4.14 : % hhs reported the income source as not new to the household but income enhanced due to access to electricity (in and or outside household)



Source: Table 4.3.8

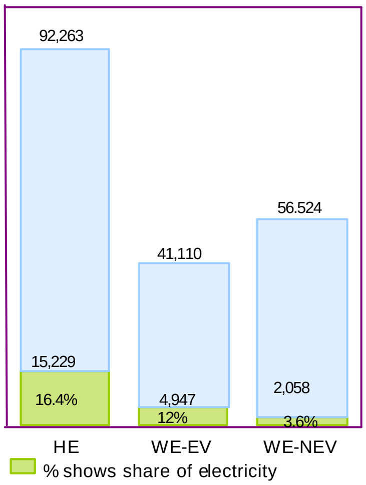
4. Households reporting that the sources of income were <u>not new,</u> but income had increased due to electricity was much pronounced. Such reporting was made by 62.9% of the electrified households, 50.4% WE-EV and 16.7% WE-NEV (Figure 4.14). This is an indication that income from various same old sources had increased after access to electricity in and outside the household.

   Thus, based on the above findings pertaining to the household reporting about increase in income and its relation with electricity, it can be inferred that electricity's influence over income is more pronounced in the households with electricity than that in the other two categories having no electricity in the households; and the same is relatively more pronounced among the households without electricity in the electrified villages compared to those in the non-electrified villages. Thus, the influence ranking, from high to low, follows the order:

HE → WE-EV → WE-NEV.

Estimates based on the methodology presented above, show that 16.4% of the annual income of the electrified households can be attributed to electricity (Figure 4.15). As for non-electrified households in the electrified villages (WE-EV), 12% of the annual income can be attributed to electricity, and it is only 3.6% for the households in the non-electrified villages (WE-NEV).

Figure 4 ..15 : Share of household income attributable to electricity (in Tk.)



Source: Table 4.3.9

The **income determination model** (IDM, presented in Section 9.5.2) supports the estimate that 16.4% of the annual net income of the electrified households can be attributable to electricity. The estimation results of the IDM show positive impact of household electricity on income with B=0.102, P=0.47 (See Table 9.4) implying had their been electricity in the now-non-electrified households their annual net income would have increase by 1.27 times (antilog of 0.102 is 1.27). The current weighted average annual net income of the non-electrified households (WE-EV and WE-NEV) is Tk. 47,067; 1.27 times increase means Tk. 59775, and therefore, the absolute increase attributable to household electricity comes to Tk.12,708. This increased amount constitute 13.7% of the average annual net income of the now-electrified households (Tk. 92962.9). Thus, by applying the estimation results of income determination model, it can be said that at least 13.7% of the annual net income of the electrified households can be attributed to the possession of electricity in the household.

It is important to note that, in absolute terms, the annual income attributable to electricity in the electrified households (Tk. 15,229 out of Tk. 92,963) is 3 times higher than that in the non-electrified households of electrified villages (Tk. 4,947), and 7.4 times higher than the households in the non-electrified villages (Tk. 2,058) (Figure 4.15).

Another interesting dimension of electricity's contribution to household income is the pattern in terms of specific sources of income. The income source-wise contribution of electricity reveals the following (Table 4.3.9):

- While 13.8% of the share of the income from <u>crop agriculture</u> of electrified household (HE) can be attributed to electricity, it is only 0.8% in the households in non-electrified villages (WE-NEV). Electricity's share of income from crop agriculture in the households without electricity in electrified villages (WE-EV) is 10.1%.

- While 31.3% of the share of income from small business and shops of electrified households is attributed to electricity, it is only 7.2% in the WE-NEV, and 11.9% in the WE-EV.

- While 32% of the share of income from livestock and poultry in WE is attributed to electricity, it is less than 1% in the WE-NEV, and 9.1% in WE-EV.

- While 61% of the share of income from cottage industry in HE is attributed to electricity, it is 35.3% in WE-EV and only 3.2% in the WE-NEV.

Based on the findings of this study, an attempt has been made here to estimate the contribution of rural electrification to the overall income of the rural households in Bangladesh. A second attempt has been made to estimate the income of the rural households in Bangladesh assuming "all rural households have electricity". This has a broad policy implication in terms of potentials for electricity-mediated economic development of Bangladesh.

First: Our estimate shows that out of the total of 19,092,224[19>] (19.1 million) rural households in Bangladesh, 3,413,825 (17.88%) households have (REB) electricity connections in their households; 6,395,086 (33.5%) households are situated in the electrified villages but do not have electricity in their households; and the rest, 9,283,313 (48.62% of total rural hhs) households are situated in the non-electrified villages (implying that they do not have electricity). Using the values generated in the survey on annual income and share of electricity in that income for the three sample categories (HE, WE-EV and WE-NEV), the nationwide weighted values have been estimated (Table 4.1 below).

Table 4.1: Estimated Annual Income and Income from Electricity: Rural Bangladesh

Households by electrification status	Number of HHs	Average annual hh income (net) (Tk.)	Share of electricity in net average hh income (Tk.)	Total annual HH income (billion Tk.)	Share of electricity in total annual HH income (billion Tk.)	% share of electricity in total annual HH income
Household with electricity (HE)	3,413,825	92,962.9	15,229.0	317.36	51.99	16.38
Household without electricity in electrified villages (WE-EV)	6,395,086	41,109.6	4,946.5	262.90	31.63	12.03
Households in non-electrified villages (WE-NEV)	9,283,313	56,523.5	2,058.6	524.73	19.11	3.64
Total	19,092,224	57,873.5	5,382.2	1,104.99	102.73	9.30

Estimates based on the above methodology show that, in rural Bangladesh, the total annual household income (at current 2002-market price) is about Tk. 1,105 billion, of which Tk. 102.73 billion can be attributed to electricity. Thus, 9.3 percent of the annual income of the total rural households (19.1 million) in Bangladesh can be attributed to electricity.

Second: Only 17.88% of the rural households in Bangladesh have electricity connections in their households. Assuming "all rural households have electricity" and their average income rises to the level of today's electrified households (in rural areas) and electricity's share in that income remains the same as now (i.e., 16.38%), the total annual household income (with 100% rural hhs having domestic connections)— at current market price— will increase to Tk. 1,775 billion from the present Tk. 1,105 billion, i.e., the annual net gain in income will be Tk. 671 billion more than today, of which Tk. 290.8 billion or 43.3% of the increment will be due to electricity. The above net gain in annual income (Tk. 671 billion) due to 100% electrification of rural households is equivalent to 26% of the current GDP (Tk. 2,580.6 billion[20>] at current market price) of Bangladesh.

[19>] According to the Bangladesh Population Census-2001 (Preliminary Report published by BBS, August 2001), 76.6% of the total 24,924,613 households (dwelling) are rural households distributed in 68,000 villages. Rural electrification program covers 34,936 villages with a total of 3,413,825 domestic connections (REB/MIS, June 2002).

[20>] Source: Statistical Pocketbook Bangladesh 2000, BBS 2002.

Finally, It would be appropriate to conclude that, ensuring non-electrified households' access to electricity will have significant impact not only in the substantive reduction in income-poverty, but also in addressing various dimensions of human poverty through its impact on improved health, education and enhanced women's empowerment and status (see Sections 4.8.3: Impact on Human Development Index, and 4.8.4: Synergistic Impact on Poverty Reduction and Human Development).

4.3.3. Impact on Occupation and Employment

Given the gloomy face of labor market in almost al the spheres of Bangladesh economy, the issues pertaining to creation of employment opportunities in rural Bangladesh through electrification is crucial for evaluating economic impact of REP. Along with the impact on employment, this section also elaborates the occupational status of three categories of households— households with electricity (HE), households without electricity in electrified villages (WE-EV), and households in non-electrified villages (WE-NEV). Employment creation for other three OMUs are discussed in details in their respective sections on employment. Local level employment created through REB and PBSs is briefly analysed at the later part of this section to have a glimpse of direct employment created through REP. Rural electrification has been instrumental in creating huge employment opportunities in various sectors, namely industry, agriculture, commercial shops and establishment. The relevant findings appear in Chapters 5, 6 and 7; the glimpses are presented in the box below:

Electrification-generated employment

- An estimated 1.1 million persons are directly involved in farmlands using RE-irrigation equipments.
- RE-connected industries (63,220 industries in 67 PBSs) employ 983,829 persons.
- RE-connected retail and wholesale shops employ 848,630 persons.
- Spill-over effect of electrification on employment in support services is enormous.

4.3.3.1. Average employment per households

The survey results revealed that the average number of persons employed[21] or involved in income generating in HE is lower (1.8) than WE-NEV (Table 4.3.14).

Average number of persons employed in WE-EV is 1.7, implying that the access to electricity in the village has resulted into higher number of persons employed even among the households without electricity, who are supposedly possessing potentials for less employment due to narrower resource-base and less education. Thus, the spill-over effect of electrification has contributed into reduced gap in terms of employment status though the households are far apart in terms of income, asset and education as revealed in the Sections 4.3.2, 4.3.7 and 4.4.1 respectively.

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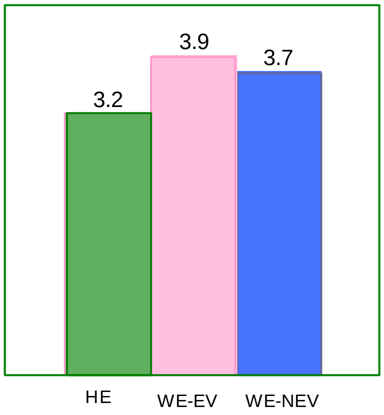
[21] Employed person is a person who was either working one or more hours for pay or profit or working without pay in a family farmer enterprise or organization during the reference period or found not working but had a job or business from which he/she was temporarily absent during the reference period (Report on Labour Force Survey in Bangladesh 1995-96, p.10, Bangladesh Bureau of Statistics, December 1996).

It is also significant to note that, 3.2% of the household members are reported to be unemployed (Table 4.3.12), compared to that in the households WE-EV (3.9%) and WE-NEV (3.7%). Access to electricity, thus, reduces unemployment if not entirely by creating new employment opportunities as well as providing impetus for increased employment opportunities through enhanced economic activities in the electrified villages (Figure 4.16). The low unemployment rate in HE is also substantiated by FGD findings. The male FGD participants in non-electrified villages reported unemployment arising out of low level of economic activity in the area. They also reported to be barred from starting IGAs like poultry, rice mill or cow rearing, that otherwise require less capital investment and can be started in a smaller scale.

Figure 4.16: Percentage of household members unemployed



Source Table: 4.3.12

> *"A large number of educated young people are unemployed in our village could have opportunities if electricity were there. Different types of business ranging from welding workshop to photostat shop could have absorbed them. Even they could have started their poultry farm on their own" (Male household members (WE-NEV), Village: Katalesthals, Union: Barthi, Thana: Gournadi, District: Barisal).*

Female members of the households in the non-electrified villages reported limited options for employment, mainly because of less opportunities to work outside household. Being over burdened with household works (discussed in Section 4.4.4.5), it is neither feasible nor encouraging for the family members to work outside.

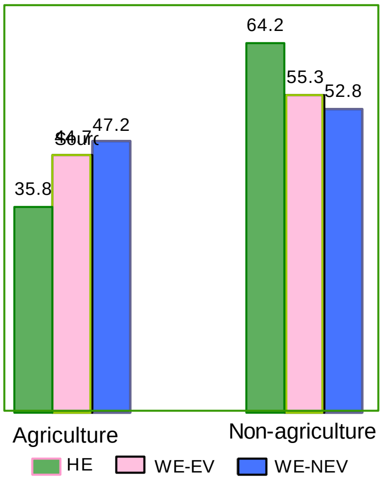
> *"The workload is heavy as we have to prepare all three meals before sunset. Due to absence of electricity it is impossible to pursue any income generating activity. We do not have any time to spare in the whole day. Workload further increases during harvesting". (Female household members (WE-NEV), Village: Defolbari, Union: Borohor, Thana: Ullapara, District: Sirajgonj).*

4.3.3.2. Occupational structure of household

Occupational pattern of all members of the households has been sought in the HHIS, to portray the livelihood status of the households. The specifications of primary and secondary occupation were brought in to identify the principal source of earning for senior members (male and female) as well as for sketching divergent of occupations arising out of electrification, both at household as well as community levels.

The divergent nature of occupations' both primary and secondary, especially among the household heads of three categories of households was evident in the survey results, revealing *modernization* of *occupation.* Primary involvement being non-agricultural activities irrespective of electrification status (Figure 4.17), 64.2% of household heads in HE are involved in non-agricultural activities, which is higher in comparison with WE-EV (55.3%) and WE-NEV (52.8%).

Figure 4.17: Household heads primary occupation



Souce: Table 4.3.14

In other words, the occupational status of household heads is reported to be influenced by the access to electricity as more HH heads (47.2%) in non-electrified villages took agriculture as their primary occupation compared to that in the electrified villages – 44.7% in WE-EV and 35.8% in HE (Table 4.3.14). The survey results thus confirm the notion of changes in occupational status of rural people brought about by economic growth. New employment opportunities are created through to market expansion, which can be directly attributable to electricity, as revealed in the FGD with male household members in electrified villages. The participants noted the changes in pattern of major occupations along with larger daily wages. The reason for higher wages is identified as the higher demand for labor in the post—electrification period due to diversified economic activities in the villages.

> *"Before electrification most of the people were employed as day laborers, rickshaw pullers etc, earning a daily wage of Tk.40-50. In the post-electrification period, due to establishment of industries, saw-mill, commercial establishments, laundry, dry cleaners, welding workshops etc, new employment opportunities are created. Daily wage has been increased to Tk.80-90, even for those Low-skilled workers, now working in different electrified industrial and commercial establishments". (Male household members (HE), Village: Amnia, Union : West Amura, Thana: Golapganj, District: Sylhet)*

The proportion of household heads involved in salaried jobs is reported to be higher in HE (10.6%) compared to WE-EV (2.9%) and WE-NEV (4.6%), which supports the FGD findings of demand for high-skill workers in the electrified area (Table 4.2.7b).

Considering all members of households, the dominant primary occupations revealed a somewhat different scenario (Figure 4.18).

- Agriculture is the most dominant occupation category and studentship is the most dominant activity among the household members for all three categories[22>]. Alike the household heads, more household members are involved in salaried jobs and businesses in HE compared to WE-EV and WE-NEV households (Table 4.3.12). It was interesting to note that, even for the households WE-EV, who are identified as the poorer segment of the electrified villages, a higher proportion of households (3.4%) are engaged in salaried job compared to WE-NEV (3%). This result signifies spill-over effect of electrification, creating employment opportunities for the local people irrespective of their household electrification status. A 2.8% of household members in non-electrified villages are involved in petty trading, which is slightly higher than the percentage of household members in WE-EV (2.4%) and in HE (2.1%).

Figure 418: Primary occupation of all household members (%)

Source: Table 4.3.12

[22>] Though occupation has an economic connotation, here occupation is interchangeably used with activity. For this section they are differentiated; occupation, implying economic activity only. Economic activity covers all market production and certain types of non-market production including production and processing of primary products for own consumption, own account construction and production of fixed assets for own use (Labor Force Survey 1995-96).

- Activity-wise, the higher percentage of studentship in the electrified villages goes in line with detailed analysis of impact on education in Section 4.4.1. Suffices to say that electricity, acting as a catalyst for longer and effective study hours, contributed to quality education in the electrified households.
- Majority of the household members for all categories of households do not have any secondary occupations (Table 4.3.12).

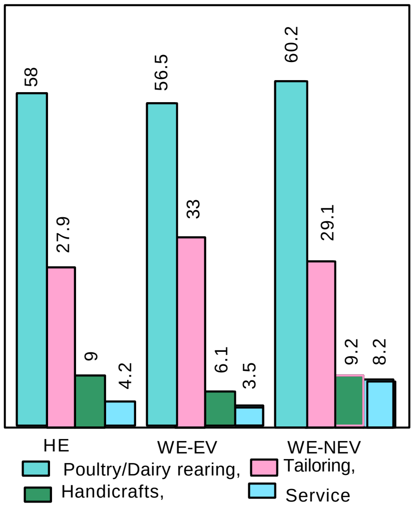
4.3.3.3. Remunerative employment[23>]

Remunerative employment is important to address the issues concerning income poverty. The role of electricity in terms of creating opportunities for remunerative employment is supposedly stronger in a direct manner for OMU rather than households. Providing electricity at the household level, however, influences remunerative employment for female member of households by way of re-allocation of more time from household chore, discussed in Section 4.4.4.

Fewer female members are reported to be housewives in electrified households (5.9%), compared to WE (9.3%) and WE-NEV (9.7%). Among the different categories of IGA activities, poultry/dairy rearing was the most prominent (Table 4.4.41d), followed by handicrafts, tailoring and shop keeping (Figure 4.19).

As for male members of the households, the occupational status in terms of percentage of households reporting involvement in IGAs, the same hierarchy as reported in Section 4.3.3.2, holds true. The male FGD participants also reported increased employment opportunities in the region due to increased work hours in the evening. The members in the electrified villages confirmed increased involvement in sewing by the female members, which is discussed in detail in Section 4.4.3. The reason however, was identified as own timing and being able to accomplish tasks in the homestead.

Figure 4.19: Pattern of women's involvement in IGA (%)



Source: Table 4.3.15

> *"The workers are earning extra income from the evening shift in the electrified villages, from which we are deprived of additional employment is created through second shift in the evening, which is impossible in our village". Male household member (WE-NEV), Village Debolbaria, Union: Barohar, Thana: Ullapara, District : Sirajganj).*

4.3.3.4. Direct employment through PBS

The extent of direct employment at the local level can be best reflected by the employment status in PBSs. Given average employee – consumer ratio as 1 : 250 (Samad 2001), the total employee is 16,233. (Based on MIS data, June 2002).

The more distinguishing feature is the exclusive appointment of local women as the *billing assistants.* Apart from increased economic security for the households as a whole, billing assistants revealed their satisfaction over the household decision-making process. The

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[23>] Remunerative employment is synonymously used for income generating activities.

provision for exclusive appointment of female employees is indicative of future employment for rural women along with the expansion of REP.

4.3.4. Impact on Expenditure

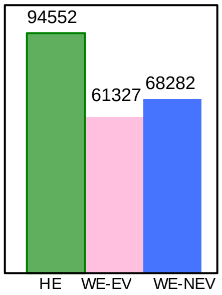
4.3.4.1. Introduction

Expenditure pattern of a household is considered as the best barometer to gauze many indicators, namely preferences, human development, propensity to savings and investment, extent of poverty, and even the level of income (which can be understated or overstated in a survey situation). Therefore, understanding the differences in the expenditure pattern of the three sample categories were considered necessary to ascertain the socio-economic preferences of people and their relationship with electrification status of the households. In so doing, detailed household level information in the survey were obtained on the following broad areas for the last one year preceding the interview: food consumption (for last week or a recent week representative of an average week); non-food expenditure including fuel and electricity, toiletries and cleanliness, transport and related expenses (for the last month); non-food expenditure including readymade garments, cloth and sewing, shoe, bed-related/bedding, housing and related, healthcare (separately for male/female), education (separately for male/female), socio-cultural and religious/festival, entertainment; tax, debt service, litigation; kitchen utensils; furniture/fixture; electrical equipment; and personal wearing and ornaments (all for the last one year). It would be worth noting that in ascertaining maximum possible information and to ensure that respondent does not miss any consumption component, information were obtained on as many as 188 components of expenditure. In addition, in order to maximize the accuracy and validity of these crucial data, all possible rechecking and cross-checking (random) mechanisms were adopted in the survey. It is also important to note that the overall pattern of expenditure found in this survey corroborates (to a large extent) with that of the National Household Income and Expenditure Survey 2000 (conducted by the Bangladesh Bureau of Statistics in 2000).

4.3.4.2 Expenditure Pattern: Food and non-food, and recurrent and capital

The overall average annual (last year's) expenditure in the electrified households was Tk.94,552. The corresponding figure for the non-electrified households in electrified villages was Tk.61,327, and for households in the non-electrified villages was Tk.68,282 (Figure 4.20). Thus, the average household expenditure in the electrified village was 38% higher than that of the households in the non-electrified villages, and 54% higher than that of the non-electrified households in electrified villages. As compared to the differences in the relative income of these three sample categories (see Section 4.3.2), the differences in relative expenditure is less pronounced implying that the electrified households spend relatively more than the other two categories.

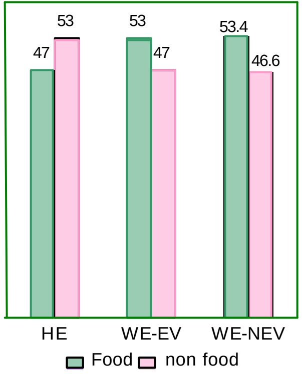
Figure 4.20: Annual average household expenditure by electrification status (in Tk.)



Source: Table 4.3.17

The food-non food pattern of expenditure was different between the electrified and non-electrified households. In absolute terms, for food, the electrified households spend (annually Tk.44,512) more than their non-electrified counterparts (Tk.32,516 in electrified villages and 36,456 in non-electrified villages Table-4.3.17). Similar was the situation in terms of non-food expenses. However, in relative terms, the share of food-non food expenditure of the electrified households exhibited a different pattern from that in the non-electrified households. While the share of non-food expenditure was higher than the food expenses in electrified, it was opposite in the non-electrified with higher share of food than non-food (Figure 4.21). The food-non food expenditure pattern in electrified resembled close-to-the national urban pattern and that in the non-electrified close-to-the national rural pattern[24>]. Thus, electrification has acted as a factor in urbanizing the consumption pattern of the rural people having electricity in their households.

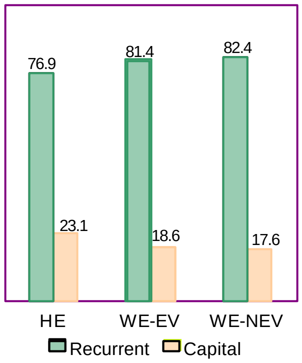
Figure 4.21: Distribution of annual household expenses by food and non-food items by electrification status (in %)



Source: Table 4.3.17

The distribution of last year's expenditure by recurrent-capital shows a much progressive pattern in the electrified households as compared to the non-electrified households. As expected, the share of recurrent expenses was higher than the capital expenses, irrespective of household electrification status. In absolute terms, both the recurrent and capital expenses were much higher in the electrified households than those in the non-electrified households. The annual average recurrent expenses in the electrified households (Tk.72,676) was 29% higher than that of the households in non-electrified villages (Tk.56,285). The same for capital expenses was as much as 82% higher in the electrified households compared to that in the households of non-electrified villages. More importantly, while share of capital expenses to overall expenditure was 23.1% in the electrified households, it was 17.6% in the households of non-electrified villages (Figure 4.22). This pattern of distribution of recurrent-capital indicates relatively more stable and stronger domestic economy and better quality of life of the electrified households as compared to their counterparts in the non-electrified ones. Thus, electricity influences strengthening of the domestic economy of households having access to electricity.

Figure 4.22: Distribution of annual household expenditure by recurrent and capital items by electrification status (in %)



Source: Table 4.3.20

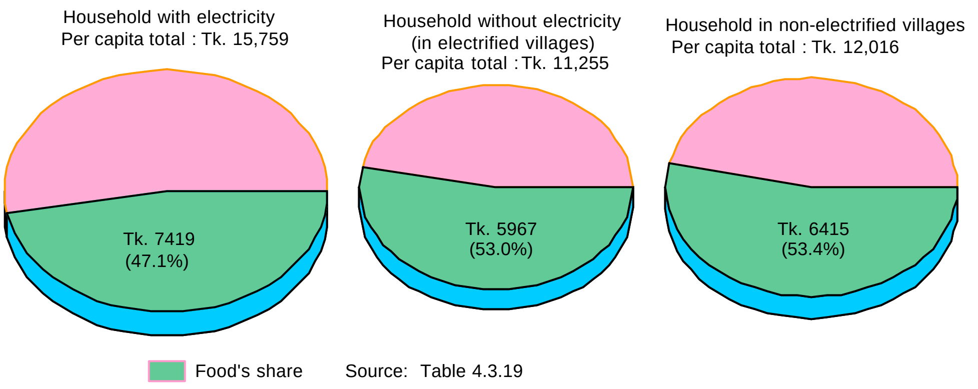
The relatively higher standard of living as well as quality of life of the members in the electrified households as compared to the members in the non-electrified households are evident from higher annual per capita expenditure on all items of expenditure (Table 4.3.19). The annual per capita expenditure on food in the electrified households (Tk.7,418.6) was 16% higher than that of the households in non-electrified villages. The corresponding figures for all other items showing the extent of higher expenses in the electrified than the non-electrified (in non-electrified villages) were 34% for fuel and electricity, 25.8% for toiletries, 99.6%for transport, 36.4% for apparels, 59.6% for housing, 36.6% for health care, 76.8% for education, 99.5% for socio-cultural and religious festivities, 7% for entertainment, 29.3% for tax and debt services, 34.3% for kitchen utensils, 96.9% for furniture and fixture, 53.3% for electrical equipments, and 155.5% for personal wearings/ornaments (estimated from data in Table 4.3.19).

[24>] The most recent Household Income and Expenditure Survey of Bangladesh 2000 (BBS 2001) provides the following figures for the distribution of household expenditure by food and non-food: National (food 54.6%, non-food 45.4%); Rural (food 59.3%, non-food 40.7%); Urban (food 44.6%, non-food 55.44%).

4.3.4.3. Food consumption: Per capita expenditure and intake

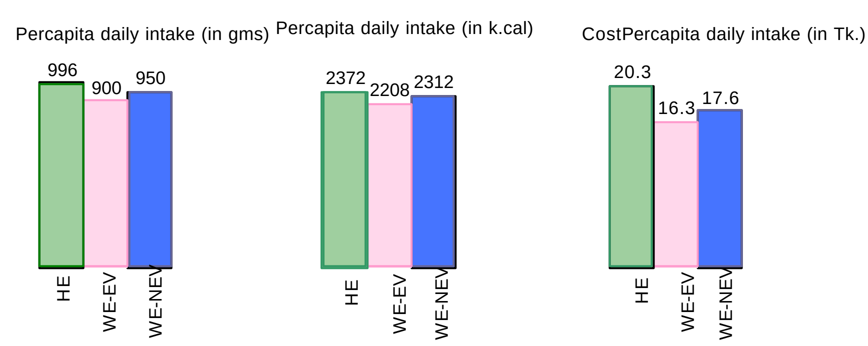
Food is the most basic as well as the predominant single item of expenditure. This is irrespective of household electrification status. In the annual per capita expenses on all items, the share of food was 47% in the electrified, 53% in the non-electrified (in non-electrified villages) and 53.4% in the households of the non-electrified villages (Figure 4.23). The higher relative share of food within the non-electrified sample category does not mean that they spent more absolute amount on food than the electrified. To the contrary, although the annual per capita share of food in electrified households is 47% of their total expenses, the per capita amount they spent on food is 24% higher than the per capita expenses on food by the non-electrified households in electrified villages and 16% higher than that by the households in the non-electrified villages (estimates based on information in Figure 4.23).

Figure 4.23: Annual per capita expenditure and share of food by households by electricity status



Source: Table 4.3.19

Figure 4.24 Percapita daily intake of food in terms of volume (gm), energy (k.cal) and money value of food by household electrification status



Source: Table 4.3.24

The members of the electrified households were reported to have consumed more food, both in terms of quantity and quality. The average daily per capita physical intake of food items in the electrified households was 996 gms., which is 11.5% higher than the corresponding national average[25>]. The corresponding value for the non-electrified households was 900 gms and that for households in the non-electrified villages 950 gms (Figure 4.24). Measured in terms of average daily per capita intake of energy (in kilo calories), the members of electrified consume 2372 K.Cal. and those in the non-electrified in electrified villages 2208 K.Cal, and those in the non-electrified villages 2312 K.Cal (Figure 4.24). Here also, an average member in the electrified household shows 132 K.Cal higher calorie intake than the national average[26>].

The average daily protein intake (fish, meat, milk and egg) of the members in the electrified households was 182.2 gm, as compared to 136.1 gm in the non-electrified (of electrified villages), and 149.9 gm in the non-electrified villages (estimated based on information in Table 4.3.24).

Finally, in terms of money value on account of daily food intake, the electrified households spent Tk.20.3 per person, which was Tk.16.3 per person in the non-electrified (of electrified villages), and Tk.17.6 per person in the households of non-electrified villages (Figure 4.24)

Thus, based on the above analysis of per capita daily intake of food by the members of households with and without electricity, the following inferences can be drawn:

First: In terms of quantity of food consumption, the members of the electrified households are much better-off than their counterparts in the non-electrified villages. The members in the electrified households, on average, consume daily 46 gms (4.8%) more than their counterparts in the non-electrified villages. In terms of intake of energy (kilo calories), it was 60 K.Cal (2.6%) more.

Second: The differences in food intake were significant while considered the quality of food. In terms of quality of food consumption, the members of the electrified households were found much better than their counterparts in the non-electrified villages. The average daily **protein** intake of the members in the electrified households (182.2 gm) was (as high as) 34% higher than that of the members in the non-electrified villages. The higher quality is also evident in the fact that while the average K. calorie for the members in the electrified households was only 2.6% higher than that in the non-electrified villages, the money value of food in the electrified exceeded 15.3% the money value of food in the non-electrified households.

4.3.4.4. Expenditure on education and health

The average annual educational expenditure ranged between 2.3% of the total household expenditure of the non-electrified households of electrified villages and 3.4% in the electrified households. The average annual (last year) household expenses for **education** incurred by the electrified households was Tk.3,260 – an about 87% higher expenditure than that in the households of the non-electrified villages, and 135% higher than the non-electrified villages (estimated based on information in Table 4.3.26). The same on account of **male** of electrified (Tk.2137) was 100% and 170% higher than their counterparts in the non-electrified villages and

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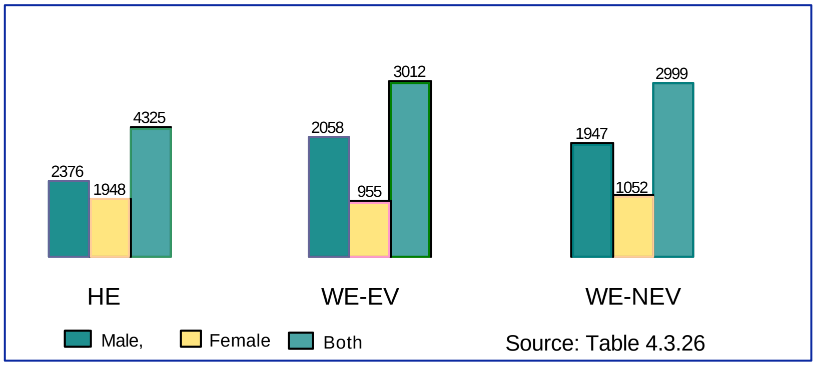
[25>] The national figures for the average daily per capita intake of food items was 893 grams with 898 grams for rural and 871 for urban (see Household Income and Expenditure Survey 2000, BBS 2001: 16).

[26>] The national figures for the average daily per capita intake of food items in terms of energy was 2240 K-Cal with 2263 K.Cal for rural and 2150 KCal for urban (see above source, page 17).

in the non-electrified households of electrified villages respectively. The annual household educational expenses for females of electrified (Tk.1124) was 66% and 89% higher than their counterparts in the non-electrified villages and non-electrified households of electrified villages respectively. Thus, spending on education for both boys and girls are much higher in the electrified than their counterparts in the non-electrified households; also the educational expenses constitute a high proportion of the higher income of the electrified (3.4% income) as compared to their counterparts (with less income than electrified). More detailed analysis of these aspects is presented in Section 4.4.1.

Figure 4.25: Average annual household expenditure on health care by male-female by household electrification status



Source: Table 4.3.26

The relative **healthcare expenditure** was high (at least higher than that education) in all categories of households. The share of health care expenses ranges between 4.4% and 4.9% of the annual average total household expenditure (Table 4.3.18). The average annual health care expenditure reported by the electrified households was Tk.4325, which is 44% higher than their non-electrified counterparts (Tk.3,012 and Tk.2,999) (Figure 4.25).

The annual healthcare expenses for the **male** of electrified (Tk. 2,376) was 22% higher than their counterpart in the non-electrified households of electrified villages and about 16% higher than those in the households of non-electrified villages. A much higher level of gender – gap was evident in case of health care expenses for the females. The annual health care expenses for the females of electrified (Tk.1,948) was 85% higher than those in the households of the non-electrified villages and 104% higher than those in the non-electrified households of electrified villages (estimated from data in Figure 4.25).

More importantly, the male-female gap in household health expenditure was much less pronounced within the electrified households than that in the two other sample categories. For example, while in the electrified households, the annual average health expenditure for the males was 22% higher than the females, the corresponding health expenses were as high as 85% higher for males than females in non-electrified households (of electrified villages), and more so, 116% higher for males than females in the households of the non-electrified villages (estimated based on data in Figure 4.25). Thus, as compared to the non-electrified households, the electrified households not only spend more on health but also exhibit less gender disparity on that. As a consequence, in terms of almost all the factors indicating people's health-hygiene-sanitation status, the electrified households were found much better posited than the non-electrified households, and, obviously, access to electricity has played immense role in changing people’s health status (for detailed analysis, see Section 4.4.2).

4.3.4.5. Entertainment expenses

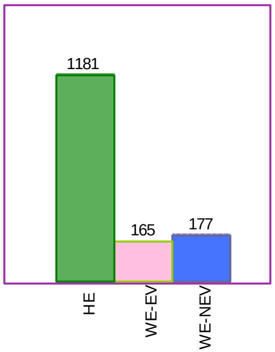
The household level entertainment expenses include those incurred on account of printed materials (books, newspapers, journals), cinema, theatre, sports, video audio cassettes, photo, renewal of licenses (TV, VCP, Radio), and battery. The average annual (last year) household expenses on entertainment was Tk.300 for the electrified, Tk.266 for the households in the non-electrified villages, and Tk.174 for the households in the non-electrified households in the electrified villages (Table 4.3.28). Although the differences between electrified and non-electrified households were not so significant (in terms of amount spent), the pattern of expenditure was different showing relatively improved quality of life in the electrified households.

The entertainment expenses in the electrified households was higher for books/newspaper/ journals, Tk.87 (which was Tk.20-34 in the non-electrified households) followed by Tk.60 for renewal of licensee of TV/VCP/Radio (which was Tk.1.5-8.4 in non-electrified). To the contrary, the highest amount of expenses for entertainment in the non-electrified households was on battery (from Tk.63 to Tk.102) followed by cinema/theatre (Tk. 37 to Tk.52).

4.3.4.6. Expenses on electrical equipment

It is most likely that the electrified households will spend more on electrical equipments/appliances. The last year's household expenses on account of purchase of electrical appliance was Tk.1,181 for the electrified households, Tk.165 for the non-electrified households in the electrified villages, and Tk.177 for the households in the non-electrified villages (Figure 4.26). This seven times higher expenses on account of purchase of electrified appliances by the electrified as compared to the non-electrified households were mainly due to the purchase of TV, fan and cassette recorder. These three appliances constitute about 80% of the total expenditure incurred for electrical appliances during the last year (estimated based on information in Table 4.3.29). The manifold higher expenditure on electrical appliances amply indicates the better quality of life and living standard of people residing in the electrified households, as compared to their counterparts in the non-electrified households.

Figure 4.26: Last year's household average expenditure for the purchase of electrical appliances by household electrification status (in Tk.)

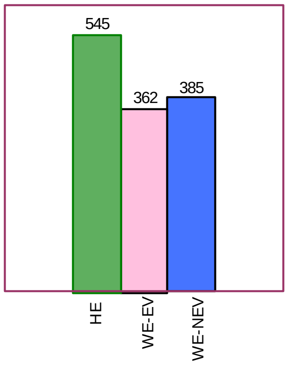


Source: Table 4.3.29

4.3.4.7. Expenditure on Fuel: Potential cost savings if switched to electricity

The average monthly expenses on fuel reported by the electrified households was Tk.545, and the corresponding amounts for the non-electrified households in electrified villages was Tk.362, and in non electrified villages Tk.385 (Figure 4.27). The major share of expenses on fuel, irrespective of household electrification status, was due to the traditional bio-mass sources (firewood, cowdung, leaves, straw). The share of bio-mass fuel was 66% of the total fuel expenses incurred by the electrified households, and the corresponding share of bio-mass was 80% in the non-electrified households. Electricity's share on fuel cost was 25% (applicable only to electrified households). Spending on kerosene was much higher in the non-electrified than in the electrified households. While, fuel expenses share of kerosene was about 20% in the non-

Figure 4.27: Monthly average household expenditure on fuel by household electrification status (in Tk.)



Source: Table 4.3.30

electrified, it was only 5% in case of the electrified households. Electrified household's monthly expenses on kerosene was only Tk. 28.3, while it was around Tk.65 in the non-electrified households.

On average, the volume of kerosene used as fuel was 1.6 litre per month in the electrified households, 3.3 litres per month in the non-electrified households of electrified villages, and 4.1 litre per month in the households of the non-electrified villages. Nationally speaking, this has significant financial implications on the imports in Bangladesh, and thereby on the overall disadvantaged situation in terms of trade and foreign currency reserve.

Considering the above, an attempt has been made in this study by using all possible data sources including the best use of the present survey data to estimate (extrapolate) the total annual volume and price of kerosene currently being used by all rural households (as fuel) as well as to make projection about the volume and expenditure that could be saved with 100% electrification of the rural households in Bangladesh. The major findings of projection is presented in Table 4.2, which are self-explanatory:

> **First:** Currently, all rural households in Bangladesh annually consume 775.53 million litres of kerosene as fuel for domestic use. If 100% rural households are connected with electricity, the annual volume of consumption will drop down to 366.58 million litres i.e; the projected annual savings will be about 410 million litres.
>
> **Second:** The valuation of the total current consumption of kerosene (as domestic fuel) by the rural households in Bangladesh is equivalent to Tk.13959.5 million, which equals to the 4.1% of the total import (CIF) of Bangladesh[27>]. The projected annual savings, on account of kerosene (as fuel), if access to electricity is ensured for 100% of the rural households, would be Tk.7361.1 million, which is equivalent to about 53% of the present rural households expenditure on kerosene, or equivalent to 2.15% of the current annual valuation of national imports (CIF) of Bangladesh. Thus, ensuring 100% electrification of rural households will have major impact not only in reducing the dependency on kerosene, which is purchased in the context of fragile foreign currency reserve situation, but also will have high positive impact on the overall economy of Bangladesh and contribute towards macroeconomic stability (to certain extent). In addition, this will have major sustainability implications in terms of accelerating the process of ensuring an environment-friendly society in Bangladesh.

[27>] The total value of imports (CIF) of Bangladesh in 1999-2000 was Tk.341,017 million (Statistical Pocketbook Bangladesh 2000, BBS 2002:247).

Table 4.2: Projection of annual costs savings possibilities on kerosene (as domestic fuel) in Rural Bangladesh: Scenario with 100% electrification of rural households

Household by electrification status	Number of HHs[1]	Annual volume of kerosene use per HH (ltr)[2]	Current annual volume of kerosene use: all HHs (mln.ltr)[3]	Projected annual volume of kerosene use : 100% hh electrification (mln.ltr)[4]	Projected/potential annual savings of kerosene with 100% hh electrified (mln.ltr)	Annual expenditure on kerosene as fuel (mln.Tk.)[5]		
						Current expenditure	Projected expenditure with 100% hh electrified	Projected annual savings
1	2	3	4	5	6	7	8	9
Household with electricity (HE)	3,413,825	19.2	65.55	65.55	0	1179.90	1179.90	0
Household without electricity in electrified villages (WE-EV)	6,395,086	39.6	253.24	122.79	130.45	4558.32	2210.22	2348.1
Household without electricity in non-electrified villages (WE-NEV)	9,283,313	49.2	456.74	178.24	278.50	8221.32	3208.32	5013.0
Total	**19,092,224**	**40.26**	**775.53**	**366.58**	**408.95**	**13959.54**	**6598.44**	**7361.1**

Notes

[1] Data adopted from Table 4.1, Section 4.3.2

[2] Present survey data, Table 4.3.30

[3] Estimated using weighted average of all households in column 2

[4] Assumed that non-electrified households will use the same average amount (volume) as the current electrified ones, i.e; annually 19.2 litres (estimated from survey data presented in Table 4.3.30).

[5] Weighted average of the present survey data gives Tk.18.00 per litre, as the current market price. The survey data have been weighted for all rural households in Bangladesh shown in column 2.

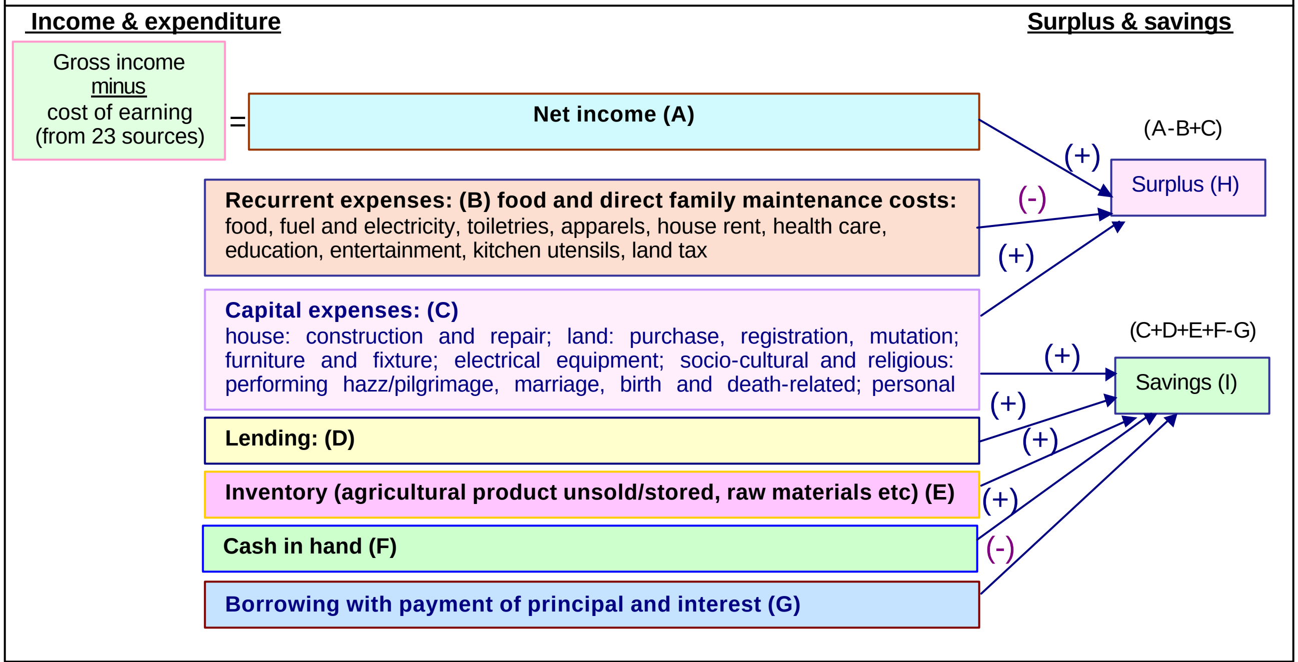
4.3.5. Impact on Surpluses and Savings

4.3.5.1. Introduction: Some methodological issues of estimation

This sub-section attempts to analyse the most complex micro level issues of economics, namely surpluses and savings. Availability of household level data on surplus and savings is scarce; and these are not available even in the most recently published official Household Income and Expenditure Survey 2000 of Bangladesh (BBS, GOB 2001). The main problem lies in the fact that while the household level status of income and expenditure can be captured for a defined time-frame (say last year, which as usual, was also the case in the present survey) using the concept of "flow", the status of household savings actually follow both the concepts of 'flow' and 'stock', and therefore, not easy to capture and measure with adequate accuracy. The estimation of surplus for a defined time frame is not difficult to measure but difficult to interpret, if there is deficit shown against a year for a household. This situation emerges when expenditure is greater than income. Accountants use straight methods to reconcile that, but in economics, 'deficit' is possible and may be explained through various components of savings.

Having mentioned all the above-stated conceptual problems, it would be pertinent to present the key methodological issues used in this study to estimate the household level surpluses and savings. As shown in Figure 4.28, the household surplus equals to sum total of net income and capital expenses **minus** recurrent expenses; and savings equals to sum total of capital expenses, lending, inventory, and cash in hand **minus** the borrowing (including payments of principal amount and the interest). The detailed components of each of the above are shown in the methodological schedule in Figure 4.28 below:

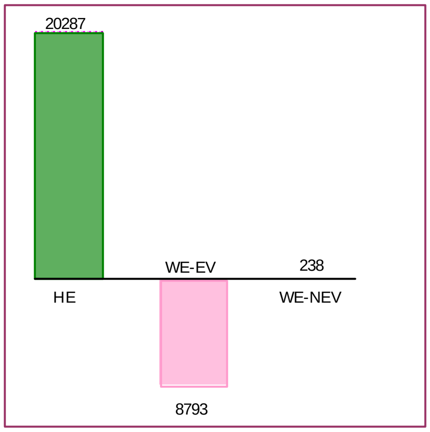
Figure 4.28: Methodology for estimation of household surplus and savings



4.3.5.2. Impact on Surpluses

On an average, an electrified household had surplus amounting to Tk.20,287 which is 85 times of the households in non-electrified villages (Tk 238.4 only) (Figure 4.29). The non-electrified households in the electrified villages represent a deficit, an average of Tk 8,793 per household[28>]. This does not imply that all households had surplus or deficits. The status of surplus and deficit varied by income and landownerships status of households.

Figure 4.29: Average amount of household annual surplus by household electrification status (inTk.)



Source: Table 4.3.31

A general pattern of surpluses was evident, irrespective of household electricity status: the low income households are deficit households; high income households are surplus households; and the amount of surplus increases with the increase in income status. As for example, all the low-income households (with annual income up to Tk.64,000) represent deficits, and all the high-income households (with annual income above Tk.64,000) represent surplus (Table 4.3.31). The surplus of the highest income groups of

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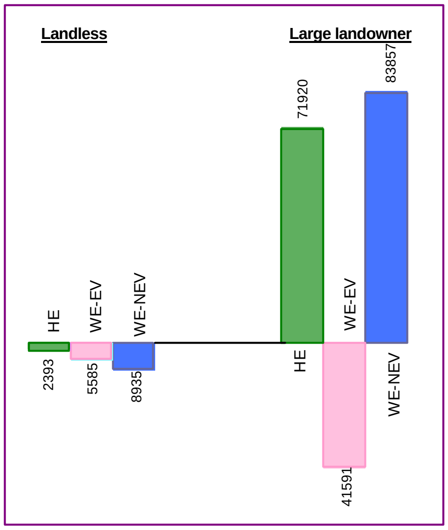
[28>] For low income group — in the short-run the propensity to consume is relatively high (i.e; recurrent expenses are relatively high), and thereby, deficit is not unlikely. About 58% of the households in this group are landless (Table 4.3.36) electrified households is Tk 155,285, which is 56% higher than that of the same income group of non-electrified villages and 91% higher that of the same income group of non-electrified households in the electrified villages (Table 4.3.31).

An interesting pattern of household surplus was found by household landownership status. Among the electrified, all landownership categories except the landless were found as surplus households (Table 4.3.32). Among the non-electrified households in electrified villages, all landownership categories were found deficit. Among households in the non-electrified villages, except the landless and marginal landowing households, other three categories (small, medium and large) were found surplus (Table 4.3.32).Most importantly, the deficits exhibited by the landless electrified households (Tk.2,393) was about 3.7 times less (Tk.8935) than that of the landless in the non-electrified villages, and 2.3 times less (Tk.5,585) than the same category in the non-electrified households of electrified villages (Figure 4.30). On the other hand, the average amount of surplus among the large landowning electrified households was Tk.71,920, which was about 17% less than among the same category of households in the non-electrified villages (Tk.83,857).

Figure 4.30: Average amount of deficits among the landless households and average amount of surplus among the large landowner households by electrification status (in Tk.)



Source: Table 4.3.32

Based on the above analysis of surplus, three inferences can be drawn:

a. The average situation of households in terms of availability of surplus is better in the households with electricity than those in the non-electrified villages.

b. The situation of households by landownership categories was also better in the electrified households than the comparable households in the non-electrified villages.

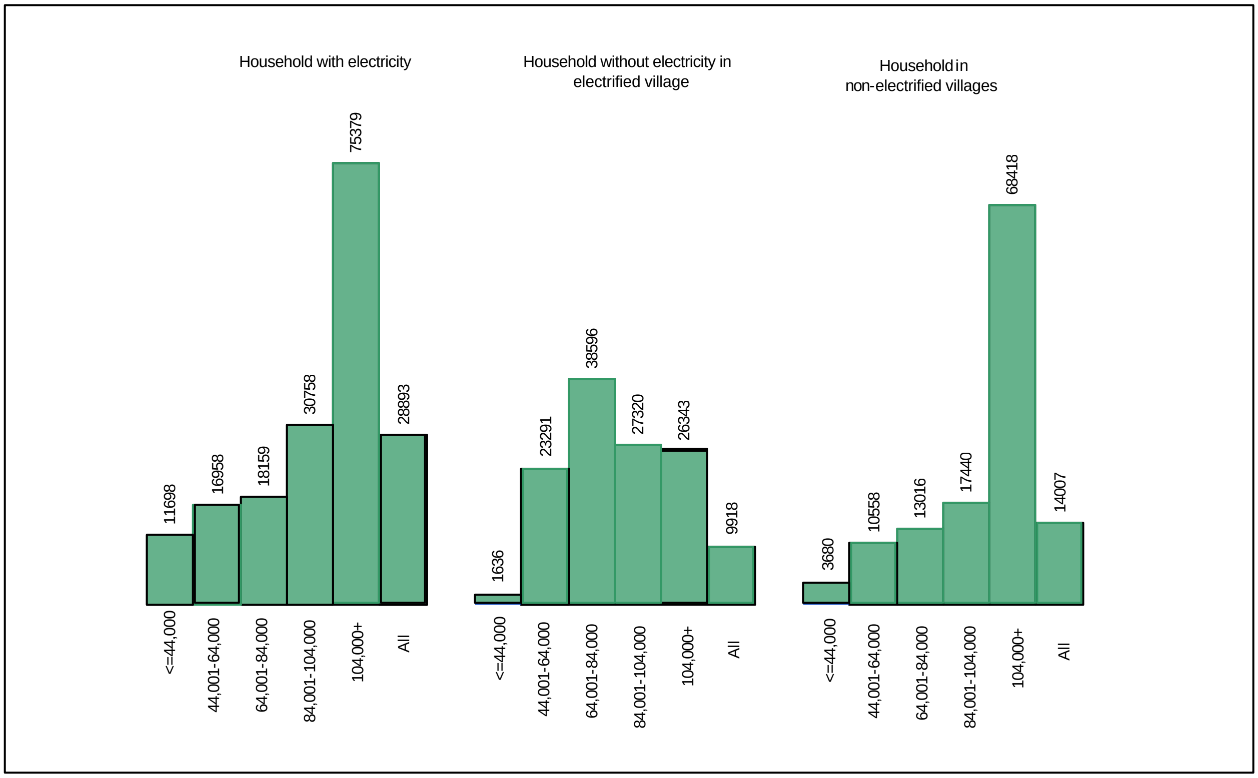
c. The rich-poor gap (landless versus large landowner) was much less pronounced in the electrified households (gap of Tk.74,312) than that in the households of non-electrified villages (gap of Tk.92,791).

4.3.5.3. Impact on savings

On average, an electrified household had savings amounting to Tk.28,893, non-electrified in electrified villages Tk. 9,918, and households in the non-electrified village, Tk.14,007. (Figure 4.31). The absolute amount of savings shows an upward trend with the higher income status of the households.

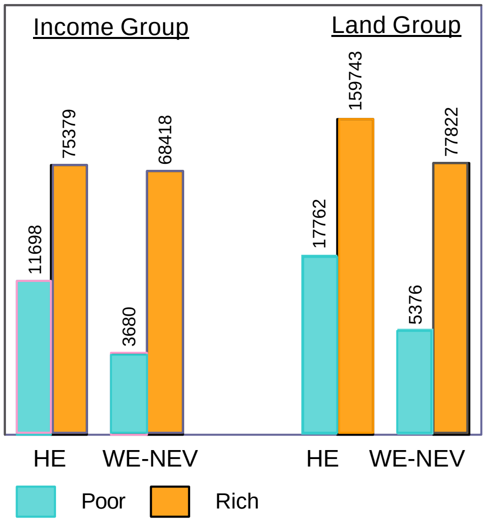
Electricity's impact on savings is most evident in the fact that, for each of the income groups, the average amount of savings in the electrified households are higher than their counterparts in the non-electrified villages (Figure 4.31). The average household savings in the electrified households was 106% higher than that in the households in the non-electrified villages. The corresponding figures for the five different income groups were 218%, 61%, 40%, 76% and 10% (estimate based on information in Figure 4.31).

Figure 4.31: Average amount of household savings by income groups by household electrification status (in Tk.)



The poverty reduction influence of electricity is also evident from the rich-poor gaps in savings. In terms of income groups, within electrified, the average amount of savings of the highest income group was 6.4 times higher than the lowest income group; and corresponding figure for the non-electrified villages was as high as 18 times. In terms of landownership groups, in electrified households, average amount of the savings of the large landowners was 9 times higher than the landless group; and the corresponding figure for the non-electrified villages was as high as 14 times (estimated based on information in Figure 4.32). Thus, based on the above analysis, it would be pertinent to draw the following conclusions indicating influence of electricity on household savings:

Figure 4.32: Rich-poor differences in average household savings by income andlandownership groups by electrification status (inTk.)



Source(s): Tables 4.3.33 and 4.3.33b

a. Average savings in the electrified households is 106% higher than that in the households in non-electrified villages. The annual net income of the electrified is 126% higher than that of the households in the non-electrified villages. The higher average propensity to savings in the electrified households is due mainly to the relatively less proportion of recurrent expenses[29>]. Thus, electricity contributes to increasing average propensity for savings.

b. Electricity contributes significantly in enhancing the savings rate of the poor in the electrified households (evident from 218% higher savings of the poor in the electrified households compared to the same category of people in the non-electrified villages).

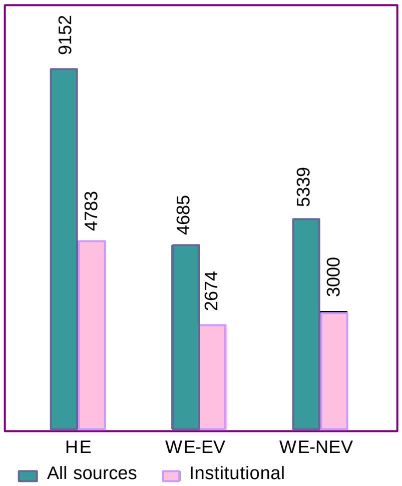
c. Electricity reduces the rich-poor gaps in savings (by income groups such gap was 6.4 times in electrified households and 18 times in the non-electrified villages)

4.3.6. Impact on Credit

Household creditworthiness, especially that from the commercial institutional sources, depends upon its asset situation. Since both asset and income were found to be higher in the electrified households than the non-electrified ones, the former has relatively high creditworthiness. This has been reflected in the actual amount of credit taken by the households during the last year.

As shown in Figure 4.33, the average amount of credit taken in the last year by electrified households was Tk. 9,153, and that by non-electrified households in the electrified villages was Tk. 4,685, and the same for the households in non-electrified villages was Tk. 5,339. The corresponding amounts from institutional sources were Tk. 4,783, Tk. 2,774 and Tk. 3,000. Thus, the average absolute amount of credit taken by the electrified households from all sources was 71.4% higher than that of households in the non-electrified villages; and the same from institutional sources was 59.4% higher for the households with electricity as compared to those in the non-electrified villages.

Figure 4.33 : Average amount of credit taken by households during last year by household electrification status



Source: Table 4.3.35

4.3.7. Impact on Ownership, Property and Assets: Land, Homestead, Animal Assets, Agricultural Equipment and Household Durables

4.3.7.1. Introduction

In this study, changes in the household asset situation during the last five years (1997-2002) were considered for all three sample categories, namely households with electricity (HE), households without electricity in electrified villages (WE-EV), and households in the non-electrified villages (WE-NEV). As per the original study design, the research team was not supposed to collect retrospective information (i.e., baseline or before-electrification status) due

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[29>] This should not be confused with the absolute amount of recurrent expenses. Because, annual average household recurrent expenses in electrified is Tk 72,676 and that in the non-electrified village is Tk 56,285. Also, recurrent expenses in electrified constitute 76.9% of the total expenses, but the same in non-electrified villages is 82.4%.

mainly to the problems associated with memory recall and associated biases. However, in the process of designing the actual study and pre-test of the household survey instruments, to enhance the quality of the study, it was decided to collect retrospective data and information on some specific indicators which suffer potentially less from memory recall problems, and thereby, data validity is adequate enough to gauze the relevant intertemporal changes. The retrospective deadline of 5 years back fits well into the analysis because the age-length (years) of domestic connection for the sample electrified households was 5.4 years. Thus, it can be well assumed that the timing of five years back from the date of interview coincides more or less with the average baseline timing of age-length of domestic connections. Moreover, five year timing is sound enough as a baseline for non-electrified households.

The ownership, property and asset-related data collected for two periods (1997 and 2002) in the survey include the following broad areas: agricultural landownership and landholding; other land and real state assets— pond, ditch, fallow, homestead, kitchen garden, dwelling and non-dwelling houses; livestock and poultry; agricultural equipments, and household durables (capital assets). In order to ensure comparability of all assets, the present market value (i.e., 2002-valuation) for all these assets was ascertained in the survey.

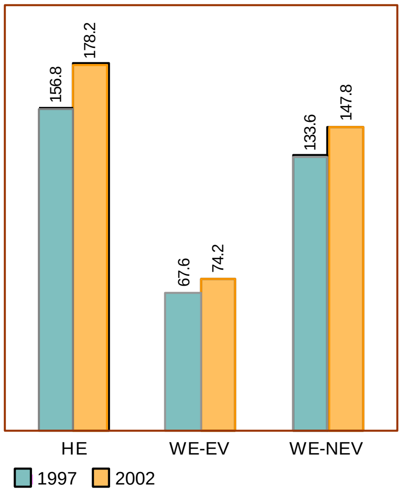
4.3.7.2. Landownership

The treatment of landownerhip has been made separately by types of land, namely, own cultivable land, pond, ditch/fallow, homestead and kitchen garden. Subsequently, combined analysis has been performed to show the overall landownership situation of the households including the changes during the last 5 years.

Cultivable own land: Amount and changes

A higher proportion of the electrified households own cultivable land, as compared to their counterpart non-electrified households (WE-EV, WE-NEV). About 79% of the electrified households (HE) reported ownership of cultivable land in 2002 (Table 4.3.36). The corresponding reporting was 59% for non-electrified households in the electrified villages (WE-EV) and 73% for the households in the villages without electricity (WE-NEV). Five years ago, the proportion of households that owned cultivable land was slightly less than today (76.4% for HE, 58.7% for WE-EV, and 70.7% for WE-NEV). There has been a change of 3.1% each in HE and WE-NEV, and 0.7% in WE-EV. This apparently means that there has been equal improvements in both the electrified and non-electrified villages. This first-hand impression disappears when one looks at the changes in the average amount of landownership and distribution pattern of such ownership (by decile households, lorenz curve and gini coefficients).

Figure 4.34: Changes in average ownership of cultivable land by household electrification status 1997 and 2002 (in decimals)

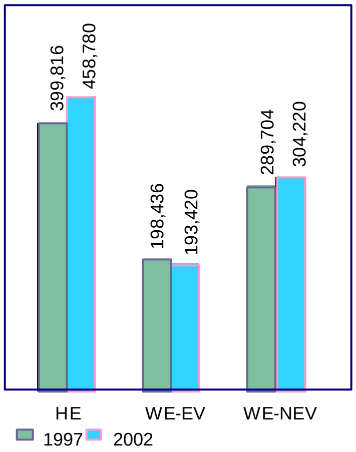


Source: Table 4.3.42(b)

The average amount of own cultivable land of the electrified households (HE) has increased from 156.8 decimals in 1997 to 178.2 decimals in 2002, a 13.6% increase during the last five years (Figure 4.34). The same for the households in the non-electrified villages has increased from 133.6 decimals in 1997 (a lower base than the HE) to 147.8 decimals in 2002, a 10.6% increase. As for non-electrified households in the electrified villages, the average amount of own cultivable land has increased from 67.6 decimals in 1997 (the lowest base) to 74.2 decimals in 2002, an increase of 9.8% over the last 5 years. Thus, even with a relatively higher base (average amount of HE 17% higher than that of WE-NEV in 1997) the rate of change in the ownership of cultivable land (during the last 5 years) of the electrified households was higher (3% points) than that of the households in the non-electrified villages. The distribution of ownership of cultivable land was less skewed in the electrified households than that in the non-electrified households (discussed below).

The before-after changes in household ownership of cultivable land becomes more revealing if the valuation of land is considered. The valuation of land for both 1997 and 2002 was done at present market price, i.e., 2002-price (to ensure comparability). The valuation of average own cultivable land of the electrified households (at present market price) has increased from Tk. 399,816 in 1997 to Tk.458,780 in 2002, an increase of 14.7% during five years (Figure 4.35). The corresponding valuation for households in the non-electrified villages were Tk. 289,704 and Tk. 304,220, a change of 5%. Thus, although the difference in five-year changes in the average amount of cultivable landownership between the electrified households and households in the non electrified villages was 3% points, it was 9.7% points in terms of valuation of the land—both being in favor of the electrified households (estimate based on information in Tables 4.3.42 and 4.3.40b).

Figure 4.35: Money value of average ownership of cultivable land by household electrification status: 1997 and 2002 (Tk. at present market value)



Source: Table 4.3.40(b)

During the last five years, the inequality situation of cultivable lanownership has improved in the electrified households compared to that in the households of non-electrified villages. This is evident in the following:

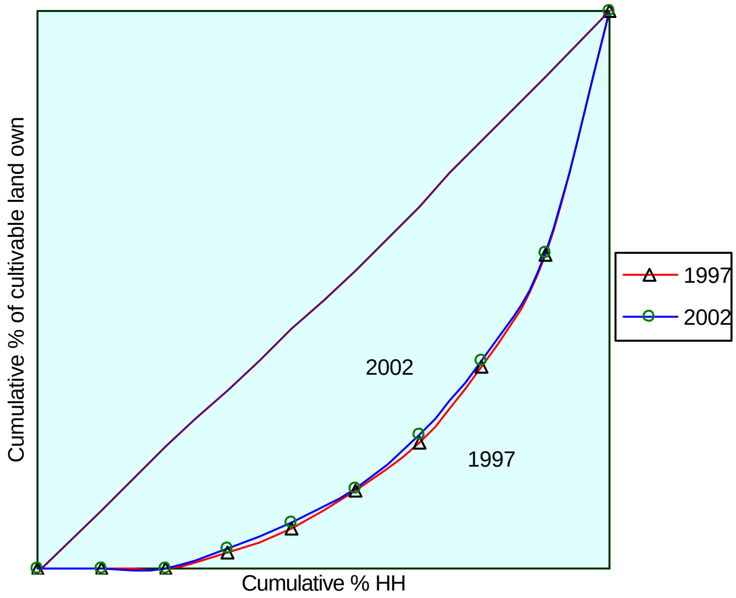
First: The bottom 40% of the electrified households now (in 2002) own 3.7% of the total cultivable land (total of all cultivable land owned by the electrified households) and the top 10% own 43% of such total land (Table 4.3.39). In the non-electrified villages, the bottom 40% of the households own only 1.6% of the total cultivable land (2.3 times less than that in the electrified households), and the top 10% own as high as 51.6% of such land (which is about 19% higher than in the electrified households). This shows prevalence of a higher extent of inequality in terms of ownership of cultivable land in the households of non-electrified villages compared to that in the electrified households.

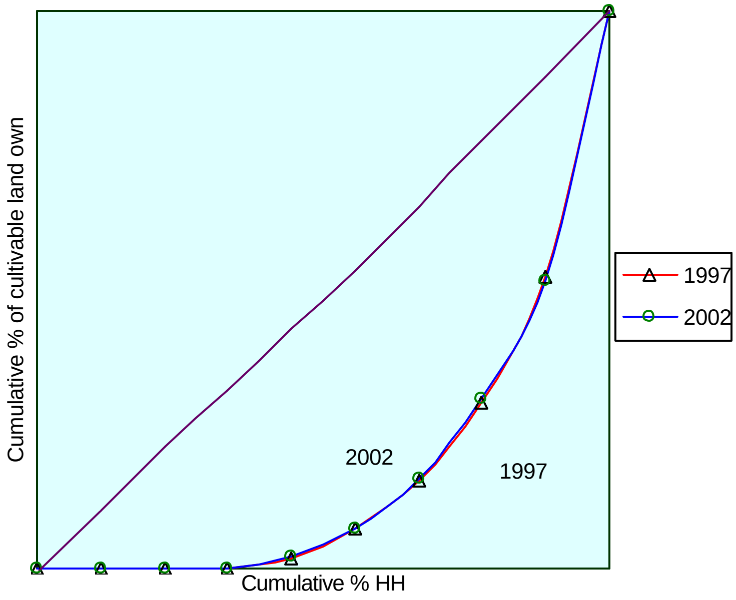
Second: The changes in the degree of inequality in cultivable landownership during the last five years were observed to be more favourable for electrified households compared to those in the households of non-electrified villages. The bottom 40% (four deciles) of the electrified households owned 3% of the total cultivable land in 1997, which has gone up to 3.7% in 2002. While the bottom 40% of the households in the non-electrified villages owned only 1.2% of the total cultivable land in 1997 which has gone up to 1.6% of the total in 2002 (Table 4.3.39). Therefore, the relative share of ownership in the total cultivable land of the bottom 40% of the electrified households has gone up at a higher rate during the last five years, as compared to that in households of the non-electrified villages.

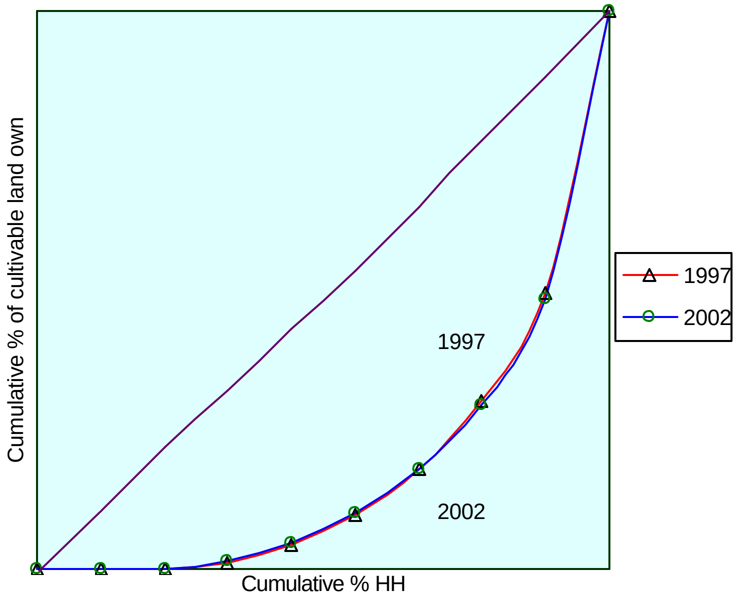
Third: The distribution of ownership of cultivable land in the electrified households, although skewed, is still better than that in the non-electrified households. The progress during the last five years was more pronounced in the electrified households. This is evident in the gini ratios and the changes in gini during the last five years. The gini concentration ratio (explained in Section 4.3.2.2) for ownership of cultivable land for the electrified households has dropped slightly from 0.62 in 1997 to 0.61 in 2002 (a decline of 1.6%); the same for non-electrified households in the electrified villages has dropped from 0.69 in 1997 to 0.68 in 2002 (a decline of 1.4%); but for the households in the non-electrified villages this has remained same at 0.67 in 1997 and 2002 (Table 4.3.40). The changes in the distributional pattern of cultivable landownership of three sample categories of households are shown in the Lorenz Curves below (Figure 4.36: A to E):

Figure 4.36: Lorenz curves showing distribution pattern of cultivable landownership of three sample categories of households — 1997 and 2002.

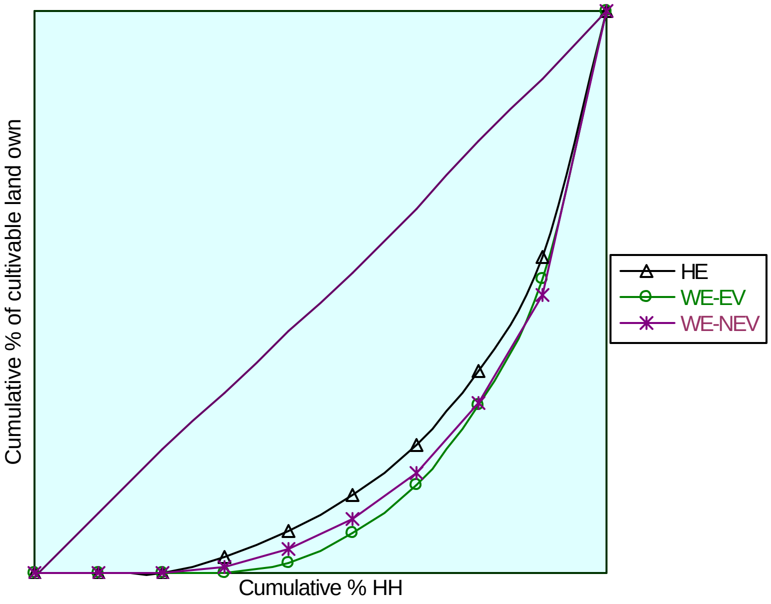
A: Electrified Households: 1997 and 2002



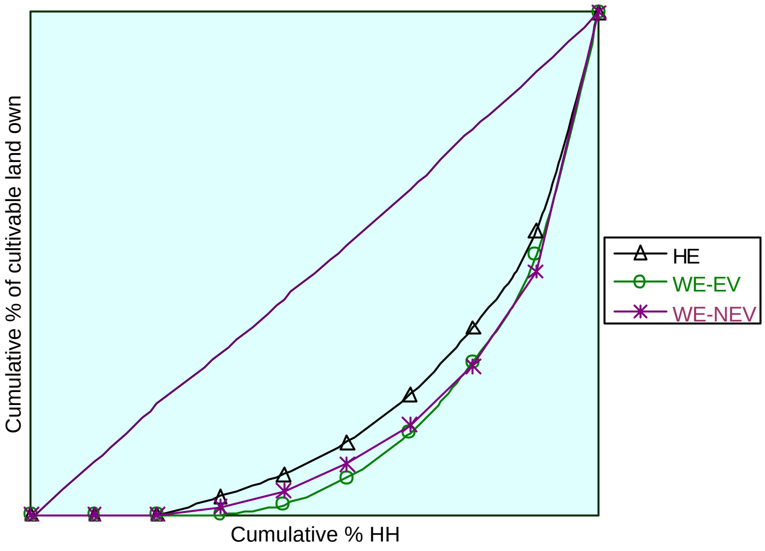

B: Non-electrified households in electrified villages: 1997 and 2002


C : Households in non-electrified villages: 1997 and 2002

D : Households of three sample categories: 1997



E : Households of three sample categories: 2002



Other land: Amount and changes

The land other than agricultural cultivable land includes pond, ditch/fallow, homestead and kitchen garden. The average amount of ownership of these land in the electrified households has gone up to 44.3 decimals in 2002 from 40.2 decimals in 1997 (Table 4.3.42). Although to a lesser extent, the average ownership of such land for WE-EV households has increased from 22.7 decimal in 1997 to 25.3 decimals in 2002; similarly for WE-NEV households, the increase was from 28.9 decimals in 1997 to 31.3 decimals in 2002. In terms of the absolute size of ownership and the increment, the higher increase in homestead, pond and kitchen garden in the electrified households compared to the others should be treated as a distinct sign of improvements in the standard of living in the electrified households.

4.3.7.3. Dwelling and non-dwelling rooms: Space and valuation

The average number and space of dwelling rooms are important indicators about the quality of life. As from this standpoint, the electrified households fare much better than the two other sample categories. During the last five years, although started with similar average number of dwelling and non-dwelling rooms, the increase in the electrified households was higher (26.3% for dwelling and 28.2% for non dwelling) than those in the households of non-electrified villages (17.6% for dwelling and 22.4% for non-dwelling) (Table 4.3.44). The average space of dwelling rooms in the electrified households has gone up to 635 sq. ft. in 2002 from 513 sq. ft. in 1997 (about 24% change), and that for households in the non-electrified villages has gone up to 440 sq. ft. in 2002 from 367 sq. ft. in 1997 (about 19.7% change). Almost all the dwelling rooms have electricity in electrified households. Moreso, the average space of non-dwelling rooms (kitchen, store, cowshed, handicrafts, cottage industry etc) in the electrified households has gone up to 242 sq. ft. in 2002 from 186 sq. ft. in 1997 (30% increase), and the same for the households in the non-electrified villages has increased to 173 sq. ft. in 2000 from 149 sq. ft. in 1997 (an increase of 16%). On average, one out of 2.2 non-dwelling rooms in the electrified households has electricity (Table 4.3.44). It is also interesting to note that the estimated present value of per square feet of dwelling rooms of electrified households is much higher (Tk. 116.7) than that of the households in non-electrified villages (Tk.97.7)[30>]. Thus, from various dimensions of dwelling and non-dwelling rooms, the electrified households exhibit a better standard of living than that of the households in non-electrified villages.

4.3.7.4. Livestock and poultry assets

During the last five years, ownership of average number of livestock (cow, goat, sheep) and poultry has increased in the electrified households, whereas the ownership of livestock has declined in the non-electrified households (Table 4.3.45). The average number of cow in the electrified households has increased from 1.1 in 1997 to 1.3 in 2002 (12% increase), and the same in the households of non-electrified villages has declined from 1.9 in 1997 to 1.2 in 2002 (37% decline). In terms of poultry birds, during the last five years, the average number owned by the electrified households has increased by 44% and the corresponding increase in the households of non-electrified villages was only 10.8% (Table 4.3.45). In terms of valuation of animal assets, during the last five years, an increase of 14.7% was recorded for the electrified households, whereas for households in the non-electrified villages there has been a decline of 27.7%. All these indicate distinct improvement in the animal asset situation in the electrified

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[30>] This, among others, also substantiates the findings that due to in-migration in to the electrified villages the price of land and related assets has increased (see Section 4.5.4: Migration and reasons).

households as compared to that in the households of non-electrified villages. It would be worthwhile to mention that, although the average non-electrified households in the electrified villages are much less well-off (in terms of income and landownership) than the households in the non-electrified villages, the former own higher number of poultry birds, on average, than the later. This might be due to the higher access to vaccines for poultry birds which is contingent upon the availability of electricity in the area. This has been substantiated by almost all the male and female participants of the FGDs conducted for the study.

4.3.7.5. Agricultural equipment and household durables

During the last five years, in terms of some household assets, there has been a major change in the electrified households. A high proportion of electrified households reported ownership of electrical appliances such as fan, TV, cassette player, iron, which are almost non-existent in the households of the non-electrified villages (Table 4.3.45b). Ownership of refrigerator was found in the electrified households (5% reporting), and it was non-existent in the households of no-electrified villages. Besides, the comparative rise in the agricultural equipment such as power tiller, irrigation equipment, thresher was more pronounced in the electrified than in the non-electrified households. In addition, the relative decline in the possession of *dhenki*, plough and bullock carts was more pronounced in the electrified as compared to the non-electrified households. The overall valuation of the agricultural and household capital assets (durable) in the electrified households stood at Tk. 84,555 per household in 2002 showing an increase of 156% during the last five years, and the same in the non-electrified villages was Tk.25,367 per household (in 2002) showing an increase of only 36% during the same period (Table 4.3.45c).

4.3.7.6. Changes in the overall asset situation: Movement of 1997 asset group into year 2002

An inter-temporal panel analysis of the movement of various asset groups during the last five years (between 1997 and 2002) has been attempted to show the changes in the relative position of each original asset group of 1997 in year 2002. The analysis has been done for all three categories of sample household (HE, WE-EV, WE-NEV). One of the main purposes of this analysis was to see whether the relevant changes in the electrified (households and areas) differ with the non-electrified or not. As for the purpose of this analysis, all households have been divided into three broad asset groups. The three asset groups are low, medium and high. The households in low asset group are those whose valuation of all assets, in 2002-market price, is up to Tk. 250,000. The medium asset group corresponds to the total asset valuation in the range of Tk. 250,001-Tk. 750,000, and the high asset group, Tk. 750,001 and above. The assets considered in the classification are movable and immovable assets, such as agricultural land, pond, ditches, homestead with dwelling and non-dwelling rooms, kitchen garden, livestock and poultry (all animal assets), agricultural equipment and household durables, business/shops, and industry (if any, including raw materials, stock etc).

In 2002, the average amount of total capital assets of an electrified household (HE) was Tk. 875,203, which is 64% higher than that of the households in the non-electrified villages (WE-NEV, Tk.532,522), and 120% higher than that of non-electrified households in the electrified villages (WE-EV, Tk.398,360) (Table 4.3.47b). The baseline valuation of asset of the electrified households for 1997 was Tk.733,057 which was 51% higher than that of WE-NEV (Tk.484,089) and 89% higher than that of WE-EV (Tk.388,837). During the last five years, the asset strength of the electrified households has improved by a much higher rate than that in the two other categories: five-year increase for HE was 19.4%, for WE-NEV 10%, and for WE-EV 2.4%.

Thus, the electrified households as compared to the non-electrified started (in 1997) with relatively higher base asset, but at the same time displayed a higher growth rate implying significant improvements in the electrified households as compared to the non-electrified. Although it is not possible to disaggregate the contribution of electricity in the incremental asset strength of the electrified household, it might be said that at least 16.4% of the increment in assets was due to electricity (by adopting the same proportion as in the case of electricity's share in income, Section 4.3.2.3).

The inter-temporal panel analysis of the movement of three asset groups presented in the flow diagrams below (Figure 4.37) shows that there were many fluctuations in the same asset group of the three different sample categories (HE, WE-EV and WE-NEV) during the last five years (between 1997 and 2002).

The detailed analysis by segments presented in the flow diagrams below prompts to conclude that upward mobility in the asset strength was much more pronounced in the electrified households compared to the non-electrified households. During the last five years, 15.4% of the electrified households (categorized in 3 broad asset groups) moved upward, whereas the corresponding proportions for non-electrified households were 8.6% (in electrified villages) and 9.6% (in non-electrified villages) (estimates based on information in Tables 4.3.47c and d).

The changes in the overall asset situation of the electrified households (HE) were as follows:

As shown in Figure 4.37 A, in 1997, the distribution pattern of households by three broad asset groups was 34.1% low, 36.2% medium, and 29.7% high. The pattern in 2002 was different with 28% in low, 35.4% in medium, and 36.5% in high. Thus, there has been a substantial decline in the low and some decline in medium asset categories, and relatively large increase in the high asset category. A general progressive scenario over the last five years in the changes in asset strength is evident. Of those representing low asset group in 1997 – after five years in 2002 – 76.2% remained low, 19.4% joined the medium, and 4.5% even joined the high asset category. Of those representing medium asset group in 1997, 75% remained medium, 4.6% joined the low (situation worsened) and as high as 20% joined the high asset category. Out of the original high asset households of 1997, by 2002, 93.4% remained at high, 5.1% joined the medium, and 1.5% even joined the low (much worsened).

The changes in the asset strength situation of the non-electrified households in the electrified villages (WE-EV) were as follows:

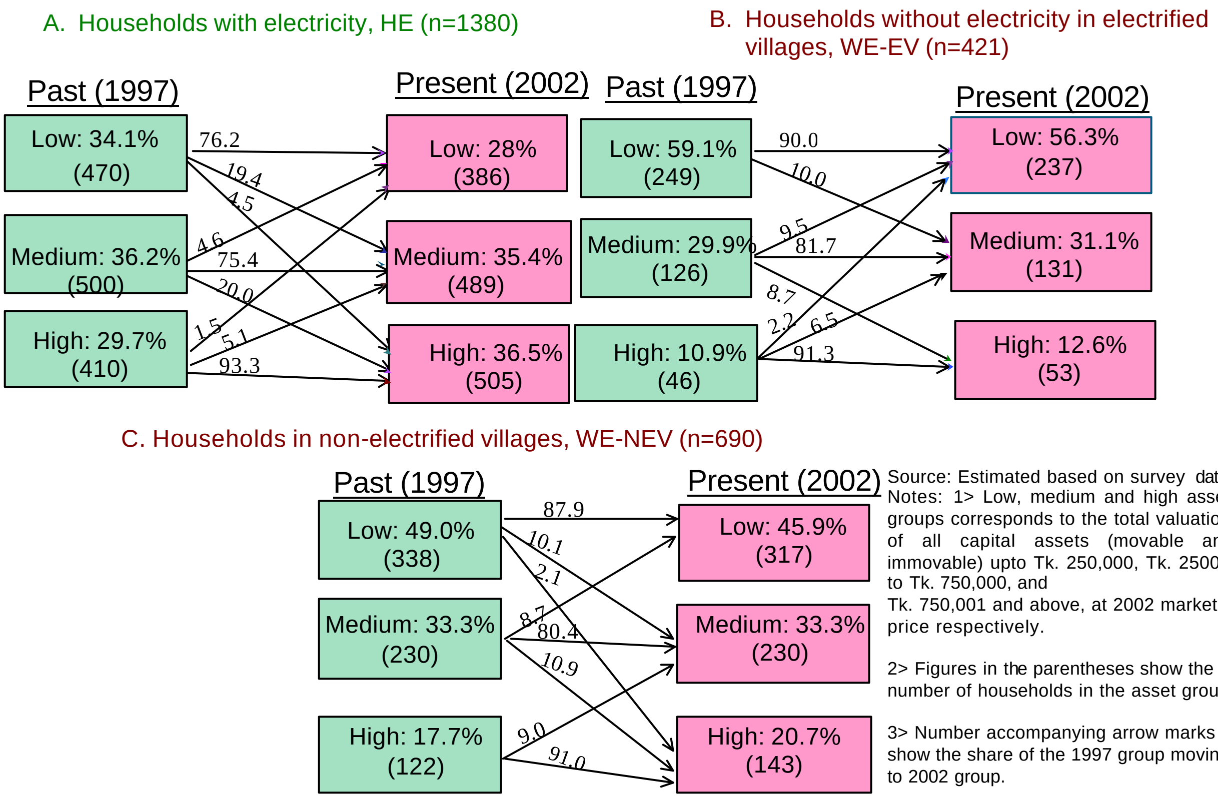
As can be seen in Figure 4.37 B, the distribution pattern in 1997 was 59.1% low, 29.9% medium, and 10.9% high. Compared to the electrified households, this sample category shows a very high share of low asset group and less share of high asset group. The 2002 pattern shows a slight decline in low (still 56.3%), a slight rise in medium (31.1%), and a slight rise in high (12.6%). Of those representing low asset group in 1997, 90% remained at the same low group, only 10% has gone up and joined the medium group, and none joined the high group (of this group, in case of electrified, 4.5% joined the high group). In 2000, the 1997 medium group's 81.7% remained at the same group, 8.7% improved and joined the high group, and 9.5% even gone down and joined the low asset group. The situation of the 10.9% of the households representing high asset group in 1997 has not changed much. However, 6.5% has gone down to join the medium and 2.2% further down and joined the low asset group.

The changes in the overall asset of the households in the non-electrified villages (WE-NEV) as shown in Figure 4.37 C depicts the following:

The 1997 pattern of distribution of asset groups was 49% low, 33.3% medium and 17% high. This pattern, as compared to the electrified, shows a higher base rate for low and a lower base rate for high. The 2002 pattern shows, a slight decline in low (from 49% to 45.9%), no changes in medium, and slight increase in the high (from 17.7% to 20.7%). Of those representing low asset group in 1997 – after five years (in 2002) – 87.9% could not improve their asset strength and remained in the same – low asset group, 10% moved to the medium and remaining 2.1% to the large asset groups. Among the original representatives of medium asset groups, 80.4% remained in the same (medium) group, 10.9% could move to the large, and 8.7% joined the low group. Of those representing high asset group in 1997, 91% remained high and 9% joined the medium asset group.

Thus, with all the fluctuations in the movement of households from one asset group to another, as compared to the non-electrified households, the electrified households have shown a much progressive trend in their economic strengths measured through upward movement of the household asset situation. This was evident in relatively less proportion of households in the low asset group— higher rate in the upward movement of the original (1997) low and medium asset groups (during 1997-2002), and relatively less pronounced downward trend of all the three asset groups (Figures 4.37 - A,B,C).

Figure 4.37: Flow diagram showing changes in the overall household situation during last five years by household electrification status: Movement of 1997 asset group in to year 2002.


A. Households with electricity, HE (n=1380)

B. Households without electricity in electrified villages, WE-EV (n=421)

C. Households in non-electrified villages, WE-NEV (n=690)

Source: Estimated based on survey data.
Notes: 1> Low, medium and high asset groups corresponds to the total valuation of all capital assets (movable and immovable) upto Tk. 250,000, Tk. 25001 to Tk. 750,000, and Tk. 750,001 and above, at 2002 market price respectively.

2> Figures in the parentheses show the number of households in the asset group

3> Number accompanying arrow marks show the share of the 1997 group moving to 2002 group.

4.4. SOCIAL AND CULTURAL IMPACT

Electricity enlightens people. Human development as a condition of enlarging people's opportunities and choices is not possible without provisioning the benefits of electricity to mass people. Electricity's role in influencing economic life of people has been evident and discussed in Section 4.3. Electricity impacts upon social and cultural development of individuals, families, and community at large. This impact is mediated through various intervening channels such as knowledge building and behavioral changes through TV viewing, radio listening, extended lighting hours etc. The changes in economic life (on income, employment, expenditure, savings, credit, asset building, as already discussed) together with the changes in the various dimensions of social and cultural life generate a sort of synergistic effect attributable to a host of development agents, of which, electricity has determining role. Thus, based on this concept of "electricity as mediating agent for social and cultural developments", this section presents the analysis of impact of electricity on the following relevant broad areas: education, health-hygiene-sanitation, gender dimensions including women's empowerment and changing status, modernization in the form of changing outlooks and ideational changes, extended hours and time allocation, and social environment and protective security.

4.4.1. Impact on Education

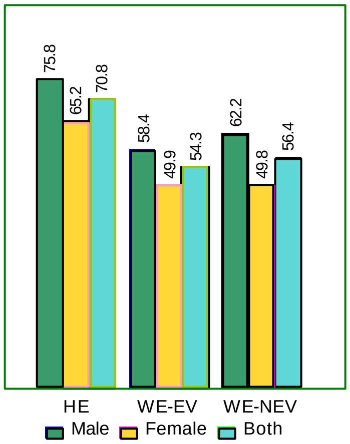
4.4.1.1. Introduction

Education forms the knowledge-base of economic development. Recognizing 'education' as a cornerstone to human capital formation (T. Schultz and G. Becker), 'education' as a means to human capability building and through that to human life, and 'education' as a key input into human development— adequate emphasis has been made in this study to reveal the educational status of the members of electrified and non-electrified households. Attempts are made to underscore the role of electricity in improving the educational status of people. In doing so, the following areas were covered: literacy (overall and adult), years of schooling, enrolment ratio, educational expenses, and quality of education. Gender disaggregated data were obtained and analysed. Gender dimensions of education have been analysed and presented in this section (in addition to those presented in Section 4.4.3: Impact on gender dimension: women's empowerment and changing status).

4.4.1.2. Literacy rates

The overall literacy rate[31>] was found much higher at 70.8% in the electrified households, compared to that in the non-electrified with 54.3% in the electrified villages and 56.4% in the non-electrified villages (Figure 4.38). Compared to the non-electrified households, the overall literacy rates for both male and female in the electrified were significantly higher. The overall male literacy rate in electrified was about 76% and that for WE-EV was 58.4% and for WE-NEV was 62.2%. Similarly, the overall female literacy rate in electrified was 65.2% (even higher than male literacy in non-electrified villages), and the corresponding rate for WE-EV was 49.9% and for WE-NEV was 49.8%.

Figure 4.38 : Overall literacy rate by sex by household electrification status (%)

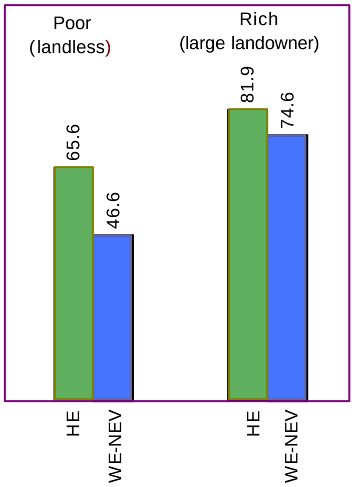


Source: Table 4.4.1

[31>] The overall literacy rate is defined in the Population Census of Bangladesh as the proportion of the members 7 years and above who read at least class III level.

The gender-divide in the overall literacy was much pronounced in the households of the non-electrified villages compared to the electrified households: male-female gap in non-electrified villages was 25%, and the same in the electrified households was 16% (estimated based on information in Figure 4.38). Thus, in the electrified households, as compared to the households in the non-electrified villages, the overall literacy rate is significantly higher (by 22%), with much less gender-inequity (female literacy in electrified is 31% higher than in the non-electrified villages). Other things being the same, these significant rises in overall literacy including that for females can be attributed to the household's access to electricity which has contributed much both in economic terms as well as in raising awareness about value of education.

Figure 4.39 : Rich-poor divide in overall literacy rate by household electrification status



Source: Table 4.4.2

Not only the overall literacy was higher, but also the rich-poor divide in literacy was less pronounced in the electrified than that in the non-electrified households (Figure 4.39). Regarding inequity in overall literacy the following are in order:

a. Across the sample categories, the more the rich (in terms of landownership status) the higher is the overall literacy rate i.e; the rich-poor divide exists irrespective of household electrification status (Table 4.4.2). However, the divide is much less pronounced in the electrified households compared to those in the non-electrified villages. In the electrified households, the overall literacy rate of the rich was about 25% higher than that of the poor, but the same was as high as 60% in the households of non-electrified villages (estimates based on Figure 4.39). This average rich-poor divide was more pronounced in case of females than the males.

b. The rich-rich divide with and without electricity was also evident. The overall literacy rate among the rich (large landowning) electrified household was 9.8% higher than the same category in the non-electrified villages. But the poor-poor divide with and without electricity was much more pronounced. The overall literacy rate among the poor (landless) electrified households was 41% higher than that among the poor in the non-electrified villages (estimated based on information in Figure 4.39). This difference in poor was 47% in case of overall female literacy of the poor.

Thus, electricity has a neutral impact on literacy of the rich, but it has significant impact on the literacy of the poor especially that of the poor women. This implies that, electricity impacts significantly in reducing the knowledge-poverty measured in terms of overall literacy rate as well as female overall literacy rate. In other words, in order to reduce knowledge-poverty and enhance literacy rate, ensuring households' access to electricity should be attached a high priority.

<u>Adult literacy rate[32>]</u> is one of the major indicators of human development (see Section 4.8.3). The adult literacy rates by sample categories, economic groups (land) and by sex show the similar pattern as was evident in the case of overall literacy rates. The pattern of adult literacy rate for electrified households as compared to non-electrified ones is characterized by relatively high rate for both male and female, relatively less gender disparity, and relatively less disparity

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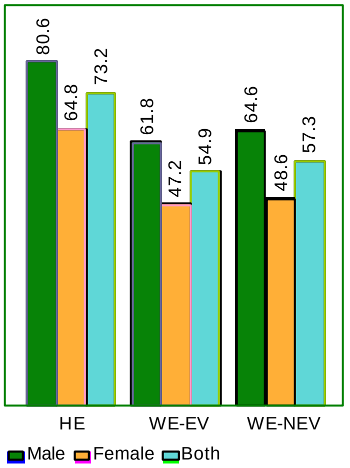
[32>] Adult literacy rate is the proportion of the population 15 years and above of age who read at least class III level.

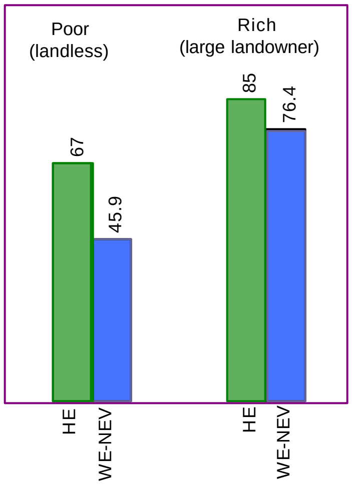
in rich-poor (Figures 4.40 and 4.41). Thus, the conclusions and implications here would be the same as in the case of overall literacy rates. Therefore, based on the above analysis of literacy, it can be forcefully argued that ensuring access to electricity in the households should be seen as a major strategy to reduce the knowledge-poverty (in terms of both raising overall literacy and adult literacy) in rural Bangladesh.

Figure 4.40 : Adult literacy rate by sex by household electrification status (%)



Source: Table 4.4.3

Figure 4.41: Rich-poor divide in adult literacy rate by household electrification status



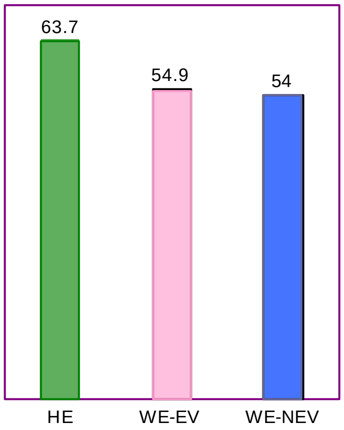
Source: Table 4.4. 3 (b)

4.4.1.3. Enrolment ratio

Primary education is free in Bangladesh; and all girls in the rural areas receive stipends at the secondary level of education. Thus, primary enrolment is supposed to be high. Around 94% of the respondents of the electrified households reported all children (6-15 years) go to schools (Table 4.4.1.b). The corresponding proportion was also high for the non-electrified households in the electrified villages (90%) and households in the villages without electricity (87%).

The gross enrolment ratio[33>]— one of the major indicators of educational attainment — was high at 63% in the electrified households, followed by 55% in the non-electrified households in electrified villages, and 54% in the non-electrified villages (Figure 4.42). This estimated 18% higher gross enrolment ratio in the electrified households compared to that in the households of non-electrified villages could be attributed to electricity via increased income, enhanced awareness about value of education etc.

Figure 4.42 : Gross enrollment ratio by household electrification status



Source: Table 4.4.4

4.4.1.4. Quality of education and associated reasons

Whether households' access to electricity influences quality of education or not was investigated in this study. The quality aspects were studied using the following parameters: expenditure on

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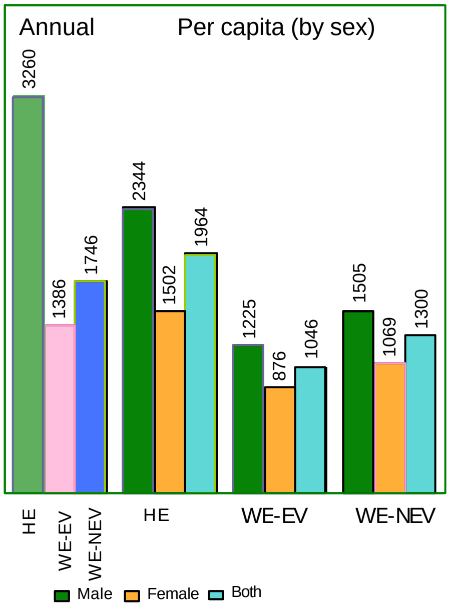
[33>] GER refers to the proportion of 5-25 years of age who are now enrolled in schools/colleges/universities.

education, marks (grades) obtained in the last final examinations, school drop-outs, school attendance rate, and time spent for study by students at night. Information on all these parameters were obtained for both sex.

Figure 4.43 : Household expenditure on education : annual (last year) and per capita by male-female (in Tk.)



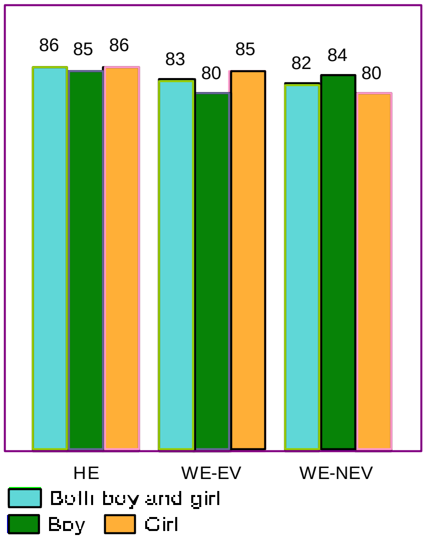
Source: Table: 4.4.5

The average annual household expenditure on education in the electrified households was Tk.3,260 which is 87% higher than that in the households of non-electrified villages, and 135% higher than that in the non-electrified households in electrified villages (Figure 4.43).

It would be pertinent to note that the electrified households not only spend a high amount on education, but also they spend a higher proportion of income for education purposes (3.5% income) than the other two categories (3.4% and 3.1%) (estimates based on data in Tables 4.4.5 and 4.3.2).

The <u>per capita annual household expenditure on education</u> in the electrified households was Tk. 1,964 with Tk. 2,344 for male and Tk. 1,502 for females (Figure 4.43). The corresponding expenditure in the households of non-electrified villages were much less at Tk. 1,300 (both), Tk. 1,505 (male) and Tk. 1,069 (female). In all categories of household, the per capita education expenditure for females was less than that of the boys. This is mostly likely largely due to the existence of the female secondary education stipend program in rural Bangladesh. Thus, the electrified households fare better than the other two categories in terms of income's share to education, overall expenses on education, as well as per capita educational expenditure and especially that for female students.

Figure 4.44 : School attendance rate (%) by boys and girls by household electrification status



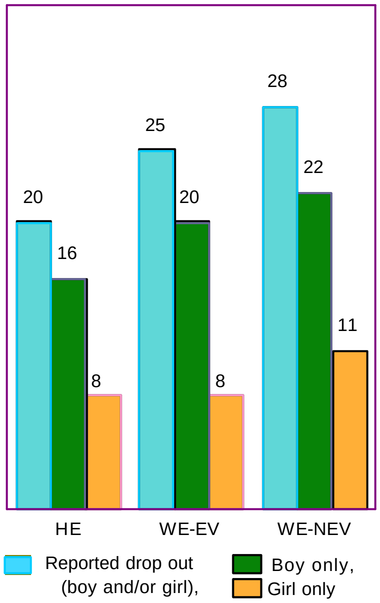
Source: Table 4.4.8

In terms of educational attainment measured through <u>marks obtained in the last final examination,</u> both boys and girls in the electrified households reported to be better-off than their counterparts, in all the classes (Table 4.4.6). Average marks obtained by the students in the electrified did not vary much by boys and girls. However, the difference was much pronounced for the students in the non-electrified households. This difference is much pronounced in the higher grades (VII-X).

The average <u>school attendance</u> rate was reported slightly higher in the electrified households (86%), compared to that in the non-electrified households (83% and 82%) (Figure 4.44). In the electrified villages, the girls attendance rate was reported higher than the boys, but in the non-electrified the opposite was true — boys attendance higher than the girls. Girls' attendance varied markedly with the availability/non-availability of electricity in the village: attendance was 85-86% in the electrified villages and about 80% in the non-electrified villages. The higher school attendance of girls in the electrified villages is associated with the availability of electricity in the schools and provisioning of fans for comfort (*study teams school level observation substantiates these findings*).

School drop-outs is a major indicator of quality of education. All three categories of households have reported such drop-out. The incidence of dropout was reported by a higher proportion of non-electrified households than that by the electrified households. In general, reported drop out was higher for the boys than for the girls (Figure 4.45). About 20% electrified households have reported incidence of drop out of school going children, the corresponding reporting was 25% for the non-electrified households in electrified villages and 28% for the households in the non-electrified villages. As for these three sample categories boys dropout was reported by 16% to 22% households, and girls dropout by 8% to 11% households (Figure 4.45). Thus, drop out increases with the non-availability of electricity in the households, or the opposite, the drop-out drops down with availability of electricity in the household.

Figure 4.45 : Percentage of households reported school drop out of boys and girls

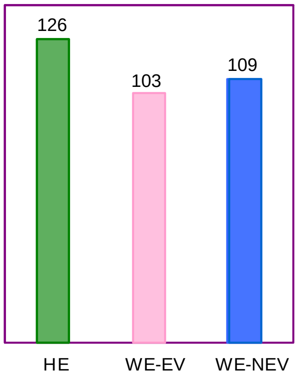


Source: Table 4.4.7

Electricity matters in improving the quality of education. This quality improvement in the electrified households works through very many channels: more time available for study after the sunset, the quality of that time due to sufficient light and fan for comfort, strengthening the knowledge-base due to access to TV (which in turn increases the appetite for learning), parents (especially mothers/other elder female members) devote more time in assisting children's education compared to before electricity etc.

The average amount of time spent on study after sunset (6 p.m.) was 126 minutes in the electrified households. It was 16% less in the households of non-electrified villages (109 minutes) and 22% less in the non-electrified households of electrified villages (Figure 4.46). In the electrified, not only the availability of more time for study (after sunset) but also the quality of that time in terms of learning environment because of sufficient light and fan for comfort must have played determining role in the improvement in quality of children's education. An additional factor, which has contributed to this improvement, is associated with parents' giving more time in assisting children's education after electricity as compared to before electricity in the household. Around 51% women reported that they now give, on average, 37 minutes more time in assisting children's study as compared to before electricity (Table 4.4.9).

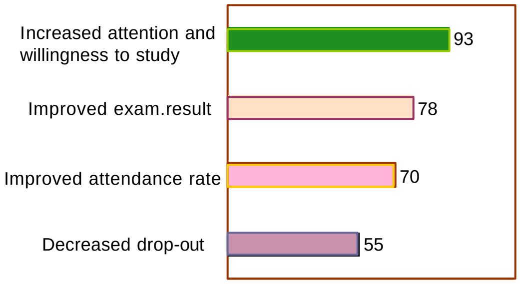
Figure 4.46 : Average time spent on study by students after sunset (6 PM) by household electricity status (in minutes)



Source: Table 4.4.11

Availability of household electricity has been instrumental in improving educational performance of the students in electrified households. About 94% of all respondents in the electrified households have confirmed so (Table 4.4.10). Among all respondents, 93% have said that because of electricity in their households the attention and willingness to study has increased; 78% associated improvements in exam. results with availability of electricity; 70% associated that with improved attendance rate; and 55% said that drop out has decreased due to availability of electricity in their households (Figure 4.47).

Figure 4.47: Percentage of respondents reported specific improvement in education due to available of electricity in their households



Source: Table 4.4.10

4.4.2. Impact on Health, Hygiene and Sanitation

4.4.2.1. Introduction

People's health status is the prime component of human development. This is because of the fact that human longevity (life expectancy at birth) which has been formally accepted as the number one variable in measuring the extent of human development or human deprivation is basically a function of health status. The linkages between health, poverty reduction and economic growth are much more powerful than has been generally understood. The WHO *Commission on Macroeconomics and Health* by-challenging the traditional argument that health will automatically improve as a result of economic growth argued that the opposite is true: improved health is a critical requirement for economic development in poor countries[34>]. This commission's path breaking report states "Health is a priority good in its own-right, as well as a central input into economic development and poverty reduction ..... . Increased investment in health would translate into hundreds of billions of dollars per year of increased income in the low-income countries. There are large social benefits to ensuring high level of health coverage of the poor, including spillovers to wealthier members of the society" (p.16). In the words of Nobel Laureate Amartya Sen, health is among the basic capabilities that gives value to human life[35>]. The global survey commissioned by UN Secretary General (Kofi Anan) (Millennium Poll, UN 2000) consistently ranked good health as number one desire of men and women around the world. In economic terms, health and education are the two cornerstones of human capital, which Nobel Laureates Theodore Schultz and Gary Becker have demonstrated to be the basis of an individual's economic productivity.

Recognizing the values of good health as means to humane capability building and through that to human life (AK Sen), health as a cornerstone of human capital (T Schultz and G Becker), and health as a central input into economic development and poverty reduction (WHO 2001) – adequate emphasis has been given in this study to understand the various dimensions of health status in the electrified and non-electrified households. Since, health practice and behavior is a function of health awareness (among others), the later has been analysed first. Such awareness is mediated through very many agents, of which, television shall be a major one. Thus, in all possible health related issues, the role of electricity has been identified using electricity-driven equipments especially TV as the agent. Electricity's impact (or influence) on health is not only mediated through TV, but also through availability of other facilities such as refrigerator, fan, modern diagnostic facilities (possible only if electricity is available) etc.

Keeping the above stated in view, the following broad spectrum areas of health-hygiene-sanitation were covered in the survey: awareness on crucial public health issues, source(s) of knowledge, disease and treatment patterns, health care expenses, attendance at child delivery, access to ANC and PNC check-ups, TT immunization, maternal morbidity, child immunization, infant death (infant mortality ratio), status of intake of vitamin A capsule to prevent night-blindness among children, use of family planning, source of drinking water, type of latrine facility in use, use of hand-washing material after defecation, use of soap while bathing, role of media in changing health-hygiene-sanitation behavior and practice. All the questions in this section of the survey were asked to the women (female head of the household or wife of the male head).

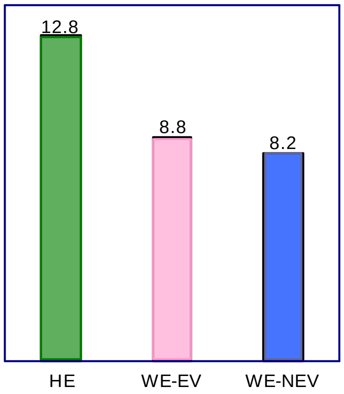
[34>] Macroeconomics and Health: Investing in Health for Economic Development, Presented by Jeffrey D. Sachs (as Commission's Chair) to GroHarlem Brundtland, DG-WHO, December 20, 2001.

[35>] Sen, AK (1999), Development as Freedom, New York: Alfred, A. Knopf (Chapter 1).

4.4.2.2. Knowledge about crucial public health issues and sources of knowledge

In terms of knowledge about each of the twenty[36>] crucial public health issues enquired in the survey, a consistent awareness pattern was found: respondents in the electrified households (HE) were reported to be much more aware than those in the non-electrified households; and those in the non-electrified households in electrified villages (WE-EV) were reported to be more aware than their counterparts in the non-electrified villages (WE-NEV)[37>] (Table 4.4.12). The higher state of knowledge among HE compared to those in WE-EV; and among WE-EV compared to those in WE-NEV is evident in the reporting about average number of issues known by the respondents, as well as in the overall knowledge coefficient constructed based on the survey findings. Out of 20 public health issues, on average, the respondents in the electrified households reported awareness about 12.8 issues, those representing WE-EV 8.8 issues, and those in WE-NEV 8.2 issues (Figure 4.48).

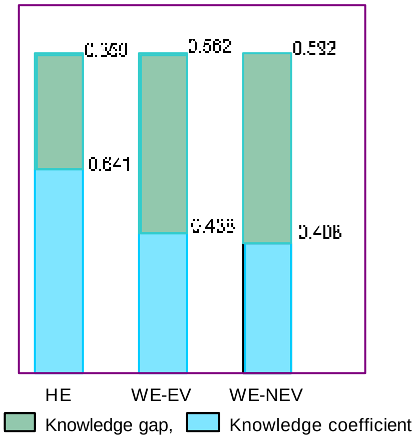
Figure 4.48 : Out of 20 crucial public health issues the average number of issues reported to be known, by hh electrification status



Source: Table 4.4.14

The overall knowledge coefficient (ranging between `0' showing "no knowledge" and `1' showing "have knowledge"/"are aware") has been constructed to show the aggregate knowledge status on 20 public health issues. One minus this coefficient is the value equivalent to the knowledge-gap (the higher the coefficient the more is the knowledge or, the less is the gap the better). The overall knowledge coefficient is 0.641 for electrified households, 0.435 for non-electrified in the electrified villages, and 0.408 for non-electrified villages (Figure 4.49). Electrified households had the least knowledge gap, and those in the non-electrified villages depicted the highest knowledge gap.

Figure 4.49 : Overall knowledge coefficient of 20 public health issues byhh electrification status



Source: Table 4.4.15

Health inequity is a major issue, across the low-income countries. This is usually termed as 'health divide' among the poor and the rich. This divide is pronounced in knowledge first. "Access to electricity" can be a major means to address and resolve this problem. This is evident from the **no-gaps** in public-health-knowledge coefficient among the poor and rich in the electrified households and high gaps in that in the non-electrified villages; as well as from the relatively high knowledge coefficient among the poor in the electrified compared to that in the non-electrified villages (Table 4.4.16). The rich-poor divide in health knowledge shows the following:

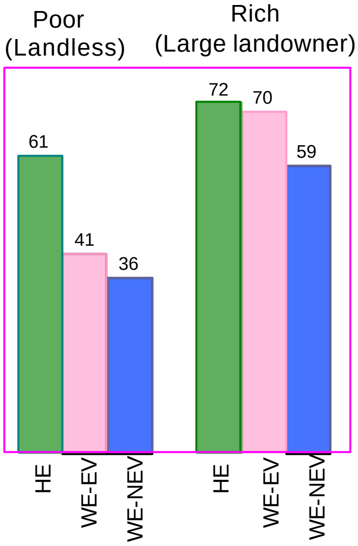
[36>] Twenty (20) crucial public health issues against which awareness (knows or don't know situation) was measured included symptom of diarrhoea (01), preparation of ORS/LGS (02), symptoms of ARI (03), Child vaccination against 6 diseases (04), place to go to for child's vaccination (05), place to go to for ANC checkup (06), five danger signs of pregnancy (07), place to go to for EOC (08), need for PNC checkup (09), prevention of goitre using iodized salt (10), name of three STDs (11), place to go to for treatment of STD (12), what is HIV/AIDS (13), how HIV transmission can be stopped (14), effect of arsenic in drinking water (15), avoidance of arsenic problem (16), reason for nightblindness in child (17), place to go to for TB treatment (18), place to go to for leprosy treatment (19), and necessity to use sanitary latrine (20).

[37>] The exceptions were in two out of 20 issues.

First: The overall public-health-knowledge coefficient in the electrified households ranged between 0.61 for landless and 0.72 for large landowning households, i.e; the gap is 11% points (Figure 4.50). The corresponding values for households in the non-electrified villages are only 0.36 (landless)and 0.59 (large landowner) with a gap of 23% points. Thus, the poor and rich in the non-electrified households are not only less aware than their counterparts in the electrified households, but also the poor-rich gap is twice as high. This means access to electricity at the household level impacts significantly in reducing the knowledge-in-health poverty by increasing the knowledge-base among the poor.

Second: The (poor) landless in the electrified households was found more knowledgeable (61%) about the public health issues than even the rich (large landowner) in the non-electrified villages (59%) (Figure 4.50). This also means, in terms of knowledge-poverty, the economically poor people become knowledge-rich if access to electricity is ensured.

Figure 4.50 : Rich-poor divide in public health knowledge by hh electrification status (overall knowledge coefficient)



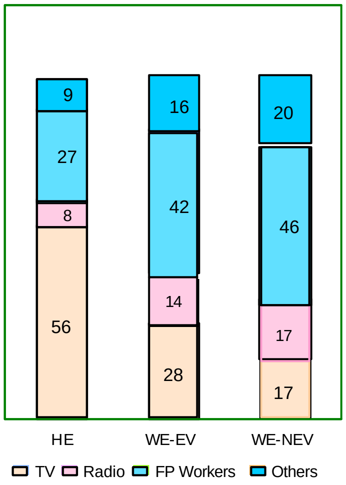
Source: Table 4.4.16

Third: The gaps in overall knowledge coefficients vary substantially for the same landownership category depending on the availability of electricity in the household. The overall knowledge coefficient of the landless in electrified villages is 25% points higher than the landless in the non-electrified villages. Such gaps were 23% points, 21% points, 19% points, and 13% points for the marginal, small, medium and large landowning households. These means that, ensuring access to electricity will have significant impact in reducing the existing knowledge gaps in the non-electrified households, and the rate of such impact will be higher for those who are poor. Thus, in transforming poor people into rich in public health knowledge – access to electricity can be a potential answer.

Electricity has contributed spectacularly to the knowledge building about crucial public health issues. Overall, as high as 56 percent of those having knowledge in the electrified households reported TV as the main source of knowledge, the corresponding figure for TV was 28 percent in the non-electrified households in electrified villages, and 17 percent in the non-electrified villages (Figure 4.51). As for both the categories of non-electrified households, the main source of knowledge was Health-Family Planning workers.

It is worthwhile to mention that the health program of the Government of Bangladesh considers the following as the most crucial ones needing vigorous media campaign (BCC campaign): issues of ARI (Pneumonia as the most killer disease among children), maternal mortality (recognizing the danger signs in pregnancy and know about where to go to in case of emergency obstetric problems), high incidence of sexually transmitted disease (STD) and their treatment, HIV/AIDS and their transmission,

Figure 4.51: Share of major sources of knowledge about 20 public health issues (aggregate share)



Source: Table 4.4.13 (b)

arsenic in drinking water and its mitigation, place to go to for treatment of tuberculosis (Bangladesh is the 4th TB burdened country in the world) and leprosy. The survey data indicate that in all these areas of public health, the respondents in the electrified households are much more aware than their counterparts in the non-electrified households. And, in that enhanced awareness building in the electrified households electricity had played immense role, because TV as a major source of knowledge was reported by over two-thirds in case of such public health issues as STD, HIV/AIDS, prevention of goitre using iodized salt, and arsenic in drinking water (Table 4.4.13).

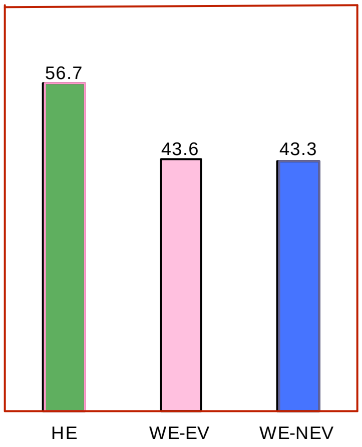
Thus, a straightforward inference can be drawn that the respondents in the electrified households and their neighbours, compared to those in the non-electrified villages, are more aware about the crucial public health issues, and electricity (through TV) had played an immense role as the major source in enhancing such knowledge.

4.4.2.3. Sickness and treatment

The sickness (illness and disease conditions) reporting was slightly more pronounced in the electrified households than in the non-electrified households.[38>] The incidence of twelve months' (preceding the interview) sickness reported was 2.2. persons per electrified household and 1.9 persons per non-electrified household. The average number of under-5 sick/ill reported was 0.3 per household in all three categories.

The pattern of incidence of sickness reported by all three categories of households was almost identical. The pattern reported by the electrified households was as follows: `fever' mentioned as the most frequent illness suffered (31.5% of all sicknesses), followed by pain (15.9%), gastric/acidity (11.2%), skin and VD (6.9%), typhoid (5.8%), ARI (5.7%), diarrhoea (5.5%), ENT problems (4.9%) (Table 4.4.18).

Figure 4.52 : Percentage reported treatment availed from MCP while sick during last year by hh electrification status



Source: Table 4.4.19

Although the pattern of sickness did not show any variation by sample categories, the distinctions were pronounced when it came to the question of treating sickness by <u>medically competent persons</u> (MCP)[39>]. This is more so true when it comes to the question of **gender-divide**. The following issues are in order:

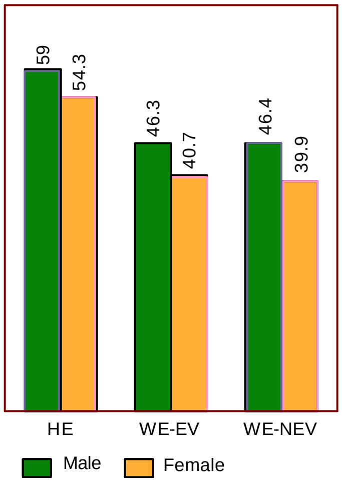
First: Availing treatment from the MCP was much more pronounced in the electrified households compared to that in the non-electrified households. About 57% of the electrified households reported that they availed treatment from MCP. The corresponding figure for non-electrified households was 43% (Figure 4.52). This means, in case of sickness, the electrified households are more likely to seek treatment from MCP (32% more) as compared to those in the non-electrified household.

[38>] Higher reporting of sickness does not necessarily mean higher incidence of actual sickness, and the opposite, the low reporting of sickness not necessarily mean low incidence of sickness. The higher or lower reporting of sickness may be a function of knowledge, availability of facilities, and affordability. The sickness reporting in the Indian province of Kerala (a high educated and socio-culturally developed province) is much higher than that in Bihar (a low income, low educated province with high mortality and morbidity rates). The infant mortality rate in Kerala is one of the lowest in the world, but sickness reporting is high.

[39>] Medically competent persons (MCP) include MBBS doctor, FWV, Nurse, MA, SACMO, other Paramedics, This is applicable throughout the study.

Second: The gender disparity in seeking treatment from MCP exists. However, it is much less pronounced in the electrified than that in the non-electrified households. The male-female proportions in seeking treatment from MCP were 59% and 54.3% in electrified; 46.3% and 40.7% in non-electrified households in electrified villages, and 46.4% and 39.9% in the non-electrified villages (Figure 4.53). The percentage points disparity was 4.7%, 5.6% and 6.5% respectively for the three sample categories respectively. Thus, although disparity existed in all categories, it was more pronounced in the non-electrified households; and females in the non-electrified were taken to MCP while sick in a much lesser proportions than those in the electrified households (difference being 14% points).

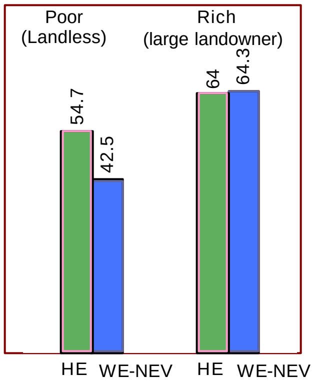
Figure 4.53 : Percentage reported treatment availed from MCP for sickness of male/female (during last year) by hh electrification status



Source: Table 4.4.19

Third: As in case of knowledge, “health divide” among poor and rich is highly pronounced when it comes to the question of accessing treatment services from MCP. The landless group in the electrified households reported that in 55% events of sickness they sought services from MCP, while it was only 42.5% in the non-electrified villages (a difference of 12.5% points). Similar was the pattern in case of marginal, small and medium landowner categories of households (Table 4.4.20). As for large landowner households, irrespective of availability of electricity, proportion availing care from MCP while sick was same (64%). The rich-poor gap between utilization of MCP in sickness was 9.3% points in the electrified households, and as high as 21.8% points in the households of the non-electrified villages (Figure 4.54). Thus, availability of electricity in the households influences the status of seeking treatment from MCP (while sick) much more in the poor households than in the rich households (Figure 4.54). This means health poverty reduction— both in terms of awareness on public health issues and utilization of medically competent persons while sick— is possible with ensuring access to electricity in the non-electrified households.

Figure 4.54 : Rich-poor divide in seeking treatment from medically competent persons (proportion sought treatment from MCP)



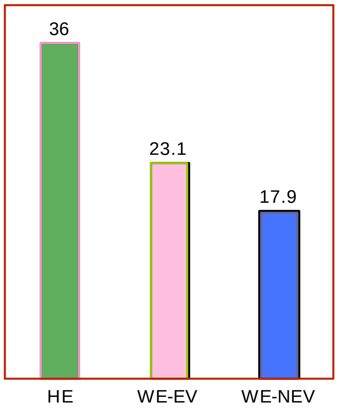
Source: Table 4.4.20

4.4.2.4. Child birth and maternal health

According to the most recent Demographic and Health Survey (BDHS 1999-2000), almost all births (92%) in Bangladesh occur at home; 12.1% of births are assisted by medically competent persons and 21.8% by trained persons; antenatal check-up coverage by medically trained provider is 33%; and TT coverage (2 or more TT injection) is 64% (BDHS, 1999-2000: 112, 114-115, 117-118). These recent national figures would be of use in comparing the same with our survey findings. However, a caveat to note is that the BDHS data quoted above are national data (not rural ones). Findings from this survey are mostly rural and were collected recently.

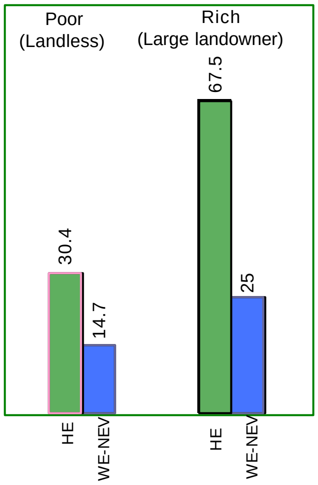
A much higher proportion of **child delivery** (last birth) in the electrified households were **assisted** by medically trained persons (36%)[40>]. The corresponding figure for the non-electrified households in electrified villages was 23.1% (around national average), and for households in the non-electrified villages was 17.9% (Figure 4.55). The rich-poor disparity was clearly evident in this aspect also. Among the last deliveries in the electrified households, 30.4% in the landless group and 67.5% in the large landowning group were assisted by medically trained persons (Figure 4.56) The rich-poor gap was 37.1% points (with a base of 30.4%). However, the same in the non-electrified villages were 14.7% (for landless) and 25% (for large landowners) respectively. The rich-poor gap being only 10.3% points (with a low base of 14.7%).

Figure 4.55 : Proportion of last birth (child delivery) assisted by medically trained persons by hh electrification status



Source: Table 4.4.21

Figure 4.56 : Rich-poor divide in proportion of last child delivery assisted by medically trained persons by hh electrification status



Source: Table 4.4.21(b)

Thus, in terms of assistance in child delivery by medically trained persons the electrified households show a much better situation – both overall, as well as by landownership categories. On this count, the poor electricity are better-off even than the rich in the non-electrified villages.

The situation of availing of **antenatal care (ANC)** check-up during pregnancy by medically trained provider, receipt of **tetanus toxoid** injections during pregnancy, and **post natal (PNC)** check-up after delivery – all reported by a much higher proportions in the electrified households compared to those in the non-electrified households (Figure 4.57). The gaps between the electrified households and households in the non-electrified villages were 20.4% points for ANC, 8.6% points for TT, and 11.3% points for PNC. Considering the national status, two inferences are in order: (i) the electrified households show much better status than the national situation, (ii) the non-electrified households show deplorable situation compared to the national rural averages on each of the three issues considered (ANC, TT and PNC).

The disparity in access to ANC and PNC by rich and poor is distinctly evident (Figure 4.58). A higher proportion of rich in both the electrified and non-electrified households received ANC and PNC check-up services compared to their counterpart poor households. In HE, the rich -poor ratio accessing ANC was 65% – 40.9%, in WE-NEV it was 33.3% – 22.1%. Almost similar was

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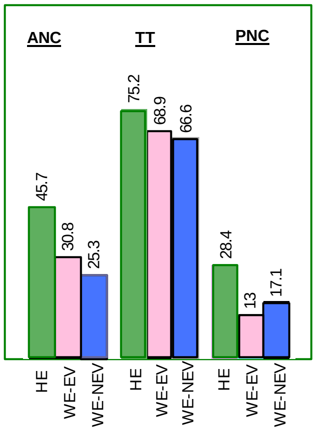
[40>] Medically trained persons (MTP) includes MBBS doctor FWV, Nurse, MA, SACMO, other Paramedics, and trained traditional birth attendants (TTBAs) and not the untrained traditional birth attendants, UTBA).

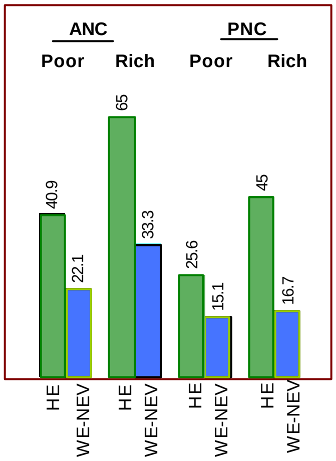
the pattern for PNC in HE (not in WE-NEV). Significant enough that, even the poor in the electrified households had received more ANC check-up services than the rich in the non-electrified villages. Thus, in general, the women in the electrified households, irrespective of rich-poor had received more ANC and PNC services as compared to the national averages; and women in the non-electrified villages received relatively very little ANC and PNC services as compared to those in the electrified villages. All these imply that having electricity in the households positively influences the utilization of ANC and PNC services, and also acts as a health-mediated poverty reduction factor by motivating poor people (through radio/TV) to use ANC and PNC services in need. It is also to be mentioned that the annual income of the poor (landless) in the electrified households is 51% higher than that of the poor (landless) in the non-electrified villages implying higher financial affordability of the poor in the electrified villages (Table 4.3.6). Therefore, for the poor people, electricity works in both ways, the income and thereby affordability, and increase in knowledge-base about the value of good health.

Figure 4.57 : Percentage reported ANC checkup, TT immunization and PNC checkup by medically trained providers by hh electrification status



Source: Table 4.4.22

Figure 4.58 : Rich-poor divide in access to ANC and PNC checkup services by medically trained provider (% reported in connection with last childbirth)



Source: Table 4.4.23

Maternal morbidity during pregnancy, delivery, and within 42 days of delivery (postpartum period) is a serious public health concern in Bangladesh. The situation is extremely distressing and unacceptable because, each year about 600,000 pregnant women in Bangladesh develop reproductive morbidities, which diminish women's fertility, productivity, quality of life, and the health and survival of the next generation[41>]. As expected, the proportions of women reported maternal morbidity by household electrification status were similar for each type of morbidity – during pregnancy, during delivery, and in 42 days after delivery. But in case of treating the morbidity by medically competent person (MCP) major variations were observed by household electrification status. Over 80% cases of 3 types of maternal morbidity each, the households with electricity availed treatment services from MCP (Figure 4.59). For households in the non-electrified villages, this has ranged between 48% for morbidity during pregnancy and 62% for morbidity in 42 days after delivery. Reduction in the burden of maternal morbidity by ensuring treatment by medically competent person is a major health-mediated poverty reduction strategy of the Government of Bangladesh. It can be asserted that this has worked more in the

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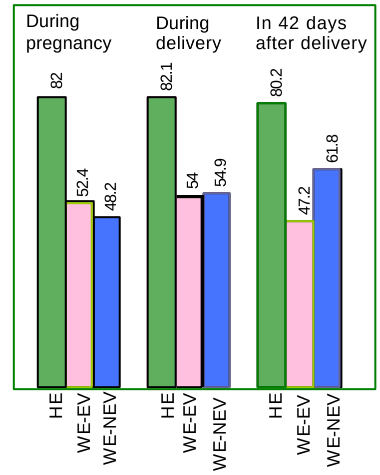
[41>] Government of Bangladesh (1999), Population and Development – Post ICPD Achievements and Challenges in Bangladesh, MOHFW, presented at Special Session of the UN General Assembly, NY June 30 - July 02, 1999, (Page 195).

households having electricity compared to those in the non-electrified villages. This is evident from the following:

a. Women from landless group (poor) in the electrified households availed maternal morbidity related treatment services from medically competent persons 38% more than their counterparts in the non-electrified villages.

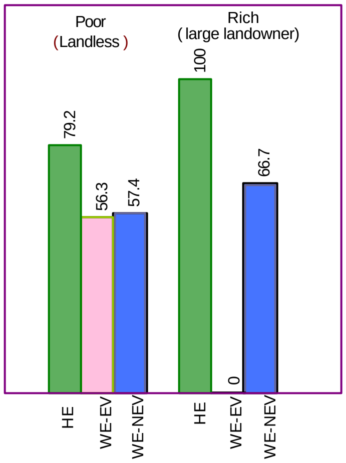
b. The landless women in the electrified households availed more services (79.2%) than even the rich in the non-electrified villages (66.7%) (Figure 4.60).

Figure 4.59 : Percentage of maternal morbidity case undergone treatment by MCP by types of morbidity by hh electrification status



Source: Table 4.4.24

Figure 4.60 : Rich-poor divide in seeking treatment from MCP while sick with maternal morbidity (% sought treatment from MCP)



Source: Table 4.4.25

4.4.2.5. Infant Mortality Rate

Infant mortality rate (IMR) is the probability of dying before the first birthday. IMR is a key reflector of a country's level of socio-economic development and quality of life. IMR is usually associated with antenatal care, delivery care, breastfeeding practices, immunization status, and nutritional status of the would-be-mother, among others. IMR is a powerful determinant of life expectancy as well, especially in a country with high IMR.

Estimation of IMR from a population sub-group (sample) is often problematic due to small sample sizes. The total sample size in the present study was 2491 (HE= 1380, WE-EV= 421, WE-NEV = 690). However, in order to overcome this problem of low sample size, the samples pertaining to the estimation of IMR for three sample categories were enhanced. In doing so, infant death related information (i.e., child birth and death/alive status during the 12 months preceding interview) for the samples were obtained. In addition, to enhance the observation sizes, the relevant information were obtained from 2 additional samples (households in which there were births in the last 12 months) against each original sample. This procedure has given us information about a total of 3146 childbirths (and associated deaths) during the last 12 months time. The possibilities of any double counting as well as validity of information obtained (considering the importance of this information) were checked and rechecked by the supervisors and the quality control officers. These have also been cross-checked with the local public health officials and the traditional birth attendants in the sample spots. The relevant portion of the data collection instrument (in addition to the sample household part), due to the methodological significance and clarity, is presented in the box below:

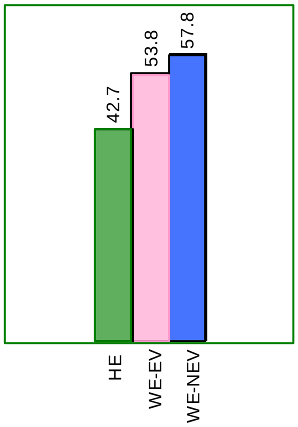
Interviewer: Obtain following information from household who are not in the sample and where there was child birth during last 12 months. For each sample household with electricity select two households with electricity (who are not in sample) where there was childbirth in the last 12 months. For each sample household without electricity select two non-electrified households where there was childbirth in the last 12 months. And then, enquire about child's status (who was born during last 12 months) – whether alive or dead. Do not include still birth in any stage.

Household electrified = 1, Household non-electrified =2
\# born last year = , # died (of those born last year) =
Interviewer: Ensure no double counting.

Source: Household Interview Schedule, Question 710

One of the most spectacular influences of electricity was found on the infant mortality rate[42>]. The infant mortality rate in the electrified households is 42.7/1000 live births, in the non-electrified households in electrified villages 53.8/1000 live births, and in the non-electrified villages 57.8/1000 live births (Figure 4.61). IMR in the electrified households is 25% less than the national average (57/1000 LB) and 35% less than the national rural average (66/1000 LB). Secondly, the IMR in the non-electrified households in the electrified villages is less (53.8) than that in the non-electrified villages (57.8). Third, the estimated IMR in the electrified villages is 49.9/1000 live births and that in the non-electrified villages is 57.8/1000 live births[43>]. Finally, our estimates show that **if access to electricity is 100% ensured in the rural households, and those electrified households maintain the same IMR as the current electrified households, the annual number of infant deaths that could be saved will be around 36,818, i.e., a savings of 101 infant deaths everyday**.

Figure 4.61 : Infant mortality rates by household electrification status

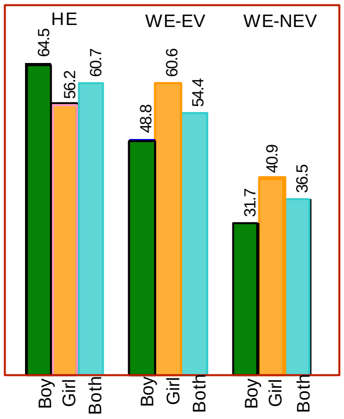


Source: Table 4.4.26

4.4.2.6. Child health: Immunization (vaccination) and vitamin-A capsule

The full immunization coverage[44>] among children 12-23 months in Bangladesh is 60.4% and that for rural areas is 58.5% (BDHS 1999-2000: 123). The same BDHS data indicate that 73% of children under five had received at least one capsule of vitamin A (VAC) in the six months before the surveys[45>].

Figure 4.62 : Full immunization coverage ratio among children 12-23 months by household electrification status



Source: Table 4.4.27

The **full immunization coverage** among children 12-23 months was significantly higher in the electrified households (60.7%) than that in the households of non-electrified villages (36.5%) (Figure 4.62). The coverage in the non-electrified households of electrified village was

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[42>] The national average of IMR for 1998 was 57/1000 live births, with 47 for urban and 66 for rural (Statistical Pocketbook Bangladesh 2000, BBS 2002: 140). The data bases on Birth Death Sample Registration. The IMR quoted in BDHS 1999-2000 for five-years periods preceding the survey is 66.3/1000 live births (BDHS 1999-2000: 101).

[43>] Among the total households in the electrified villages (in Bangladesh) the electrified households constitute 34.8%, and non-electrified households, rest 65.2% (estimates based on Table 4.1 in Section 4.3.2)

[44>] Full immunization includes a BCG vaccination against tuberculosis; three doses of DPT vaccine for the prevention of diphtheria, pertussis (whooping cough), and tetanus; three doses of polio vaccine; and a vaccination against measles (WHO recommended guideline).

[45>] Vitamin A deficiency is the leading cause of preventable childhood blindness, as well as a major contributing factor to the severity of several other causes of childhood morbidity and mortality. Deficiency in this crucial micro nutrient can be avoided by giving children supplements of vitamin A capsule, usually every six months (BDHS 1999-2000: 129, 130).

54.4%, which is close to the electrified households. The full immunization rate varied by household economic status of the children. In the electrified households, the full immunization rate was 52.2% for landless and 100% for large landowners (Table 4.4.27.b). The same ranged between 28.9% and 66.7% in the villages without electricity. Thus, not only the overall full immunization coverage, but also, the coverage by rich - poor were high in the electrified households compared to the households in the non-electrified villages.

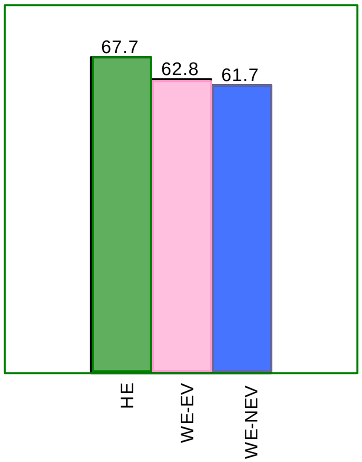
The vitamin A coverage (one capsule during last 6 months) among children under 5 was consistently high in all three household categories (ranging from 86% to 89%) (Table 4.4.28). No pronounced variations were observed by landownership status of sample households (Table 4.4.29).

4.4.2.7. Family planning: Current use, intention to use, and demand

About 68% of the currently married women in the electrified households reported their use of a contraceptive method[46>]. The contraceptive prevalence rate is 62.8% in the non-electrified households of electrified villages, and 61.7% in the non-electrified villages (Figure 4.63). The estimated total fertility rates are 2.54 for the electrified households, 2.87 for the non-electrified households in electrified villages, and 2.94 for the households in the non-electrified villages. Thus, in terms of attaining the national goal of NRR=1 by 2005 (which is equivalent to TFR= 2.1 by 2005), the electrified households appear to be more close-to-goal than the non- electrified households. On the top of these current use status, about 11% in the electrified households have expressed their intention to use FP in the future; this rate was 14.1% in WE-EV and 10.1% in the WE-EV. These mean that the total demand for family planning would be 78% in the electrified and 73% in the non-electrified villages. All these imply that electricity provides a great impetus towards reaching the national demographic goal of Bangladesh.

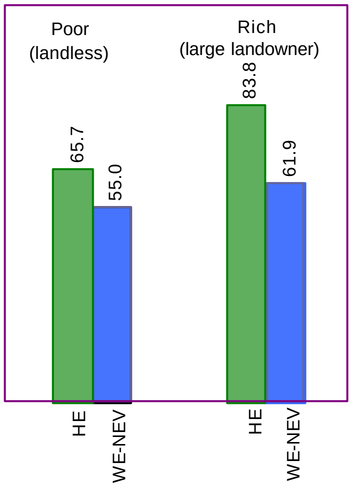
Access to electricity not only contributes to the overall increase in the CPR, but also influences significantly in raising CPR among the poor-landless. As shown in Figure 4.64, the CPR among electrified poor-households (65.7%) was found 19.5% higher than that among the poor in the non-electrified villages (CPR being 55%). The CPR in the electrified poor-household was even higher (by 6%) than that of the rich households in the non-electrified villages (CPR being 61.9%). These imply that ensuring access of the poor to electricity will have far reaching impact in the whole demographic future, as well as human development in Bangladesh.

Figure 4.63 : Contraceptive prevalence rate (CPR) by household electrification status



Source: Table 4.4.30

Figure 4.64: Rich-poor variations in the contraceptive prevalence rate by household electrification status

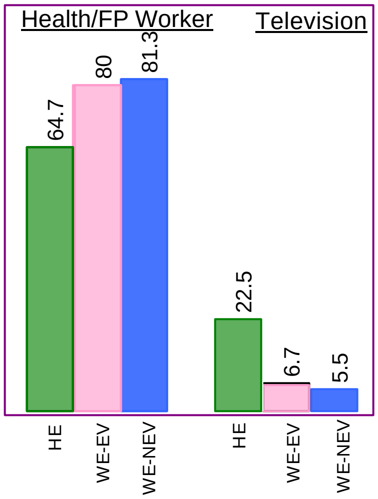


Source: Table 4.4.31

[46>] The national contraceptive prevalence rate for 1999-2000 was 53.8% with 60% in the urban and 52.3% in the rural areas (BDHS 1999-2000: 51, 52)

The indication that electricity provides a great impetus in accelerating the process of attainment of the demographic goal of Bangladesh is clearly evident from the fact that a large share of FP use was contributed by the <u>television</u>. The family planning users in all sample categories were asked about the factor/agent, which prompted them most to use family planning. For 22.5% of the family planning users in the electrified household, TV was mentioned as the most influential factor prompted FP use. This self-reported weight assigned to TV was only 6.7% in the non-electrified households in electrified villages, and 5.5% in the non-electrified villages (Figure 4.65).

Figure 4.65: Self-reported most influential factors prompted use of family planning (% users report)



Source: Table 4.4.32

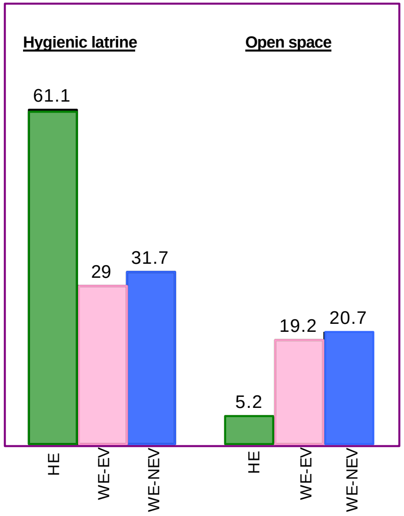
Thus, based on the above analysis, it can be concluded that provisioning of electricity in the household combined with access to TV would most likely contribute significantly in expediting the process of reaching the national demographic goals of Bangladesh.

4.4.2.8. Water, sanitation and hygiene

Almost all households use tubewells as a source of drinking water (Table 4.4.34).

One of the most notable findings in the study is related to the use of <u>hygienic latrines</u>. Sixty one percent of the electrified households reported use of hygienic latrines (sanitary, sealed closed), while the corresponding figures for non-electrified households in electrified villages was 29% and for non-electrified villages, 31.7% (Figure 4.66). Another significant finding was related to the proportion reporting `open space' for defecation: it was only 5.2% for the electrified, and around 20% for the others.

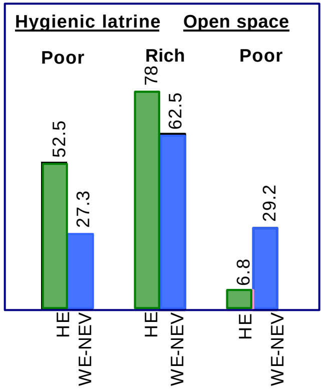
Figure 4.66: Percentage reported use of hygienic latrines and open space for defecation by household electricity status



Source: Table 4.4.35

Another crucial finding having far-reaching cultural, public health and poverty reduction implications is related to the rich-poor divide in the use of hygienic latrines and open spaces for defecation. Over 50% of the poor households having electricity use hygienic latrine, while it was only 27.3% among their counterpart poor in the non-electrified villages. The rich-poor gap in the use of hygienic latrines was 25.5% points in electrified households and 35.2% points in the non-electrified villages. More spectacularly, while only 6.8% of the electrified poor-households reported use of open place for defecation, it was as high as 29.2% for the poor in the non-electrified villages (Figure 4.67).

Figure 4.67 : Percentage of poor and rich households using hygienic latrine and open space for defecation purpose



Source: Tables 4.4.35(b) and (c)

There has been distinct cultural changes in the hygienic practices due to household electrification. The <u>use of soap after defecation</u> was reported by 66% of the electrified households and only 33% of the households in the non-electrified villages (Table 4.4.36). Besides, use of nothing (not even ash/mud) was reported by only

4.7% of the electrified and as high as 17% of the non-electrified households (Table 4.4.36). Electricity has contributed significantly in promoting the use of soap/ash(mud) as hand-washing materials after defecation (which is televised frequently). Out of those using soap/ash (mud) as hand-washing materials after defecation 40.4% in the electrified households, 13.2% in the non-electrified households in electrified villages and 9.6% of those in the non-electrified villages have reported TV as the most influential factor promoting such decision-making. The use of soap as hand-washing material after defecation was reported by a higher proportion of the poor households (60.7%) in the electrified villages than even the rich in the non-electrified villages (58.3%) (Table 4.4.37b). In addition, the proportion of households reporting regular use of soap for bathing was higher in the electrified than that in the non-electrified ones (84% and 64% respectively) (Table 4.4.39). The use of soap brand was influenced much by TV advertisement: 53.4% in the electrified, 30.4% in the non-electrified in electrified villages, and 22.7% in the non-electrified villages. All these imply that, in terms of all hygienic behavior and practices, the electrified households depict a much higher standard than the non-electrified households, and that especially as compared to the non-electrified villages.

4.4.3. Impact on Gender Dimensions: Women's Empowerment, Changing Status and Modernization Effects

4.4.3.1 Introduction

In Bangladesh, socio-economic changes triggered by increasing rates of landlessness and impoverishment has not only profoundly affected men, but also has changed the lives of rural women. The subsequent five-year plans of the government of Bangladesh tried to involve women in various development activities[47>].

This section provides an insight into whether Rural Electrification Program (REP) has contributed to the socio-economic empowerment of women and has given them more opportunities for sustainable livelihood and for changing their status. The impacts of REP on the major issues that concern women’s socio-economic status have been analysed. The discussion of various issues are assessed against the present conditions that prevail in the local community and in the rural electrification sector. The findings will enable to draw some useful directions and implications for policy formulation on gender and rural electrification.

Against the broader objective of this study, all relevant indicators were used which helped to collect the gender-sensitive and sex-specific data. Gender-sensitive data compare the situation of women to that of men, and identify various aspects of their relative advantages or disadvantages. On the other hand, sex-specific data record the absolute position of women at particular points in time. This section focuses on household level data and information obtained in the study. The specific objectives of this section are to evaluate the extent of benefits to women flowing from rural electrification, to examine the level on involvement of women in income-generating activities against women’s status to social, economical and institutional spheres/aspects, and to identify the gap that needs to be addressed in policy formulation.

[47>] The Fourth Five Year Plan (1990-1995) used terms as “gender” and adopted the objectives of WID (Women in Development)policy which included such concerns as increasing women’s participation in public decision-making, raising productivity and income, improving nutrition and health, reducing population growth, reducing infant and maternal mortality and the male female literacy gap, and ensuring the participation of the “poorer 50%” in development programs. Furthermore, the Government of Bangladesh is committed to implement the PFA (Platform for Action) adopted in the Fourth World Conference on Women in Beijing. The PFA emphasizes the strategy of mainstreaming of women’s development into government policies and programs.

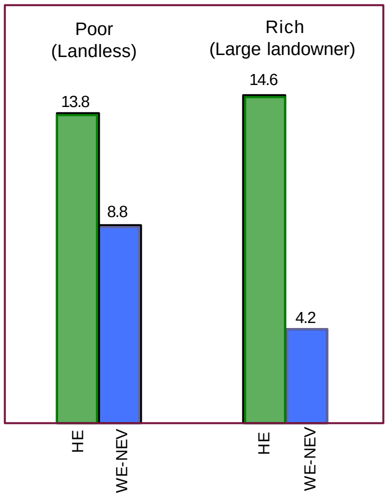
As for evaluating women's progress through REP on women's life, this section has used both quantitative and qualitative techniques. Quantitative techniques are used to measure the quantitative dimensions whereas qualitative techniques are used to extract people's judgement and perception about a subject.

4.4.3.2. Involvement in income generating activities

Nowadays in rural Bangladesh, women are contributing to the family income by involving themselves in various types of income-generating activities (IGAs). About one-fourth of the households in all three categories have reported that women are involved in IGAs to support family income (Table 4.4.41). Irrespective of availability of electricity, patterns of women's income-generation activities was the same. The two major activities in which women were highly involved are poultry raising, livestock rearing, and handicrafts (4.4.41b). A similar pattern was found in all the three categories of households.

The supply of electricity in rural areas has increased the working hours of women. Women in electrified households are involving themselves in various types of income-generating activities enhancing their income (Figure 4.68). The rich-poor variation exists in women's involvement in handicrafts and sewing work during the night. The variation in women's involvement in handicrafts and sewing work during the evening is higher in large landowner households (a difference of 10.4% points) than that in the landless groups (a difference of 5 % points). Thus, it can be inferred that, women in the electrified households compared to those in the non-electrified villages are more involved in handicrafts and sewing work during the evening (Figure 4.68).

Figure 4.68: Rich-poor variation in women's involvement in handicraft and sewing w ork at night by hh electrification status

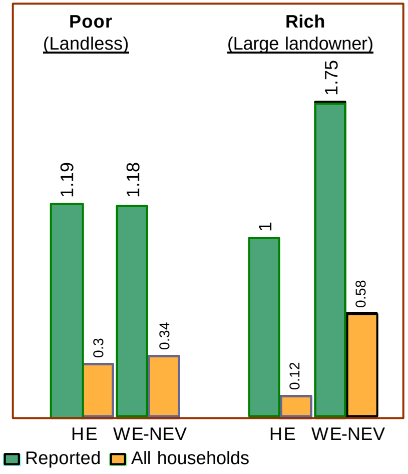


Source: Table 4.4.41 (b)

Electricity has given women more opportunities for employment. Women from the electrified households (in FGDs) also mentioned that due to intense farming (with irrigation) women now have to work during evening once the harvested crop is brought in the household. Therefore, according to these women, their workload has not reduced much. Crop threshing is done usually during the evening. What has changed is that electricity has given these women an advantage to organize their work to their convenience. Women now have flexible time table to plan their work. It should be noted here that electricity might have given women some freedom to perform their household chores according to their desire. However, the prevailing gender-based division of labour is yet to be eliminated. The norms and values with regard to gender roles within the households affect obligations and rights, division of labour, allocation or resources and benefits, control over resources, and decision making. *(Source: FGDs conducted in Ullahpara, Jessore and Sylhet).*

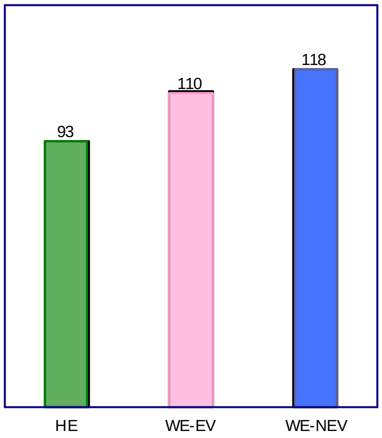
The average number of women involved in IGAs differs by land ownership status. It is found that the average number of women from landless electrified households is involved in more IGAs than those of the large landholding households. The scenario is totally opposite in the non-electrified villages where the average number of women involved in IGAs from the large landholding category is higher than those in the landless group (Figure 4.69).

Figure 4.69: Rich-poor variation of average number of women involved in IGA by hh electrification status



Source: Table 4.4.42

Figure 4.70: Overall average of person days women was involved in IGA during last year by hh electrification status

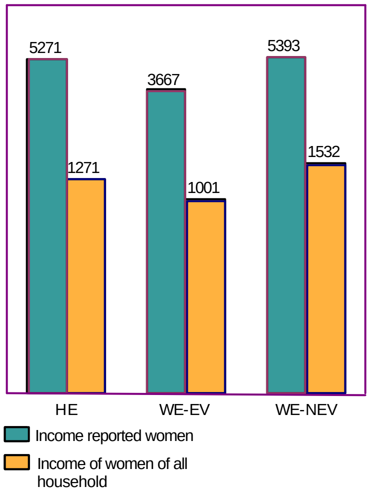


Source: Table 4.4.42 (b)

The findings reveal that women of the non-electrified households engaged more person-days than those of the electrified households. It is the same in all categories of landholding households. The overall average person days in last year is quite high in the non-electrified village than that in the electrified households. The corresponding difference is 25.4 person days (Figure 4.70). Variation also exists in the rich-poor dichotomy. Irrespective of the availability of electricity, women of the large landholding category engaged more person days in IGAs than those of landless group. This indicates women's capability to work in both of rich and poor households. Women of the rich households with electricity are more capable to invest more hours in work than those of the poor households (Table 4.4.42:b.)

Data on **women's earnings** (cash and kind together) in the last year indicate that the income of women in the non-electrified village is a little higher as compared to those in the electrified households. In both cases (i,e reported women and women of all households), the mean income of women in the households of non-electrified villages is higher than that of the electrified households (Figure 4.71). The women of non-electrified households are more involved in income-generation activities because their male partners, unlike the male partners of the electrified villages, are not in a position to contribute substantially. Consequently, women in the non-electrified villages earn more money as compared to those of the electrified households.

Figure 4.71: Mean income of women in the last year by hh electrification status (in Tk.)

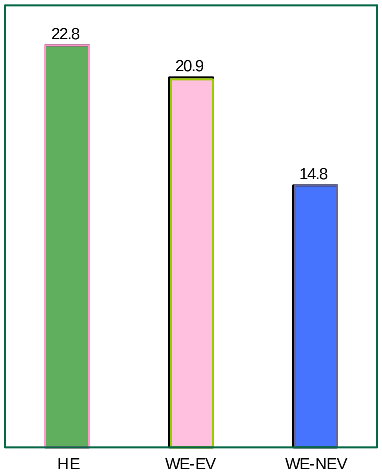


Source: Table 4.4.43

4.4.3.3. Women's empowerment: Decision making on use of income

Most rural Bangaldeshi women are conditioned by informal social, cultural and religious traditions, which give them little power to use their income. However, this scenario has started changing. Some women take their own decisions up to a certain extent on how to spend their earnings. It is much more pronounced in the electrified households than that in non-electrified households. The percentage of women reporting their decision-making independence (freedom) to spend their earnings is 22.8% in electrified households, and only 14.8% in the non-electrified villages (Figure 4.72). In addition, male domination in making decision over spending of women's earnings is more pronounced in non-electrified households than that in electrified households (Table 4.4.44). Thus, it can be said that women in the electrified households (influenced by various radio and TV programs) and their neighbours compared to those in the non-electrified villages are more empowered in terms of scope for making decisions to spend their own earnings. A case in point is Sabia of village Amania, Sylhet: *Sabia mentioned that her husband is a rickshaw puller. He always takes her consent on how to use the earnings and also consults her in taking other decisions.*

Figure 4.72: Percentage of women's reporting about decision making independence (freedom) to spend their earnings by hh electrification status



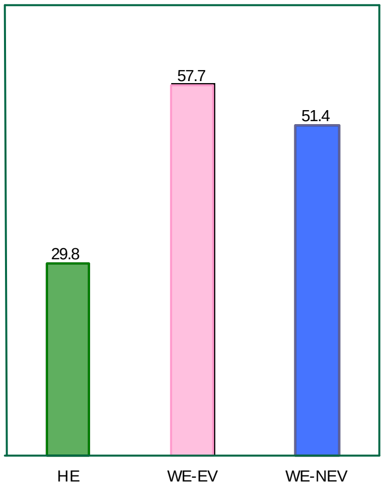
Source: Table 4.4.44

4.4.3.4. Wage discrimination

Both in formal and informal sectors women get lower wages than men for the same type of work. While about 30% women in electrified households who work outside house reported wage discrimination, the corresponding reporting was about 58% for non-electrified households in the electrified villages, and 52% in the non-electrified villages (Figure 4.73). These figures, among others, suggest that women in the electrified households are more aware about the proper wages in the workplaces than those in the non-electrified villages.

This finding is also supported by the FGDs conducted in electrified villages where women mentioned that when they work as labourers they are deprived of equal wages as compared to their male counterpart. Further, these women in FGDs mentioned that they do not protest this unfair act of the employers because protest leads to loss of jobs. *(Source: Village: Kajua, Ullahpara, Sirajganj)*

Figure 4.73: Percentage of women who reported wage discrimination by hh electrification status



Source: Table 4.4.45

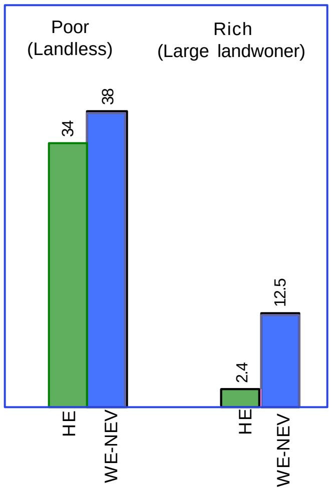
4.4.3.5. Membership in credit group and amount of loan taken

Women's membership status in credit groups by all three categories of households is reported as follows: 25% in electrified households; 35% in non-electrified households in electrified villages, and 29% in the non-electrified villages (Table 4.4.46). Of those who have memberships in credit groups, more than 85% are operated by Non-government Organization (NGOs). The rich-poor variation of women's memberships in credit groups also exists. Women from landless (poor) households have a higher share of membership than those from rich landowning households (Figure 4.74).

It is to be noted here that, for landless households irrespective of availability of electricity, proportion of women having reported membership in credit group is almost same (between 34% and 44%, Table 4.4.46b). It is so because the landless households are economically more marginalized, therefore, have more membership than their rich-counterparts.

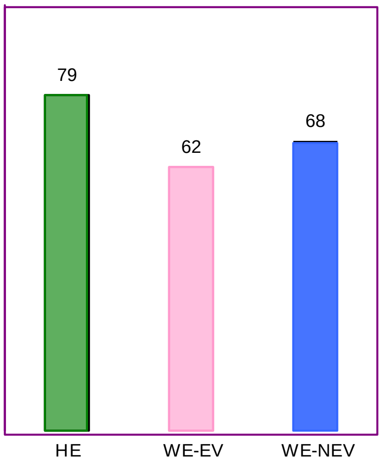
Although women in the non-electrified villages have reported more memberships than their counterparts in the electrified households, the amount of credit taken during last five years shows that the women of the electrified households utilized the higher amount of credit. The five year's average amount of credit taken by each women-loanee were as follows: Tk. 21,863 in electrified; Tk.16,343 in non-electrified households in electrified villages, and Tk.15,070 in the non-electrified villages (Table 4.4.46e). The proportion of women reported to have taken credit (Table 4.4.46d) of more than Tk. 20,000 is higher (21%) for the electrified villages than that for the women in the non-electrified villages (18%). This variation indicates that women of the electrified households have higher capability to initiate income-generation activities by taking credits from GOs and NGOs.

Figure 4.74: Rich-Poor variation of women's membership in credit group by hh electrification status



Source: Table 4.4.46(b)

Figure 4.75: % of women reported choice of independence in using savings by hh electrification status



Source: Table 4.4.47(c)

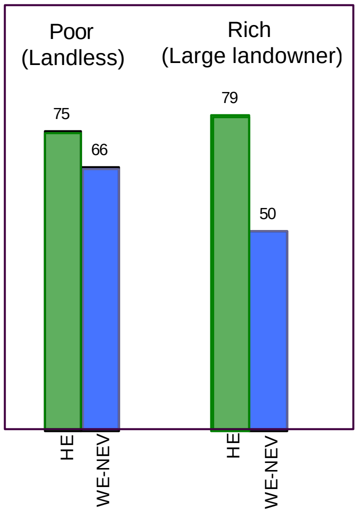
4.4.3.6. Savings and women's freedom

More than 60% of the respondent women in all three categories have reported no savings for women (Table 4.4.47). However, the proportion of women having savings is higher in the electrified villages. The survey finding shows that women who have saving enjoy freedom in using savings independently. This freedom is much pronounced in the electrified households. The proportions of women reported enjoying independence of choice in using own savings are 79% in electrified households and 68% in the households of non-electrified villages. Electrified households shows 17% points difference with their non-electrified neighbors in electrified village and 11% points difference with the non-electrified villages (Figure 4.75).

The rich-poor differences in women's enjoyment of freedom in spending own savings according to her choice are more pronounced in the non-electrified village. The difference between the poor and the rich groups in the non-electrified village is 16% points, while it is only 4% points in the electrified households (Figure 4.76). In additions, the poor women in electrified households enjoy more freedom than the rich in the non-electrified households (75% vis 50%).

However, in an FGD held at the electrified village Kajua (in Ullah para, Serajganj), the women respondents pointed out that the use of savings in general was usually done in consultation with the male members of the households. One of these women maintained that her husband says, *from whom have you got the money to save? Therefore, it is me whom you should give the money not to someone else.*

Figure 4.76: Rich-poor divide in enjoying freedom by women in using their savings by hh electrification status

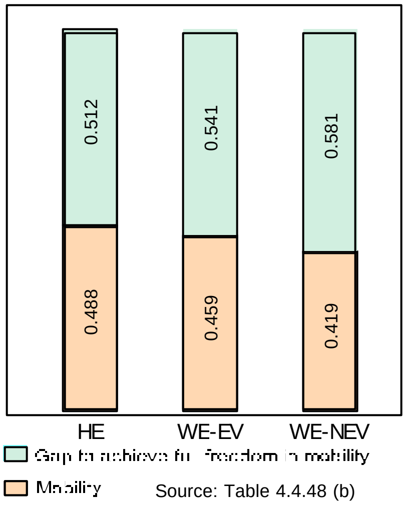


Source: Table 4.4.47(d)

4.4.3.7. Women's spatial mobility

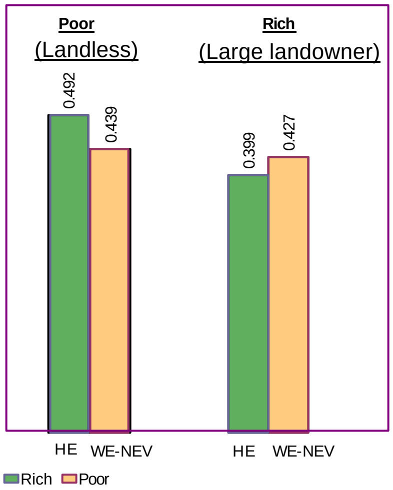
Due to the provisioning of electricity in the rural areas, women's spatial mobility has widened. The use of light during evening ensures women's safe movement from one place to another (see Section 4.4.5). Due to electricity, along with changes in other aspects, women (un-accompanied by male adults) now can alone visit the neighbours, relatives, nearby bazar and can also attend women's group meetings. This is much more evident in the electrified households than that in the non-electrified households (Table 4.4.48).

Figure 4.77: Overall women's mobility score by hh electrification status



Source: Table 4.4.48 (b)

Figure 4.78: Rich-poor gap in women's mobility score by hh electrification status



Source: Table 4.4.48 (b)

The higher state of women's independence/freedom in mobility (i,e women can do all the works/visit health and NGOs alone) among electrified households compared to those in non-electrified households is reflected in overall mobility score (co-efficient) constructed on the basis of survey finding[48>]. The overall women's mobility score in all three categories of households are as follows: 0.488 in the electrified, 0.459 in the non-electrified households in electrified villages and 0.419 in the non-electrified villages (Figure 4.77). The overall gaps to achieve full freedom of mobility in all three categories of households are as follows: 0.512 in the electrified, 0.541 in the non-electrified households in the electrified village, and 0.581 in the non-electrified village (Figure 4.77).

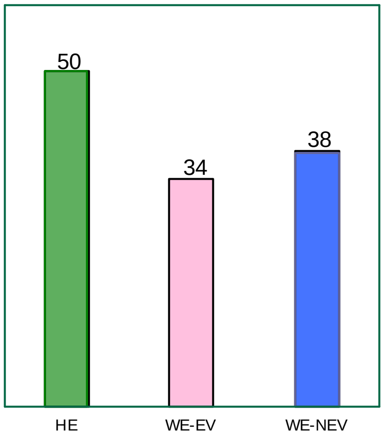
Women's mobility scores in the electrified households ranged between 0.399 for large landowning household and 0.492 for landless households, i.e., the gap is 9.3% points in favour of the landless. The corresponding values for households in the non-electrified villages are 0.427 for large landowning households and 0.439 for landless households with a gap of 1.2% points (Figure 4.78).

[48>] The overall mobility co-efficient (ranging between 'o' showing absolute no mobility and '1' showing 100% independence/freedom in mobility) has been constructed to show the level of freedom in women's mobility. Eight mobility issues are considered. One minus co-efficient indicates the value equivalent to gap to achieve full freedom in mobility. The higher the co-efficient the higher is the freedom or the less is the gap.

4.4.3.8. Husband's consultation on major family decision.

Patriarchal attitude of the society limits women's participation in decision-making process. Husbands or the male members of the households, in many cases, are not willing to consult with their female partners. Survey findings depict a positive picture of women's empowerment. Women in the electrified households have more participation in decision-making process, including purchase/sale land, construction/repair houses, purchase/sale livestock, marriage, health and education. The women's report on their husbands' all-time consultation "on major decision" in the family are as follows: A 50% of the electrified households, 35% of non-electrified households in electrified villages, and 37.5% in the non-electrified villages (Figure 4.79). On the other hand, the prevalence of male domination, i.e., husband's "never consultation" with wife in decision-making process is more prevalent in the non-electrified households (Table 4.4.49). Thus, women in the electrified households and their neighbours, compared to those in the non-electrified villages, are more empowered in terms of sharing decisions with their male partners.

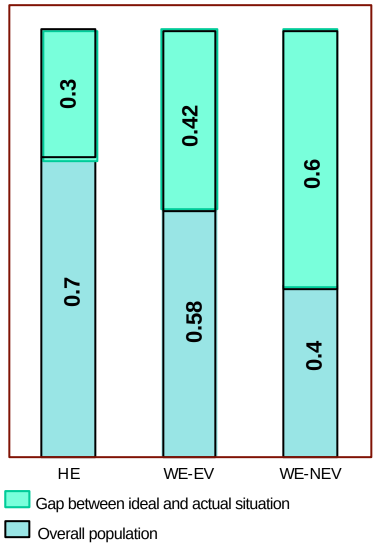
Figure 4.79: Percentage of women reported always consultation on major family decisions by hh electrification status



Source: Table 4.4.49

The high degree of participation of women in decision-making process in the electrified households compared to those of the non-electrified households is clearly evident in the women's participation score co-efficient constructed based on the survey findings[49>]. The overall participation score is 0.70 for electrified households, 0.58 for non-electrified households in the electrified village, and 0.40 for non-electrified villages (Figure 4.80). Electrified households had the least gap, while non-electrified households depict a higher gap implying a lower extent of participation. Thus, it can be said that access to electricity can be a major way to empower women in the true sense. This will have a influence on women's political empowerment.

Figure 4.80: Overall participation score of women by hh electrification status



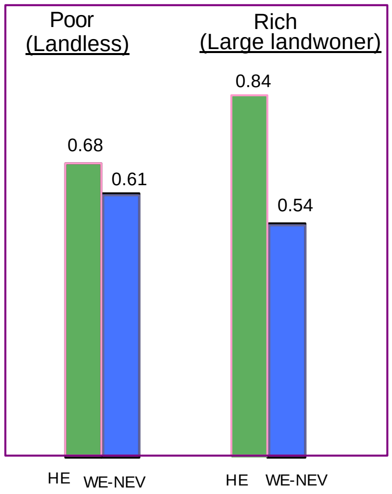
Source: Table 4.4. 50

The extent of women's participation in decision-making on major family affairs can be analyzed in terms of rich-poor dichotomy. The participation co-efficient in the electrified households ranged between 0.68 for landless households and 0.84 for large landholding households i,e., the gap is 16 points in favour of the rich. The corresponding values for households in the non-electrified villages are 0.61 (landless) and 0.54 (large landowners) with a gap of 7 points. The participation of the poor in electrified villages is higher than the rich in non-electrified villages (Figure 4.81). Thus, the women of rich and poor categories in the non-electrified villages have lower participation in decision-making on major family decisions (Figure 4.81).

[49>] The participation score (co-efficient) ranges between '0' and 1, where '0' denotes 'never consulted', '1' denote 'consulted sometimes. One minus the actual (constructed) score equals to the value indicating gap between the ideal and the actual situations. The higher is the gap the lower is the extent of situation.

The gaps in participation score vary substantially for the same landownership category depending on the availability of electricity in the households. The participation co-efficient of the landless in the electrified villages is 7% points higher than the landless in the non-electrified villages. Such gaps were 10% points in each of the three landholding categories: marginal, small and medium, and 30% points in the large landowner households (Table 4.4.50). This means that ensuring access to electricity will have significant impact in reducing the existing gap between the actual and ideal situations of women's participation in decision making process (Table 4.4.50).

Figure 4.81: Rich-poor divide in women's participation score by hh electrification status

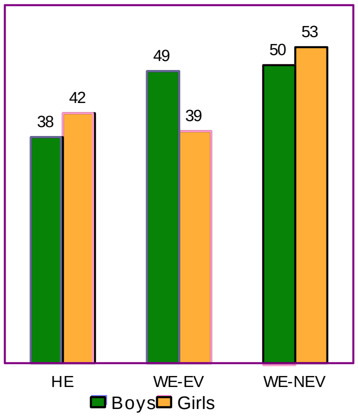


Source: Table 4.4.50

4.4.3.9. Disparity in health care

As already analysed and concluded in Section 4.4.2, electrification has already caused miracles in people's health, and potentials for further improvements still exist. As for both boys and girls availing treatment from the medically competent persons (MCP), they are much more pronounced in the electrified households compared to those in the non-electrified households. On the other hand, the prevalence of taking advice or treatment in case of sickness from the quack is higher in the non-electrified households than their counterparts in electrified households. It is to be noted here that, irrespective of the availability of electricity, the proportions reporting seeking of advice or treatment from quacks in case of sickness of the girls is higher than that in case of boys in the households (Figure 4.82). The gender disparity in seeking treatment from MCPs also exists. However, it is much more pronounced in the non-electrified households than that in the electrified households (for details see Section 4.4.2.3).

Figure 4.82: Percentage reporting about treatment of boys/girls by quack by hh electrification status



Source: Table 4.4.51

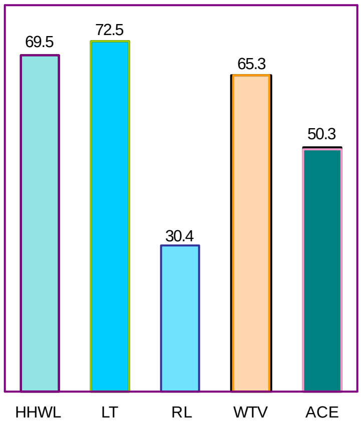
4.4.3.10. Equipment for cooking, husking and grinding of spices

More than 95 percent of women, irrespective of availability of electricity in all three categories of the households, use earthen burners for cooking (Table 4.4.52). The practice of using paddy husking mills and spice-grinding mills are more evident in the electrified village than non-electrified villages (Tables 4.4.53 and 4.4.54). This indicates that the existence of mechanized mills have reduced the workload of women in the electrified households, and these women have now started involving themselves in other income-generating activities.

4.4.3.11. Women's empowerment: Knowledge about gender equality issues and overall empowerment score

Some issues have been investigated in the survey to measure women's empowerment in the electrified households. The workload of women in the electrified households has reduced and they have sufficient time to watch TV, listen the radio; and they can also assist their children in their education. About 70% of women have reported that their household workload (HH WL) has reduced, while 72.5 percent reported that their leisure time (LT) has increased, 65.3 percent reported that they can spend more time watching TV (WTV) than before because of having electricity (Figure 4.83). Women in the electrified households can now give more attention to their children by assisting them for education (ACE). This will, in future, improve the quality of education in rural areas of our country.

Figure 4.83: Percentage reporting about selected women's empowerment issues in the electrified households

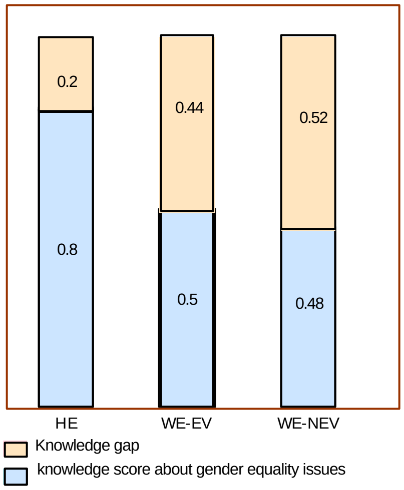


Source: Table 4.4.55

In terms of knowledge about each of the seven[50>] selected gender equality issues, a consistent awareness pattern was found: women in the electrified households were reported to be much more aware than those in the non-electrified households in electrified villages and those in the non-electrified villages (Table 4.4.56).

The higher state of knowledge among women in the electrified households compared to those in the non-electrified households in the electrified villages and among women in the non-electrified households in electrified villages than those in the non-electrified villages is evident in the overall knowledge score based on the survey findings[51>]. The overall knowledge co-efficient is 0.80 for electrified households, 0.56 for non-electrified households in the electrified villages, and 0.48 for non-electrified villages (Figure 4.84). Electrified households had the least gap and those in the non-electrified households depicted a higher knowledge gap.

Figure 4.84: Women's knowledge score of gender equality issues by hh electrification status



Source: Table 4.4.56(c)

Women's knowledge score of gender equality issues in the electrified households ranged between 0.79 for landless households and 0.84 for large landowner households, i.e., the gap is 5% points (Table 4.4.56c). The corresponding values for households in the non-electrified village are 0.44 (landless) and 0.64 (large landowners) with a gap of 20% points. Thus, the poor and the rich in the non-electrified households are not only less aware than their counterparts in the electrified

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[50>] Seven gender equality issues against which awareness was measured include equality of man and woman in terms of access to resources (01), equality of men and women in terms of wage, employment (02), women trafficking: punishable criminal offence (03), child trafficking: punishable criminal offence (04), acid throwing: punishable criminal offence (05), informed choice of family planning use (06); and right to participate in election (07) (details see Table 4.4.56).

[51>] The overall knowledge co-efficient (ranging between '0' denotes no knowledge and '1' shaming 'have knowledge') has been constructed to show the aggregate knowledge of women about 7 gender equality issues. One minus this coefficient is the value equivalent to knowledge gap. The higher the co-efficient the more is knowledge or the less is the gap.

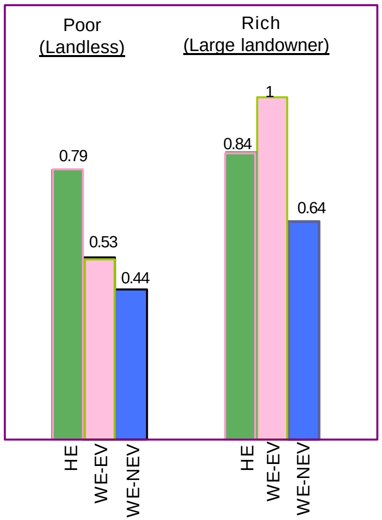
households, but also the rich-poor gap was twice as high (Figure 4.85). It is found that the poor women in the electrified households were more knowledgeable (79%) about gender equality issues than even the rich in the non-electrified villages (64%). This means that access to electricity at the household level significantly increases the knowledge-base among the poor. This also means, in terms of knowledge-poverty, economically poor people become more knowledgeable than the rich if access to electricity is ensured.

The gaps in women's knowledge co-efficients vary substantially for the same landownership category depending on the availability of electricity in the households. The knowledge score of women about gender equality issues for the landless in the electrified households is 35% points higher than the landless women's in the non-electrified villages. Such gaps were 33% points, 34% points, 24% points, and 20% points for the marginal, small, medium and large landowner group respectively (Table 4.4.56(c). This means that ensuring access to electricity will have significant impact in reducing the existing knowledge-gaps in the non-electrified households.

In order to understand the effect of electricity on women's empowerment, a combined knowledge-score has been constructed. This overall women's empowerment score is a combined effect of three indicators: women's freedom in mobility, participation in family decision-making process, and the knowledge about gender equality issues. The higher score of women's empowerment is found in the electrified households as compared to that in non-electrified households (Figure 4.86). Electrified households had the least gap between the ideal and actual situations of women's empowerment score.

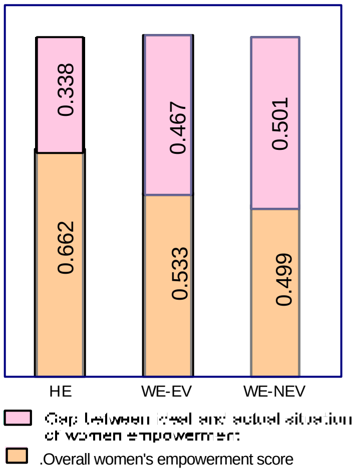
Electricity has contributed spectacularly to knowledge-building about selected gender equality issues. Overall, as high as 64% of those women having knowledge in the electrified households reported TV as the main source of knowledge, the corresponding figure for TV was 34% in the non-electrified households and 19.1% in the non-electrified villages (Figure 4.87). As for both the categories of non-electrified households, the main source of knowledge was neighbours and relatives. The survey data indicate that, in all these areas of gender equality issues, the women in the electrified households are much more knowledgeable as compared to their counterparts in the non-electrified households. In this enhanced knowledge building in the electrified households, electricity had played an immense role, because TV as major source of knowledge was reported by nearly two-thirds of women for familiarization to such issues as women trafficking, child trafficking, acid throwing and equal voting rights etc (Table 4.4.56).

Figure 4.85: Rich-poor divide in women's knowledge of gender equality issues by hh electrification status



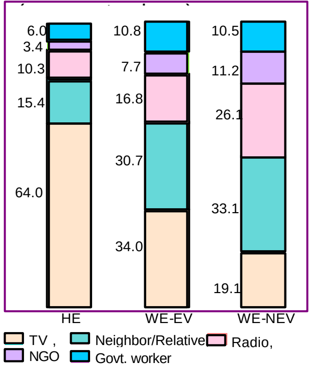
Source: Table 4.4.56 (c)

Figure 4.86 : Overall women's empowerment score by hh electrification status



Source: Tables 4.4.48; 4.4.50, 4.4.56(c)

Figure 4.87: Share of major sources of knowledge of women about selected gender equality issues



Source: Table 4.4.56 (b)

Thus, an inference can be drawn that women in the electrified households and their neighbours, compared to those in the non-electrified villages are more aware and knowledgeable about the selected gender equality issues; and electricity (through TV) had played an immense role as the major source of enhanced knowledge. In addition, based on the values of the overall empowerment scores and role of TV as source of knowledge, it can be said that access to electricity at the household level can be a major way to increase the level of women's empowerment.

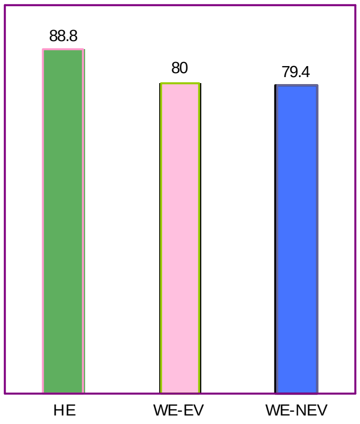
4.4.3.12. Women's empowerment: Perception issues (dowry, education, arrangement of marriage, job outside village, ideal family size, birth spacing)

The findings on marriage with/without dowry show that a vast majority of the respondents do not want to arrange marriages of their children by taking or giving dowry. However, the situation varies by the households electrification status. The women of the electrified households are more aware about not practicing dowry than those in the non-electrified villages. The percentage point differences with regard to women's tendency to arrange marriage without dowry between the electrified households and non-electrified households in electrified villages is 3.4 and that between electrified households and non-electrified villages is 8.8 (Table 4.4.57). It is also found that the proportions of women who want to arrange marriages with dowry is lower in the electrified households than their counterparts in non-electrified households (Table 4.4.57).

It is interesting to note here that in FGDs most women have mentioned that though they did not have direct access to electricity, they learned from watching TV in the neighbours houses that *“the practice of dowry is evil.” (Source: FGDs conducted with women respondents from non-electrified households in electrified village Amania, Upazilla, Golapgomj, Union,West Amura, Sylhet)*

Electricity has contributed in to the knowledge-building of women in the rural areas in terms of their growing awareness about the negative impact of dowry on women's situation. Women in the electrified households are more aware about negative impact of dowry on women's situation than their counterparts in the non-electrified households (Figure 4.88). However, the women in FGDs mentioned that, though they are against dowry, the society demands dowry. The practice of dowry is prevailing in "with and without electricity households". The local elite are setting standards by getting their offspring children married with dowry. The dependence of the poor on the affluent class has reduced through the proliferation of NGOs and the influence of the media. However, the poor community still tries to emulate the life style of the elite. *(FGDs conducted in Jessore, Sylhet and Ullahpara).*

Figure 4.88: Percentage of women reported negative impact of dowry on women's situation by hh electrification status



Source: Table 4.4.57(b)

Gender disparity exists in women's perception about male/female education. However, it is much less pronounced in the electrified households than that in the non-electrified households. In response to the question about how many years of schooling a boy and a girl should have, the average years mentioned by women in electrified household was 14 for boy and 11 for girls. The corresponding figures were 12 years and 10 years in non-electrified households in electrified villages, and 12 years and 9 years in the non-electrified villages (Table 4.4.58).

Irrespective of availability of electricity, women of the landless group reported a less number of years of schooling for both boys and girls as compared to those in the other large landholding categories. Women of the large landowner households reported highest years of schooling for both boys and girls. Thus, it can be said that women's perception about male/female education is directly related to the level of poverty. Women of the poor households engage their children in various activities to earn some money instead of sending them to school. On the other hand, women of the rich households hold specific visions about the future of their children (Table 4.4.58).

Gender disparity is also found in terms of level of education of women's reporting about boys and girls higher education: reporting about graduation and post-graduation is higher in the electrified village as compared to those in the non-electrified households (Table 4.4.58b). It is to be noted here that women's reporting about girls' education up to primary and secondary levels is higher in the non-electrified households than those in the electrified households. Therefore, an inference can be drawn that women's perception about higher levels of education, especially for girls, have association with their access to electricity.

A higher proportion of women in electrified households reported "school" as the place of education than the women in non-electrified households (Table 4.4.59). Survey data indicate a positive picture about girls' education. Irrespective of the availability of electricity, more than 95 % of women in all three categories of sample households have reported "school" as the place of girls' education. Such views of women indicate the picture of modernization in rural areas of the country.

According to national law, the minimum age at marriage for boys and girls are 21 years and 18 years respectively. Women's <u>perception about ideal age at marriage</u> in line with the national law is more pronounced in the electrified households than those in the non-electrified households. The proportions of women who said 21 years of age is the ideal age at marriage of boys in all three categories of households are as follows: 88% in the electrified households, 73% in non-electrified households in the electrified village, and 75% in the non-electrified village (Table 4.4.60). The corresponding figures for girls (18+ years) are 87%, and 70% each for non-electrified households respectively.

It is most likely that, the incidence of child marriage especially of girls is higher in the non-electrified households than that in the electrified households. This is evident from the fact that while 5% of the women in electrified households have said that 10-15 years (i.e; early marriage) is the ideal age at marriage for the girls, the corresponding figures were 14% to 17% in the non-electrified households (Table 4.4.60).

Women's reporting about <u>groom and bride's consent regarding their choice of marriage</u> shows that more than 80% women in the electrified households have reported that girls should be consulted for the consent regarding their choice of marriage. The corresponding figure for non-electrified household is 66% only (Table 4.4.60b). This shows a much better attitude of women in the electrified households compared to those in the non-electrified in terms of modern outlook towards marital consent.

Socio-cultural barriers in rural society limit <u>young girl's/women's scope to work outside village</u>. However, economic necessity is leading women to involve themselves in various income generating activities. The attitude to accept the fact that women can participate in outside employment is also changing and 'access to electricity' is one of the most impeding variables to bring this change in attitude. The proportion of women who reported allowing young girls/women to work outside the village are as follows: 53% in the electrified, 39% in the non-electrified households in the electrified village, 38% in the non-electrified village (Figure 4.89). Thus, women in the electrified households compared to those in the non-electrified households are more modernized and generous about allowing young girls/women to work outside the village. They think that women need to be economically independent to overcome male dominance in the society. Economic independence together with education can empower women in the real sense. Such an attitude can be examined in terms of rich-poor dichotomy. The proportion of women permitting young girls/women to work outside the village in the landless group in electrified households is 46% in the electrified villages and 36% in the non-electrified villages (10% points difference) (Figure 4.90). As for large landowner households, the corresponding figures are 61% and 48%.

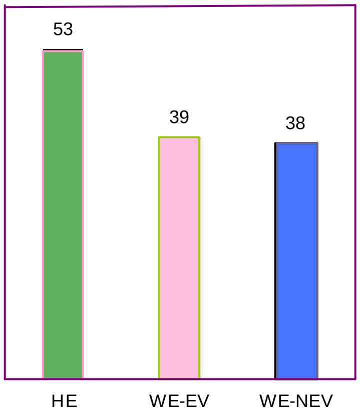
The survey data indicate that women's perception in decision-making on ideal family size, i.e., how many children a couple should have, is associated with the household electrification status. In the electrified households, 71% women reported that a couple should have two children. The corresponding figure for two-child family for the non-electrified households in the electrified villages and non-electrified villages are 62% and 59% respectively (Figure 4.91). Women's preference for 3 and 4 children for a couple is much higher in the non-electrified households as compared to those in the electrified households (Figure 4.91). Thus, a distinct trend is evident: While the electrified households tend to prefer a small family size, the non-electrified households prefer a larger family size as the ideal size.

The rich-poor variation is clearly evident in this aspect also. Women of the landless group in the electrified households reported the average number of children a couple should have is 2.4, while it was 2.7 in the non-electrified villages. As for large landowner households the corresponding figures were 2.4 and 2.5 respectively (Table 4.4.62b).

In terms of average number of children a couple should have, there is no variation between poor and rich groups in the electrified households, but this is not the case in the non-electrified villages.

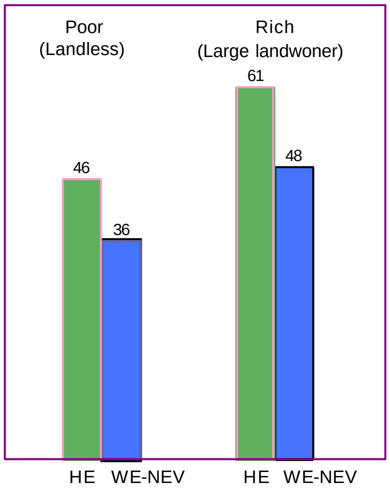
Women's perception about spacing between child births indicate that, on an average, women in the electrified households want a gap of 4 years between the birth of two children, while it is 3.8 years in the households in non-electrified villages (Table 4.4.62c). Data on preference for small family size and large birth spacing among women in the

Figure 4.89: Percentage of women opined young girl/women shall go outside the village for work/job by hh electrification status



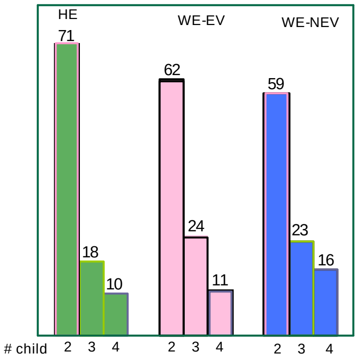
Source: Table 4.4. 61

Figure 4.90: Rich-poor variation in allowing young girl/women to work outside the village by hh electrification status (% reported allowing)



Source: Table 4.4.61 (b)

Figure 4.91: Percentage of women reported 2 child, 3 child, 4 child family size as ideal by hh electrification status



Source: Table 4.4.62

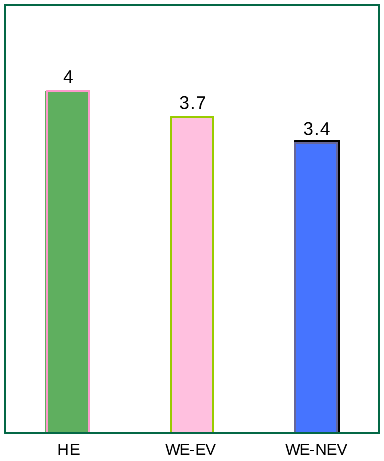
electrified households are indicative of a more modern outlook among them, as compared to their counterparts in the non-electrified households.

4.4.3.13. Modernization effect through radio listening

Mass media is an important way to increase the level of modern outlook of women in the rural areas. In the survey, modernization effect through radio listening and TV watching have been measured. Around 25% electrified households have radio sets. The corresponding figures are 23% in the non-electrified households in the electrified villages, and 33% in the non-electrified villages. The data on listening status show that 39% women in the electrified households listen to the radio whether they have radio sets or not, while it is 33% and 39% in the non-electrified households in electrified villages and in non-electrified villages respectively (Table 4.4.63). Women in the electrified households listen to the radio for a longer duration than their counterparts in the non-electrified households. Data an average time per day spent on radio-listening show that, on an average, women in the electrified households spend 27 minutes per day on radio-listening. The corresponding figures for two other categories of households are 23 minutes and about 27 minutes respectively (Table 4.4.63b). Irrespective of availability of electricity, women in the landless group in all three categories of household spend more time on radio-listening than those in the large landowner group. The major programs which women listen usually are modern songs, folk song, drama, news, health-nutrition related programs, agriculture-related programs and cinema advertisements (Table 4.4.63d). Women in the electrified households spend more time on listening to news and health-nutrition related programs than other programs.

In the survey, more emphasis was given to measure the modernization effect through radio listening. In terms of each of the 15 areas of knowledge disseminated through radio[52>], a consistent knowledge pattern was found: Women in the electrified households were reported to gain much more knowledge through radio-listening than those in the non-electrified households (Table 4.4.63e). The higher state of knowledge among women in the electrified households compared to those in non-electrified households is evident in the reporting about average number of issues known by women through radio listening, as well as in the overall knowledge co-efficient constructed based on the survey findings. Out of the 15 areas of knowledge gained through radio-listening which were perceived as useful in life, on average, women in the electrified households reported awareness about 4 issues, while it was only 3.7 in non-electrified households in electrified villages and 3.4 in non-electrified villages (Figure 4.92).

Figure 4.92: Out of 15 areas the average number of issues reported by women to be known by hh electrification status

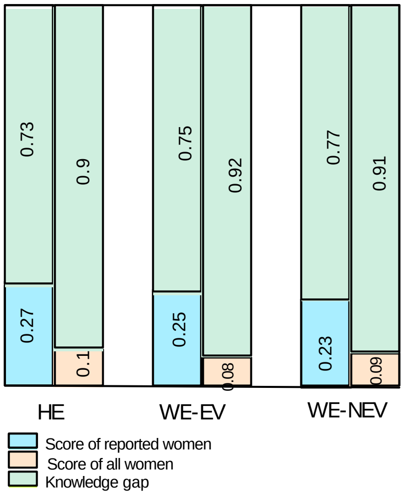


Source: Table 4.4.63 (e)

[52>] 15 areas of knowledge disseminated through radio include value of good health (01), value of education (02), value of female education (03), utility of family planning (04), development of knowledge-base through news (05), improvement in agriculture practice (06), knowledge of modern fishing (07), knowledge of pest management (08), govt program for the distribution of *Khas* lend (09), prohibition of dowry (10), laws about divorce (11), legal tools to combat violence against women (12), local governance issues (14), and issues of human rights (15)

The overall knowledge-score has been constructed to show the aggregate knowledge status on 15 crucial issues which are perceived useful in life[53] through radio-listening what extent of knowledge the women gain about various issues is our primary concern. The overall knowledge-scores are 0.27 and 0.10 for respondent women and all women respectively in the electrified villages. The correspinding scores for non-electrified households in electrified villages are 0.25 among respondent women and 0.08 among all women. In case of households in non-electrified villages these scores are 0.23 among respondent women and 0.09 among all women (Figure 4.93). In both cases, electrified households had the least knowledge gap and women in the non-electrified villages depicted the highest knowledge gap.

Figure 4.93: Overall knowledge score of 15 issues through radio listening by hh electrification status

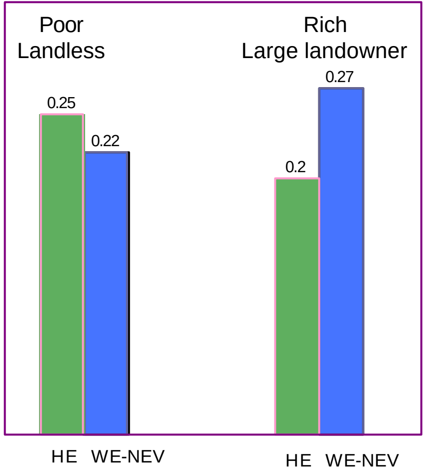


Source: Table 4.4.63 (f) of reported women

It has also been found that women who listens to the radio have more knowledge than all women in all three categories of households.

Knowledge-score attributable to radio-listening shows a rich-poor variation (Figure 4.94). It is interesting to note that women of the large landowner category in the electrified households have a lower knowledge score than those of the landless category. The opposite scenario is found in the non-electrified villages. The knowledge-score in the electrified household ranged between 0.25 for landless households and .20 for large landowning households. The corresponding values for households in the non-electrified villages are 0.22 (landless) and 0.27 (large landowner). Thus, women of the landless category in the electrified households who have reported radio-listening are more knowledgeable than their counterparts in the non-electrified villages.

Figure 4.94: Rich-poor divide in knowledge-score attributable to radio listening by hh electrification status (reported women)



Source: Table 4.4.63 (f)

4.4.3.14. Modernization effect through TV watching

Over 50% of the electrified households possessed TV, and it was only 10% in the households of non-electrified villages (Table 4.4.65). Only 6% of the non-electrified households in electrified villages possessed TV. Thus, the corresponding reporting about watching TV is much higher in the electrified households than that in non-electrified households. TV watching was reported by 70% respondents in electrified households, 30% in the non-electrified households of electrified villages, and only 17% in the households of non-electrified villages (Table 4.4.65).

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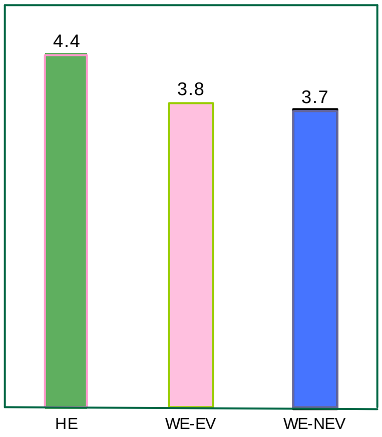
[53] >Two different scores have been constructed: one for those women who had reported listening to radio and the other for all women of the household. The range of the score is between 0 and 1. `0' means `no knowledge' gained through radio listening and `1' denotes `sufficient knowledge' gained through radio listening. One minus this score is the value equivalent to knowledge gap between the required and actual knowledge status. The higher is the score the more the knowledge or the less is the gap.

Women in the electrified households watch TV for a longer duration than their counterpart in the non-electrified households. Data on average time per day spent on TV watching show that, on an average, women in the electrified households spend 65 minutes per day on watching TV. The corresponding figures for two other categories of households are 18 and 13 minutes respectively (Table 4.4.65b). Women of the landless group in electrified villages spend 6.3 times more time in watching TV than their counterparts in non-electrified villages do. The differences per day, is 50 minutes (Table 4.4.65c). But it is quite opposite in the households in non-electrified villages. Women of the large landholding group watch TV for a longer than those of landless group. The difference between these two groups is 52.3 minutes per day (Table 4.4.65c). Women in the electrified households watch usually dramas, cinema, news, and health-nutrition related programs more than their counterpart in non-electrified households do (Table 4.4.65d).

Figure 4.95: Out of 16 areas of knowledge disseminated through TV the average number of issues reported by women by hh electrification status

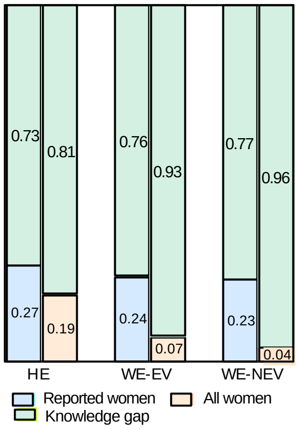


Source: Table 4.4.65 (f)

Women in the electrified households watch Bangla and English dramas and movies more than those in the non-electrified households (Table 4.4.65e).

In terms of each of the 16 areas of knowledge disseminated through TV[54>], a consistent pattern was found: women in the electrified households were reported to gain much more knowledge through watching TV than those in the non-electrified households (Table 4.4.65f). The higher level of knowledge among women in the electrified households compared to those in the non-electrified households is evident in the reporting about average number of issues learnt by women through watching TV, as well as in the overall knowledge gained through watching TV which were perceived as useful in life. On an average, women in the electrified households reported awareness about 4.4 issues, while it was only 3.8 in non-electrified households in electrified village, and 3.7 in non-electrified villages (Figure 4.95).

Figure 4.96: Overall knowledge-score of 16 issues attributable to TV watching by hh electrification status



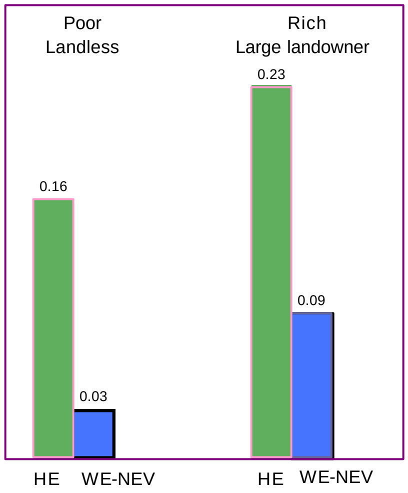
Source: Table 4.4.65 (g) of reported women

The overall knowledge-score has been constructed to show the aggregate knowledge status on 16 crucial issues, which are perceived as useful in life. Two different scores have been constructed following the methodology presented in the previous sub-section one for those women who had reported TV watching, and the other – one for all women of the households. Women who watch TV have more knowledge on 16 crucial knowledge areas than all women in all three categories of the households. The overall scores are 0.27 and 0.19 for respondent women and all women respectively in the electrified households. The corresponding scores for non-electrified households in the electrified villages and non-electrified villages are_0.24, 0.07 and 0.23, 0.04 respectively. In both cases, women in the electrified households had the least knowledge gap compared to their counterparts in the non-electrified villages (Figure 4.96).

[54>] 16 areas of knowledge disseminated through TV include the following: Value of good health (01), value of education (02), value female education (03), utility of family planning (04), development of knowledge-base through news (05), improvement in agricultural practice (06), knowledge about modern fishing (07), knowledge about integrated pest management (08), govt. program about distribution of *Khas* land (09), prohibition of dowry (10), laws about divorce (11), legal tools to combat VAW (12), local governance issues (13), women's right issues (14), issues of human right (15), and Mina Cartoon (16)

Figure 4.97 indicates the rich-poor variation of women's knowledge attributable to TV watching. The knowledge score of landless women in electrified village is 13% points higher than the landless in the non-electrified villages. On the other hand, the knowledge score of rich women in the electrified households is 14% points higher than the rich women in non-electrified villages. Thus, it can be said that, in transforming poor people into rich in knowledge, access to electricity can be a potential step.

Figure 4.97: Rich-poor divide in knowledge-score attributable to TV watching by hh electrification status (reported women)



Source: Table 4.4.65 (g)

4.4.3.15. Preference of electrified/non-electrified households in arranging their children's marriages

Irrespective of the availability of electricity, in all three categories of households, electrified households are given preference by women in arranging marriages of their children (if other things remain equal). More than 95 % women choose "electrified households" as the new destination of their children (Table 4.4.65h).

Considering the significance of the impact of rural electrification on various gender dimensions analysed above (in sub-sections 4.4.3.1-4.4.3.15), it would be worthwhile to recapitulate the major findings and put forward some relevant recommendations. Empowerment is an elusive concept, and defining it in a precise manner is difficult. As put by Rapport "Empowerment is like obscenity, you don't know how to define it but you know it when you see it" (cited in Kvinnoforum Foundation of Women's Forum, Report on Women's Empowerment, 2000). Most definitions of empowerment include concepts such as agency, self reliance, ability to make choices, awareness, etc. but sometimes structural measures such as laws, social security systems, etc. are also considered very relevant. In short, empowerment is a process of awareness and capacity building leading to greater participation in decision-making, power, control, and transformative action.

An attempt has been made in the above section to assess and illustrate the impact of rural electrification on the socio-economic empowerment and the changing status of women. The assessment is based on data collected from the 23 sample PBSs using both quantitative and qualitative techniques. Some important observations and recommendations about the impact of electrification on women's changing status have been furnished here:

- There is no doubt that electrification has contributed to the positive development on women's socio-economic status. The data reflects that the women of electrified households than their counterpart in non-electrified households have made substantial progress in their living standard. Electricity has left a profound impact on women's mobility, participation in IGAs, decision-making, freedom in using income and savings, better utilization of credit, knowledge about gender inequality issues, household work plan according to convenience, changes in attitude in terms of reducing healthcare disparities, increase in overall years of schooling for both boys and girls, preference to send girls to schools, awareness of legal issues (as for example, marriage for girls at 18 and boys at 21) and awareness about negative impact of dowry.

- Women in non-electrified households in electrified villages have an implicit impact of electricity through watching TV in neighbours' houses. It is essential, therefore, to take into account the women's situation in the non-electrified villages and non-electrified houses in electrified villages. The data reflects that, if these households can have access to electricity, it is going to affect women's overall life situation.

- Although, women in the non-electrified villages are working inside and outside home they have less control over the utilization of their earnings, decision-making and their level of awareness of fundamental rights is low. One of the significant facts emerged is if electricity is provided to them these women can benefit substantially with more power or status. In this process, they would also be able to control more decisions in the future.

- Women in electrified households have enhanced their social mobility, decision-making and greater awareness. These impact influences gender roles. Research findings and the prevailing rural reality reveal that many of these women, however, have not been able to enjoy the freedom of mobility, savings and the capacity to take household decisions. As argued by Amartya Sen (1995), capability implies acceptance of the relevance of freedom over a broader space, that is, women need to be capable of participating in all the spheres of society beyond the formal definitions of capability. Providing only electricity and involving women in income-generating activities is not going to bring real change in their status. Even when rural women have access to resources, their powerlessness to avail of various opportunities prevent them from changing their situation.

  Against this context, it is important to enhance women's role in the decision-making bodies. The FGD data reveal that women's political awareness is much higher in the electrified households as a result of the influence of TV and Radio, and to a certain degree, because NGOs' endeavours. However, women do not have direct access to informal power structure and to many local committees. As for instance, in PBS's committees, only that person can participate against whose name the electricity connection has been taken; and it is always men who take electricity as their main breadwinner of the household. Although women are the *defacto* managers of the households, they are usually bypassed from membership in various committees. Three women are usually taken as the adviser in the committees, but other women from electrified households are not taken in as general members. There is a scope to include women in the PBS committees in a meaningful manner and to strengthen women's role in the decision-making institutions which is critical for women's struggle for freedom from patriarchy and subjugation.

- It should be noted here that Bangladesh, in terms of involving women in mainstream development, marked a change from WID to GAD (Women-in-Development and Gender-and-Development) which implies that a transition from welfare-based activities to "not only integrate women into development but look for the potential in development initiatives to transform unequal social/gender relations and to empower women." In June 1996, WID focal points had been identified in 33 ministries to screen the policies of respective sectors. However, the rural electrification program has done little so far, to integrate women directly. Therefore, it is required to involve more women in the top-level management and, in the implementation stage, to formulate more gender sensitive policies. It is against this context that REP should aim at changing rural women's overall living standard.

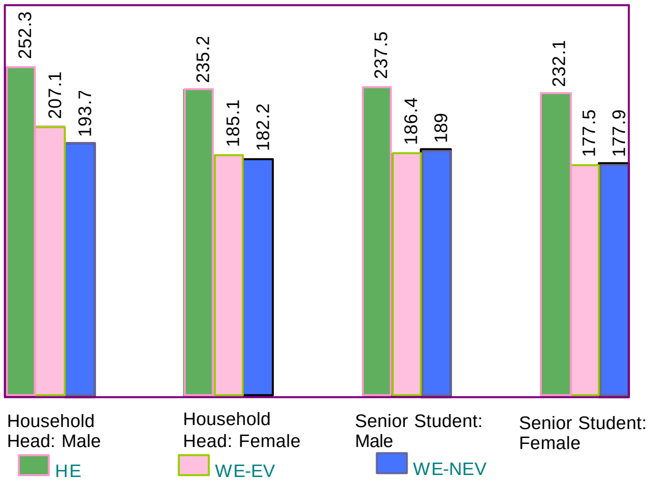
4.4.4. Impact on Household Time Allocation after Sunset

The availability and allocation of time is one of the major determinants in shaping the life style, for each individual concerned. In this section, the allocation of time for household members after sunset has been analysed for three categories of household— HE, WE-EV and WE-NEV. Electricity enables the household members to accomplish their activities in an effective manner, both in terms of time and job quality. Given the extra time available after sunset due to electricity, it is also possible to explore new activities having significant impact on the living standard of family members in the electrified household. With an objective to capture the diverging pattern of time allocation, comparisons have been made among household heads and senior most students — both for male and female, for three categories of households. Households with electricity were asked separate questions to address the change in time allocation by comparing pre and post-electrification era and is analysed with respect to broad categories of activities. On the last part of the section, the use of additional time due to electricity has been evaluated with reference to poverty reduction. For this, the pattern of allocation of time has been discussed for landless households only.

4.4.4.1. Daily average time available after sunset

Under a rural setting, the provision of electricity at house creates a different environment altogether mainly in the evening and onwards, when it is needed the most. Based on this rationale, the household members were asked to report their allocation of time between sunset and sleeping.

Figure 4.98: Daily average time (minutes evening) between sunset and sleep for all household members



Source: Table 4.4.66

In electrified households, for all members irrespective of gender, electricity increases the availability of time, as has been revealed in Figure 4.98. The daily average time in the stipulated period is higher for all categories of household members in HE compared to WE-EV as well as WE- NEV (Table 4.4.66). Electricity is providing comfortable environment and wider choices of activities through different electrical equipment, enabling the household members to have more time in HE compared to WE-EV and WE-NEV. This result is substantiated by estimated result of TOBIT model analysis in Section 9.6.

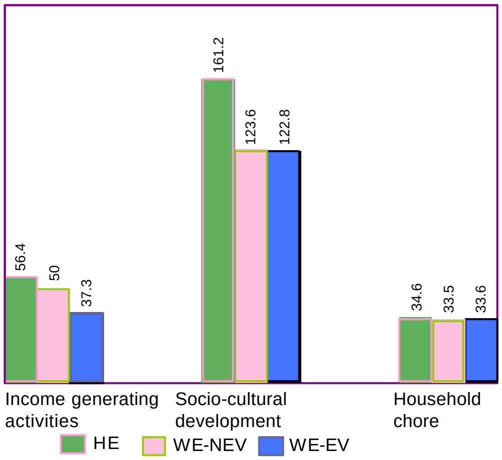
The incremental time available for HE, as expressed by percentage difference between electrified and non-electrified is higher for WE-NEV, for all household, members except senior male student, compared to WE-EV (Table 4.4.66). Thus, the household without electricity in the electrified villages signify spillover effect of electrification. Electricity in the vicinity has enable household members in WE-EV, to have more time after sunset and thus having less difference with HE. The particular use of time and the extent of spillover effect have been evaluated in the next sections for all categories of household members.

4.4.4.2. Activity-wise time allocation for household elederlies

A. Male Households or Elderlies

Time allocation for male household heads deserves analysis, as they are the principal earners and the prime decision-makers in the family. Activity-wise daily average time spent by male household heads after sunset for three broad categories of activities has been shown in Figure 4.99.

Figure 4.99: Activity wise time allocation after sunset by male household heads (minutes/ evening)



Source: Table 4.4.67

- ***Socio-cultural development***

The most dominant activity for all categories of households is socio-cultural development, covering activities like watching TV, gossiping etc. *Watching TV* and listening to the radio occupy most of the time of senior male member in HE, which is 175.7% higher than that in household WE-EV and 404.9% higher than that in households in WE-NEV (Table 4.4.67). Absence of electricity at the household level not necessarily bars the male members to watch TV at community places like markets/shops, as revealed in the study results implying significant spillover effect. Watching late night news, however, is possible only in HE. Time spent for *visiting neighbors* and *gossiping* appears to be a more dominant activity for male members in WE-EV and WE-NEV (Table 4.4.67). Less options for recreation in the evening inspires the male members to spend more time for gossiping in WE-NEV (52.5 mins) compared to WE-WV (51.2 mins) and HE (43.6 mins). Though gossiping permits dissemination of news/events to some extent in all places, dissemination in the electrified villages is more informed and multidimensional due to the influence of the electronic medias– TV and the Radio.

- ***Income-Generating Activities (IGA)***

The senior member/household head in HE spends more time on average for income generating activities compared to households WE-EV and households WE-NEV (Figure 4.99). Among those, *business* emerges as the most preferred occupation in the evening irrespective of their (4.4.67) electrification status. However, larger difference between HE and WE-NEV (92.2%) compared to WE-EV (62%), signifies spillover effect as scope for business is higher in electrified villages compared to non-electrified ones due to increased economic activities in the post-electrification days. Thus, given the same electrification status at the household level, electrification at community level enables the households in WE-EV, to have increased business opportunities in the evening and thus ensures productive use of time.

The longest time is allocated for *rickshaw/van pulling* in case of households WE-EV (20 mins) compared to HE (9.1 mins) and households WE-NEV (5.9 mins). This empirical result also rationalizes the hypotheses of increased economic activities and greater social mobility in the electrified villages, which ensures income even for those who do not have direct access to electricity.

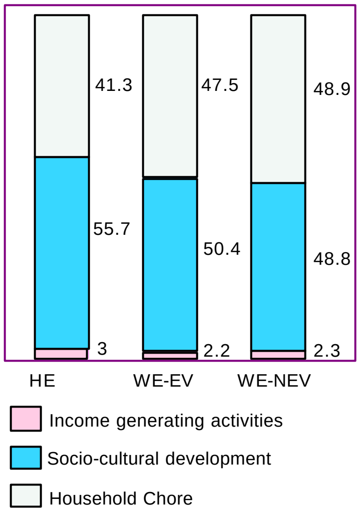
- ***Household chore***

In the social context of Bangladesh, minimal involvement of senior male members/household heads in household chore is reflected in similar time allocation pattern across the households HE (34.6 min), WE-EV (33.5mins) and WE-NEV (33.6 mins) (Table 4.4.67).

B. Female Household heads or Elderlies

In contrast to male members, the preference hierarchy of senior female members of the households in terms of time allocation in different activities is influenced by the electrification status of the household both at the individual as well as community level, as depicted in Figure: 4.100.

Figure 4.100: Activity wise time allocation (% total) after sunset by female household heads (minutes/evening)



Source: Table 4.4.67(b)

- ***Socio-cultural Development***

In the electrified villages, activities relating to socio-cultural development tops the work schedule which is facilitated by access to electronic media and increased security at night resulting into larger scale of socialization (Table 4.4.67b). On the other hand, female members in the non-electrified villages (WE-NEV), though not by a large margin, spend more time in household chore (48.9%) compared to activities related to socio-cultural development (48.8%). The hypothesis related to electronic media is further confirmed for senior female members in HE spending 542% more time in *watching TV* than those in non-electrified villages (WE-NEV).

As part of socio-cultural development, female members in HE spend more time (14.9 mins) in *teaching their children* than those in WE-EV (5.3 mins) and WE-NEV (7.9 mins). Apart from extended time period and better environment facilitated by electrified appliances, guidance from the senior female members contributes to quality education in electrified households discussed in details in Section 4.4.1. Senior female members in HE spend less time for *visiting neighbours* (3.8 mins) and *gossiping* (30 mins) compared to WE-EV (6 mins and 43.8 mins respectively) and WE-NEV (51 and 37.3 mins respectively). As for WE-EV, gossiping appeared as a prominent activity not because of having less options as would be the case for WE-NEV, but for accessing facilities provided by electricity at the community level. Visiting neighbours, especially for watching TV is a common practice in the rural Bangladesh and is revealed in FGDs with female members of households. In all cases, female FGD participants in electrified villages reported to be informed about wage discrimination from TV.

- ***Household chore***

Household chore obviously occupies more time of senior female members as they are responsible for accomplishing most of the household works. Electricity, however, enabling the rural women to work efficiently, has reduced the burden of household work in terms of time spent for household purposes as revealed by smaller time allocation (Figure 4.100) for HE (41.3%) compared to WE-EV (47.5%) and WE-NEV (48.9%). FGDs with female members of non-electrified households revealed huge workload, especially because of cooking. Most of them finish cooking for all three meals before sunset.

- ***Income-Generating Activities***

Among IGAs, sewing is the most dominant one in HE, which is entirely attributable to electricity. The difference in terms of average time spent for sewing is 564.8% and 978.6% higher than WE-EV and WE-NEV respectively (Table 4.4.67b). Sewing, a favourite pastime for women, is regarded as a strong source of income as has been analyzed in Section 4.4.3. In this case, electricity allows the rural women to make effective use of time and thereby address income-poverty even without higher skill, technological advancement and huge cost of production. As in case of sewing, activities like mat/basket making, weaving etc. have also flourished in HE as a result of electrification (Table 4.4.67b).

4.4.4.3. Activity-wise time allocation for senior students : Male and female

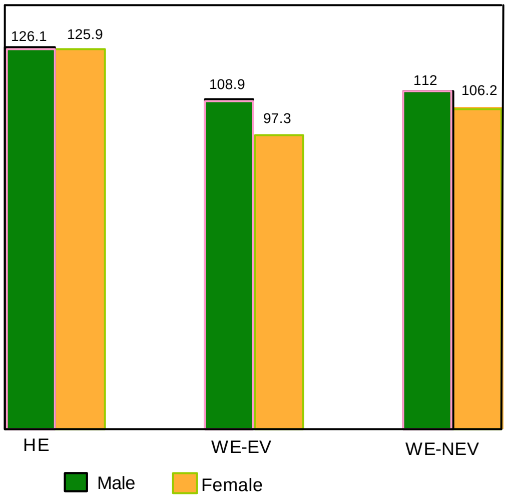
In analysing the pattern of time allocation for senior students (both male and female), the main focus has been education, as the average time spent in studying is the most dominant activity for them irrespective of their electrification status.

- ***Study vs. Household Chore***

As for students, both male and female, electricity plays the role of a catalyst in having a quality education. Because of electrification, the comfort provided through electrical appliances ensures productive use of the time all day long, especially after sunset.

The average time spent by the senior students (both male and female) is higher for HE compared to those in WE-EV and WE-NEV. Figure 4.101 provides evidences for hypotheses in this regard on education of household members. Household electricity also contributes to better guidance for junior students in the households. The study reported higher average time spent in teaching children (younger siblings) by the senior male students in HE (1.9 mins) compared to those in WE-EV (0.3 mins) and complete absence of this phenomenon in WE-NEV (Table 4.4.67c).

Figure 4.101: Average time spent on studying by senior students after sunset (minutes/ evening)



Source: Table 4.4.67(c), 4.4.67(d)

Electricity influences the pattern of time allocation of senior students in the households resulting into less male-female gap in HE in terms of average time spent for studying after sunset (Figure 4.101). This is validated by the smaller workload for senior female students in HE compared to that in WE-EV and WE-NEV (Table 4.4.67). The daily average time spent for household chore by the senior female students is lower in HE (13.5%) compared to WE-EV (18.8%) and in WE-NEV (18.9%).

As for senior students, the reason for diverging trade-off among other components of activities contributing to socio-cultural development for three categories of household is similar as has been the case for senior male/female members (Tables 4.4.67c and 4.4.67d) mentioned in previous sections.

- ***Income-Generating Activities***

Income-generating activities are not prominent because of studentship as part of IGAs, business and sewing are the ones for which the average time spent is highest for senior male and female student respectively in HE (Tables 4.4.67c, 4.4.67d). As for female students, the presence of electricity after sunset facilitates sewing, which is completely absent in WE-EV and WE-NEV. Sewing can be a stable source of income for the female students as their school days are over. In case of male students, compared to those in households WE-NEV, the ones in HE spent 819.3% more time in business (Table 4.4.67c), as an outcome of increased economic opportunities in the region in the post-electrification period.

4.4.4.4. Activity-wise time allocation pattern in households with electricity: Pre and post-electrification period

With an objective to evaluate the changes in the post-electrification period in terms of use of additional time, the survey results have been analysed separately in this section for electrified households only. The time attributable to electricity, i.e., the time difference between pre-electrification and post-electrification periods has been utilized by increased timing of previous activities as well as venturing some form of new activities by the electrified household members.

The percentage distribution of additional time according to broad categories of activities for the family members are shown in Figure 4.102, based on which the following observations made:

a. Male members of the family have benefited more in terms of availability of additional time due to electricity (Table 4.4.68).

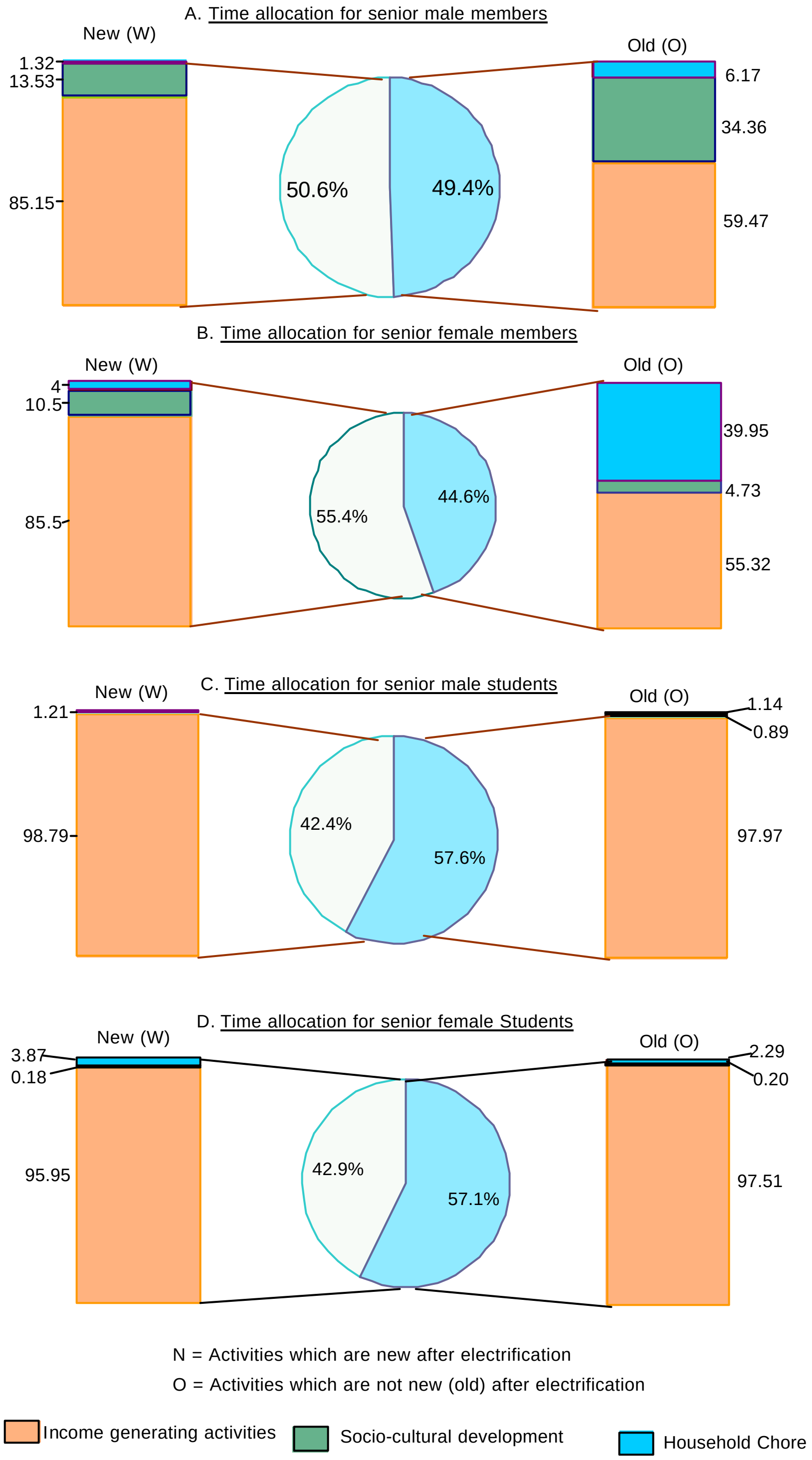
b. The allocation of additional time is different between the senior members/household heads and the senior students. The senior members explored more irrespective of their gender status, in the sense that they become involved in activities, which they did not pursue in the pre-electrification period. The senior students are bound to continue the activities they were mostly involved in the pre- electrification period, as their principal job is to study in the evening (Figure 4.102).

c. Considering activities that are new after electrification, activities relating to socio-cultural development emerges as the major category for all the members - both male and female (Table 4.4.70). Watching TV is the principal one among them, in terms of time allocation (Figure 4.102). As watching TV is solely facilitated by electricity, the study results are significant as far as influence of electrification is concerned.

d. Among the old activities (Figure 4.102), though the broad category, socio-cultural development prevails as the major one, a single activity irrespective of household status can not be identified.

   For senior members socialization is the major one (Figure 4.102 A, B) and that for senior students, is studying (Figure 4.102 C, D). Both the activities are directly facilitated by electricity. Increased security at night due to lighting enable more socialization, such as visiting neighbors (Table 4.4.71). Environment compatible for studying is created through electrical appliances like fans and bulbs, which induces students to spend more time in studying compared to pre-electrification period (Figure 4.102, C, D).

Figure 4.102: Percentage distribution of additional time attributable to electricity by members in electrified households



Source: Tables 4.4.68, 4.4.70, 4.4.71

e. As for senior male members, increased working hour for businesses ensures more income for the household and thus influences the livelihood status (discussed in detail in the next section).

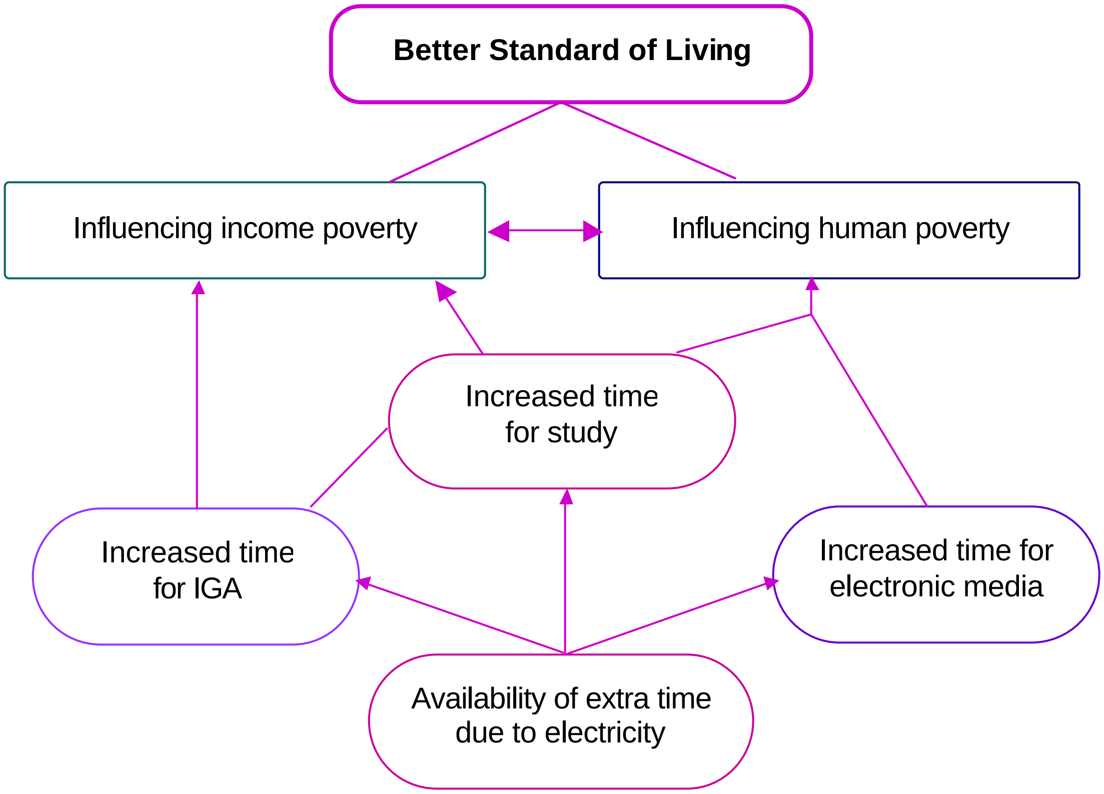
f. As for senior female members, redistribution of workload for household chore emerges as post-electrification phenomenon (Table 4.4.70). This has been cited by the female participants too, in the FGD in the electrified villages.

> *"Our household work has reduced a lot because of electricity. Apart from learning on various issue like vegetable gardening, poultry through TV/Radio, we are able to spend more time in teaching kids due to this addition time". (FGD with Female household members; Village: Rahmatpur, Union: Rahmatpur, Thana: Babuganj, District: Barisal).*

4.4.4.5. Time allocation and poverty reduction

Thought it is difficult to prove the direct relationship between poverty and availability of extra time, nonetheless better use of available extra time may act as a catalyst in poverty reduction. Effective use of time can help in creating avenues for eradicating income-poverty as well as human poverty, as revealed in Figure 4.103. To assess the electricity in reducing poverty, the time allocation of landless households (the poorest segments of sample population) has been discussed in this section.

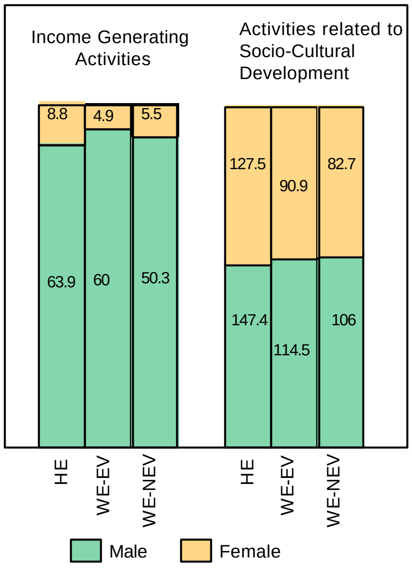
Figure 4.103: Electricity, Time Allocation and Poverty Reduction



Activities contributing to socio-cultural development— principally, exposure to electronic media and study hours, addresses the problems with human poverty directly. On the other hand, increased time for IGAs addresses income-poverty. Interplay of influences on human as well as income poverty thus, provides impetus for a better standard of living (Figure 4.103).

As for **senior members of landless households,** the following observations can be made:

Figure 4.104: Activity wise time allocation after sunset by landless household heads (minutes/evening)



Source: Table 4.4.67(e), 4.4.67(f)

1. Senior members in HE spends more time in IGA, compared to those in WE-EV and WE-NEV (Figure 4.104)

   For senior female members, the role of electricity is more evident as the daily average time spent for *sewing* is 577% higher in HE in comparison with WE-EV and 766.2% higher than WE-NEV (Table 4.4.67f). Even after incorporating other IGAs, the difference in terms of time allocated for IGAs by senior female members are 79.4% and 60.7% higher in HE as compared to the WE-EV and WE-NEV respectively (Table 4.4.67f).

2. With respect to activities related to socio-cultural development, *socialization* appeared as the most dominant category both for male and female members of the households, irrespective of economic status in terms of asset holding/possession. Time spent for radio and TV thus ranks second for all categories of households. The difference between HE and WE-NEV in terms of time spent for radio/TV is highest (580.4%) for senior female members (Table 4.4.67f).

3. The gender gap is more evident in case of IGA, compared to activities contributing socio-cultural development (Figure 4.104)

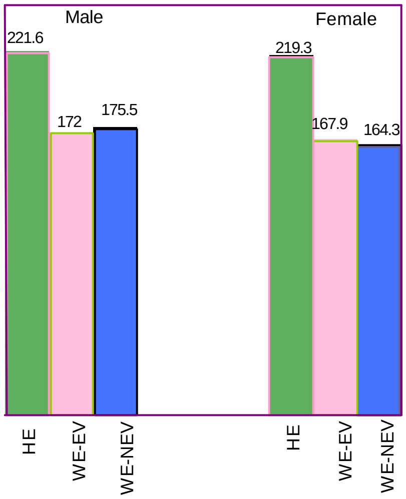
4. In terms of daily average time spent for *household chore,* electrified and non-electrified households are not that much different among male and female household heads.

5. The interplay of activities addressing human as well as income poverty is reflected in the FGD findings, as the female members in the electrified villages reported to initiate different IGAs, being informed from radio/TV.

> *"Different programs in the Television have influenced us to be involved in different IGAs like poultry, cow rearing, sewing etc, by means of which we are having economic benifits from electrification." (Female household members in electrified villages, Village: Bakhua, Union: Ullapara, Thana: Ullapara, District: Sirajgonj).*

For landless households, the daily average **time spent for studying at evening** is analysed in Figure 4.105. Both male and female students in HE spend more time in studies compared to those in WE-NEV. The difference is more prominent for female students (33.5%) compared to male students (26.3%) for landless households (Table 4.4.69). Senior female members in HE spending more time in teaching kids, 146.6% higher than those in WE-NEV, also contributes to ensure quality education (Table 4.4.67f).

Figure 4.105: Daily average study time available for senior students in landless households (minutes/evening)



Source: Table 4.4.69

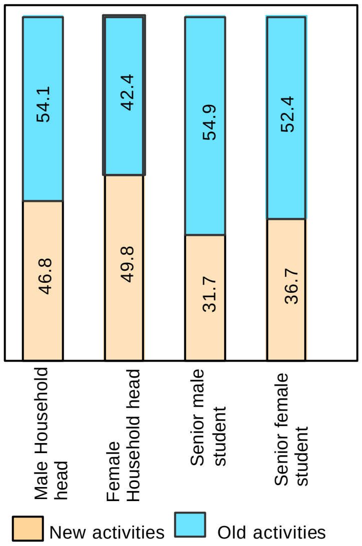
In order to better understand the relationship between time allocations and poverty reduction an attempt has been made to analyse availability and use of extra time attributable to electricity by comparing pre and post-electrification time allocation pattern for landless households. The salient findings having deep-rooted implication are as follows:

a. The distribution of extra time between old and new activities for all members is almost similar (Figure 4.106).

b. Watching TV is the most dominant new activity for all members, which, is absolutely a electrification phenomenon, changing the rural evenings through electricity (Table 4.4.70b). Information from electronic media equipped them to address poverty in a better manner, as has already been discussed.

c. Among the old activities, the gender gap is evident for household heads (Table 4.4.71b), in terms of time spent for income generating activities (Table 4.4.70b). Male household heads spending 61.49% of their extra time for IGAs, reveals the role of electricity in reducing income poverty (Table 4.4.71a).

Figure 4.106: Allocation of extra time of electrified landless household members (minutes/evening)



Source: Table 4.4.70(b), 4.4.71(b)

d. For senior students, studying is the major activity irrespective of their gender status (Table 4.4.71b). The allocation of time for household chore by the senior female students is much lower (4.68%) among the landless household, in comparison with HE (13.5%) irrespective of landownership status (Table 4.4.67d). Female household heads spend more time in teaching kids in comparison with male members (Table 4.4.71b), which contributes to better education and thus to the reduction of human poverty.

To recapitulate, provisioning of electricity at the household level is crucial to ensure better standard of living as the effective use of time shapes up the life style for each individual concerned. Given the study results, the better use of additional time attributed to electricity, has facilitated the electrified household members to explore new range of activities as well as extended time period for the old ones. Comparing the pre and post-electrification time allocation pattern for electrified household members, the study results revealed increased time allocation for income-generating activities or watching TV, which address income as well as human poverty. In the electrified household, reduced household chore for female members and reduced gender gap in terms of daily average time for studying is clearly indicative of improved gender status. Thus, it can be concluded that, electricity, acting as a catalyst for efficient allocation of time, has significant impact on livelihood status of households concerned.

4.4.5. Impact on Social Environment and Protective Security

4.4.5.1. Introduction

Social environment and protective security constitute major components of human development seen as a freedom-mediated process (AK Sen, 2000). It has been hypothesized in this study that electricity will accelerate this process through creation of employment opportunities in different fields, through enhanced security of household, through facilitating the security of mobility at night, and through access to TV watching which will, in turn, influence social norms and values. Most of the relevant issues have already been analysed and discussed in the previous chapters. The remaining parts of investigation in to these areas are presented below.

4.4.5.2. Creation of employment opportunities

Irrespective of availability of electricity in the households, almost all (96%) have said that electricity created significant employment opportunities (Table 4.4.72). The reasons for holding such opinion were multiple. The most pronounced among those were creation of scopes for work at night (reported by 63% respondents), expansion of local trade and business activities (54%), generation of employment opportunities for unemployed youth (54%), broadening of scopes for employment in crop agriculture (53%), establishment of small and cottage industries (29%), increase in the opportunities for poultry raising (29%), and increase in the scopes for earning from multiple sources (27%).

4.4.5.3. Home lighting and protective security

Almost everyone (98%), irrespective of access to household electricity, agreed that protective security has increased due to electrification at the household level. The reasons reported include light available throughout the night (mentioned by 83%), reduction in the incidence of theft and robbery became difficult (73%), availability of light at front side and backyard (36%) (Table 4.4.73).

The fact that security of mobility at night has increased due to electricity was confirmed by all respondents (98.4%), irrespective of availability of electricity in their households. The reasons for confirming this statement include "everything distinctively visible" (reported by 97% respondents), and "less fear of snakes and other reptiles and insects" (36%) (Table 4.4.74).

4.4.5.4. TV's influence on social norms and values

TV as a vehicle for social change was reported by 84% of all respondents with 90% in electrified households, 79% in the non-electrified households in electrified villages, and 74% in the non-electrified villages (Table 4.4.75). TV's influence (positive impact) in changing social norms and values was explained through the following aspects: TV provides rapid flow of news/information and changes people's mind-set (reported by 72% respondents); TV broadens the scope and opportunities for children's education (72%); enhances recreational opportunities (69%); improves health, hygiene and nutrition related knowledge (84%); inspires/facilitates changes in social-economic-cultural status (32%); strengthens knowledge-base about rights and responsibilities (27%). Thus, TV-mediated social changes was asserted by almost all respondents, no matter whether they have access to TV or not.

4.5. IMPACT ON DEMOGRAPHICS

4.5.1. Introduction

Demography basically deals with the size, composition and spatial distribution of human population and their changes through the operations of the five processes of fertility, mortality, marriage, migration, and social mobility. The present study's main purpose was not to study all the dimensions of demographic development of the population in the context of with and without electricity. Also, demographic changes *per se* is a time consuming process. And the impact of such latent factor as electricity on demographic changes is a time-demanded process mediated-through various other intervening variables — knowledge about family planning, availability of employment opportunities, access to education and health etc. However, in order to draw inferences on demographic changes (without having baseline data), the following areas of demographics were considered: number of children ever born and died, family size, age-sex structure, sex ratio, dependency ratio, infant mortality rate, total fertility rate, and migration. It would be pertinent at the outset to clarify the operational meaning (definitions) of the following key demographic aspects dealt into this study:

a. Age-sex structure: The composition of a population is determined by the number or proportion of males and females in each age category. The age-sex structure of population is the cumulative result of past trends in fertility, mortality and migration.

b. Dependency ratio: The ratio of the economically dependent part of the population to the productive part is usually defined as the ratio of the elderly (65 years and over) plus the young (under 15 years of age) to the population in the working ages (15-64 years of age).

c. Infant mortality rate: The number of deaths to infants under one year of age in a given year per 1000 live births in that year.

d. Migration: The movement of people across a specified boundary for the purpose of establishing a new permanent residence.

e. Outmigration: The process of leaving one sub-division of a country to take up residence in another.

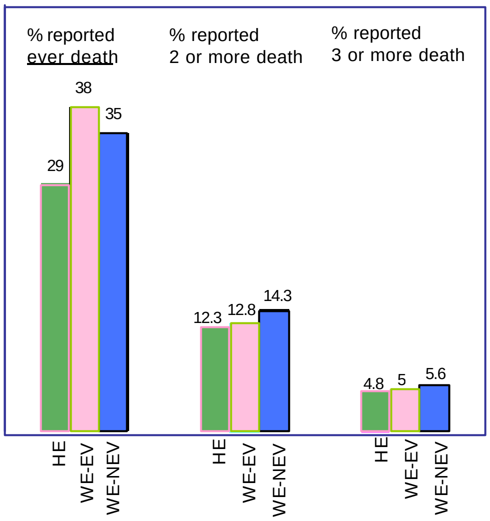
f. Sex ratio: The number of males per 100 females or, the reverse, the number of females per 100 males (showing number of missing females, if less than 100).

g. Total fertility rate (TFR): The average number of children that would be born alive to a woman (or group of woman) during her life time if she were to pass through her childbearing years conforming to the age-specific fertility rates of given year.

4.5.2. Birth and Death

The reported mean number of children ever born to women was 4.3 in both the electrified households and households in the non-electrified villages (Table 4.5.1b). However, the mean number of deaths was relatively less in the electrified households with 50 (ever) deaths per every 100 households, which was high in the non-electrified villages with 62 deaths per every 100 households, and 59 deaths per 100 non-electrified households in the electrified villages (estimates based on Table 4.5.1). In the electrified households, not only the mean number ever died was relatively low, but also both the incidences of death and severity of death (measured in terms of death of 3 or more members) were less pronounced. As for example, while 29% of the electrified households reported ever death, the proportion was 35% in the households of non-electrified villages; while death of 3 members or more was reported by 4.8% of the electrified households the same was 5.6% in the non-electrified villages (these proportions were in-between in the non-electrified households of electrified villages) (Figure 4.107). As a result, the demographic consequences are distinct: the proportion of ever born still surviving is higher in the electrified households (88.4%) than that in the households of non-electrified villages (85.8%). It is also important to note that for each of the five landownership groups, the proportion of ever born who are still surviving is higher in the electrified households compared to their counterparts in the households of villages without electricity (Table 4.5.1.c).

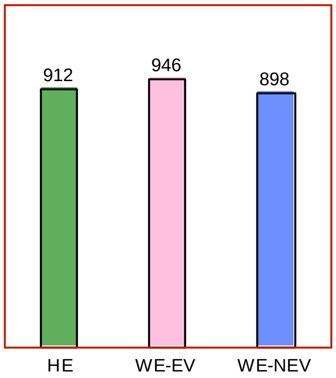
Figure 4.107: Household death reporting by electricity status: incidence and severity



Source: Estimated based on information in Table 4.5.1

Whether this higher survival rate in the electrified households is due to electricity or not is a difficult and complex question to answer[55>]. However, it can be asserted, based on the relatively low infant mortality rate in the electrified households (42.7/1000 live births, see Table 4.4.26) as compared to the households in the non-electrified villages (57.8/1000 live births), that this IMR (among others) has positively influenced the overall survival rate of those in the electrified households. In addition, the knowledge about crucial public health issues and the relevant health behaviour and practice formed in the electrified households (as analysed in Section 4.4.2: Impact on Health) has had positive influence in ensuring higher survival rate.

Figure 4.108: Number of females for every 1000 males by household electrification status



Source: Estimation based on information in Table 4.2.1

The total population size at a given point in time at any place is an outcome of such factors as birth, death and migration. Within that population, the ideal male to female ratio (known as sex ratio) should ideally be 1:1, if population size is fairly large. Any deviation from this ratio has high demographic consequences,[56>] and such a deviation is not accidental (unless caused by major man-made disasters, such as war). This type of deviation is evident in the analysis of <u>number</u>

[55>] This is difficult to ascertain in the present survey, because we do not know the age-at-death of the person(s) died to link the time of death with the timing of electrification of the corresponding household(s); — secondly, we lack information about the reasons for and conditions associated with the death (which needs use of verbal autopsy techniques in survey); third, there is no baseline to compare with. A rigorous research work on impact of electricity on birth, death and survival ratios would be important to ascertain demographic benefits of household access to electricity in rural Bangladesh.

[56>] Bangladesh is one of the few countries where women on average die younger than men: there are only 945 females for every 1000 males — an estimated 3 million women are "missing" (Peter Stalker, A Fork in the Path: Human Development Choices for Bangladesh, co-sponsored by FAO, ILO, UNDP, UNFPA, UNICEF, WHO, World Bank, 1999). The data base for the above estimates (3 million 'missing') is about ten years old. This issue of missing women has been vividly analysed by Amartya Sen in his 1990 and 1992 publications (see Sen. 1990. “More than 100 million women are missing”, *The New York Review of Books;* 1992. “Missing Women”, *British Medical Journal* 304 : 587).

of females per 1000 males. In the electrified households, there are 912 females for every 1000 males, i.e., 88 females are 'missing' against 1000 males (Figure 4.108). The corresponding missing number of females was lower at 54 in the non-electrified households in the electrified villages, and even higher at 102 in the non-electrified villages. Thus, the estimated missing number of females in the households of the non-electrified villages was about 16% higher than that in the electrified households.

The issue of "missing females" has high gender, demographic and human development implications. Estimates done in this study for the whole of rural Bangladesh show a total of 942,215 missing females in the electrified households, 966,937 missing females in the non-electrified households of electrified villages, and a disproportionately high 2,857,404 missing females in the households of non-electrified villages (Table 4.3).

Table 4.3: Estimated number of "missing females" in rural Bangladesh by household electrification status

Household by electrification status	Number of HHs[a>]	Population[b>]	Population by sex[c>]		Missing females	
			Male	Female	Number	% total
Household with electricity (HE)	3,413,825	20,482,950	10,712,583	9,770,367	942,215	19.8
Household without electricity in electrified villages (WE-EV)	6,395,086	34,533,464	17,750,200	16,783,264	966,937	20.3
Household in non-electrified villages (WE-NEV)	9,283,313	52,914,884	27,886,144	25,028,740	2.857.404	59.9
Total	19,092,224	107931298	56,348,927	51,582,371	4.766.556	100

***Notes:** a> Derived from Table 4.1, Section 4.3.2; b> Extrapolated HH size values from Table 4.2.5 using data from Bangladesh Population Census 2001; c> Extrapolated male-female distribution from Table 4.2.1.*

The inferences which can be drawn as to the positive influence of electricity in reducing the missing female population are as follows:

First: The number of missing females is disproportionately high in those villages where there is no electricity. Although the non-electrified villages constitute 49% of the rural population, they represent about 60% of the missing females of rural Bangladesh.

Second: Had there been no-electricity in the electrified households, the approximate number of missing females could have been 163,865 more than today (current number is 942,215)[57>], i.e., among other determinants, electricity has contributed in reducing the missing females by 163,865 persons. This implies that access to electricity has been instrumental in reducing the number of missing females in the electrified households by 17.4%.

Third: Had there been electricity in the households of the non-electrified villages the approximate number of missing females could have been reduced by 423,320 persons (i.e., from current 2,857,404 to 2,434,084)[58>].

[57>] Estimated by applying the male-female ratio of the households of non-electrified villages to the electrified households.

[58>] Estimated by applying the male-female ratio of the electrified households to the households in the non-electrified villages.

4.5.3. Age-sex Distribution, Household Size, and Dependency Ratio

The mean age of the household members was 26 years in electrified, 24.8 years in the non-electrified villages, and 24 years in the non-electrified household in electrified villages. Two important inter-related findings having significant demographic implications are as follows:

a. The mean age of the female members of the electrified households is 1.3 years less than that of the male members, 25.3 and 26.6 years, respectively. In the non-electrified villages the female mean age is 1.6 years less than their counterpart male members (24 and 25.6 years respectively) (Table 4.2.6). This relatively low female age in the non-electrified villages can be explained through relatively high proportion of women in the younger age group (38.4% of total female population in the age group 0-14). This was 34.9% in the electrified households, and relatively low proportion in the older age group (15.1% in the age group 45+, which was 17.7% in the electrified households; estimates based on information in Table 4.2.6).

b. The proportion of both male and female in the higher age group (45+ including the older age 60+) was relatively high in the electrified compared to those in the non-electrified. As for the younger age group (up to 14 years of age), the proportions of both male and female in the electrified were lower than those in the non-electrified households (Table 4.2.6). Thus, young age structure was more pronounced for the non-electrified than the electrified households.

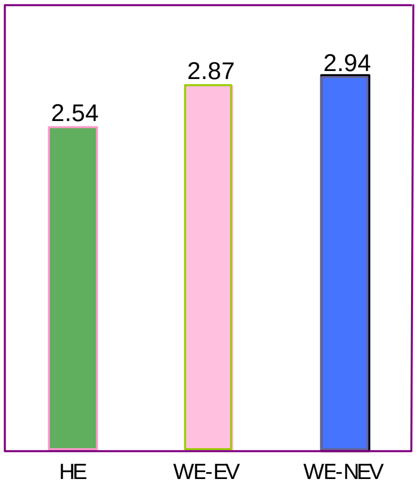
The average household size of the electrified households is slightly higher (6 persons per household) than that in the non-electrified households (5.4 and 5.7respectively for those in the electrified and non-electrified villages) (Table 4.2.1). It is most likely that, this slightly high average household size of the electrified household is due to less poverty-induced out-migration of family members, higher incidence of joint-family structure, and job opportunities in the electrified areas (see Sections 4.5.4, 4.8.2). It would be important to note that about 21% of the electrified households have 8 or more members in the family indicating higher incidence of joint-family structure (Table 4.2.5). The corresponding proportion was 15.2% for the households in non-electrified villages and 13.8% in the non-electrified households in electrified villages.

The dependency ratio gives an indication about the size of the economically dependent part of the population (under 15 years and 65 years and above) on the productive part (between 15-64 years of age). The ratio is lowest (0.64) in the electrified households, highest (0.73) in the non-electrified households of electrified villages and in-between (0.68) in the households of non-electrified villages (Table 4.5.2). Another important dimension revealed in the study was that the dependency ratio of the electrified landless and marginal households were much less than their counterparts in the non-electrified households (Table 4.5.2). Thus, compared to the non-electrified, the same number of active population supports a smaller number of dependent population in the electrified households.

4.5.4 Total Fertility Rate

The key issue that has emerged from the 1999-2000 BDHS (Bangladesh Demographic and Health Survey) is that the impressive 50% fertility decline that characterized the 1980s has stalled a little above three children per women. The three successive demographic and health surveys covering the period from 1991 to 2000, have shown almost a plateuing in the TFR at 3.3. The government of Bangladesh has a target in achieving replacement level fertility equivalent to a TFR of 2.2 by 2005. The decline in TFR is important, because every five years' delay in attaining replacement level fertility (or TFR ≤ 2.2) results in a 3% larger population size, equivalent to an additional 8 million or so people[59>].

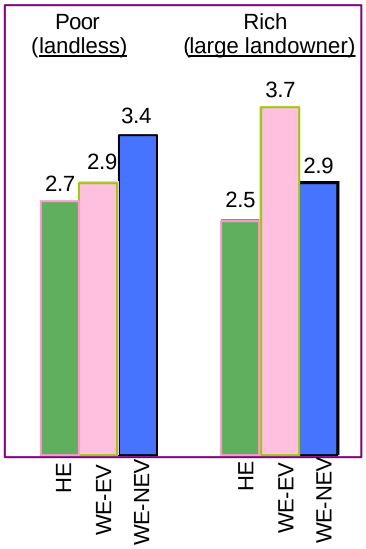
Figure 4.109: Total fertility rate by household electricity status



Source: Estimated based on CPR in Table 4.4.31

Further estimates based on the estimated TFR (Figure 4.109) shows that availability of electricity in the household contributes 15.7% in the reduction in overall TFR (comparison of TFRs in two extreme samples), but availability of electricity in the village but not in the household contributes only 2% in the reduction in TFR. The refinements of these estimates need further studies related to the entire demographics of population and reproductive health programs. It is to be noted here that, in addition to such infrastructure as electricity, there exist many other proximate determinants (other than the family planning program *per se*) such as income, employment, education, age at marriage, which determine declining total fertility rate[60>]. However, the actual behavior and relative strengths of all these determinants – to a varied degree – are also influenced by access to electricity.

Figure 4.110: Rich-poor divide in TFR by household electrification status



Note: 'Rich' shown for WE-EV is medium (cell frequency for rich was low).

Source: Table 4.5.3

TFR is usually high among the poor as compared to the rich. However, both among the poor (landless) as well as the rich of the three sample categories the TFRs were less for the electrified than those of the non-electrified (Figure 4.110). The TFR of poor in the electrified (2.7) was 26% less than that of the poor in the non-electrified villages, and it was even 7.5% less than that of the rich in the non-electrified villages (2.9). Thus, electricity not only contributes to declining overall TFR, but also contributes significantly to reduction in TFR among the poor.

4.5.5 Migration and Reasons Thereof

The role of rural electrification in the relative reduction of out-migration due to increased availability of employment/job opportunities in the rural areas and urbanization of rural life constitute one of the major explicit goals of REP. However, such impact of rural electrification on the rural out-migration was not clearly evident in the quantitative part of the survey.

The survey provided a number of indications about the urbanization of rural life in the electrified areas, as evident from the analysis of the pattern of household expenditure-and-asset situation of the electrified households (explained in Section 4.3.4: Impact on Expenditure). The qualitative

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[59>] Streatfield K., AA Sabir and EL Arifeen (2001), "Implications for Policy" in BDHS 1999-2000, NIPORT, MA, ORC Macro, May 2001 (p.165).

[60>] It is important to note that in terms of availability of some major physical infrastructural facilities such as primary schools, pucca roads, health facilities (per 1000 population), on average, the sample electrified and non-electrified villages did not vary much (see Section 4.2.2: Profile of sample villages, and Table 4.2.8).

part of the present survey gave positive indications about high incidence of in migration in the electrified areas. It should be kept in mind that out-migration from rural Bangladesh is basically push-migration caused by entitlement contraction in the rural economy.[61>]

During the last five years, a total of 966 persons have migrated-out from 2491 sample study households (Table 4.5.5). The reasons for these migrations included education, marriage, and job.

The proportion of households that reported any migration-out during the last five years was 32 % for the HE, 20.4% for WE-EV, and 28.1% for WE-NEV (Table 4.5.4). This data on migration revealed two interesting characteristics:

a. The higher the landownership status the higher is the reporting.

b. Out-migration (incidence) was least reported among the poorest groups. The landless and marginals in the non-electrified household of electrified villages reported less incidence (18.5% and 14%) than their comparable categories in the two other samples (Table 4.5.4). Overall, the poorest in the electrified villages reported less incidence of migration. Direct empirical evidences as to whether or not this has any relationship with the creation of more employment opportunities in the electrified villages could not be ascertained in the quantitative survey.

On an average, the number of persons migrated out per household (during last five years) were 0.44 in HE, 0.28 in WE-EV, and 0.36 in WE-NEV (Table 4.5.5b). The corresponding figures for those households who reported migration were 1.37 in HE, 1.35 in WE-EV, and 1.27 in WE-NEV.

The share of all out-migration by sample categories shows an uniform pattern (Table 4.5.6). Most out-migration was associated with marriage (ranging between 61% in HE and 72% in WE-NEV), followed by job (22% in WE-NEV and 33% in WE-EV), and education (4.3% in WE-EV and 6.1% in HE and WE-NEV each) (Table 4.5.6). This pattern of out-migration for job with higher share for the electrified households may not necessarily mean that they have migrated solely due to the lack of employment opportunities for the poors in the rural areas. To the contrary, a large part of the out-migrations, irrespective of electrification status, are represented by those in the medium and large landowning categories, i,e those possessing higher levels of education for whom job opportunities are still limited in the rural Bangladesh.

A new phenomenon of in-migration into the electrified village was reported by most participants in the focus group discussions conducted for this study. According to them, such in-migration has both temporary (seasonal) and permanent features. They said that, because of electricity, new economic activities have emerged, which has created more employment opportunities, and that, in turn, gave impetus for people in the non-electrified villages toward electrified villages for work. The occupational pattern has changed in the electrified villages.

In addition, due to the availability of improved educational and health facilities, people are also attracted toward electrified villages. Electrified villages have better agricultural facilities due to electricity-driven equipments for land preparations, irrigation, threshing, husking; demand for

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[61>] Barkat A and S Akhter (2001), "A Mushrooming Population: The Threat of Slumization Instead of Urbanization in Bangladesh", in The Harvard Asia Pacific Review. Volume 5, Issue 1, Winter 2001, pp. 27-30, Cambridge, MA, USA.

labour during harvesting has increased. All these have been instrumental in reducing out-migration for job from electrified villages, and in increasing in-migration (both temporary/ seasonal and permanent) to electrified from non-electrified villages. Because of the combined effect of all these factors mediated-through rural electrification a tendency has been developed among people to shift their residence from non-electrified to electrified villages. As a result, the price of land in the electrified villages has increased.

While explaining the impact of rural electrification on the industrial, agricultural and employment aspects, some of the FGD participants came up with the following citeable statements:

> *"After electricity small and medium size industries have been established; we have now welding workshops, saw mills, rice mills, banks and insurances companies, educational institutions, NGOs, hospitals here; and therefore, people from non-electrified villages are coming here to settle. Employment opportunities are also more here. The land price has increased manifold" (Male FGD participant from electrified households, Village: Rahmatpur, Upazila: Babuganj, Barisal)*
>
> *"Employment opportunities in agriculture have increased due to use of electrified irrigation equipments, and therefore, people from outside come to our area for work during harvesting season. Daily wage rate before electricity was Tk.40-50, now it is Tk. 80-90". (Male FGD participant from electrified households, Village: Bankhua, Upazila: Ullapara, Sirajganj).*
>
> *"Our unemployed young boys and girls do not need to go outside the area for work. Because, after electricity, we have here phone-fax, photostat machines, welding machines, saw mills, poultry farms" (Male FGD participant from electrified households, Village: Amnia, Ward: 5, West Amura, Upazila: Golapganj, Sylhet).*

4.6. IMPACT ON DIRECT USERS OF DOMESTIC ELECTRICITY: CONSUMER PREFERENCES, DEMAND, BENEFITS, PROBLEMS OF SUPPLY INTERRUPTIONS, AND WILLINGNESS TO PAY MORE

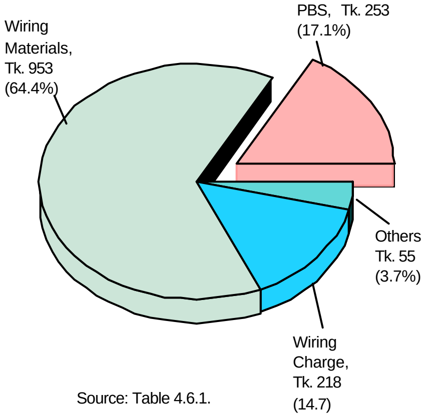
4.6.1. Introduction

This section provides analyses of various dimensions pertaining to consumer preferences, demands, and benefits. The analysis of the direct users of domestic electricity includes various aspects of demand and supply including the following: expenditure in getting connections; use of bulb and tubes; hours of lighting at night; preference for means of lighting; purchase and use of electrical appliances; intention to purchase electrical appliances in the future; location of supply side (market) for electrical appliances; benefits of electricity in terms of things/activities/works reported as not possible without electricity, changes in daily-life standard; effect on children's study, changes in habits; experiences of disconnection and that with paying bills; status of regularity in power supply and timing and seasonality in power interruption; and willingness to pay more with assurance of quality services (no power fluctuations and availability round-the-clock).

4.6.2. Expenditure for Domestic Connections

As reported by the domestic consumers, the average amount of expenses incurred for domestic connections was Tk. 1,480 per household with Tk. 253 to the PBS (as membership fee and guarantee deposit), Tk. 953 for purchase of wiring materials, Tk. 218 for wiring charges (to technician), and Tk. 55 for 'other' purposes (Figure 4.111). Thus, the one time capital expenditure required to get domestic connection is about US$26, with 64% for wiring materials and only 17% to the PBS. The average amount needed as one time capital expenditure varies by household economic status (in terms of lanownership status). In general, the higher is the economic status the more is the one time expenditure incurred (Table 4.6.1). This reported average amount was Tk. 1,412 for the poor (landless group) and Tk. 2,085 for the rich (large landowners). Thus, as capital expenditure for domestic connections, rich spent 48% more than the poor, and the most part (73%) of the increased expenditure was due to the wiring materials and related charges

Figure 4.111: Distribution of average expenditure incurred to get electricity connections at home (Tk.)



Source: Table 4.6.1.

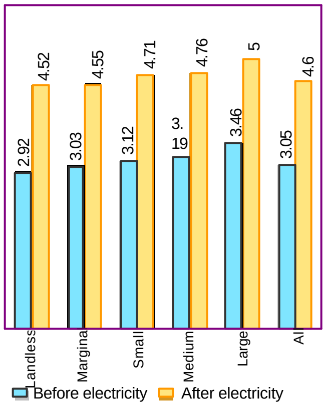
It would be worthwhile to make a note for the policy planners that the reported average amount of money needed as one time capital expenditure in getting domestic connection (Tk.1,480) is not that high even for the landless households. This one-time cost of connection is equivalent to just 4.2% of the annual net income of the landless non-electrified households in the electrified villages.[62>]

[62>] Among the landless households in 3 sample categories (HE,WE-EV, WE-NEV), the lowest average annual net income was represented by landless in the households without electricity of electrified villages (WE-EV) (Table 4.3.5).

4.6.3. Consumer Preferences for Electrical Appliances and Market Expansion

As a means of household lighting, all the consumers prefer electricity to any other means. Before having electricity, as means of lighting, 51% has the habit of using lantern and 49% k*upee* (Table 4.6.4). They used to light the lanterns/k*uppes*, on average, for 3.05 hours per night, ranging between 2.92 hours for landless households and 3.46 hours for large landowning households (Table 4.6.4). Now, with the electricity in households, they use electricity, on an average, 4.6 hours per night for lighting (Figure 4.112). This means, on average, electrified households now have 1 hour 33 minutes additional lighting hours available for leisure and/or for income generation activities. Thus, compared to before electricity, they now have 51% more time for lighting per night.

Figure 4.112: Average lighting-time (hours) before and after electricity by land ownership groups



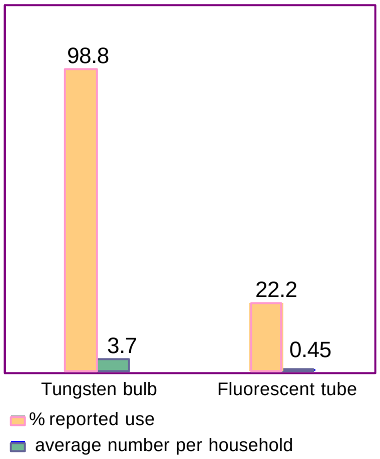
Source: Tables 4.6.3, 4.6.4

Another significant aspect of hours of lighting is related to the availability of those hours by economic categories of households. Two dimensions are in order:

a. The average hours of lighting (of bulb at night) increase with the enhanced economic status of household: 4.52 hours for landless, 4.55 hours for marginal, 4.71 hours for small, 4.66 hours for medium and 5.00 hours for large landowning households. Thus, the demand for lighting is contingent upon economic status.

b. In terms of changes in the average lighting-time, among all the economic (landowning) categories, the landless households reported highest extent of change: 55% more lighting-time now than before electricity (for rich, large landowning category the corresponding ratio is 45%). This change in the lighting-time, both in terms of quantity and quality of light, has significant implications in changing life and living of the people, especially the poor.

Figure 4.113: Consumers reporting about household use of tungsten bulb and fluorescent tube

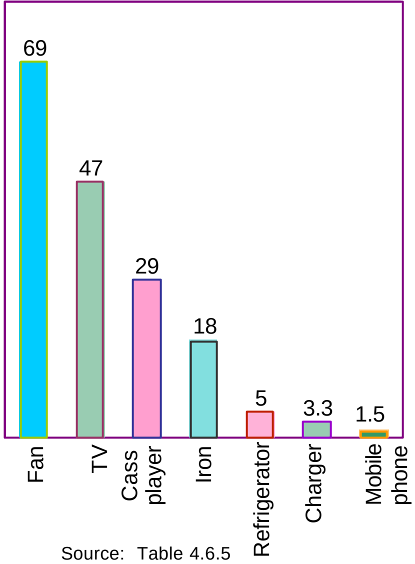


Source: Table 4.6.2

Consumers of electricity reported use of both tungsten bulbs and fluorescent tubes. Almost all households (98.8%) reported use of bulbs and over one-fifth (22.2%) reported use of tubes. The average number of bulbs in use was 3.7 per household, and that for tubes was 0.45 per household (Figure 4.113). The average number of bulbs and tubes in use increases with the economic status of the households e.g., the average number of bulbs and tubes in use was 3.1 and 0.31 for landless households, and the corresponding figures for large landowning households were 5.7 and 1.32 (Table 4.6.2). **Considering a total of 3,413,825 domestic connections of REB (as on June 2002, REB/MIS), the approximate number of total tungsten bulbs in use would be 12.6 million and the number of fluorescent bulbs 1.54 million.**

The use of electrical appliances by the domestic connection holders shows a standardized pattern, irrespective of households' economic status: Use of fan was reported by 69% households, followed by use of TV (46.9% households), cassette player (29.2%), Iron (17.7%), refrigerator (5%), charger light (3.3%), and mobile phone (1.5%) (Figure 4.114).

Figure 4.114: Percentage of households reported use of electrical appliances



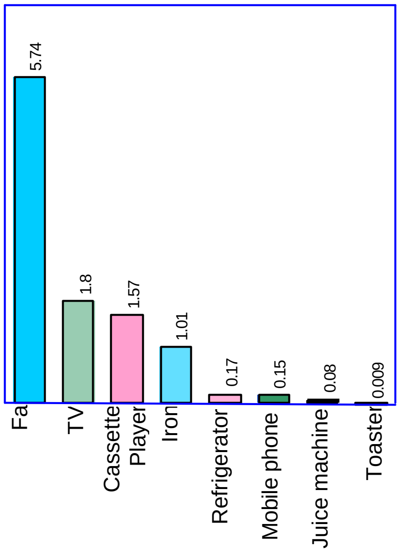
Source: Table 4.6.5

The future demand for electrical appliances is evident from the intention to purchase those in the future. The proportion of respondents expressed intention to purchase appliances in the future was highest for refrigerator (31.9%), followed by TV (28.6%), fan (19.2), cassette player (15.6), Iron and charger light (14% each), and mobile phone (5.9%) (Table 4.6.5).

The pattern of purchase of electrical appliances within one year and after five years of receiving connection is interesting. Within one year of receiving connection, about 46% of the consumers bought fan, 23% bought TV, 12% bought cassette, 5.4% bought iron, and 1.4% bought refrigerator (Table 4.6.5b). After 5 years of connection, 13% of the consumers bought fan, 11.4% bought TV, 6.4% bought cassette players, 5.4% bought iron, 2% bought refrigerator, 1.5% bought charger light, and 1.3% bought mobile phone.

The estimated average number of various electrical appliances purchased <u>per 100 households</u> was as follows: 168 fans, 53 TVs, 46 cassette players, 30 irons, 5 refrigerators, 4.3 mobile phones, and 2.4 juice machine (Table 4.6.5c). **Estimates based on these survey-based averages show that nation-wide, due to REB (with 3413825 domestic connections as on June 2002), the total number of various electrical equipments sold (indication about the market) would be 5,735,226 fans, 1,795,672 TV, 1,570,356 cassette players, 1,010,492 irons, 170,691 refrigerators, 146,794 mobile phones, 81,500 juice machines, and 9,900 toasters** (Figure 4.115).

Figure 4.115: Estimated number of electrical equipment purchased by REB domestic connection holders (in million)

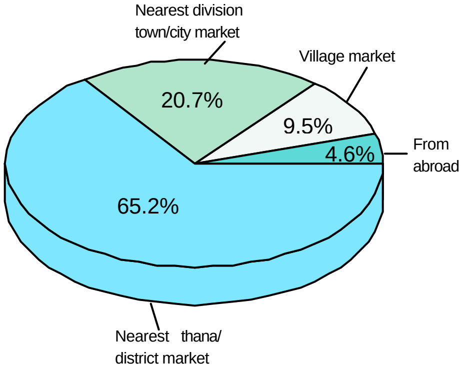


Source: Estimates based on extrapolation of present survey findings to the present 3,413,825 domestic connection of REB

Assuming that the intention to purchase in the future as expressed by the REB domestic connection holders realizes, the future market for electrical appliances would be a huge one: the market for refrigerator would be 6 times higher than now, the market for charger lights will increase by 4.2 times, the market for TV will increase by 61% (Table 4.6.5). Increase in the number of domestic connections will further expand the market for electrical appliances, and thereby, will have enhanced impact on people's standard of living and quality of life. Based on all these, it is most likely that with the advent of rural electricity, the consumer preference for modern electrical appliances is undergoing a qualitative change indicating increased latent demand for modernization of rural life.

The source(s) of purchase or procurement of the electrical appliances now possessed by the households indicate development of relevant market close-to-consumers: 65% have purchased from nearest thana/district town, 20.7% purchased from nearest division town, about 10% from village market, and about 5% from outside country (most probably sent by relatives working abroad) (Figure 4.116). This also indicates an expansion of employment opportunities in the commercial establishments selling electrical appliances as well as in the electrical equipment repairing shops (as knock-on effect). These are substantiated by the participants of focus group discussions and the research team's observation in the field.

Figure 4.116: Source(s) of purchase/ procurement of electrical appliances own by households (%)



Source: Estimated from survey findings (Table 4.6.5d)

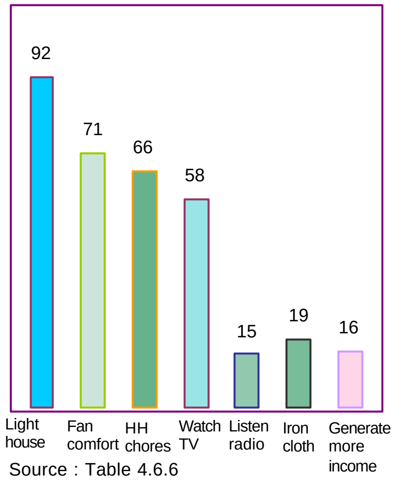
4.6.4. Beneficial Effects on Selected Quality Aspects of Life

As explained earlier, possession of electricity in the households has distinct tangible and intangible benefits in terms of enhanced income, improved health-hygiene-sanitation and education status, and knowledge-building through higher exposure to electronic media. There are other substantive beneficial effects (not discussed earlier) on selected quality of life aspects.

As high as 74% of the respondents attributed significant positive changes in their standard of living to household electricity. Another 25% perceived marginal changes in their standard of living due to electricity. This pattern of attributing electricity in changing living standard holds true, irrespective of rich and poor (Table 4.6.8).

The consumers prefer electricity for eight different reasons/ purposes, proportion of reporting being different (Table 4.6.6). The consumers prefer electricity for the quality of light (household lighting mentioned by 92%), comfort (use of fan, 71%), more time for household chores (66%), watch TV (58%), listen radio and iron cloths (19% each), and generate more income (16%) (Figure 4.117). Seventy eight per cent of the respondents reported at least 3 benefits of electricity; and the average number of benefits reported was 3.5 (Table 4.6.6).

Figure 4.117: Percentage reported various types of benefits of electricity (in terms of things/activities can be performed now which could not be possible before-electricity)



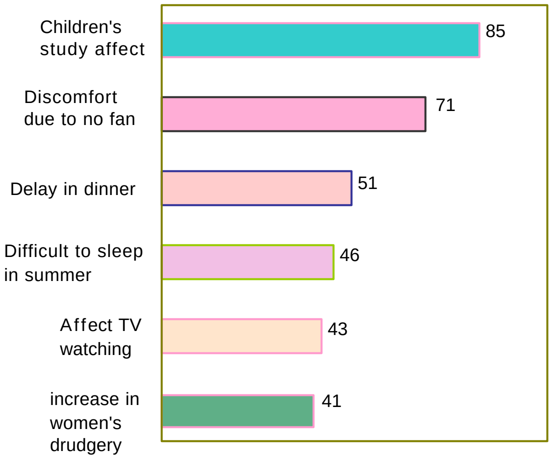
Source : Table 4.6.6

Almost all the respondents (94%) felt that electricity has affected children's study positively. Of those that reported such, 99% said that children's attentiveness and willingness to study has improved, 83% said that examination results has improved, 75% said higher school attendance, and 59% said that school drop-out has gone down (Table 4.6.9). Thus, household electricity has been instrumental in improving the quality of education through creation of enabling environment for education and study.

Changes in habits mediated-through electricity have taken place. The favorable changes in habit reported include reading habit i.e; family members devote more time now than before-electricity in reading books and newspapers (reported by 95%), watching TV (87%), listening radio (59%), socializing in the form of *adda*/gossiping (53%), participation in cultural programs (42%), watching VCR (38%), playing cards/chess (23%) (Table 4.6.10). This pattern of favorable changes in habit and in leisure activities have direct positive impact in improving the quality of life and changing mind-set of people towards better life. This can be denoted as electricity-driven demand creation for improved standard of living.

One of the most prominent benefits of electricity was found to be associated with the availability of longer duration of work and leisure due to lighting. Ninety per cent of the respondents said that household members now work for longer hours than before electrification (Table 4.6.11).

Figure 4.118: Problems if electricity supply interrupted/fails for a sustained period (% reporting)



Source: Table 4.6.7.

Another practical way of gauzing the benefits of domestic electricity is to know about the nature of the problems cause due to the electricity supply interruptions or failures for a sustained period. The consumer's reporting on this substantiates the earlier findings about the benefits of electricity. Most have reported that electricity interruption/failure for sustained period affect children's study (reported by 85%). The other problems reported were discomfort due to no fan (71%), unnecessary delay in dinner (51%), difficult to sleep at night during summer (46%), affect TV watching (43%), and increase in women's drudgery (41%) (Figure 4.118).

4.6.5. Supply Side Problems: Experience of Disconnection, Troubles in Paying Bills, and Regularity/Irregularity in Power Supply

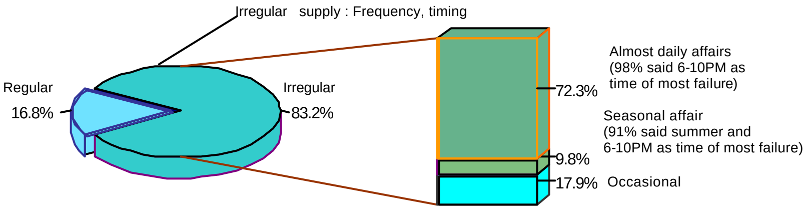
Eighty seven per cent of the consumers (domestic) never faced problem of disconnection associated with the non-payment of bills (Table 4.6.12). About 13% had experienced a disconnection for non-payment of bills. Further probing has shown that, 23% of the respondents ever faced trouble in paying the bill (Table 4.6.13). Three reasons were mentioned: 67% could not pay due to want of money, 14% each did not get the bill in time and got incorrect bill (Table 4.6.13b). Thus, two notable issues are in order:

First: A 28% of those having had trouble in paying bills (6.5% of all consumers) were due to the causes associated with PBS management (incorrect bill or disbursement of bill not in time). This implies that, at least 28% of the problems associated with bill payment or delayed payment (which had affected 6.5% consumers) can be resolved by improving the relevant management parts of the PBSs.

Second: A 67% of those ever experienced trouble in paying bills (15.6% of all consumers) were associated with the non-availability of cash at the time of bill payment. Compared to the rich segment of the consumers, a higher proportion of the poor segments (especially the landless connection holders) has mentioned so. However, based on these findings, it would be difficult to draw any firm conclusion about what can be done by PBS to resolve the issue. This is at least because of two reasons: (a) the average amount of bill is not that high as compared to the income (for landless category, monthly bill would be at best 4% of monthly income), (b) uninterrupted or irregular cash flow is a reality among many in the rural areas. Cash-flow has a seasonal characteristics in the rural areas, and that especially among the poor.

Irregularity of power supply and load shedding are acute problems in REP. As shown in Figure 4.119, an 83% of the customers have said that, power supply is irregular (meaning voltage fluctuations, supply interruptions, load shedding). Of these, 72% said that such irregular power supply is almost a daily affairs, 18% said that as occasional, and about 10% said that as seasonal. Irregular power supply mostly takes place in the summer (reported by 90% of those who responded to the seasonality of irregular supply) and the 6-10 PM is the time of most irregular supply. These findings are sufficient enough to raise the question of quality of electricity supply through REP in the PBSs. The policy implications are straight forward: regularity in power supply needs to be ensured (or frequency of irregularity needs to be minimized); power supply during prime time, 6-10 PM should be made regular; and all mitigation efforts should be directed to address the problem of irregular supply during the summer season. Among other things, it is most likely that more generation of power (than now) is the most important route to resolve the issue of irregular power supply. This is more so, in view of the increasing population size and increasing demand for electricity in the rural households in Bangladesh (Figure 4.119).

Figure 4.119: Regularity/irregularity in power supply: extent and timing (% reporting)



Source: Table 4.6.14

4.6.6. Willingness to Pay More

A large number of the domestic consumers are willing to pay more for electricity than now providing better quality is ensured. About 45% of the consumers have expressed their willingness-to-pay more for electricity providing their is no power fluctuations and round-the-clock availability of electricity is ensured (Table 4.6.15).

On average, the customers are willing to pay 7.42% more amount than now if better quality of services are guaranteed (Table 4.6.16). The rich customers (who belong to the large landowning groups) are willing to pay 9.68% more amount than now. Overall, 31% customers are willing-to-pay 10% more amount than they pay now; and about 13% are willing-to-pay 20% more amount than they currently pay for electricity (estimates based on survey information in Table 4.6.16).

An average household pays Tk. 147.22 per month as electricity bill (Table 4.6.16b). Assuming this rate to be true for overall REPs domestic connections, the estimated annual revenue comes to Tk. 5007 million (for 3,413,825 domestic connections, June 2002). If better quality of services are ensured (i.e., no power fluctuation and round-the-clock availability of electricity is ensured) and people pay as per their willingness-to-pay more (7.42% more than now), then the estimated amount of annual revenue from domestic connections would be Tk. 5378.5 million, i.e., an annual increment of Tk. 371.5 million. It is most likely, if quality of electricity supply is really ensured, the actual extent of increment in the revenue will be much higher than the estimated Tk. 371.5 million. This is because of the following:

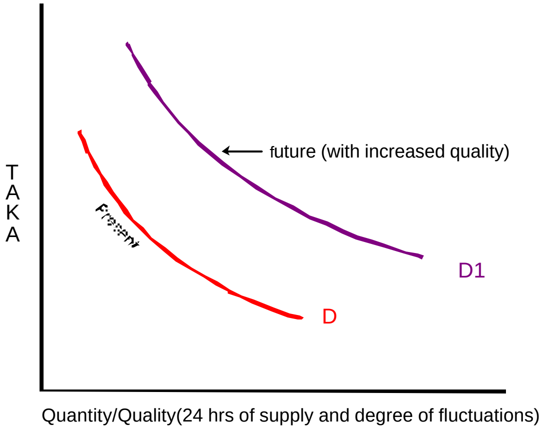
a. A large part of 55% of the consumers who have expressed their unwillingness to pay more are perhaps unwilling because of their dissonance with the experience of frequent power failure in prime time (6 PM to 10 PM) and in needy season (summer). Irregular supply during 6 PM-10 PM badly affects children's study, as well as forces spending in alternative lighting (lantern, *Kupee*, candle etc.). Thus, if quality of electricity supply is improved and becomes visible and sustained, then, of course, dissonances and annoyances will be removed, and a large part of those expressed unwillingness-to-pay more in the survey will actually be ready to pay more than now.

b. A substantial part of those 45% of the customers who have expressed their willingness-to-pay more for better quality of services have actually reported a minimal amount of increment (ranging between 2% and 5% more than now). It can be argued that they will also actually pay more than now if visible and sustained improvements in the quality of electricity supply is ensured.

Thus, the possibility for increased revenue from domestic electricity supply exists, providing better quality of services in the form of sustainable uninterrupted power supply (available round-the-clock with no fluctuations) is ensured.

In a nutshell, as shown in Figure 4.120, the marginal willingness-to-pay curve with improved and sustained quality of electricity supply will take the shape of the demand curve situated well to the right (D_1) of the other (D, representing the present situation). The rightward shift in the demand curve showing higher willingness-to-pay (D_1) for electricity will depend much on the experience that consumers have and the information gather over time about the quality of and increased appreciation for electric supply over time. Such implications are quite likely to happen due to the increasing demand for electricity, and more so, for its increasing quality and due to its long-run benefits. Improvements in the quality of electricity supply will change all the following variables responsible for shifting the willingness-to-pay demand curve rightward: preferences, number of consumers, price of related goods (both substitutes and complements), consumer's income, expectations of future prices, and consumer's information.

Figure 4.120: Willingness-to-pay demand curves for electricity



4.7. DEMAND FOR ELECTRICITY AND REASONS FOR NOT HAVING ELECTRICITY

4.7.1. Introduction

Demand for electricity is a multidimensional issue involving demand by economic sectors (agriculture, industry, business), by social sectors (education, health and others institutions), and that by the individual households. Demand for rural electrification has been well documented as a potential pro-poor growth in the most recent official policy document "Bangladesh: A National Strategy for Economic Growth, Poverty Reduction and Social Development"[63>]. This strategy document has emphasized four priority areas to ensure pro-poor orientation in the growth process, "rural electrification" being one of those four. In reality, success in all the three other areas, namely accelerated growth in rural areas, development of small and medium manufacturing industries, and information and communication technologies depend decisively on the availability of electricity, especially in the rural areas.

Keeping in view the above stated, this section intends to limit the analysis of the demand for electricity at the household level. This is important in view of the fact that, out of the 19 million rural households in Bangladesh do not have access to electricity (with about 6.4 million households even in the electrified villages)[64>]. Thus, in the quantitative survey, all households not having access to electricity were enquired about their willingness to have electricity connections and reasons for such willingness; about their knowledge of amount required as one time investment for getting electricity connection, about monthly bills, unit tariff for domestic use; and finally, ascertained were the reasons for not having electricity connection in the households when electricity is available in the same village.

4.7.2. Willingness to Have Electricity

Around 94% of the non-electrified households have expressed their willingness to have electricity in their households. It was interesting to investigate as to why the remaining 6% are unwilling to have electricity in their households? Two reasons could be ascertained.

First: The proportions of households that expressed such unwillingness are higher among the poor (landless and marginal landowners, 7.8% and 6.7% respectively, Table 4.7.1). That poverty is a major reason for unwillingness was further revealed in the fact that while only 4.4% of the landless in the non-electrified villages (i.e., people having less experience of benefits of electricity) reported such unwillingness, it was as high as 12.3% in the electrified villages (i.e., people having more experience of seeing the benefits of electricity). For marginal households, the corresponding proportions expressing unwillingness were 3.9% and 11.2%. Thus, poverty could be a major reason for expressed unwillingness in having domestic electrification.

Second: Most of those who expressed unwillingness to have electricity are actually unaware of the one time amount of money required to get electricity connection, or unaware of approximate monthly bill, or unaware of the both. Thus, poverty

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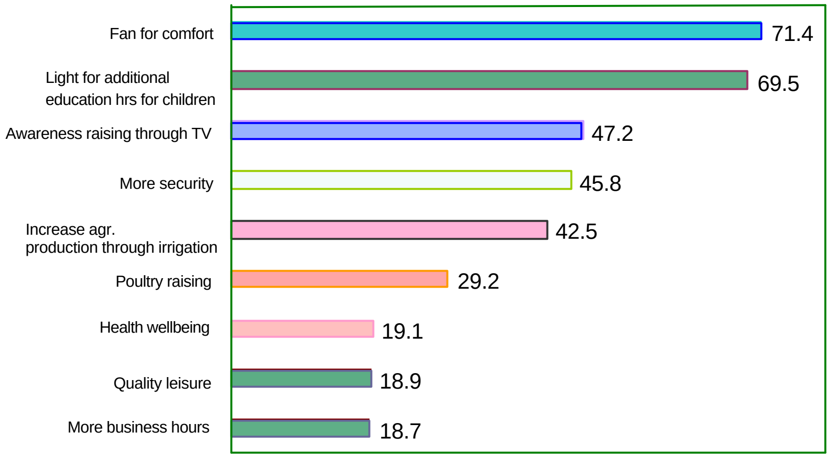
[63>] This document is popularly known as PRSP, published by Economic Relations Division (ERD), Ministry of Finance, GoB, September 2002.

[64>] The basis for this estimates are presented in Section 4.3.2.

combined with unawareness about the extent of one-time investment and monthly billing amounts explain the reason for unwillingness to have electricity connection. The implications are straight forward: both information campaign for awareness raising among the poor (landless and marginal landowner groups) about the investment requirements and monthly bill, and provisioning of some safety net or system of deferred payments (or sort of that for example, micro credit to the poor for electricity) for them could be thought of in transforming the unwillingness into willingness, and thereby, facilitate poor people's informed decision making in favor of electricity connections at their households.

Figure 4.121: Reasons for willingness to have electricity (% reported reason)



Source: Table 4.7.1(b)

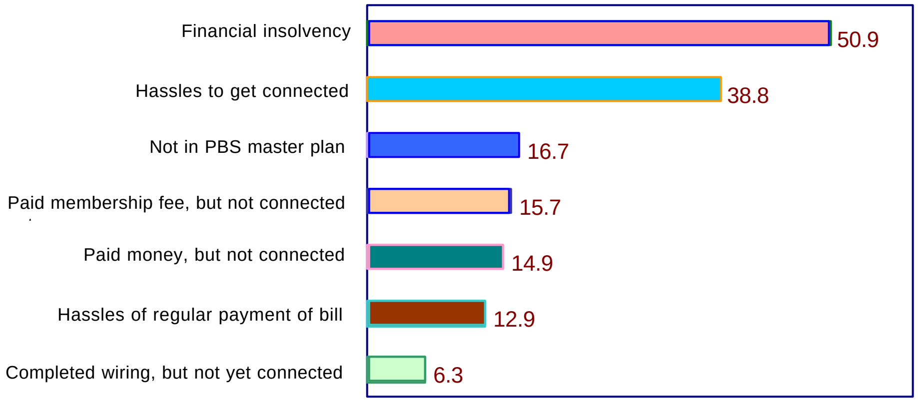
Respondents showing willingness to have electricity at their households reported multifarious reasons for such willingness. The expressed order of reasons for such willingness, as depicted in Figure 4.121, were fan for comfort (mentioned by 71.4% respondents), light for additional educational hours for children (69.5%), awareness raising through TV viewing (47.2%), more security (45.8%), increase agriculture production through irrigation (42.5%), poultry raising (29.2%), wellbeing of members health (19.1%), quality leisure time/more recreation (18.9%), quality leisure (18.9%), and prosperity in business due to long work hours (18.9%). A close scrutiny of the reasons shows that people’s demand for electricity at their households is primarily determined by both the socio-cultural and economic needs associated with desire for enhanced quality of life.

The reasons for willingness vary by rich-poor on certain counts. Since, poor are both land-poor and income-poor, compared to the rich, a lesser proportion of poor mentioned reasons such as to increase agriculture production through irrigation (26% poor reported this reason compared to 67% rich), for prosperity in business (16.9% v/s 33.3%), and for awareness raising through TV viewing (38.8% v/s 75%).

4.7.3. Village Has Electricity, but Its Households Do Not Have: Why?

According to our estimates, 17.88% of the rural households in Bangladesh have electricity connections, and 65% of the households in the villages electrified do not have access to electricity (see Table 4.1, Section 4.3.2). What are the reasons for households' in access to electricity even in the electrified villages? The reasons reported include financial insolvency (reported by 51%), hassles to get connection (24%), not included in PBS master plan (17%), paid membership fee long ago but not yet connected (16%), paid money but not yet connected (15%), hassles of regular payment of bill (13%), completed wiring awaiting connection (6%) (Figure 4.122). The reported reasons show a pattern worth further analysis: Some will get the connection soon (those paid money and completed wiring); many will not get connection because of their financial insolvency and because of non-inclusion in the master plan; and many are less interested due to the hassles in getting connection as well as hassles of paying the bill on a regular basis. Thus, two categories of problems can be resolved with PBS management intervention, and thereby, increase the number of direct beneficiaries of electricity : those paid money and completed wiring, and those who have said various forms of hassles associated with getting connection and paying the bills.

Figure 4.122: Reasons mentioned for household's in access to electricity in the electrified villages (% reported reasons, multiple reporting)

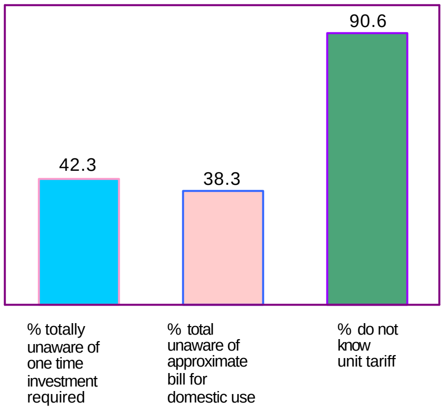


Source: Table 4.7.2

4.7.4 Knowledge about Costs Associated with Household Electrification

In general, people in the non-electrified households are not adequately aware about the costs associated with household electricity. Over two-fifths (42.3%) have said that they know nothing about the one time amount of money (investment) required to get electricity connection. About 17% have said upto Tk 1,000, 27% have said Tk 1,000-1,500, and 4% have said Tk 3,000+as one-time cost (Table 4.7.3). The average amount of money required reported was Tk 1,703. This pattern also substantiates the fact that in addition to those who have said straight "don't know", some reported specific amount also do not know the actual amount required as one-time investment. These two categories combinedly constitute 50% who actually are fully unaware about the actual (approximate) one time cost required for domestic electricity connection.

Figure 4.123: Inadequacies in knowledge about expenses related to domestic electrification



Source(s): Table 4.7.3, 4.7.4, 4.7.4(b).

About two two-fifths of the respondents in the non-electrified households are unaware about the approximate amount of monthly bill to be paid for domestic use of electricity (Figure 4.123). About 91% were found unaware about the per unit tariff for domestic use of electricity. The corresponding figure for the (non-electrified) households in the electrified villages was 86% and that in the non-electrified villages was 94%. The extent of unawareness about the unit tariff was more pronounced among the poor than among the rich landowner categories. **Thus, inadequate knowledge about one-time investment, approximate monthly bills and unit tariff were highly pronounced among the respondents in the non-electrified households, implying that dissemination of these information would be necessary to make activities more transparent which, in turn, will facilitate people's informed decision-making in having electricity connections at their households.**

4.8. IMPACT ON POVERTY REDUCTION AND HUMAN DEVELOPMENT

4.8.1. Introduction

Poverty has both economic and non-economic (social and cultural) dimensions. Since electricity enlightens people and that enlightement is mediated through all aspects of life, both the economic poverty and human deprivation aspects of poverty has been assessed for all three sample categories of households, namely with electricity (HE), without electricity in electrified villages (WE-EV), and without electricity in non-electrified villages (WE-NEV).

In case of evaluating various dimensions of economic-poverty the head count measures using the direct calories intake (DCI) and the cost-of-basic-needs (CBN) methods were used. In order to ensure comparability of the estimated values, the official methodology used by the Bangladesh Government in the Household Income and Expenditure Survey 2000 (published by BBS in 2001) was adopted. Also, to ensure comparability, the relevant correction factors were applied (e.g., Taka value per person per month for 2001 in estimating the lower and upper poverty lines using CBN method). All pertinent technical notes are also presented in the relevant places including in a more detailed fashion in Annex-C (after the Table 4.8.1b). In addition, attempts have been made to understand the poverty status of the three sample categories using indicators such as per capita income, landownership, gini-concentration ratios for land, income etc. Moreso, in order to evaluate the nature of changes in the poverty status, inter-temporal data on self-assessed poverty situation were analysed and triangulated, to the extent possible.

Electricity's impact on reducing human poverty was evaluated using the human development conceptual framework, which has the potential to show the direction of the real impact of electricity on human life (because that impact is much more significant and in-depth than just economic *per se*). In doing this, the human development index (HDI) values have been estimated separately for all the 3 sample categories (HE, WE-EV, WE-NEV). The HDI takes into account three major dimensions of life, namely, human longevity, human knowledge, and per capita real income. Electricity, as hypothesized in this impact evaluation study, contributes to each of these critical life-dimensions.

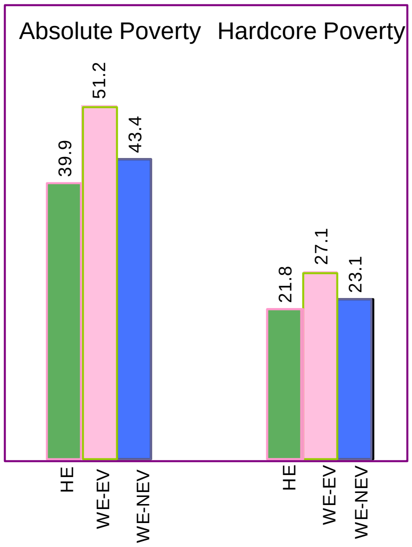
4.8.2. Impact on Poverty Reduction

4.8.2.1. People below poverty line: Impact on incidences of poverty

The head-count index measured in terms of DCI and CBN methods shows distinctively that poverty situation is much better in the electrified than that in the non-electrified households. Our estimates revealed the following:

Absolute poverty was most pronounced among population in the households without electricity in electrified villages. About 40% of the population in the electrified households are below absolute poverty line (i.e; per capita consumption is less than 2122 k.cal per day). The corresponding figures for the population in non-electrified households of electrified villages is 51%, and that for the population of non-electrified

Figure 4.124: Population below poverty lines by household electrification status (DCI method)

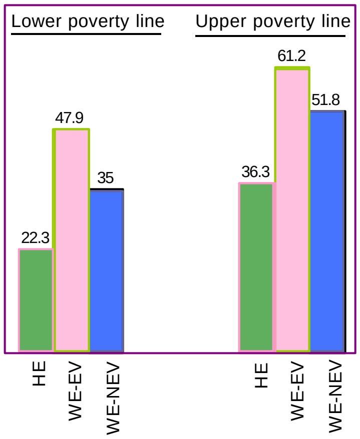


Source: Table 4.8.1

villages is 43.4% (Figure 4.124). Compared to the national level of absolute poverty (44.3%) the electrified household's level is 11% less implying that electricity has contribution in poverty reduction.

Like absolute poverty, the **hard core poverty** was also most prominent among population in the non-electrified households in the electrified villages (27.1%). In the electrified households, 21.8% of the population were found below the hard core poverty line. The corresponding value for the population in the non-electrified villages was 23.1%.

Figure 4.125: Population below poverty line by household electrification status (CBN method)

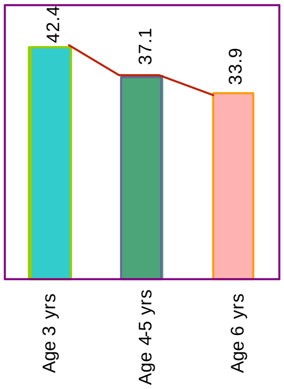


Source: Table 4.8.1(b)

The incidence of poverty calculated using CBN method disaggregated by household electrification status is presented in Figure 4.125. Both the lower and upper poverty lines are much less pronounced for the electrified than the non-electrified households. The size of the population below the lower poverty line was 22.3% for the electrified, 47.9% for the non-electrified households in electrified villages and 35% for the households in the non-electrified villages. The corresponding proportions for upper poverty line (population below that) were 36.3%, 61.2% and 51.8% respectively. Thus, proportion of population below both the lower and upper poverty lines were highest in the non-electrified households of the electrified villages (47.9% and 61.2%), followed by households in the non-electrified villages (35% and 51.8%), and lowest in the electrified households (22.3% and 36.3%).

The very high incidence of both lower and upper poverty among the population of non-electrified households (incidence higher than national averages, Table 4.8.1b), and high gaps in those incidences between the electrified and non-electrified households with electrified showing the least incidences (51% less in lower poverty line and 37% less in upper poverty line) signify that access to electricity in the poor households (not in the villages only) had much impact in poverty reduction. **Thus, ensuring poor people's (households) access to electricity should be assigned with high priority in any future poverty reduction strategy for the rural Bangladesh.**

Figure 4.126: Percentage of population below absolute poverty lines by age-length of electricity in the household



Source: Analysis based on survey

In terms of incidence of poverty, one of the most interesting findings was the positive relationship between the age length[65>] of electricity in the household and the declining incidence of absolute poverty. As shown in Figure 4.126, 42.4% population in the households with 3 years of age-length of electrification are poor (below absolute poverty line), which drops down to 37.1% if the household age-length of

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[65>] Methodologically, it is important to note that not all 1380 sample electrified households were considered in the analysis. Because of the fact that it takes some amount of time – after household being connected with electricity – to see the visible and tangible impact of electricity, the households below 3 years of age-of-connection (total 337 households) were excluded from the analysis. The older-connected households were also excluded due to two reasons: (a) low cell frequency in most of the single-ages which has every possibility to mislead the direction of impact, and (b) plateuing effect might be applicable for the older-age connections. The analysis presented above pertains to 47% of the total sample electrified households (i.e., a total of 645 households with age-length of electricity between 3 and 6 years).

electrification is 4-5 years, and further falls down to 33.9% if households electrification age is 6 years. This is quite a revealing findings to show that electricity influences poverty reduction, overtime, with a gestation period. Further indepth studies and analysis of the nature of association between the age-length of domestic connections (with baseline status of these households) and poverty reduction are warranted.

Thus, based on the above analysis of incidences of poverty, the following major inferences can be drawn:

a. In terms of the incidences of poverty measured using both the DCI and CBN methods, the population in the electrified households are much better-off than the national averages and their counterparts in the non-electrified households. Thus, electricity has strong poverty reduction influence.

b. The incidences of poverty are highest among the non-electrified households in the electrified villages, and the poverty gap between the electrified and non-electrified households in the electrified villages is substantial. These imply that electrification in the village only without electrification of households will not be sufficient enough to reduce poverty.

c. Household level incidences of poverty declines with the age-length of electricity in the household. This is more so if poverty is viewed not narrowly i.e; income-poverty alone, but holistically with all dimensions of human deprivation including health, education, attitude and ideational changes (detailed analysis provided in Sections 4.4.1, 4.4.3, 4.4.4, 4.4.5, 4.5, 4.6 and 4.7).

> ***"Life without electricity could be anything but human development in the truest sense of the term"***
>
> Imam Hossain,
> Member of PBS Board and Teacher-cum-farmer, Gopalganj PBS.

4.8.2.2. Trend in self-assessed economic and social status, and crisis and coping strategies

Self-assessment of the respondents (most cases household head) about the economic and social statuses over the last five years shows not only their perception about the issues raised but also amply indicate the close-to-reality situation. This is why social science researchers, worldwide, use the self-assessment data to understand socio-economic dynamics of life, especially those pertaining to the understanding of poverty. Although subjective, self-assessment has been recognized as a useful powerful tool. All data related to the self-assessment were collected for the last five years (1997-2001) preceding the interview. The methodology of processing of the self-assessed values, due to its innovativeness and to ensure transparency, is presented in brief in the box below:

In the self-assessment of poverty, a range of ranking-scales were used in the survey. The aggregate scores were estimated using self-assessed, ranking or scale values. The scales (ranking) are as follows:

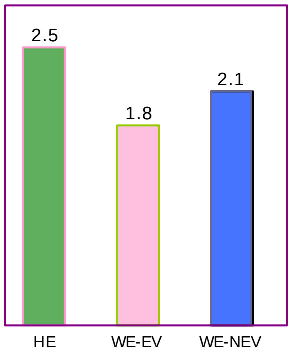
i) Household economic status: poor (=1), lower middle (=2), middle (=3), upper middle (=4), rich (=5).
ii) Household food availability status: always deficit (=1), occasionally deficit (=2), neither deficit nor surplus or breakeven (=3), surplus (=4).
iii) Economic crisis faced by household : yes (=0), no (=1).
iv) Household incidence of distress selling to cope economic crisis: yes (=0), no (=1).
v) Household economic strength in meetings (bearing) health care related expenses: very difficult (=1), difficult (=2), not difficult (=3).
vi) Household economic strength in meeting (bearing) education-related expenses: very difficult (=1), difficult (=2), not difficult (=3).

The key aspects of the methodology applied were as follows: As a matter of principle "higher value for better status/situation" was adopted; this permits additiveness of scores against all relevant indicators. The higher the sum total value, the better the status.

The single year score for each variable was estimated first, and then the five-year weighted score was estimated. Finally, a grand total score of five items (except distress sales) showing the overall scenario of socio-economic status of three sample categories of households were calculated.

Data on trend of <u>self-assessed economic status of households</u> show relatively less extent and high intensity of poverty reduction among the electrified households (HE) compared to the other two categories (WE-EV and WE-NEV). According to the self-assessment of the electrified household, the share of poor and lower middle class has dropped down to 46% in 2001 from 51% in 1997. The corresponding reporting by WE-EV was 77% and 82%, and by WE-NEV 60% and 70%. The (five-year) aggregate economic status scores[66>] based on self-assessed economic status were 2.5 for HE, 1.8 for WE-EV, and 2.1 for WE-NEV (Figure 4.127). These scores clearly indicate relatively better economic status of the electrified households compared to the non-electrified households.

Figure 4.127: Aggregate score of self-assessed economic status of households for the last five years (1997- 2001) by household electrification status



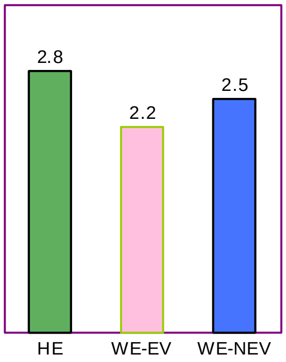
Source: Table 4.8.2(b).

Households' self-assessment in terms of <u>food availability status</u> shows a general positive trend over the last five years (Table 4.8.3). The proportion of households declared 'always deficit' and 'occasionally deficit' has reduced, for all categories, between 1997 and 2001. The proportion of households declared food surplus has increased from 17.3% in 1997 to 22.8% in 2001 for HE category; and that for WE-EV category from 4.8% to 6.7%, and for WE-NEV category from 10.6% to 13.0%.

[66>] Aggregate economic status score ranges between 1 and 5, '1' being 'poor' and '5' being 'rich'. Aggregate economic status has been estimated as weighted sum total of individual year's score divided by five years total observations (sum of 'n').

The aggregate scores of self-assessed food availability status[67>] of households for last five years (1997-2001) were 2.8 for HE, 2.2 for WE-EV, and 2.5 for WE-NEV (Figure 4.128). Within the context of general improvements in the food availability at the household level, the higher score value for electrified households confirm the hypothesis that the situation has been relatively better there.

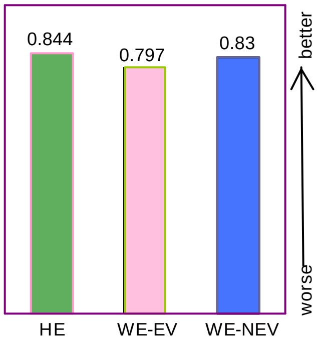
Figure 4.128: Aggregate score of self assessed food availability status of household for last five years by household electrification status



Source: Table 4.8.3(b)

Household facing economic crises in terms of economic hardship due to crop failure, unemployment, flood/cyclone, draught, ill-health, ceremony, dowry etc., is common in Bangladesh. All respondents were enquired about whether they have ever faced such crises during the last five years, and if so, what was (were) done to cope with that including the distress selling. For some reasons or others, all categories of households reported such crisis in a higher proportion for 1998 (perhaps due to devastating flood) and for 2001. However, these proportions of reporting about the incidences of crisis faced for 1998 and 2001 were less intense for electrified households compared to the two other categories. The five year average of economic crisis score[68>] for electrified households was 0.844, and that for WE-EV was 0.797 and for WE-NEV 0.830 (Figure 4.129).

Figure 4.129: Aggregate score for household economic crisis for last five years by household electrification status



Source: Table 4.4.8.4(b)

In terms of the nature of crisis, the most frequently pronounced incidence was "high expenditure due to ill-health", irrespective of electricity status and timing (i.e., all five years except 1998) (Table 4.8.4c). For 1998, irrespective of sample category, the most pronounced incidence was loss of crops (crop failure), followed by high expenditure due to ill-health, flood/cyclone, and loss of business. Among the crisis coping strategies, taking loan was reported by around 50% of those faced crisis (Table 4.8.4c). Among other crisis coping strategies mentioned were utilization of savings, sale of livestock, land sale, sale of durable assets, mortgaging out-of-land, engaging school going children to work; in varying proportions by different categories of sample households. **As crisis coping strategy, the increasing and high incidence of 'utilization of own savings' and declining incidence of "sale of livestock and land sale" among those in the electrified households, and the reverse trend in the non-electrified households imply the development of a more sustainable coping capacity and livelihood among those in the electrified households compared to the non-electrified households.**

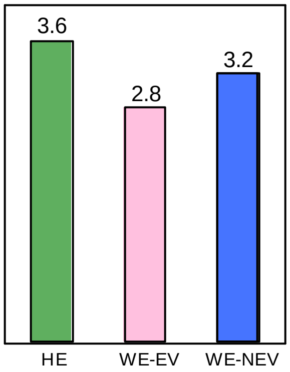
As in the case of crisis timing, the distress sales were also relatively more pronounced in 1998 and 2001, irrespective of electricity status of households. The five years' average of proportion of households reported distress sale was 6% in the electrified, 6.8% in the non-electrified households in electrified villages, and 8% in the non-electrified villages.

[67>] Aggregate food availability status score ranges between 1 and 4, '1' being 'always deficit' and '4' being 'surplus'. Aggregate score is weighted sum total of individual year's score divided by five year's total observations (sum of 'n').

[68>] Aggregate economic crisis score ranges between 1 and 0, '1' being no crisis and '0' being crisis faced. The closer the value to '1' is the better. Aggregate crisis score has been estimated as weighted sum total of individual year's crisis score divided by five years' total observation (sum of 'n').

In terms of self-assessment of the household's economic strength in bearing/meeting health care expenses 14% electrified households reported "very difficult" for 2001. Such reporting for WE-EV was 26.6% and for WE-NEV was 22.3% (Table 4.8.8). During the last 5 years, the proportion assessed 'not difficult' in electrified household has increased while the same has not changed in the non-electrified households in electrified villages, and decreased (by 8.5%) in the non-electrified villages (Table 4.8.8). The five-year aggregate score of household's economic strength in meeting/bearing health care expenses[69>] was 3.6 for HE, 2.8 for WE-EV and 3.2 for WE-NEV (Figure 4.130). The scores constructed based on self-assessed values are indicative enough to show that the electrified households are much better placed than the non-electrified ones.

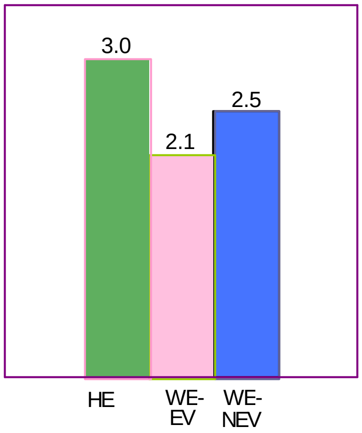
Figure 4.130: Aggregate score showing household's economic strength in bearing/meeting health care expenses by household electrification status



Source: Tables 4.8.8.(b)

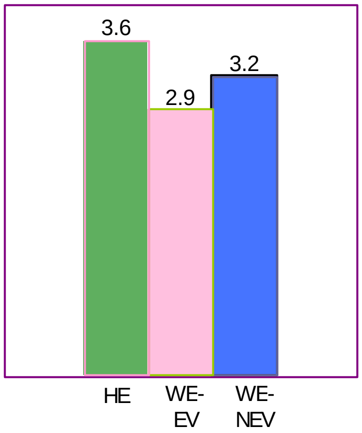
The five-year aggregate score of households' economic strength in meeting/bearing educational expenses was 3.0 for those with electricity, 2.1 for those without electricity in the electrified villages, and 2.5 for those in the villages without electricity (Figure 4.131).

Figure 4.131: Aggregate score showing household's economic strength in bearing/meeting educational expenses by household electrification status



Source: Table 4.8.9(b)

Figure 4.132: Overall grand score showing household economic strength in terms of combined five self-assessed indicators by household electrification status



Source: Estimated based on all relevant score values

Finally, the overall five-year combined (grand) score of self-assessed indicators— household economic status, food availability status, economic crisis faced, meeting health care expenses, and meeting educational expenses— has been constructed using a 0-5 points scale. Transformations were made for those having scoring values different than 0-5. The closer the value toward '5' the better. The grand overall (combined) socio-economic status score comes to

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[69>] The aggregate score ranges from 1 to 5; '1' being very difficult, '2' being difficult, and '5' being not difficult. Our own judgement has been applied to assign high value for not difficult (in reality this scale ranges between not difficult and not difficult at all or easy to meet expenses). The incidence of " high expenditure on account of ill-health/sickness" has been reported by around 50% of the samples, irrespective category. Thus, the decision to assign disproportionately high value for 'not difficult' (compared to the distance of '1' between 'very difficult' and 'difficult') is justified. The overall aggregate range score has been estimated as weighted sum total of individual year's value divided by fine years total number of observation (sum of 'n'). Similar procedure has been used in the construction of the similar score for meeting educational expenses.

3.6 for electrified households, 2.9 for non-electrified in electrified villages, and 3.2 for households in the non-electrified villages (Figure 4.132).

4.8.3. Impact on Human Development : Human Development Index

Human Development Index (HDI) has been constructed for all three categories of sample households. Constructing this, the standard methodology of UNDP[70>] has been adopted with some technical corrections. The major issues pertaining to the technical corrections are presented at the footnote under Table 4.4.

The HDI values obtained for electrified household is 0.642, for non-electrified households in the electrified villages is 0.440, and for households in the non-electrified villages is 0.436 (Table 4.4). Based on the analysis of HDI of 3 categories of sample households the following inferences are in order:

First : The HDI for electrified households (HE) 0.642 is substantially higher than the overall HDI of Bangladesh (0.478).[71>] The electrified households' HDI corresponds to the lower-mid-level index for medium HDI countries (ranking 100 out of 173 countries, in which Bangladesh current rank is 145). This implies that, by ensuring 100% access to household electricity in the rural areas, Bangladesh may raise its HDI ranking substantially from current 145th position to a position of around 100 (corresponding to the ranking of such countries as Egypt, Bolivia, Indonesia, Honduras). Thus, electricity's potential impact on enhancement of national HDI could be very significant.

[70>] Methodological notes:

The HDI is a simple average of the life expectancy index, educational attainment index and adjusted real GDP per capita index, and so is derived by dividing the sum of these three indices by 3 each of the indices is computed according to the following general formula:

Index = [Actual Value - Minimum Value]/[Maximum Value - Minimum Value]

For the construction of these indices, fixed minimum and maximum values have been established for each of the indicators as:

- Life expectancy at birth: 25 years and 85 years
- Adult literacy: 0% and 100%
- Combined gross enrolment ratio: 0% and 100%
- Real GDP per capita (PPPS): $100 and $40,000 [the discounted value of the $6,154 (PPPS) has been used for the upper limit (see note below)].

The construction of income index is a little more complex. The world average income of $5,835 (PPPS) in 1994 is taken as the threshold level, and any income above these level is discounted using the formula based on Atkinson's formula for the utility of income. Using that formula, the discounted value of the maximum income of $40,000 (PPPS) is $6,154 (PPPS). Since Bangladesh's real GDP per capita is less than the threshold level, so it needs no adjustment.

Given the variations in the estimates of the per capita GDP in PPPS provided in HDRs and WDRs, the following method was adopted. The per capita GDP (PPPS) figure for 1996/97 was taken from Human Development Report 1997, HDR 1997 gives a figure of 1331 for 1994. This figure has been updated by using the national growth rate in GDP over 1994-1996/97 to derive the real GDP per capita for 1996/97. Similarly, the 1998/99 figure has been derived by applying the national growth rate in GDP actually observed during 1996/97-1998/99.

[71>] Human Development Report 2002, “Deepening democracy in a fragmented world”, UNDP, NY. 2002, page 151

Table 4.4: Human Development Index by Household Electrification Status

Human Development Indicator	Household with electricity	Household without electricity (in electrified villages)	Household without electricity (in non-electrified villages)
A. Adult literacy rate (%) (AL) (15 yrs and above	73.2	54.9	57.3
B. Combined gross enrolment ratio (CER) (5-24 yrs.)	63.7	54.9	54.0
C. Life expectancy at birth (LE)[a>]	74.5	60.0	54.9
D. Per capita income (as proxy of per capita[b>] real GDP: PPP)	2519	1238	1612
E. Indexed LE	0.825	0.583	0.498
F. Indexed AL	0.732	0.549	0.573
G. Indexed CE	0.637	0.549	0.540
H. Indexed Education Attainment (EA)	0.700	0.549	0.562
I. Indexed Adjusted Income	0.400	0.188	0.250
Human Development Index (HDI)	**0.642**	**0.440**	**0.436**

Notes:a> Data on Life expectancy at birth (LE) was not available in the survey. Data on child birth and infant death (last year) were obtained, and infant mortality rate has been estimated. LE is function of many factors including IMR. LE and IMR are inversely related. LE for specific IMR has been calculated using formula: 100 - IMR x 1.3 (constructed for Bangladesh). The estimated IMR in the current survey are found as follows: HE = 42.7/1000 LB, WE-EV = 53.8/1000 LB, and WE-NEV=57.8/100 LB.

b> Per capita real GDP for 1999/00 was 1632 PPP$ (Bangladesh Human Development Report 2000: 30). The overall per capita rural income in Bangladesh (estimated using information in Section 4.3.2) in 2001 was Tk. 10,036. This amount equivalent to 1632 PPP$ i.e; Tk.1= PPP$ 0.1626$. The actual per capita found in the survey for HE was Tk. 15,494, for WE-EV Tk. 7,613 and for WE-EV, Tk. 9,916. The PPS$ equivalent to these Taka value has been estimated using the above conversion coefficient.

Second: Even the non-electrified households in the electrified villages (WE-EV), which are predominantly poor, represents an HDI almost similar to that of the Bangladesh country average. The former category's HDI value is even higher than the households in the non-electrified villages (which are economically better off than the non-electrified households in electrified villages). This imply that, HDI increases with the village level electrification even when household's access to electricity is denied. This, as found in the survey, is most likely influenced by the relatively low infant mortality rates and higher combined gross enrolment.

Third: The differences in HDI values between the electrified HHs and the non-electrified households in the electrified villages is 45.9%; between the non-electrified households in the electrified villages and the non-electrified villages is less than 1%, and that between the electrified households and the households in the non-electrified villages is 47.2%. All these imply that, provisioning of access to electricity for the non-electrified households will have spectacular impact in raising HDI in Bangladesh. **Thus, village electrification without electrifying the households will have not much effect on improving human development and increasing HDI values. Or, in other words, universal rural household electrification will have spectacular impact on human development in rural Bangladesh.**

4.8.4. Synergistic Impact on Poverty Reduction and Human Development

Based on the analysis presented in this and previous sections, the following conclusions indicating poverty reduction role of electricity can be drawn:

a. Both absolute poverty and hard-core poverty are significantly less pronounced in the electrified than those in the non-electrified households. The share of population with food (energy) intake less than 2122 K. cal. per day (absolute poor) and those with less than 1805 K.cal per day (hard core poor) – both are much less pronounced in the electrified compared to those in the non-electrified households.

b. The electrified households are much better-off than the non-electrified ones in terms of all human development indicators, namely human longevity (measured using infant mortality rate as proxy), human knowledge, and per capita real income. The value of human development index (HDI) for electrified household is remarkable at 0.642, which is 34% higher than the overall HDI for Bangladesh, and about 46% higher than that for the non-electrified households. Bangladesh is a low HDI country (ranks 145 out of 173 countries) but the HDI value for electrified village-segment corresponds to the medium HDI countries such as Egypt, Honduras, Bolivia. Thus, ensuring household access to electricity alone can be seen as a necessary precondition to significantly improve human development scenario of Bangladesh.

c. Electricity contributes to income-poverty reduction. The average annual income (last year's) of the electrified households (Tk.92,963) is much higher (65%) than that in the households of non-electrified villages. The annual income of the poor (landless category) in the electrified (Tk.58,864) was around 50% higher than that of the poor in the non-electrified households.

d. Electricity has income-enhancing effect. 16.4% of the income of electrified households can be attributed to electricity. The corresponding figures for the non-electrified households in electrified villages was 12% and for those in the non-electrified villages only 3.6%. Other things being the same, 100% electrification of rural households (currently 17.88% of rural households are electrified) might increase the annual rural income by Tk.671 billion (which is equivalent to the 26% of the current GDP), and as high as 43% of this incremental income can be attributed to electricity.

e. Electricity contributes significantly in asset-building of the poor. Land-ownership (cultivable land) distribution is less skewed in the electrified than in the non-electrified – the bottom 40% of the electrified households own 3.7% of total cultivable land, whereas the bottom 40%of the households in non-electrified villages own only 1.6% of the total land. During the last five years, changes in the land ownership of the bottom 40% was more progressive in the electrified households than in the households of the non-electrified villages. The gini-concentration ratio of cultivable land ownership was 0.61 for electrified and 0.67 for non-electrified segments. Similar changes (during the last five years) in favor of the poor in the electrified households as compared to the poor in the households of non-electrified villages were evident in the ownership of other capital assets – dwelling/non-dwelling rooms, livestock and poultry, agricultural equipments and household durable. During the last five years (1997-2002), the average amount of capital assets of electrified households has increased by 19.4% (from Tk.733,057 in 1997 to Tk.875,203 in 2002) and that for the households in the non-electrified villages by only

2.4% (from Tk.483,089 to Tk.532,522). The poverty reduction effect is distinctly evident in the fact that, in the household with electricity as compared to the non-electrified households, the rate of growth (upward movement) of the original (1997) low and medium asset groups were higher, and downward trend of all asset groups was less pronounced.

f. Electricity has had significant impact in strengthening the socio-economic foundation and in improving the quality and living standards of the people in the electrified households. This has been amply reflected in the dynamics of self-assessed poverty status by the respondents. The five-year aggregate scores (1997-2002) obtained, based on the self-assessment ranking of poverty status in terms of the following show much higher values for the electrified compared to the non-electrified households: household economic status (from poor to rich), food availability status (from always deficit to surplus), economic crisis faced (yes or no), incidence of distress sales (yes or no), household economic strength in terms of meeting/bearing health care related expenses and educational expenses (very difficult, difficult, not difficult).

g. Electricity has major demographic impacts. The population growth rate in the electrified household segment is less than that in the non-electrified. This is evident from the relatively low total fertility rate (TFR) as compared to the non-electrified segment. Young age structure and dependency ratio were relatively less pronounced in the electrified than those in the non-electrified household. Electricity in the household contributed 16% of the reduction in TFR. The TFR of the poor in the electrified household is 26% less than that of the poor in the non-electrified villages. As compared to the non-electrified villages, in-migration of electrified villages was much pronounced (due to access to electricity and other associated modern amenities). Population survival rate is higher in the electrified than in the non-electrified villages. Among others, this is evident from the relative low infant mortality rates in the electrified, 42.7/1000 live births against 57.8/1000 live births in the non-electrified villages. Also, the female-to-male ratio in electrified is much higher than that in the non-electrified villages. In electrified villages, 64 females are `missing' against every 1000 males, and it is 100 in non-electrified villages. Access to electricity has been instrumental in reducing the number of missing females by 17.4% in the electrified households. Had there been electricity in the households of the non-electrified villages the approximate number of missing females could have been brought down to 2,434,084 from 2,857,404 i.e., savings in life of 423,320 female population in the non-electrified villages.

h. Electricity has played an immense role in improving people's overall health status, especially for those in the electrified households, and more so for the poor, women and children. The electrified households are much better endowed than the non-electrified households in the electrified villages and significantly better-off than the households in the non-electrified households in terms of the following heath indicators: awareness of crucial public health issue, seeking treatment by medically competent person while sick, use of medically trained persons in child delivery, accessing ANC and PNC check-ups, use of TT immunization, seeking treatment of medically competent persons in maternal morbidity, rate of full immunization of children (vaccines against 6 diseases), aversion of infant deaths, intake of Vit-A capsule to prevent nightblindness among children, use of family planning methods, use of hygienic latrines, and use of hand washing materials after defecation. In all these indicators, not only that the rich-poor divide was less pronounced in the electrified compared to the non-electrified households, but also the poor (landless) in the electrified have shown much better health outcomes than their counterparts in the non-electrified households, especially than those in the non-electrified villages. The significant impact of electricity in people's health-hygiene-sanitation improvements is mediated through TV viewing, radio listening, easy availability and accessibility to other health-status-promotion facilities as refrigerator, fan, modern diagnostic centres etc. Electricity has the immense potential to improve peoples health status to expedite the process of attainment of almost all the planned health sector goals of the government (in most cases which are not attained and shifted to the next cycle of the five year plan). Just to mention a few (a) if access to electricity is ensured for the 100% rural households, the annual number of infant deaths that could be saved would be around 36,818 i.e; a savings of 101 infant deaths everyday, (b) household access to electricity contributes much in resolving the problem of over population through family planning: the FP use rate in the electrified households is about 10% higher than that in the households in non-electrified villages, and the total fertility rate is about 16% less in the electrified; more so, the TFR among the poor in the electrified is 26% less than that for the poor in the non-electrified villages. Thus, expanding poor household's access to electricity should be accepted as a most powerful, high priority strategy in addressing the issue of the health-mediated poverty reduction in Bangladesh.

i. Electricity has significant influence on education, especially on quality of education. This influence is much more pronounced among the poor and girls in the electrified than the poor and girls in the non-electrified households. Compared to the non-electrified, the electrified households fare much better in terms of overall literacy rate; adult literacy rate; enrollment ratio; expenditure on education; performances in terms of examination results, attendance rate, dropout, and average time spent on study (after sunset, 6 PM). The overall literacy rate in the electrified (70.8%) is 26% higher than that in the non-electrified households. The same for the female is 31% higher: the rates being 65% in the electrified and around 49% in the non-electrified. The rich-poor gap in literacy is 20% in the electrified, but it is as high as 60% in the households of non-electrified villages. The literacy rate among the poor in the electrified (66%) is about 41% higher than that of the poor in the non-electrified villages. The similar pattern holds true for adult literacy. In addition, the average annual household expenditure on education was 87% higher in the electrified (Tk.3,260) compared to that in the non-electrified villages (Tk.1,746). The annual per capita educational expenses for female students was about 30% higher in the electrified (Tk.1,386) compared to that for those in the non-electrified villages (Tk.1,069). Also, the students in the electrified households spend 16% more time for study in the evening (after sunset) than their counterparts in the non-electrified villages, and the quality of the incremental time is much better due to sufficient lighting and comfort (due to fan). More so, the parents in the electrified households devote, on average, 37 minutes per day more time in the evening than before electricity in assisting children's education. Thus, in order to both increase the quantity (literacy) and improve the quality of education, and thereby, expand and strengthen the basis of human capital formation, all rural households should have access to electricity.

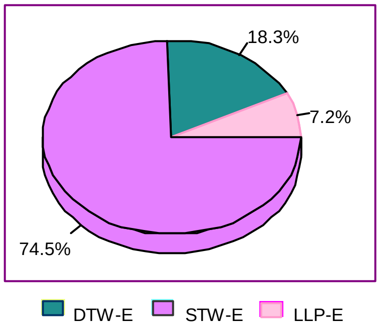
CHAPTER 5

IMPACT ON IRRIGATION AND AGRICULTURAL PRODUCTION

5.1. INTRODUCTION

Initially, Rural Electrification Program (REP)(1978) aimed at electrification of pumps and tubewells used for irrigation, and at the same time, providing electricity to agro-based industries and serving domestic and commercial demands. To achieve the aim, catchment areas were selected in such a way to cover most of the facilities. It emerges that, from the REP's initial days, electrification of irrigation equipment and other facilities has been considered as one of the thrust areas under its electrification strategy. According to REB MIS Report June 2002, a total of 103,980 irrigation equipment were being operated in 67 PBSs using REP connections[72>] with 18,983 DTW, 77,500 STW, and 7,497 LLP connections (Figure 5.1).

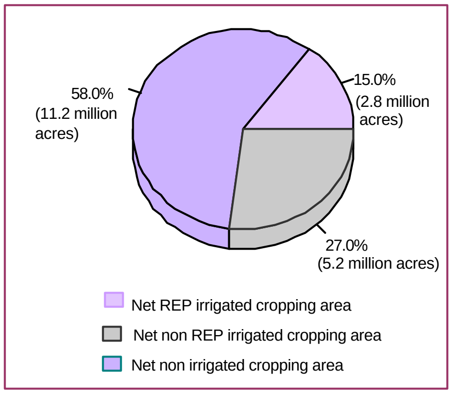
Figure 5.1: Irrigation equipment served by REP: 2002 (n= 103,980)



Source: MIS Report, REB, June 2002

Comparison of REB and BBS information reveals that more than one-sixth of total irrigation equipment operated in Bangladesh are being powered through REB. Estimation based on the survey findings and BBS data show that over 2.8 million acres, out of approximately 8 million of net cropped irrigated areas using modern irrigation technology (BBS 2001) is being served by REP. This implies that almost 15 % (out of 19.2 million acres) of net cropped area in the country is being irrigated by electricity operated equipment (Figure 5.2).

Figure 5.2: Distribution of irrigated area in Bangladesh (in million acres and shares)



Source: Estimated based on MIS data, study findings and GoB BBS statistics.

Almost 65 % of electricity-powered equipment were initially diesel-operated. It is important to mention that irrigation equipment serving one third of the total irrigation command area switched over from diesel to electricity operation.

5.2. GROWTH IN ELECTRICITY POWERED IRRIGATION DURING LAST TWENTY YEARS

Contributing to the attainment of self-sufficiency in agricultural food production through expanded use of electricity-driven irrigation equipment constitutes one of the major strategic objectives of REP. This strategy was adopted in order to after a number of comparative advantages of electricity-driven irrigation equipment: higher productivity (yield per unit area), higher cropping intensity, more scopes for crop diversification, lower cost of production, higher return against cost, uninterrupted water supply for irrigation, and creation of employment. As

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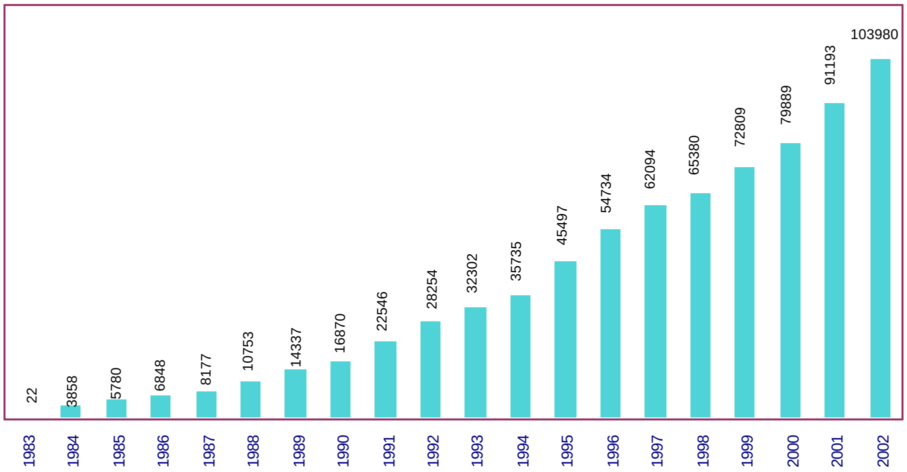
[72>] Henceforth, throughout this Chapter, Deep tube well will be denoted as DTW, Shallow tube well as STW, and Low lift pump as LLP; and electrified will be shown as 'E' and diesel (non-electrified) as 'D'; thus DTW-E will mean electrified DTW and so on. All-E will mean total of all electrified, and All-D will mean total of all diesel equipment.

evident from the growth in irrigation equipment run by electricity, the comparative advantages have been realized to a good extent, which has contributed considerably to food self-sufficiency in Bangladesh.

In 20 years between 1979 and 1999, the total number of irrigation equipment increased from about 50,000 in 1979 to 425,000[73] in 1999. Initially, in 1979, only a few of those equipment were electricity-powered. The growth of electricity-powered irrigation equipment was spectacular during the 1980s and 1990s : from only 22 in 1983 to 72,809 in 1999. This means that 17% of the total irrigation equipment used in Bangladesh in 1999 were electricity-powered. The subsequent growth was more spectacular: from 72,809 in 1999 to 103,980 in 2002, i.e, a rise of about 43% in 3 years.

The remarkable growth of rural electricity-driven irrigation equipment is simply evident in the 4726 time increase of such equipment during the last 20 years (1983-2002): from only 22 in 1983 to 103,980 in 2002 (Figure 5.3). The estimated average annual growth rate (20-year cumulative) of electricity-powered irrigation equipment was 52.7%. During the last 20 years, the average number of irrigation connections per PBS has increased by 776 times: from only about 2 per PBS in 1983 to 1552 connections per PBS in 2002 (calculated based on information from Table 4.2.10).

Figure 5.3: Twenty years in the number of connections to irrigation equipment: 1983-2002



Source: Compiled by authors based on last twenty years (1983-2002) MIS Reports obtained from REB (all data related to the month of June of the relevant year)

The growth was substantial in terms of share of irrigation equipment to the total RE connections: from only 0.77% of the total connections in 1983 to 3.1% in 2002 (Table 4.2.10). Furthermore, the choice of irrigation equipment as depicted from the cumulative connection-mix 75% STW, 18% DTW, and 7% LLP (Figure 5.1).

Monthly electricity (power) consumption trend for irrigation indicates a highly skewed distribution over time (Figure 5.4). This has evolved from an analysis of the monthly trends during 1983-2002 as available of REB's MIS data. The monthly consumption (MWH) in June 2002 shows a 4.5-fold increase between 1983 (1055 MWH) and 2002 (4734 MWH). The peak years showing consumption were 1984, 1987, 1992, 1995, 1998 and 2002, with 2002 representing the peak of

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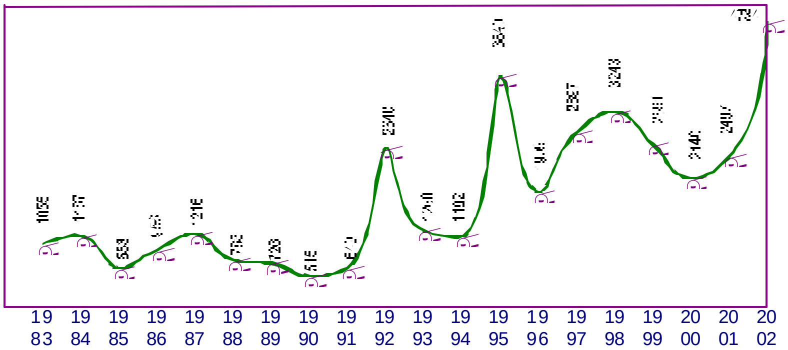
[73] 1999 Yearbook of Agricultural Statistics, BBS: 2001

Figure 5.4: Trend in the MWH consumed by irrigation equipment: 1983-2002 (this month)



Source: Compiled by the authors based on last twenty years' (1983 - 2002) MIS Reports obtained from REB (all data relate to the month of June of the relevant year)

all peaks. The relative rise was 117% between 1987 and 1992, 45.5 in 1992 and 1995, and 46% between 1995 and 2002 (calculated based on information in Figure 5.4).

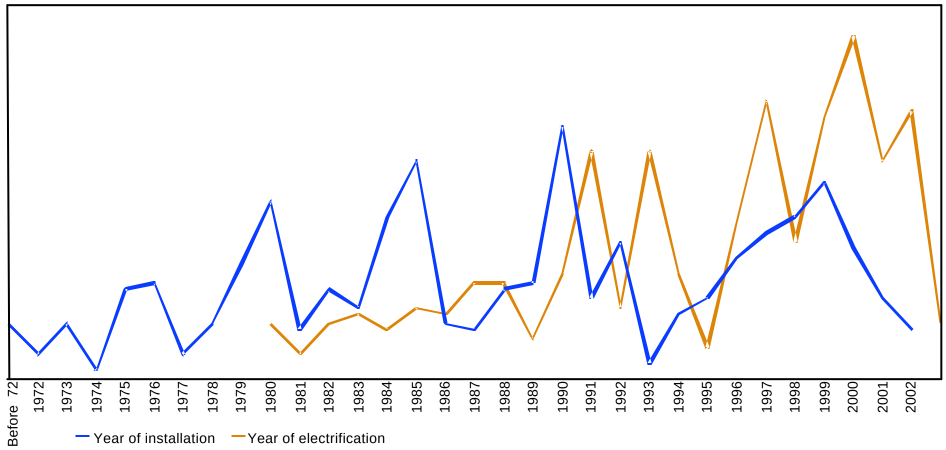
5.3. CHARACTERISTICS OF SAMPLE UNITS

In this section, the profiles of the sample units (irrigation equipment and their owners, farmland, and plots) have been delineated.

5.3.1. Years of Installation and Electrification of Irrigation Equipment

The traditional methods of irrigation are almost as old as the history of agriculture. However, the modern methods have been introduced in Bangladesh in the late sixties (1.5 % of all sample irrigation equipment). Nearly 12 % of currently electrified equipment were installed as diesel-driven before 1978. The first batch of the few electrified equipment (1.8 % of the sample), started their journey in the early seventies, the number of electrified equipment started to increase only after the formal introduction of REP (4.7 % of currently electrified equipment in the sample were found as electrified during the period1979-1982).

Figure 5.5: Gap between installation and electrification of sample



Source : Tables 5.1 and 5.2

Average age of currently electrified irrigation equipment is (since the year of installation) 14 years, while, currently diesel-driven equipment are, on average, 10 years old (Figure 5.5).

Among the electrified equipment, on average, a deep tubewell (DTW-E) was installed 18 years back; while STW-E and all LLP-E were installed 11 years and 20 years back respectively. On an average, DTW was installed 16 years ago, and STW and LLP-diesel were both installed 8 years ago. A substantial number of tubewells were energized with electricity some time after the year of installation. Out of the 383 sample electricity-powered equipment, 249 had been initially installed as diesel-operated ones. On average, the gap between installation and electrification is 5 years (Figure 5.5).

The investigation was made to ascertain the years of electrification of all the pumps in the sample currently powered with electricity. Figure 5.5 reveals that, there exists a 5-year gap, on average, between installation and electrification.

It appears that, on average, a DTW-E and LLP-E has been converted as electricity-powered after 8 years of operation. As for STW-E, the stated gap was 4 years.

Almost 45% of the DTW-Es have been electrified during last ten years, and, of them, almost two-thirds were brought under electrification during last five years (Table 5.2). About three-fourths of STW-Es have been electrified during last ten years, and over 42 % of LLP-Es received electrical connection during last ten years. The mean year of electrification of irrigation equipment under REP is 9 years. Almost two-thirds of the electrified equipment were connected during 1992- 2002, and three-fourths during the last five years.

5.3.2. Technical Specification of Irrigation Equipment

This sub-section deals with some technical parameters of irrigation equipment: capacity, diameter, depth of well, distance from the water source (in the case of LLP).

The average capacity of DTW-E is 24 horse-power (17.9 KW). The same for DTW-D is 25 HP (18. 64 KW). About 60 % of the DTW-Es are run by 21-25 HP motors, followed by 24 % with 16-20 HP, and 13.5 % with 26-30 HP. In diesel driven group, DTW-D engines with 21-25 HP are the most common (41 %); the next available category of diesel-powered equipment is 26-30 HP (27.3 %),18% of DTW-D run by 16-20 HP and 9 % by 31 HP and above.

An average STW-E works with 7-HP motor, and an average STW-D with an engine 14-HP (Table 5.3). About 71% of STW-E are run by motors of 4-5 HP, followed by 18 % with 1-3 HP. Distribution of capacity of diesel-powered equipment has been observed as follows: 37% to the category of 6-10 HP engines, followed by 29% with 4-5 HP and 15% by 11-15 HP engines. It is to be noted that the share of diesel driven engines with capacities 31-HP and above has been found much higher (12.2%) than that of electrified (2.9%).

An average LLP-E is driven by a 16-HP engine, and the same for LLP-D is 17-HP. About 61% of LLP-Es use motors ranging between 11-15 HP, 18% use 16-20 HP motors, and 12% with motors 5-HP and less. Among the LLP-Ds, 40% have engines ranging between 16-20 HP, and 20% use 4-5 HP engines.

It has been observed that, on average, the diameter of pipes used for both DTW-Es and DTW-Ds is 7.5 inches. The same for STW-Es is 4.1 inches, while the average for STW-Ds is 3.9 inches. The average diameter of LLP-Es and LLP-Ds are 6.4 inches and 4.7 inches respectively.

The survey findings reveal that, on average, the depth of DTW-Es and DTW-Ds are 222 ft. and 214 ft. respectively. The same for STW-Es and STW-Ds are 121ft and 107ft respectively. The average distance between LLP-E and source of water is 39 ft., and that for LLP-D is 29 ft.

Thus, on average, the electrified equipment need less capacity and can pump water from comparatively deeper water level. Since the diameter of pipes have been found more in electricity driven equipment than the diesel-operated, the potential output of the former is also higher than the latter.

5.3.3. Price of Irrigation Equipment and Cost of Installation

It has been observed that installation cost (price of the equipment, cost of material and labour at the time of installation taken together) of DTW-E (Tk. 69,944) is less than that of DTW-D (Tk. 101,695: Table 5.6). However, the same for STW-E and LLP-E is higher than the installation cost of diesel operated analogous types of equipment. The price of DTW-E (Tk.36,387) is twice higher than that of LLP-E (Tk.18,170). In terms of materials and cost of labour needed for installation, the electrified equipment cost less than those of diesel-driven units (Table 5.6).

Analysis shows that installation cost per acre of total irrigated land (including procurement of equipment and materials) of an average electricity-operated unit (Tk. 1,215) is almost half than that of diesel-operated one. It has been found that the least installation cost per acre of irrigated land has been incurred by LLP-E followed by LLP-D. Using the same criterion, DTW-D has been found as the most expensive (Tk.2,801), while the same for an average DTW-E is Tk. 1,069 only (Table 5.6). Therefore, it can be summarized that, farmers prefer irrigation equipment driven by electricity then diesel.

5.3.4. Equipment Owner's Land in the Command Area

It is commonly believed that most of the irrigation equipment owners belong to the group of rich peasantry. The survey findings reveal that, on an average, the electricity-powered equipment owner possesses 2.6 acres of land within the command area of the equipment (Table 5.7). Their counterpart from diesel-operated category possesses less (2.2 acres). The average amount of land owned within the command area by a owner of DTW-E is 2.89 acres followed by owners of DTW-D and STW-E with 2.5 acres each. It has been observed that the owners of LLP-D, on average, possesses smallest amount of land (1.6 acres). It has also been reported that one-tenth of all the pump owners possess over 5 acres of land, except the owners of LLP-E (3%), DTW-D (5%) and LLP-D. Moreover, owners of DTW-D who reported possessing over 5 acres of land within the command area, own more than 10 acres.

The findings revealed that more than one-fourth of the electrified equipment owners possess lands between 2.5 acres and 5 acres in their command area. One-third of the owners of DTW-D and LLP-D belongs to land ownership category having 2.5 acres to 5 acres, while little less than one-sixth of the STW-D owners belong to the same category. Further, one-third of DTW-E owners possess 1 acre or less of land under the command area of their equipment. A similar proportion among the DTW-D and STW-D owners reported analogous amount of land ownership within the command area. However, more than one out of two owners of LLP-D reported the size of their land ownership within their command area having 1 acre or less. Thus, it can be mentioned that relatively new avenue for the rural entrepreneurs in the form of selling water has been opened up, and a substantial portion of pump owners does not need to have large amount of land in command area of the equipment.

5.3.5. Days of Operation of Equipment

It is important to note that the irrigation equipment in Bangladesh seldom work round the year. According to the respondents, up to 10% of the equipment work more than 150 days in a year including 5% percent 180 days and more (Table 5.8). Average number of days of irrigation in last year for DTW-E was 130 days (for DTW-D the operation duration is almost same: 128 days). STW-E worked about 114 days on average (STW-D for 117 days) and LLP-E 112 days. The diesel operated LLP, however, worked for 82 days only. Drying up of the water sources is the root-cause for the latter, the participants informed as the investigation went on.

5.3.6 Tenancy Pattern of Sample Plots

Four types of tenancy pattern were found. The most common type being land own by the farm-house (95% of all plots). For All-E, 365 plots out of 383 plots were owned by the farmer-cultivators (average plot size 37.1 decimals). The same for All-D was 68 out of 73 plots; for no irrigation 64 out of 67 plots. The sharecroppers own 11 out of 365 plots in electrified group (average plot size 39.5 decimals), while in diesel 4 out of 73 plots (average plot size 36.8 decimals). The share of leased-in plots was in significant, 4 plots in All-E only. The mortgaged-in lands category was also been observed to be insignificant.

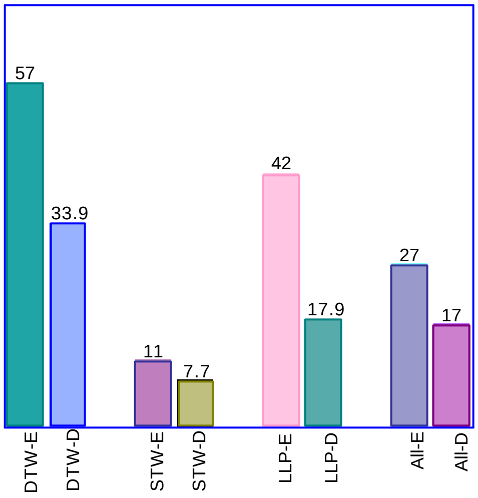
5.4. IMPACT ON COMMAND AREA

This section examines the impact of electricity on net area under irrigation, total area under irrigation, and amount of land new-to-irrigation.

5.4.1. Net Command Area

The study findings reveal that, on an average, an electrified irrigation equipment covers more net area than the diesel operated one. All electrified equipment (All-E), on average, provide irrigation to 27 acres of net area against 17 acres served by diesel-powered (All-D) (Figure 5.6). The average net area irrigated by DTW-E has been estimated as 57 acres (DTW-D: 33.9 acres), STW-E serves on average 11 acres of net land (STW-D: 7.7 acres), while average command area under LLP-E has been 42 acres (against 17.9 acres by LLP-D). The test of difference confirms the hypothesis that DTW-E covers more command area than diesel operated equipment (see Section 9.3.2, item # 44).

Figure 5.6: Average net irrigated area (in acres) by type of equipment (2002)



Source: Table 5.9

Estimation of the net irrigated area of REP, based on the survey findings, show that a total of 2,8 millions acre of net land have been irrigated using electrified irrigation (Table 5.1 below). It further reveals that, of all REP irrigation areas, DTW-Es' contribution is over 38%, which is more than one-eighth of all currently irrigated area in the country. Electricity-driven STWs provide irrigation to another one-tenth of net irrigated area (0.85 million acre).

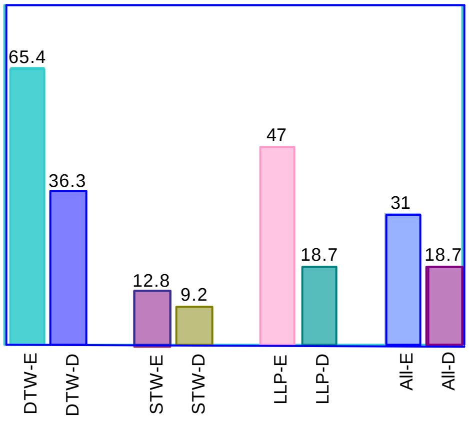
Table 5.1: Distribution of irrigation equipment and command area using REP electricity

Equipment	Number of equipment	Net command area per equipment	Net irrigated area under REP	Net area as % of net irrigated total REP area	Number of equipment as % of total REP irrigation equipment
DTW-E	18,983	57	1,082,031	38.5	18.3
STW-E	77,500	11	852,500	30.4	74.5
LLP-E	7,497	42	314,874	11.2	7.2
Total-E	103,980	27	2,807,460	100.0	100.0

5.4.2. Total Command Area

The average total command area (Figure 5.7) under electrification (31 acres) is higher than that under diesel operation (18.7 acres). The average total command area of DTW-E is 65.4 acres and DTW-D is only 36.3 acres, i.e., DTW-E covers, on average, 80% higher land than that by DTW-D. Similarly, the average total command area of an STW-E is 12.8 acres and it is 3.6 acres higher than that of STW-D (9.2 acres). The total command area of an average LLP-E is 31.5 acres comparing to 17.1 acres by LLP-D.

Figure 5.7: Average total irrigated area (in acres) by type of equipment (2002)



Source: Table 5.10

5.4.3. Area New to Irrigation

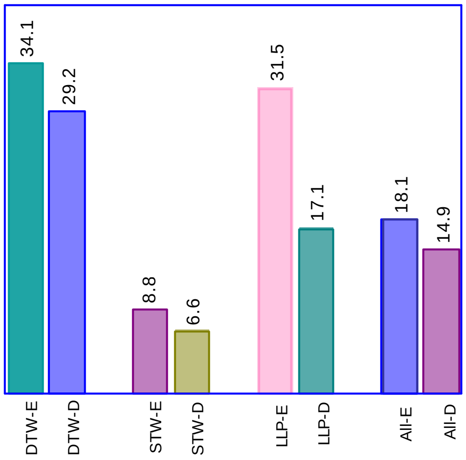
An electrified equipment covers 3.9 acres of "more new to irrigation net land" than the diesel equipment. An average electrified equipment has brought under irrigation 18.1 acres of new to irrigation net land, while the same for diesel category is 14.9 acres (Figure 5.8). In interpreting the data, it should be taken into account that:

a) almost two-thirds of currently electrified equipment have been installed earlier as diesel operated ones, and therefore, had comparatively less scope to cover new-to-irrigation area than diesel-operated units, and

b) electricity operated equipment are installed in the areas which are being electrified, while diesel-operated equipment can be installed any where.

The analysis by type of irrigation equipment shows that DTW-E on average covers 34. 1 acre of new-to-irrigation net land, almost 5 acres more comparing to the same of DTW-D (Figure 5.8). The coverage of new-to-irrigation net

Figure 5.8: Average new-to-irrigation area (in acres) by type of equipment (2002)



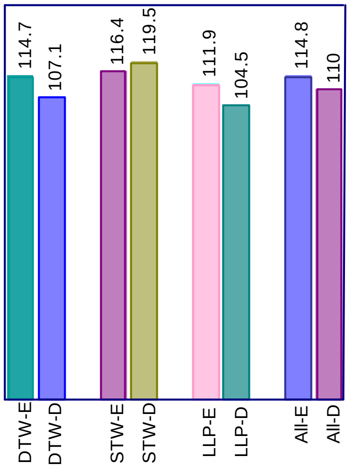
Source: Table 5.11

land by STW-E is higher than STW-D. An average STW-E has brought under irrigation 8.8 acres of new net area previously not irrigated. The average coverage of new-to-irrigation land by STW-D has been found 6.6 acres. For LLP, the superiority of electricity driven equipment over the diesel was evident: LLP-E (31.5 acres) covers14.4 acres of more new-to-irrigation land than LLP-D (17.1 acres).

5.4.4. Land Use Intensity under Irrigation

Land use intensity under irrigation (total irrigated area as percentage of net irrigated area) is an important indicator for measuring the impact of irrigation. The higher the intensity, the better utilization of land is recorded. The analysis shows that for all electricity-powered irrigation equipment, the land use intensity is higher at 114.7 as compared to all diesel operated 110.0 (Figure 5.9). Land use intensity under irrigation by types of equipment is higher for electrified than that of diesel equipment (except for STW). The value of same for DTW-E was 114.8. For DTW-D the same was 107.1. The land use intensity (total area as % of net area) under irrigation of LLP-E, and LLP-D has been estimated as 111.9 and 104.5 respectively.

Figure 5.9: Land use intensity under irrigation by type of equipment (2002)



Source: Table 5.12

Thus, the positive impact of electrified equipment in agriculture in terms of command area can be validated with the study findings:

a) Net area of irrigation under electrified powered equipment is higher than that of diesel operated, ones;
b) Total area of irrigation under electrified powered equipment is higher than that of diesel operated equipment;
c) Net area new-to-irrigation under electrified equipment is higher as compared to the diesel operated ones; and
d) Land use intensity under irrigation of electrified equipment is higher than that of diesel operated ones (except for STW).

5.5 IMPACT ON PRODUCTION AND PRODUCTIVITY

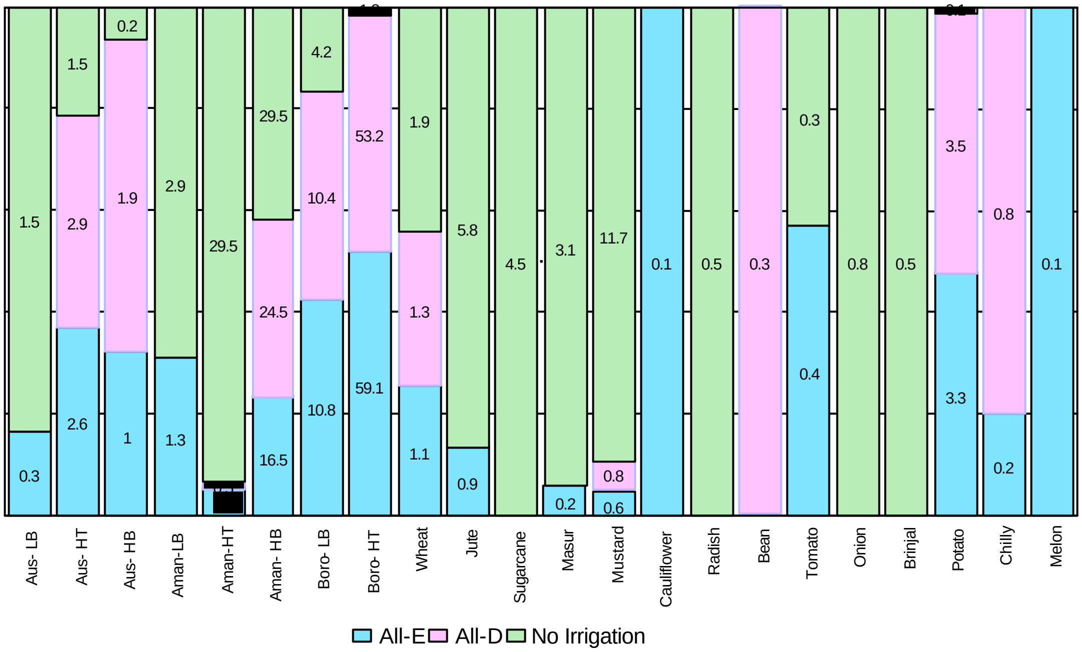
The impact on the production of different crops by types of irrigation has been investigated. Estimation has been made to compare yield per acre (productivity) of different crops cultivated during last year in 523 sample plots using electrified, diesel operated and rain-fed irrigation (no irrigation).

5.5.1. Land under Different Crops by Type of Irrigation

A total of 15 different crops grow in the sample plots (Table:5.13). The total land in 523 sample plots was 356.4 acres of which All-E 189 acres, All-D 37.4 acres and no irrigation 130 acres. The distribution of 189 acres of All-E was DTW-E 53 acres, STW-E 122. 4 acres, and LLP-E 13.7 acres. The same distribution for All-D was DTW-D 11 acres, STW-D 23.6 acres and LLP-D 2.5 acres.

Ninety-four percent of the total cropped area under electrified equipment is engaged in cereal cultivation including 93% in rice with almost 70% of total area growing different types of Boro (Figure 5.10). Under diesel equipment 89 % of the total cropping area cultivates cereals with 88 % rice (64 % Boro). Under no irrigation (rain-fed) 73% were given to cereal growing with only 6% for Boro (71% rice).

Figure 5.10: Distribution of land under different crops by type of irrigation equipment (All-E =100, All-D = 100, No irrigation = 100)



Source : Table 5.13

Sixty-two percent of total cropping area under no irrigation was used for cultivating different types of Aman with 59% for high yielding variety and only 3% for local variety. HYV Boro constituted 59% of the electrified irrigation plots, 53% of the diesel driven irrigation plots, it was as low as 1.8% of non-irrigated plots. The share of Aus in rice culture was insignificant (around 4%). Other crops were cultivated in 6% of cropped areas under different types of equipment, but it was as high as 17% for non-irrigated (rain-fed) plots.

Under DTW-E, the largest share (92. 3 %) is being used for cereal production with 70 % Boro, and 19 % in Aman and 2% wheat. Other crops included Jute (1.9 %), oil seed (0.2 %), vegetables including Tomato and Chilly (1.7 %), and Potato (1.9 %). Similarly, 94% of total cropped area under STW-E grow cereals with 68 % Boro, 21 % Aman, 2 % Aus, 0.8 % wheat and 4% Potato. Jute, Masur, Mustered, Cauliflower, Tomato, Melon etc are being grown in 2 % of the total area under STW-E. All (100%) cropped area under LLP-E is being used for cultivation of rice with Boro 87%, Aman 7 %, and Aus 6 %. Under DTW-D rice is being cultivated in 96% areas with Boro 67%, Aman 19% and Aus 10%. Potato and Bean's share are 3% and 1% respectively. In the total cropped area under STW-D, 94 % of the area are being used for cereal production with Boro 60%, Aman 30 %, Aus 3 %, Wheat 2 %. Potato and Chilly's share are 5% and 1% respectively. Under LLP-D, 80% cropped area was used for Boro and 8% for Aman (Cereal: 88 %), and 12% for oil-seed culture (Mustard).

Attempts were made to estimate the amount of total area under selected crops by type of irrigation equipment in the catchment area of REP (Table 5.2 below). Estimation was based on: (a) the number of equipment of each type reported by REB MIS (as on June 2002), (b) the estimated total command area found in this survey, and (c) estimated distribution of area under different selected crops by type of electrified irrigation equipment. **Estimation reveals that, out of 2.8 million acres of total cropped irrigated land under REP, approximately 1.8 million acres have been engaged for Boro; near about 0.5 million acres under Aman; and 0.08 million acres under Aus.** This indicates that with the development of irrigation facilities, specially electrified, Boro cultivation has grown up significantly and it pushed out not only other low yielding variety of rice, and also other crops. The commendable achievement of the country towards relative food self sufficiency have been made possible because of shift towards HYV and especially high yielding Boro followed by HYV Aman at a massive scale. **The contribution of REP in attaining food self sufficiency in Bangladesh should be attributed to the fact that REP has ensured uninterrupted supply of water for irrigation through 103,980 electrified equipment to approximately 2.3 million acres of land for HYV Boro and HYV Aman (including Aman HB and Aman HT) out of 6.7 million acres of total irrigated land under cultivation of Boro and Aman in Bangladesh. Thus, REP-powered irrigation equipment contribute 34% of the total irrigated land under Boro and Aman in Bangladesh.** The estimation further reveals that approximately 0.1 million acres out of 3.5 millions of countries all land under traditional and high yielding variety of Aus is under the command area of REP operated irrigation equipment.

Table 5.2: Estimated area under selected crops using REP-power by type of irrigation equipment

(in acres)

Crop	DTW-E (Acres)	STW-E (Acres)	LLP-E (Acres)	ALLE	
				(Acres)	Acres as % of Total
Aus- LB	-	-	13246.6	13246.6	0.51
Aus- HT	39821.3	23503.3	7947.9	71272.5	2.76
Aus- HB	-	15398.7	-	15398.7	0.60
Aman-LB	-	19451	-	19451	0.75
Aman-HT	56218.3	7294.1	-	63512.5	2.46
Aman- HB	178024.7	183973.9	23843.8	385842.4	14.92
Boro- LB	119464	113464.1	34441.1	267369.1	10.34
Boro- HT	751920.2	558405.2	272879.5	1583205	61.23
Wheat	25766.7	8104.6	-	33871.3	1.31
Jute	23424.3	5673.2	-	29097.5	1.13
Masur	-	2431.4	-	2431.4	0.09
Mustard	2342.4	8915	-	11257.5	0.44
Cauliflower	-	810.5	-	810.5	0.03
Tomato	14054.6	1620.9	-	15675.5	0.61
Potato	23424.3	41333.3	-	64757.6	2.50
Chilly	7027.3	-	-	7027.3	0.27
Melon	-	1620.9	-	1620.9	0.06

5.5.2. Productivity by Type of Irrigation

Figure 5.11 presents productivity measured in terms of per acre yield (in maund) of crops under different type of irrigation equipment. On average, per acre yield for almost all major crops using electrified equipment is higher than those of diesel operated equipment. By and large, yield under rain-fed irrigation was lower.

The yield of local broadcast Aus cultivated under LLP-E is 28 maunds per acre, while the same under rain-fed/no irrigation is 23 maunds[74>]. Per acre average yield of Aus HYV transplanted under different broader categories of irrigation have been estimated as, rain-fed/no irrigation 32 maunds, the same under diesel irrigation is 36 maunds and 40 maunds under electrified irrigation equipment. The yield of different types of Aman under no irrigation is 9 to 10 maunds less than that of electricity operated. For different varieties of Boro, the yield under electrically operated irrigation is 10 to 17 maunds higher than the yield of the same under no irrigation. For wheat, the yield under rain-fed /no irrigation is slightly higher than two-thirds of per acre yield cultivated using electricity-powered irrigation. The yield of potato per acre under electricity-driven irrigation equipment is 160 maunds, and is reported to be higher by one third (120 maunds) compared with that under no irrigation.

Relative Productivity Index (RPI)[75>] of crops under modern irrigation and no irrigation presented in Table 5.18 reveals the advantage of irrigation using modern methods. The said index for land under electrified irrigation against no irrigation has been estimated as 1.2939, while the same for diesel irrigated land has been observed as 1.0962. It implies that on an average electrified irrigation is 29 % more productive in comparison with no irrigation, and the diesel irrigation is 9 % more productive with respect to no irrigation.

Comparison has been made between electrified irrigated land and diesel variety to measure the relative productivity using RPI (Table 5.19). The estimation reveals that productivity of land under electrified irrigation is 24 % higher than that under diesel irrigation.

The above discussion enables us to draw an inference that the productivity of land under electrified irrigation is significantly higher than diesel irrigation and much higher than the rain-fed agriculture. However, electrified irrigation is not the panacea for attaining higher production, rather irrigation in time and sufficient quantity is one of the necessary preconditions for it.

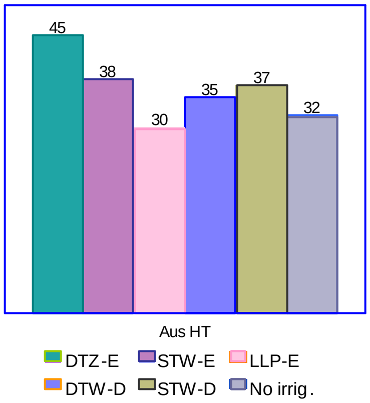
At this point, when the crop and irrigation wise land distribution and productivity has been known, it is interesting to attempt to estimate the share of REP in rice production and compare that with the national figures. The estimation has been made for HYV Boro and Aman because both the crops depends on irrigation and 53% of land under rice cultivation in Bangladesh has been involved in growing the two types of rice out of 10 different types available in the country. BBS information reveal that the total production of HYV Boro amounts to 10.0 million of M. tons and 4.2 million M. tons of HYV Aman rice have been annually grown in the country.[76>] **Approximately, 4.05 million tons of rice has been produced from HYV Boro and Aman in REP-irrigated lands (2.03 million acres). It means that 28.5% of all similar types of rice produced in Bangladesh is the contribution of REP.**

[74>] Productivity of land under different crops using different type of electricity powered irrigation as percentage of productivity of land under different crops using rain-fed or no irrigation.

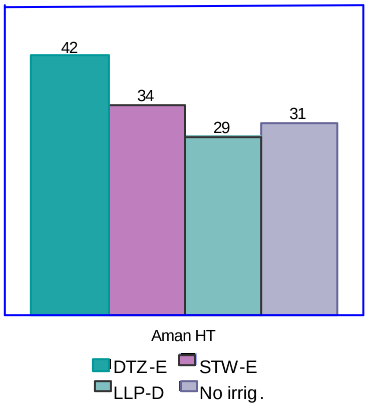
[75>] Relative Productivity Index (RPI) a commonly used in economic statistics as an indicator for comparing the performance of two or more production units. RPI basically measures the ratio between unit production of the compared entity and that of comparable.

[76>] Yearbook of Agriculture Statistics of Bangladesh, BBS, 2001

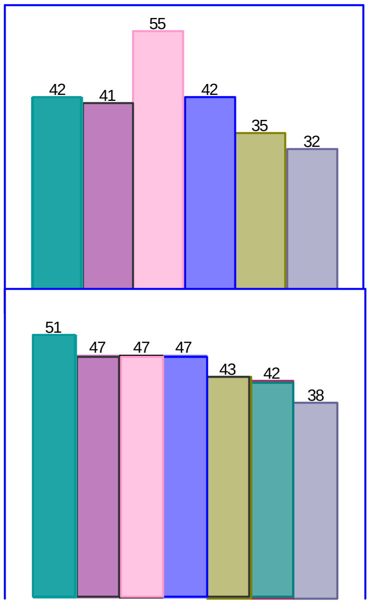
Figure 5.11: Productivity (yield per acre) of different crops by type of irrigation



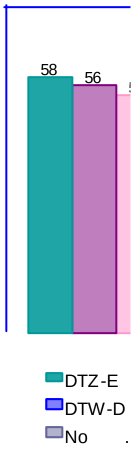
Source: Table 5.16



Source: Table 5.16



Source: Table 5.16



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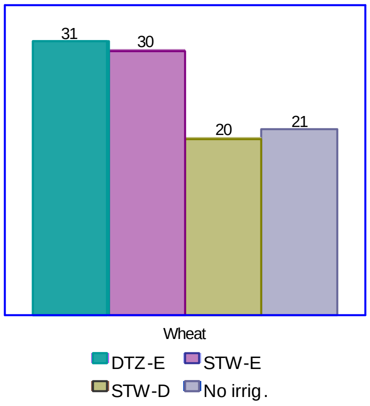
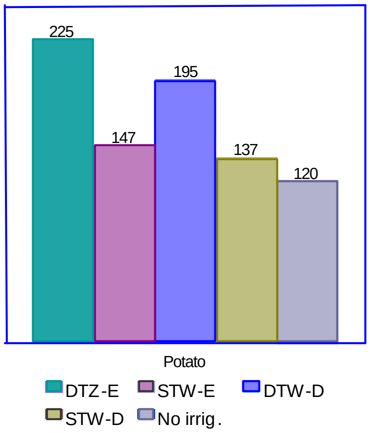


Source: Table 5.16

5.5.4. Production per Irrigation Equipment



Source: Table 5.16

Estimates have been made for working out the productivity of different crops per irrigation equipment. An average electrified equipment produces 2005 maunds of Boro, 246 maunds of Aman, 82.2 maunds of Aus, and 10.2 maunds of wheat. The corresponding figures for an average diesel powered equipment are Boro 601 maunds, Aman 168 maunds, Aus 30 maunds, and 5 maunds of wheat. The estimated productivity per DTW-E is much higher than that of any other type of irrigation equipment (including DTW-D). The total quantity of crops produced in the command area of an average DTW-E are cereal 3272 maunds (including 2299 maunds of Boro and 43 maunds of wheat), jute 35 maunds, oil seed 2.6 maund, vegetable 335 maunds (including potato 280 maunds). An average DTW-E is 87 % points more productive than DTW-D in growing cereals. The productivity of DTW-D in producing non-cereal crops has also been observed to be significantly lower in comparison with its electricity-driven counterpart. As for example, the production of vegetable per DTW-D has been observed to be 231 maunds (including 198 maunds of potato), meaning that the same is 69 % of the productivity of DTW-E.

Estimates reveal that if an average DTW-D is converted to electricity driven one, 1937 maunds of additional cereals and 104 maunds of additional vegetable along with 35 maunds of jute can be produced. It implies that with the conversion of each 100 diesel deep tube wells into electricity powered ones, (diesel engines replaced by motors having the same capacity, and the pumps being upgraded with the required capacity), an additional amount 0.17 million maunds of crops (all crops taken together) including 0.15 million maunds of rice can be produced. Similarly, in instance of transformation of each 100 average type of diesel operated equipment to electricity powered, the net addition to production will be 85,4 thousand maunds of crop including 53 thousands maund of rice.

Analysis of REB MIS information shows that, on an average, annually 7,573 electrified irrigation equipment have been set up in the country during the last ten years. If REP pursues the practice of converting the existing diesel-powered equipment with electricity, the net additional production will be approximately 646.7 million maunds of crop (including 401.3 million maunds of rice) given that all other preconditions for cultivation remaining same in a single year.

5.6 IMPACT ON CROPPING INTENSITIES

Cropping intensity basically measures the number times of a specific land is used in a year.[77>] Sometimes, cropping intensity is also measured in terms of number of crops grown in the same land in a year. This measure may suffer from many disadvantages.[78>] This subsection focuses on cropping intensity of land irrigated by electrified equipment. This assessment has been done to measure efficiency of land use in connection with extension of facilities for uninterrupted supply of water and therefore ability to utilize the land under crop cultivation more than once during the year. For estimating cropping intensity, the sum of amount of land engaged under each crop cultivated in all sample plots under a type of irrigation equipment during last year has been divided by sum of net plot size of all samples under the same irrigation equipment type and presented in the form of percentage. Figure 5.12 reveals that the cropping intensity of

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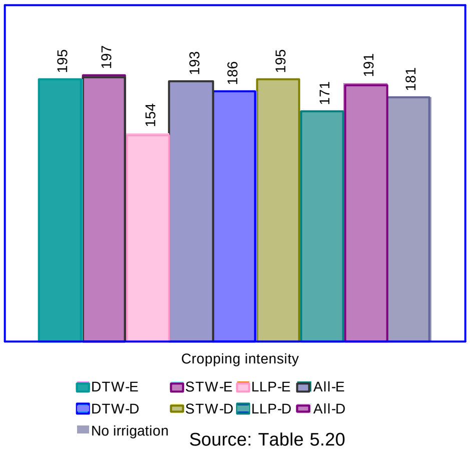
[77>] Cropping intensity (CI) is usually considered to be a measure of agricultural development, but in some cases it can be a very misleading measure. Two successive crops of some low yielding crop will show up as 200 % cropping intensity, while one crop of high yielding variety will be only 100% of CI. (Bangladesh Agriculture Performance and Policies, Compendium, Vol. III, page 121).

[78>] Sugarcane land has only 100% CI but if broadcasted Aman (low productive crop) is followed by Kheshari the CI is 200%. Yet the returns to former are many times than to the latter.



Source: Table 5.20

sample plots using electrically powered irrigation is 193, meaning the land under plots are being utilized for any type of crop culture on an average for 1.93 times a year. The corresponding figure for plots irrigated by diesel engines is 191 and for plots with no irrigation or rain-fed is181. It implies that electrified irrigation intensifies the land use by 12 % points more than rain-fed/no irrigated lands, while diesel powered irrigated land intensifies by 10% points. In other words, 8 acres of total cropped area under no-irrigation becomes 9 acres (an addition of 1 acre) if electricity-powered irrigation is introduced. Similarly, electrified irrigation intensifies the land use by 2% points in comparison with diesel-powered irrigation.

Thus, the estimated total cropped area of 2.8 million acres under electrified irrigation[79] through out the country would have been 0.3 million acres less if the 103,980 electrified equipment were not installed and the cultivation in electricity powered irrigated land would have been done under no-irrigation. Accordingly the total cropped land under electrified irrigation would have reduced by 0.05 million acres through out the country if all land currently irrigated using electricity operated equipment be replaced by diesel engines.

5.7. EFFICIENCY AND OPERATIONAL COST

5.7.1. Breakdowns and Days Lost

It has been observed that electrified irrigation equipment in general are more dependable compared to diesel operated (Table 5.21). For three-fifths of the sample electrified equipment (62 %) no incidence of break down or loss of days during last year was reported. Two-fifths of diesel operated equipment reported the same. More than one out of four diesel powered equipment (26 %) during last year have faced the hassles of two or more break downs. While, less than 10% of electrified equipment had the same experience. Highest number of break, as observed in the survey, have been experienced by operators of diesel powered shallow tube wells (29% of all STW-D have two or more break downs). Only 4 % of DTW-E had two breakdowns and there were no incidences of more than two breakdowns among the same category of equipment during last year. Analysis of information related to break down leads to the inference that extended use of electrified equipment for irrigation can assure more uninterrupted water supply for cropping as compared to the diesel driven irrigation equipment. Among the electricity powered equipment the DTW have been found more efficient and less hazardous.

It is obvious that breakdown of equipment is directly related with the loss of working days of the same. As for three-fifths of the electrified equipment, no loss of irrigation days were reported. Among diesel operated ones, less than one-third reported no-loss. The STW-E owners has reported least number of days lost with two-third reported no loss of working days. Within the diesel category, the LLP-D appears to be more dependable with two-fifths having no loss of working days in the last season.

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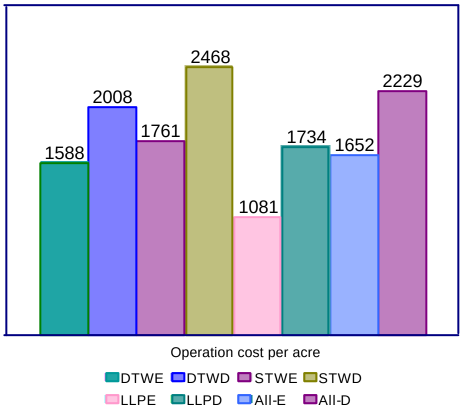
[79] Imputed estimation made on the basis of secondary analysis of survey findings by the authors.

An average electrified equipment lost 3 working days, while the same for diesel was 5 days. Only one out of thirty electricity operated equipment have complained of loosing 11 or more days due to break down of the equipment. The corresponding figure for diesel driven group was 3 times higher with one out of ten.

5.7.2. Operational Cost of Irrigation Equipment

The average annual operational cost of electrified equipment is Tk. 1,652 and that for diesel, Tk. 2,229 (Figure 5.13). The difference is statistically significant (see Section 9.4.3, item # 46). It implies that the average operational cost of irrigation through out the country can be meaningfully reduced by extending share of electrified irrigation. For all major heads of cost (energy, lubricants, maintenance and repairing) the STW-E and LLP-E is cheaper than that of STW-D, LLP-D (Table 5.22). In terms of all operational cost, except maintenance, DTW-E has been found cheaper than those of diesel driven DTW. The maintenance cost of DTW-E has been reported to be higher than that of DTW-D. However, in terms of total operational cost (all heads taken together) all individual sub-categories of electrified equipment: DTW-E (Tk. 1,588), STW-E (Tk. 1,761) and LLP-E (Tk. 1,080) have been observed to be cheaper than the corresponding diesel operated categories (Tk. 2,008, Tk. 2,468, and Tk.1,734 respectively).

Figure 5.13: Operational cost per acre of irrigation by type of equipment (inTaka)



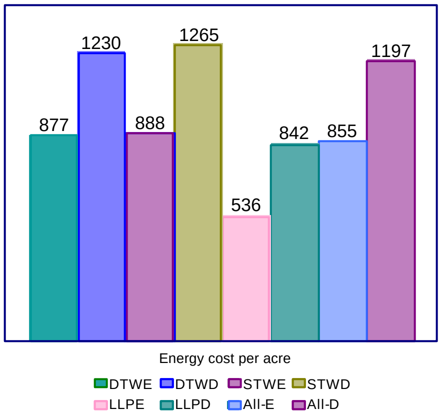
Source: Tables 5.22

Cost of energy

The average energy cost of electrified equipment per acre is 40% lower that of diesel driven with Tk.855 for electrified and Tk.1,197 for diesel (Figure 5.14). It implies that the average energy cost of irrigation through out the country can be meaningfully reduced by extending share of electrified irrigation (Table 5.22). It has been reported that the cost of energy of electrified irrigation for DTW-E ,STW-E and LLP-E is cheaper than that of DTW-D, STW-D, LLP-D (Figure 5.14).

The cost of lubricant per acre for average electricity-powered equipment (All-E) is 5.5 times lesser than that of diesel operated equipment (Tk.79) (Table 5.23). Among all types of irrigation equipment the per acre cost of lubricant was the lowest at Tk. 5 for DTW-E. The corresponding cost was Tk. 25 for DTW-D, Tk. 81 for LLP-D, and Tk.108 for STW-D. Moreover, for all individual type of electrified equipment the combined cost of energy and lubricants per acre are less than their counterpart diesel driven equipment.

Figure 5.14: Energy cost per acre of irrigation by type of equipment (inTaka)



Source: Tables 5.22 and 5.23

Cost of maintenance

The maintenance cost per acre of total irrigated land of an equipment, one of the important heads of expenses related with operational cost, have been observed to be ranging between 7% and 10% of the electrified operational cost. Such maintenance cost (Table 5.23) of equipment in general (All-E) was Tk. 123 and for diesel equipment Tk. 171. These differences in cost of maintenance were found statistically significant at 5% level (details see Section 9.4.3, hypothesis # 46). Among the electricity operated irrigation units, the LLP-E has the lowest maintenance expenses. The cost of maintenance per acre for LLP-E was Tk. 45 only. It has been observed that with in the two broader categories - electricity operated and diesel driven - the maintenance costs of STWs are relatively high as compared to DTWs and LLPs. The highest maintenance cost per acre was recorded for diesel powered shallow tube wells (Tk. 203 per acre) (Table 5.23). In this connection the focus group discussions substantiate the findings with over two-thirds of the participants admitted that, *"by extending the electrified irrigation the cost of maintenance of irrigation equipment can be substantially reduced".*

Cost of repairing

Any equipment needs to undergo repairing during its operation. The yearly cost of repairing per acre of total land under irrigation for an average electricity operated equipment (Tk. 168) is about 1.5 times less than that of diesel operated one (Tk. 252). The corresponding cost of repairing of electrified deep tube wells was lowest at Tk. 140 followed by electricity operated low lift pumps, Tk. 164. The findings reveal that the repairing cost per acre of total land under irrigation of most commonly used irrigation equipment STW-E is higher than that of DTW-E and LLP-E. As compared to STW-E the STW-D is also more costly.

Wages

It has been observed that the wages per acre of land under different types of irrigation varies significantly. For example, the wages per acre for DTW-E is Tk. 322 while the same for the most common type of modern irrigation, STW-E and STW-D are higher at Tk. 782 and 671 respectively. The wage per acre of irrigated land for average electrified equipment has been estimated as Tk. 405 while the same for diesel operated one is higher at Tk.635 (Table 5.23).

5.7.3. Hazards and Mental Tension

As already discussed, the number and frequency of breakdown of diesel-operated irrigation units is much more pronounced than that of electricity operated ones.

The majority of participant's of FGD shared that the breakdowns are hazardous and involves mental tension. *"The farmers' tension limits no bound in instances when the irrigation equipment during the peak session goes out of order"*, shared a farmer from Sirajganj. Most of the other farmers expressed that the diesel-operated pumps have more frequent breakdowns than the electricity-operated pumps. The FGD participants in Jessore mentioned *"hazards and mental tension are the factors which prompted the pump owners to switch from diesel to electricity".*

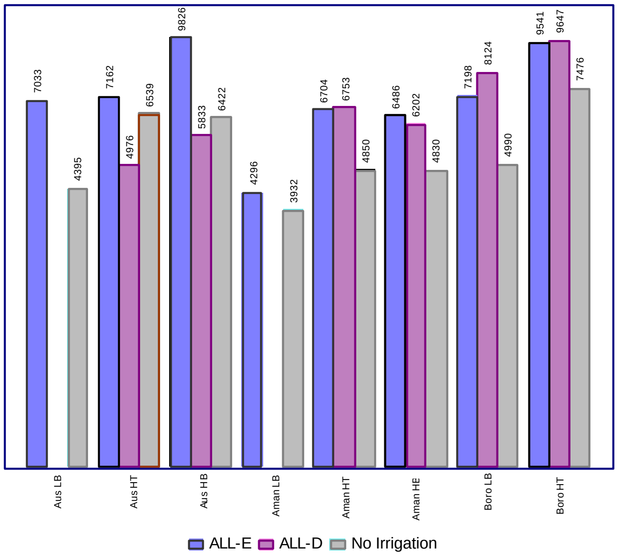
To recapitulate, the average annual operational cost of electrified equipment is Tk. 1,652 which is much less than that of diesel operated Tk. 2,228. This implies that a huge amount of savings is possible by bringing country's 8 million acres of irrigated land (BBS 2001) under electrified irrigation. Thus, if all the net irrigated area would have been cultivated using the present distribution pattern of DTW-E, STW-E and LLP-E the annual amount of savings due to operational cost could be almost Tk. 3,113 million at current market price. The cost of hazards and mental tension in using the diesel-operated irrigation equipment is difficult to measure, and thus, not included in the estimation.

5.8. COST OF CROP CULTURE

The cost of production per acre under irrigation is higher than that of no irrigation. The field survey revealed that, in general, the same for electricity powered irrigation is higher than that of diesel powered except in cases of Aman HT, all varieties of Boro, mustard and chilly. It implies that for huge majority of land (90.3 % of land covered by electricity powered irrigation) the cost of crop culture is less in comparison with diesel engine powered irrigated land (92,4 % of all land under diesel) though in other instances the cost is apparently higher.

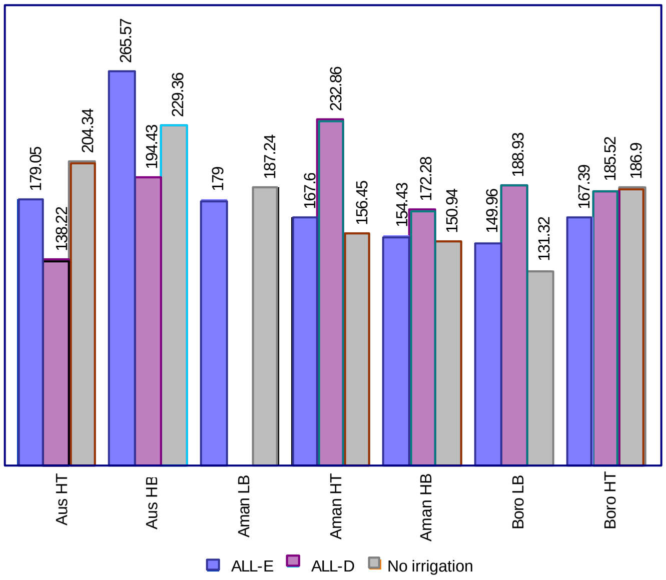
On average, the cost per acre of Boro HT with electricity operated irrigation was Tk. 9,541 and that with diesel, Tk. 9,647 (Figure 5.15). Similarly, the average cost per acre of Boro LB in electricity powered irrigated land has been enumerated as Tk. 7,198 against Tk. 8,124 for diesel equipment operated irrigated plots.

Figure 5.15: Production cost of rice per acre by type of equipment (Tk.)



Source: Table 5.24

Figure 5.16: Cost of production per maund of rice by type of irrigation (in Tk.)



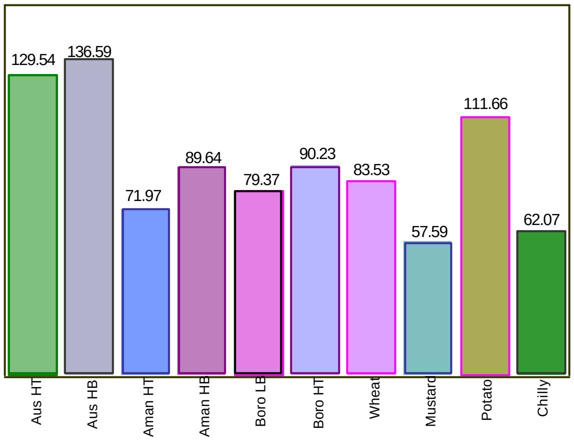
Source: Table 5.25

It is found that the economy from cultivating high yielding Boro in an acre of land under electricity is Tk.1,718 less per acre than the same with diesel. It implies that the economy in terms of reduction of cost of production due to use of electricity as power source in high yielding Boro cultivation in estimated 1,6 million acres of land irrigated by equipment operated by power from REP (All-E) is valued at Tk. 2,154.7 million approximately. Similarly, the economy in Boro LB culture in an acre of land under electricity operated irrigation compared to the same under diesel driven irrigation equipment on average amounts to Tk. 1,718 (in last year price). The average reduction of cost of production attained through use of electricity powered irrigation in all Boro LB land (0.26 million acres) within the irrigation area of REP in the country has been computed as Tk. 459.3 million.

Accordingly, the average economy of Tk. 3.1million in cost of production have been attributed through growing Aman HT in 63,512 acres through out the country in irrigated land using electricity as power source instead of irrigation made by diesel engines.

An amount of Tk. 2,617.2 million has been economized by growing 3 types of high yielding rice in land irrigated with electricity powered irrigation. In terms of production of the said types of rice taken together the quantity has been estimated as 3,965,396 metric Tons grown in 1.9 millions acre of land irrigated using REP powered energy throughout the country. An estimated quantity of almost 0.4 million metric tons of more rice have been produced in the stated lands since it is using electricity powered irrigation in lieu of diesel powered. This implies that the economy due to stated afore reasons amounts to Tk. 2617. 2 million due to reduced cost and 0. 4 million metric Tons of additional Boro and HYV Aman rice due to higher productivity of lands having electricity powered irrigation in a year.

Figure 5.17: Cost of production per maund under ALL-E as % of cost of diesel powered



Source: Table 5.26

5.9 EMPLOYMENT BY IRRIGATION TYPES (PER ACRE LAND)

It has been found that irrigation generates employment in two ways: (a) employment generated in connection with operation of respective equipment, and (b) increased number of person days are being required for cultivation of new crop and/ or to raise the efficiency of cultivation.

5.9.1. Employment Related to Operation of Equipment

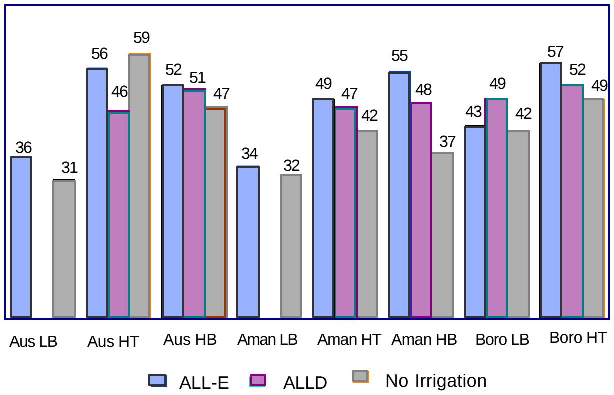
Table 5.9.1 reveals that, on average, an electrified irrigation equipment creates employment for two persons for almost half of the year (236 person-days for two). Only one person is needed to keep the diesel operated irrigation equipment functioning during the irrigation season on average for 115 days. **It appears that more than two hundred thousand persons (207,980 persons) have been employed for a period of almost half of the year in all 103,980 electrified equipment**. Thus, with the electrification of irrigation equipment more than one hundred thousand additional employment have been created for throughout the year in rural areas of the country by the existing electricity driven irrigation facilities for keeping them into operation. In addition, according to the owners interviewed, the electricity powered irrigation equipment, on average, provide opportunity to 10 persons for being employed as casual worker; the same for diesel powered equipment have been observed to be same. It is to be noted that the deep tube wells from both the power categories generate more casual employment (26 persons and 23 persons respectively) compared with two other types.

5.9.2. Employment in Crop Culture

Figure 5.18 portrays that, by and large, employment in irrigated plots is higher than that of plots with no irrigation (except few exceptions), and same is true for plots using irrigation from electricity operated sources than the plots with diesel driven irrigation.

The survey findings show that the number of person days utilized per acre of land for cultivation of HYV rice of all variety (Aus, Aman and Boro) with irrigation is higher than the same with diesel powered irrigation and/ or no irrigation (rain-fed rice culture) (except for rain-fed HYV transplanted Aus). It has been also observed that for rice culture within the electrified irrigation category, the highest number of person days have been required in cultivation of high yielding variety of Boro (57 person days per acre). This average was 52 person-days per acre per diesel powered irrigated sample plots, and 49 person-days per acre in sample plots with no irrigation. The findings reveal that highest number of person days per acre has been needed for jute cultivation, though the acreage of jute in sample plots (1.7 % of sample electricity irrigated land engaged for jute growing) was low. The number of person-days per acre in plots growing jute under the electrically irrigated plots has been observed as higher (63 person-days) in comparison with jute cultivated in plots with no irrigation (54 person-days). It is to be noted that the coverage of jute in no irrigated sample plots has been higher (7.6 % of sample land with no irrigation has grown jute last year). Broadcast HYV Aus was the third highest major crop in terms of person-days per acre among the electricity operated irrigation category (56 person-days per acre) followed by HYV broadcasted Aman (on average 55 person days per acre). The latter is the crop that has been observed to engage second highest amount of land in the country, and the yield per acre of the same has also been observed as second highest among all types of rice cultivated in the country. For growing HYV broadcasted Aman, the diesel irrigated plots, on an average, utilized 48 person-days per acre during last year, and plots with rain-fed irrigation, 37 person days.

Figure 5.18: Person days-use in rice cultivation by type of irrigation equipment



Source: Table 5.29

Among vegetable and fruits grown in the sample plots, it was found that highest number of person-days per acre was needed for growing cauliflower (181 person-days) followed by Melon (114 person-days) and Bean (108 person-days). But in terms of land engaged under their cultivation, these crops were found not significant.

5.9.3. Estimated Employment of Agricultural Labour in Farmlands using Electrified Irrigation

Estimations are made to identify the total employment attributed to crop culture in irrigated land using the electricity under REP. The results reveal that altogether 140 million person-days of employment is being made in crop-culture through out the country in lands which are being irrigated by electricity operated equipment (Table 5.3) below. In other words, 140 million person days is equivalent to yearly employment of 0.56 million persons (the working day has been assumed as 8 hours and working 250 days in a year). It is to be noted in the said context that the agricultural year is highly dependent upon seasonal nature of crops. Therefore, the scope of employment in agriculture is season-based and having casual nature. Based upon the expert opinion collected from the field, the estimated labor requirement of all crops grown in an average farm house amounts to 125 calendar days approximately. **Thus, in reality, an estimated number of 1.1 million persons are being directly involved in farmlands using electrically powered irrigation under the Rural Electrification Program.**

Moreover, the estimation shows that an average number of 3,400 person-days of employment in a year has been generated in crop culture by an electricity operated deep tube well. The electrified shallow tube well generates yearly employment for 833 person days, while 2,763 person days generated by an electricity powered low lift pump. It has been estimated that an electricity operated irrigation equipment, on average, generates employment for 1,348 person-days in a year for the agricultural labor force.

Table 5.3: Estimated yearly employment in crop cultivation under electricity-operated irrigation by equipment types

Crop	Person-days				Person through out the year @ 250 working days (8 hour a day)				
	DTW-E	STW-E	LLP-E	ALL-E	ALL-E as % of Total	DTW-E	STW-E	LLP-E	ALL-E
Aus- LB	0	0	476877.6	476877.6	0.34	0.0	0.0	1907.5	1907.5
Aus- HT	1831780	1386695	691467.3	3991260	2.85	7327.1	5546.8	2765.9	15965.0
Aus- HB	0	800732.4	0	800732.4	0.57	0.0	3202.9	0.0	3202.9
Aman-LB	0	661334	0	661334	0.47	0.0	2645.3	0.0	2645.3
Aman-HT	2698478	357410.9	0	3112112.5	2.22	10793.9	1429.6	0.0	12448.5
Aman- HB	9613334	10118565	1311409	21221332	15.14	38453.3	40474.3	5245.6	84885.3
Boro- LB	5256416	4765492	1859819	11496871.3	8.20	21025.7	19062.0	7439.3	45987.5
Boro- HT	40603691	32387502	16372770	90242685	64.39	162414.8	129550.0	65491.1	360970.7
Wheat	876067.8	283661	0	1185495.5	0.85	3504.3	1134.6	0.0	4742.0
Jute	1452307	368758	0	1833142.5	1.31	5809.2	1475.0	0.0	7332.6
Masur	0	63216.4	0	63216.4	0.05	0.0	252.9	0.0	252.9
Mustard	35136	294195	0	348982.5	0.25	140.5	1176.8	0.0	1395.9
Cauliflower	0	146700.5	0	146700.5	0.10	0.0	586.8	0.0	586.8
Tomato	632457	192887.1	0	971881	0.69	2529.8	771.5	0.0	3887.5
Potato	1288337	1983998	0	3173122.4	2.26	5153.3	7936.0	0.0	12692.5
Chilly	245955.5	0	0	245955.5	0.18	983.8	0.0	0.0	983.8
Melon	0	184782.6	0	184782.6	0.13	0.0	739.1	0.0	739.1
Total person-days	64533958	53995929	20712343	140156484	100.00	258135.8	215983.7	82849.4	560625.9
Employ-ment/ equipment	3399.6	832.7	2762.8	1347.9		13.6	3.3	11.1	5.4

5.10. COST RETURN ISSUES

Return from equipment

This sub-section provides an analysis of yearly return made by the owners of different types of irrigation equipment. The estimation points out that average return (that is total income per equipment from water selling) from electricity-powered equipment is higher in general, while earning per acre from water selling is less as compared to diesel operated equipment. The latter implies that the farmer has to pay less for irrigation per unit of land if uses water from sources where electricity is used as power source. Income from an average electricity powered irrigation equipment is more than Tk. 39,460 (Table 5.30), while an average diesel powered equipment is Tk. 29,133. Average earning per acre made by a electricity powered equipment amounts to Tk. 1,502. The corresponding figure for a diesel operated equipment is Tk. 1558. Detailed analysis shows that income from all types of electricity powered equipment have been observed higher than the income from respective type of diesel operated equipment. Average income from DTW-E during last year has been estimated at Tk. 83,416, while average income from DTW-D is more than two-fifth less at Tk. 49,599 only. Similarly average income per acre from water selling during the same period has been observed lower in favor of electricity operated equipment for all individual type except LLP. However, as has been mentioned earlier, average per acre income from all type of electricity powered equipment taken together is found lower.

Cost of major crops

The estimation on cost of different crops per maund by type of irrigation reveals that for most of the crops irrigated by electricity powered equipment is less than that of diesel powered. The cost per maund in sample plots irrigated by electricity driven motors for Aman HT , Aman HB, Boro LB, Boro HT, wheat, jute, mustard and chilly has been observed as less than the same produced in sample plots with irrigation provided by diesel engines. On the other, cost of Aus HT grown under diesel powered irrigation is 87.6 % of the same under no irrigation. Comparison between similar crops grown under electrified irrigation and no irrigation reveals that, the cost of agricultural products grown, using earlier type of irrigation per maund of Aman LB (95.6 %), Boro HT (89.6 %), wheat (96,2 %), Jute (90.3 %), Mustard (96.3 %), Tomato (56.7 %) and Potato (62.7 %) compared to the same types of crops grown using no irrigation. Thus, for the most vital crop among all grown in the country: Boro HT (59 % of electricity irrigated land and 53 % of total rice production), grown under electricity operated irrigation generates more income than irrigated by diesel engine driven equipment and/ or no irrigation. Analogous inferences have been observed to be valid for some other crops while the comparison is made one to one with electrified irrigation category in one side, and diesel and/or no irrigation, on the other.

Cost return ratio

Cost Return Ratio (CRR) in crop culture essentially measures efficiency of input cost in comparison with the value produced by individual types of crops. Thus, CRR is one of the most commonly used criteria for assessing the economic impact of crop-culture. CRR shows the amount of return against unit input in terms of money value[80>].

[80>] One farm gets 300 % of gross return from Aman rice having 30 maunds of production/ per acre, cultivated in 33 decimals of land using no irrigation and the money value of inputs including labor is Tk. 1000. Therefore, the gross return amounts to Tk. 3000 for the first farm. Another farm have engaged 300 decimals of land under the same crop uses irrigation (electricity/ diesel operated) produces 60 maunds per acre of same crop. The cost of all inputs in terms of money value has amounted Tk. 15,000 and the gross return amounts to

The cost return ratios have been estimated on the basis of per acre cost of production and return, as well as cost of per unit production (in maunds) and return from the same.

In terms of per acre cost return ratios, tomato (2.98), *masur* (2.95), and potato (2.48) under electricity operated irrigation are the highest three crops among all (Table 5.31). As for diesel driven irrigated sample plots, the comparison can be made only with potato having cost return ratio per acre of production as 1.7.The corresponding figures for no irrigation sample plots with the earlier are available and the ratios are Tomato (1.7), Masur (2.94) and Potato (1.4). However, the most significant among all the ratios presented in the table appeared to be cost and return ratio per acre of high yielding variety Boro. The same under no irrigation and/ or diesel driven irrigation constitutes 1.4. While in sample plots with electricity operated irrigation, the per acre cost return ratio has been identified as 0.1 more compared with other two broader categories of irrigation. This implies that for each of 100 Taka expenditure in HYV Boro cultivation in plots irrigated with electricity provides Taka ten more than in the plots with diesel powered irrigation and also not irrigated/ rain-fed plots. The finding has significant implication in the context of total electricity operated irrigation based high yielding Boro culture throughout the country.

These findings imply that by cultivating HYV Boro in approximately 1.6 million acres of land using electricity operated irrigation, the farmers are getting additional benefit amounting Tk. 2188 per acre. In other words, the total additional benefit received by the HYV Boro farmers due to use of electricity powered irrigation (instead of no irrigation) approximately amounts to Tk. 3501 million.

Cost return ratio per unit of physical quantity (maund) of output denotes the amount of gross return that can be obtained against unit input expenditure. As mentioned earlier, cost return ratio per unit physical quantity (maund) of production has been estimated. The indexes for various crops by type is presented in Table 5.32. Special caution needs to be applied in interpreting to avoid the possibility of being misguided. For example, the Table reveals that per maund cost return ratio of high yielding Boro grown in sample plots under electricity operated irrigation is 0.32 index points higher than that of the same crop grown under no irrigation (rain-fed Boro culture), and 0.17 index points higher than HYV Boro grown in plots using diesel powered irrigation. On the other hand, the per acre productivity of non-irrigated plots as observed in Section 5.5 is much lower (40 maunds per acre) than that of plots under any technology based modern methods of irrigation: diesel, 52 maunds per acre and electricity, 57 maunds per acre.

Precisely per maund cost return ratio of HYV Boro reveals that with the expenditure of Tk.1.00 in the production of the same, the return in the electricity operated irrigated plots amounts to Tk. 0. 55 more than the investment. The return per maund in diesel driven irrigation plots is Tk. 0.37 over 1 taka investment in cultivation of high yielding Boro. While the same in non irrigated plots amounts to Tk. 0.20. In real terms of investment, the per maund return from HYV Boro in plots irrigated with electricity amounts to Tk. 91, the same in plots irrigated under diesel powered equipment amounts to Tk. 69, and Tk. 46 in plots with no irrigation. Thus, on an average, gross return from high yielding Boro culture in a single acre of land under electricity operated irrigation provides the farmer with Tk. 5187, while in an acre of diesel irrigated land, the same amounts to Tk. 3588, and for land with no irrigation the amount is 1840 only.

Taka 30,060. The CRR for the first farm is 3.0, while the same for the second farm is 2.0. Apparently the first farm's performance is more efficient, but in terms of gross absolute return the second one is at much more advantageous position. On the other, the contribution of the second one for the national economy in physical quantity is 60 maunds of rice against 10 maunds. Similarly the first one contributes to GDP in kind with 10 maunds of rice only, on the other the second one's contribution is 180 maunds.

5. 11. PATTERN OF SWITCHING OVER

This sub-section delineates the trends of switching from one type of energy to another, reasons for switching or not switching over, and intention to switch in future including justifications.

Trends of switching

The survey information reveal that out of the 383 electified equipment in the sample 250 were diesel driven before switching over to electricity (Table 5.33). Switching over from diesel to electricity was reported by 94 currently electrified DTW out of 111 DTW -Es in the sample, and the same situation was reported by 135 out of 239 STW-Es. No instances of switching over from electricity were reported. Almost two-thirds of currently electricity powered sample equipment were diesel operated before. The rests are newly installed electric equipment.

Reasons for switching/ and not switching over

The major reasons reported by those who have switched from diesel were "easy to operate' (87.7%), "less costly/ cheaper" (62.2%), "higher longevity of motors" (42.2 %), "reliable" (40.6%), and "less trouble" (36.1%). As to the "reasons for not switching over to diesel, pronounced were the following: "easy repair" of electrified equipment (24.6 %), and "electrically operated pumps are more reliable" (23.8 %). Three-fifth of the owners of diesel operated units mentioned non-availability of electricity as their main reason for not switching.

5.12. ENVIRONMENTAL ASPECTS OF IRRIGATIOON EQUIPMENT

Electrification has tremendously contributed to the Agriculture production system of the country particularly irrigated agriculture. Diesel fuel power pumps are replaced with electricity generated DTW, STW and LLP. About 9% of the total electricity consumption of REB is used for irrigation agriculture purpose. The electricity generated irrigation systems are more environment-friendly than the diesel generated systems. Gasoline and diesel fuels when burned or evaporated produces numerous harmful chemicals and Volatile Organic Compounds (VOC) which are toxic to human health and contributes to the increase in Green House Gases in the atmosphere. For example, the gaseous components of diesel exhaust contain benzene, 1,3-butadiene, arsenic and nickel, which are known to cause cancer in humans. Moreover, diesel exhaust includes over 40 substances that are listed by the US, EPA as hazardous air pollutants and by the California Air Resources Board (CARB) as toxic air contaminants. Use of electricity greatly reduces the pollutant load of these harmful gases in the air.

Introduction of electricity-generated irrigation pumps has contributed to the cleaning up of the air pollution which otherwise would have polluted due to burning of diesel fuel. Emission from the fuel oil combustion depends on the grade and composition of the fuel, type and efficiency of the combustion engine and the level of equipment maintenance. It is estimated that electricity used by the irrigation pumps by REB is equivalent to about 31 % of the total diesel fuel combustion of irrigated agriculture in Bangladesh. Based on the thumb rules of emission factors used by USA, EPA for uncontrolled fuel oil combustion, an estimate of the positive benefit out of the reduced pollution due to reduced use of diesel in the REB supported irrigation schemes is given below.

Table 5.4: Amount of Pollutants (in Kg) reduced due to electrified irrigation

Name of the pollutants	Quantity equivalent in Kg
Total Organic Carbon (TOC)	24,011.15
Carbon Monoxide (CO)	115,438.21
Oxides of Sulfur (SO_x)	3,624,759.77
Oxides of Nitrogen (NO_x)	1,269,820.30
Methane	6,464.54
Lead	34,862.34

Chemicals have become an essential part of agricultural production and the benefits are enormous. A high nutrient level is essential for productive agriculture. However, when misused, the adverse impacts can be extensive. The use of both natural and chemical fertilizers may result in an excess of nutrients, which can cause problems in water bodies and to health. The pesticides are a more common source of poisons associated with irrigation schemes. They are poisonous to plants, fish, birds and mammals including humans.

In recent time there has been considerable increase in the use of agrochemicals. The farmers whether they run their irrigation pump by electricity from REP or diesel generated electricity the trend is same. Use of pesticides is increasing at an alarming rate: it was 11,367 tons in 1997 and by 1999 it has increased to 14,340 tons. Fertilizer consumption in Bangladesh has increased progressively over the last two decades and it is now around 1.73 million tons per year. Current per ha. use of fertilizer is about 86kg. Urea dominates (about 65 %) the fertilizer consumption. For the HYV about 75% of the fertilizer is used as nitrogen, 12% phosphate and only 6% potash as against the recommended dose of 100:60:60 g per ha. Rapid increase in use of nitrogen has lead to the increased concentration of nitrate in surface and ground water. High nitrate content in the drinking water can cause human health hazard and also causes mortality of the fishes due to eutrophication.

Arable land is continuously going out of production at approximately 5 to 7 million hectares per year (approx. 0.5%) due to soil degradation (FAO, 1992). The 1996 Agricultural Census noted that during the period from 1983 to 1996, the physical area under municipalities and cities increased by 607,000 ha. Accounting for nearly 60 percent of the decline in arable land. There were also increases in homestead land within the rural areas to the extent of 142,000 ha accounting for another 14 percent of the land taken out of cultivable land. The homestead area in rural Bangladesh now accounts for 6.4 percent of the operational holdings. The development of rural roads and other infrastructure is also taking sizeable amount of land out of agriculture. The average size of the farm holding has declined from 1.7 ha in 1960 to 0.91 ha in 1983 and to .86 ha in 1996. Per capita availability of arable land dwindled from 0.11 ha to .07 ha.

Lowering of watertable and salinization on irrigated lands is the major cause of land being lost to production and are the most prolific adverse environmental impacts associated with irrigation. Salinity severely limit the choice of crop, adversely affect crop germination and yields, and can make soils difficult to work. The location of the boundary between fresh and salt water at the coast line is a function of the hydraulic potential of the fresh water. A lowered water table will result in the boundary moving inland as the pressure reduces. Large numbers of people may be affected by a reduction in the quality of their drinking supplies when fresh water is replaced by salty water. Moreover, people may be forced to turn to sources of water whose collection and use have important health risks. The plant life in the area may also change as only salt-tolerant species survive. The environmental effects can be irreversible as reversing the movement of a salt water wedge is usually both difficult and very expensive.

5.13. CONCLUSIONS

On an average, electricity-powered irrigation equipment were found 14 years old, while the same for diesel were 10 years. Out of 383 electricity powered equipment, 249 were installed as diesel-operated. There exists a 5 year gap, on an average, between installation and conversion to "electricity type".

The capacities of irrigation equipment were found as follows: DTW-E run by 24 HP, DTW-D by 25HP, and STW-E by 7 HP. On the other hand, STW-D by 14 HP, LLP-E by 16 HP, while LLP-D by 17 HP. The diameter of pipes for DTW-E and DTW-D was 7.5 inches, for STW-E 4.1 inches, for STW-D 3.9 inches. The LLP-E and LLP-D were 6.4 inches and 4.7 inches respectively. Depth of DTW-E and DTW-D are 222 ft. and 214 ft. respectively. The same for STW-E and STW-D are 121ft and 107ft. The average distance between LLP-E and source of water is 39 ft. For LLP-D, the average distance has been found to be 29 ft.

It is observed that installation cost of DTW-E is less than that of DTW-D. The same for STW-E and LLP-E is higher than the installation cost of diesel-operated equipment. The price of DTW-E has been reported to be twice higher than the LLP-E.

Electricity-powered equipment owners in general, possess 2.6 acres of land while their counterpart of diesel-operated category possess 2.2 acres.

Average number of days of irrigation in last year for DTW-E was 130 days, for DTW-D 128 days, STW-E 114 days, STW-D 117 days, LLP-E 112 days, and LLP-D 82 days.

Net area of irrigation under electricity powered equipment (27 acres per equipment) is higher than that of diesel operated (17 acres).

Total area of irrigation under electricity powered equipment (31 acres) is higher than that of diesel operated equipment (18.7 acres).

Net area new-to-irrigation under electricity powered equipment (18.1 acres) is higher comparing to diesel driven (14.9 acres).

Land use intensity under irrigation of electricity powered equipment (115) is higher in comparison with diesel operated ones' (105) except for STW.

94 % of total cropped area of the sample plots under electrified irrigation is engaged in cereal cultivation.

Distribution of total cropped area by type of irrigation reveals that, of all cropped areas under DTW-E, the largest part is being used for cereal production. The rest is engaged in cultivating other crops. 94% of total cropped area under STW-E are being engaged in growing cereals. Potato is also being grown in areas under STW-E. Jute, masur, mustered, cauliflower, tomato, melon are being grown in 2 % of the total area under the same type of irrigation equipment. 100% of total cropped area under LLP-E is being used for cultivation of rice. Rice is being cultivated in 96 % cropped area under DTW-D. Potato being grown in 3% of cropped area, and bean in 1 % area under DTW-D. In the total cropped area under STW-E, 94% are being used for cereal production, 5 % for Potato, and 1% for Chilly. 80% of total cropped area under LLP-D deals with Boro and Aman.

Concomittant to the development of irrigation facilities, Boro cultivation has grown up significantly and it pushed out not only other variety of rice, but also other crops as well. The commendable achievement of the country towards relative food self sufficiency have been made possible because of shift towards HYV and especially high yielding Boro followed by HYV Aman at a massive scale. The contribution of REP in attaining the same can be attributed to the facts that REB has ensured uninterrupted supply of water through more than 103 thousands of electricity operated irrigation equipment to approximately 2.3 million of acres of land during HYV Boro and HYV Aman.

On an average, yield per acre in plots under electricity powered irrigation is higher than that of diesel operated, and productivity of land under electricity powered irrigation is 24 % higher than that of diesel.

Cropping intensity in plots using electrically powered irrigation is 193, the corresponding figure for plots irrigated by diesel is 191 and for plots with no irrigation or rain-fed is 181. It implies that electrified irrigation intensifies the land use by 12% points more than rain-fed/no irrigated lands, while diesel powered irrigated land intensifies by 10% points.

Electrified irrigation equipment in general are more dependable compared to the diesel-operated pumps.

Operational cost of electrified equipment, on average, is three-fourths than that of the diesel-operated ones. Energy cost of electrified equipment is 75% than that of diesel-operated ones, maintenance cost ranging between 7-10 % of operational cost, cost of repairing for an average electricity operated equipment is almost one and a half less than that of diesel operated one.

On an average, electrified irrigation equipment create employment for two persons for almost half of the year; and with the electrification of irrigation equipment, more than 100,000 additional employment have been created throughout the year in rural areas of the country.

As land use intensity and cropping intensity through electrified equipment is higher, and cost of operation of the same is lower including breakdown and associated problems in comparison with diesel equipment, electrified irrigation has got distinct advantages over other types of irrigation. HYV crops and HYV Boro has been greatly facilitated by Rural Electrification Program contributing to spectacular growth in food production and thereby growth of GDP in the country. Therefore, in order to secure further growth in food production, particularly in the backdrop of WTO considerations - where countries are supposed to capitalize on their competitive advantage-electricity as a source of power needs to be made widely available in the rural areas of Bangladesh.

As the contribution of electricity is evidentially clear in the agriculture sector of Bangladesh, more generation of electricity on the one hand and better distribution of the same, on the other, is recommended. The REB needs to entertain its initial mission of connecting all irrigation pumps and consider its mission/goal about engaging itself into generation of electricity too.

CHAPTER 6

IMPACT ON INDUSTRIAL DEVELOPMENT

6.1. INTRODUCTION

In this chapter, an attempt has been made to evaluate the impact of REP on various dimensions of industrialization in the country. In evaluating such impact of REP on industrial development the specific objectives pertaining to this part (see Chapter 2) of the study were strictly adhered to.

The need of rapid industrialization in Bangladesh in the backdrop of burgeoning unemployment and poverty is undisputed. All the previous governments during the post-independence period have underscored the urgent need for industrialization and adopted various measures to expand the industrial base. However, little has been achieved and contribution of the manufacturing industry to GDP was accounted for about 15.46 percent, which is one of the lowest among the low-income countries.

Whatever has so far been achieved in the field of industrialization is a disproportionate development characterised by high concentration in the major large cities, particularly in the capital and port cities. The development initiatives thus excluded the vast rural areas where most of the population (76% population) are living. The ultimate result of this trend of growth ends up with huge migration from the rural areas to the few already over-crowded large cities, threatening the economies in both urban and rural areas. Eighty percent of the rural population earns their subsistence from agriculture, but low price elasticity of demand for agricultural products reduces the long-term potentials for income earning. The opposite is rather true for the manufactured goods.

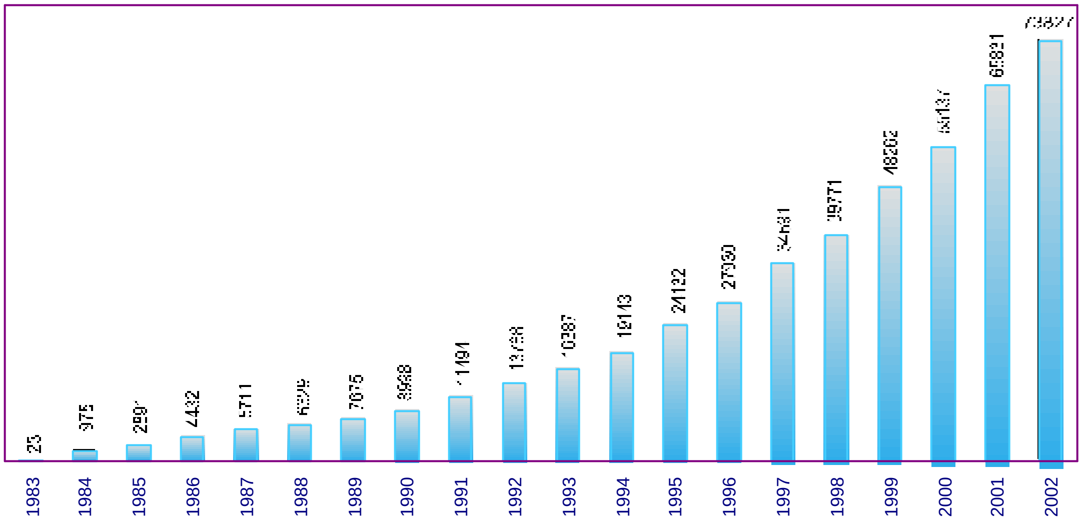
Even if the manufacturing industry has not been considered as an alternative to agriculture, it has to be developed, as it supplements agriculture. Therefore, for this densely populated poverty-stricken country like Bangladesh, there is no alternative to industrialization. As such, unless the rural sector is considered in the development strategy, industrialization would hardly bring any benefit to the economy.

One of the major factors which stand on way to rapid industrial growth is the absence of power. Steady and uninterrupted generation and supply of power is the most important precondition for industrialization. The absence of electricity has been identified as the principal obstacle to industrialization in the rural areas and semi-urban areas. The existing industries are mostly cottage industries characterized by outdated technology, low productivity, and localized production centres. With the opening up of the markets, cheap foreign products have flooded the market of rural areas threatening the traditional handicrafts. In addition to that, many handicraft goods are facing major problem of reduced consumption due to changes in life style and taste. Therefore, in order to overcome these bottlenecks, traditional industries need to be upgraded, and more new and qualitative products are to be produced along with the old ones. This could be achieved by installing new machinery and technologies. Furthermore, a few diesel-driven agro-processing industries are operating at the rural level. In spite of REP's provision of electricity connection these industries have remained (or proved to be) inefficient, and they have turned to operate with electricity competing with many other new entrants. It would, therefore, be wrong to consider REP as the only pre-requisite for industrialization. But experience shows that electricity is the primary input without which the goal of industrialization in the rural as well as urban and semi-urban areas is hardly possible to achieve.

6.2. GROWTH IN INDUSTRIAL CONSUMERS OF RURAL ELECTRICITY DURING LAST TWENTY YEARS

Industry is the second highest consumer of rural electricity representing consumption of 42.3% of the total MWH to date (Table 4.2.10). During the last twenty years (1983-2002), the total number of industrial consumers of rural electricity has increased 3,210 times, from only 23 in 1983 to 73,827 in 2002 (Figure 6.1). The estimated average annual growth of industrial consumers of RE is 49.74%. The average number of industrial connections per PBS, during 1983-2002, has increased by 550 times: the average number of industrial connections per PBS was only 2 in 1983 and rose to 1,102 per PBS in 2002 (estimated using information in Table 4.2.10). On average, 3,690 industries have been connected each year. Almost all the industrial connections are general power (GP) connections (99.2%) (Table 4.2.10).

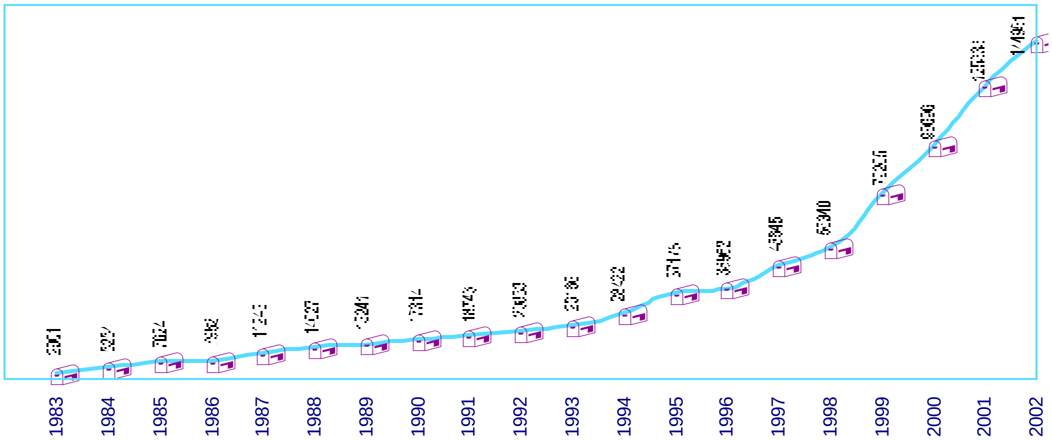
Figure 6.1: Trend in the number of industrial connections: 1983-2002



Source: Compiled by the authors based on last twenty years' (1983 - 2002) MIS Reports obtained from REB (all data relate to the month of June of the relevant year)

Industrial consumption of rural electricity has shown considerable increase during the last twenty years: monthly average consumption (MWH) has increased by 50 times from 2,901 MWH per month in 1983 to 144,951 MWH per month in 2002. The sharp rise has been

Figure 6.2: Trend in the MWH consumed by industry: 1983-2002 (this month)



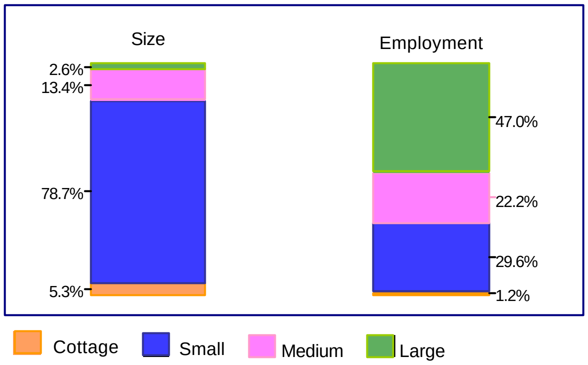
Source: Compiled by the authors based on last twenty years' (1983 - 2002) MIS Reports obtained from REB (all data relate to the month of June of the relevant year)

recorded during the last five years with 56,340 MWH per month in 1998 to 144,951 MWH per month in 2002 (Figure 6.2). Out of the total monthly MWH consumption, industry consumes about 44%, i.e., ranks second after the domestic consumption (48.2%) (Table 4.2.10).

6.3. GROWTH OF INDUSTRIES: VOLUME AND DIVERSITY OF INDUSTRIAL PRODUCTION IN 67 PBSs

According to the information obtained from all 67 PBSs (as on May 2002), the total number of industries connected through Rural Electrification Program is 63,220. The industries have been divided into four categories by size[81>]. Among these, the number of smaller industries rank highest with 49,822 units (78.8% of total number of industries of all size groups of REP) followed by medium size 8,466 or 13.4%, cottage industries occupy the third position with 3,377 units (or 5.3%), and the number of large industry is only 1,655 (2.6%) (Figure 6.3).

Figure 6.3: RE-connected industries by size and employment : All 67 PBS combined



Source: Table 6.1

Surprisingly, the cottage industry still dominates rural industrialization with a share of only 5.3 of the total industrial units. This does not mean that the cottage industries have been on the brink of extinction or they have been declining. As have been defined, cottage industries are being operated by the owners' family member and mostly with hand-made instruments. Utilization of modern technology is still at the initial stage. Our findings show that only 3,277 industries have been using electricity to run their industries, but it is important to note that a large number of cottage industries derive benefit from rural electricity. According to the household survey, only 7 percent (or 97 of the 1,380 sample households) have electrified cottage industries; this implies that country-wide a total of 239,957 non-electrified cottage industries are enjoying the benefits of household electricity connection by lighting their workplaces and office rooms.

With regard to the employment level, the first three groups of industry — the cottage, small and medium industries experience a similar share in the hierarchy except the large industry's group. The cottage industries, ranking third position in terms of number, occupy the last position with only 1.2 percent of the total employment in the REP industries. The small industries, comprising 78.8% of the sample industrial units, share 29.6% of the total employment.

An upward trend in employment is evident in the medium-scale and large industries. While medium-scale industries make 13.4% of the sample total industrial units, it absorbs 22.2% of the total employment (Figure 6.3). The large industries, although constitute only 2.62% of the total industries, absorb 47% of all sample employment. These figures demonstrate that the small and cottage industries employ less labour compared to their number of units. To the contrary, the medium-scale and the large industries, in particular, are highly labour intensive, i.e., employ more labour against smaller investments. Around 50% of all textile industries belong to the large

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[81>] The Census of Manufacturing Industries (CMI) (Nov.2001) has divided the industries on the basis of number of workers. According to CMI the categories are: *Cottage industry:* Manual labor within the family, own premise; *Small industry:* With upto 9 workers; *Medium industry:* with 10-49 workers; and *Large industry:* With 50+ workers.

category (calculated based on information of industries from all 67 PBSs, Table Annex 6.2). During the last two decades, the garments industries witnessed an unprecedented rate of growth surpassing all other industries and turned into the single largest export earner industry of the country. In the earlier period, these industries were largely confined to the Dhaka City, but later on, began to spread to other cities and towns. These industries are mostly labour intensive and large in size.

Table 6.1 below shows the share of REP-connected industrial units and employment, and compares that with the national level. Since the data on cottage and small industries at the national level are not available, comparison has been made with only medium-scale and large-size group of industries.[82>] In addition, data published by CMI-2001 are based on the Financial Year of 1995-1996. Data and information on REP-connected industries relate to the year 2002. In order to compare REP industries with that of the national level, the 1995-96 data have been upgraded to the financial year 2001[83>]. This comparison shows that REP connected medium-scale industries share 23.85% of industrial units, accommodating 20.77% of employment of the country's corresponding size of industries. The large industries, on the other hand, shares 9.31% of the country's industrial units with 4.77% of employment of the national total large industries.

Table 6.1: Share of REP-connected medium and large scale industries to similar size of industries at the national level.

Size	No. of REP industrial unit	No. of employment in REP industrial unit	No. of unit at the national level	No. of employment in the national level industry	% share of industries	% share of employment
Medium	8,466	197,343	35,495	950,302	23.85	20.77
Large	1,655	417,855	17,771	8,724,831	9.31	4.77

Source: Information about industries supplied by 67 PBS and Census of Manufacturing Industries (CMI) 1995-96, Chapter III, P. 9, Chapter IV, P-13, 18.

6.4. CHARACTERISTICS OF SAMPLE UNITS

A total of 176 industrial units were covered in the sample survey with 117 electrified, 26 cottage, 36 small, 31 medium, and 24 large industries. The distribution of 59 sample non-electrified industries were as follows: 20 cottage, 31 small, and 8 medium-scale industries. No large industries in non-electrified group was found in the sample areas.[84>]

All the small, medium-scale and large electrified and non-electrified industries are managed by male members. Only 11.5% of the electrified cottage industries and 25% of the non-electrified cottage industries are run by female members; showing almost entirely male-dominated

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[82>] Q.2. CMI (Census of Manufacturing Industries) provides data on medium and large industries. Data on small industries comprise only handloom establishment. Due to these limitations only medium and large industries have been compared with that of central level.

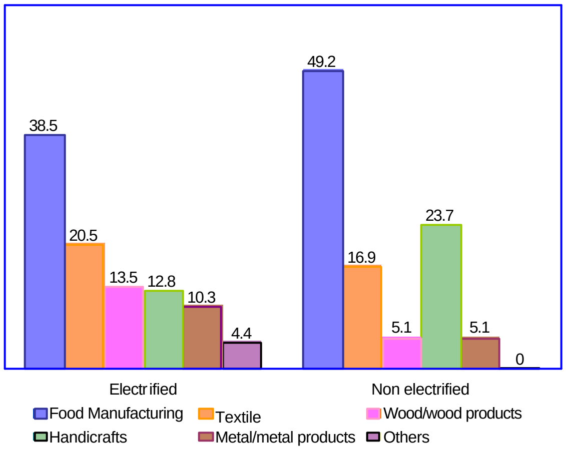
[83>] This up-gradation has been done by taking total average growth of the previous five years and adding this growth with the last Five years 1996-2001. The latest data of 67 PBSs had been prepared on the basis of information of 2002.

[84>] Actually, large scale non-electrified industries were not available in the sample area because of high costs resulted from diesel, or furnace oil, and many other problem with the use of machine and technology. These problems are discussed in this chapter.

industrialization in the sample areas. Only 3.8% cottage industries have been enjoying LP (large power) connection, while 41.7% of the large industries are enjoying the same. On average, 84.6% have GP and 15.4% have LP connections (Table 6.4)

The structure of growth highlights that the food processing industries surpassed all other group of industries. The food processing industries alone constitute 38.5% of all electrified industries followed by textile 20.5%, (Figure 6.4). In the non-electrified group, the food processing industries share almost half (50%) of all industries and with 23.7% handicrafts ranks second in distribution by type of industries. In the non-electrified food processing industries, the rice mills emerged as the highest in numbers characterizing high concentration of agro-based industries in both electrified and non-electrified group. However, the non-electrified industries exhibit that out of total food processing the rice mills share 49.2% which shows non-electrified industries are less diversified and confined mostly within rice processing industries.

Figure 6.4: Percentage of industries by major industry group (in line with CMI code)



Source: Table 6.7

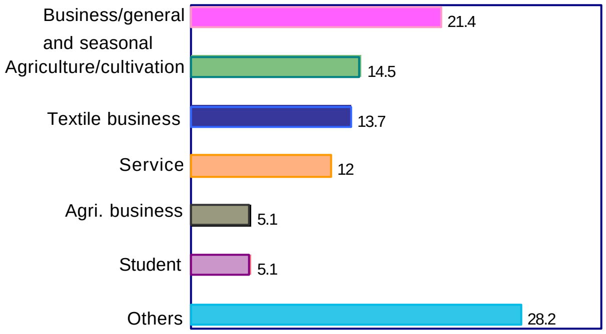
The size distribution shows that 55.6% of electrified small industries belongs to food manufacturing, while food manufacturing occupy 41.9% and 38.9% of medium and large industries respectively. With a share of 15.4% only, cottage industries of this type ranks the lowest. In the non-electrified group, the distribution pattern is more lop-sided toward food processing industries, comprising 80.6% of non-electrified small industries. The medium-scale and cottage industries are 37.5% and 5.0% respectively. 50.0% of large electrified industries belong to textile sectors. 38.5% of electrified and 60% non-electrified cottage industries are engaged in producing handicrafts.

The distribution pattern of industries by size and type indicates that the spread of rural electrification has not only diversified the industry, but also facilitated the growth of medium-scale and large industries contributing to employment generation in the rural areas, while the non-electrified industries are more concentrated within small and cottage industries and confined within a narrow industrial base.

While asking about the reasons which prompted the owners to invest, 60.7% of the owners of electrified industries answered for more profit, 53.8% related it to the increasing demand, 24.8% wanted to generate employment, 23.9% came to industry as it was their paternal business. About 16.2% inspired by the availability of raw materials and 5.1% because of locally thriving business (Table 6.8). Almost a similar type of answers was given by the respondents of non-electrified industries (Table 6.8). However, a 69.2% of the electrified cottage industries were established to take the advantage of high profit, while the number of non-electrified industries in this group was 45%.

With regard to the previous occupations in electrified industries, 21.4% reported businesses (general and seasonal), 14.5% agriculture, 13.7% textile business, 12.0% service, and agri-business and student 5.1% each (Figure 6.5). The remaining 28.2% reported agriculture or agro-based small businesses as the past occupations. It can, therefore, be generally said that majority of the entrepereneurs in the electrified industries were previously engaged in agriculture or various agro-based occupations. Experience as agriculturist or agri-business persons encouraged them to promote agro-based industries, which, in turn, accelerated the industrial growth as well as generated employment in both agriculture and industry. A considerable number of people (13.7% of the total) have come from the textile business and turned into textile entrepreneurs, which indicate that investment in industries would bring more prospects as compared to that in trading business. On the other hand, 12.0% of service holders and 5.1% of student's/ex-student's have been running industries which mean that more qualified persons and ex-students, instead of searching and waiting for jobs, have made productive investments in the rural areas. Such innovative initiatives were, earlier, a rare case, mainly because of the lack of electricity.

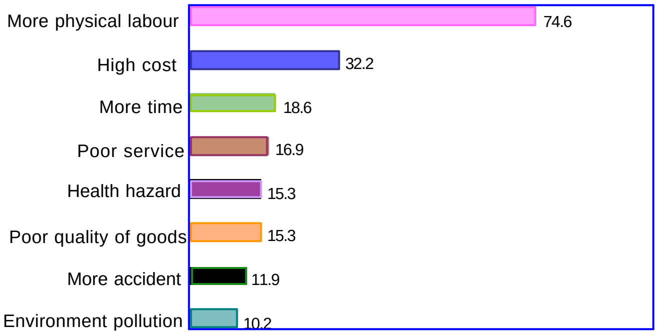
Figure 6.5 : Percentage distribution of previous occupation of the respondents of electrified industries



Source: Table

As has been noted earlier, industrial growth was inhibited due to the absence of electricity. With the inception of REP, new industries grew up and many diesel-driven machines switched over to RE. But still, a few of them are running their industries with diesel. The respondents of non-electrified industries spoke on the disadvantages with diesel-driven and advantage with electrified machine. About 75% of the respondents spoke on more physical labours, 32.2% high cost, 18.6% and 16.9% informed about more time cost and poor service respectively (Figure 6.6). Other types of problem identified were health hazards (15.3%), poor quality of goods (15%), more accidents (11.9%), and environmental degradation (10.2%).

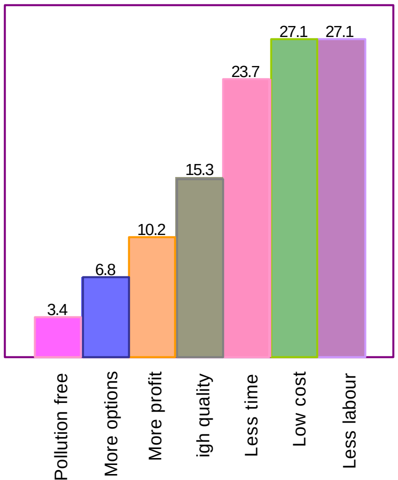
Figure 6.6 : Percentage distribution of respondents about the problems with diesel driven/ manual machine



Source: Table 6.11

The respondents of the non-electrified industries spoke about the advantages of electrified industries (Figure 6.7). The highest, 27.1% spoke about less labour and an equal percent informed about low cost. In addition, 23.7%, 15.3% and 10.2% spoke about less time, high quality and more profit respectively. Electrified industries bring more profit and make less pollution reported by 6.8% and 3.4% respondents respectively. All these information are indicative of comparative effectiveness of electrified industry over the non-electrified. These also imply that the rural electricity not only promotes new industries, a distinct tendency prevails wherein the industries operating with diesel will switch over to electricity driven industries, as soon as the supply is available.

Figure 6.7 : Percentage distribution of respondents of non-electrified industries by their responses about advantages of electrified over diesel driven machines



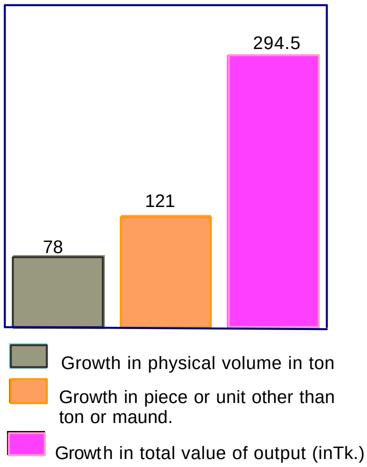
Source: Table 6.12

6.5. IMPACT ON PRODUCTION, EMPLOYMENT, WORKING HOURS, PRODUCTIVITY, COST PROFILE AND EFFICIENCY

6.5.1 Growth of industrial output in volume and value (gross and net revenue)

Along with a high rate of employment generation, impact of electrification was also evident in the growth of industrial output, both in terms of volume and value. Since the volume of output is measured in various units depending on type of production, for the convenience of measurement, two broad type of units were used – one is ton, and the other one is piece or number of units (other than ton or maund). In order to evaluate the trend over the years retrospective data of last five years have been taken into account.[85>]

Figure 6.8: Growth in value and volume of electrified industries: 1997-2002



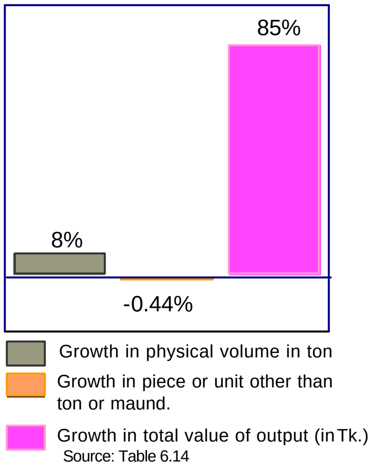
Source: Table 6.13

As for convenience of the research, the industries have been divided into producing (manufacturing) and processing. The former producing goods for final consumer, using primary, semi-finished or processed raw materials – while the latter involves in processing the primary raw materials for further production by another unit.

Estimations pertaining to the amount of growth in both physical volume and value (in Tk) during the last five years for electrified and non-electrified industries are presented in Tables 6.13 and 6.14 respectively. The total market value (at current price) of all electrified industries increased by 294.5% Figure 6.8. At the same time, the total market value for non-electrified industries rose to 85% (Figure 6.9). For electrified, the change in physical volume (in ton) was 78%, and that in number of units was 121% (Figure 6.8). The growth in non-electrified industries was much lower in both volume and value. In non- electrified industries, although there has been an 8% growth in physical volume (in ton) but the change in number of piece (or units other than ton, or maund) was negative. Output was reduced by 0.44% during the last five years.

Thus, the highly pronounced growth of electrified industries in terms of employment, volume and value of production are validated in the study.

Figure 6.9 : Growth in value and volume of non-electrified industries: 1997-2002



Source: Table 6.14

6.5.2. Productivity

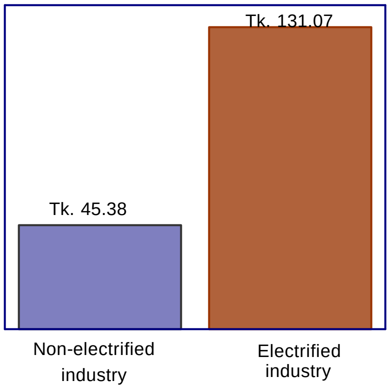
Electrified industries depict much higher productivity than the non-electrified ones. The estimated productivity is Tk 131.07 per hour for electrified industry, and Tk.45.38 per hour for non-electrified industry (Figure 6.10) which shows that productivity per unit of time in electrified industries is 2.48 times higher than that in non-

---

[85>] As noted earlier some industries started their operation 8 years ago some 4 years ago and some only one year ago. So, for appropriateness, a time period of 5 years has been considered, i.e; five years ago and last year.

electrified industries[86>.] Statistical test validate the relationship between electricity and productivity for medium industries (see Section 9.3.5).

Figure 6.10 : Productivity per hour



6.5.3. Efficiency on Employment and Working Hours

As has been hinted earlier, most of the people of rural and semi-urban areas depend, for their livelihood, on agriculture as the chances of job opportunities in the non-farm areas are extremely limited. Rural electrification expanded the scope of employment opportunities in the industries of various types and sizes (Tables 6.16 and 6.17).

In order to make a comparative analysis, we have taken the data of current year and of five years ago[87>]. Five years ago the total number of employment of 117 electrified industrial units was accounted 4763 with 4074 males (85.53%) and only 689 female (14.47%). Today, after five years, employment rose to 7280 persons with 5755 males (79.05%) and 1525 females (20.95%). As against this, in the 59 non-electrified industries, five years back, the total labour was 259 with 179 male and 80 female. The figure rose to 333 with 208 male and 125 female. Five years ago, the skilled labour numbered 158 with 129 male and 29 female; and last year, the number rose to 223 with 141 male and 82 female. Five years ago, in the electrified industries, the male female ratio was 1:59 for all labor and for skilled labours it was 1:14.36. As for non-electrified industries, these male-female ratios were 1:2.2 and 1:4.9 respectively. A considerable shift in female labor has taken place. The total labour force of electrified industries has increased to 7280 (52.84%) with an increase in male laborer by 41.26% and female by 121.33% (Table 6.18). But the increase in skilled female labour was 417.32 (amounting to 1045) during the last five years. The increase in growth of female labour force has reduced the disparity in industrial employment from 1:59 to 1:3.7 for all labours. The same for skilled labour has came down to 1:4.3 from 1:14.36, which shows increasing female participation in industrial labour force. Although male-female ratio in electrified industries favors males than in non-electrified industries, the male-female gap has been reduced at a higher rate in electrified industries than that in the non-electrified industries. During the last five years the skilled female labour force in electrified industries has increased to 1045 from 202 or 417.3% as against 55% of their male counterparts. But the overall growth of female labour in non-electrified industries was 125 from 80 (56.3%) and number of skilled female labour rose from 29 to 82 (171%). This growth and structure of employment demonstrate that rural electrification has not only created employment opportunities but also are producing more and more skilled labour force. In addition, increase of skilled female labour force at a much higher rate than that of the male members indicates the efficiency of female labour in professional and technical jobs instead of odd jobs. At the same time , slow growth of skilled labour force in the non-electrified industries indicates that the electrified industries have been providing better opportunities for the female labour than the non-electrified industries.

[86>] Productivity is usually defined as production per unit time. The productivity as shown in the figure has been calculated by dividing the total value of production by total person hours devoted to the production of that value.

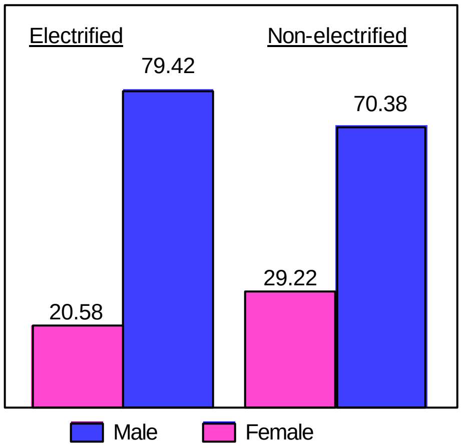
[87>] Most of the cottage, small and even some medium scale industries have no proper documentation or record on employment. Some units have started their production 20 years ago, but they have records for only the last couple of years. Considering this, we have taken the period of five years for comparison.

6.5.4. Working Hours

An increase in employment corresponds with an increase in working hours, or synonymously hours of employment. It is evident that as compared to the part-time, the full time workers have been increased at a higher rate (Table 6.17). Thus, we can assume that working hours has also been increased along with the increase of employment. But due to the absence of accurate information, it becomes difficult to make a comparison of relative changes in working hours along with the changes in the employment level.

The total amount of employment generated by the electrified industries during the last year was about 17.7 million hours, and that by the non-electrified 0.78 million hours (Table 6.17). The average number of working hours per electrified industry during the last year was 151,120 hours and that per non-electrified 13,267. This implies that the electrified industries, on average, generate 11.4 times more employment than the non-electrified industries.

Figure 6.11: Percentage distribution of working hours

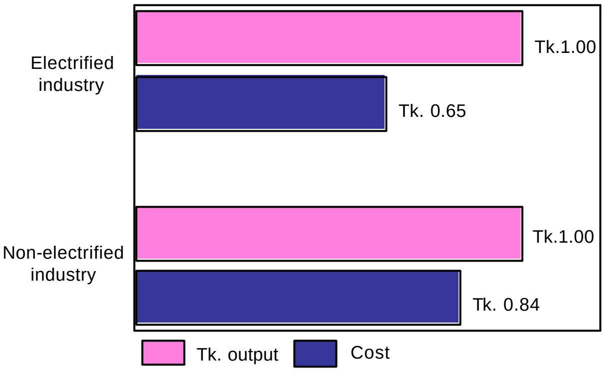


Source: Table 6.20

As for electrified industries, the total working hours of the current year have been estimated to be 17,681,022 hours, out of which the share of male members amounted to 14,042,716 hours (79.42%) and the female members 36,383,06 hours (20.58%) (Figure 6.11). In the non-electrified industries, the total working hours amounted to 782,773 of which the male members share is 550,985 hours (70.38%) and the female members 231,878 hours (29.62%) showing a higher percentage of female participation in the non-electrified that in the electrified industries. This is due to the fact that nearly half of the non-electrified industries are rice mills. In these mills, a considerable number of female workers works. Low wage rate and proximity to residence were identified as the principal reasons. However, if we compare the absolute numbers, the total female workers of electrified industries are more than 15 times higher than their counterparts in the non-electrified industries.

6.5.5. Average Cost of Production

Figure 6.12 : Cost per Taka output by electrified and non-electrified industries



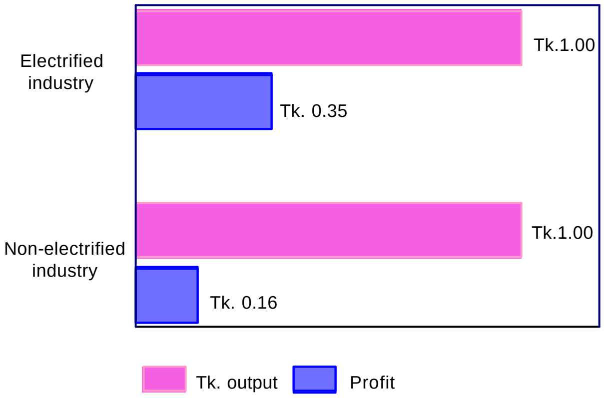
Source: Table 6.15

The average cost of production depicts wide discrepancy between the electrified and the non-electrified industries. Average cost has been estimated as the amount of money needs to be invested to produce one Tk value of output. In other word, how much money needs to be invested to produce an amount of output valued one taka. Figure 6.12 shows that to produce one Tk. value of output, the electrified industry spends on average Tk.0.65, while non-electrified industry spends Tk.0.84. This means that to produce an output of Tk.1 the electrified industry spends 29% less than that by the non-electrified industry showing the ability of electrified industry to produce at a cheaper rate than the non-electrified industries. Thus, the electrified industries compete better in the market than the non-electrified industries.

6.5.6. Rate of Profit in Electrified and Non-electrified Industries

Since the average cost per unit of taka differs widely in the electrified and non-electrified industries, rate of profit will also vary. From the information in Figures 6.10 and 6.11 gross profit has been estimated from market value less the cost of production. Accordingly, gross profit per Taka of market value in electrified industries is Tk. 0.35 (Tk.1.00-0.65), and that in non-electrified industry is Tk.0.16 (Tk.1.00-Tk.0.84) (Figure 6.13). That is, per taka output the gross profit of electrified industries is over 2 times higher than of non-electrified industries. The estimated annual gross profit in electrified industries was Tk.12.8 million, and the same for non-electrified was Tk.0.55 million. The average gross profit of electrified is 23.3 times higher than that of non-electrified industry[88>].

Figure 6.13 : Profit per taka output by electrified and non-electrified industries



Source: Table 6.15

6.6. IMPACT ON BACKWARD-FORWARD LINKAGES AND DIVERSIFICATION

6.6.1. Introduction

Expansion of an industry takes place in many ways. An industrial unit may expand its operation by producing raw materials which was previously purchased from another firm. This type of expansion is called the *Backward Linkage*. When an industry moves towards final demand or sets up operation for further processing of its goods which was earlier done by another firm, is *Forward Linkage*. Both of these linkages taken together are named *Vertical Integration*. In addition to these, as an industry grows up, its scale of operation is expanded by setting up a new unit producing dissimilar production. This later type of expansion is called *Diversification*. Expansion and growth of an industry may take place by capacity utilization, by installing new machines and by adopting new technologies. But an industry strengthens its base by promoting backward and forward linkages. By promoting backward and forward linkages, it increases value addition and technological capability and establish direct contact with the consumers. Diversification enables the industry to produce a wider range of commodities and brings stability in earnings by compensating the loss of one commodity by another.

In our study, an attempt has been made to assess the type of expansion occurred within the industries. We have seen that most of the industries grew up with REP connections are small scale agro-based industries and textile industries. The process of vertical integration and diversification is capital intensive and usually evident in financially sound, large or medium scale

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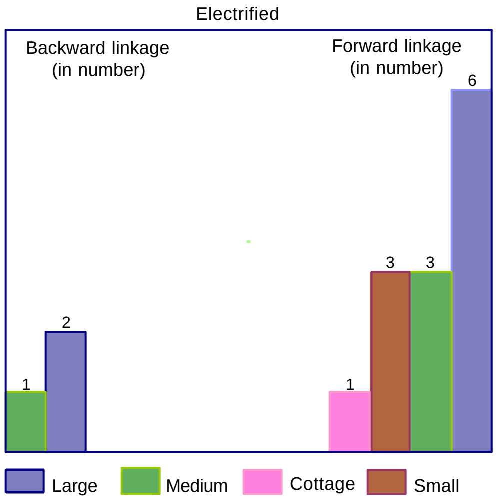
[88>] One of the main reasons of high profit is the absence of large industries in non-electrified industries. In the large industries, the volume, value and also productivity are higher than the smaller units. But since we are concerned about the totality of electrified and non-electrified industries disaggregated estimation by size industries has not been made.

industries. Nonetheless, our findings indicate that some industries, although very few as compared to the total number in the sample, have expanded their industrial strength through backward and forward linkages. This is a relatively new and encouraging development, because, more an industry moves towards backward and forward linkages, more it becomes competitive in the market and assertive for future development.

6.6.2. Backward and Forward Linkages

As has been shown in Figure 6.14 among the sample-electrified industries, 3 industries expanded through backward linkages: 1 medium size and 2 large size industries. None of non-electrified industries went for backward linkages showing a relatively new and superior trend in the electrified industries over the non-electrified ones. 13 out of 117 electrified industries enlarged their industries through forward linkages. Out of these 13 units 1 in cottage, 3 each in small and medium size group and 6 in large scale industries. Only 2 out of 59 non-electrified resorted to forward linkages. Thus, although still not much development, evidence of such backward and forward linkages in the electrified as compared to the non-electrified ones, is encouraging.

Figure 6.14 : No. of industries expanded through backward and forward linkages



Source: Table 6.21

Expansion of industries through backward and forward linkages needs additional capital, advancement in technology, skill, risk-bearing ability and decision. An industrialist goes through these serious operations when s/he becomes assertive in his/her business and optimistic about the future prospect. In this process s/he acquirers entrepreneurial skills. Our study shows that many of our respondents have gone through this process and it is because of electrification which has facilitated the growth of a new class of entrepreneurs.

With regard to the type of industry, the rice mill ranks first in both backward and forward linkages followed by textile. The other type of expansion (though forward linkage) took place in welding, oil mills, twisting (also belongs to textile mill) and biscuit (confectionery) factories.

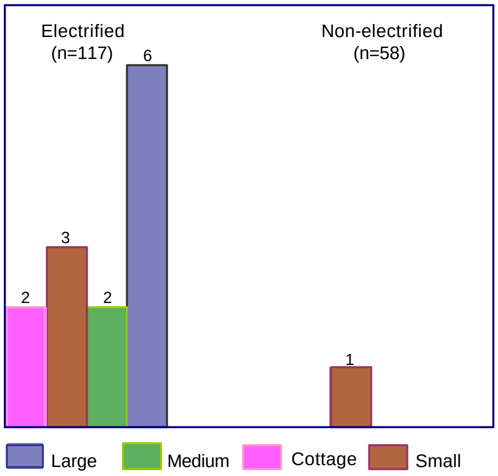
6.6.3. Diversification

In addition to the backward and forward linkages, industry may also expand through diversification. In this case, as mentioned earlier, industries extend operation by producing a dissimilar or non-substitutional product. In our study, 13 out of 117 electrified industries and 1 out of 59 non-electrified industries went for diversification, which again shows industrialist in the electrified group are more capable to diversity along with backward and forward linkages. The highest number of diversified industries are large by size, and 4 out of 6 of these large industries are twisting industry, and the second group diversified is small scale (Figure 6.15). The only unit diversified in the non-electrified group is also small scale industry.

While inquiring about the reasons for diversification, the respondents answered like a truly experienced entrepreneur that, there are fluctuations in demand of a particular commodity "**If you have a number of industries producing different goods, you can compensate the loss of one product by another**" (Said an entrepreneur under Sirajgonj PBS).

Diversification of products is a risky task. An industrialist undertakes such venture when s/he attains a certain stage of development and confidence. The increasing number of diversification indicates the potentiality of the industrialists and confidence on business. It is, among other, the rural electrification program, which enabled them to undertake such industrial venture. The other factors involved as mentioned in the focus group discussions are banking facilities (investment and running capital facilities), transportation, other utilities, market stability etc.

Figure 6.15 : No. of industries expanded through diversification



Source: Table 6.22

6.6.4. Sub Contracting Arrangement

Expansion and growth of industries may take place in the form of sub-contracting arrangement[89>]. Businessmen and professionals may take the advantage of this relation and set-up new industries of their own or expand their already set-up industries. The present study shows that nine electrified industries and only one non-electrified industry have been running their industries under sub-contracting arrangement. These include 2 cottage, 4 small and 3 large electrified industries, and one small non-electrified industry (Table 6.26). This distribution demonstrates the potentiality of electrified industries to generate new industrial unit and strengthen their foundations based on sub-contracting arrangements.

6.7. IMPACT ON FORMATION OF AGGLOMERATION

Almost all economic activities tend to concentrate in areas which offer benefit at low expenditures. These benefits are drawn by firms by way of agglomeration of many other firms in the same area[90>].

Because of these benefits, industries have an inherent tendency to concentrate in a particular location. When an industrial enterprise is set-up, the very existence of this industry may turn to be an attractive location to other industries. Some may use the product of the established firm as their raw material, while other may supply their products to be used as raw materials by the established firm. For example, a spinning mill supplies its product to the weaving industries while weaving industry send its product to the garment industry. These inter-linkages may take place under sub-contracting arrangement in which one smaller unit produces semi-finished

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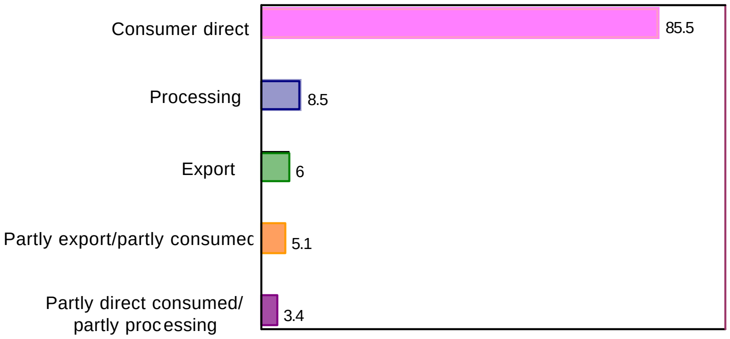
[89>] Under subcontracting arrangement, two firms come to an arrangement according to which smaller unit supplies raw materials to the large one as per contract. Large unit may provide the smaller one with machine, raw materials, finance and training facilities.

[90>] Chandra R (1972), Industrialization and Development in the Third World, Routledge, London, 1972: 80-81.

products as per contract signed with the established firm. Some firms may set up auxiliary units or workshops for a secured supply of spare parts of their machines and technologies. The process does not end here. This process tends to be rather cumulative and form industrial clusters. The growth and expansion of the industries in the cluster attract many services like banking, health, market, telecommunication, education and recreation facilities. In this way, the area turns into an agglomeration emerged from growth of industries.

Why the industries tend to concentrate in a particular location? The industries grow and form a cluster because they want to reap the benefit of economies of scale. In other words, they enjoy the cost advantage resulted from the cumulative growth of industries of the cluster. Low cost of industries in the cluster are attributed to many reasons: For example, growth of the nucleus generates many industries out of which some product of one industry is used as raw material of an another industry of the centre. This inter-industry linkage lowers cost by reducing transport cost and saving time. Such growth of clusters attracts many industries of different type producing varieties of consumer and capital goods. Producers of many industries turn to be the consumer of other goods and create a market of their own source (Figure 6.16). Similarly, expansion of industries encourages the farmers to augment their agricultural output due to the high demand of their product used as raw materials in the industries. Geographical proximity of these raw materials reduces the transport cost. In addition to that, growth and expansion of industries, earn confidence of the banking institutions while sanctioning loan. As regard power supply the concerned authority may offer special programme to ensure speedy and uninterrupted supply of power. The large-scale industry may have their own power supply to their industries[91>]. It is evident form our survey that some firms and industries have been expanding through various linkage effects while others are joining them accruing to the benefits of cluster which later form an agglomeration. Indications of agglomeration are inter industry linkage, back-forward linkage diversification, growth of services and markets, expansion of transport linkages etc.

Figure 6.16 : Percentage distribution of output sold to various market



Source: Table 6.25

As has been found in the survey, the electrified industries expanded their industries through effective linkage, out of which 3 were backward linkages and 13 forward linkages. Through this linkages they have increased their volume of investment, output number of employees. Along with these linkages, 14 industries have gone through diversification to produce dissimilar products, and 9 established sub-contracting arrangements. In addition, concentration of many firms producing dissimilar products generates markets within the industrial area as the producer of one industry turns to be the consumer of the commodities of other industries, which is validated by the study findings. As for example, 37.6% workers in electrified industries purchase

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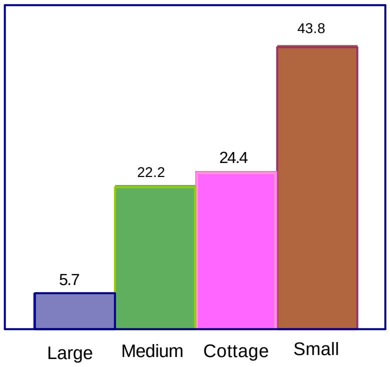
[91>] There are very few example of power generations as this is highly capital intensive and only large entrepreneurs can afford. Beximco conglomerate is an example of this kind. Beximco has set-up a 7 MWT power generation unit for their large industrial agglomeration. Such power generation unit is financially and technically not feasible for small industrial clusters in the rural areas. However, there are instances of installing power generator during load shedding.

goods from their own industry, while 43.6% purchase good of other industries within the area. The corresponding figures for non-electrified industries were 39% and 28.8% (Table 6.27). These figures show that almost half of the products are consumed by the worker of the locality. Growth of industries generate employment and income which in turn expands market of non-farm goods. In addition to that, the nucleus of industries generates many services giving additional impetus to growth which are vividly evident in Tables 6.33 and 6.34. In this regard, nearly three-fourths of the respondents (73.5%) reported that there has been growth in shops, and around 40% said development of services like telephone, restaurant and repairing workshops as a result of the growth of industries (Table 6.33). A variety of services have been developed following the concentration of industries in particular location. These include establishment of shops, fax, e-mail, telephone, photocopy, hotel, restaurant, and cinema –high rate of growth. Some specialized institutions like technical training centre computer training centres and diagnostic centres, have also experienced substantial growth (Table 6.34). Many of these services are not directly linked with the industries. As the concentration of industries forms a cluster, it generates side by side the growth of commerce and trade related services, and many urban facilities. People get benefit of these facilities in terms of income and employment. All these grew-up from a nucleus of industries which emerged with rural electricity. Therefore, it is the rural electrification which has acted as the key pull factor for the development of industrial growth.

6.8. IMPACT OF RURAL ELECTRIFICATION BY NATURE OF INDUSTRY

The beginning of rural electrification stimulated the growth of industries. But not all industries of similar type and size grew up at an equal rate (Figures 6.17 and 6.18). As for the fastest growing industries, 32% said rice/oil/flour mills, followed by 20% for textile, 14% for handicrafts, 9% engineering workshops and 3% saw mills (Figure 6.18). Among these fast growing industries, 44% are small, and around 24% medium and cottage each.

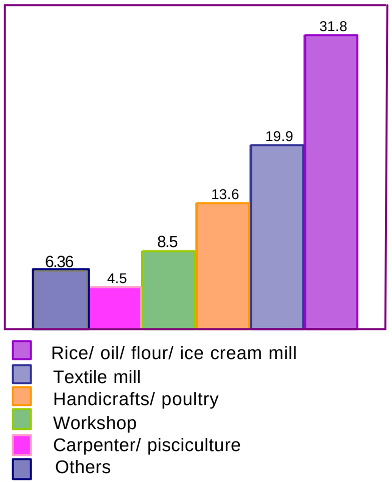
Figure 6.17 : Percentage of respondents' reporting fastest growing industries by size after RE



Source: Table 6.29

A spectacular industrial growth has taken place during the last five year 1997-2002 in the sample areas (Table 6.30). The total number of industries, five years ago was 2055 units and that rose to about 6129 in the current year showing a three - fold increase in five years. The highest rate of growth was achieved by rice, oil, flour, ice-cream unit group which rose from 82 in 1997 to 366 in 2002 (346.34% increase), followed by workshop 252.6% increase carpentry/ pisciculture 229.8% increase and textile mill 225.2% increase. The small industries outnumbered other groups which grew up by 814% during the last five years in the REP areas (Table 6.31). The large size industries witnessed the slowest rate of growth (Table 6.31). While investigating into the cause behind the growth of a particular type and size of industry 31% of them reported the reason as high demand, 30% mentioned availability of raw materials, and 19% related it to high profit. The other important factors mentioned were skilled labour force and infrastructure with contributed 14.2% and 10.2% respectively. No less significant was the role of

Figure 6.18 : Percentage of respondents report about fastest growing industries by type after RE

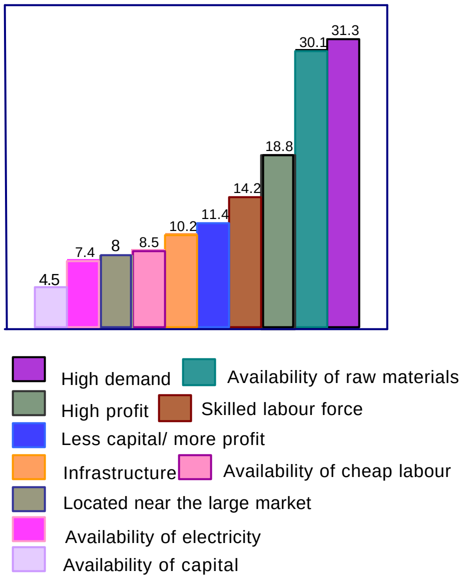


Source: Table 6.28

capital (less capital/ more profit) which ranks fourth in the hierarchy of reasons behind growth (Table 6.32).

The factors for the growth of a particular type and size of industry indicate that the agro-based small industries are dominant in the race. Most of these industries are agro-based, because raw materials exist available and they are small scale, and require less capital. In light of these information, one can conclude that there exist enormous opportunities of the growth of agro-based industries, textile mills and workshops due to high demand, profit and availability of raw materials (Figure 6.19). Although important factors, such as availability of raw materials, skilled labor and markets were available, due to the absence of electricity the local entrepreneurs could not exploit these for industrial ventures before. As rural electrification removed these obstacles, industries started to grow rapidly.

Figure 6.19 : Percentage distribution of respondents by their reporting about the causes of fastest growing industries after RE



Source: Table 6.32

6.9. IMPACT ON DEVELOPMENT OF SUPPORT SERVICES

Development is the amalgamation of many sectors and sub-sectors. When the initial growth triggers from any particular industry or industries, its spread effect exerts influence on a wide range of economic and non-economic activities. The increase of production in industries of any particular centre attract the wholesale and retail traders from the locality and distant area. Growth and expansion of trade and commerce would inspire the local people to open bank and money exchange institution. With the gradual increase of commerce and industry, new schools, colleges of both specialized and general nature would be developed which will attract many education-based-services like photocopy machine, library, computer and other relevant services. Concentration of trade and commerce and educational institutions will encourage the local young educated people to set up mobile phones, offices, fax-machines, e-mail systems, which were earlier available only in the large urban centres. It needs to be mentioned here that most of the rural people are deprived of one of the basic human needs— the medical facilities. Due to the lack of electricity combined with low purchasing power, the qualified doctors do not have incentives to set up practice in the rural areas. But the situation takes a favorable turn with the launching of RE. The growth of industries, trade and commerce increases the purchasing power of the rural people by generating income and employment (details see Chapter 4.3). The expansion of roads and high way links the centre with the remote areas. All these sectors call for the development of clinic and hospitals to cater the needs of local patient. People who for any kind of treatment were compelled to take a distant route, have now been benefited from these health facilities offered within their reach. (details see Chapter 4.4.2). Tables 6.33 and 6.34 show that there has been much expansion of various type of support services. The huge growth of shops, fax- e-mail and telephone facilities, mobile phones, restaurants, banks, photocopy shops, school and colleges, bus/tempo stoppages, availability of MBBS doctors, diagnostic centres and clinics have been reported in the areas of electrified industries. To the contrary, in the non-electrified areas, growth of such support-service facilities were much less pronounced.

One of the main obstacles which stand on way to rapid industrialization is the **capital**. The banking facilities which are mainly confined to district centre, have little or no access to the rural entrepreneurs. The growth of industries have made the financial institutions within reach of the local entrepreneurs. About 60% respondents have said that banking facilities have been developed, and 79% have said that they are availing those facilities (Tables 6.34 and 6.36). About 94% of medium-scale industries and 92% of large industries enjoyed the credit facilities while the same for cottage and small industries were 69% and 64% respectively showing the competence of the larger firms in getting credit facilities (Table 6.36).

The services that grew up alongside industries are mostly electricity-driven. Statistical test further validate the finding (Section 9.3.4). Many of these services are neither directly nor indirectly industry-based. These services expanded spontaneously accruing the benefits of agglomeration, which has emerged mainly due to the launching of rural electrification.

6.10. ENVIRONMENTAL ASPECTS

REB has provided electricity connections to the different industries and industrial estates within the country. It is estimated that industries connection accounts for 42% of the total yearly consumption by PBS. Out of the total pollution textile sector contribute to the 37% pollution load and Food industries contribute 32% of the pollution load (Table 6.2 below). Some environmental aspects pertaining to the Rural Electrification Program are described in Annex-D.

Table 6.2: Industrial pollution intensity in terms of employment by types of industries

Type of industry	Small		Medium		Large		Total		% distribution of pollution load
	# industries	# employees	# industries	# employees	# industries	# employees	# industries	# employees	
Food Manufacturing industries	28797	157058	3490	74499	259	54904	32546	286461	32.656554
Beverage industries	155	935	11	353	5	1197	171	2485	0.28329
Tobacco Manufacturing	23	144	40	1318	14	2564	77	4026	0.458964
Animal feeds/by -products	507	1164	34	442	37	5986	578	7592	0.865488
Textile	3267	25413	3191	90533	815	209318	7273	325264	37.080096
Wearingapparels including readymade garments (except footwear)	0	0	18	963	218	92746	236	93709	10.682826
Leather and its, products	4	23	22	576	12	2208	38	2807	0.319998
Footwear	16	158	5	158	23	4217	44	4533	0.516762
Jute pressing and bailling	14	49	7	172	4	705	25	926	0.105564
Embro of textile goods	138	941	16	468	4	725	158	2134	0.243276
Wood and wood products	5707	26735	391	5751	7	741	6105	33227	3.787878
Wooden furniture	1211	7137	197	2342	3	300	1411	9779	1.114806
Paper and paper products	5	33	25	679	21	2412	51	3124	0.356136
Printing and publishing	223	800	37	478	3	680	263	1958	0.223212
Drugs and pharmaceutical	5	283	21	541	17	3091	43	3915	0.44631
Chemical industries	55	249	20	807	13	1951	88	3007	0.342798
Other chemical industries	47	309	33	818	12	1319	92	2446	0.278844
Petroleum refineries and products	15	96	38	1138	1	150	54	1384	0.157776
Rubber products	5	40	26	767	10	1702	41	2509	0.286026
Plastic products	15	109	45	1176	27	2925	87	4210	0.47994
Pottery and chinaware	27	420	1	15	11	1143	39	1578	0.179892
Glass products	0	0	2	50	1	60	3	110	0.01254
Non-metallic products	8	47	134	2817	77	11152	219	14016	1.597824
Iron and steel	931	2050	66	1834	22	9295	1019	13179	1.502406
Non-ferrous metal industries	0	0	1	20	0	0	1	20	0.00228
Fabricated metal products	7455	33250	521	7167	14	1430	7990	41847	4.770558
Machinery except electrical	716	3808	37	407	7	2685	760	6900	0.7866
Electrical machinery	212	607	31	982	18	2249	261	3838	0.437532
Workshop	238	714					238	714	0.081396
Cold storage	7	420					7	420	0.04788
Ice cream	1	10	6	72			7	82	0.009348
others	18	90					18	90	0.01026
Total	49822	263092	8466	197343	1655	417855	59943	878290	100.12506

6.11 CONTRIBUTION OF REP TO INDUSTRIAL PRODUCTION IN BANGLADESH

The economy of Bangladesh is agro-based, and inspite of some improvement, the industry's share in GDP is only 15.46% at current price. However, during the last two decades, the industrial sector had undergone a moderate change by promoting diversification and generating industries beyond the traditional areas and types. This process has largely been accelerated and intensified by the RE-connected industries.

The estimated total net revenue produced in the RE-connected industries of all 67 PBSs during the last year was Tk. 320,414.73 million (Table 6.3). The last year's total net revenue by size of RE-connected industries was Tk. 75.4 million for cottage industries, Tk.105,423 million for small industries, Tk. 156,003 million for medium industries, and Tk. 58,913 million for large industries. The average per industry annual net revenue was Tk.5.07 million ranging between Tk. 0.02 million for cottage and Tk.35.6 million for large scale industries.

Table 6.3: Total industrial contribution of RE industries[1>] :
Cost of production, gross revenue, net revenue- 2001.

Size of industries	Total # industries in 67 PBSs (2001)[2>]	Per industry[3>] in 2001 (Tk. million)			All industries under 67 PBSs in 2001 (Tk. million)[4>]		
		Cost of Production	Gross revenue	Net revenue	Cost of production	Gross revenue	Net revenue
Cottage	3277	0.115	0.138	0.02	376.85	452.22	75.37
Small	49822	1.225	3.341	2.11	61031.95	166455.30	105423.35
Medium	8466	11.604	30.031	18.42	98239.46	254242.44	156002.98
Large	1655	97.008	132.605	35.59	160548.24	219461.27	58913.03
All	63220	5.06	10.13	5.07	320196.50	640611.23	320414.73

Notes: [1>] Total number of industries in all 67 PBSs
[2>] Obtained from all 67 PBSs using secondary data collection format
[3>] Obtained in the survey
[4>] Estimated based on information in columns 2 to 5

6.12. CONCLUSIONS

Industry is the second highest consumer of rural electricity-using 42.3% of the total MWH. During the last twenty years (1983-2002), the total number of industrial consumers of rural electricity has increased 3,210 times and the average number of industrial connections per PBS has increased 550 times.

A substantial growth in industrial output and value has been identified in the study. During last five years, the growth in value was about 295% in electrified industries. The total volume of output (in terms of ton) has increased by 78 percent, while the same growth was only 8 percent in the non-electrified industry. The volume of output in terms of piece unit (other than by weight) grew up by 121% in the electrified industries, and it was –0.44 percent (negative) in the non-electrified industries.

The total employment in 63,220 industries in 67 PBSs was 983,829. During this five-year period, growth in employment in the electrified industries was attained up to 52.84% with 41% for males and 121% for females. Growth of skilled labour force was 78.6% with 55% for males and 417% for female labourers. Growth in employment in non-electrified industries during this period was 28.6% with 16.2% for males and 56.3% for females. The growth of skilled labour force was 41% with 11% for male and 170% female. The male labour force of electrified industry (last year) shares 79% of total working hours, and the same was 70% in case of non-electrified industries. The average cost of production in electrified industries is Tk.0.65 to produce one taka output for electrified industries. The same was Tk.0.84 for non-electrified industries.

Similarly, productivity in electrified industries is Tk.131.07 per hour and in non-electrified industries Tk. 45.38 per hour. The low cost of production and high productivity have also been reflected in the net revenue in the electrified industry which amounted to Tk. 302,417.73 million, last year. All these indicators, such as productivity, low cost of production and high profit, indicate the efficient performance of electrified industries over the non-electrified industries.

RE-connected industries have strengthened the local industrial-base by promoting backward and forward linkages and diversification which, later on, forms agglomeration by attracting and generating diversified services. Out of the 117 electrified industries, 3 industries were expanded through backward and 13 forward linkages, another 13 went for diversification, and 9 expanded through sub-contracting arrangements. The shares of these industries are not much pronounced compared to the total RE connected industries. But once this process has started, it would be intensified in the future. All these estimates indicate the significant contribution of RE-connected industries and underscore the need for further expansion of rural electrification for a rapid growth of industries. In view of the above stated, the following suggestions are be forwarded for policy-scrutiny:

i) The rural electrification should be expedited to cover more villages and areas;

ii) The local bazar or village market should be brought under rural electrification with utmost priority to provide incentives for establishing small and cottage industries which, in turn, will not only generate more employment opportunities in the rural and semi-urban areas, but also well act as a powerful factor to stop or minimize the rural-push migration.

iii) The quality of power supply should be improved and load shedding should be brought under the minimum level without increasing the tariff thereof initially.

iv) Those people who have successfully expanded their industries with RE-connections should be encouraged to contribute to the Board of Management.

v) In the north and southwest region, expansion of many RE connected industries inhibited due to the absence of gas supply. REB may take initiative to speed up the process of gas-based electricity production and distribution in the north and southwest regions for accelerated industrialization.

vi) Local agro-based industries should be encouraged to generate more income and employment in the country, and thereby, facilitate the process of minimizing forced rural-to-urban migration.

vii) More security measures should be adopted to save the rural consumers from accidents caused by electricity.

Electricity has to be seen as one of the basic needs of life like food, cloth, education, health, and shelter. Even for the fulfilment of these basic needs, electrification is a must. A country can hardly provide her people with enough food by relying solely on subsistence agriculture. Agriculture has to be modernized to augment its output. Modernization comprises such components like plough, irrigation and harvesting machine, pesticide, fertilizer and others. Most of these components are produced or processed by industry. Therefore, industry needs to be promoted not only for the upliftment of the society to a higher stage of development, but also to meet the principal basic human need— ensure food security.

Rural electrified industries have been playing a pivotal role in changing the living condition of the rural people whose fortune was tied up with subsistence agriculture till the introduction of rural electrification. More and more people have been shifting from their traditional stereotype businesses to the more dynamic industrial ventures. Development of agglomeration resulted from industrial concentrations in many rural areas generated income and urban facilities and reducing the urban-rural gap.

Agriculture has undergone a moderate change during the last couple of years. Modernization has augmented the output in one hand but uprooted many small and marginal farmers on the other. This process of uprooting has been accelerated and aggravated by population pressure, river erosion and many other natural calamities and man made reasons. Rural electrification has, to some extent, been able to absorb these uprooted people in their concerned areas. But the most striking feature in this process is the participation of many female labourers of both skilled and unskilled, who otherwise would have remained confined to household work.

Lastly, more villages are electrified more industries will be established, more people will be able to change their living condition, more rapid will be the process of social transformation–essential for the economy and nation as a whole.

CHAPTER 7

IMPACT ON COMMERCIAL ACTIVITIES

7.1. INTRODUCTION

With the broad objective "to make an assessment of economic and social impacts of Rural Electrification Programme in Bangladesh", the specific objective was "to assess the impact of Rural Electrification Programme on the development of commercial activities". In order to measure the impact of rural electrification, particularly within the commercial units like retail and wholesale shops of different kinds, a questionnaire was framed along with focus group discussion guideline. The questionnaires were administered and group discussions were held. The questionnaire had two parts, one for retailers and the other for wholesalers. Most of the questions were common for both the groups while a few were unique to specific group. On the other hand, some questions were directed to those shops which were electrified while others were meant for those which were non-electrified, still others were for both.

341 electrified and 118 non-electrified **retail shops** and 59 electrified and 10 non-electrified **wholesale shops** were interviewed. On the other hand, 6 Focus Group Discussions (FGDs) with retailers were conducted: 3 for electrified and 3 for non-electrified. The group discussions were participated by 6-8 shop owners, of different types, representing different shops. A moderator who was helped by a note taker moderated each focus group.

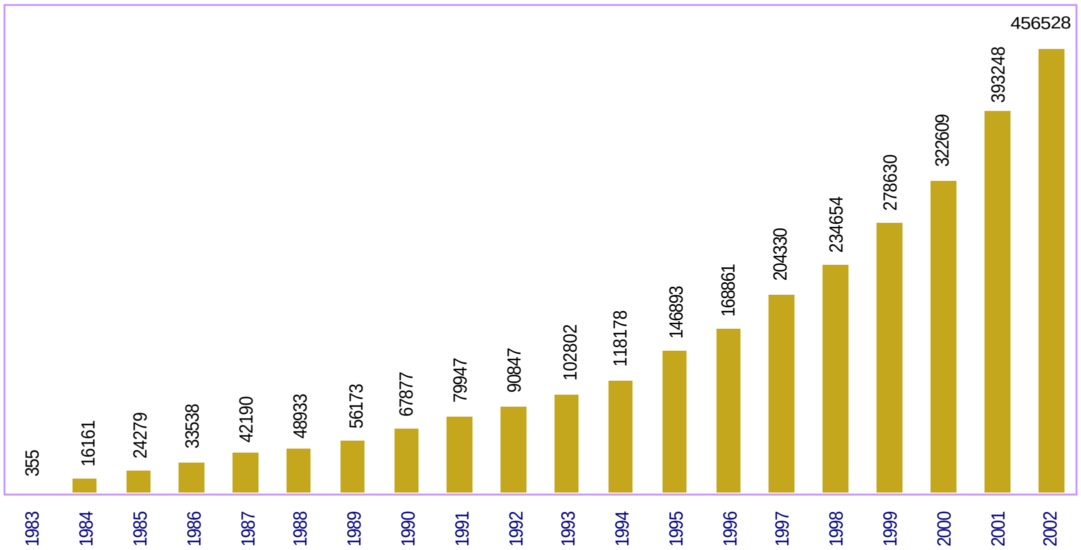
7.2 GROWTH IN RURAL ELECTRICITY IN SHOPS AND ESTABLISHMENTS DURING LAST TWENTY YEARS

It is most likely that, the contribution of rural electrification in the shops and establishments (commercial connections), and thereby, in the overall boost of economic activities is much more significant than our conventional thinking. No studies, so far, have been conducted on this dimension in Bangladesh. In Bangladesh, data is not even available about the total number of shops (retail and wholesale) in the country at a given point in time. Therefore, an attempt has been made in this study to estimate about what could be the share of RE connected commercial establishments out of the total such establishments in Bangladesh. Our estimate shows that, **out of the total shops (retail, wholesale and other establishments) in Bangladesh about 24% are using rural electricity.** While, it would not be easy to claim 100% accuracy of this information, but at the same time, it would not be an exaggeration to claim that this figure may represent close-to-reality providing the methodology used is valid. The methodology used is presented in the box below:

Using the Secondary Data Collection Formats for the study, we have collected data about number of shops (by type – retail and wholesale , and by electrification status) from 30 randomly selected unions (which include all the villages in the union and union HQs) in the thanas under 23 sample PBSs. We found 210.4 shops per union with 202.6 retail and 7.8 wholesale, i.e; 26 :1 ratio of retail and wholesale. Thus, at the Union level and below (i.e; villages) the estimated number of shops in Bangladesh will be 943, 434 (210.4/union x 4484 unions in Bangladesh). Similarly, assuming an average of 1000 shops in each Upazila HQ levels, the total number of shops at the Upazila levels in Bangladesh would be 468,000 (1000 shops x 468 Upazilas); assuming 5000 shops, on average, per district HQs, the total for district will come to 320,000 (5000 shops x 68 districts); and further assuming that the total shops in the Statistical Metropolitan Areas including Dhaka would be 200,000. All these combined, the estimated total number of shops in Bangladesh would be 1,931,434. On the other hand, the total commercial connections of RE in 2002 is 456,528.

In terms of consumers served by REP, the commercial users rank second (after domestic) with 11.3% of the total RE consumers. The number has increased 1250 times during the last twenty years: from only 355 in 1983 to 456,528 in 2002 (Figure 7.1). The estimated average annual growth rate (cumulative average of 20 years) of commercial connections is 43%. During the same period, the PBS-wise commercial connection has increased 252 times: from only 27 commercial connections per PBSs in 1983 to 6814 connections in 2002 (estimate based on information in Table 4.2.10).

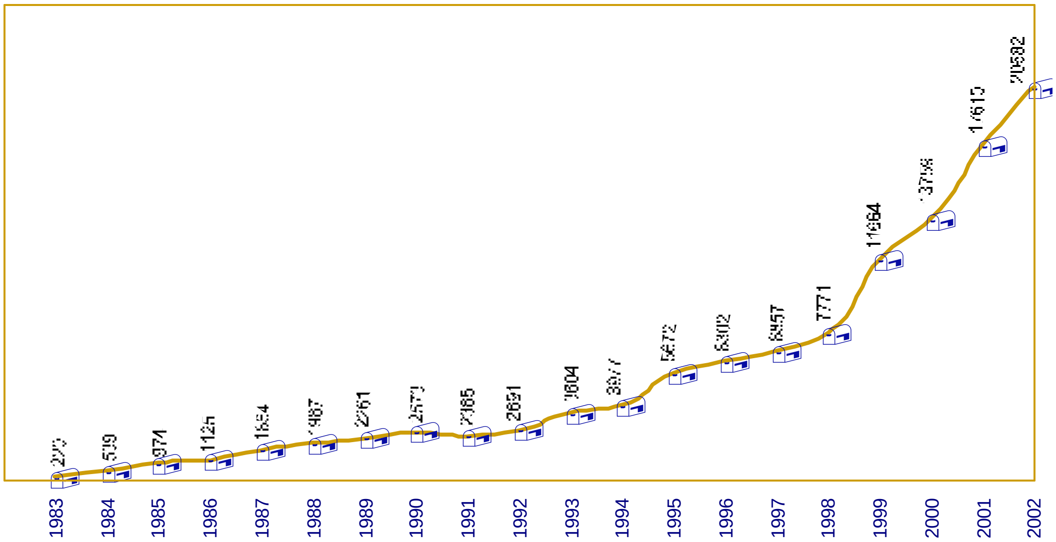
Fgure 7.1: Trend in the number of commercial connections: 1983-2002



Source: Compiled by the authors based on last twenty years' (1983 - 2002) MIS Reports obtained from REB (all data relate to the month of June of the relevant year)

In terms of consumption (power) of electricity (MWH per month), the commercial units show 94-fold increase during the last twenty years: from 220 MWH (per month) in 1983 to 20,682 MWH (per month) in 2002 (Figure 7.2). As usual, with the rise in the number of consumers, the consumption (MWH) depicts sharp upward trend. The sharp rise in both the number of consumers and consumption has been recorded especially during the last five years.

Fgure 7.2: Trend in the MWH consumed by commercial: 1983-2002
(this month)



Source: Compiled by the authors based on last twenty years' (1983 - 2002) MIS Reports obtained from REB (all data relate to the month of June of the relevant year)

7.3. CHARACTERISTICS OF SAMPLE UNITS

Of those surveyed, 88.3% of the electrified and 52.5% of the non-electrified retail shops were attached to market place while 91.5% of electrified and 50% of the non-electrified wholesale shops were of same nature. The remainders of both the categories were detached to market places (Table 7.1). Wholesale shops appeared more attached to marketplace than retail shops - which is quite natural because of the nature of trade. The retail shops that were surveyed were mainly grocery, stationery, confectionery, and pharmacy, again, wholesale shops were mainly grocery, stationery, and drugstores. No wholesale drugstores were available in the non-electrified region of the surveyed area (Table 7.3). There were few shops in the electrified area where the shops were not electrified. On closer examination, it appeared that, these shops are mainly disconnected from the service as they failed to pay the dues or follow PBS norms.

Majority of the retail shops (57.4%), that were surveyed, both of electrified (53.2%) and non-electrified (69.8%) were established during 1991-2000. Similar is true for wholesale shops of both the areas. There were retail and wholesale shops particularly in the electrified areas, which were established before 1980s. Therefore, there are shops in our sample, which is at least 22 years old to shops, which is of recent (2001-2002) origin (Table 7.4).

66% wholesale and 74% of retail shops got electrified after the year 1989 (Table 7.6). On the other hand, it appears that the areas adjacent to the shops got electrified much earlier (Table 7.7) but the adoption of electricity was slower in initial stages but got momentum after sometime.

About 55% of the surveyed retail shops and 80% of the wholesale shops were electrified for at least five years and above. On the other hand, 45% of the retail shop and 20% of wholesale shops were electrified for less then five years (Table 7.8).

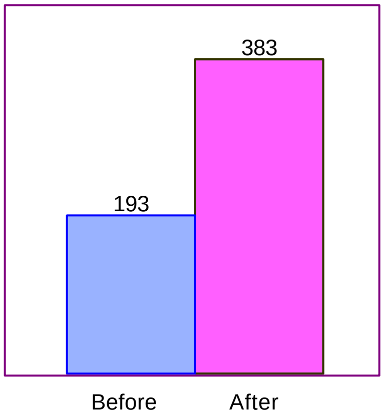
7.4. USE AND IMAPCT OF ELECTRICAL APPLIANCES

Electric bulbs, tube-lights, electric fans, TV, radio, cassette players and refrigerators are some of the electrical equipment that are being used by both retail and wholesale shops. 91.8%, 81.5%, 80.6% of electrified retail shops reported to be equipped with fan, tube-light and electric bulb respectively (Table 7.9). The trend is similar for wholesalers too. On the other hand, hurricane lantern, indigenous lamp, indigenous fan and radio appear to be widely available equipment with retailers and wholesalers of non-electrified areas. Some of these equipment are used in non-electrified shops and are powered by batteries of different types (Table 7.9). The shopkeepers of electrified region were asked as to how the equipment is contributing to their business. They observed that bulbs and tube lights make the shop attractive and transparent; TV, Cassette player and Radio attracts potential customers. Those shopkeepers who do not have access to electricity, right at this moment expressed similar perceptions.

A shopkeeper in a focus group discussion drew an analogy between potential customers to electrified shops with insects to light. He philosophized *'as insects are attracted to lights, same is true for humans — lumen is brighter, attraction is stronger!'* On effect of electric lights, one shopowner observed *"(when) darkness is around, customers and potentials are not attracted. Moreover, during load -shedding, it is very difficult to locate items and serve the customers. Particularly difficult to run business in hot and humid times of the year when electric fans can not be plied".* Another shopowner quipped, *"customers prefer those shops which has got electric fans".*

About 20% of the electrified retail shops have refrigerator in the shop (Table 7.9). Those possessing fridge in their shops, observed that fridge is used for variety of purposes ranging from 'preservation of goods' to 'attracting customers' (Table 7.10). Mainly, soft drinks, milk, youghart, Ice-cream, chocolate, sweets etc, are kept inside the fridge (Table 7.11). About 34 of shops that reported having fridge has got the same right from the beginning of the shop (Table 7.12). The shopkeepers observed that they are able to stock and sell stuffs that were either impossible or difficult before fridge i.e., electricity. Our estimate shows that while before electricity i.e. fridge, their earning due to fridgeable item was daily on an average Tk. 193, now they are able to earn Tk. 383 after there is electricity i.e., fridge (Figure 7.3). It appears that earning has doubled as a result of fridge i.e., electricity. 75% of those who has got fridge observed that they were not used to sale those stuffs which has been made possible by fridge (Tables 7.13 and 7.14). Electricity or fridge has either made selling some of the stuffs possible or facilitated the process of selling. Moreover, it has been reported that space inside the fridge is sometimes rented out to those shopkeepers who are yet to afford a fridge.

Figure 7.3: Change in average daily earning due to fridge: Retail (in Tk.)

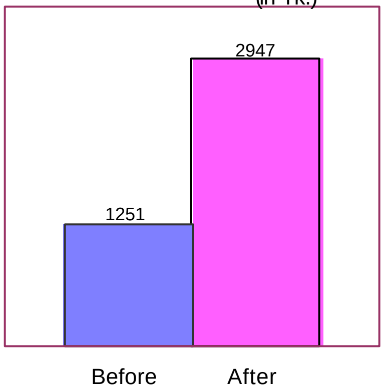


Source: Table 7.13

7.5. IMPACT ON BUSINESS TURNOVER

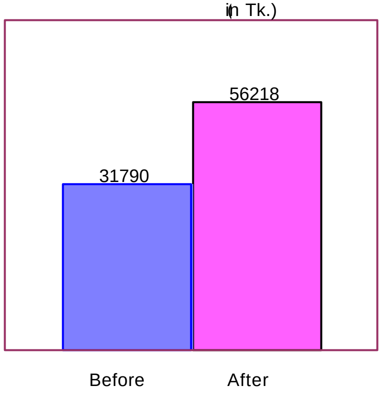
Almost 80% of the shops that were surveyed came into existence after the area got electrified- the relationship between availability of electricity and cropping-up of shops is evident here (Table 7.15); and the shop owners who had shops before-there-was-electricity, opined that, among others, business was dull in those days compared to now (Tables 7.15 and 7.16). They were asked as to how much money they used to make daily before there was electricity and how much they are making now. They observed that, in the past they used to make Tk. 1,251 daily which is now approximately Tk. 2,947 i.e. a 2.36 times increase in daily sales with electricity in the shop (Figure 7.4). The shop owners implied that this staggering change is mainly because of electricity and concomitant factors. The shopowners who had shops in the area before-there-was electricity observed that their monthly sale was average Tk. 31,790 before electricity while the same is Tk. 56,218 now (after electricity) i.e. a 1.77 times increase in monthly average sales after electricity in the shop (Figure 7.5). Significant increment is also reported here that corroborates with daily figure (Table 7.17) and in line with the stated contribution of fridge (Table 7.12).

Figure 7.4: Extent of daily sale before and after electricity: Retail (in Tk.)



Source: Table 7.17

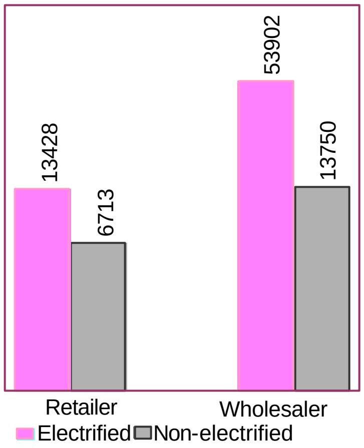
Figure 7.5: Extent of monthly sale before and after electricity: Retail (in Tk.)



Source: Table 7.18

Average sale in a week in electrified retail store is Tk 13,427 while that in non-electrified store its Tk 6,713. On the other hand, the same for electrified wholesaler is Tk 53,902 while that for non-electrified is Tk 13,750. (Figure 7.6). It appears that there is two-fold difference between electrified and non-electrified retailers while the difference is four-fold for wholesalers. The difference is significant and a substantial portion of it can be assigned to electricity. However, the possible reason for four-fold growth of wholesalers may point to the fact that, as a result of electricity, as stature and style of business has undergone a massive change, more business opportunities has been grabbed. This robustness of business is not reflected though in Table 7.39 wherein it appears that non-electrified wholesalers owns more shops than their electrified counterparts but it is quite possible that electrified wholesalers invested not exclusively in shop but related ventures. Nonetheless, the spectacular difference is no doubt the contribution of electricity, partly, if not fully.

Figure 7.6: Extent of weekly sale by type ofsaler by electrification (inTk.)



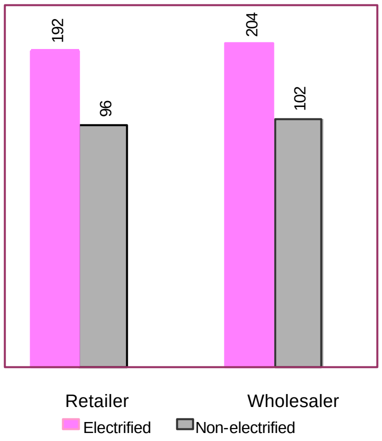
Source: Table 7.41

7.6. IMPACT ON BUSINESS HOURS

Average business hours in electrified retail shop are 14.5 hours while that in non-electrified are 13 hours. Again, the scenario with wholesale shop is 14.7 hours in electrified and 13.3 hours in non-electrified (Table 7.21). Therefore, it appears that on an average, electrified shops are at least one more hour open than their non-electrified counterparts. Again, this extra hour is in the evening which is one of the two pick-times for business, the other being morning. On the other hand, average business hours before electricity in those shops were 13.3 hrs. (retail) and 12.9 hrs. (wholesale) (Table 7.22). It appears that, on an average, electrified retail shops are an hour more open then before-there-was-electricity. Again, electrified wholesale shops are two hours more open then before-there-was-electricity (Table 7.22). As is evident from the comparison, electrified wholesale shops are more open than electrified retail shops after the advent of electricity.

These estimates and observations are well supported from the transcriptions of the FGDs where the shop-owners dwelt on these issues quite elaborately. *'On an average, one fourth of sale is in the daytime while three-fourth is after sunset'* - ratified a shop-owner. On the other hand, a shop-owner of an area where the benefit of electricity is yet to reach observed that *'had there been electricity, business hours could have been lingered in the evening'.* Retail non-electrified shops appear to be slightly more open throughout the week than the electrified shops (Table 7.34). Again, it has been found that 5.6% of electrified shops and 5.1% of non-electrified shops are not open throughout the week. As more electrified shops (Table 7.1) are attached to a marketplace, these shops are expected to follow a culture that is in vogue in the area, as a result shops are expected to follow the norms.

Figure 7.7: Length of business hours after sunset (in minute)

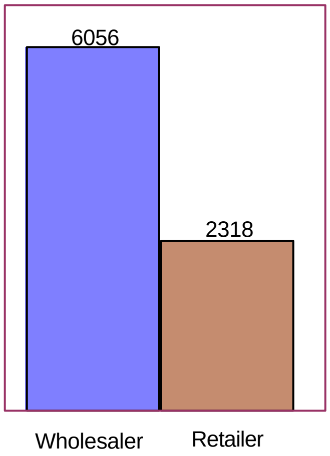


Source: Table 7.23

The respondents were asked as to how long they keep their shops open after sunset (6:30pm) (Table 7.23) and how long they used to keep their shops open when there was no electricity (Table 7.24). It appears that on an average electrified retail shops are open for 3.2 hrs. after the sunset while their non-electrified counterparts are open for 1.5 hrs. (Figure 7.7). **Therefore electrified retail shops are 1.7 hrs. more open after sunset than their non-electrified counterparts.** Again, electrified wholesale shops are open for 3.3 hrs after the sunset while their non-electrified counterparts are open for 1.7 hrs. **Therefore, electrified wholesale shops are 1.6 hrs. more open after sunset than their non-electrified counterparts.**

On question as to how long the shop used to remain open after sunset when-there-was no electricity, it has been found that, on an average, electrified retail shops were open for 1.5 hrs. while electrified wholesale shops were open for 1.93 hrs. (Table 7.24). It appears from our calculation (Tables 7.23, 7.24, and 7.25) that the retail shops are open for **extra** 108 minutes, while the wholesale shops are open for **extra** 97 minutes. It had been reported elsewhere and in focus group discussion that sale is brisk in the evening, particularly after sunset. Therefore a clear advantage is visible among the electrified shops than their non-electrified counterparts. The said advantage has been found statistically significant. Now, the reported **extra** income as a result of **extra** working hours due to electricity is weekly Tk. 2,318 for retailers and Tk 6,056 for wholesalers (Figure 7.8). One should restrain from the claim that the extra income is solely because of electricity but one can assert the fact that the extra income is substantially because of electricity. The assertion is further strengthened by non-electrified shop owners' perception about increment in sale had-there-been electricity, where the retailers observed that 64.8% would have been average increment and 46% would have been average increment for wholesalers (Table 7.28). The shop-owners from an area in a focus group discussion made a smart reply *'sales turnover has increased to the tune of 30%-50% as a result of electricity'.*

Figure 7.8: Weekly extra earning from extra time (in Tk.)



Source: Table 7.26

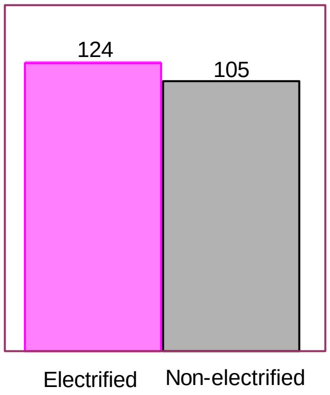
7.7. IMPACT ON VOLUME OF BUSINESS AND CUSTOMER FLOW

An estimate on the **stock in hand** of both retailers and wholesalers were tried for and it emerged that the retailers of electrified shops stocks, on an average, Tk. 107,362 worth of goods while their non-electrified counterparts, stocks Tk 27,062 worth of goods. Again, similar trend is true for wholesaler where electrified shop stocks Tk 499,915 worth of goods while that of non-electrified is Tk. 85,300 (Figure 7.9). These estimates are conservative for both electrified and non-electrified shops as the owners are reluctant to divulge financial information to anybody, nonetheless the difference between two types is quite significant pointing lower magnitude of business activities in non-electrified ships in comparison with business in electrified ones. The figure in Table 7.19 is in congruence with that of Tables 7.17-7.18 and needless to mention that higher inventory begets higher profit via higher sale.

Figure 7.9: Stock in hand with retailers and wholesalers (inTk.)

Source: Table 7.19

Figure 7.10: Average number of daily customers in electrified retail shops



Source: Table 7.33

Average **number of customers** and prospects in a day in a retail electrified shop is 123 while that in non-electrified is 105 (Figure 7.10). Statistical test yield the difference as significant. These difference along with difference in business hours (Tables 7.23-7.25) and difference in stock in hand (Table 7.18) strongly points to the magnitude of business, on the one hand, and impacts of electricity, on the other.

7.8. CAPITAL, COST OF BUSINESS, ELECTRICITY BILL, AND PREFERENCE TO HAVE ELECTRICITY CONNECTIONS

It appeared that the **source of capital** of electrified retail and wholesale shops is the owner himself. Followed by family, bank loan is the third pronounced source. These two again are pronounced in electrified than non-electrified shops (Table 7.20). Interestingly, bank loan or support-from-relatives or support- from-wife as a source of capital is reportedly absent in case of non-electrified wholesalers.

As to the cost of business, the average expenses of electrified retailers in a month is Tk. 3,515 while that for non-electrified is Tk. 1,360 - the major item being salary for electrified retailers, on the other hand, transportation being the major item for non-electrified retailer. Again, monthly expenses for electrified wholesaler is Tk. 5,752 while that for non-electrified wholesaler is Tk. 1,646; the major item being the same as retailers (Table 7.42). As electrified shops are more attached to marketplace (Table 7.1), it is quite possible that rent for those shops will be higher than non-electrified. Interestingly, electricity/fuel cost is much higher in non-electrified shops than electrified, though magnitude/volume of business is bigger in all respects, in the latter (Tables 7.19, 7.21 and 7.23). Cost of entertainment is quite higher in retail electrified than that of non-electrified; 'entertainment', being the dominant way to promote sale (Table 7.43). While expenses on salary substantiate the presence of employees (Table 7.35) in electrified shops than the expenses in transportation by non-electrified shop point to the reality of lower magnitude of business in the vicinity that compels trader to fetch their stocks. This is further supported from discussion in focus group where one trader reported, *"before there is electricity, we had to fetch services from far-flung areas but now (after electricity) the services are available at our doorsteps".*

Average **monthly electricity bill** paid by the retailers is Tk. 295 and that by wholesalers is Tk. 397 (Table 7.27). 100% of non-electrified shop owners expressed their desire to get electricity connection (Table 7.29). Perceived gain from electricity connection (Table 7.30) is 'more customers begets more sale and more profit'. All respondents feel that investment for having electricity connection is worth from business point of view (Table 7.31). One of the shopowners from non-electrified region observed - *"had there been electricity, variety and dimension of business could have been expanded. Some businesses depend solely on electricity like photo-studio, photocopier, phone-fax. On the other hand, some businesses like restaurant, barbershop and tea stalls are greatly profited by electricity. We are not able to exploit those opportunities".*

On **preference to have electricity connection,** 58% observed that they will prefer to have connections simultaneously both in home and in shop and 39% to have in shop alone, a few cases were there who would prefer connection in home alone (Table 7.32).

7.9. IMPACT ON SALES PROMOTION AND BUSINESS DIVERSIFICATION: SPECIALTY STORES, MEDIA EXPOSURE, POSSESSION OF CELLPHONE

Variety of ways are taken to promote sale and are more taken resort to by the electrified shop-owners than non-electrified — be it retailers or wholesalers (Table 7.43). It appears that retailers use sales promotion efforts more than wholesalers. Again, electrified retailers use more promotion efforts than non-electrified retailers. Still further, "well behaviour with customers" has been mentioned by electrified retailer-not by electrified wholesalers, not to speak of non-electrified retailers or wholesalers. It appears, among others, that as a result of electricity traders of electrified shops have been able to take advantage of some ways/methods which otherwise could not have been possible. A professional approach by electrified trader toward business is quite pronounced here.

As an indication of state of formation of specialty stores, about 14% of the drugstores were are found to be equipped with fridge (Table 7.44) and 43% of the pharmacists are of the view that at least 10% of their sale is due to fridge. However, there are others, 14.3%, who even claimed that 60% of their sale is due to fridge (Table 7.45). Drugstores usually place life-saving drugs, vaccines for human being and animal, and medicines, which is advised by the manufacturers 'to be stored in cool dry place' - in their fridge. As a result, it is quite possible that some stores may gain 10% of their sale due to fridge while others may gain as high as 60%. The variation in sale appears to be mainly caused by the existence of poultry and cattle farm and heightened income-generating-activities by local and national NGOs.

Exposure to media, be it electronic or print appears to be more with retailers of electrified region than non-electrified. However, listening to radio is higher with non-electrified retailers. Interestingly, non-exposure to media is quite prominent too in both the types of trader (Table 7.37). Again, reading newspaper is substantially higher in electrified shop, pointing, among others, to the status of literacy.

On question as to how media exposure is helpful to business, retailers' of electrified shops are found to be able to *use* information from TV while their non-electrified counterparts appear to be *watching* TV. Roughly speaking, processing of information is more by the electrified retailers than non-electrified. Though it has been reported that Radio is more listened to by non-electrified retailers (Table 7.37) but opinion on Radio as a source of information is found to be more pronounced by the electrified retailers than non-electrified. One may tend to conclude that listening to a piece of information is not sufficient but using the same is necessary and, on that count, electrified retailers score higher. Likewise, newspaper is more read by the electrified retailer but opinion on the same has more been forwarded by non-electrified retailers (Table 7.38).

On responding as to whether there are shops other than this, no striking difference between electrified and non-electrified retailers is available but quite a difference is available with wholesalers of non-electrified establishments (Table 7.39). It appears that non-electrified wholesalers own more shops than their electrified counterparts.

Fourteen percent of the electrified retailers **possess a cell-phone** while 3.4% possess the same in non-electrified shop (Table 7.40). Possession of cell-phone is strikingly higher among electrified retailers pointing to their need for information and network.

7.10. IMPACT ON EMPLOYMENT

On question as to who usually operates the shops (Table 7.35), about 22% in electrified and 42% in non-electrified shops reported to run their shops by themselves. About 35% of electrified retail shop is run with the help of employee but corresponding figure for non-electrified shop is only 14%. While 65% of the electrified retail shops are operated by family persons, it was 85% for the non-electrified shops (Table 7.35). It can be concluded that while running business is more a one- man- show in non-electrified shop the same is not true for electrified shop where formal (employee) and informal (family assistance) support is taken resort to. This sort of formal and informal support is presumably needed when the magnitude of business is relatively higher.

On employment in retail shops, 36% shops in electrified region are found to have 2.45 persons on an average as employees, while 15% shops in non-electrified region are found to have 1.71 persons as employees. Our estimates based on survey findings show that there are 86 paid employees per 100 electrified shops, and the same is only 25 per 100 non-electrified shops. This implies that the number of employees is 3.44 times higher in electrified shop than non-electrified—again pointing toward higher magnitude of business. Statistical test further validate the difference. Employment of female is negligible, but slightly higher in electrified shop than non-electrified (Table 7.36).

7.11. CONTRIBUTION OF ELECTRICITY TO NATIONAL SALES TURNOVER OF RETAIL AND WHOLESALE SHOPS: SOME ESTIMATES

It is not an easy task to estimate the actual contribution of electricity on the sales turnover of commercial activities. The task is daunting because of lack of information about the relevant parameters needed to perform such estimation. However, based on our survey findings we know the following upon which an attempt has been made to estimate contribution of electricity on sales turnover:

1. The total number of shops in Bangladesh is 1931,434 (Section 7.2)
2. The total number of shops using RE connections by retail and wholesale (Union survey findings) is 456,528 (Section 7.2)
3. The ratio of retail and wholesale is 26:I (Section 7.2)
4. The ratio of electrified and non-electrified for retail is 70 : 30 (Union survey findings)
5. The ratio of electrified and non-electrified wholesale is 80 : 20 (Union survey findings)
6. Average weekly sales turnover of retail and wholesale by electrified and non-electrified (Table 7.4).

In estimating the national figures, the relevant values obtained in the present survey were applied, as appropriate. Our estimates pertaining to the contribution of rural electricity on sales turnover of retail and wholesale shops are furnished below in Tables 7.1 and 7.2 which reveal the following:

1. In case of electrified **retail shops,** rural electricity's contribution to the **additional** sales turnover is 34.51% and the same to the **overall** sales turnover is 17.26% (Table 7.1)

2. In case of electrified whole sale shops, rural electricity's contribution to the **additional** sales turnover is 15.08% and the same to the overall sales turnover is 11.23% (Table 7.2).

3. For overall Bangladesh, the total annual (2001) sales turnover of retail and wholesale shops is Tk.1274.1 billion of which RE connected shops' share is Tk.301.2 billion i.e; RE connected shops share 23.64% of the total annual sales turnover of all shops in Bangladesh (Table 7.2)

4. Most importantly, out of the total annual (2001) sales turnover of retail and wholesale shops in Bangladesh (Tk.1274.1 billion) rural electricity's share is Tk.174.9 billion, i.e.; rural electricity's contribution (through commercial connections) to the national overall annual sales turnover of retail and wholesale establishments is 13.72%.

Table 7.1: Estimated sales turnover of retail and wholesale shops:2001

Type of shops	Last week's sale (in Tk)[a]		Difference(s) in last week's sales between electrified and non-electrified retail and wholesale Shops (in Tk.)	Weekly additional sale as a result of extra hours due to electricity (Tk/week)[b]	% additional sales turnover attributable to electricity	% total sales turnover attributable to electricity
	Electrified	Non-electrified				
Retail	13428	6713	6715	2317.68	34.51	17.26
Wholesale	53902	13750	40152	6055.56	15.08	11.23

Note: [a] Last week's sale figures are information taken from Table 7.41.
[b] Survey data, Table 7.26

Table 7.2: Annual sales turnover of retail and wholesale shops. Overall Bangladesh and RE connected shops (2001)

Type of shops	Total shops: Bangladesh			RE Connected Shops				
	No. of shops	Annual Turnover per shop (in million Tk)[d]	Annual turnover: all shop (in million Tk)	No. of Shops	Annual Turnover per shop (in million Tk)	Annual turnover: all shop (in million Tk)	% sales turnover in electrified shops attributable to electricity	Amount of Annual sales turnover of electrified shops attributable to electricity (in million Tk)
Retail:								
Electrified	1301929 [b]	0.698	908746.40	307734	0.698	214798.3	17.26	1566849.6
Non-electrified	557970 [b]	0.349	1947731.5	131886	0.349	46028.2	0	0
Total	1859899 [a]	0.593	1103477.9	439320	0.593	260826.5		
Wholesale:								
Electrified	57228 [c]	2.803	160410	13526	2.803	37913.4	11.23	18014.1
Non-electrified	14307 [c]	0.715	10229.5	3382	0.715	2418.1	0	0
Total	71535 [a]	2.385	170639.5	16938	2.385	40331.5		
Grand Total:	1931434	0.66	1274117.4	456528	0.66	301158		174863.7

Note: [a] Estimates presented in Section 7.2 (retail: whole sale = 26 : 1)
[b] Retail electrified: non-electrified = 70 : 30 (survey finding)
[c] Wholesale electrified: non-electrified = 80 : 20 (survey finding)
[d] Considering 52 weeks in a year (survey findings available for one week: Table 7.41)

7.12. CONCLUSIONS

1. Of those surveyed, as compared to the non-electrified, electrified shops are more attached to market and wholesale shops are all the more attached to marketplace. In some cases availability of electricity has given rise to constellation of shops, on other cases, already existing constellation of shops have been served with electricity.

2. Quite a number of electrical appliances are used in the shops and they are found to be profitable. Fridge is spectacular in its contribution, both financially and emotionally.

3. Business turnover be it daily, weekly or monthly for electrified retail shops are more than double than that of non-electrified. It is four times higher for electrified wholesale shops as compared to non-electrified wholesale shops. Similar is true for volume of business, business hours, volume of customers and employment. Generally, the traders of electrified areas appear more vibrant than those of non-electrified. Sometime electricity appear as ‘world-view’, as an ‘outlook’, as ‘status symbol’ and all pervasive 'source of power’. More professional approach toward business is visible among electrified traders than non-electrified.

4. Those traders who are yet to get the benefit of electricity are ready to invest for electricity as they think it worth from the business point of view.

5. Electricity has been able to contribute 13.72% of total business turnover of retail and wholesale establishments in Bangladesh.

6. As there is clear impact of electricity on trade and business with presumable multiplier effect, electricity should be made more available in rural areas.

7. Cost-benefit considerations at a given point in time in the short-run may not be much encouraging but given the longer and sustainable benefit of electricity with multiplier effect – investment in generation and distribution of electricity is strongly recommended.

8. Customer care for commercial connections on the part of REB is not adequately praiseworthy. The approach of REB towards commercial connection holders should be more customer-oriented, and toward that the relevant management part of the PBSs need to be made more proactive.

9. Those who are yet to get electricity have been found to use diesel generators for lighting and other purposes. REB can think of better-options, other than electricity, for them.

10. Latent demand for electricity is there but effective demand is yet to emerge. REB can think of networking with local organizations, associations to translate latent demand into effective demand.

CHAPTER 8

IMPACT ON LOCAL GOVERNANCE AND DEMOCRATIZATION

8.1. INTRODUCTION

Recognizing that good governance, economic progress and poverty reduction are directly linked, Bangladesh requires commitment to the pursuit of greater transparency, accountability, the rule of law and elimination of corruption from all spheres of public life. In the Government's strategy, a broad consensus on the need to improve governance exists along with the recognition that poor governance is a strong impediment to poverty reduction efforts. To reduce poverty, different types of development interventions must be designed and implemented. This sort of interventions could be highly successful if the "Best Actors" of human governance can be involved in local development. Main actors for human governance include individuals, the community, civil society organizations, media, private sector, local institutions (including Local Government Institutions), state and international organizations. Local governance can contribute to the required scaling up of the rate of poverty reduction through enhancing the developmental choices available at the local level, and a better inclusion of all social groups in these choices. It is assumed that a country or a region with high economic, political and civic governance would also have high human development. It is more likely that good governance will ensure equitable resource allocation to the poor and powerless.

The strategy to promote good governance has five critical dimensions: (a) strengthening the core institutions of accountability, (b) building civil society, (c) decentralization to bring government closer to the people, (d) making public administration more effective and efficient, and (e) mobilizing the national efforts to bring about the needed reforms[92>].

Good governance hinges on having in place mechanisms that will make the concerned institution accountable to its members in a way that ensures the equitable treatment of all its members–rich and poor. This requires, firstly, respect for the rule of law, based on an honest and equitable system and effective law enforcement; secondly, a fair and open system for contestation and the periodic election; thirdly, transparency; fourthly, arrangements to permit stakeholders to be consulted and to participate in decision-making that directly effects them; and fifthly, responsive officials who recognize they hold office to serve the members. It has been realized during public consultation and group discussions that the PBS members have respect for the rule of law; in PBS there exists a fair and open system for contestation and the periodic election; transparency in operations and management of PBS; there is arrangement to permit stakeholders to be consulted and to participate in decision-making and responsive officials are discharging their duties to serve the PBS members i.e. the owners of PBS.

Students of schools and colleges are made aware of PBS norms and practices and made familiar about what they can derive out of electric power. In addition, there is one Village Advisor in each electrified village, who volunteers to get training regarding PBS policies. The need for participation to up keep PBS standard brings immense benefit to PBS management and to the PBS consumers equally. PBS also assumes responsibility to make consumer members aware about undergoing safety measures during natural calamities, publish leaflets on issues like peak hour restriction, tariff refixing, scheduled power outage etc. In addition, as for these motivational

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[92>] The World Bank, 2002, *Taming Leviathan: Reforming Governance in Bangladesh*, p. ix.

activities the PBS members are aware of their right to be served better by the PBS and respectful to their obligation of participation.[93>]

Voting for election of their representatives, i.e., PBS Director, in a free and fair environment develop the democratic practices of the population in a PBS area. This practice, by itself, facilitates strong sense of discipline among the PBS members. Moreover, electricity facilitates people's participation in political as well as local governance related activities. People spend longer period in union council, clubs, cooperatives and *samities* and strongly participate in local level decision making since electricity created congenial environment for political and social gathering, community and courtyard meeting.

8.2. PBS MANAGEMENT, BOARD FUNCTIONS AND ROLE OF ELECTED DIRECTORS IN PBS MANAGEMENT

A PBS is a democratic, decentralized and autonomous organization where the member consumers enjoy equal opportunities and are entitled to exercise their equal rights. The strict adherence to transparency, accountability and the unflinching support of the GOB, donors and the people associated with the program has set a high level of standard in the excellency of work. PBS members elect a Board of Directors consisting of a maximum of 15 members. Each year one third of the Board of Directors are elected and each Director holds office for tenure of three years. To represent the interest of the womenfolk of the PBS, the Board of Directors nominates a maximum of three Lady Advisors to the Board. The primary functions of the Board of Directors is to set policy instructions for healthy operation and management of the PBS and to ensure that the policies are properly implemented by the management…Interrelationship between the Board of Directors and the Management can be crudely compared with two organs of a government viz., the Parliament and the Cabinet. While the Board Directors formulates rules and policy instructions for the operation of the PBS, the management carryout the task of implementing those rules and policy instructions[94>]. The Board regularly holds a monthly Board meeting and if situation demands they also hold special Board meetings.

There are two main institutional elements in the rural electrification program. One is Rural Electrification Board (REB) and the other one is Palli Biddut Samity (PBS). REB is entitled to operation of generation, transmission and electric distribution network. The function of REB is to establish, develop, monitor and provide technical assistance to PBS. Palli Biddut Samity is a rural electric society formed on the cooperative concept. Each PBS has a local board constituted by elected area ('elaka') representative. This board oversees PBS affairs at policy level, planning and control. Being an electric distribution unit, each PBS has its own organogram, where the General Manager is the Chief Executive. Each PBS is managed to its requirements as per number of customers by various departments, e.g., engineering, finance and administration, and member service. The PBS has its legal entity and manages all aspects of an electric distribution unit e.g. operations and maintenance, commercial, consumer connection and consumer-member relation.[95>]

[93>] Islam, Syed Nurul, *Metering, Billing and Collection: Participation and Motivation*, paper presented in the workshop on "Rural Energy Utilities Meeting Rural Electric Needs in South Asia-The Bangladesh Experience", May 8-10, 2001, Dhaka.

[94>] Habib, Ahsan, *Organizational Structure of PBSs Board/Management Interrelationships Methods to Ensure Transparency*, paper presented in the workshop on "Rural Energy Utilities Meeting Rural Electric Needs in South Asia-The Bangladesh Experience", May 8-10, 2001, Dhaka.

[95>] Samad, M.A., *Introduction to the Bangladesh Rural Electrification Program*, paper presented in the workshop on "Rural Energy Utilities Meeting Rural Electric Needs in South Asia-The Bangladesh Experience", May 8-10, 2001, Dhaka.

The five major functions of the Board are as follows[96>]:

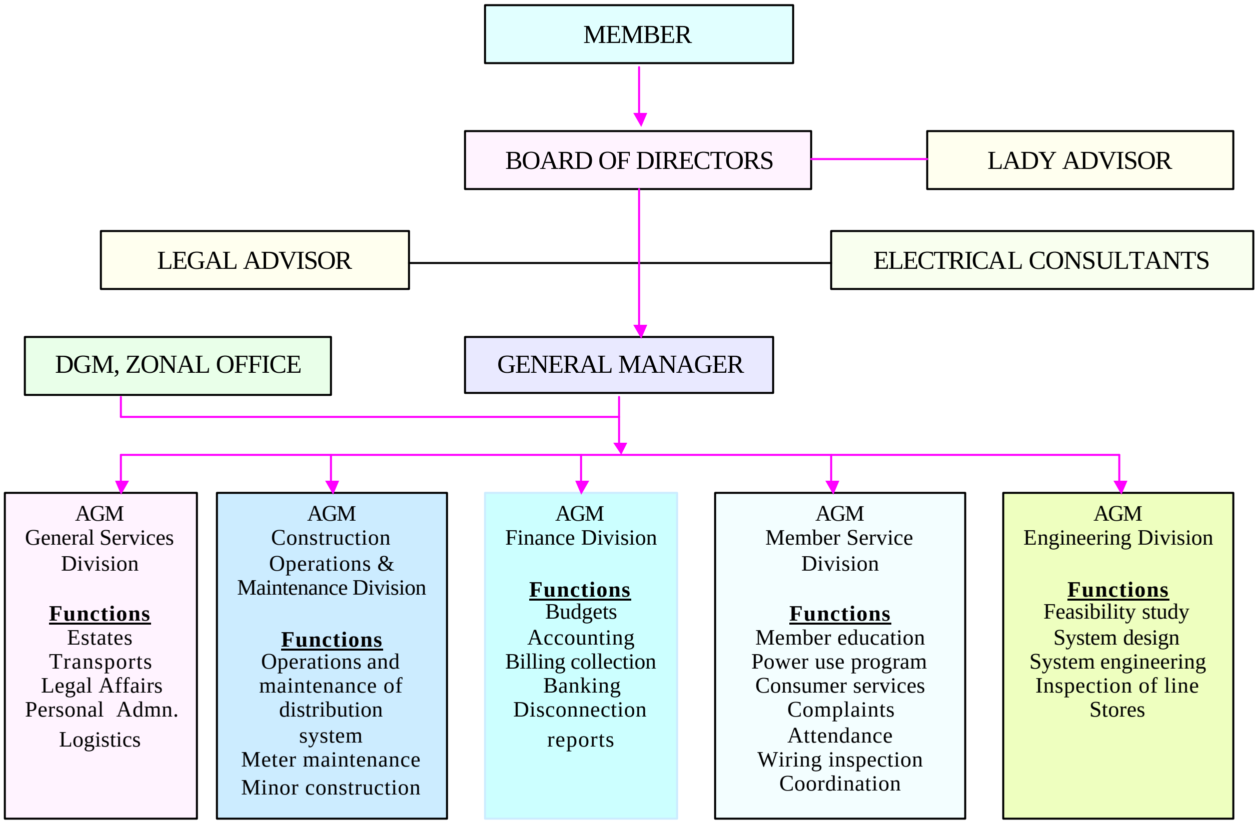
Five major functions	Specific functions
1. Establish and maintain legal entity	• Registration and Bye-laws • Make legal contracts • Defend, protect legal rights
2. Act as trustee of member's interests with respect to	• Soundness of investments • Security of assets • Continuity of enterprise • Quality of service • Prestige and good will • Character and personality of the organization
3. Plan with respect to	• Viewpoints • Objectives • Goals • Politics • Major facilities • Resources • Board and annual meetings
4. Provide operating requirements	• A qualified General Manager • Adequate authority for General Manager • Financial resources in terms of cash or credit • Member support • Community support • Productive Board meetings
5. Measure and control	• Prevent unauthorized actions • Receive, review adequate reports • Set strategic points for warning signals.

Therefore, the functions of PBS Board of Directors include generation, production, manufacturing, purchasing, acquisition, accumulation and transmission electric power and energy, and to distribute, sell, supply and dispose of electric power and energy to the *samity* members, to governmental agencies and others; administer and guide the business and affairs of the *samity*; formulate plans, adopt policies, promulgate rules and Bye-Laws for the management, operations and conduct of the business affairs of a *samity*; fix retail rate charges for sale of electricity; on behalf of the *samity*, execute agreements, contracts, deeds and other legal documents, with the Power Development Board. [97>] These functions of PBS are performed through the management structure of PBS. The management structure of a PBS is shown below to understand the organizational structure and elected representatives' position in PBS management:

[96>] Habib, Ahsan, *Organizational Structure of PBSs Board/Management Interrelationships Methods to Ensure Transparency*, paper presented in the workshop on "Rural Energy Utilities Meeting Rural Electric Needs in South Asia-The Bangladesh Experience", May 8-10, 2001, Dhaka.

[97>] Rural Electrification Board, *Rural Electrification Board Bye-Laws (revised, 1992),* Dhaka, p.8.

Figure 8.1: Functional Chart of a PBS[98>]
(At Full Operation)



8.3. MEMBERSHIP OF PBS

Typically, the poor have weak social networks–they lack social capital–and therefore tend to be excluded from mechanisms that would allow their voices to be heard. Social capital with those features of social organizations such as trust, norms and networks that can improve the efficiency of society by facilitating coordinated actions[99>]. Social capital extends people's freedom by creating institutional structures that in turn creates capabilities to exercise choice.

The fundamentals of PBS concept is based on participation or involvement of all classes of people of the community irrespective of age, financial position, social status and educational attainment in the utility. It is all through a participatory program since day one of its offing and continues its operation every day only through this spirit. During formation and organizational stage, the importance and benefits of electrification is explained along with the importance of participation by an individual in the formation of an electric co-operative. The members are made aware of his participatory role through which he acquires knowledge about how he is going to be an owner and caretaker of the co-operative without risking any cash. The more the

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[98>] Habib, Ahsan, *Organizational Structure of PBSs Board/Management Interrelationships Methods to Ensure Transparency*, paper presented in the workshop on "Rural Energy Utilities Meeting Rural Electric Needs in South Asia-The Bangladesh Experience", May 8-10, 2001, Dhaka.

[99>] Putnam (1993) (with Robert Leonardi and Rafaella Y Nanetti*): Making Democracy Work: Civic Traditions in Modern Italy,* Princeton, New Jersey, Princeton University Press.

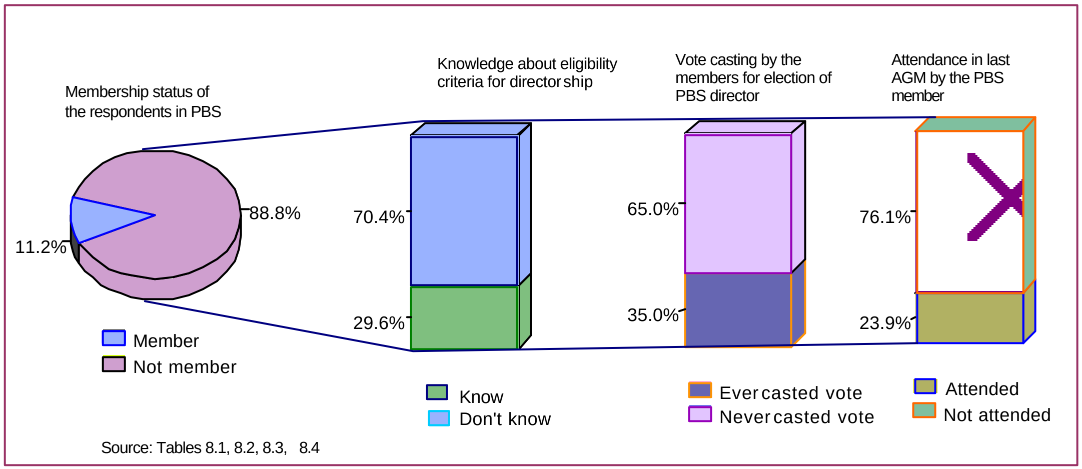
participatory role is played by the members, the more is the benefit awaiting on management and the members as well. The members can help the co-operative in maintaining a democratic standard by participating in election of office bearer of the PBS Board, where he has option to vote for some one whom he thinks suitable to up held the cause of PBS and the community. The members so voted to held office acquires right to know about every details of PBS activities on each monthly meeting. The views expressed by the director are indirectly the opinions of the voters he represents. Moreover, each member can effectively exercise his right to know about any aspect by participating in the Annual General Meeting of the PBS. Thus transparency in administration is developed.[100>]

Respondents of the electrified villages were asked about their membership status with PBS. A large majority (88.8%) of them is member of PBS. Though rest of the respondents (11.2%) has electricity connection in their households but they are not members of PBS (Figure 8.2). Almost all the electricity users are members of PBS and the members elect the PBS Directors by direct voting so it gives them opportunity to build a social networks among the users and to have control over the mechanisms that allow their voices at the PBS management level.

8.4. KNOWLEDGE ABOUT ELIGIBILITY CRITERIA FOR DIRECTORSHIP IN THE PBS

The eligibility criteria to be a Director (highest 15 constituencies) are as follows: must be a member of PBS; at least SSC; age 30-70 years; not convicted for criminal offense; permanent residence of the area; not an office bearer of any political party; not an elected chairman/member of the local government. Mentioning about any three of these was treated as having knowledge about eligibility criteria. According to this condition, less than one-third of the PBS members (29.6%) were found to know the eligibility criteria to be a Director. More than two-thirds of the PBS members are unaware about the eligibility criteria for directorship in the PBS (Figure 8.2).

Figure 8.2: Percentage distribution of PBS members by their knowledge about eligibility criteria of directorship, status of ever vote casting and attendance in last AGM



Source: Tables 8.1, 8.2, 8.3, 8.4

Among the PBS members 29.6 percent of them know about eligibility criteria of directorship, 35 percent of them ever cast their votes for electing PBS director and 23.9 percent of them attended the last Annual General Meeting (Figure 8.2).

[100>] Islam, Syed Nurul, *Metering, Billing and Collection: Participation and Motivation*, paper presented in the workshop on “Rural Energy Utilities Meeting Rural Electric Needs in South Asia-The Bangladesh Experience”, May 8-10, 2001, Dhaka.

8.5. PARTICIPATION IN PBS ELECTION

Popular participation in local development planning, decision-making, and implementation is viewed as the most crucial element needed to efficiently link people's needs and frustrations into popular demands and thus ensure effective participation and grassroots influence over local policy-making.

The valid voters of the PBS vote for electing the PBS Director of their respective area. As for each of the areas, one Director is elected e.g., in both Serajgonj and Gopalgonj PBSs, there are 13 areas and the voters of those concerned areas elect 13 directors. Subsequently, PBS Board Directors elect the President and the Secretary of the PBS. To be a member of PBS, one consumer has to pay Tk.20. Prior to participating in the voting, one has to be a valid voter having paid all his dues.

Survey findings show that majority of the PBS members (65%) never cast their vote (Figure 8.2). Participants of a group discussion reported that the board of PBSs are not really representative in the sense that the electorates are not quite aware about the process of election. All members i.e. customers are supposed to be voters toward the election of the board but the voters are hardly notified about election schedules etc. As a result, PBSs, REB and other concerned are missing vital feedback, which could have been important. But it is known that among other activities of PBS, motivation and participation of the PBS members goes hand in hand. PBSs carry out its motivational activities to develop more participation by its members. So it can be assumed that this motivational activities will foster feeling of friendliness to help each other for accomplishing PBS's day to day business. The growing customer awareness will inevitably help the PBS members to realize the importance of participation in PBS election and consequently will increase the rate of participation in PBS election. The study team recorded some constraints of participation in PBS elections during public consultations in PBS areas arising out of such reasons as long distances of PBS election centers from the household, lack of time, transport fare.

Female FGD participants of electrified villages in Sirajgonj informed that there are many female members of PBS in their area, and these female PBS members usually attend the Annual General Meeting (AGM) and cast their votes. According to them majority of the female voters do not go to cast their votes or participate in AGMs due to their personal negligence or not realizing the importance.

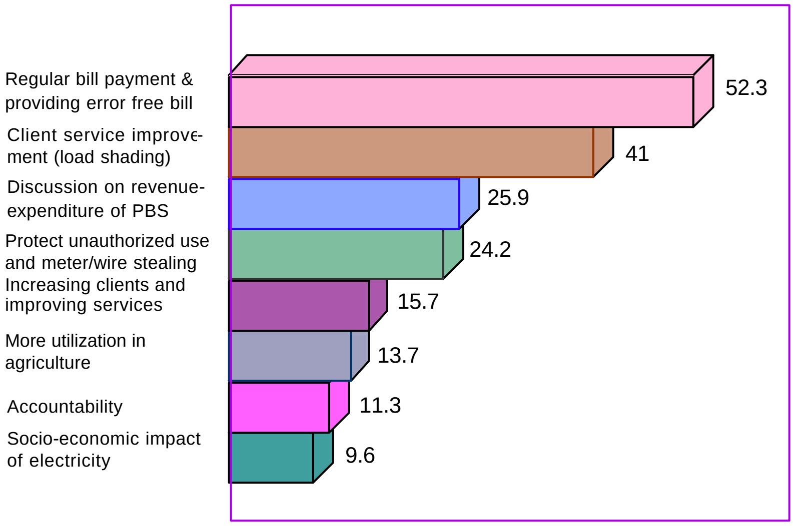
8.6. ATTENDANCE IN ANNUAL GENERAL MEETING (AGM) AND ISSUES DISCUSSED

The PBS arranges annual convention of its members where members can assemble together, exchange ideas, become aware about the future activities of REB. All PBS members have the opportunity to get acquainted with those who aspire to be elected to the board.

PBS members in the electrified villages were asked whether they attended the last Annual General Meeting (AGM). About one-fourth (23.9%) of the PBS members reported to attend the last AGM and rest reported to be absent in last AGM (Figure 8.2).

PBS members who reported attendance in the AGM were asked to mention about 3 major issues reviewed and discussed in AGM. They told about various issues, which were reviewed and discussed e.g. regular bill payment and providing error free bill (53.2%), improvement of client services i.e. load shading (41%), discussion on revenue-expenditure of the samity (25.9%), protecting unauthorized use of electricity and preventing stealing of meter, wire etc. (24.2%), increasing clients and improving services (15.7%), more utilization in agriculture (13.7%), accountability (11.3%), socio-economic impact of electricity (9.6%) and increasing communication (4.4%) (Figure 8.3).

Figure 8.3: Major issues reviewed and discussed in last AGM

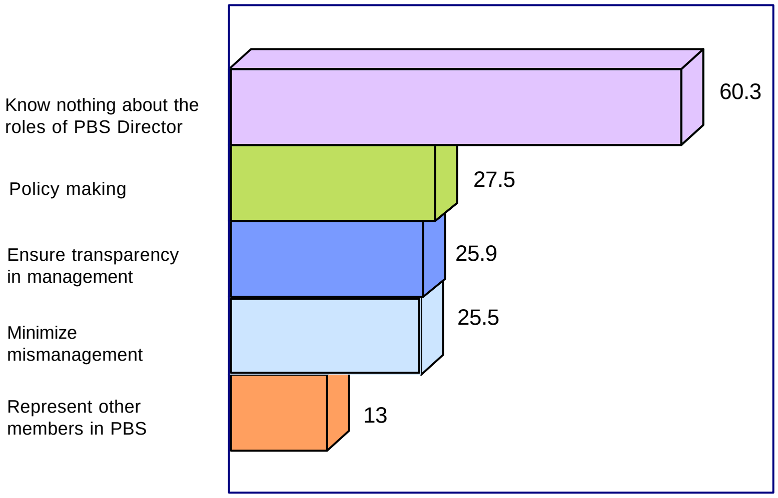


Source: Table 8.5

8.7. KNOWLEDGE ABOUT THE ROLES OF PBS DIRECTORS

PBS members were asked if they knew the roles that the elected directors played in PBS management. Majority of the PBS members (60.3%) appeared to be ignorant about the roles of the elected directors in PBS management. According to the respondents the roles of the PBS directors include policy making (27.5%), ensure transparency in management (25.9%), minimize mismanagement (25.5) and represent other members in PBS (13%) (Figure 8.4).

Figure 8.4: Knowledge on the role of Directors in PBS management

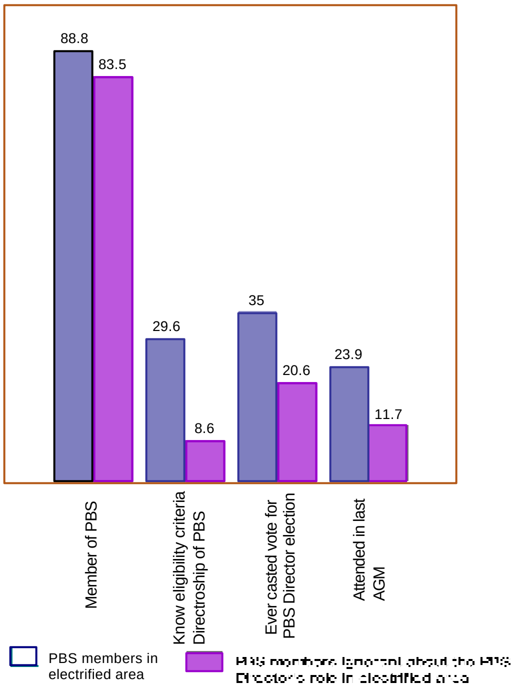


Source: Table 8.6

8.8. KNOWLEDGE OF THE PBS MEMBERS "WHO DO NOT KNOW ABOUT THE ROLES OF PBS DIRECTORS"

Among the households in the electrified villages 89 percent of the respondents are PBS members but among the respondents who do not know the roles of PBS Directors 83.5% are members of PBS. About one-third (29.6%) PBS members know the eligibility criteria of PBS directorship but only less than one-tenth (8.6%) of the PBS members who are ignorant about the roles of PBS Director know the eligibility criteria of PBS directorship. In case of ever casting of vote for PBS Director election, 35 percent of the PBS members reported to cast their vote but among the PBS members ignorant about the roles of PBS Director 20.6 percent cast their vote. The rate of attendance in last AGM by the PBS members is double (23.9%) than that of the PBS members ignorant about the roles of PBS Director (11.7%) (Figure 8.5).

Figure 8.5: Distribution of PBS members and PBS members ignorant about the role of a Director by knowledge on eligibility criteria of PBS Director, ever casting of vote for Director election and attendance in last AGM



Source: Tables 8.1, 8.2, 8.3, 8.4 and 8.6b

The participants of the group discussion with the PBS board of directors and PBS officials in Sylhet reported that the operations system of PBS reduces corruption. The Board of Directors, along with the PBS administration, takes measures against corruption. PBS usually imposes fines for any offence made by the members of PBS. PBS has the authority to fine, to disconnect permanently and to file a suit against any member if she/he commit any crime or offence in using electricity. The board of directors also oversees the activities of linemen and billing system.

8.9. ACCOUNTABILITY OF PBS TO GENERAL MEMBERS

Decentralization, by way of deconcentration, delegation or devolution, will not achieve the desired results of good governance unless public accountability in the exercise of power and authority of the local level institutions and functionaries are simultaneously introduced. In the absence of such accountability, decentralization will only bring about decentralization of corruption, oppression and harassment, which can not be desired by any rational person. The systemic endemicity of corruption in the fabric of our society is vast and found every sphere of our country. Corruption feeds on the nexus between various levels of decision makers and is compounded by the silence of the majority. So, mobilization and involvement of the PBS members and their voice against mis-governance, is also very important.

Rivalry between the Board and the Management within the limit of logic is also not undesirable. When one works as the watchdog against the other, there are likely to be less mistakes and minimum autocracy. To ensure transparency the following methods are practiced in the PBS:[101>]

[101>] Habib, Ahsan, *Organizational Structure of PBSs Board/Management Interrelationships Methods to Ensure Transparency*, paper presented in the workshop on "Rural Energy Utilities Meeting Rural Electric Needs in South Asia-The Bangladesh Experience", May 8-10, 2001, Dhaka.

- The Manuals and Policy Instruction
- Form 550 and the MIS Report
- Monitoring
- Management Audit
- Financial Audit
- Performance Target Agreement
- Annual Report and the Annual General Meeting.

Besides, public meetings on the occasion of some ceremonies, consumer education program, visit by external delegates, seminars and symposiums also act as methods of transparency. There is nothing called secret or confidential in the management of a PBS. Even the Annual Performance Appraisal of an employee is written by Supervising Officer in his/her presence and his/her signature is obtained in the report.

Majority of the respondents (53.7%) think that the elected directors are accountable to the general members. Among the respondents who think that the elected PBS Directors are responsible, reported different nature of accountability e.g. respond to the members' query (85.8%), answerable to members in AGM (60.1%), consult members before framing policy decisions (35.5%) and share audit report (17.3%) (Table 8.7).

The REB negotiates annual performance targets (PTA) with each PBS. All staff in the PBSs receive bonus or incur penalties based upon the achieved results. The PTA includes issues related with system loss, accounts receivable, consumer growth, disconnection, reconnection, load factor, power factor, preventive maintenance repair of equipment etc.[102>]

This direct and indirect participation from the members makes the PBS management more cautious in discharging their duties, indirectly this spirit help to increase capability of the PBS to serve better. Participatory relation also builds up when the PBS consumer member comes to office with some of his difficulties; since the PBS people are well trained to receive him cordially and taking a positive feeling, sort out the problem. Instead of requiring the member consumer movement to different desk, some one of the PBS is working for him while the consumer member is comfortable in his seat. Thus PBS takes into account and enlists the difficulties that bring a consumer most to visit office. This helps the PBS to formulate policy that could avoid recurrence of consumers' difficulties.[103>]

It was found from the secondary data that almost all the complains (94%) were already resolved by the PBS authority which were recorded from January to April 2002. The average number of complains were 7199.81 per PBS in 2000 and the number of complains resolved were 6987.85 (97.1%). The number of complains per PBS and the percentage of the resolved cases proves the nature of accountability to the PBS members and level of efficiency (Table 8.10).

[102>] Samad, M.A., *Introduction to the Bangladesh Rural Electrification Program*, paper presented in the workshop on "Rural Energy Utilities Meeting Rural Electric Needs in South Asia-The Bangladesh Experience", May 8-10, 2001, Dhaka.

[103>] Islam, Syed Nurul, *Metering, Billing and Collection: Participation and Motivation*, paper presented in the workshop on "Rural Energy Utilities Meeting Rural Electric Needs in South Asia-The Bangladesh Experience", May 8-10, 2001, Dhaka.

8.10. KNOWLEDGE ABOUT LOCAL BOARD MEMBER, VILLAGE ADVISOR AND ROLE OF LADY ADVISORS

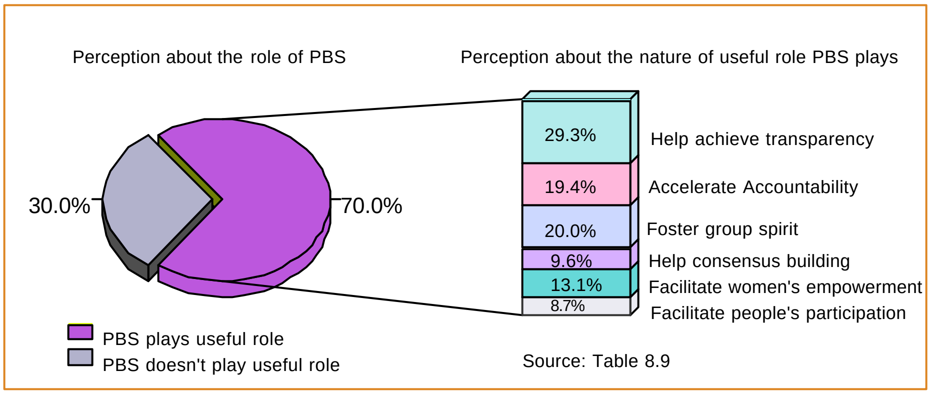
During the survey, respondents in the electrified villages were asked as to whether they knew the local Board Member and Village Advisor. About half of the respondents (42.5%) reported to know the local Board Member but only one fourth (26.1%) reported to know the village Advisor. Respondents who knew the Lady Advisor said that these advisors mobilized female member (31.7%) and collected savings from female members (22.1%) (Table 8.8).

8.11. PERCEPTION ABOUT THE ROLE OF PBS

Arrangements are in place in all PBS to organize regular motivation meeting on important location; issues like procedures for getting connection, PBS policies practices, necessity of right of way clearance, development of patience with growth of system of PBS, to increase feeling of ownership and protecting PBS property, greater understanding of load shading comes up in the discussion. Periodic meeting with government officials, community and religious leaders and people who matters in a group/society help PBS to explain the necessity for making timely payment of electric bill.[104>]

Majority of the respondents (70%) in electrified villages reported that PBS played a useful role for members. Among the respondents who reported in affirmative, said that it facilitates people's participation (64.1%), facilitates women's empowerment through appointing women as billing assistants (42.4%), helps building consensus among members with diverse opinion (43.8%), accelerates accountability (28.7%), foster group spirit (21%) and helps achieve transparency (19%) (Figure 8.6).

Figure 8.6:Perception about the role of PBS



Source: Table 8.9

[104>] Islam, Syed Nurul, *Metering, Billing and Collection: Participation and Motivation*, paper presented in the workshop on "Rural Energy Utilities Meeting Rural Electric Needs in South Asia-The Bangladesh Experience", May 8-10, 2001, Dhaka.

8.12. CONCLUSIONS

PBS system creates the opportunity to involve "Best Actors" of human governance in PBS and strengthen local governance and ensures transparency and accountability in management and operations of PBS.

Almost all the electricity users (88.8%) are members of PBS and the members elect the PBS Directors by direct voting so it give them opportunity to build a social networks among the users and to have control over the mechanisms that allow their voices at the PBS management level. Since electricity created congenial environment for political and social gathering, community and courtyard meeting, people spend longer period in union council, clubs, cooperatives and *samities* and strongly participate in local level decision making.

Less than one-third of the PBS members (29.6%) were found to have known the eligibility criteria to be a Director, about one-fourth (23.9%) of the PBS members were reported to attend the last AGM and majority of the PBS members (65%) never cast their vote. Participants of a group discussion reported that the boards of PBSs are not really representative in the sense that the electorates are not quite aware about the process of election. As a result, PBSs, REB and other concerned are missing vital feedback, which could have been important. But PBSs carry out motivational activities to develop more participation by its members. The study team recorded some constraints of participation in PBS elections during public consultations in PBS areas as a result of long distances of PBS election centers from the households, lack of time and transport.

PBS members who attended the AGM mentioned different issues reviewed and discussed there, e.g., regular bill payment and providing error-free bill (53.2%), improvement of client services i.e. load shading (41%), discussion on revenue-expenditure of the samity (25.9%), protecting unauthorized use of electricity and preventing stealing of meter, wire etc. (24.2%), increasing clients and improving services (15.7%), more utilization in agriculture (13.7%), accountability (11.3%) etc.

Majority of the PBS members (60.3%) appeared ignorant about the roles of the elected directors in PBS management. Though in the electrified villages 88.8 percent of the respondents are PBS members but among the respondents in the electrified villages who do not know the roles of PBS Director 83.5 percent are members of PBS. About one third (29.6%) PBS members of the electrified village know the eligibility criteria of PBS directorship but in the same villages only less than one tenth (8.6%) of the PBS members who are ignorant about the roles of PBS Director know the eligibility criteria of PBS directorship. In case of ever casting vote for PBS Director election, 35 percent of the PBS members of the electrified villages reported to cast their vote but in the same villages, among the PBS members ignorant about the roles of PBS Director, 20.6 percent cast their vote. The rate of attendance in last AGM by the PBS members of the electrified villages is double (23.9%) than that of the PBS members ignorant about the roles of PBS Director (11.7%) in the same villages.

Majority of the respondents (53.7%) think that the elected directors are accountable to the general members. It was found that almost all the complains (94%) were already resolved by the PBS authority which were recorded from January to April 2002. The average number of complains were 7199.81 per PBS in 2000 and the number of complains resolved were 6987.85 (97.1%). The number of complains per PBS and the percentage of the resoled cases proves the nature of accountability to the PBS members and level of efficiency.

About half of the respondents (42.5%) reported to know the local Board Member but only one fourth (26.1%) of them reported to know the Village Advisor. Majority of the respondents (70%) in electrified villages reported that PBS played useful role for members. Among the respondents who reported in affirmative mentioned that it facilitates people's participation (64.1%), facilitates women's empowerment through appointing women as billing assistants (42.4%), helps consensus building among members with diverse opinion (43.8%), accelerates accountability (28.7%), foster group spirit (21%) and helps achieve transparency (19%).

Local governance contributes to the required scaling up of the rate of poverty reduction through enhancing the developmental choices available at the local level and a better inclusion of all social groups in these choices. PBS system is one of the best existing models of local governance and decentralization in Bangladesh. The model of PBS can be replicated in other sectors of development and resource management for the better future of Bangladesh.

In order to achieve the objective of rural power supply for poverty reduction, governance system of PBSs should be improved and democratization should be the norm for implementing the PBSs' activities. The following recommendations are advanced to improve good governance of PBS and to strengthen democratic practices in PBS management:

- Good governance, economic progress and poverty reduction are directly inter-linked and good governance will ensure equitable resource allocation to the poor and powerless. To strengthen local governance and to ensure transparency and accountability the "Best Actors" of human governance e.g. individuals (PBS members and non-members), the community, civil society organizations, media, private sector, local institutions including local government organizations should be involved for development of PBS.

- The motivational and awareness activities for the PBS members, to make them aware of their rights and obligations should be strengthened because the findings of the study show that PBS members lack in awareness regarding the importance of voting in PBS elections and participation in Annual General Meetings. In addition, a small portion of the PBS members knows the roles of a PBS Director, eligibility criteria of PBS directorship and about the Village Advisors.

- Since the poor have weak social networks and they are excluded from mechanisms that allow their voices to be heard, PBS can play an important role in building trust and norms for coordinated actions to extend people's freedom and to exercise choice by creating institutional structures that in turn create capabilities.

- All the users of electricity are not members of PBS. Knowledge on the eligibility criteria of PBS directorship and rate of casting of vote for PBS Director election is much lower among the PBS non-members than the PBS members. So all the electricity users should be the members of PBS for better participation in local level planning, decision-making and implementation.

- Constraints of participation in PBS elections faced by the PBS members should be eliminated. More polling centers should be established for PBS Director elections to let the PBS members cast their votes within their reachable distances and affordable time.

CHAPTER 9

STATISTICAL INFERENTIAL ANALYSIS

9.1. INTRODUCTION

Drawing inferences and conclusions about population characteristics on the basis of sample information is the key purpose of any survey research work. However, for such purposes, scientific tools and techniques are necessary to be adopted. We have performed such tasks for the present study, derived and results have been presented in this chapter. We have mainly adopted few statistical tools appropriate for this study, namely —

a) Contingency chi-square test of association
b) Test of differences (two samples t-test, z-test, paired t-test)
c) Factor analysis
d) Cluster analysis
e) TOBIT model analysis.

The outcome of the adoption of such tools has been presented here in the above order.

9.2. CONTINGENCY CHI-SQUARE TEST OF ASSOCIATION

This is a simple statistical tool applied to identify whether some factors bear any association or not. Although, such a test does not provide magnitude and direction of relationship, it provides significance of association among various factors. This technique also helps to choose factors needed for further analysis. Thus, we have adopted such a technique for the present task and results have been discussed herein.

As for identifying existence of association between use of electricity and other factors, we have applied contingency chi-square test for some selected indicators. Such indicators have been chosen from different domains.

First of all, we set the hypotheses followed by associated tables and analyses.

Economic

Electricity is supposed to leave impact on economic conditions of its users. Thus, existence of association between economic indicators and use of electricity has been tested.

Hypothesis 1: Income level is independent of having/not having electricity

Possession of electricity	Income level (in .000 Tk)				Total
	44	45-85	85-104	105+	
Have electricity	563	404	110	303	1380
No electricity	676	279	52	104	1111
Total	1239	683	162	407	2491

At 5 percent level of significance with d.f. = 3 tabular value of $c^{2}_{5\%}$=7.8. Since χ^{2}_{cal} = 123.6 is higher than tabular value, null hypothesis of independence between two factors namely, income level and use of electricity, is rejected. Here, we have considered only net income of households, and it is revealed that a strong association exists between the net income level and the possession of electricity.

Hypothesis 2: Total capital asset is independent of having/not having electricity;

Possession of electricity	Capital asset (Tk. '000)				Total
	<200	200-400	401-800	800+	
Have electricity	303	272	337	468	1380
No electricity	491	236	202	182	1111
Total	794	508	539	6850	2491

At 5 percent level of significance with d.f. = 3 tabular value of $c^{2}_{5\%}$=7.8. Since χ^{2}_{cal} = 179.7 is higher than tabular value, null hypothesis of independence between two factors namely, Capital asset level and use of electricity, is rejected. As income level bears strong association, so is the case with asset holding.

Hypothesis 3: Carrying out of income generating activities is independent of having/not having electricity

Possession of electricity	Status of home-based work		Total
	Do home-based work	No home-based work	
Have electricity	333	1047	1380
No electricity	311	800	1111
Total	644	1847	2491

At 5 percent level of significance with d.f. = 1 tabular value of $\chi^{2}_{5\%}$=3.8. Since χ^{2}_{cal} = 4.79 is higher than tabular value, null hypothesis of independence between two factors namely, income earning activities and use of electricity, is rejected. Availability of electricity facilitates work environment.

Hypothesis 4: Self-assessed Economic status is independent of having/not having electricity;

Possession of electricity	Economic condition					Total
	Poor	Lower Middle	Medium	Upper Middle	Rich	
Have electricity	142	486	581	145	26	1380
No electricity	339	439	289	31	13	1111
Total	481	925	870	176	39	2491

At 5 percent level of significance with d.f. = 4 tabular value of $c^{2}_{5\%}$=9.4. Since χ^{2}_{cal} = 232.9 is higher than tabular value, null hypothesis of independence between two factors namely, self assessment about economic position and use of electricity, is rejected. This has a lot to do with previous test results, and this result is in coherence with previous results.

Hypothesis 5: Self-assessed economic strength of the household to meet educational expenses is independent of having/not having electricity

Possession of electricity	Very Difficult	Difficult	Not Difficult	Total
Have electricity	100	340	940	1380
No electricity	125	299	687	1111
Total	225	639	1627	2491

At 5 percent level of significance with d.f. = 2 tabular value of $\chi^2_{5\%}$=5.9. Since χ^2_{cal} = 15.8 is higher than tabular value, null hypothesis of independence between two factors namely, self assessment of economic strength to meet educational expenses, is rejected. In other words, we can say, a crucial factor like educational expense is related to use status of electricity.

Health

As use of electricity is supposed to keep impact on economic conditions, it also generates scopes for more health facilities in terms of knowledge and services. Thus, existence of association and its significance between health indicators and electricity use has been tested.

Hypothesis 6: Use of health services from competent medical personnel is independent of having/not having electricity

Possession of electricity	Use of Medically Competent Persons (MCP)		Total
	Used	Not used	
Having electricity	1706	1304	3010
No electricity	925	1205	2130
Total	2631	2509	5140

At 5 percent level of significance with d.f. = 1 tabular value of $\chi^2_{5\%}$=3.8. Since χ^2_{cal} = 87.6 is higher than tabular value, null hypothesis of independence between two factors namely, use of competent health care person and use of electricity, is rejected.

Hypothesis 7: Having knowledge on health issues, like place for ANC, is independent of having/not having electricity

Possession of electricity	Status of Possession of knowledge		Total
	Have knowledge	No knowledge	
Have electricity	1149	231	1380
No electricity	678	433	1111
Total	1827	664	2491

At 5 percent level of significance with d.f. = 1 tabular value of $\chi^2_{5\%}$=3.8. Since χ^2_{cal} = 155.64 is much higher than tabular value, null hypothesis of independence between two factors namely, knowledge on ANC facilities and use of electricity, is rejected. Such a result indicates strong association between possession of electricity and knowledge on health issues.

Hypothesis 8: Having knowledge on 3 STDs is independent of having/not having electricity

Possession of electricity	Knowledge on there STDs		Total
	Have knowledge	No knowledge	
Have electricity	316	1064	1380
No electricity	66	1045	1111
Total	382	2109	2491

At 5 percent level of significance with d.f. = 1 tabular value of $\chi^2_{5\%}$=3.8. Since χ^2_{cal} = 136.32 is much higher than tabular value, null hypothesis of independence between two factors namely, knowledge on 3 STDs and use of electricity, is rejected.

Hypothesis 9: Having knowledge on ORS preparation is independent of having/not having electricity

Possession of electricity	Knowledge of ORS preparation		Total
	Have knowledge	No knowledge	
Have electricity	1303	77	1381
No electricity	963	148	1111
Total	2266	225	2491

At 5 percent level of significance with d.f. = 1 tabular value of $\chi^2_{5\%}$=3.8. Since χ^2_{cal} = 44.89 is higher than tabular value, null hypothesis of independence between two factors namely, knowledge on preparing ORS and use of electricity, is rejected.

Hypothesis 10: Food in intake (in kilo-caloric) is independent of having/not having electricity;

Possession of electricity	Food intake in kilo-calorie				Total
	$\leq$1805	1806-2122	2123-3100	3100+	
Have electricity	285	236	672	187	1380
No electricity	268	225	499	119	1111
Total	553	461	1171	306	2491

At 5 percent level of significance with d.f. = 3 tabular value of $c^2_{5\%}$=7.8. Since χ^2_{cal} = 12.5 is higher than tabular value, null hypothesis of independence between two factors namely, caloric intake in kilo calorie (energy) and use of electricity, is rejected.

Social and Cultural

Electricity facilitates improvement in social and cultural status structure through pushing up educational and cultural levels. Thus, how far social factors are related to electricity use has been tested in the framework of contingency chi-square test.

Hypothesis 11: Study hours of children at home is independent of having/not having electricity

Possession of electricity	Study hours (minutes)			Total
	1	2	3	
Having electricity	246	688	587	1501
No electricity	306	487	255	1048
Total	552	1155	842	2549

1= <60 minutes 2 = 61 - 120 minutes 3 = 121 Hi minutes

At 5 percent level of significance with d.f. = 2 tabular value of $\chi^2_{5\%}$=5.9. Since χ^2_{cal} = 88.06 is much higher than tabular value, null hypothesis of independence between two factors namely, student study time and use of electricity, is rejected.

Hypothesis 12: Attainment of education level (years of schooling) is independent of having/not having electricity

	Years of schooling				Total
	0	<5	5 -10	10+	
Have electricity	2263	2798	1945	1274	8280
No electricity	2433	2324	1059	399	6215
Total	4696	5122	3004	1673	14495

At 5 percent level of significance with d.f. = 3 tabular value of $\chi^2_{5\%}$=7.8. Since χ^2_{cal} = 484.6 is much higher than tabular value, null hypothesis of independence between two factors namely, education level and use of electricity, is rejected.

Hypothesis 13: Desire for higher education (14 years and above) of children is independent of having/not having electricity;

Possession of electricity	More education		Total
	Desire	No desire	
Have electricity	930	450	1380
No electricity	494	617	1111
Total	1424	1067	2491

At 5 percent level of significance with d.f. = 1 tabular value of $\chi^2_{5\%}$=3.8. Since χ^2_{cal} = 107.7 is much higher than tabular value, null hypothesis of independence between two factors namely, propensity to have education and use of electricity, is rejected.

Awareness of self-right

Apart form economic, social and health impacts, electricity also keeps impact on people's awareness about their right and security in livelihood domain. Such association has also been tested using contingency chi-square test.

Hypothesis 14: Awareness about fundamental rights of women is independent of having/not having electricity

Possession of electricity	Knowledge on		Total
	Have knowledge	No knowledge	
Have electricity	1006	374	1380
No electricity	194	227	421
Total	1200	601	1801

We have considered only equality of right in terms of access to resources

At 5 percent level of significance with d.f. = 1 tabular value of $\chi^2_{5\%}$=3.8. Since χ^2_{cal} = 222.1 is much higher than tabular value, null hypothesis of independence between two factors namely, women's awareness about their fundamental right and use of electricity, is rejected. In electrified households, women have better and more access to most media like TV and Radio, so they are more informed about their rights.

9.3 TEST OF DIFFERENCES

In order to assess the impact of electricity, it is pertinent to verify how electrified areas differ from non-electrified areas in terms of relevant indicators.

In performing tests of differences, we followed a particular sequence namely, first of all, we set testable hypotheses along with associated rationale for each of four study measurement units, viz., household units, irrigation units, commercial units, and industrial units. In each case, the testable Null Hypothesis is denoted by H_0 and relevant alternative by $H_{1.}$ Beside this, in each case, test of difference in means, test of difference in paired observations, and difference test for proportions have been adopted, whichever is applicable depending on the nature of Hypothesis under consideration. Moreover, for some hypotheses, two-tailed test, and for someone's one-tailed tests, as applicable, have been adopted.

Thus, we proceed to perform testing exercises in the order mentioned above.

9.3.1 Household Units

It has been analysed in chapter 4 that, the households with electricity do differ from those without electricity in many respects. However, the differences may be minor or major depending on the nature of indicator under question. Thus, it is logical to adopt some procedure to ascertain whether such differences are statistically significant or not. This helps us to ascertain the role of electricity by dimensions.

Thus, we set testable hypotheses for different domains with justification and present test results followed by analysis.

ECONOMIC
(Income, Employment, Expenditure, Surplus, Savings and Asset Generation)

Economic-1: INCOME AND EMPLOYMENT

Rationale

Electricity provides necessary infrastructure for a broader range of income-generating activities: in terms of accessing new ventures (e.g. poultry) as well as the better operation of the old ones (like electricity operated irrigation equipment). The extended working hours in the evening enables the households, especially women, to engage themselves in home-based income generating activities like sewing, handicrafts etc. Due to the expansion of local markets in the electrified villages, the households in the vicinity (even without electricity) are exposed to increased employment opportunities compared to the households in the non-electrified villages. The same applies to the expansion of industrial base.

1. H_0 = Households with and without electricity do not differ in terms of average net income.
   H_1= Households with electricity have higher net income compared to those of households without electricity.

   This is a one tailed test. The calculated value of the test statistic which is 't' in this case is $t_{cal\ .}$=5.62 with d.f.=2068 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households in terms of net income earning. Average net income of electrified households is significantly higher than that of non-electrified household (see Section 4.3.2.1).

In this case, we have considered two types of non-electrified households, namely, non-electrified households in non-electrified villages and those in electrified villages. The above test result is for the former case. For the later case also similar test results have been obtained. Here t_{cal} ..= 4.36 which also implies highly significant difference in average net income between two types of households. In this case d.f. = 1799 and level of significance is as before.

2. H_0 = Households with and without electricity do not differ in terms of proportion of doing home-based economic activities
   H_1= More electrified households are engaged in home-based economic activities compared to non-electrified households.

   This again is a one-tailed test . The calculated value of the test statistic which is 'z' in this case z_{cal}= 4.56 Tabular value is $z_{5\%}$ = 1.65 which leads to rejection of H_0. Such result implies that electrified households are better-off compared to non-electrified households in terms of income earning activities. Such highly significantly differing results imply that presence of electricity facilitates work opportunities and conditions. Here handicraft has been considered (see Section 4.3.2.1).

3. H_0 = Households with and without electricity do not differ in time spent on business
   H_1= Households with electricity spend more time in business.

   This again is a one-tailed test. The calculated value of the test statistic which is 't' in this case t_{cal} = 1.90 tabular value is $z_{5\%}$ =1.65 which leads to rejection of H_0. Such result implies that electrified households are better-off compared to non-electrified households in terms of income earning activities. Such highly significantly differing results imply that presence of electricity facilitates work opportunities and conditions (see Section 4.3.2.1).

4. H_0 = Women in the households with and without electricity do not differ in terms of average net income.
   H_1= Women in the households with electricity have more net income compared to that of households without electricity.

   This is a one-tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal} = 3.14 With d. f. = 2068 and 5 percent level of significance the tabular value is $t_{5\%}$ =1.65 which leads to rejection of H_0. Such result implies that electrified households are better-off compared to non-electrified households in terms of net income earning of women member (see Section 4.4.3).

5. H_0 = Women in the households with and without electricity do not differ in terms of employment opportunities(proportion of women doing extra work).
   H_1= Women in the households with electricity have more employment opportunities compared to that in the households without electricity.

   This is a one-tailed test. The calculated value of the test statistic which is 'z' in this case is z_{cal} = 3.73 Tabular value is $z_{5\%}$ =1.65 which leads to rejection of H_0. Such result implies that electrified households are better-off compared to non-electrified households in terms of income earning activities of women (see Section 4.4.3).

Economic-2: EXPENDITURE

Rationale

On the basis of different income base (by value and by sources), households in the electrified and non-electrified areas, supposedly differ in terms of their purchasing power. Along with the purchasing power, diverging outlook towards life brought about by electricity- both by facilitating better education through lighting (direct effect) and also by exposure to modern amenities like TV; can contribute significantly towards a different expenditure pattern between electrified and non-elctrified households.

6. H_0 = Households with and without electricity do not differ in terms of per head food consumption (in kilo calorie).
   H_1= Households with and without electricity differ in consumption of food in terms of kilo calorie.

   This is a two-tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal} = 5.66. With d.f.= 2068 and 5 percent level of significance the tabular value is $t_{5\%}$ =1.96 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households in terms of calorie intake which can also be taken as an indicator of poverty alleviation in electrified areas (see Sections 4.3.4.3 and 4.8).

7. H_0 = Households with and without electricity do not differ in terms of non-food consumption expenditure (on clothing, education, health etc).
   H_1= The expenditure on non-food items (in different categories) differs among households in electrified and non-electrified areas.

   This is a one tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal} = 9.10. With d.f.= 2068 and 5 percent level of significance the tabular value is $t_{5\%}$=1.96 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households in terms of non-food expenditure as well. This highly significantly differing expenditure pattern definitely implies more economic solvency and affordability of electrified households (see Section 4.3.4.2).

Economic-3: SURPLUS, SAVINGS AND ASSET GENERATION

Rationale

Households in the electrified areas is supposedly capable of generating more revenue surplus from production oriented activities. In addition to that increased access to information (through electronic media) as well as broader range of institutions (like NGOs) offering easier credit schemes will contribute to the process of higher annual savings and higher investment among the electrified households than the households without electricity. Higher savings and cash available in hand (due to increased access to credit) will thereby contribute to asset generation – both tangible (e.g. land) and intangible (e.g. government savings certificate) assets for electrified households.

8. H_0 = Households with and without electricity do not differ in terms of average annual savings.
   H_1= Annual savings is higher for households with electricity than that of households without electricity.

Here also we need a one-tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal} = 4.66. With d.f.= 2068 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.96 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households with respect to saving ratio which is a strong indicator of being financially well-off. Higher earning opportunities for electrified households lead to more income, more expenditure and more savings (see Sections 4.3.2.1, 4.3.4.2, 4.3.5.2).

9. H_0 = Households with and without electricity do not differ in terms of average annual investment.
   H_1 = Annual investment is higher for households without electricity than that of households without electricity.

   Like the previous case this is a one-tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal} = 6.65 With d.f.= 2068 and 5 percent level of significance the tabular value is $t_{5\%}$=1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off in terms of gaining multiplier effect due to investment opportunities (see Sections 4.3.4, 4.3.5.2, and 4.3.7).

10. H_0 = Households with and without electricity do not differ in terms of average total asset holding.
    H_1 = Households with electricity have higher asset holding.

    Asset holding is an indicator of financial security. Difference of such asset holding between electrified and non-electrified household was tested. This is a one-tailed test. The calculated value of the test statistic which is 't' in this case is $t_{cal\,..}$=3.98. With d.f.= and 5 percent level of significance the tabular value is $t_{5\%}$ = which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households in terms of average total asset. In electrified areas more earnings take place resulting in more asset holding (see Section 4.3.7).

11. H_0 = For the same household average amount of land under cultivation before and after electrification does not vary.
    H_1 = For the same household the average amount of land under cultivation is higher after electrification than it was before.

    This is the case of a paired t-test. The calculated value of the test statistic is t_{cal} =. 3.15 With d.f.= 1379 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households in terms of cultivated land area. Due to presence of electricity people are in more comfortable conditions to cultivate more land either own or leased (see Section 4.4.7).

12. H_0 = For the same household without electricity average amount of land under cultivation 5 years ago remains the same at present.
    H_1 = For the same non-electrified household average amount of land under cultivation is more at present than it was 5 years ago.

    This is also a one tailed paired-*t* test. The calculated value is $t_{cal\,...}$= 3.68. With d.f.= 689 and 5 percent level of significance the tabular value is $t_{5\%}$ =1.65 which leads to reject H_0. Electricity appears not to distinguish too much in this regard (see gini coefficients in Section 4.3.7.2).

13. H_0 = For the same household average amount of vegetable garden remains the same before and after electrification.
    H_1 = For the same household average amount of vegetable garden is more after electrification.

    This again is a case of paired t-test. At 5 percent level of significance with df= 567 tabular *t*=1.65 and t_{cal} =10.03. Thus, H_0 is rejected. Difference is highly significant. Electrified households have more land, more exposure to mass media and thus, they are more knowledgeable about food values and nutrition. So, more scopes and facilitates prompt them to practice food cultures more (see Section 4.3.7.2).

14. H_0 = For the same household without electricity average amount of vegetable garden remains the same between 5 years before and at present.
    H_1 = For the same household without electricity average amount of vegetable garden is more at present.

    This is a one tailed paired-*t*-test. The calculated value of the test statistic which is 't' in this case. t_{cal} = 16.68.With d.f.= 689 and 5 percent level of significance the tabular value is $t_{5\%}$ =1.65 which leads to reject $H_{0.}$ Such result implies that more vegetation practices are observed among people. This may be partially attributed to national nutritional campaign.

15. H_0 = For the same household with electricity average total assets remains the same before and after electrification.
    H_1 = For the same household with electricity average total assets is more after electrification.

    Like previous 4 testing cases, it is also the case of paired t-test. The calculated value is t_{cal}= 8.006. At 5% level of significance with d.f.= 689 tabular value is $t_{5\%}$ =1.65 which leads to reject H_0. Along with increase in economic activities asset building is more among electrified households and difference is highly significant between two time period (see Section 4.3.7.2).

16. H_0 = For the same household without electricity average total assets before 5 years and at present do not differ
    H_1 = For the same household average total assets is more at present compared to that of 5 years ago.

    The aforesaid statement in the previous Hypothesis testing, is reinforced by this test result. This is a paired t-test. t_{cal} = 2.84 and tabular t=1.65 at 5% level of significance with df = 689. Straightway we can reject H_0, which implies that improvement in total asset in the case of non-electrified household during last 5 years. But, one thing is noticeable that the difference is not as high as in the case of electrified households (see Section 4.3.7.2).

SOCIAL and CULTURAL (Education, health, hygiene, sanitation, access to information and awareness, mobility and security)

Social-1: EDUCATION

Rationale

Electricity enables the school going children to study in a more productive way due to the extended study hour in the evening as well as the comfort offered by electrical appliances.(e.g. fan). Thus, electricity facilitates literacy, enrolment and attainment. Along with their affordability, the enlightened outlook towards education due to media exposure contributes to their willingness in pursuing higher studies for their children, especially girl. The operation of night schools in the electrified villages can also contribute in rejuvenating the thirst for education for adult and female members as well.

17. H_0 = Children of households with and without electricity do not differ in terms of study hours at home.
    H_1 = Children of households with electricity have longer study hours compared to children in the non-electrified households.

    This is a one-tailed test . The calculated value of the test statistic which is 't' in this case t_{cal} =10.34. With d.f.= 2547 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households in terms of educational facilities for children. Children in electrified households live in better and more comfortable conditions. As a result they study more compared to children of non-electrified households (see Section 4.4.1.4).

18. H_0 = Electrified and non-electrified areas do not differ in terms of overall literacy rate (7 years and above).
    H_1 = Electrified areas have higher overall literacy rate than non-electrified areas.

    This is an one-sided z-test, z_{cal} = 6.41and tabular Z = 1.65 at 5% level of significance. A highly significant difference is observed between electrified and non-electrified households in respect of literacy position (see Section 4.4.1.2). This can be related to our previous test result that electrified households are better-off in respect of economic indicators and as a result they can naturally afford to devote more to education.

19. H_0 = Electrified and non-electrified areas do not differ in terms of adult literacy rate (15 years and above).
    H_1 = Electrified areas have higher adult literacy rate than non-electrified areas.

    This is an one-sided z-test, z_{cal} = 7.13 and tabular Z = 1.65 at 5% level of significance. A highly significant difference is observed between electrified and non-electrified households in respect of adult literacy (see Section 4.4.1.2). This can be related to our previous test result that electrified households are better-off in respect of economic indicators and as a result they can naturally afford to devote more to education.

20. H_0 = Electrified and non-electrified areas do not differ in terms of educational attainment (defined by years of schooling) – both for male and female members.
    H_1 = Electrified areas have higher educational attainment (both for male and female) than non-electrified areas.

This is a one tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal}= 16.6. With d.f.= 2068 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households in terms of average years of schooling (see Section 4.4.1.4). This again re-inforces our previous remarks that electrified households are educationally better-off. The test result shows highly significant difference between average years of schooling of households members between households with and without electricity.

21. H_0 = Electrified and non-electrified areas do not differ in terms of quality of education (defined by attendance and marks obtained) – both for male and female.
    H_1 = Electrified areas have higher educational attainment both for male and female compared to non-electrified areas.

Regarding education, quality standard is another dimension in which electricity may keep some impact. For this study we have considered examination result as an indicators of quality of education. The test has been performed for both boys and girls separately. First we present test result for boys.

This is a one-tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal} = 3.31. With d.f.= 1292 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households in terms of quality of education (see Section 4.4.1.4). As children in electrified households' study in relatively better conditions, they supposedly learn better and do better in examination.

The above assertion turns out to be more true for girls. Highly significant difference is observed in this case with t_{cal} = 5.98 and *df* = 1191 (see Section 4.4.1.4).

22. H_0 = Households with and without electricity do not differ in terms of drop-out rate (for male and female).
    H_1 = Households in electrified areas have less drop-out rate (for male and female) compared to households in the non-electrified areas.

Dropout rate is an indication of wastage or system loss in education. This has been t-tested in the present study. This is a one tailed test. The calculated value of the test statistic which is 'z' in this case z_{cal} = -1.61. At 5 percent level of significance the tabular value is $z_{5\%}$ = -1.65 which leads to accept $H_{0.}$ But, at 10 percent level for which tabular value = -1.30 H_0 is rejected. Such result implies that electrified households are better-off compared to non-electrified households in terms of continuing education(see Section 4.4.1.4). This has one-to-one correspondence with our previous test results. Economic activities and income earning is more among electrified households and thus their children have more continuation rate in education.

23. H_0 = Proportion of school-going children does not differ between households with and without electricity.
    H_1 = Proportion of school-going children is more among electrified household compared to those without electricity.

Like the above test this is a Z-test for which the calculated value is 2.29 and tabular value at 5% level of significance is 1.65. This shows a highly significant difference between two types of households (electrified and non-electrified) in result of current enrolment of children at school (see Section 4.4.1.3).

24. H_0 = Women in households with and without electricity do not differ in terms of time spent for child education (at home).
    H_1 = Women in with electricity households devotes more time (at home) in child education compared to women in the non-electrified households.

    This is a one-tailed test. The calculated value of the test statistic which is 't' in this case t_{cal} = 6.84 With d.f. = 148 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households in terms of child care in education. Women can comfortably afford to spend more time to education (see Sections 4.4.1.4 and 4.4.4).

Social 2: HEALTH, HYGIENE & SANITATION

Rationale

Electricity enables the electrified households to have improved health status due to more knowledge on issues related to health, hygiene and sanitation (through electronic media especially TV); and also because of better health care facilitated by electrical appliances like fans, refrigerators etc. The health providers can also contribute more effectively with modern appliances (machines conducting various diagnostic tests e.g. X-Ray machines) and extended working hour in the evening. Thus, it can be rationally postulated that electricity contributes to knowledge, practice and services pertaining to health, hygiene and nutrition.

25. H_0 = Women in households with and without electricity do not differ in terms of knowledge about five danger signs of pregnancy.
    H_1 = More women in households with electricity have knowledge about five danger signs of pregnancy.

    This is the case of one-tailed Z-test for which Z_{cal} = 9.8 and at 5% level $Z_{5\%}$ = 1.65. This highly significantly differing result indicates that women in electrified households are much more informed about maternal health issues (see Section 4.4.2.2). This is also evidenced by their more exposure to mass media like TV, which conducts programs on health issues.

26. H_0 = Women in households with and without electricity do not differ in terms of knowledge about place for ANC checkup.
    H_1 = More women in households with electricity have knowledge on place for ANC checkup.

    This is the case of one-tailed Z-test for which Z_{cal} = 11.4 and at 5% level $Z_{5\%}$ = 1.65. This highly significantly differing result indicates that women in electrified households are much more informed about ANC health issues (see Section 4.4.2.2). This is also evidenced by their more exposure to mass media like TV, which conducts programs on health issues.

27. H_0 = Women in households with and without electricity do not differ in terms of knowledge about three STD.
    H_1 = More women in households with electricity have knowledge about STD.

    This is the case of one-tailed Z-test for which Z_{cal} = 9.55 and at 5% level $Z_{5\%}$ = 1.65. This highly significantly differing result indicates that women in electrified households are much more informed about STD-related health issues (see Section 4.4.2.2). This is also evidenced by their more exposure to mass media like TV, which conducts programs on health issues.

28. H_0 = Households with and without electricity do not differ in terms of availing health services from medically competent persons during illness.

    H_1 = Members in the households with electricity when sick or ill avail health services from medically competent persons more compared to members in non-electrified households.

    This is a one-tailed test. The calculated value of the test statistic which is 'z' in this case z_{cal}=3.25. At 5 percent level of significance the tabular value is $z_{5\%}$ = 1.65 which leads to rejection of H_0. Such result implies that electrified households are better-off compared to non-electrified households in terms of caring for the health of household members (see Section 4.4.2.3). Due to better economic conditions and education, people are more conscious and they preferably use competent health professionals more compared to non-electrified households. Here we have considered morbidity of all members of a household combinedly over last 12 months.

29. H_0 = Women in households with and without electricity do not differ in terms of availing services from medically competent person for ANC checkup.

    H_1 = Availing services from medically competent person for ANC checkup is higher for women in households with electricity compared to that of women in non-electrified households.

    This is a one-tailed test. The calculated value of the test statistic which is 'z' in this case z_{cal}=5.61. At 5 percent level of significance the tabular value is $z_{5\%}$ =1.65 which leads to rejection of H_0. Such result implies that electrified households are better-off compared to non-electrified households in terms of availing ANC related health care facilities (see Section 4.4.2.4) avail these.

30. H_0 = Women in households with and without electricity do not differ in terms of availing services from medically competent person for PNC checkup.

    H_1 = Availing services from medically competent person for PNC checkup is higher for women in households with electricity compared to that of women in non-electrified households.

    This is a one-tailed test. The calculated value of the test statistic which is 'z' in this case z_{cal}= 7.37. At 5 percent level of significance the tabular value is $z_{5\%}$ = 1.65 which leads to rejection of H_0. Such result implies that electrified households are better-off compared to non-electrified households in terms of PNC checkup (see Section 4.4.2.4)

31. H_0 = Households with and without electricity do not differ in respect of infant mortality rate.

    H_1 = Households with and without electricity differ in respect of infant mortality rate.

    This is a two-tailed test. At 5% level of significance the tabular z-value is $\pm$ 1.96 and the calculated value of the test statistic z is -27.34 which is highly significant. Such highly significantly differing result implies that in electrified areas occurrences of infant mortality are much less (see Section 4.4.2.5). This has supposedly links with more knowledge about value of children, more awareness, more media exposure, more education in electrified area.

32. H_0 = Households with and without electricity do not differ in terms of immunization rate for children.

H_1 = Child immunization rate (for children aged 11-23 months) is higher in the households with electricity compared to that in non-electrified households.

This is a one-tailed test. The calculated value of the test statistic which is 'z' in this case $z_{cal.}$= 5.98. At 5 percent level of significance the tabular value is $z_{5\%}$ = 1.65 which leads to reject $H_{0.}$ Such result implies that electrified households are better compared to non-electrified households in terms of child health care through vaccination against 6 deadly diseases (see Section 4.4.2.6). This may be due to the fact that immunization is a universal concept in Bangladesh and electrification does distinguish much because of media exposure.

33. H_0 = Households with and without electricity do not differ in terms of Contraceptive Prevalence Rate (CPR).
    H_1 = Contraceptive Prevalence Rate (CPR) is higher in households with electricity compared to that of the without electricity households.

This is a one-tailed test. The calculated value of the test statistic which is 'z' in this case $z_{cal.}$ = 4.62. At 5 percent level of significance the tabular value is $z_{5\%}$ =1.65 which leads to reject $H_{0.}$ Such result implies that electrified households are better in respect of family planning practices (see Section 4.4.2.7). Such scenario has links with mass media exposure and other health facilities which are relatively more in electrified area.

34. H_0 : Households with and without electricity do not differ in terms of using medically trained personnel during delivery.
    $H_{1\,:}$ Households with and without electricity differ in terms of using medically trained personnel during delivery.

This is a one-tailed test. The calculated value of the test statistic which is 'z' in this case $z_{cal.}$ = 9.08. At 5 percent level of significance the tabular value is $z_{5\%}$ =1.65 which leads to reject $H_{0.}$ Such result implies that electrified households are better in respect of child delivery care (see Section 4.4.2.4). Such scenario has links with mass media exposure and other health facilities in electrified areas.

35. H_0 : Households with and without electricity do not differ in terms of TV as a source of knowledge on health issues.
    $H_{1\,:}$ Households with and without electricity differ in terms of TV as a source of knowledge on health issues.

This is a one-tailed test. The calculated value of the test statistic which is 'z' in this case $z_{cal.}$ = 19.9. At 5 percent level of significance the tabular, value is $z_{5\%}$ =1.65 which leads to rejectH$_{0.}$ Such highly significant test result implies that electrified households are lot better in respect of mass media use (see Section 4.4.2.2).

36. H_0 : Households with and without electricity do not differ in terms of treatment of maternal morbidity by medically competent persons.
    $H_{1\,:}$ Households with and without electricity differ in terms of treatment of maternal morbidity by medically competent persons.

This is a two-tailed test. The calculated value of the test statistic which is 'z' in this case is $z_{cal.}$ = 4.59. At 5 percent level of significance the tabular value is $z_{5\%}$ =2.3 which leads to reject $H_{0.}$ Such result implies that electrified households are better in respect of care of maternal morbidity (see Section 4.4.2.4). This has links with electricity because electrified areas have more health care facilities.

37. H_0 : Households with and without electricity do not differ in terms of hygienic latrine use.
$H_{1\,:}$ Use of hygienic latrine is more in households with electricity.

This is a one-tailed test. The calculated value of the test statistic which is 'z' in this case $z_{cal.}$ = 13.33. At 5 percent level of significance the tabular value is $z_{5\%}$ =1.65 which leads to rejection of $H_{0.}$ Such highly significant result implies that electrified households are more aware of hygienic practices for defecation health care information. Such scenario has links with mass media exposure and other health care information (see Section 4.4.2.7).

38. H_0 : Households with and without electricity do not differ in terms of soap use.
$H_{1\,:}$ Use of soap is more in households with electricity.

This is a one-tailed test. The calculated value of the test statistic which is 'z' in this case $z_{cal.}$ = 14.87. At 5 percent level of significance the tabular value is $z_{5\%}$ =2.3 which leads to reject $H_{0.}$ Such result implies that electrified households are lot better in respect of health care practices (see Section 4.4.2.7). Such scenario has links with mass media exposure and other health related information.

Social-3: ACCESS TO INFORMATION AND AWARENESS

Rationale

Electronic media has been instrumental in building awareness (social, economic and cultural) among the rural people. Apart from widened vision towards education, health rights, security and other socio-cultural issues, better access to information through electronic media enables the households (especially women) in the electrified villages to be aware of their fundamental human rights.

39. H_0 = Women in electrified and non-electrified areas do not differ in terms of average time allocation for listening radio and TV.

H_1 = Women in electrified areas spend more time in listening radio and TV compared to that of non-electrified areas.

This is a one tailed test. The calculated value of the test statistic which is 't' in this case t_{cal} = 0.52 with d. f. = 944 and 5 percent level of significance the tabular value is $t_{5\%}$ =1.65 which leads to accept of $H_{0.}$ Such result implies that electrified households are not better-off compared to non-electrified households in terms of spending time on radio listening as a source of recreation as well as knowledge. But, in case of TV, highly significant difference exists between two groups (see Sections 4.4.3.13 and 4.4.3.14).

Women play on important role in managing family affairs. Thus, their outlook and knowledge are also important and these bear relation with TV watching and Radio listening on the average. Electricity as a source of energy facilitates the use of such media.

40. H_0 = Women in the electrified and non-electrified areas do not differ in terms of awareness regarding their fundamental rights.

H_1 = Women in the electrified villages are more aware of their fundamental rights compared to non-electrified villages.

This is a one tailed test. The calculated value of the test statistic which is 'z' in this case z_{ca}=2.54. With d.f.= and 5 percent level of significance the tabular value is $z_{5\%}$ =1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households in terms of awareness of the fundamental rights of women. Fundamental rights are not felt and perceived by both men and women. As per our social structure, women are more deprived of their fundamental rights. Extent of awareness of such rights depends on education, exposure to mass media etc. Proportion of women who are aware of such rights is very high in electrified areas compared to non-electrified area. Such difference is statistically highly significant (see Section 4.4.11).

Social 4: MOBILITY

Rationale

Electrification at household level, by providing light in the courtyard helps people, especially women, to move freely with a greater sense of security after sunset. Electricity accelerates market expansion, which in turn enhances mobility for rural population.

41. H_0 = Households with and without electricity do not differ in terms of free mobility.
H_1 = Households in electrified area have more free movement compared to households in the non-electrified areas.

For this test we have used aggregate mobility score in percentages as discussed before in section 4.4.3. This is a one tailed test. The calculated value of the test statistic which is 'Z' in this case Z_{cal} = 4.63 with 5 percent level of significance the tabular value is $Z_{5\%}$ = 1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified households are better-off compared to non-electrified households in terms of free mobility. Highly significant difference is observed (see Sections 4.4.3.7 and 4.4.5).

9.3.2 Irrigation Units

Productivity

Rationale

Uninterrupted water supply is vital for a specific duration of production for each crop. In addition to timely and adequate supply of water facilitated by irrigation equipments, electricity-driven irrigation equipments is able to ensure higher production of crops due to uninterrupted water supply.

42. H_0 = Average area under cultivation using irrigation does not differ between electrified and non-electrified areas.
H_1= Average area under irrigation is higher in electrified area compared to that of no electrification.

Area under irrigation depends on irrigation facilities and such facilities supposedly prevail more in electrified area. It was tested in the present study. This is a one tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal}= 2.82 With d.f.= 454 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.65 which leads to rejection of $H_{0.}$ Such result implies that households with electricity are better-off compared to non-electrified households in terms of average area under cultivation using irrigation. In electrified areas irrigation pump facilities are more and they are cheaper as well. Thus, people can avail of such facilities more.

43. H_0 = Yield per acre in land using irrigation equipment does not differ from that of land without irrigation.

H_1 = Yield per acre in land using irrigation equipment is dissimilar to that of land without irrigation.

Irrigation naturally improves and promotes production. This is a two tailed test. The calculated value of the test statistic which is 't' in this case t_{cal} = 5.70, with d.f.= 506 and 5 percent level of significance the tabular value is $t_{5\%}$ =1.96 which leads to reject $H_{0.}$ This result suggests that for electrified irrigation per acre yield may or may not be higher but our study result suggests a highly significant difference in favor of electricity because in electrified areas more (electrified) irrigation Facilities are present which supposedly lead to higher yield (see Sections 4.3.7 and 5.5).

44. H_0 = Average area under deep tube-well using electricity does not differ from that using diesel.

H_1 = Average area under deep tube-well using electricity is more.

This one-tailed t-test has a calculated value 1.9, which is marginally significant at 5% level of significant with 1048 d.f. It is highly significant at 10% level. Both, the result show that deep tube well under electricity captures more area under irrigation which may be due to less cost, uninterrupted water supply etc (see Section 5.4)

Cost of Irrigation

Rationale

Cost of all inputs – irrigation, labor, fertilizer, and pesticides etc, especially cost of irrigation would be different for electricity-driven irrigation equipment compared to that of non-electrified irrigation equipment. For the same piece of land, the use of fertilizer, pesticides and other inputs will be different because of different pattern of land use for cropping intensity.

45. H_0 = Electricity-driven irrigation equipments and non-electrified irrigation equipments do not differ in terms of average yearly revenue earning.

H_1= Earning from irrigation is higher for electrified irrigation equipment compared to that of non-electricity-driven irrigation equipment.

Electrified driven irrigation equipment compared to diesel-driven costs less. For example, carrying cost of diesel. Thus, significance of difference has been tested in the present study. This is a one tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal} = 18.5 with d.f.= 451 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.65 which leads to rejection of $H_{0.}$ Such result implies that irrigation costs differs highly between two types irrigation equipment's (see Section 5.7).

A similar testing exercise has also been performed for cost of power used for irrigation equipment. The calculated test statistic in this case in 5.98, which shows significant difference between electrified and non-electrified equipment's. The cost of power used is much higher for equipment's run by energy source other than electricity (see Section 5.7)

Cost of Maintenance

Rationale

Electricity facilitates smoother operation of irrigation equipments and thus requires smaller maintenance expenditure compared to that of non-electrified irrigation equipment.

46. H_0 = Average yearly cost of maintenance does not differ between electricity-driven and diesel-operated irrigation equipments.
H_1= Cost of maintenance is unequal for electricity-driven to that of diesel-operated ones.

This is a two-tailed test. The calculated value of the test statistic which is 't' in this case t_{cal} = 2.43 With d.f.= 454 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.96 which leads to rejection of H_0. Such result implies that costs for maintaining irrigation equipments is less for electricity driven than the diesel driven (see Section 5.7.2). Cost is an important factor of production. Electricity certainly eases such cost for irrigation pump owners.

9.3.3. Commercial Units

Market Expansion

Rationale

Electricity is able to provide the necessary environment for accelerated commercial activities. By providing lighting facilities, electricity lengthens working hours for business people. Among others , hours of businesses for commercial establishments (hats, bazars, shops & stores) in the rural areas depends on the availability of customers, environment and others. Electricity begets a new work culture where people of electrified areas has got a different life-style than that of non-electrified areas. Therefore it can be reasonably expected that productive activities in general and commercial activities in particular are more in electrified areas and thus contributes to higher business turnover and greater assortment of products in the electrified commercial establishments.

47. H_0 = Electrified and non-electrified commercial units do not differ in terms of average business hours.
H_1 = Longer business hours are available for commercial units with electricity.

Due to better lighting and preserving facilities as well as other facilities like TV, sitting arrangements etc. electrified shops operate for longer hours. Statistical significance of difference has been tested. This is a one tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal} = 8.9. With d.f.= 457 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.65 which leads to rejection of H_0. Such result implies that electrified shops are better-off compared to non-electrified shops with respect to run business for longer hours (see Section 7.6). This definitely has links with availability of electricity.

For wholesalers also significant difference is observed. In this case t_{cal} = 3.4.

48. H_0 = Electrified and non-electrified commercial units do not differ in terms of average number of customers per day.
H_1 = Number of customers is higher in electrified commercial units compared to non-electrified commercial units.

This test has been divided into two parts, namely upto 50 customers and upto 100 customers per day. Calculated value of test statistic, which is `Z' in this case is -.049 and 1.99 respectively. The first one leads to accept H_0 implying electrified and non-electrified shops do not significantly differ about turning up of 50 customers. However, higher number of customers is more in electrified shops as because such shops have longer business hours and better business conditions. Thus, there is significant difference between electrified and non-electrified shops regarding flow crowding of customers (see Section 7.7).

49. H_0 = Electrified and non-electrified commercial units do not differ in terms of average annual business turnover.
H_1 = Business turnover in the commercial units with electricity is higher than in the units without electricity.

Turning up of more customers, longer business hours etc should result in more business turnover. Even then, difference between electrified and non-electrified shops in this regard has been statistically tested. This is a one tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal} =6.08. With d.f.=457 and 5 percent level of significance the tabular value is $t_{5\%}$ =1.66 which leads to rejection of $H_{0.}$ Test result shows highly significant difference between electrified and non-electrified shops regarding annual turnover. Electrified shops have better scopes, longer business hours and more sales (see Sections 7.6 and 7.11).

Employment

Rationale

Accelerated business activities entails more of inputs, of which, manpower is one. Therefore, hired manpower is likely to be more used in the electrified commercial establishments compared to non-electrified ones.

50. H_0 = Electrified and non-electrified commercial units do not differ in terms of average number of employees.
H_1 = Employment in commercial units with electricity is greater than non-electrified units.

As electricity provides better business facilities it also provides more job opportunities to local people. This is a one tailed test. The calculated value of the test statistic which is 't' in this case is t_{cal} =3.38 With d.f.= 457 and 5 percent level of significance the tabular value is $t_{5\%}$ = 1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified shops are better-off compared to non-electrified shops in terms of employment opportunities (see Section 7.10). More business activities enhance more jobs/work and electrified areas have more business activities which provide more employment.

9.3.4. Industrial Unit

Production and Sales

Rationale

Electricity has created an atmosphere which enables higher production, productivity (production per unit of time), value addition, market value of output and profit.

Thus, although electrified enterprises are supposed to have more production, the difference has been tested statistically in the present study.

51. H_0 = Average annual value of production (AVP) does not differ between electrified and non-electrified industries.
    H_1 = AVP is higher in electrified industries than that of non-electrified industries.

    This test has been divided into three components namely, cottage, small and medium industries. In each case one-sided t-test has been applied. For the first two types, insignificant difference has been revealed by test results with calculated t-values –1.03 and 1.06 respectively. But, in case of medium industries test result shows significant difference between electrified and non-electrified areas. The calculated test t-value is 2.26. At 5 percent level we reject H_0, which implies that electricity opens up horizons for medium sized enterprises to flourish and it is not possible without access to electricity (see Section 6.5).

Cost of production

Rationale

By offering better working condition for the workers and availing modern technology (through electrical appliances) the cost of production in the electrified industrial units is likely to be less.

52. H_0 = Average total cost of production does not differ between electrified industries and non-electrified industries.
    H_1 = Average total cost of production is lower for electrified industries than non-electrified industries.

    Contribution of electricity in cost reduction is an aspect to be considered. This test has been divided into three components namely, cottage, small and medium firms. In each case one-sided t-test has been applied. For the first two types, insignificant difference has been revealed by test results with calculated t-values –1.03 and 1.06 respectively. But, in case of medium firms test result shows significant difference between electrified and non-electrified industries. The calculated test t-value is 2.26. At 5 percent level we reject H_o, which implies that electricity opens up horizons for medium sized enterprises to flourish and it is not possible in non-electrified areas (see Section 6.5).

Diversification

Rationale

Electricity is supposed to promote the generation of new units of dissimilar or non-substitutional products e.g. a owner of rice mill opens up a new mill for oil processing, and then set up a saw mill.

53. H_0 = Electrified and non-electrified areas do not differ in terms of diversification of industries.
    H_1 = Electrified areas have more diversified industries.

    This is a one-tailed test. The calculated value of the test statistic which is 't' in this case z_{cal} = -1.73 at 5 percent level of significance the tabular value is $t_{5\%}$ = 21 which leads to accept $H_{0.}$ Such result implies that electrified industries are not better-off compared to non-electrified industries in terms of diversification (see Section 6.6.3).

Backward and Forward Linkages

Rationale

Electricity enables extended operation of the existing unit by producing those raw materials which was previously purchased (downstream-backward linkages) and process those goods which was earlier accomplished by other industrial units (upstream-forward linkages).

54. H_0 = Electrified and non-electrified industries do not differ in terms of number of backward linkages.
    H_1 = More backward linkages industries are established for electrified industries.

    This is a one tailed test. The calculated value of the test statistic which is z' in this case z_{cal} = 0.2617 and 5 percent level of significance the tabular value is $t_{5\%}$= 1.65 which leads to accept $H_{0.}$ Such result implies that electrified industries are not better-off compared to non-electrified industries in terms of backward linkages (see Section 6.6.2).

55. H_0 = Electrified and non-electrified industries do not differ in terms of number of forward linkages.
    H_1 = More forward linkages industries are established for electrified industries.

    This is a one tailed test. The calculated value of the test statistic which is z' in this case z_{cal} = 2.2 and 5 percent level of significance the tabular value is $t_{5\%}$= 1.65 which leads to reject $H_{0.}$ Such result implies that electrified industries are better-off compared to non-electrified industries in terms of forward linkages (see Section 6.6.2). Thus, it can be asserted that electrified areas are in more favorable positions to extend supplies to other many factory industries.

Industrial Cluster

Rationale

Electricity will facilitate concentration of industries, making them a cluster and thereby reap the benefit of agglomeration.

56. H_0 = Electrified and non-electrified areas do not differ in terms of industrial clusters.
    H_1 = More industries are clustered in electrified areas.

    This is a one tailed test. The calculated value of the test statistic which is 'z' in this case z_{cal} = 0.3298. At 5 percent level of significance the tabular value is $t_{5\%}$ = 1.15 which leads to accept $H_{0.}$ Such result implies that electrified areas not better-off compared to non-electrified areas interms of formations of clusters (see Section 6.7).

Development of Support-Service Sector

Rationale

With the diversification and expansion of industries, growth of other service sectors (like credit institutions) is possible in the electrified areas. Development of infrastructure is also probable due to increased economic activities, results in employment opportunities for households in the electrified areas.

57. H_0 = Electrified and non-electrified areas do not differ in terms of growth of support service sector like shops, e-mail, clinics..

H_1 = Development of support-service sector is more in electrified areas than that of non-electrified.

Study results show several sub-sectors have emerged in the study area as a result of industrial growth. Difference of such growth by types between electrified and non-electrified areas have been tested. Separate results are presented here.

Study in shopping centres:

This is a one-tailed test. The calculated value of the test statistic which is 'Z' in this case Z_{cal} = 2.09 and 5 percent level of significance the tabular value is $Z_{5\%}$ =1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified areas better-off compared to non-electrified areas in terms of growth in support services (see Section 6.9).

Growth in Fax, phone, E-mail facilities:

This is a one-tailed test. The calculated value of the test statistic which is 'Z' in this case is Z_{cal} = 5.25. At 5 percent level of significance the tabular value is $Z_{5\%}$=1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified areas better-off compared to non-electrified areas in terms of public facilities (see Section 6.9).

Growth in establishment of schools and colleges:

This is a one-tailed test. The calculated value of the test statistic which is 'Z' in this case Z_{cal} =1.71. At 5 percent level of significance the tabular value is $Z_{5\%}$ =1.65 which leads to rejection of $H_{0.}$ Such result implies that electrified areas better-off compared to non-electrified areas in terms of expansion of educational facilities due to growth in industries and industrial activities (see Section 6.9). However, non-significant differences are identified in the growth of computer centers, clinics.

9.4. FACTOR ANALYSIS

Factor analysis is the most widely used multivariate technique of research studies, more particularly in the domain of social and behavioral sciences. It is a technique to identify commonality of a set of interdependent variables. Here we seek some factors, which summarize the commonality of all the variables under consideration. For the present study we have identified few factors to analyse a large set of variables. It is noted that such factors are latent variables, which account for variations in other variables.

In connection with Factor Analysis it may be noted that two important things which are presented here, are of concern for analysing a data set. One is communality coefficient (h^2) and the other is Eigen value or Latent root. While the former identifies how much of total variability of a variable is explained by the factor under consideration, the latter indicates the relative importance of each factor in accounting for the particular set of variables. For the present study, we have adopted principal component method of Factor Analysis which enables to decide how many components to be retained in a study. Here, we have adopted Kaiser's criterion, which states that PC having eigen value or latent root >1 should be retained in the study.

The results and analyses are presented below:

Table 9.1: Total Variance Explained

Component	Initial Eigen Values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.891	15.922	15.922	5.891	15.922	15.922
2	3.070	8.297	24.219	3.070	8.297	24.219
3	2.197	5.938	30.157	2.197	5.938	30.157
4	1.543	4.169	34.326	1.543	4.169	34.326
5	1.365	3.688	38.014	1.365	3.688	38.014
6	1.287	3.478	41.492	1.287	3.478	41.492
7	1.183	3.196	44.689	1.183	3.196	44.689
8	1.151	3.110	47.799	1.151	3.110	47.799
9	1.090	2.946	50.745	1.090	2.946	50.745
10	1.066	2.881	53.626	1.066	2.881	53.626
11	1.031	2.788	56.414	1.031	2.788	56.414
12	1.017	2.749	59.163	1.017	2.749	59.163
13	0.993	2.684	61.847			
14	0.969	2.619	64.466			
15	0.944	2.551	67.017			
16	0.931	2.517	69.534			
17	0.913	2.467	72.002			
18	0.884	2.391	74.392			
19	0.865	2.337	76.729			
20	0.812	2.195	78.924			
21	0.787	2.126	81.050			
22	0.778	2.103	83.153			
23	0.743	2.009	85.162			
24	0.710	1.918	87.080			
25	0.671	1.814	88.894			
26	0.633	1.711	90.605			
27	0.615	1.662	92.267			
28	0.520	1.404	93.671			
29	0.470	1.270	94.941			
30	0.442	1.195	96.136			
31	0.421	1.137	97.273			
32	0.295	0.796	98.069			
33	0.255	0.690	98.759			
34	0.210	0.567	99.327			
35	0.105	0.284	99.610			
36	7.734	0.209	99.819			
37	6.681	0.181	100.000			

Extraction Method: Principal Component Analysis.

Table 9.2: Factor Score Coefficient Matrix

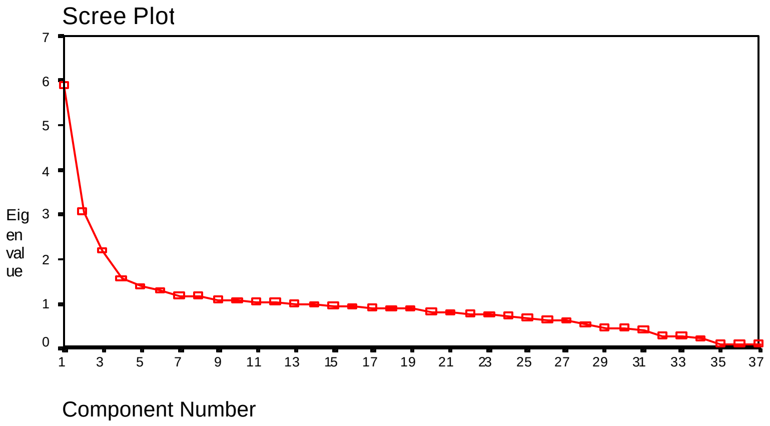
	Factors											
	1	2	3	4	5	6	7	8	9	10	11	12
Electricity Status	-0.136	0.123	-0.030	-0.050	0.002	0.006	0.036	0.003	-0.002	0.002	0.002	0.002
Present market value of agricultural own land (in Tk.)	0.063	0.159	-0.074	0.135	-0.012	-0.062	-0.096	0.140	0.092	-0.018	-0.091	0.103
Present market value of livestock	0.035	0.136	-0.020	0.128	-0.093	-0.082	-0.132	-0.025	-0.023	0.101	-0.253	0.028
Present market value of capital assets	0.043	0.084	-0.041	-0.096	-0.191	0.330	-0.183	0.211	-0.108	-0.073	0.047	0.034
INC_NET	0.041	0.084	-0.039	-0.028	-0.035	0.182	-0.146	0.027	-0.179	0.114	-0.082	-0.202
Irrigation status of areas under cultivation (last year)- Total area	0.047	0.168	-0.053	0.253	0.071	-0.064	-0.158	-0.022	0.111	0.028	-0.134	0.097
V404_C5	0.032	0.137	-0.035	0.265	0.064	-0.057	-0.201	-0.050	0.177	-0.009	-0.084	0.038
HH daily Food consumption in terms of K-Calories	0.054	0.178	0.176	0.020	0.002	0.119	-0.056	0.017	0.075	0.072	-0.040	-0.069
Situation of HH by availability of foods in 2001	0.080	0.124	-0.202	-0.033	0.090	0.088	0.274	-0.125	-0.057	-0.037	0.174	-0.049
Economic status of HH-2001	0.095	0.151	-0.164	-0.026	0.055	0.079	0.150	-0.050	-0.115	-0.024	0.127	-0.036
Economic strength in meeting/bearing educational expenses-2001	-0.030	-0.072	-0.284	0.065	-0.025	0.124	-0.052	0.002	0.041	0.028	-0.131	-0.021
Economic strength in meeting/bearing health care related exp.2001	0.064	0.113	-0.190	-0.027	0.082	0.094	0.320	-0.146	-0.100	-0.034	0.128	-0.134
ANC Checkup	-0.065	-0.008	0.046	0.271	-0.188	0.248	0.143	0.046	-0.026	-0.063	0.005	0.008
Prepare ORS (labon-gur-sarbatV7	-0.036	-0.022	0.031	0.212	-0.108	0.205	0.176	0.039	-0.031	0.098	-0.127	-0.053
The three STDs	-0.052	0.000	0.038	0.208	-0.119	0.049	0.222	-0.122	0.130	0.067	0.141	-0.076
HH member age between 5 and 24	0.035	0.143	0.326	-0.081	-0.008	0.035	0.111	-0.023	-0.004	-0.016	-0.022	-0.099
HH member age between 5 and 24 and go to school	0.051	0.138	0.304	-0.082	0.038	-0.035	0.138	-0.015	-0.042	-0.059	0.098	0.001
Time income generating activities	0.062	-0.048	-0.008	-0.211	-0.228	0.160	-0.018	-0.192	0.181	0.018	-0.160	-0.077
More attention and willingness to study	0.149	-0.121	0.041	0.080	0.022	0.034	-0.003	0.026	0.012	0.012	0.025	0.010
Better exam. results	0.141	-0.134	0.049	0.127	0.039	0.057	0.003	0.034	-0.004	0.018	0.015	0.016
Higher school attendance	0.140	-0.136	0.044	0.128	0.041	0.075	0.018	0.041	0.004	0.027	0.021	0.003
Less dropout	0.138	-0.134	0.052	0.141	0.060	0.078	0.014	0.045	0.003	0.015	0.036	0.017
Sum of 20 health indicators	-0.090	-0.005	0.067	0.261	-0.178	0.223	0.227	0.044	0.032	-0.010	-0.007	-0.042
Crop Agriculture	-0.065	0.007	0.022	0.027	0.127	0.263	-0.218	0.036	-0.214	0.107	0.027	0.041
Livestock	-0.010	0.001	-0.014	-0.065	0.176	0.065	0.199	0.385	0.200	-0.244	0.123	-0.023
Poultry	-0.027	0.015	-0.019	-0.049	0.295	0.100	0.015	0.267	0.307	0.022	-0.109	-0.183
Trees/nurseries	-0.014	0.022	-0.005	-0.031	0.083	0.157	-0.243	-0.089	0.339	-0.106	0.232	-0.098
Kitchen/home gardening	-0.007	0.002	0.027	0.031	0.106	0.066	0.019	-0.121	-0.321	-0.510	-0.263	0.494
Fruit/vegetables	-0.009	0.009	0.002	-0.136	0.025	0.112	0.183	0.154	0.061	0.365	0.038	0.530
Pisciculture/ Fisheries	-0.026	-0.013	0.049	0.002	0.286	0.320	-0.075	-0.219	0.012	-0.269	0.047	0.047
Selling water: DTW	-0.037	-0.033	0.046	-0.028	0.272	0.283	-0.168	-0.088	-0.109	0.322	-0.017	-0.048
Business/shops	-0.046	-0.003	0.009	0.255	0.240	-0.209	0.052	0.103	-0.098	-0.011	0.145	-0.058
Rent: house, shop,	-0.038	-0.050	0.049	0.067	0.328	-0.058	0.129	-0.300	0.040	0.075	-0.231	-0.142
Agr. implements	-0.010	-0.009	-0.004	0.025	0.030	-0.003	-0.075	0.463	-0.114	-0.241	0.027	-0.135
Salaried employment	-0.016	0.009	0.008	0.089	-0.056	0.011	-0.162	-0.164	0.266	-0.038	0.550	0.360
Transport: van, rickshaw, boat, motorcycle, cycle	0.016	0.031	-0.018	-0.044	0.144	0.041	0.186	0.157	0.178	0.267	-0.231	0.345
Cottage industry	-0.008	0.023	0.015	0.072	0.083	-0.089	-0.083	0.088	-0.438	0.294	0.348	-0.002

Extraction Method: Principal Component Analysis.

Table 9.3: Communalities

	Initial	Extraction
Electricity Status	1.000	0.795
Present market value of agricultural own land (in Tk.)	1.000	.524
Present market value of livestock	1.000	.391
Present market value of capital assets	1.000	.539
INC_NET	1.000	.326
Irrigation status of areas under cultivation (last year)- Total area	1.000	.605
V404_C5	1.000	.505
HH daily Food consumption in terms of K-Calories	1.000	.597
Situation of HH by availability of foods in 2001	1.000	.761
Economic status of HH-2001	1.000	.743
Economic strength in meeting/bearing educational expenses-2001	1.000	.531
Economic strength in meeting/bearing health care related exp.2001	1.000	.688
ANC Checkup	1.000	.537
Prepare ORS (labon-gur-sarbatV7	1.000	.330
The three STDs	1.000	.375
HH member age between 5 and 24	1.000	.795
HH member age between 5 and 24 and go to school	1.000	.780
Time income generating activities	1.000	.521
More attention and willingness to study	1.000	.933
Better exam. results	1.000	.915
Higher school attendance	1.000	.915
Less dropout	1.000	.913
Sum of 20 health indicators	1.000	.985
Crop Agriculture	1.000	.435
Livestock	1.000	.462
Poultry	1.000	.467
Trees/nurseries	1.000	.377
Kitchen/home gardening	1.000	.800
Fruit/vegetables	1.000	.596
Pisciculture/ Fisheries	1.000	.517
Selling water: DTW	1.000	.525
Business/shops	1.000	.462
Rent: house, shop,	1.000	.530
Agr. implements	1.000	.401
Salaried employment	1.000	.649
Transport: van, rickshaw, boat, motorcycle, cycle	1.000	.446
Cottage industry	1.000	.522

Extraction Method: Principal Component Analysis



In factor analysis 37 variables from different domains have been used. Initial run shows that there are 12 factors each of which is a linear combination of 37 variables and each of such factors has eigen value >1. Secondly, the contribution of each factor on each variable and corresponding communality coefficient h^2 have been obtained. About 60% of total variance is accounted by these 12 factors.

Table 9.1 shows that 15.9 percent of total standardised variance is explained by factor 1 and it is the highest. The second highest value is 8.3 percent.

So, this table shows how many factors need to be retained for the data and they are 12. These factors each has latent root >1. Now, contribution of each of 12 factors on a particular variable is important. As observed in Table 9.2, these coefficients are called factor loading since they indicate how much weight is associated to each factor. These coefficients show how a standardised variable is formed by factors. Factors with large coefficients in absolute value are closely associated with the corresponding variable. For example, factor 1 has largest loading 0.149 with variable "more attention and willingness to study". Household electricity status has factor loading 0.136 which is fifth in order of rank for factor1. For factor 2, electricity status has rank 10 out of 37. Factor 1 accounts for 2% ($=.136^2$) of variance for electricity.

Table 9.3 shows that 79.5% of variance in electricity status is accounted for by 12 factors as shown by communality coefficient.

From factor analysis it has become clear to us that not all variables are necessary for analysing the present situation. So, crucial variables like electricity status, present market value of land, market value of capital asset, net income, irrigation, caloric intake, educational indicator, economic status etc. are important. It is also clear that electricity and variables associated with it play important role in forming factors, and factors in turn, influence electricity remarkably.

9.5. CLUSTER ANALYSIS AND INCOME DETERMINATION MODEL

9.5.1 Rationale Behind Clustering

The population may have a distribution, which is a mixture of several distributions. Thus, the aim is to isolate the component distributions on the basis of the sample drawn from the mixture of distributions. The clearer the distinction between groups of similar and dissimilar objects (e.g. consumers) is, the better the understanding of their behavior (e.g. consumption behavior) is. As a result, inferences drawn for the population as a whole are more realistic.

In most of the purchase decision processes, complex behavioral combinations of decisions occur. But, it is true at the same time that several individuals may form alike groups in terms of those factors, which characterize consumption behaviour.

Therefore, we need to identify such alike groups. It is also true that in order to compare and contrast consumers, one dimensional judgment is not enough. We need an assessment of consumption behaviour in terms of several relevant factors, which should be simultaneously taken into account. Cluster analysis as a statistical tool can serve such a purpose of bringing consumers (households) into meaningful sub-groups simultaneously on the basis of a number of dimensions. In the multidimensional attribute space, the consumers (households) form vectors of measurements of a given dimension and clustering techniques fuse the closest neighbours to form alike groups. Boundaries of groups or clusters are derived according to the patterns existing in the measurement space from the clusters or groups.

The results obtained from a cluster analysis may prove to be very useful to a research in that they enable one to get new insights and ideas about the practical data set such as (see Ball, 1971): (a) proposals about the underlying data structure(s), (b) generating hypotheses, (c) how to modify an existing structural model or constructing a relevant model, (d) data reduction, (e) sub-division of the main problem into several component problems, (f) investigation of a given hypothesis.

The principal attraction of cluster analysis for our purpose is to identify behavioural patterns which, depend on relevant factors such as income levels, social classes, ethnic compositions, geographical locations (state differences and rural/urban differences).

We are interested in homogeneous clusters, which indicate high internal coherence and external non-coherence. Thus, we need an appropriate clustering method, which can provide us with more homogeneous clusters of consumers. Now, we need to consider the appropriateness and computational feasibility of the clustering method and hierarchical process is a suitable candidate for such purpose. This procedure has the advantage and attraction that it does not need a prespecified distance between objects to be clustered as is necessary in a non-hierarchical clustering procedure. It sometimes becomes too hard task to determine an appropriate inter-object distance a priori. This is more so with a large data set like ours. So, we adopt the hierarchical clustering method and avoid all complex problems associated with non-hierarchical procedures. We note that we do not need a strict natural clustering as a biologist does. We principally intend to partition the given sample into a number of clusters such that within cluster heterogeneity is minimised. Our purpose is in comparative performances of a given model across several clusters and to draw inferences abut the population on a firm methodological footing. In this respect, a hierarchical clustering is one of the useful techniques which provides an wide range of clusters to choose from (see Jardine and Sibson, 1971; Day and Heeler, 1971; Anderberg, 1973; Wind, 1973; Doyle and Hutchinson, 1976; Wolfe, 1970, 1978; Everitt, 1980 and Godehart, 1988).

One related issue arises regarding the choice of an appropriate hierarchical clustering method. Here, we need to consider the computational feasibility of the method we apply. We are concerned with two aspects of the method we choose viz,

(1) the performance of the method in forming homogeneous clusters, and

(2) computational feasibility.

Now, average linkage and centroid methods are easily manageable computationally by using algorithms in existing packages like SPSS, SAS. We have decided to use centroid method for our purpose and have used the algorithm in the SPSS package. In forming clusters of households we have used 25 variables altogether choosing important ones from each of domains of demography, health, education, economic status, agriculture, knowledge, electricity use status, access to media exposure. In economic domain we have considered net income, sources of income related to electricity, total capital asset, land ownership status. We have identified two broad clusters of households or two groups at homogenous households. For each of these clusters we have estimated an income determination model. Such results are presented herein associated with necessary analyses. However, at first we present the formulation of the income determination model along with rationale of determinants included.

9.5.2 Income Determination Model

In this model, income (net) is taken as dependent variable. Variables of different measuring scale are included such as nominal scale, ratio scale. First of all, we provide the rationale of inclusion of a variable and show the model followed by estimation results and analysis.

Income determinants and their rationale.

Dependent variable is income (I)

Regressors:

Land X_1 :

In rural economy size of land owned by a household is an important determinant of the size of income earned by the household. Such income accrues from varieties of use of land. Thus, we include amount of own cultivable land as a regressor.

Family Labor X_2 :

Labor contributed by the household to farm and non-farm earnings is also an important determinant. Such labor can be to own farm, to other paid works. Thus, number of earning member in the family is taken as a regressor.

Education Level X_3:

Education is an important determinant of income in any case and for rural household it is more important because of low literacy in rural areas. Education offers knowledge on various issues, enlightens with ideas and enhances abilities. This also varies with level of education. For our purpose we have used household level adult literacy rate as a determinant of income.

Access to Electricity (E):

This is an infrastructure variable, which promotes income scopes. Our previous testing results showed significant relationship exists between electricity and other issues including income. Thus, use of electricity is considered as a necessary determinant of income earning.

Capital X_4:

Amount of capital employed in farm and non-farm activities is taken as a regressor because it contributes to income earning. We have used present market value of all assets except land.

Source of income

Total income may heavily lean on some particular source (s) and some sources may be closely related to electricity. Thus, in our model we have used those sources which have been reported by respondent to be, in someway, related to electricity. These are, agricultural crops, livestock, poultry, home gardening, pisciculture, selling water, business, salaried employment, transport, cottage industry.

However, our preliminary regression run showed not all these sources keep significant impact. Thus, we retained all those sources which showed significant t-values and these are,

Fruit/vegetables (X_5),
Business/shops (X_6),
Salaried Employment (X_7),
Transportation (X_8),
Rent from shops/house (X_9),
Cottage Industries (X_{10}),

The regression equation has been set in loglinear form in which natural log of the dependent variable income, and log of regressor cultivable land and number of labor (household earning member) have been used.

Keeping sound health contributes to income in two ways, firstly it provides more working ability and secondly, it increases saving through reducing expenditures on health. Keeping sound health in turn depends on health care facilities as well as knowledge on health issues. So, we have included following health related indicators as regressor.

Knowledge on over 10 out of 20 public health issues (X_{11}). Use of sanitary latrine (X_{12}).
Exposure to mass media affects people's earning status although not directly. It increases knowledge status on health issues, education, awareness, self-right etc. Thus, watching TV has been considered as a regressor in the regression model (X_{13}).

The regression model estimated is

$$l_n I = B_0 + B_1 l_n X_1 + B_2 l_n X_2 + B_3 X_3 + B_4 E + B_5 X_4 + B_6 X_5 + B_7 X_6 + B_8 X_7 + B_9 X_8 + B_{10} X_9 + B_{11} X_{10}$$

$$+ B_{12} X_{11} + B_{13} X_{12} + B_{14} X_{13} + e$$

Model Valuation

For model selection strategy we have adopted the simple procedure of backward selection. This has been done for households in cluster 1 and cluster 2 separately. The parsimonious model turns out to differ partially in two clusters. However, it is admitted that diagnostic tests of hetero-scedasticity, and autocorrelation have not been performed although multi-collinearity has been tested using pairwise correlation coefficient. No severe multicollinearity has been detected. For cross-section data autocorrelation should not be a problem at all.

Estimation Results and Analysis

It may be noted that the same regression has been replicated clusterwise and within each homogenous cluster the regression model has further been estimated for all households. This will provide more accurate estimate of effects of determinants because of treatment of homogenous agents together.

For model estimation we have adopted ML using EViews package program. The estimation results along with analysis are presented here. We present results for households of cluster 1 and cluster 2 separately. It may be noted that parsimonious model differs among those two groups in terms of regressors which turn out to be significant on the bass of t-ratio.

Estimation Results for Cluster 1.

Irrespective of electrified and non-electrified status, the model was run for all households together using 25 regressors at first. Then, deletion of regressor was adopted based on value of R^2 and t-ratio. Estimation results of final model are presented in Table 9.4. As it is appears from estimation results, several variables keep significant positive impact on earning of households. Many of such variables bear association with electricity. Rural economy is principally dominated by agriculture and it is reinforced by present result. Highly significant impact of amount of cultivable land and that of household earning member is observed even at 1% level of significance. Both of these variables are identified to bear close association with possession of electricity. Elasticity of cultivable land is 0.201 which indicates that 1% increase in cultivable land increase income by 20.1% and such increase for household earning member is even more 24%. Adult literacy which is also related to electrification status of households, also lays highly significant impact on household income. Another highly significant determinant is asset holding.

As mentioned earlier, knowledge on health keeping issues and health care keep indirect impact on income earning. This has been revealed in present study. Household having knowledge on 10 out of 20 public health issues and use of sanitary latrine appear to be highly significant determinants of income even at 2% level.

All income sources are not equally important for a particular household. Our estimation results show that on the whole several income sources keep significant impact on income earning although they differ by level of significance. For example, income source like fruit/vegetables and employment are significant at 6% and 9% level while earning from business/shops is significant ever at less than 1% level. A very highly significant determinant of income earning is earning from transportation (significant at <2%). Highly significant determinant of income is TV watching, although it effects income indirectly.

Table 9.4: Estimation Results of Income Determination Model for Cluster 1.

Regressor(s)	Coefficients			P-value
	B	Std. Error	t	
Constant	9.107	.130	70.065	.000
Log value of own cultivable land	.201	.027	7.296	.000
Log value of hh earning member	.268	.057	4.704	.000
Adult Literacy rate	2.923	.001	2.963	.003
10 out of 20 health indicators	.129	.068	1.985	.0511
Knowledge on use of sanitary latrine facility	.181	.063	2.899	.004
Electricity Status	.102	.049	2.08.	.047
Valuation of capital assets-2002 (except own cultivable land)	1.599	.000	3.745	.000
Fruit/vegetables	.858	.433	1.981	.060
Business/shops	.404	.084	4.822	.000
Salaried employment	.236	.134	1.759	.079
Transport van, rickshaw, boat, motorcycle, cycle	.531	.223	2.381	.018
Watch TV	.210	.072	2.920	.004

Estimation Results of Cluster 2.

The rationale put forth for clustering has been proved in the present study. Although most of the determinants of the previous case are also significant in cluster 2, some determinants do not play significant role at all in cluster. For example, in case of households earning from cottage industry is significant in cluster 2, but it is highly insignificant for households in cluster 1. Similar is the case with earning from renting house/shop. Fruits/vegetables is more significant for households in cluster 1.

Many determinants are similar, adult literacy appears to be more significant for these households. Fruits/vegetable is highly insignificant. Cottage industry is marginally important but income from salaried employment is highly significant while income from transportation is highly insignificant. TV watching is almost equally important in 2 clusters. Existence of electricity keeps similar influence as in cluster 1.

Table 9.5: Estimation Results of Income Determination Model in Cluster 2.

Regressor(s)	Coefficients			P-value
	B	Std. Error	t	
Constant	8.995	.118	76.437	.000
Log value of own cultivable land	.228	.024	9.596	.000
Log value of hh earning member	.204	.050	4.047	.000
Adult Literacy rate	3.341	.001	3.811	.000
Use of sanitary latrine facility	.204	.098	2.07	.047
Electricity Status	1.220	.060	.020	.984
Valuation of capital assets-2002 (except own cultivable land)	2.836	.000	6.572	.000
Business/shops	.368	.074	4.989	.000
Rent: house, shop	.359	.140	2.561	.011
Salaried employment	.307	.121	2.539	.011
Cottage industry	.367	.212	1.731	.122
Watch TV	.205	.059	3.490	.001

Considering estimation results for two clusters together, there are 11 determinants which keep significant impact on income earning of households in cluster 1 and there are 14 such determinants for cluster 2. However, many of these determinants are common and some are uncommon. For the convenience of readers we present such determinant as follows.

Significant common determinants in 2 clusters:

Log value of own cultivable land
Log value of hh earning member
Adult Literacy rate
Use of sanitary latrine facility
Electricity Status
Valuation of capital assets-2002 (except own cultivable land)
Business/shops
Salaried employment
Watch TV

Uncommon significant regressors:

Significant in cluster 1 only	Significant in cluster 2 only
Public health issues, Fruit/vegetables, Transport	Rent from shops/house, Cottage industry

9.6. TOBIT MODEL ANALYSIS

9.6.1 Model Building

In many practical situations particularly in consumption behavior it happens that dependent variable in the data set cannot take negative values and lot of zeros are present. Instead of discarding such observations censored regression can be adopted to obtain an elegant analysis of the data. A lucid idea of such method is highlighted below.

Suppose a household produces an output vector of M-commodities by using an input vector. In short-run household/firm minimises its cost subject to given production but in the long-run it chooses the best combination of M-commodities which maximises utility function subject to a minimum cost of producing M-commodities. We can write this as a direct utility function as

$$u = f [M_i \ Q_k, T_h)$$

Here, M_i = non-traded goods and services produced by household
Q_k= vector of goods and services purchased by household
T = Time which has components such as.

- home production time (cooking, washing, unpaid works etc)
- time spent at home for income earning
- time for human capital formation (school plus study at home)
- leisure time (recreational activities)
- market labor time supplied by household (time in paid labour)
- i = 1 ....m (number of non-trated M- commodities)
- K = 1 .... p (number of market goods and services produced by household)

Now, the indirect utility function can be written as,

$u = f[y, p_{i,} P_Q, P_{x,} W_r]$

Where

y = Income

$p_{i,}$ = Price of M-commodity produced by household

P_Q, = Price of market goods and services purchased by households

P_x = Price of inputs for producing M-commodity by household

W_h = Wage of hth household member

Now, utility maximisation leads to a set of equations to be estimated for the present study and they are as follows.

Dependent variables in our case are,

T_{CFh} = Human capital formation time by hth household member. It has following sub-elements

T_{Ih} = Time spent for income earning

T_{sh} = Time by hth household member for socio-cultural development

T_{ch} = Time by hth household member for household chore

The equations are :

$T_{CFh} = f(y, p, P_Q, P_x, S_h, D_h, E_h, E\,©_h)$

$T_{Ih} = f(y, p, P_Q, P_x, S_h, D_h, E_h, E\,©_h)$

$T_{sh} = f(y, p, P_Q, P_x, S_h, D_h, E_h, E\,©_h)$

$T_{ch} = f(y, p, P_Q, P_x, S_h, D_h, E_h, E\,©_h)$

$X = f(y, p, P_Q, P_x, S_h, D_h, E_h, E\,©_h)$

Here S_h = Socio-economic characteristic vector of hth household

D_h = Vector of demographic characteristics of hth household

E_h = Service of electricity of the household

$E\,©_h$ = Vector of alternative energy sources of hth household

It is noted that we followed Gronau (1973, 1977) for the above approach.

Estimation Procedure

We assume all the equations to be linear both in parameter and variables. Now, parameter estimates will be biased and inconsistent if we,

a) Use OLS on only positive values of dependent variables
b) Use OLS on all observations since censoring is at `0'
c) Use only non Zero values will lead to sample selection bias.

Thus, to take account of censoring of dependent variable at 0, Tobit regression model (censored variant) has been used for the present study.

In order to avoid sample selection bias Heckman's technique has been used for the present situation. Running a Probit model (binary) we obtained in the first step Inverse Mill's ratios which is used as an explanatory variables at the second step. Such procedure allows us to identify two effects of the explanatory variable on the dependent variable namely, an effect on the mean value of dependent variable and probability of the dependent variable to be observed.

As mentioned above in Tobit formulation, total time for human capital formation T_{CFh} has been split into ingredients Viz income generation activities, social -cultural development, and household chore. We discuss estimation results of Tobit model by categories of respondents namely, household head, spouse, male senior student, female senior student by total time and its ingredients as mentioned above. Besides, Tobit model analysis has also been estimated for household behaving kerosene consumption and expenditure on education and health.

9.6.2. Estimation Results and Analysis

A. Household Head

Total Time:

It is observed in Annex Table 9.1 that there is 95 percent probability of a household head being involved in human capital formation depending on earning members in the household. It is evident from the table that an electrified household has increased average time spent for human capital formation by about 40 minutes per day. A household in electrified village has about 4.8% more chance to devote to human capital formation.

Annex Table 9.2 shows still more encouraging information that an household head in an electrified household has 49.16% more chance to devote time to income generation activities and increment in such time is about 6.3 units. Such chance for a household in an electrified village is 14.5% more and average time increment is 13.8 units (Table 9.6).

In Annex Table 9.3 we observe that a household head in an electrified village has 75% more chance to devote time to socio-cultural development with an increment of 1.8 units. Highest contribution in this regard is for electrified household by 30.5 units.

Annex Table 9.4 shows that household head in an electrified village has 91.3% more probability of doing household core and for an electrified household it is 13.8% with an average contribution of 2.5 units.

B. Spouse

In Annex Table 9.5 we notice that a spouse in electrified village has 25.8% more chance to devote time to human capital development and on the whole with an increase of 6.7 units and for a spouse in an electrified household contribution is lot more 35.6 minutes. As our previous test results suggest strong association between possessing electricity and income, a spouse in an electrified villages has 87.7% more chance to do income generation activities (Table 9.7).

In Annex Table 9.7 it is evident that a spouse in an electrified household has about 12% more chance to devote time to socio-cultural development and on the average 6.9 unit time is spent for such purpose. There is a very high probability, about 93%, that a spouse in an electrified village will perform household chore.

C. Male Student

For a male student member in electrified village has only 6.9% more chance to do human capital development activities, a male student in an electrified household spent 61 minutes more compared to non-electrified household. In Annex Table 9.10 we notice, a male student in an electrified village has 82.7% more probability to do income generation activities and there is positive contribution on the average (0.237).

D. Female Student

In an electrified household a female student has 98.7% more chance to perform human capital development work and for the present situations such contribution is more by .22 units. In the context of Bangladesh a female student can not be expected to devote much time in income generation activities. This is evident for the present study as well. In an electrified household a female student although has 48.4% probability of doing income generation activities, and for the present data set there is increase by 32 units (Table 9.8).

An expected result in the context of Bangladesh, both by sign and probability, is observed in Annex Table 9.15. A female student in an electrified village has 95.4% more probability of devoting time to socio-cultural development and on the average there is 0.66 units increase. A female student in an electrified household contributes for such purpose by 28.6 units. There is also very good chance for female student in electrified household village to do chores.

E. Use of Kerosene

In using Tobit model we have introduced use of an alternative source of energy, namely, kerosene as a dependent variable. As expected, there is not much chance that an electrified household will use kerosene. Current study results show that there is almost nil chance of using kerosene by an electrified household and there has been 45 units decrease in such use (Annex Table 9.17). A household in electrified village shows that there has been decrement by 3.2 units in kerosene use.

Another variant of Tobit model was estimated for expenditure pattern. We have considered expenses on education and health which are supposed to be two important elements of human capital formation. We discus such result here.

F. Expenditure on Education

There is 29.3% more chance that a household in an electrified village will spend on education and according to current data set there is decrease in such expenses (Annex Table 9.18). Although an electrified household has not high probability of spending on education but such household spends 1204 units more compared to non-electrified household.

G. Expenditure on Health

In Annex Table 9.19, it is evident that an electrified household has 56.16% more chance of spending on health care and there is 353.7 units increase for such purpose. A household in an electrified village has even a higher chance (65%) of spending on health care although on the average its contribution to mean expenditure is a little lower, 282.6 units.

Table 9.6: Estimation Results of censored Tobit

Dependent Variable: -Total time (in minute) in income generating activities ((HH_HHI) HH head (Male)

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.435455	0.217459	-2.002465	0.0452
HH size(Mem_tot)	-0.481792	1.756137	-0.274347	0.7838
HH member involved in IGA (IGA_mem)	5.055068	3.414128	1.480633	0.1387
Adult literacy rate (A15_mem)	-0.006649	0.097337	-0.068311	0.9455
Valuation of capital assets (PPR_Cost)	3.13E-06	3.14E-06	0.998150	0.3182
HH net income (INC_Net)	1.79E-05	1.57E-05	1.143411	0.2529
Expenditure on Bio-mass fuel (V502_B1)	-0.009463	0.012390	-0.763745	0.4450
Expenditure on Kerosin oil (V502B2_V)	0.018073	0.053885	0.335407	0.7373
HH electrification status (HES)	6.278897	9.129514	0.687758	0.4916
Village electrification status (Vill_ES)	13.84612	9.495126	1.458235	0.1448
C	47.99501	13.65972	3.513616	0.0004

[Note: Parentheses indicate the name of the variables/fields]

Table 9.7: Estimation Results of censored Tobit

Dependent variable : Time (in minutes) in income generation activities

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.486513	0.466659	-1.042545	0.2972
HH size(Mem_tot)	-14.42508	4.029976	-3.579447	0.0003
HH member involved in IGA (IGA_mem)	39.38331	7.337724	5.367239	0.0000
Adult literacy rate (A15_mem)	0.129686	0.204717	0.633489	0.5264
Valuation of capital assets (PPR_Cost)	4.15E-06	6.86E-06	0.605881	0.5446
HH net income (INC_Net)	-6.01E-05	7.45E-05	-0.807605	0.4193
Expenditure on Bio-mass fuel (V502_B1)	-0.029254	0.029950	-0.976758	0.3287
Expenditure on Kerosin oil (V502B2_V)	0.046498	0.114687	0.405433	0.6852
HH electrification status (HES)	48.82440	20.18903	2.418362	0.0156
Village electrification status (Vill_ES)	-3.283648	21.20719	-0.154837	0.8770
C	-236.8831	34.18885	-6.928665	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.8: Estimation Results of censored Tobit

Dependent Variable: Time (in minute) in income generating activities after 6.00pm (HH_MSI) Senior most male student

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.006966	0.024820	-0.280667	0.7790
HH size(Mem_tot)	0.139312	0.200052	0.696379	0.4862
HH member involved in IGA (IGA_mem)	-0.004317	0.390004	-0.011069	0.9912
Adult literacy rate (A15_mem)	-0.001760	0.011156	-0.157736	0.8747
Valuation of capital assets (PPR_Cost)	1.57E-08	3.70E-07	0.042366	0.9662
HH net income (INC_Net)	-2.39E-06	2.35E-06	-1.018426	0.3085
Expenditure on Bio-mass fuel (V502_B1)	-0.000819	0.001415	-0.579023	0.5626
Expenditure on Kerosin oil (V502B2_V)	0.001811	0.006265	0.288981	0.7726
HH electrification status (HES)	1.026297	1.053576	0.974108	0.3300
Village electrification status (Vill_ES)	0.237668	1.089218	0.218201	0.8273
C	0.251831	1.593451	0.158041	0.8744

[Note: Parentheses indicate the name of the variables/fields]

Table 9.9: Estimation Results of censored Tobit

Dependent Variable: Time (in minute) in income generating activities after 6.00pm (HH_FS1) Senior most female student.

Regressors	Coefficient	Std. Error	t-Statistic	Prob.
Age of HH head (VII_Age)	-0.014235	0.011086	-1.284101	0.1992
HH size(Mem_tot)	0.243101	0.089637	2.712048	0.0067
HH member involved in IGA (IGA_mem)	-0.510548	0.174668	-2.922960	0.0035
Adult literacy rate (A15_mem)	0.002969	0.004979	0.596181	0.5511
Valuation of capital assets (PPR_Cost)	5.37E-08	1.64E-07	0.326682	0.7439
HH net income (INC_Net)	-9.16E-07	8.61E-07	-1.063168	0.2878
Expenditure on Bio-mass fuel (V502_B1)	-0.001329	0.000628	-2.115143	0.0345
Expenditure on Kerosin oil (V502B2_V)	-0.000654	0.002821	-0.231810	0.8167
HH electrification status (HES)	0.328927	0.469041	0.701276	0.4832
Village electrification status (Vill_ES)	-0.064618	0.483223	-0.133722	0.8936
C	1.336113	0.692948	1.928157	0.0539

[Note: Parentheses indicate the name of the variables/fields]

KEY FINDINGS

Variables from different domains like socio-economic, health, knowledge on self-right appear to bear close association with possession of electricity. Highly significant differences are observed between electrified and non-electrified households, and such differences exist in respect of income, expenditure, savings, social status, health, and free mobility.

Significant differences also exist between electrified and non-electrified households with respect to agricultural productivity, irrigation costs, commercial activities, industrial production and development of support service sectors.

A set of factors which bear close association with electricity have been identified to be crucial for analysing current scenarios. Tobit model analysis shows that existence of electricity increases probability for members of a household to participate in various human capital development functions, income-generation activities, socio-cultural development, and household chores.

CHAPTER 10

FINDINGS, IMPLICATIONS AND RECOMMENDATIONS

This economic and social impact evaluation study was aimed at assessing the multidimensional aspects of the direct and indirect, tangible and intangible benefits of Rural Electrification Program of Bangladesh. Such impact was assessed for four observation measurement units, namely household, irrigation, industry and commercial activities. Impact by these units were evaluated separately and then attempts were made to synthesise the impact, which are interrelated and interdependent, and produces synergy.

ECONOMIC AND SOCIAL IMPACTS – HOUSEHOLD LEVEL

The economic and social impacts of rural electrification at the household level are multidimensional, and both tangible and intangible. The approximate number of persons who are now deriving direct benefit of household (domestic) connections of REB would be 20.5 million. The household level impacts are mediated through availability of electricity in the household as well as outside the household (agriculture, fisheries, commercial activities—shops and establishments, and industry). In the later event, the benefits go not only to the 20.5 million people who are connected through domestic connections, but also to those not having domestic connections.

During the last 20 years (1983-2002), the total number of domestic consumers of RE has increased almost 1200 times, from 2852 in 1983 to 3,413,825 in 2002. The estimated average annual growth rate (cumulative of domestic connections) is 42.53%.

The multifaceted impacts and benefits are either direct or indirect. The direct impacts are mostly economic, and reflected in enhanced income, and employment, and optimized expenditure pattern, surpluses, savings, and asset building. Most indirect impacts are related to the social and cultural aspects of life, which include, among others, such areas as education, health, women's status, modernization etc. These direct and indirect benefits together produce synergy in economic growth, poverty reduction, and human development.

ECONOMIC IMPACT

Impact on Income

The average annual income of households with electricity (HE) is 64.5% higher than that in the households of non-electrified villages (WE-NEV), and 126.1% higher than that in the households without electricity of electrified villages (WE-EV). The last year's average household income of HE was Tk. 92,963, and the same for WE-EV was Tk. 41,110 and that for WE-NEV was Tk. 56,524.

In terms of broad categories of sources of income, the households with electricity show a relatively higher share on account of non-agricultural sources (66.8% of annual income) than that of the same for non-electrified households (WE-EV and WE-NEV, 57.9% and 51.5% respectively).

The distribution of income by income groups shows a much better-off situation of the electrified households compared to that of their counterparts— non-electrified households.

The gini-coefficient of income distribution is 0.53 for electrified households, 0.43 for non-electrified households in electrified villages (WE-EV), and 0.45 for households in the non-electrified villages (WE-NEV). As compared to the non-electrified households, the electrified households show a higher income inequality but with higher income in the comparable groups. This means, the electrified households can be characterized as being relatively high income inequality with relatively high income.

Estimates show that 16.4% of the annual income of the electrified households can be attributed to electricity. As for non-electrified households in the electrified villages (WE-EV), 12% of the annual income can be attributed to electricity, and it is only 3.6% for the households in the non-electrified villages (WE-NEV).

Extrapolated estimates show that (a) 9.3 percent of the annual income of the total rural households (19.1 million) in Bangladesh can be attributed to electricity, and (b) assuming "all rural households have electricity" the total annual household income – at current market price – will increase to Tk. 1,775 billion from the present Tk. 1,105 billion, i.e., the annual net gain in income will be Tk. 671 billion more than today, of which Tk. 290.8 billion or 43.3% of the increment will be due to electricity. This net gain in annual income (Tk. 671 billion) due to 100% electrification of rural households is equivalent to 26% of the current GDP (Tk. 2,580.6 billion at current market price) of Bangladesh.

Impact on Employment

Electricity generates employment. The impact on employment was both direct and indirect. In agriculture, an estimated 1.1 million persons are directly involved in farmlands using rural-electricity connected irrigation equipments. Currently, 63,220 industries using rural electricity employ 983,829 persons; and electrified industries, on average, generate 11 times more employment than the non-electrified industries. Retail and wholesale shops using rural electricity employ 848,630 persons. There has been direct employment of 16,223 persons in the PBSs. More so, women in the electrified compared to those in the non-electrified households are involved more in household level income-generation activities and depict better re-allocation of time for remunerative employment; unemployment rate is relatively low in the electrified households; and relatively higher share of non-agricultural employment in the electrified households indicates modernization effect of electricity on occupation. On the top of all these, there has been an enormous spill-over effect of rural electrification on employment in various support-services.

Impact on Expenditure

The overall average annual (last year's) expenditure in the electrified households was Tk.94,552. The corresponding figure for the non-electrified households in electrified villages was Tk.61,327, and for households in the non-electrified villages was Tk.68,282. As compared to the differences in the relative income of these three sample categories, the differences in relative expenditure is less pronounced implying that the electrified households spend relatively more than the other two categories.

The food-non food expenditure pattern of electrified households resembled close-to-the national urban pattern and that in the non-electrified close-to-the national rural pattern. Thus, electrification has acted as a factor in urbanizing the consumption pattern of the rural people having electricity in their households.

The distribution of expenditure by recurrent-capital depicts a much progressive pattern in the electrified households as compared to the non-electrified households. The annual average recurrent expenses in the electrified households (Tk.72,676) was 29% higher than that of the households in non-electrified villages (Tk.56,285). The same for capital expenses was as much as 82% higher in the electrified households compared to that in the households of non-electrified villages. More importantly, while share of capital expenses to overall expenditure was 23.1% in the electrified households, it was 17.7% in the households of non-electrified villages. This pattern of distribution of recurrent-capital indicates relatively more stable and stronger domestic economy and better quality of life of the electrified households as compared to their counterparts in the non-electrified ones. Thus, electricity influences strengthening of the domestic economy of households having access to electricity.

The relatively higher standard of living as well as quality of life of the members in the electrified households as compared to the members in the non-electrified households are evident from higher annual per capita expenditure on all items of expenditure. The annual per capita expenditure on food in the electrified households (Tk.7,418.6) was 16% higher than that of the households in non-electrified villages.

The analysis of per capita daily intake of food by the members of households with and without electricity shows that:

First: In terms of quantity of food consumption, the members of the electrified households are much better off than their counterparts in the non-electrified villages. The members in the electrified households, on average, consume daily 46 gms (4.8%) more than their counterparts in the non-electrified villages. In terms of intake of energy (kilo calories), it was 60 K.Cal (2.6%) more.

Second: The differences in food intake were significant while considered the quality of food. The average daily **protein** intake of the members in the electrified households (182.2 gm) was 34% higher than that of the members in the non-electrified villages. The higher quality is also evident in the fact that while the average K. calorie for the members in the electrified households was only 2.6% higher than that in the non-electrified villages, the money value of food in the electrified household exceeded 15.3%, the money value of food in the non-electrified households.

The average annual household expenses for education incurred by the electrified households was Tk.3,260 – an about 87% higher expenditure than that in the households of the non-electrified villages, and 135% higher than the non-electrified villages.

The average annual healthcare expenditure reported by the electrified households was Tk. 4,325, which is 44% higher than their non-electrified counterparts (Tk. 3,012 and Tk. 2,999). The annual health care expenses for the females of electrified (Tk.1,948) was 85% higher than those in the households of the non-electrified villages and 104% higher than those in the non-electrified households of electrified villages.

The average monthly expenses on fuel reported by the electrified households was Tk.545 and the corresponding amounts for the non-electrified households in electrified villages was Tk.362, and in non electrified villages Tk.385. Spending on kerosene was much higher in the non-electrified than in the electrified households. Electrified households monthly expenses on kerosene was only Tk. 28.3, while it was around Tk.65 in the non-electrified households. On average, the volume of kerosene used as fuel was 1.6 litres per month in the electrified households, 3.3 litres per month in the non-electrified households of electrified villages, and 4.1 litre per month in the households of the non-electrified villages. Nationally speaking, this has significant financial implications on the imports in Bangladesh. Currently, all rural households in Bangladesh annually consume 775.53 million litres of kerosene as fuel for domestic use. If 100% rural households are connected with electricity, the annual volume of consumption will drop down to 366.58 million litres i.e; the projected annual savings will be about 410 million litres. This amount of projected annual savings equals to Tk.7361.1 million, which is equivalent to about 53% of the present rural households expenditure on kerosene, or equivalent to 2.15% of the current annual valuation of national imports (CIF) of Bangladesh. Thus, ensuring 100% electrification of rural households will have major impact not only in reducing the dependency on kerosene, which is purchased in the context of fragile foreign currency reserve situation, but also will have high positive impact on the overall economy of Bangladesh and contribute towards macroeconomic stability (to certain extent). In addition, this will have major sustainability implications in terms of accelerating the process of ensuring an environment-friendly society in Bangladesh.

Impact on Surpluses and Savings

On an average, an electrified household had surplus amounting to Tk.20,287 which is 85 times of the households in non-electrified villages (Tk 238.4 only) . The situation of households by landownership categories was also better in the electrified households than the comparable households in the non-electrified villages. The rich-poor gap (landless versus large landowner) was much less pronounced in the electrified households (gap of Tk 74,312) than that in the households of non-electrified villages (gap of Tk 9,2791). On average, an electrified households had savings amounting to Tk 28,893, non-electrified in electrified households Tk 9,918, and households in the non-electrified village, Tk 14,007. The influence of electricity on household savings is evident from the higher average propensity to savings in the electrified households which is due mainly to the relatively high income and less proportion of recurrent expenses. Electricity contributes significantly in enhancing the savings rate of the poor in the electrified households, and reduces the rich-poor gaps in savings (by income groups such gap was 6.4 times in electrified households and 18 times in the non-electrified villages).

Impact on Credit

Since both asset and income were found to be higher in the electrified households than in the non-electrified ones, the former has relatively high creditworthiness. The average amount of credit taken in the last year by electrified households was Tk. 9,153, and that by non-electrified households in the electrified villages was Tk. 4,685, and the same for the households in non-electrified villages was Tk. 5,339.

Impact on Ownership and Assets

A higher proportion of the electrified households own cultivable land, as compared to their counterpart non-electrified households. About 79% of the electrified households (HE) reported ownership of cultivable land. The corresponding reporting was 59% for non-electrified households in the electrified villages and 73% for the households in the villages without electricity.

The average amount of own cultivable land of the electrified households is 178.2 decimals, that of WE-EV 74.2 decimals, and WE-NEV, 147.8 decimals.

During the last five years, the inequality situation of cultivable landownership has improved in the electrified households compared to that in the households of non-electrified villages. The relative share of ownership in the total cultivable land of the bottom 40% of the electrified households has gone up at a higher rate during the last five years, as compared to that in households of the non-electrified villages. The distribution of ownership of cultivable land in the electrified households, although skewed, is still better than that in the non-electrified households. The gini concentration ratio for ownership of cultivable land for the electrified households has dropped slightly from 0.62 in 1997 to 0.61 in 2002 (a decline of 1.6%); the same for non-electrified households in the electrified villages has dropped from 0.69 in 1997 to 0.68 in 2002 (a decline of 1.4%); but for the households in the non-electrified villages this has remained same at 0.67 in 1997 and 2002.

In terms of the absolute size of ownership and the increment, the higher increase in homestead, pond and kitchen garden in the electrified households compared to the others should be treated as a distinct sign of improvements in the standard of living in the electrified households.

During the last five years, in terms of dwelling and non-dwelling rooms the increase in the electrified households was higher than that in the households of non-electrified villages. The average space of dwelling rooms in the electrified households has gone up to 635 sq. ft. in 2002 from 513 sq. ft. in 1997, and that for households in the non-electrified villages has gone up to 440 sq. ft. in 2002 from 367 sq. ft. in 1997.

During the last five years, ownership of average number of livestock (cow, goat, sheep) and poultry has increased in the electrified households, whereas the ownership of livestock declined in the non-electrified households.

In terms of some household assets, there has been a major change in the electrified households. A high proportion of electrified households reported ownership of electrical appliances such as fan, TV, cassette player, iron, which are almost non-existent in the households of the non-electrified villages.

During the last five years, the asset strength of the electrified households has improved by a much higher rate than that in the two other categories: five-year increase for HE was 19.4%, for WE-NEV 10%, and for WE-EV 2.4%.

With all the fluctuations in the movement of households from one asset group to another, as compared to the non-electrified households, the electrified households have shown a much progressive trend in their economic strengths measured through upward movement of the household asset situation. This was evident in relatively less proportion of households in the low asset group, higher rate in the upward movement of the original (1997) low and medium asset groups (during 1997-2002), and relatively less pronounced downward trend of all the three asset groups.

SOCIAL AND CULTURAL IMPACT

Impact on Education

The overall literacy rate was found much higher at 70.8% in the electrified households, compared to that in the non-electrified households with 54.3% in the electrified villages and 56.4% in the non-electrified villages. Compared to the non-electrified households, the overall literacy rates for both male and female in the electrified households were significantly higher, especially due to the household's access to electricity which has contributed much both in economic terms as well as in raising awareness about value of education. The rich-poor divide in literacy was also less pronounced in the electrified than that in the non-electrified households.

The adult literacy rates for electrified households as compared to non-electrified ones is characterized by relatively high rate for both male and female, relatively less gender disparity, and relatively less rich-poor disparity. Therefore, it can be forcefully argued that ensuring access to electricity in the households should be seen as a major strategy to reduce the knowledge-poverty (in terms of both raising overall literacy and adult literacy) in rural Bangladesh.

The gross enrolment ratio – one of the major indicators of educational attainment – was high at 64% in the electrified villages, followed by 55% in the non-electrified households in electrified villages, and 54% in the non-electrified villages.

The quality of education measured in terms of household expenditure on education, marks (grades) obtained in the last final examinations, school drop-outs, school attendance rate, and time spent for study by students at night-all found much improved in the electrified than in the non-electrified household. Electricity matters in improving the quality of education. This quality improvement in the electrified households works through vary many channels: more time available for study after the sunset, the quality of that time due to sufficient light and fan for comfort, strengthening the knowledge-base due to access to TV (which in turn increases the appetite for learning), parents (especially mothers/other elder female members) devote more time in assisting children's education compared to before electricity etc.

Impact on Health, Hygiene and Sanitation

In terms of knowledge about the crucial public health issues respondents in the electrified households were reported to be much more aware than those in the non-electrified households. Out of 20 public health issues, on average, the respondents in the electrified households reported awareness about 12.8 issues, those representing WE-EV 8.8 issues, and those in WE-NEV 8.2 issues.

The (poor) landless in the electrified households was found more knowledgeable (61%) about the public health issues than even the rich (large landowner) in the non-electrified villages (59%). This also means, in terms of knowledge-poverty, the economically poor people become knowledge-rich if access to electricity is ensured.

Electricity has contributed spectacularly to the knowledge building about crucial public health issues. Overall, as high as 56% of those having knowledge in the electrified households reported TV as the main source of knowledge, the corresponding figure for TV was 28% in the non-electrified households in electrified villages, and 17% in the non-electrified villages.

Television had played an immense role as the major source of such enhanced knowledge on health issues.

Although the pattern of sickness did not show any variation by sample categories, the distinctions were pronounced when it came to the question of treating sickness by medically competent persons (MCP). Availing treatment from the MCP was much more pronounced in the electrified households (57%) compared to that in the non-electrified households (43%). The gender disparity in seeking treatment from MCP exists. However, it is much less pronounced in the electrified than that in the non-electrified households. Also, the rich-poor gap between utilization of MCP in sickness was 9.3% points in the electrified households, and as high as 21.8% points in the households of the non-electrified villages. Thus, availability of electricity in the households influences the status of seeking treatment from MCP (while sick) much more in the poor households than in the rich households. This means health poverty reduction— both in terms of awareness on public health issues and utilization of medically competent persons while sick— is possible with ensuring access to electricity in the non-electrified households.

A much higher proportion of child delivery (last birth) in the electrified households were assisted by medically trained persons (36%) as compared to that in the non-electrified households in electrified villages 23.1%. In terms of assistance in child delivery by medically trained persons, the electrified households show a much better situation – both overall, as well as by landownership categories.

The situation of availing of antenatal care (ANC) check-up during pregnancy by medically trained provider, receipt of tetanus toxoid injections during pregnancy, and post natal (PNC**)** check-up after delivery – all reported by a much higher proportions in the electrified households compared to those in the non-electrified households. All these imply that having electricity in the households positively influences the utilization of ANC and PNC services, and also acts as a health-mediated poverty reduction factor by motivating poor people (through radio/TV) to use ANC and PNC services in need.

Maternal morbidity during pregnancy, delivery, and within 42 days of delivery (postpartum period) is a serious public health concern in Bangladesh. Reduction in the burden of maternal morbidity by ensuring treatment by medically competent person is a major health-mediated poverty reduction strategy of the Government of Bangladesh which has worked much better in the households having electricity compared to those in the non-electrified villages.

One of the most spectacular influences of electricity was found on the infant mortality rate. The infant mortality rate in the electrified households is 42.7/1000 live births, in the non-electrified households in electrified villages 53.8/1000 live births, and in the non-electrified villages 57.8/1000 live births. IMR in the electrified households is 25% less than the national average (57/1000 LB) and 35% less than the national rural average (66/1000 LB). Estimates show that **if access to electricity is 100% ensured in the rural households, and those electrified households maintain the same IMR as the current electrified households, the annual number of infant deaths that could be saved will be around 36,818, i.e., a savings of 101 infant deaths everyday**.

The full immunization coverage among children 12-23 months was significantly higher in the electrified households (60.7%) than that in the households of non-electrified villages (36.5%).

About 68% of the currently married women in the electrified households reported their use of a contraceptive method. The contraceptive prevalence rate is 62.8% in the non-electrified households of electrified villages, and 61.7% in the non-electrified villages. Thus, in terms of attaining the national goal of NRR=1 by 2005 (which is equivalent to TFR= 2.1 by 2005), the electrified households appear to be more close-to-goal than the non- electrified households.

Access to electricity influences significantly in raising CPR among the poor-landless. CPR among electrified poor-households (65.7%) was found 19.5% higher than that among the poor in the non-electrified villages (CPR being 55%). These imply that ensuring access of the poor to electricity will have far reaching impact in the whole demographic future, as well as human development in Bangladesh.

The indication that electricity provides a great impetus in accelerating the process of attainment of the demographic goal of Bangladesh is clearly evident from the fact that a large share of FP use was contributed by the television. As for 22.5% of the family planning users in the electrified household, TV was mentioned as the most influential factor prompted FP use. Thus, electricity and TV together can contribute significantly in expediting the process of reaching the national demographic goals of Bangladesh.

One of the most notable findings in the study is related to the use of hygienic latrines. Sixty one percent of the electrified households reported use of hygienic latrines (sanitary, sealed closed), while the corresponding figures for non-electrified households in electrified villages was 29% and for non-electrified villages, 31.7%. Another significant finding was related to the proportion reporting `open space' for defecation: it was only 5.2% for the electrified, and around 20% for the others. Moreover, 50% of the poor households having electricity use hygienic latrine, while it was only 27.3% among their counterpart poor in the non-electrified villages. More spectacularly, while only 6.8% of the electrified poor-households reported use of open place for defection, it was as high as 29.2% for the poor in the non-electrified villages.

There has been distinct cultural changes in the hygienic practices due to household electrification. The use of soap after defecation was reported by 66% of the electrified households and only 33% of the households in the non-electrified villages. Besides, use of nothing (not even ash/mud) was reported by only 4.7% of the electrified and as high as 17% of the non-electrified households. Electricity has contributed significantly in promoting the use of soap/ash(mud) as hand-washing materials after defecation (which is televised frequently). In terms of all hygienic behavior and practices, the electrified households depict a much higher standard than the non-electrified households, and that especially as compared to the non-electrified villages.

Impact on Gender Dimensions: Women's empowerment, changing status, and modernization effects

Electrification has contributed to the positive development on women's socio-economic status. Electricity has left a profound impact on women's mobility, participation in IGAs, decision-making, freedom in using income and savings, better utilization of credit, knowledge about gender inequality issues, household work plan according to convenience, changes in attitude in terms of reducing healthcare disparities, increase in overall years of schooling for both boys and girls, preference to send girls to schools, awareness of legal issues, and awareness about negative impact of dowry.

Although, women in the non-electrified villages are working inside and outside home, they have less control over utilization of their earnings, decision-making; and their level of awareness of fundamental rights is low. One of the significant facts that, emerged is that if electricity is provided to them these women can benefit substantially with more power or status.

Against this context, it is important to enhance women's role in the decision-making bodies. Women do not have direct access to informal power structure and to many local committees. As for instance, in PBS's committees, only that person can participate against whose name the electricity connection has been taken; and it is always men who take electricity as their main breadwinner of the household. Although women are the *defacto* managers of the households, they are usually bypassed from membership in various committees. Three women are usually taken as the advisers in the committees, but other women from electrified households are not taken in as general members. There is a scope to include women in the PBS committees in a meaningful manner and to strengthen women's role in the decision-making institutions. Therefore, it is required to involve more women in the top-level management, and in the implementation stage, to formulate more gender-sensitive policies. It is against this context that REP should aim at changing rural women's overall living standard.

Electricity enables all members in electrified households to avail more time after sunset, in comparison with those in WE-EV and WE-NEV. The daily average time from sunset to sleeping is higher for all categories of household members in HE.

Socio-cultural development is the most prominent activity after sunset for household of their electrification status. Watching TV/listening radio is the major activity for senior members both male and female in HE followed by socialization. Both the activities facilitated through electricity also signifies spillover effect of electrification for female members in non-electrified households in the electrified villages as the study results revealed less difference with WE-EV (40.7%) in terms of time allocation for socio-cultural development in comparison with WE-NEV (47.5%).

Male household heads/senior male member in the electrified household spent more time in income generating activities (56.4 mins) after sunset, in comparison with WE-EV (50 mins) and WE-NEV (37.3 mins).

Business, emerging as the most prominent activity signifies increased economic activities in the region as has been reflected with higher time spent by WE-EV in comparison with WE-NEV.

Considering income generating activities for female household heads/senior female members sewing (IGA) appeared as the one entirely attributable to electricity. The difference in terms of average time spent for sewing in HE is 564.8% and 978.6% higher than WE-EV and WE-NEV respectively. Even for senior female students in HE, sewing can be treated as future source of income which is completely absent in WE-EV and WE-NEV.

Electricity plays the role of a catalyst in having a quality education both by extended time period and by creating comfortable environment through electrical appliances.

For landless electrified household, longer study hours for students and more time spent for socio-cultural development by the female household heads, acted as a catalyst for reducing human poverty. Higher allocation of time by the male household heads, the principal earner of the family in most cases, can contribute in reducing income poverty in an indirect fashion. The interplay of all those, actually create the environment for new opportunities to overcome the hardship of poverty

Providing electricity at the household level is crucial to ensure better standard of living as the effective use of time shapes up the life style for each individual concerned. Given the study results, the better use of additional time attributed to electricity, has facilitated the electrified household members to explore new range of activities as well as extended time period for the old ones. Comparing the pre and post electrification time allocation pattern for electrified household members, the study results revealed increased time allocation for activities like income generating activities or watching TV, which address income as well as human poverty. In the electrified household, reduced household chore for female members and reduced gender gap in terms of daily average time for studying is clearly indicative of improved gender status.

Thus, it can be recommended that to ensure better use of time after sunset by efficient allocation across different activities, it will be important to provide electricity at the household level. Electricity available at the household level should be a priority from the perspective of poverty reduction and women empowerment too, as the study revealed improved gender status in HE in the post - electrification period. Dominant spillover effect reported by higher difference in terms of time allocation between HE and WE-NEV, also rationalise the provision of electricity at the community level to ensure environment conducive to economic growth and higher standard of living.

Impact on Social Environment and Protective Security

Irrespective of availability of electricity in the households, almost all (96%) have said that electricity created significant employment opportunities. The most pronounced among those were creation of scopes for work at night (reported by 63% respondents), expansion of local trade and business activities (54%), generation of employment opportunities for unemployed youth (54%), broadening of scopes for employment in crop agriculture (53%), establishment of small and cottage industries (29%), increase in the opportunities for poultry raising (29%), and increase in the scopes for earning from multiple sources (27%).

Almost everyone (98%), irrespective of access to household electricity, agreed that protective security has increased due to electrification at the household level. The fact that security of mobility at night has increased due to electricity was confirmed by all respondents, irrespective of availability of electricity in their households.

IMPACT ON DEMOGRAPHICS

The reported mean number of children ever born to women was 4.3 in both the electrified households and households in the non-electrified villages. However, the mean number of deaths was relatively less in the electrified households with 50 (ever) deaths per every 100 households, which was high in the non-electrified villages with 62 deaths per every 100 households, and 59 deaths per 100 non-electrified households in the electrified villages. In the electrified households, not only the mean number ever died was relatively low, but also both the incidences of death and severity of death (measured in terms of death of 3 or more members) were less pronounced. As a result, the demographic consequences are distinct: the proportion of ever born still surviving is higher in the electrified households (88.4%) than that in the households of non-electrified villages (85.8%).

In the electrified households there are 935 females for every 1000 males i.e; 64 females are 'missing' against 1000 males. The corresponding missing number of females was higher at 71 in the non-electrified households in the electrified villages, and even higher at 100 in the non-electrified villages. Thus, the estimated missing number of females in the households of the non-electrified villages was about 54% higher than that in the electrified households. This issue of "missing females" has high gender, demographic and human development implications. Estimates done for the whole of rural Bangladesh show a total of 942, 215 missing females in the electrified households, 966,937 missing females in the non-electrified households of electrified villages, and a disproportionately high 2,857,404 missing females in the households of non-electrified villages. The inferences which can be drawn as to the positive influence of electricity in reducing the missing female population are as follows:

First: The number of missing females is disproportionately high in those villages where there is no electricity. Although the non-electrified villages constitute 49% of the rural population, they represent about 60% of the missing females of rural Bangladesh.

Second: Had there been no-electricity in the electrified households, the approximate number of missing females could have been 163,865 more than today (current number is 942,215), i.e, among other determinants, electricity has contributed in reducing the missing females by 163,865 persons. This implies that access to electricity has been instrumental in reducing the number of missing females in the electrified households by 17.4%.

Third: Had there been electricity in the households of the non-electrified villages the approximate number of missing females could have been reduced by 423,320 persons (i.e, from current 2,857,404 to 2,434,084).

The mean age of the household members was 26 years in electrified, 24.8 years in the non-electrified villages, and 24 years in the non-electrified households in electrified villages. Two important inter-related findings having significant demographic implications are as follows: (a) The mean age of the female members of the electrified households is 1.3 years less than the male members, 25.3 and 26.6 years, respectively. In the non-electrified villages the female mean age is 1.6 years less than their counterpart male members (24 and 25.6 years respectively). This relatively low female age in the non-electrified villages can be explained through relatively high proportion of women in the younger age group and relatively low proportion in the older age group. (b) The proportion of both male and female in the higher age group (45+ including the older age 60+) was relatively high in the electrified compared to those in the non-electrified. As for the younger age group (up to 14 years of age), the proportions of both male and female in the electrified were lower than those in the non-electrified households. Thus, young age structure was more pronounced for the non-electrified than the electrified households.

The average household size of the electrified households is slightly higher (6 person per household) than that in the non-electrified households (5.4 and 5.7respectively for those in the electrified and non-electrified villages). It is most likely that, this slightly high average household size of the electrified household is due to less poverty-induced out-migration of family members, higher incidence of joint-family structure, and job opportunities in the electrified areas.

The dependency ratio is lowest (0.64) in the electrified households, highest (0.73) in the non-electrified households of electrified villages and in-between (0.68) in the households of non-electrified villages. Thus, compared to the non-electrified, the same number of active population supports a smaller number of dependent population in the electrified households.

Estimates show that availability of electricity in the household contributes 15.7% in the reduction in overall total fertility rate (TFR) (comparison of TFRs in two extreme samples), but availability of electricity in the village but not in the household contributes only 2% in the reduction in TFR.

The TFR of poor in the electrified (2.7) was 26% less than that of the poor in the non-electrified villages, and it was even 7.5% less than that of the rich in the non-electrified villages (2.9). Thus, electricity not only contributes to declining overall TFR, but also contributes significantly to reduction in TFR among the poor.

The survey provided a number of indications about the urbanization of rural life in the electrified areas, as evident from the analysis of the pattern of household expenditure, and asset situation of the electrified households. The qualitative survey gave positive indications about high incidence of in-migration in the electrified areas.

During the last five years, a total of 966 persons have migrated-out from 2491 sample study households. Most out-migration was associated with marriage (ranging between 61% in HE and 72% in WE-NEV), followed by job (22% in WE-NEV and 33% in WE-EV), and education (4.3% in WE-EV, and 6.1% in HE and WE-NEV each).

A new phenomenon of in-migration into the electrified village has been reported. Many have said that, because of electricity, new economic activities have emerged, which has created more employment opportunities, and that, in turn, gave impetus for people in the non-electrified villages toward electrified villages for work. The occupational pattern has changed in the electrified villages. In addition, due to the availability of improved educational and health facilities people are also attracted toward electrified villages. Electrified villages have better agricultural facilities due to electricity-driven equipments for land preparations, irrigation, threshing, husking and demand for labour during harvesting has increased. All these have been instrumental in reducing out-migration for job from electrified villages, and in increasing in-migration (both temporary/seasonal and permanent) to electrified from non-electrified villages. Because of the combined effect of all these factors mediated-through rural electrification a tendency has been developed among people to shift their residence from non-electrified to electrified villages. As a result, the price of land in the electrified villages has increased.

IMPACT ON DIRECT USERS OF DOMESTIC ELECTRICITY: CONSUMER PREFERENCES, DEMAND, BENEFITS, PROBLEMS OF SUPPLY INTERRUPTIONS, AND WILLINGNESS-TO-PAY MORE

The average amount of expenses incurred for domestic connections was Tk. 1,480 per household with Tk. 253 to the PBS (as membership fee and guarantee deposit), Tk. 953 for purchase of wiring materials, Tk. 218 for wiring charges (to technician), and Tk. 55 for 'other' purposes. Thus, the one-time capital expenditure required to get domestic connection is about US$26, with 64% for wiring materials and only 17% to the PBS. Thus, as capital expenditure for domestic connections, rich spent 48% more than the poor, and the most part (73%) of the increased expenditure was due to the wiring materials and related charges. The policy - makers should note that this one time cost of connection (equivalent to 4.2% of the annual net income of the landless non-electrified households in the electrified villages) is relatively low.

As a means of household lighting, all the consumers prefer electricity to any other means. Before having electricity, as means of lighting, 51% had the habit of using lantern and 49% *kupee*. They used to light the lanterns/*kuppes*, on average, for 3.05 hours per night. Now, with the electricity in households, they use electricity, on an average, 4.6 hours per night for lighting.

This means, on average, electrified households now have 1 hour 33 minutes additional lighting hours available for leisure and/or for income generation activities. Thus, compared to before electricity, they now have 51% more time for lighting per night. Among all the economic (landowning) categories, the landless households reported highest extent of change: 55% more lighting-time now than before electricity.

Consumers of electricity reported use of both tungsten bulbs and fluorescent tubes. **Considering a total of 3,413,825 domestic RE connections, the approximate number of total tungsten bulbs in use would be 12.6 million and the number of fluorescent bulbs 1.54 million.**

The estimated average number of various electrical appliances purchased per 100 households was as follows: 168 fans, 53 TVs, 46 cassette players, 30 irons, 5 refrigerators, 4.3 mobile phones, and 2.4 juice machine. **Estimates show that nation-wide, due to REB (with 3,413,825 domestic connections as on June 2002), the total number of various electrical equipments sold (indication about the market) would be 5,735,226 fans, 1,795,672 TV, 1,570,356 cassette players, 1,010,492 irons, 170,691 refrigerators, 146,794 mobile phones, 81,500 juice machines, and 9,900 toasters**.

The future market for electrical appliances would be a huge one: the market for refrigerator would be 6 times higher than now, the market for charger lights will increase by 4.2 times, the market for TV will increase by 61%. Increase in the number of domestic connections will further expand the market for electrical appliances, and thereby, will have enhanced impact on people's standard of living and quality of life, by way of increased latent demand for modernization of rural life.

The source(s) of purchase or procurement of the electrical appliances now possessed by the households indicate development of relevant market close-to-consumers. This also indicates an expansion of employment opportunities in the commercial establishments selling and repairing electrical appliances.

The consumers prefer electricity for seven different reasons/purposes (proportion of reporting being different): for the quality of light, comfort, more time for household chores, watch TV, listen radio, and iron cloths and generate more income. Another prominent benefit of electricity was the availability of longer work hours and leisure due to lighting.

Changes in habits mediated through electricity have taken place. The pattern of favorable changes in habit and in leisure activities have direct positive impact in improving the quality of life and changing mind-set of people towards better life. This can be denoted as electricity-driven demand creation for improved standard of living.

Eighty seven per cent of the consumers (domestic) never faced problem of disconnection associated with the non-payment of bills. About 13% had experienced a disconnection for non-payment of bills. Further probing has shown that, 23% of the respondents ever faced trouble in paying the bill. Three reasons were mentioned: 67% could not pay due to want of money, 14% each did not get the bill in time and got incorrect bill. Thus, two notable issues are in order:

First: A 28% of those having had trouble in paying bills (6.5% of all consumers) were due to the causes associated with PBS management (incorrect bill or disbursement of bill not in time). This implies that, at least 28% of the problems associated with bill payment or delayed payment can be resolved by improving the relevant management parts of the PBSs.

Second: A 67% of those ever experienced trouble in paying bills (15.6% of all consumers) were associated with the non-availability of cash at the time of bill payment. Compared to the rich segment of the consumers, a higher proportion of the poor has mentioned so. However, based on this findings, it would be difficult to draw any firm conclusion about what can be done by PBS to resolve the issue. This is at least because of two reasons: (a) the average amount of bill is not so high as compared to the income (for landless category, monthly bill would be at best 4% of monthly income), (b) uninterrupted or irregular cash flow is a reality among many in the rural areas. Cash-flow has a seasonal characteristics in the rural areas, and that especially among the poor.

<u>Irregularity of power supply and load shedding</u> are acute problems in REP. About 85% of the customers have said, power supply irregular. Of these, 72% said that such irregular power supply is almost a daily affair. Irregular power supply mostly takes place in the summer and the 6-10 PM is the time of most irregular supply. These findings are sufficient enough to raise the question of quality of electricity supply through REP in the PBSs. The policy implications are straight forward: regularity in power supply needs to be ensured (or frequency of irregularity needs to be minimized); power supply during prime time, 6-10 PM should be made regular; and all mitigation efforts should be directed to address the problem of irregular supply during the summer season. It is most likely that more generation of is the most important route to resolve the issue of irregular power supply, because of the increasing population size and increasing demand for electricity in the rural households.

A large number of the domestic consumers are <u>willing-to-pay more</u> for electricity than now providing better quality is ensured. About 45% of the consumers have expressed their willingness-to-pay more for electricity providing their is no power fluctuations and round-the-clock availability of electricity is ensured. On average, the customers are willing to pay 7.42% more amount than now if better quality of services are guaranteed.

An average household pays Tk. 147.22 per month as electricity bill. Assuming this rate to be true for overall REPs domestic connections, the estimated annual revenue comes to Tk. 5,007 million (for 3,413,825 domestic connections, June 2002). If better quality of services are ensured (i.e, no power fluctuation and round-the-clock availability of electricity) and people pay as per their willingness-to-pay more, then the estimated amount of annual revenue from domestic connections would be Tk. 5,378.5 million, i.e; an annual increment of Tk. 371.5 million. It is most likely, if quality of electricity supply is really ensured, the actual extent of increment in the revenue will be much higher than the estimated Tk. 371.5 million.

DEMAND FOR ELECTRICITY AND REASONS FOR NOT HAVING ELECTRICITY

Around 94% of the non-electrified households have expressed their willingness to have electricity in their households. Respondents showing willingness to have electricity at their households reported multifarious reasons for such willingness. A close scrutiny of the reasons shows that people’s demand for electricity at their households is primarily determined by both the socio-cultural and economic needs associated with desire for enhanced quality of life.

According to our estimates, 17.88% of the rural households in Bangladesh have electricity connections, and 65% of the households in the villages with electricity do not have access to electricity. <u>What are the reasons for households' in access to electricity even in the electrified villages?</u> The reasons reported include financial insolvency, hassles to get connection, non-inclusion in PBS master plan, paid membership fee long ago but not yet connected, paid money but not yet connected, hassles of regular payment of bill, and completed wiring awaiting connection. The reported reasons show a pattern worth further analysis: Some will get the connection soon (those who paid money and completed wiring); many will not get connection because of their financial insolvency and because of non-inclusion in the master plan; and many are less interested due to the hassles in getting connection as well as hassles of paying the bill on a regular basis. Thus, two categories of problems can be resolved with PBS management intervention, and thereby, increase the number of direct beneficiaries of electricity : those who paid money and completed wiring, and those who have reported various forms of hassles associated with getting connection and paying the bills.

In general, people in the non-electrified households are not adequately aware about the costs associated with household electricity. About 50% of the respondents in non-electrified household are fully unaware about the one time amount of money (investment) required to get electricity connection. About two-fifths of the respondents in the non-electrified households are unaware about the approximate amount of monthly bill to be paid for domestic use of electricity. About 91% were found unaware about the per unit tariff for domestic use of electricity. The extent of unawareness about the unit tariff was more pronounced among the poor than among the rich landowner categories. **Thus, inadequate knowledge about one time investment, approximate monthly bill and unit tariff were highly pronounced among the respondents in the non-electrified households, implying that dissemination of these information would be necessary to make activities more transparent, which, in turn, will facilitate people's informed decision-making in having electricity connections at their households.**

IMPACT ON POVERTY REDUCTION AND HUMAN DEVELOPMENT

Absolute poverty was most pronounced among population in the households without electricity in electrified villages. About 40% of the population in the electrified households are below absolute poverty line. The corresponding figures for the population in non-electrified households of electrified villages is 51%, and that for the population of non-electrified villages is 43.4%. Compared to the national level of absolute poverty (44.3%) the electrified household's level is 11% less implying that electricity has contribution in poverty reduction.

Like absolute poverty, the **hard core poverty** was also most prominent among population in the non-electrified households in the electrified villages (27.1%). In the electrified households, 21.8% of the population were found below the hard core poverty line. The corresponding value for the population in the non-electrified villages was 23.1%.

The incidence of CBN poverty shows that both the lower and upper poverty lines are much less pronounced for the electrified households than the non-electrified households. The very high incidence of both lower and upper poverty among the population of non-electrified households, and high gaps in those incidences between the electrified and non-electrified households with electrified showing the least incidences (51% less in lower poverty line and 37% less in upper poverty line) signify that access to electricity in the poor households (not in the villages only) had much impact in poverty reduction. **Thus, ensuring poor people's (households) access to electricity should be assigned with high priority in any future poverty reduction strategy for the rural Bangladesh.**

In terms of incidence of poverty, one of the most interesting findings was the positive relationship between the age length of electricity in the household and the declining incidence of absolute poverty. 42.4% population in the households with 3 years of age-length of electrification are poor (below absolute poverty line), which drops down to 37.1% if the household age-length of electrification is 4-5 years, and further falls down to 33.9% if households electrification age is 6 years. This is quite a revealing finding to show that electricity influences poverty reduction, overtime, with a gestation period.

Human Development Index (HDI) has been constructed for all three categories of sample households. The HDI values obtained for electrified household is 0.642, for non-electrified households in the electrified villages is 0.440, and for non-electrified households in the non-electrified villages is 0.436. Based on the analysis of HDI of 3 categories of sample households, the following inferences are in order:

First : The HDI for electrified households (HE) 0.642 is substantially higher than the overall HDI of Bangladesh (0.478). The electrified households' HDI corresponds to the lower-mid-level index for medium HDI countries. This implies that, by ensuring 100% access to household electricity in the rural areas, Bangladesh may raise its HDI ranking substantially from current 145th position to a position of around 100 (corresponding to the ranking of such countries as Egypt, Bolivia, Indonesia, Honduras). **Thus, electricity's potential impact on enhancement of national HDI could be very significant.**

Second: Even the non-electrified households in the electrified villages (WE-EV), which are predominantly poor, represents an HDI almost similar to that of the Bangladesh country average. The former category's HDI value is even higher than the households in the non-electrified villages (which are economically better off than the non-electrified households in electrified villages). This imply that, HDI increases with the village level electrification even when household's access to electricity is denied. This, as found in the survey, is most likely influenced by the relatively low infant mortality rates and higher combined gross enrolment.

Third: The differences in HDI values between the electrified HHs and the non-electrified households in the electrified villages is 45.9%; between the non-electrified households in the electrified villages and the non-electrified villages is less than 1%, and that between the electrified households and the households in the non-electrified villages is 47.2%. This implies that, provisioning of access to electricity for the non-electrified households will have spectacular impact in raising HDI in Bangladesh. **Thus, village electrification without electrifying the households will have not much effect on improving human development and increasing HDI values. Or, in other words, universal rural household electrification will have spectacular impact on human development in rural Bangladesh.**

To recapitulate, electricity at the household level impacts upon almost all economic variable, improves living standard and quality of life, and reduces poverty.

a. Both absolute poverty and hard-core poverty are significantly less pronounced in the electrified than those in the non-electrified households.

b. Electricity contributes to income-poverty reduction. The average annual income (last year's) of the electrified households (Tk.92,963) is much higher (65%) than that in the households of non-electrified villages. The annual income of the poor (landless category) in the electrified (Tk.58,864) was around 50% higher than that in the non-electrified households.

c. Electricity has income-enhancing effect. 16.4% of the income of electrified households can be attributed to electricity. The corresponding figures for the non-electrified households in electrified villages was 12% and for those in the non-electrified villages only 3.6%. Other things being the same, 100% electrification of rural households (currently 17.88% of rural households are electrified) might increase the annual rural income by Tk.671 billion (which is equivalent to the 26% of the current GDP), and as high as 43% of this incremental income can be attributed to electricity.

d. The electrified households are much better-off than the non-electrified ones in terms of all human development indicators, namely human longevity (measured using infant mortality rate as proxy), human knowledge, and per capita real income. Bangladesh is a low HDI country (ranks 145 out of 173 countries) but the HDI value for electrified village-segment corresponds to the medium HDI countries such as Egypt, Honduras, Bolivia. Thus, ensuring household access to electricity alone can be seen as a necessary precondition to significantly improve human development scenario of Bangladesh.

e. Electricity contributes significantly in asset-building of the poor. Land-ownership (cultivable land) distribution is less skewed in the electrified than in the non-electrified – the bottom 40% of the electrified households own 3.7% of total cultivable land, whereas the bottom 40%of the households in non-electrified villages own only 1.6% of the total land. During the last five years, changes in the land ownership of the bottom 40% was more progressive in the electrified households than in the households of the non-electrified villages. The gini-concentration ratio of cultivable land ownership was 0.61 for electrified and 0.67 for non-electrified segments. Similar changes (during the last five years) in favor of the poor in the electrified households as compared to the poor in the households of non-electrified villages were evident in the ownership of other capital assets–dwelling/non-dwelling rooms, livestock and poultry, agricultural equipments and household durable.

f. Electricity has had significant impact is strengthening the socio-economic foundation and in improving the quality and living standards of the people in the electrified households. This has been amply reflected in the dynamics of self-assessed poverty status by the respondents.

g. Electricity has major demographic impacts. The population growth rate in the electrified household segment is less than that in the non-electrified. This is evident from the relatively low total fertility rate as compared to the non-electrified segment. Young age structure and dependency ratios were relatively less pronounced in the electrified than those in the non-electrified household. Electricity in the household contributed 16% of the reduction in TFR. The TFR of the poor in the electrified household is 26% less than that of the poor in the non-electrified villages. As compared to the non-electrified villages, in-migration was much pronounced in electrified villages (due to access to electricity and other associated modern amenities). Population survival rate is higher in the electrified than in the non-electrified villages. Among others, this is evident from the relative low infant mortality rate in the electrified, 42.7/1000 live births against 57.8/1000 live births in the non-electrified villages.

h. Electricity has played an immense role in improving people's overall health status, especially for those in the electrified households, and more so for the poor, women and children. The electrified households are much better endowed than the non-electrified households in the electrified villages and significantly better-off than the households in the non-electrified households in terms of the following heath indicators: awareness of crucial public health issue, seeking treatment by medically competent person while sick, use of medically trained persons in child delivery, accessing ANC and PNC check-ups, use of TT immunization, seeking treatment of medically competent persons in maternal morbidity, rate of full immunization of children (vaccines against 6 diseases), aversion of infant deaths, intake of Vit-A capsule to prevent nightblindness among children, use of family planning methods, use of higienic latrines, use of hand washing materials after defecation. In all these indicators, not only that the rich-poor divide was less pronounced in the electrified compared to the non-electrified households, but also the poor (landless) in the electrified have shown much better health outcomes than their counterparts in the non-electrified households, especially than those in the non-electrified villages.

i. Electricity has significant influence on education, especially on quality of education. This influence is much more pronounced among the poor and girls in the electrified households than the poor and girls in the non-electrified households. Compared to the non-electrified, the electrified households fare much better in terms of overall literacy rate; adult literacy rate; enrollment ratio; expenditure on education; performances in terms of examination results, attendance rate, dropout, and average time spent on study (after sunset, 6 PM). The overall literacy rate in the electrified (70.8%) is 26% higher than that in the non-electrified households. The same for the female is 31% higher: the rates being 65% in the electrified and around 49% in the non-electrified. The rich-poor gap in literacy is 20% in the electrified households, but it is as high as 60% in the households of non-electrified villages. The literacy rate among the poor in the electrified (66%) is about 41% higher than that of the poor in the non-electrified villages. The similar pattern holds true for adult literacy. In addition, the average annual household expenditure on education was 87% higher in the electrified (Tk.3,260) compared to that in the non-electrified villages (Tk.1,746).

IMPACT ON IRRIGATION AND AGRICULTURAL PRODUCTION

In agriculture, REP has contributed significantly in attaining food self-sufficiency through use of productive and efficient irrigation equipments, and generated stable employment opportunities.

Average number of days of irrigation in last year for DTW-E was 130 days, for DTW-D 128 days, STW-E 114 days, STW-D 117 days, LLP-E 112 days and LLP-D 82 days.

Electricity powered irrigation equipments, on average, cover 10 acres more net area, 12 acres more total area, and 3 acres more new-to-irrigation area as compared to the diesel operated irrigation equipments.

Land use intensity under irrigation of electricity powered equipment is higher in comparison with diesel operated ones' except for STW.

94% of total cropped area of the sample plots under electrified irrigation is engaged in cereal cultivation. Of all cropped areas under DTW-E, the largest part is used for cereal production. Similarly, 94% of total cropped area under STW-E are engaged in growing cereals. Potato is also being grown in areas under STW-E. Jute, Masur, Mustard, Cauliflower, Tomato, Melon are being grown in 2% of the total area under the same type of irrigation equipment. 100% of total cropped area under LLP-E is being used for cultivation of rice. Rice is being cultivated in 96 % cropped area under DTW-D. Potato being grown in 3% of cropped area and Bean in 1% area under DTW-D. In the total cropped area under STW-E, 94 % of area are being used for cereal production, 5% for Potato, and 1% for Chilly. 80% of total cropped area under LLP-D deals with Boro, and for Aman.

The above reveals that with the development of irrigation facilities, Boro cultivation has grown up significantly and it pushed out other variety of rice. **The commendable achievement of the country towards relative food self sufficiency have been made possible because of shift towards HYV and especially high yielding Boro followed by HYV Aman at a massive scale. The contribution of REP in attaining the same can be attributed to the facts that REB has ensured uninterrupted supply of water through more than 103 thousands of electricity operated irrigation equipment to approximately 2.3 million of acres of land under HYV Boro and HYV Aman.**

Average, <u>yield per acre</u> in plots under electricity powered irrigation is higher than that of diesel operated, and productivity of land under electricity powered irrigation is 24 % higher than that of diesel.

Cropping intensity in plots using electrically powered irrigation is 193, the corresponding figure for plots irrigated by diesel is 191 and for plots with no irrigation or rain-fed is 181. It implies that is electrified irrigation intensifies the land use by 12% points more than rain-fed/ no irrigated lands, while diesel powered irrigated land intensifies by 10% points.

Electrified irrigation equipment in general are more <u>dependable</u> compared to diesel operated.

<u>Operational cost</u> of electrified equipment, on average, is three-fourths in comparison to that of diesel operated ones. Energy cost of electrified equipment is 75% to that of diesel operated ones, maintenance cost ranging between 7-10 % of operational cost, cost of repairing for an average electricity operated equipment is almost one and a half less than that of diesel operated one.

Electrified irrigation equipment <u>creates employment</u> for two persons for almost half of the year and with the electrification of irrigation equipment, more than one hundred thousand additional employment have been created through out the year in rural areas of the country.

As land use intensity and cropping intensity through electrified equipment is higher and cost of operation of the same is lower including breakdown and associated problems - in comparison with diesel equipment, electrified irrigation has got <u>distinct advantages</u> over other types of irrigation. It is once again established that HYV crops and HYV Boro has been greatly facilitated by Rural Electrification contributing to spectacular growth in food production and thereby growth of Gross Domestic Product in the country. Therefore, in order to secure further growth in food production, particularly in the backdrop of WTO considerations, where countries are supposed to capitalize on their competitive advantage, electricity as a source of power needs to be made widely available in the rural areas of the country.

As the contribution of electricity is evidentially clear in the agriculture sector of Bangladesh, therefore, more generation of electricity, on the one hand, and better distribution of the same, on the other, is recommended. The REB needs to entertain its initial mission of connecting all irrigation pumps and think its mission/goal about engaging itself into generation of electricity too.

IMPACT ON INDUSTRIAL DEVELOPMENT

Industry is the second highest consumer of rural electricity-using 42.3%of the total MWH. During the last twenty years (1983-2002), the total number of industrial consumer of rural electricity has increased 3210 times and the average number of industrial connections per PBS has increased 550 times.

A substantial growth in industrial output (both in terms of volume and value) has been identified in the study. During last five years, the growth in value was about 295% in electrified industries. The total volume of output (in terms of ton) has increased by 78 percent, while the same growth was only 8 percent in non-electrified industry. The volume of output in terms of piece unit (other than ton and maund) grew up by 121% in electrified households, and it was –0.44 percent (negative) in non-electrified industries during the last five years.

The total employment in 63,220 industries in 67 PBSs is 983,829. During the last five-year, the overall, growth in employment in electrified industries was 52.84% with 41% for male and 121% for female. But the overall growth of skilled labour force was 78.6% with 55% for male and 417% for female labors. The total growth in employment in non-electrified industries during this period was 28.6% with 16.2% for male and 56.3% for female. The increase in the number of skilled labor was 41% – 11% for male and 170% female. The male labour force of electrified industry (last year) shares 79% of total working hours, and the same was 70% in case of non-electrified industries.

Electrified industries are both cost-efficient and productive. The average cost of production is Tk. 0.65 to produce output of one Tk. for electrified industries while the same was Tk.0.84 for non-electrified industries. Similarly the productivity in electrified industries isTk.131.07 per hour and in non-electrified industries Tk. 45.38 per hour. The low cost of production and high productivity have also reflected in the net revenue of the electrified industry which amounted to Tk. 302.4 billion, last year. All these indicators such as productivity, low cost of production and high profit indicate the efficient performance of electrified industries over the non-electrified industries.

RE connected industries have strengthen the local industrial base by promoting backward and forward linkages and diversification which later forms agglomeration by attracting and generating diversified services. The study shows that 3 industries were expanded through backward and 13 forward linkages, another 13 went for diversification, and 9 expanded through sub-contracted arrangements. The shares of these industries are not much pronounced compared to the total RE connected industries. But once this process has started, it would be intensified in the future. All these highlight the significant contribution of RE connected industries and underscore the need for further expansion of rural electrification for a rapid growth of industries. In view of the above stated, the following suggestions can be forwarded for policy-scrutiny:

i) The rural electrification should be expedited to cover more villages and areas.

ii) The local bazar or village market should be brought under rural electrification with utmost priority to provide incentives for establishing small and cottage industries, which, *inter alia*, will act as a powerful factor to stop or minimize the rural-push migration.

iii) The quality of supply should be improved and load shedding should be brought under minimum levels without increasing the tariff, initially.

iv) Those people who have successfully expanded their industries with the RE- connection should be encouraged to contribute to the Board of Management.

v) In the north and southwest region, expansion of many RE connected industries are inhibited due to the absence of gas supply. REB may take initiative to speed up the process of gas-based electricity production and distribution in the north and southwest regions for accelerated industrialization.

vi) Local agro-based industries should be encouraged to generate more income and employment in the country, and thereby facilitate the process of minimizing forced rural-to-urban migration.

vii) More security measures should be adopted to save the rural consumers from accidents caused by electricity.

Rural electrified industries have been playing a pivotal role in changing the living condition of the rural people whose fortune was tied-up with subsistence agriculture till the coming of rural electrification. More and more people have been shifting their traditional stereotype business to the more dynamic industrial venture. Development of agglomeration resulting from industrial concentration in many rural areas generated income and urban facilities and thus contribute in reducing the urban-rural gap.

Modernization of agriculture has taken shape during the last twenty years. Such modernization has augmented the output, in one hand, but ousted many small and marginal farmers, on the other. This process of uprooting has been accelerated and aggravated by population pressure, river erosion and many other natural calamities and man made reasons. Rural electrification has, to some extent, been able to absorb these ousted people in their concerned areas. But the most striking feature in this process is the participation of many female labors of both skilled and unskilled, who otherwise have been confined to household work.

Finally, more villages are electrified, more industries will be established, more people will be able to change their living condition, more rapid will be the process of social transformation– essential for the economy and nation as a whole.

IMPACT ON COMMERCIAL ACTIVITIES

Rural electricity has acted as a leap-forward in the development of commercial activities in rural Bangladesh. Out of the total shops in Bangladesh an estimated 24% are using rural electricity.

E<u>lectrified shops are more attached to market</u> and wholesale shops are all the more attached to marketplace. In some cases availability of electricity has given rise to constellation of shops, on other cases already existing constellation of shops have been served with electricity.

Quite a number of <u>electrical appliances</u> are used in the shops and they are found to be profitable. <u>Fridge</u> is spectacular in its contribution both financially and emotionally.

<u>Business turnover</u> be it daily, weekly or monthly for electrified retail shops are more than double than that of non-electrified. In case of <u>wholesale</u>, business turnover is 11 times higher

in electrified than in non-electrified. Similar is true for volume of business, business hours, volume of customers, employment of electrified shops then non-electrified. Generally, the traders of electrified areas appear more vibrant than those of non-electrified. Sometime electricity appear as world-view, as an outlook, as status symbol and all pervasive 'source of power'. More professional approach toward business is visible among electrified traders than non-electrified.

Those traders who are yet to get the benefit of electricity are ready to <u>invest for electricity</u> as they think it worth from the business point of view.

Estimates pertaining to the <u>contribution of rural electricity on sales turnover</u> of retail and wholesale shops reveal the following:

i. In case of electrified retail shops, rural electricity's contribution to the additional sales turnover is 34.51% and the same to the overall sales turnover is 17.26%.

ii. In case of electrified whole sale shops, rural electricity's contribution to the additional sales turnover is 15.08% and the same to the overall sales turnover is 11.23%.

iii. For overall Bangladesh, the total annual (2001) sales turnover of retail and wholesale shops is Tk.1,274.1 billion of which RE connected shops' share is Tk.301.2 billion i.e; RE connected shops share 23.64% of the total annual sales turnover of all shops in Bangladesh.

iv. Most importantly, out of the total annual (2001) sales turnover of retail and wholesale shops in Bangladesh (Tk.1274.1 billion) rural electricity's share is Tk.174.9 billion, i.e.; rural electricity's contribution (through commercial connections) to the national overall annual sales turnover of retail and wholesale establishments is 13.72%.

As there is clear impact of electricity on trade and business with presumable multiplier effect, electricity should be made widely available in rural areas.

Cost-benefit considerations at a given point in time may not be encouraging but given the longer benefit with multiplier effect - investment in generation and distribution of electricity is strongly recommended.

Although complain resolution rate at PBS is commendable (97%), customer care on the part of REB-PBS is still not praiseworthy. The whole approach of REB should be made more customer-oriented and toward that, the PBSs need to be activated further.

Those who are yet to get electricity have been found to use diesel generators for lighting and other purposes. REB can think of better-options, other than electricity, for them.

Need for electricity is there but demand is yet to emerge. REB can think of networking with local organizations, associations to translate those need into effective demand.

PBS: IMPACT ON LOCAL GOVERNANCE AND DEMOCRATIZATION

PBS members elect the Board Directors by direct voting which create an opportunity to build a social network among the users and to have control over the mechanisms that allow their voices at the PBS management level. Since electricity created congenial environment for political and social gathering, community and courtyard meeting, people spend longer period in union council, clubs, cooperatives and *samities* and strongly participate in local level decision making.

Less than one-third of the PBS members (29.6%) were found to know the eligibility criteria to be a Director, about one-fourth (23.9%) of the PBS members reported to attend the last AGM and majority of the PBS members (65%) never casted their vote. Mentioned reasons for non-participation in PBS election were – distance of PBS election centers from the household, lack of time and transport fare etc. Majority of the PBS members (60.3%) appeared to be ignorant about the roles of the elected directors in PBS management. The rate of attendance in last AGM by the PBS members of the electrified villages is low (23.9%).

Majority of the respondents (70%) in electrified villages reported that PBS played useful role for members. The average number of complains were 7199.81 per PBS in 2000 and the number of complains resolved were 6987.85 (97.1%). The number of complains per PBS and the percentage of the complains resolved proves the nature of accountability to the PBS members and level of efficiency.

Local governance contributes to the required scaling up of the rate of poverty reduction through enhancing the developmental choices available at the local level and a better inclusion of all social groups in these choices. PBS system is one of the best existing models of local governance and decentralization in Bangladesh. The model of PBS can be replicated in other sectors of development and resource management for the better future of Bangladesh.

To achieve the objective of rural power supply for poverty reduction, governance system of PBSs should be improved and democratization should be the norm of implementing the PBSs' activities. The following recommendations are advanced to improve good governance of PBS and to strengthen democratic practices in PBS management:

- To strengthen local governance and to ensure transparency and accountability, the "Best Actors" of human governance should be involved for development of PBS.

- For PBS members the motivational and awareness activities on their rights and obligation should be strengthened.

- Since the poor have weak social networks and they are excluded from mechanisms that allow their voices to be heard, PBS can play an important role in building trust and norms for coordinated actions to extend people's freedom and to exercise choice by creating institutional structures that in turn create capabilities.

- All the electricity users should be the members of PBSs for better participation in local level planning, decision-making and implementation.

- Constraints of participation in PBS election faced by the PBS members should be eliminated.

RECOMMENDATIONS

1. Based on the empirical findings of this Study it would be pertinent to conclude that rural electricity has profound and far-reaching economic, socio-cultural and demographic impacts on life and living of the rural people in Bangladesh. Access to rural electricity has significant and sustained impact on the reduction of both income-poverty and all dimensions of human poverty (health, education, women empowerment). The Study's findings also indicate that rural access to this commodity has deep-rooted impact on agricultural development, industrialization, and business and commercial activities. In addition, it has impact on human capital formation through knowledge building mediated through electricity-driven media exposure. Thus, in order to accelerate the process of economic growth, strengthening pro-poor orientation in growth process and to further human development in Bangladesh, access to electricity of the households and social and economic institutions should be expanded within shortest possible time.

2. Vigorous efforts are needed to devise appropriate strategies (means and ways) to increase the coverage of the non-electrified households in the electrified villages (65% households in the electrified villages, which is equivalent to 33.5% of all rural households in Bangladesh) in to the scheme of the rural electrification program. This will contribute to both increasing socio-economic impacts as well as improving the financial viability of the PBSs.

3. Special policies and strategies should be designed and implemented to accelerate the process of poor peoples' access to electricity.

4. Analyses of numerous and diverse impacts of rural electrification provide adequate logical basis to argue that rural electrification should be given top most priority as a catalyst for ensuring accelerated human development, poverty reduction and economic growth in Bangladesh. Therefore, rural electrification should be viewed as the cornerstone of national poverty reduction strategy.

5. Due to the richness in content and diversity, and potential high knowledge-building and policy utility (for almost all economic and social sectors) of the Study, the findings should be widely disseminated for both awareness raising amongst the masses of people and for policy advocacy purposes among both the development partners and high level policy makers, including those amongst the people's elected representatives. To expedite this dissemination process to these different target populations, the production of relevant materials in the form of short films, documentary, booklets would be useful.

6. It is due to the innovative nature of the study design that the methodology used in the Study should be disseminated among the relevant research community – both at home and abroad. An in-depth understanding of the study methodology will be of high utility for the capacity building of REB staff members who are involved in the designing and evaluation of socio-economic impacts of rural electrification. The dissemination of this innovative study design would be useful for all RPPR partners and other stakeholders in their quest for developing the system for measuring impacts under the RPPR Program.

7. The production and publication of research-based books – one in Bangla and the other in English – on the subject "Economic and Social Impact of Rural Electrification Program in Bangladesh" would be useful for a broader audience. This would be the first of its kind in Bangladesh and perhaps elsewhere as well.

8. The empirical data-base produced in this Study is huge, and of high quality in terms of accuracy and depth. This database should be profitably used in the future as a baseline and/or as a benchmark for all subsequent socio-economic impact evaluation studies of rural electrification in Bangladesh.

9. Considering the availability of a wealth of data produced in this research and prepared in a working database, it is highly recommended that all possible secondary analyses be conducted for better understanding of many dimensions of relevant impact to expedite the process of informed policy and decision making by the concerned authorities. Secondary analyses are also suggested to strengthen and generate a new knowledge-base on the subject.

10. The knowledge gap of all stakeholders about various relevant dimensions of the impact of rural electrification is still considered to be high. Thus, in order to minimize this knowledge gap, further more focused and in-depth studies should be launched on areas of specific interest, such as migration and rural electrification, the relationship between poverty reduction and age-length of domestic connections, the relationship between willingness-to-pay and quality services, electricity's role in improving people's health, relationship between electricity and mortality and morbidity, electrification's role in empowerment of women, and the PBS as a good governance model. These studies should be conducted on a priority basis, in which poverty reduction, production, and human development areas should be assigned as the top priorities.

11. The development needs of the entire Bangladesh Rural Electrification Program and the probable requirements of the donors and development partners will likely require similar large-scale impact assessment studies to be conducted in the future on a periodic basis with the recommended interval being a minimum five years.

12. In order to expand the concept of sharing best practice experiences worldwide and to lend support to the partner-countries, all members of the donor community and other development partners involved in rural electrification, such as NRECA, could gainfully utilize the innovative design and methodology of this research to study economic and social impact of rural electricity programs in other countries such as Costa Rica, Bolivia, Philippines, India, Indonesia, Vietnam, Nicaragua, Ecuador, Panama, Ghana, El Salvador, etc. The national research and policy partners in these partner countries can be trained on this Bangladesh Methodology, which will also contribute to their own national capacity building efforts.

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ANNEXES

ANNEX A:	**ISSUES ON METHODOLOGY**
ANNEX B:	**DATA COLLECTION INSTRUMENTS**
ANNEX C:	**TABLES**
ANNEX D:	**SOME ENVIRONMENTAL ASPECTS OF RURAL ELECTRIFICATION PROGRAM**
ANNEX E:	**TERMS OF REFERENCE**
ANNEX F:	**STUDY PERSONNEL**

ANNEX – A

ISSUES ON METHODOLOGY

Annex-A1: Understanding REP’s Objective
Annex-A2: Glimpses of Relevant Studies
Annex-A3: Universe and Sample
Annex-A4: Field Staff Training Schedule
Annex-A5: Issues on Data Quality and Data Management
Annex-A6: List of Participants of “Study Findings Dissemination Meetings” with USAID, and with REB and RPPR Partners.

A1: UNDERSTANDING REP'S OBJECTIVES[1]

A1.1. Intended or direct Objectives

The major intended or direct objectives are as follows:

- Poverty reduction,
- Increase in farm-yields and non-farm production
- Enhance productivity and efficiency in agricultural production and industrial units.
- Greater job opportunities for rural people, especially for the deprived – poor, women, female-headed households
- Reduce rural-urban disparity by relocating the growth centers in the electrified rural areas.

A1.2. Indirect Objective Broader Impacts

The indirect objectives or broader impacts of REP has been analysed in line with the diagram-1, by identifying the impacts on the individual levels and community levels as well.

A1.2.1. Individual Level

- Education: Improved environment for education due to availability and proper use of educational hours and awareness created out of media exposure.
- Health: Better health care facilitated by electric appliances and better knowledge on health issues and nutritional status.
- Access to information: Greater access to information due to electronic media.
- Access to institution: Local level democratization in PBSs and greater awareness concerning GO-NGO programs like micro-credit.
- Women empowerment (in addition to the above stated):
  i) Extended work hour for womenfolk and effective use of extra hour
  ii) Greater control over earnings and household decision making due to income generation and media exposure

A1.2.2. Community Level

- More effective and efficient use of existing resource base.
- Increased social security, especially for mobility of women at night, like attending night schools.
- Reduction in gender disparity due to media exposure and access to institutions as well as increased social interactions of the womenfolk.
- Increased efficiency in operating public institutions like health complexes, dispensaries, schools, places of worship etc.
- New job opportunities for local people to meet the demand for support service system.
- Increased job opportunities in all the sectors (including the non-electrified ones) due to expanded work-hours and multiplier effect of enhanced activities in the electrified consumer units (like expansion in the rural industrial base).
- Reduced import of kerosene and diesel and thus foreign exchange savings.
- Conservation of nature by substituting fossil fuel with electricity.
- Reduced rural-urban migration.
- Exposure to modern amenities and a new worldview for the rural folk.

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[1] The objective of REP (In ToR objective B.1 in Annex D) was termed as "intended" and "unintended". Later on, a meeting was held between the Core-team and NRECA (only 31st March 2002) to review the draft Report 1. After much brainstorming about the essence/contents of the two categories, namely "intended" and "unintended" objectives, it was resolved that from now on, the "intended" objective will be termed synonymously as "direct" objective; and the term "unintended" objective will be replaced by "indirect" objective or broader impacts.

A2. GLIMPSES FROM RELEVANT STUDIES

The findings of different studies with reference to respective literature is presented in Table-1, with a separate discussion on 1996 impact evaluation study funded by USAID. The rationale for presenting 1996 study results in a relatively detailed manner, lies with the fact of being the inceptive one.

Table A1: Socio-economic Impacts of Rural Electrification

Community	**Individual**	
	Production units	**Household**
• More efficient lighting (Khan, 1997) • Increased social security (Davis 1983, Rahman 1993) • Improved social services (Davis 1983) • Increased effectiveness of other (existing) infrastructure(Davis 1983) • Gender awareness(Rahman1993) • Reduction in pollution and conservation of trees (Rahman 1993) • Increased demand for rural electrification from non-electrified households (UN/ILO1986)	**Agriculture** • Expansion in irrigation (Khan 1997, Salehuddin 1989, UN/ILO1986, Daily Star 1995) • More adoption of HYV technology (Salehuddin1989, UN/ILO1986) • Reduction in the cost of production as compared to diesel and kerosene (Davis 1983, Daily Star1995, Rahman 1953) • Increased cropping intensity (Islam1993) • Increased agricultural productivity (Davis 1983, Daily Star1995) • Better land use (Daily Star1995) **Industry** • Enhanced opportunities for rural industrialization (Islam 1993, Khan1997) **Commercial establishment** • Increased business hour (UN/ILO1986, Daily Star1995) • Income equalizing effects for small merchants(Davis 1983)	• Increased employment opportunities (Davis1983, Islam1993, Rahman1993, Daily Star1995) • Increased income and consumption (Rahman 1993, Khan 1997, Davis 1983, UN/ILO 1986) • Facilitating educational efforts (Rahman 1993, UN/ILO 1986, Davis 1983) • Utilization of more family labor for irrigation equipment-owners (UN/ILO 1986) • Better access to information through electronic media (Davis 1983, Rahman 1993) • Better access to health care facilities (Davis 1983) • Increased satisfaction with life and higher standard of living (UN/ILO 1986, Davis 1983)

The 1996 Impact Evaluation Study (Rahman A et. al 1996) evaluated the socio-economic impacts of rural electrification using both qualitative and quantitative methods. According to the 1996 study, the respondents ranked electrification as the single most important ingredient critical to improving quality of life in rural areas. The major findings are as follows:

1. Increased income (nearly twice the average income) in electrified villages
2. Increased farm yield
3. Increased off-farm income by over 65% in the majority of electrified houses
4. Moderate industrialization in the electrified villages
5. Better provision for education
6. Exposure of women and empowerment
7. A new world view for the rural folk. Moreover, while nearly 46% of the national population lives below the poverty line , the poverty rate for villagers served by PBSs is 34% for all PBSs, and only 27% for the members of developed PBSs(18)

A3. UNIVERSE AND SAMPLE

A3.1. Selection of Sample PBS

According to MIS statement of June 2001, age distribution of PBSs is highly negatively skewed which is supposed to be so. PBSs are heterogeneous in terms of age length as well as their contributions. Therefore, we form three, more or less homogenous, age groups according to Quartile values. Proportional allocation of 23 sample PBSs to these strata have been made and shown in Table A2.

Table A2: Selected Sample PBS

Strata	Number of Selected PBSs	Name of Selected PBSs (PBS Code)
Q_3 and above **(18 years and above)**	6	1. Dhaka PBS-1 (D1)
		2. Comilla PBS – 1 (C5)
		3. Sirajgonj PBS (R 17)
		4. Jessore - PBS – 2 (K 3)
		5. Natore PBS - 2 (R 9)
		6. Feni PBS - (C 8)
Above Q_1 and up-to Q_3 **(6 years to <18 yrs)**	11	1. Mymensingh PBS - 1 (D 9)
		2. Dinajpur PBS – 1 (R 2)
		3. Bogra PBS (R 1)
		4. Barisal PBS - 2 (B 2)
		5. Meherpur PBS (K 8)
		6. Norsigndi PBS-1 (D 13)
		7. Naogaon PBS (R 7)
		8. Sylhet PBS-1 (S 3)
		9. Chittagong PBS-2 (C 4)
		10. Cox's Bazar PBS (C 7)
		11. Netrokona PBS (D 15)
Q_1 and below **(upto $\leq$ 6 years)**	6	1. Faridpur PBS (D 3)
		2. Rajshahi PBS (R 14)
		3. Magura PBS (K 7)
		4. Brahman Baria PBS (C 1)
		5. Nilphamari PBS (R 11)
		6. Gopalgonj PBS (D-4)
Total	**23**	

In selecting sample PBSs within each stratum we adopted PPS (Probability Proportionate to Size) according to number of villages electrified.

A3.2. Selection of Control Sampling Units

In determination of control sample sizes statistical formula used are as follows:

$$n = \left(\frac{? S^2}{C} \right)^{\frac{1}{2}}$$

where

n = Sample size

? = Arbitrary constant

C = Increase in cost per unit increase in interviewee under linear cost function

S^2 = Variance of a pertinent variable which is electricity consumption of last month in the present case

[Cochrane, 1999]

Now, in order to adopt above formulation, we surveyed some sampling units during our familiarization (pre-field) visit to Sirajgonj and Gopalgonj (during the period between April 10 and 20, 2002). We have collected data on electricity consumption of last month for 60 households, 20 industrial units, 20 commercial, and 20 irrigation units. We have also collected such data for 20 agricultural units without irrigation. However, herein we present determination of representative sample sizes for different categories.

Household level

Non-electrified household in electrified village

From the information collected during pre-field visit we have estimated

? = 1000

C = Tk. 35

S^2 = 6194.2

These estimates produce **n = 421.** It is noted here that S^2 is the variance of electricity consumption of last month for households with electricity and it is assumed here that same variance is also true for households without electricity if they become consumer.

Village without electricity

Household level: As in the case of experimental area, 30 households per PBS i.e. 23 x 30 = **690**

Area (within PBS) with or without electricity

Industry level:

In line with above formulation for `without electricity’,

S^2 = 645506

C = Tk. 45

? = 23.23%

n = 59

Commercial Level:

S^2 = 222878.8

C = Tk. 25

? = 1.7

n = 128

Irrigation level:

(a) User of other than electrified irrigation equipments

S^2 = 580325.3

C = Tk. 40

? = 36.1%

n = 73

(b) No irrigation at all

Just as the above case we have decided the sample size of households without irrigation. In this case also we have assumed that if these households would be electricity consumers for irrigation, same variance in consumption of electricity would occur.

S^2 = 580325.3
C = Tk. 40
? = 30%
n = 67

Table A3: Village Level Sample Size of Households

Experimental/Control	**# Village**	**# Households**	**# Household per village**
Intervention PBS area (PBS village)[1>] i. With electricity : **Experimental**	46 ↓	46X30 = 1380	30
ii. Without electricity : **Control**	Villages same as above	46X (9 to 10) = 421	9 to 10
iii. Within PBS area without electricity (Non-PBS village): **Control**	23	23X30 = 690	30
Total	**69**	**2491**	**-**

[1>] ***PBS Village*** *means village with electricity* ***; non-PBS village*** *means village without electricity.*

For selecting specific households, sampling frames of corresponding PBS and non-PBS villages will be used.

From the household list of selected PBS village, required number of households is randomly selected using Simple Random Sampling (SRS) Procedure. In case of control area (non-PBS village), household list of village is used.

A4: FIELD STAFF TRAINING SCHEDULE

Table A4: ESIES Field Staff Training Schedule

Date (Day)	Time		Events	Responsibility
18/05/02 (Day 1)	7:30		Arrival at HDRC	AS
	8:45		Arrival at REB	AS
	8:50	9:20	Registration	AS
	9:20	10:00	Briefing Session	AB, SHK
	10:00	10:30	Tea	
	10:30	12:40	Inaugural Session	Ziaul Islam Chowdhury, Chairman, REB
				James M. Ford Chief of Party, NRECA
				Touhidul Islam Member-PBS and Training
				Ahsan Habid Executive Director, REB
				ABM Ali Hossain, Director, PBS (Management & Operation, South)
	12:40	1:30	Lunch	
	1:30	3:30	HHIS	AB, AP, MM
	3:30	3:55	Tea	
	3:55	5:00	HHIS	AP, MM, SH
19/05/02 (Day 2)	8:30	9:00	Registration	AS
	9:00	10:30	HHIS	AB, NNR
	10:30	10:45	Tea	
	10:45	12:00	HHIS	AB, NNR
	12:00	12:30	Group Formation	AB, SHK, AKMM
	12:30	1:15	Lunch	
	1:15	3:30	FSG 1 & 2- HHIS	AB, AP, AK
			FSG 3- IUIS	SZ
	3:30	3:45	Tea	
			FSG 1 & 2-IEAIS	AP, AB, SH
			FSG 3- IUIS	SZ
20/5/02 (Day 3)	8:15	9:00	Registration	AS
	9:00	10:30	FSG 1- HHIS	SH, MM, AB
			FSG 2- IEAIS	AK, AP
			FSG 3- IUIS	SI, SZ
	10:30	10:45	Tea	
	10:45	11:05	FSG 1, 2 & 3 – Quality of Data	KKD
	11:05	12:15	FSG 1- HHIS	SH, MM
			FSG 2- IEAIS	AP, AK
			FSG 3- IUIS	SZ, SI
	12:15	1:00	Lunch	
	1:00	3:30	FSG 1- HHIS	AB, NNR
			FSG 2- IEAIS	AP
			FSG 3- IUIS	SZ, MR
	3:30	3:45	Tea	
	3:45	5:00	FSG 1- HHIS	AB, NNR
			FSG 2- IEAIS	AP
			FSG 3- IUIS	SZ, SHK

Date (Day)	Time		Events	Responsibility
21/05/02 (Day 4)	8:30	9:00	Registration	AS
	9:00	10:30	FSG 1- HHIS	AB, NNR
			FSG 2- IEAIS (Role Playing)	AP, AK
			FSG 3- CUIS	SHK
	10:30	10:45	Tea Break	
	10:45	11:05	FSG 1, 2 & 3- PBS: Formation & Functions	ABMAH
	10:45	12:35	FSG 1- HHIS	AB, SH
			FSG 2- IEAIS (Role Playing)	AP, AB
			FSG 3- CUIS	SHK
	12:35	1:30	Lunch	
	1:30	3:45	FSG 1- HHIS	SH, MM
			FSG 2- FGD Guideline for IEA	AP
			FSG 3- CUIS	SHK
	3:45	4:00	Tea Break	
	4:00	5:00	FSG 1- HHIS	MM, MR
			FSG 2- FGD Guideline for IEA	SH, AP
			FSG 3- CUIS	SHK
22/5/02 (Day 5)	8:25	9:00	Registration	AS
	9:00	10:45	FSG 1- FGD Guideline for HH	SH
			FSG 2- IEAIS	AP
			FSG 3- IUIS	SZ
	10:45	11:00	Tea Break	
	11:00	11:15	PBS and Democratization	A.B.M Ali Hossain, Director, PBS (M & O – South)
	11:00	12:35	FSG 1- HHIS (Role Playing)	SH, AB, NNR
			FSG 2- Estimation Exercise for IEA	AB, AP
			FSG 3- FGD Guideline for IU	SZ, SH
	12:35	2:00	Lunch	
	2:00	3:35	FSG 1- HHIS (Role Playing)	SH, MM
			FSG 2- Estimation Exercise for IEA	AP, AB
			FSG 3- CUIS	SHK, MR
	3:35	4:00	Tea Break	
	4:00	4:30	FSG 1- HHIS (Role Playing)	SH
			FSG 2- IEAIS	AP
			FSG 3- FGD Guideline for CU	SHK
	4:30	5:00	Orientation on Field Test	AB, SHK, SH , AKMM
23/05/02 (Day 6)	7:30	8:30	Field Test in Narshingdi	Full Team: 117 persons[> **]
24/ 05/02 (Day 7)	9:30	12:00	FSG 1 & 2- Field Test Review for HHIS	AB, MM, AP
			FSG 3- Field Test Review for CUIS & IUIS	SHK, SZ, MR
	2:00	4:30	FSG 1- Field Test Review for HHIS	AB, SH, NNR
			FSG 2- Field Test Review for IEAIS	AP, AB, AK
			FSG 3- Field Test Review for CUIS & IUIS	SZ, SHK
25/ 05/02 (Day 8)	8:00	3:30	FSG 1, 2,3 - Role Playing	AKMM, AS

[> **] ***The team comprises of 4 consultants, Field Coordinator, System Analyst , 12 QCOs and 99 field trainees***

Date (Day)	**Time**		**Events**	**Responsibility**
27/5/02 (Day 9)	8:30	9:00	Registration	AS
	9:00	10:40	FSG 1- Role Playing Review for HHIS	AB, SH, MM
			FSG 2- Role Playing Review for IEAIS	AK
			FSG 3- Role Playing Review for CUIS	SHK, MR
	10:40	11:00	Tea Break	
	11:00	12:35	FSG 1- Role Playing Review for HHIS	AB, SH, NNR
			FSG 2- Role Playing Review for IEAIS	AP
			FSG 3- Role Playing Review for CUIS	SHK, MR
	12:35	1:20	Lunch	
	1:20	2:45	FSG 1 & 2- HHIS	AB, AP, SH
			FSG 3- Role Playing Review for CUIS	SZ, SI
27/05/02 (Day 9)	2:45	3:15	FSG 1, 2 & 3- Sampling	MR, AB
	3:15	3:45	Concluding Session	Ziaul Islam Chowdhury Chairman, REB
				AB
	3:45	4:10	Tea	
	4:10	4:30	Concluding Notes	Ahsan Habib, Executive Director REB
				K. K. Dey, NRECA
	4:30	5:05	Group wise Reporting Time for Field Staff	AB, AKMM
29/05/02 (Day 10)	2:00	4:00	FSG 1- Estimation Exercises for HHIS	AB , MR
			FSG 2- FGD Guideline for IEA	AK
			FSG 3- FGD Guideline for IU	SZ, SH
	4:00	4:15	Tea	
	4:15	6:20	FSG 1- FGD Guideline for HH	SH, MM
			FSG 2- FGD Guideline for IEA	AK, AB
			FSG 3- FGD Guideline for CU	SHK
30/07/02 (Day 11)	10:00	11:30	FSG 2 & QCO- SDCF	AB, AKMM
	11:30	1:30	FSG 2 & QCO - Field Implementation	MR
	1:30	2:00	Lunch	
	2:00	4:30	FSG 2 & QCO – Quality Control & Field Monitoring	AB, SHK, AKMM
	4:30	4:50	Tea	
	4:30	6:00	FSG 2 & QCO – Dos and Don'ts in the field	SHK, AB

Note: AB = Abul Barkat, Ph.D, MR = Matiur Rahman, Ph.D, AK = Ansarul Karim, Ph.D.,
SHK = Sayeedul Haque Khan, , Ph.D., SZ = Shafique uz Zaman, Ph.D.,
SH = Sadeka Halim, Ph.D., MM = Murtaza Majid, MBBS, Dip. in MCH-FP,
SI = Shafiqul Islam, Ph.D.,NNR = Nazmun Nahar Ratna, MSS, MECDev,
AP = Avijit Poddar, Ph.D., AKMM = AKM Maksud, MSS

A5: ISSUES ON DATA QUALITY AND DATA MANAGEMENT

A5.1. Data Quality

Right after signing the contract to conduct the study, the core team of consultants started to develop the DCIs to be used and in the process, the individual consultants undertook mini field trips to enlighten themselves. At one stage, a formal familiarization visit to two PBSs was arranged and consultants got a fairer idea based on which the DCIs were blown fully. These full blown DCIs were pre-tested by both the in-house and hired enumerators of HDRC. Pre-tested questionnaires were reformulated again and again. Sometimes contents were changed while forms were also changed at other times. Once the DCIs were tentatively found suitable for the training of enumerators, the enumerators were short-listed and advised to attend the training. It was decided by the core team that all enumerators will have general idea about the study and its purposes, enumerators will specialize by specific observation measurement unit, as has been mentioned in Section 4.2. After imparting general and specific training to respective group of enumerators, the whole team of enumerators undertook a field trip to conduct a field test of DCIs by themselves. Based on the feedback from the field tests, the questionnaires were again improved, adjusted and updated.

Simultaneously manuals like guideline for estimating net income attributable to electricity by various sources of income was made available to the enumerators (Annex-B15). This has enabled them to comprehend the key issues of ESIES. The enumerators were also advised to consult the manual during their training and beyond.

At the fag end of the training sessions, the quality control mechanisms were spelled out to the enumerators and a system of reward for motivation e.g. certificates for all field staff was declared by the Project Director.

On the other hand, the stakeholders i.e. NRECA, REB and USAID expressed interest in the study as well as the fieldwork. In particular they were also requested to inform the HDRC, if they appear to learn anything form the field so far as quality of data in concerned. In short, a team, comprising of variety of stakeholders was committed to work together in order to ensure best possible output form the study.

A5.2. Quality Control Checks

Field checking was undertaken in both `presence' and `absence' of the interviewing teams. `Checking in presence' means verification of the work of an interviewing team in a sample area during the time of the interview. `Checking in absence' means verification of the work of an interviewing team in a sample area after the team had left the site, having completed its assigned work in the area.

During their field checking, the Quality Control Officers were instructed to perform re-interview, and check the data accuracy. Some of the reported non-response items were checked to ensure validity. `Field checking in presence' was conducted for all field investigators, while `field checking in absence' was done over randomly selected sites.

A5.3. Registration of Questionnaires

As soon as the questionnaires were received from the field, they were entered into registration books. Four Registration Assistants were responsible for this task, as well as for storing and maintaining the schedules. Also, they supplied the schedules for use by other data processing staffs and receive these schedules back, when their work is over.

A5.4. Data Processing

The survey data processing activities involve editing and coding of the questionnaire, and computerization of data.

Editing were done by a team consisting of two Consultants, the Systems Analyst, four editors and four edit verifiers. These editors and edit verifiers were appointed for a duration of one month. Since, many of the questions answered in the questionnaire were coded from the field, the major objectives of editing were to verify that the survey questionnaires had been correctly filled-in, correct samples had been interviewed; that items of information recorded or responses to questions obtained were consistent with one another; and that all questions in the questionnaire had been asked.

Editors were entrusted with the responsibility to do the job of initial editing of schedules. Edited schedules are then verified 100 percent by the Editing Verifiers. Consultants randomly checked the edited schedules after verification, and the programmer checked another 5 percent. This system has previously proved to be an effective one to ensure a high standard of the editing work.

The open-ended questions provide broader insights. Responses to such open-ended questions were recorded `Verbatim'. Responses to the open-ended questions in every schedule was categorized and coded, using the coding scheme.

The categorization and coding of responses to the open-ended question requires lot of professional expertise. Thus, this activity was supported by the core team under the overall supervision of the Consultants. However, there are several questions for which field coding were difficult. Answers to such questions are being coded in-house at HDRC. This activity was undertaken by four coders and four code-verifiers under the direct supervision of one of the consultants.

A5.5. Computerization of Data

The data was analyzed, using the in-house computer facility of Human Development Research Centre (HDRC), under the overall guidance and supervision of the Systems Analyst, taking necessary assistance from the Consultants. Computerization of data involves the following major tasks:

1. Preparation of data dictionary and data entry format
2. Data Entry
3. Conducting validation checks to ensure that data have been correctly entered onto the computer.

Data was entered, using SPSS/PC+ Data Entry II module which is a fully integrated data entry, cleaning and editing tool with user-defined skip logic, rules, and input screens. Before giving output tables, proper range checks and checks of internal consistencies were completed. The System Analyst and the data entry operator of HDRC were responsible for computerization of data. The System Analyst, with technical assistance from the Consultants prepared the code-manual. In case of FGD, the data was analyzed qualitatively by the FGD experts.

A6: LIST OF PARTICIPANTS OF “STUDY FINDINGS DISSEMINATION MEETINGS”

A6.1: Meeting with USAID Mission (October 3, 2002)

USAID Mission Personnel

- Mr. Bruce McMullen, Sr. Energy Advisor, EGFE/Energy Team
- Ms. Kathleen Bridges, Regional Contracts Officer
- Ms. Caryle Cammisa, Program Office Team Leader
- Ms. Carol Horning, Team Leader, Democracy and Governance Team
- Mr. Lawrence Dolan, Program Officer, Program Office
- Ms. Carol Jenkins, Program Officer, Program Office
- Md. Kamaruzzaman, Engineer (General), EGFE/Energy Team
- Mr. Ahsan Ul Haye, Program Management Specialist, EGFE/Energy Team
- Mr. A.K.D. Sher Mohammad Khan, Program Management Specialist, EGFE/Energy Team
- Mr. Aniruddha Hom Roy, Program Management Specialist, Program Office
- Ms. Nishat Chowdhury, Program Management Specialist, Democracy and Governance Team
- Ms. Begum Shawkatara, Program Management Specialist, Democracy and Governance Team
- Mr. Fazlul Karim, Development Program Specialist & Program Operations Officer, Program Office
- Mr. Dewar Alamgir, Development Program Specialist, EGFE Team
- Ms. Shanwaz Zakaria, Program Specialist, EGFE Team
- Dr. Bhuiyan Shahidur, Program Specialist, EGFE Team

Representatives from other Development Partners

1. Mr. Paul Zwetsloot, Deputy Head of Development Corp., Embassy of the Kingdom of Netherlands
2. Dr. Reazul Islam, Sr. Economic Advisor, DFID Bangladesh, British High Commission

A6.2: Meeting with REB (REB Board Room, October 27, 2002)

REB participants

01. Ziaul Islam Chowdhury, Chairman
02. Nirmal kumar Sarker, Member, Administration
03. Md. Tauhidul Islam, Member, PBS & Training
04. Md. Abdul Halim Molla, Member, Engineering
05. Md. Kalilur Rahman, Member, Finance
06. Md. Mahfuzur Rahman, Chief Eng, Project
07. Md. Anwarul Kabir Chowdhury, Chief Eng, P & P
08. Md. Ahsan Habib, Executive Director
09. Md. Latifur Rahman, Controller (Accounts & Fin.)
10. Md. Mozammel Haque, S. E. Dhaka
11. Md. Shahjahan Ali, Director, Sys. Ope. (S)
12. Syed Abu Abdullah, Director, Program Planning
13. Abu Naim Mohammad, Director, Inspection & Testing
14. Md. Asraful Islam, Director, S E & D
15. Md. Nazmul Hossain Chowdhury, SE, Generation
16. Md. Abdul Momen, Director, C S & M
17. Md. Abdur Rahim, Director, Training
18. Md. Shawkat Ali Khan, S.E. 33KB Line Con.
19. SK Ahmed Ali, Director, Loans & Audit
20. Md. Rezaul Haque Bhuiyan, Director, PBS Dev. & Op. (Central.)
21. G.A.M. Mohiuddin Qaderi, Director, Internal Audit
22. Begum Mahmuda, Director, Finance
23. Syed Sarwar Hossain, Director, Procurement
24. Matija Begum, Director, PBS Dev. & Op. (North)
25. A B M Ali Hossain, Director, PBS Dev. & Op. (South)
26. Syed Musaddeque Hossain, Director, Public Relations & Publications
27. Md. Azizul Alam, Director, Enquiry & Discipline
28. A I M Latiful Azam, Dy. Director, SEMC.

ANNEX B

DATA COLLECTION INSTRUMENTS (DCIs)

Annex B1: Household Interview Schedule (HHIS)
Annex B2: Irrigation Equipment and Agriculture Interview Schedule (IEAIS)
Annex B3: Industrial Unit Interview Schedule (IUIS)
Annex B4: Commercial Unit Interview Schedule (CUIS)
Annex B5: FGD Guideline for Household
Annex B6: FGD Guidelines for Irrigation Equipment and Agriculture
Annex B7: FGD Guidelines for Industrial Units: Electrified Industries
Annex B8: FGD Guideline for Commercial Units
Annex B9: Issues of Group Discussion (with REB and PBS officials)
Annex B10: Secondary Data Collection Format: PBS
Annex B11: Secondary Data Collection Format: Village Level
Annex B12: Secondary Data Collection Format: Union Level
Annex B13: Secondary Data Collection Format: Upazila Level
Annex B14: SDCF for Industries Collected by PBSs (67)
Annex B15: Guidelines for Household Interview Schedule

Serial # ☐☐☐☐

Sample ID ☐☐☐☐☐

Annex-B1

Household Interview Schedule (HHIS)

Economic and Social Impact Evaluation Study of Rural Electrification Program in Bangladesh

Household Questionnaire

(Questionnaire 1)

Study undertaken for

NRECA International Ltd.

Partners with the REB and USAID for the Rural
Power for Poverty Reduction (RPPR) Program

Human Development Research Centre
Road # 8/A, House #59, Dhanmondi R/A, Dhaka – 1209
Phone: 8116972, Fax: 880-2-8620229
email: hdrc@bangla.net

Respondent Consent Form

Interviewer – read this before the actual interview. Interview should be conducted only after the informed consent of the interviewee. Interviewer, read the following: We have come to you, as part of the process to conduct Economic and Social Impact Study of Rural Electrification Program in Bangladesh. We are conducting the study on behalf of REB under the auspices of NRECA (explain NRECA, USAID/TA). We are deployed by a Research Firm named Human Development Research Centre (address Dhanmondi Rd. 8/A, House 59).

We will collect information on economic background of your household members; income (by sources) and expenditure patterns (including consumption expenditure); production activities; various social – health – demographic dimensions (such as education, health care, and hygiene, sanitation, use of contraception etc); various aspects of women's empowerment; benefits of rural electrification etc.

This study has national significance, because it is based on your information that the impact of REP will be judged, critically. Thus, we would highly appreciate if you and some of your male-female member(s) of the household (as applicable) would kindly share with us the relevant information we are looking for in this study. All information provided by you will be confidential and shall not be used for any purpose other than this research study. Are you willing to participate in this survey?

Respondent willing 1 , Respondent unwilling 2 , (Go to next sample respondent)

After respondent agrees, proceed with the questionnaire interview (set convenient date and time, if additional time is required).

I. SAMPLE IDENTIFICATION

Name of the Household Head: _______________________________________

2. Sample HH No. ☐☐☐☐ 3. Converted HH ☐☐ PBS ☐ EL ☐ VI ☐☐ HH

4. Household Electricity Status: Electrified ☐ 1 , Non electrified ☐ 2 (Within electrified village) , Non electrified ☐ 3 (in village without electricity)

(Year electrified___________ ☐☐

Account # : ☐☐☐☐☐☐☐

5. Village Electricity Status: Electrified ☐ 1 , Village Non-electrified ☐ 2

(Year electrified___________) ☐☐

6. Division: _______________ ☐ 7. District: ____________________ ☐☐

8. Upazila: _______________ ☐☐ 9. Union/Ward: ______________ ☐☐

10. Village/Mahalla/Para ________ ☐☐ 11. PBS ____________________ ☐☐

[**PBS Code:** 01=Barisal PBS-2, 02=Bogra, 03=Brahmanbaria, 04=Chittagong PBS-2, 05=Comilla PBS-1, 06=Cox's Bazar, 07=Dhaka PBS-1, 08=Dinajpur PBS-1, 09=Faridpur, 10=Feni, 11=Gopalganj, 12=Jessore PBS-2, 13=Magura, 14=Meherpur, 15=Mymensingh PBS-1, 16 = Naogaon, 17= Natore PBS-2, 18= Narsingdi PBS-1, 19= Netrokona , 20= Nilphamari, 21=Rajshahi, 22=Sirajgnj, 23=Sylhet PBS-1].

Division Code: 1= Dhaka, 2 = Chittagong, 3 = Rajshahi, 4 = Khulna, 5 = Barisal, 6 = Sylhet

District Code: 01 = Dhaka, 02 = Faridpur, 03 = Gopalgonj, 04 = Mymensigh, 05 = Narsingdi, 06 = Netrokona, 07 = Brahmanbaria, 08 = Chittagong, 09 = Comilla, 10 = Cox's Bazar, 11 = Feni, 12 = Bogra, 13 = Dinajpur, 14 = Naogaon, 15 = Natore, 16 = Nilphamari, 17 = Rajshahi, 18 = Sirajgonj, 19 = Jessore, 20 = Magura, 21 = Meherpur, 22 = Barisal, 23 = Sylhet

INTERVIEW INFORMATION

Interview call	1	2	3	4
Date				
Respondent: Male Female (Name)				
Result Code *				
Interviewer's Name (code)				

* Result Codes: Completed =1, Deferred = 2, Dwelling vacant = 3, Other ___________ (specify) = 4

Name of Supervisor: ________________________________ Date: ____________________

Re interviewed or spot checked by (name): ____________________ Date: ______________

Coder's name: __________________________________ Date: __________________

Editor's name: __________________________________ Date: __________________

II. HOUSEHOLD : BACKGROUND INFORMATION

201. Please provide us some background information about all individual members of the HH*

Sl #	Name (use age sequence: in a descending order)	Age (in Yrs)	Sex Male=1, Female=2	Education (year of schooling**)	Occupation ***	
					Main	Secondary****
1	2	4	5	6	7	8
01.						
02.						
03.						
04.						
05.						
06.						
07.						
08.						
09.						
10						
11.						
12.						

* Household member : Takes food form the same '*Chula*`, generally sleep at night under the same roof at least once in the last 6 months (son/daughter), guests will not be induded.

** Use the education code; if 'adult literacy' (night school) write down 26; it 'no education' write down '00`.

*** Occupation code:
Farmer/cultivator =01, Homemaker (housewife) =02, Agri-laborer = 03, Non-agri-laborer = 04, Salaried job =05, Mason =06, Carpenter =07, Rickshaw/van puller =08, Fisherman = 09, Boatman =10, Blacksmith =11, Potter =12, Cobbler =13, Shopkeeper =14, Petty trader =15, Business =16, Tailor =17, Umbrella Repairer =18, Driver =19, Cottage Industry =20, Medical (MBBS) doctor =21, Village doctor/Quack =22, Homeopath =23, Imam = 24, Retired service holder =25, Student =26, Unemployed =27, Children =28, Disabled =29, other ______________ (specify) =30

**** If no secondary occupation, write code 61

,III. OWNERSHIP, PROPERTY AND ASSETS

3.A. Agriculture land ownership and landholding

301. Whether own cultivable land (including leased out, rented out, mortgaged out) Yes =1, No = 2 (skip to ☐4) ☐

302. Cultivable agricultural own land (including leased out, rented out, mortgaged out agr. land) _______ decim ☐☐☐☐☐

303. Present market value of agricultural own land______________________ Tk. ☐☐☐☐☐☐☐

304. If electrified HH, amount of cultivable agricultural own land immediately before electricity in HH/If non-electrified HH, amount of cultivable agricultural own land 5 years ago*:________ decimal ☐☐☐☐☐
(if no land, skip to 306)

305. Present market value of such land : ____________________ Tk. ☐☐☐☐☐☐☐

306. Leased out/rented out/mortgaged out/agr-land: Amount at present ________ decimal (if no land, skip to 30 ☐☐☐☐

307. Present market value of such land: ________________ Tk. ☐☐☐☐☐☐☐

308. If electrified HH, amount of leased out/rented out/mortgaged out agr. land immediately before electricity in HH/If non-electrified HH, amount 5 years ago: ________ decimal ☐☐☐☐

309. Present market value of such land _______ ________________ Tk. ☐☐☐☐☐☐☐

310. Leased in/rented in/ mortgaged in agr-land: Amount at present __________ decimal ☐☐☐☐

311. If electrified HH, amount of leased in/rented in/mortgaged in agr. land immediately before electricity in HH/ if non-electrified HH, amount 5 years ago* :________ decimal ☐☐☐☐

3.B. Other land assets

312. Whether own pond? Yes = 1, No = 2 (skip to 315) ☐

313. Area under pond ____________ decimal ☐☐☐☐

314. Present market value of pond _________________ Tk. ☐☐☐☐☐☐☐

315. If electrified HH, area of pond immediately before electricity in the HH/ if non-electrified, pond area 5 years ago* _______ decimal (if no such land, skip to 317) ☐☐☐☐

316. Present market value ______________________ Tk. ☐☐☐☐☐☐☐

317. Whether own ditch/fallow? Yes = 1, No = 2 (skip to 320) ☐

318. Area under ditch/fallow __________ decimal ☐☐☐☐

319. Present market value __________________ Tk ☐☐ ☐☐☐☐

320. If electrified HH, area under ditch/fallow immediately before electricity in the HH/ if non-electrified HH, such area 5 years ago* ________ decimal ☐☐☐☐
(if no such area, skip to 322).

321. Present market value ______________________ Tk ☐☐☐☐☐☐☐

C. Homestead

322. Whether own homestead? Yes = 1, No = 2 (skip to 325) ☐
323. Total area under homestead (include home/kitchen garden) ___________ decimal ☐☐☐☐
324. Present market value of homestead (excluding home) ____________________ Tk. ☐☐☐☐☐☐☐
325. If electrified HH, area of homestead (excluding home/kitchen garden) immediately before electricity in HH/ if non-electrified HH, such area 5 years ago*: ______ decimal (if no such area, skip to 329) ☐☐☐☐
326. Present market value _____________________ Tk. ☐☐☐☐☐☐☐
327. Area under home/kitchen garden: __________ decimal (if no such area, skip to 329) ☐☐☐☐
328. Present market value of the area under home/kitchen garden__________ Tk. ☐☐☐☐☐☐☐
329. If electrified HH, area of home/kitchen garden immediately before electricity in the HH/if non-electrified HH, such area 5 years ago*:________ decimal (if no such garden, skip to 331) ☐☐☐☐
330. Present market value (of # 329): ________________________ Tk ☐☐☐☐☐☐☐
331. # dwelling rooms at present? __________ ☐☐
332. Number of dwelling rooms with electricity? __________ (NA =99) ☐☐
333. Total sq.ft of dwelling rooms _____________ sq.ft ☐☐☐☐
334. Present market value of dwelling rooms? : ____________________ Tk. ☐☐☐☐☐☐
335. If electrified, total area of dwelling rooms immediately before electricity in HH/If non-electrified, dwelling rooms 5 years ago*: ________ sq.ft (if no such rooms, skip to 337) ☐☐☐☐
336. Present market value of those rooms: __________________ Tk. ☐☐☐☐☐☐☐
337. # and area of non-dwelling rooms (kitchen, cowshed, store, cottage industry etc.) at present: ________ #, __________ sq.ft.(if no such non-dwelings, skip to 340) ☐☐ ☐☐☐☐
338. Present market value of non-dwelling rooms: ___________________ Tk. ☐☐☐☐☐☐☐
339. Number of non-dwelling rooms with electricity ? _________ ☐☐
340. If electrified HH, # and area of non-dwelling rooms immediately before electricity/if non-electrified, # and area 5 years ago *: ______ #________ sq.ft. (if no such non-dwelings, skip to 342) ☐☐ ☐☐☐☐
341. Present market value of such rooms _____________________ Tk. ☐☐☐☐☐☐☐

342. Would you kindly tell us about livestock and poultry assets of your household?

Sl. #	Assets	Present status			Past status: For electrified HH: immediately before electricity; For non- electrified HH: 5 years ago*	
		Number	Present market value (Tk.)	Number raised/ fattened for sale	numbers	present market value (Tk.)
1.	Cow					
2.	Buffalo					
3.	Calf					
4.	Goat/Sheep					
5.	Poultry/Birds					
6.	Others __________ (specify) ☐					

3.E. Capital Assets

343 Now we would like to know about capital assets owned by your household.

Sl #	Assets	Present status		Past status: For electrified HH: immediately before electricity; For non- electrified HH: 5 years ago*	
		Number	Present market value (Tk.)	Numbers	Present market value (Tk.)
1.	Power tiller				
2.	Plough				
3.	Irrigation equipment¿ (DTW STW =2, LLP =3, Trad =3)(if group ownership, value of share)				
4.	Thresher				
5.	Dhenki				
6.	Sugarcane crashing machine				
7.	Boat (traditional)				
8.	Boat (engine)				
9.	Bullock carts				

*Interviewer: For before electricity/five years ago, ascertain the share of this household if had been part of a joint family

Sl #	Assets	Present status		Past status: For electrified HH: immediately before electricity; For non- electrified HH: 5 years ago*	
		Number	Present market value (Tk.)	Numbers	Present market value (Tk.)
10.	Rickshaw/van				
11.	Motorcycle				
12.	Bicycle				
13.	Sewing machine				
14.	Fan				
15.	Iron				
16.	Toaster				
17.	Oven				
18.	Juice machine				
19.	Heater				
20.	Refrigerator				
21.	Mobile phone				
22.	TV				
23.	Radio				
24.	Cassette Player				
25.	VCP/VCR				
26.	Camera				
27.	Tubewell				
28.	Furniture				
29.	Handloom *				
30.	Rice Mill *				
31.	Shop/godown *				
32.	Industrial Unit *				
33.	Raw materials *	▨			
34.	Cash in hand (capital)	▨			
35.	Other investments	▨			
36.	Others ___________ (specify)				

Note: If group ownership, allocate the value of share of the household only

344. Interviewer check: Electrified Househol 1 1 (skip to 401), Non-electrified Househol 2 ☐

345. This village is electrified? Yes = 1, No =2 (skip to 348) ☐

346. Do your neighbors have electricity? Yes = 1, No =2 (skip to 348) ☐

347. Why there is no electricity in your household? (*multiple responses possible*)

Is not in PBS master plan /was not in PBS plan/don't know about PBS plan = 01,
Paid money, not yet connected = 02
Completed wiring, not yet connected =03
Submitted membership fee long ago, not yet connected = 04
Non-cooperation from the neighbors = 05
Financial insolvency =06,
Hassles to get connected = 07
Hassles of regular payment of bill = 08
Unwilling to use electricity =09
No need = 10 Others ____________________(specify)=11

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☐☐
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☐☐

348. Do you want electricity connection? Yes = 1, No = 2 (skip to 350) ☐

349. Why do you want electricity? (*multiple responses possible*)

To increase agriculture production through irrigation = 01 ,
Poultry raising = 02 ,
For prosperous business (long work hours, Refrigerator, TV) = 03 ,
Awareness raising through TV viewing = 04 ,
Fan for comfort = 05 ,
Light for additional educational hours for children = 06 ,
More security = 07,
Quality leisure time/more recreation = 08 ,
Other (specify) ____________ = 09

☐☐
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☐☐

350. Do you know how much money is required to get electricity connection?

One time _______________ Tk. ☐☐☐☐☐

(membership fee, wearing charge, wearing materials, GD)

Monthly bill (approximate) _____________ Tk. ☐☐☐

Per unit tariff electricity _____________ Tk.

Know = 01, Don't know = 02 ☐

Interviewer : Please collect information on the per unit tariff from the respective PBSs

IV. INCOME, PRODUCTION, COST (REF TIME: LAST BANGLA YEAR : 1 BAISAKH – 30 CHAITRA 1408 BY, 14 APRIL 2001 – 13 APRIL 2002)

401. Now we would like to know about your household income from various sources. We would concentrate our discussion for the last year only (Baisakh – Chaitra 1408). We will try to work out gross income from various sources, and then make an attempt to estimate cost of earning for each source, and then try to estimate the share of net income by source which can be attributed to electricity.

> Interviewer: Read out all sources; identify all those applicable for the household's last year income

Household income and share of electricity: Last year, 1 Baisakh – 30 Chaitra 1408 BY, 14 April 2001 – 13 April 2002

Source(s)	Applicable for this household: Yes =1, No = 2	Gross Income (Tk.)	Cost incurred to earn gross income (Tk.)	Net (operating) income (Tk.)	Whether the income from this source has any relationship with the availability of electricity in the household Yes = 1, No =2, NA=9	Whether the income from this source has any relationship with the availability of electricity in the area (outside household) Yes = 1, No = 2	Relationship of the source with electricity: Absolutely new to the HH and emerged with electricity =1, Not new but developed with electricity =2, Others =3	% net income from the source which can be attributed to electricity*	Code for basis of estimation in column 9**
1.	2	3	4	5	6	7	8	9	10
01. Crop Agriculture [**Interviewer**: First ask Qns 402 to 404 and then come back to this section]	1 2				1 2 9	1 2	1 2 3		
02. Wage labor: Agriculture	1 2				1 2 9	1 2	1 2 3		
03. Wage labor: Non-agriculture	1 2				1 2 9	1 2	1 2 3		
04. Livestock	1 2				1 2 9	1 2	1 2 3		
05. Poultry	1 2				1 2 9	1 2	1 2 3		
06. Trees/nurseries	1 2				1 2 9	1 2	1 2 3		
07. Kitchen/home gardening	1 2				1 2 9	1 2	1 2 3		
08. Fruit/vegetables	1 2				1 2 9	1 2	1 2 3		
09. Pisciculture/Fisheries	1 2				1 2 9	1 2	1 2 3		
10. Selling water: DTW, STW, LLP	1 2				1 2 9	1 2	1 2 3		

[* Interviewer: Discuss in line with cost savings, more production, availability of more hours – all associated with electricity – as light and/or as power. In case of crop agriculture, ascertain amount of land irrigated using electricity-driven equipment's, identify amount not used before or not used multiple times before. In case of poultry, ascertain number of poultry birds before electricity to compare with after (with) electricity situation. Same with livestock. In case of shops/business, and cottage industry, if electricity is being used, try to obtain turnover/production figures for before-after etc. Use the list of examples in the guideline for estimation for column 9]

**Direct financial=01, Amount of land=02, Amount of production=03, Multiple use of the same land=04, Person-days/Working days/Working hours=05, Amount of production (non-crop)=06, Km./no. of passengers=07; Others = 10

Source(s)	Applicable for this household: Yes =1, No = 2	Gross Income (Tk.)	Cost incurred to earn gross income (Tk.)	Net (operating) income (Tk.)	Whether the income from this source has any relationship with the availability of electricity in the household Yes = 1, No =2, NA=9	Whether the income from this source has any relationship with the availability of electricity in the area (outside household) Yes = 1, No = 2	Relationship of the source with electricity: Absolutely new to the HH and emerged with electricity =1, Not new but developed with electricity =2, Others =3	% net income from the source which can be attributed to electricity*	Code for basis of estimation in column 9**
2.	2	3	4	5	6	7	8	9	10
11. Business/shops	1 2				1 2 9	1 2	1 2 3		
12. Rent: house, shop,	1 2				1 2 9	1 2	1 2 3		
13. Agr. implements (except irrigation) : thresher, power tiller, plough, draft animal etc.	1 2				1 2 9	1 2	1 2 3		
14. Salaried employment	1 2				1 2 9	1 2	1 2 3		
15. Transport: van, rickshaw, boat, motorcycle, cycle	1 2				1 2 9	1 2	1 2 3		
16.Cottage industry	1 2				1 2 9	1 2	1 2 3		
17. Other industries/factories	1 2				1 2 9	1 2	1 2		
18. Industries									
19. Remittances	1 2				1 2 9	1 2	1 2 3		
20. Insurance	1 2				1 2 9	1 2	1 2 3		
21. Dividend	1 2				1 2 9	1 2	1 2 3		
21. Gifts	1 2				1 2 9	1 2	1 2 3		
22. Gratuity/Pension	1 2				1 2 9	1 2	1 2 3		
23. Others: FFW, female stipend, plantation on khas land	1 2				1 2 9	1 2	1 2 3		

[* Interviewer: Discuss in line with cost savings, more production, availability of more hours – all associated with electricity – as light and/or as power. In case of crop agriculture, ascertain amount of land irrigated using electricity-driven equipment's, identify amount not used before or not used multiple times before. In case of poultry, ascertain number of poultry birds before electricity to compare with after (with) electricity situation. Same with livestock. In case of shops/business, and cottage industry, if electricity is being used, try to obtain turnover/production figures for before-after etc. Use the list of examples in the guideline for estimation for column 9]

**Direct financial=01, Amount of land=02, Amount of production=03, Multiple use of the same land=04, Person-days/Working days/Working hours=05, Amount of production (non-crop)=06, Km./no. of passengers=07; Others = 10

402. **Interviewer check Qn. 302, 306, 310:** ☐
Respondent's household has operational cultivable land = 1
Respondent's household does not have any operational cultivable land = 2
(fill-in 401 and then skip to 406)

403. Irrigation status of areas under cultivation (last year):
Total area ___________ decimal, ☐☐☐☐☐
Irrigated ________ decimal, of which electricity driven ☐☐☐☐☐ ☐
DTW/STW/LLP: _________ decimal ☐☐☐☐☐

404. Agriculture (crop) production and costs
(1 Baisakh – 30 Chaitra, 1408 BY; 14 April 2001 – 13 April, 2002)
(Interviewer: Consider only those crops which were harvested during the reference period)

SL #	Crop code *	Irrigation with electricity =1 Irrigation with diesel = 2 other irrigation =3 No irrigation =4	Total own cultivation area (decimal)	Output (maund)	Production from share cropping (maund)	Unit price: main product (Tk./maund)	Total value (Tk.) : By-product **	Total cost of production (Tk.)***	
				Main product				Own cultivation	Share cropping
1	2	3	4	5	6	7	8	9	10
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									

***Crop code:** 1=Aus (Local Broadcast), 2 =Aus (HYV Transplant), 3 =Aus (HYV Broadcast), 4=Aman (Local Broadcast), 5=Aman (Local Transplant, 6=Aman (HYV-Transplant), 7=Boro (Local Transplant), 8=Boro (HYV Transplant), 9=Wheat, 10=Jute, 11=Sugarcane, 12 = Masur, 13 = Mung, 14 = Chola, 15= Other pulse, 16=Mustard, 17=Sunflower, 18 = Other oilseed, 19=Bottle Gourd, 20=Bitter Gourd, 21=Cucumber, 22=Cauliflower, 23=Radish, 24=Lal Shak, 25=Bean, 26=Tomato, 27=Onion, 28=Brinjal, 29=Potato, 30=Chilly, 31=Other vegetables, 32=Melon, 33=Banana , 34=Other fruits, 35=Other crops

** Shall include paddy straw, jute straw, coconut coir, oilcake etc. Total price of by-product must be obtained irrespective of availability of quantity of by-product.

*** Cost include seed, draft power, power tiller, labor, fertilizer, irrigation, pesticide, herbicide (all costs from land preparation to harvesting including threshing and drying)

Loan/Credit taken (last year)

405. Have you taken any loan/credit during last year ? ☐
Yes =1, No=2 (skip to 501)

Please tell us about amount of loan taken by sources during the last year

Source(s)	Tk. (last year)	
Krishi Bank		☐☐☐☐☐☐☐
Commercial Bank		☐☐☐☐☐☐☐
BRDB		☐☐☐☐☐☐☐
NGO		☐☐☐☐☐☐☐
Money lender		☐☐☐☐☐☐☐
Friends/relatives/neighbors		☐☐☐☐☐☐☐
Other (specify) ☐		☐☐☐☐☐☐☐

V. HOUSEHOLD EXPENDITURE

501.

Intterviewer take this information from Section II (do not ask)	
Total member in HH = , Male = , Female =	☐☐ ☐☐ ☐☐
Member<10 yrs, total = , Boys = , Girls =	☐☐ ☐☐ ☐☐
Member 10+, total = , Male = , Female =	☐☐ ☐☐ ☐☐

502. Now we would like to ask you about your household expenditure for the last year. For food consumption expenditure we will restrict to weekly pattern (more or less a representative week), and for non-food expenditure - monthly average and annual, depending on the

nature of items. I will read out the items, and then, for applicable items, you will provide approximate figures (please do consult with other members of your household, if needed).

502 (a). Food Consumption (last one week)

Food items	Unit	Quantity Consumed	Unit market price (Tk.)	Total market value (Tk.)
1	2	3	4	5
01. Rice	kg.			
02. Atta/Wheat Flour	kg.			
03. Fish	kg.			
04. Meat	kg.			
05. Egg	#			
06. Milk	litre			
07. Pulses	gm			
08. Vegetables	kg			
09. Potato	kg			
10. Edible oil ‡fvR¨ †Zj	gm.			
11. Spices gkjv	gm.			
12. Fruits	kg.			
13. Salt	gm.			
14. Sugar	gm.			
15. Gur	gm.			
16. Others (specify)__________________ ☐ (Tea/coffee, tobacco products, etc)				

[Interviewer: obtain information for column 3 "quantity consumed", and for each item fill-in column 4 or 5 which ever is easier for respondent]

502(b). Non-food expenditure (monthly average : last month)

Items	Unit	Quantity	Expenditure (Tk.)
A. Fuel and electricity R¡vjvbx Ges we`¨yr →			
A.1. Bio-mass fuel (fire wood, cowdung, leaves, straw) → A.2. Kerosene	ltr		
A.3. Gas/LPG cylinder			
A.4. Electricity →	kwh		
A.5. Others (coal, matches, candle etc.)			
B. Toiletries and cleanliness [(Cream, powder, snow, nail polish, lipstick, scent, hair oil/cream/comb/dressing/hair cutting, razor/blade/shaving cream, soap (bath), soap (laundry/cloth wash), soap (utensils), Laundry, Mosquito coil/spray)]			
C. Transport and other miscellaneous [Bus/Tempo ( ), Rickshaw/van ( ), Boat/Launch ( ), Train ( ), Cycle: tyre, tube, maintenance ( ), Petrol/diesel ( ), Telephone/telegraph ( ), Servants (salary) ( )]			

Interviewer: Specific sub-items mentioned are just to assist the respondent. Sub-items need to be prompted to facilitate recall. If you need to write amount against sub-items, please do so; this will ease estimation]

502(c). Non-food expenditure (Annual: last Year)

Items	Unit	Quantity	Expenditure (Tk.)
Ready made Garments for adults			
1. Lungee/Dhutti	number		
2. Shirt	number		
3. Trouser	number		
4. Saree	number		
5. Blouse/Petticoat	number		
6. Shelowar/Kamiz/Orna	number		
7. Paijama/Panjabee	number		
8. Sweater/Jacket	number		
for child:			
1. Lungee/Dhutti	number		
2. Shirt/T Shirt	number		

Items	Unit	Quantity	Expenditure (Tk.)
3. Trouser-full	number		
4. Trouser-half	number		
5. Frock/Baby Suit	number		
6. Sweater/Jacket	number		
for both:			
1. Towel/Gamcha	number		
2. Chador/Shawl	number		
B. Cloth and sewing: [Mill/handloom cloth ( ), Wool/silk ( ), Stitching (cost), ( )]			
C. Shoe : (hide/Skin ( ), Sandals ( ) , Brush/polish/repair) ( )	number		
D. Bed related/bedding: [Winter cover (Lep/Kantha) ( ), Bed sheet ( ), Foam/cushion/Zazim/Toshok/pillow ( ), Pillow (cover) ( ), Table cover ( ), Screen ( ), Mosquito net ( )]			
E. Housing (and related):			
of which home expansion/construction			
[House rent ( ), Imputed rent (if own house) ( ), Water/sanitation (bill) ( ), Home whitewash, etc. ( ), Maintenance and repair ( ), Tax (municipality etc.) ( ), Housing service related ( )			
F. Health Care **Male** [Doctor's fee ( ), Other Physician (homeopath etc) ( ), Medicine ( ), Ayurved/Kabiraj etc ( ), Tests/diagnostic (X-ray, blood, stool, urine etc.) ( ), Hospital/Clinic charge ( ), Dentist ( ), Spectacle ( ), Health related transport etc. ( ), Others ( )]	person		
Female [Doctor's fee ( ), Other Physician (homeopath etc) ( ), Medicine ( ), Ayurved/Kabiraj etc ( ), Tests/diagnostic (X-ray, blood, stool, urine etc.) ( ), Hospital/Clinic charge ( ), Dentist ( ), Spectacle ( ), Health related transport etc. ( ), Others ( )]	person		
G. Education **Male** [Registration ( ), Exam-fees ( ), Annual charge/fee ( ), School fees ( ), Private Tuition ( ), Book, Khata, Pen, Pencils etc. ( ), Hostel charge ( ), Tiffin ( ), Others ( )]	Person		
Female [Registration ( ), Exam-fees ( ), Annual charge/fee ( ), School fees ( ), Private Tuition ( ), Book, Khata, Pen, Pencils etc. ( ), Hostel charge ( ), Tiffin ( ), Others ( )]	person		
H. Socio-cultural and religious [Jakat/Fitra/Daan/Sadka/Korbani ( ), Milad/Puja ( ), Hajj/Pilgrimage ( ), Marriage (Birth-related (Akika, Khatna, birth day etc.) ( ), Death related ( ), Others ( )]			
I. Entertainment			
1. Books/Newspapers/Journals	number		
2. Cinema/Theater	number		
3. Sports	number		
4. Video/Audio Cassettes	number		
5. Photo	number		
6. License (renewal) of TV/VCP/Radio	number		
7. Battery	number		
8. Other (specify) __________________________ ☐	number		
J. Tax, debt service, litigation			
of which land registration, mutation (in Tk.)			
[Income tax ( ), Debt service ( ), Litigation related ( ), Land tax ( ), Chowkidari tax ( ), Other ( )]			
K. Kitchen Utensils [Plate.Jug/Glass ( ), Pan ( ),Spoon/Knife etc ( ), Stove/gass burner ( ), Other ( )]	number		

Items	Unit	Quantity	Expenditure (Tk.)
L. Furniture/fixture [Khat/Cowki ( ), Table/Chair ( ), Sofa ( ), Dressing Table ( ), Almirah/wardrobe ( ), Showcase ( ), Alna ( ), Repair/maintenance ( ), Others ( )]	number		
M. Electrical Equipment			
1. Radio	number		
2. TV	number		
3. Cassette Recorder	number		
4. VCP/VCR	number		
5. Washing Machine	number		
6. Musical instruments	number		
7. Computer	number		
8. Fan	number		
9. Air cooler/AC	number		
10. Camera	number		
11. Iron	number		
12. Other (specify) ____________________	number		
N. Personal wearing/ornaments [Gold ornaments ( ), Silver ornaments ( ), Bags ( ), Umbrella ( ), Watch ( )]	▨	▨	

VI. POVERTY ALLEVIATION/REDUCTION

601. Is the household situated on khas land, Ashrayan, Guccha Gram, Adarsha village? ☐
Yes = 1, No = 2

602. Is there any one in the household who is a

	Yes	No
VGD card holder	1	2
Holder of distress women allowance	1	2
Old-age distress pension holder	1	2

603. How would you categorize your household in terms of availability of food: individual year-by-year for last five years?

	Code(s) *				
2001	1	2	3	4	☐
2000	1	2	3	4	☐
1999	1	2	3	4	☐
1998	1	2	3	4	☐
1997	1	2	3	4	☐

Incase of electrified household, situation in year (___________) i.e., immediate before electricity in HH: 1 2 3 4 ☐☐ ☐

- Codes: Always deficit =1, Occasionally deficit =2, Neither deficit nor surplus (breakeven) = 3, Surplus = 4

604. How would you categorize economic status of your household: individual year-by-year for last five years?

	Code(s) *					
2001	1	2	3	4	5	☐
2000	1	2	3	4	5	☐
1999	1	2	3	4	5	☐
1998	1	2	3	4	5	☐
1997	1	2	3	4	5	☐

Incase of electrified household, situation in year (________) i.e., immediate before electricity in HH: 1 2 3 4 ☐☐ ☐

*
Codes: Poor =1, Lower middle =2, Middle = 3, Upper middle =4, Rich = 5

604. Was your family in crisis (economic hardship, health related, ceremony, flood/cyclone, draught, etc.) during the last five years?

	Yes	No
2001	1	2
2000	1	2
1999	1	2
1998	1	2
1997	1	2

In case of electifical household situation in year (______) i.e, immediate befor electricity in HH : 1 2

606. Did your household experienced distress sale to cope with poverty/crisis during last five years?

	Yes	No
2001	1	2
2000	1	2
1999	1	2
1998	1	2
1997	1	2

Incase of electrified household, situation in year (________) i.e., immediate before electricity in HH: 1 2

607. How would you rank your household's economic strength in meeting/bearing educational expenses of members/children – last five years?

	Code(s) *	NA		
2001	1	2	3	9
2000	1	2	3	9
1999	1	2	3	9
1998	1	2	3	9
1997	1	2	3	9

Incase of electrified household, situation in year (________) i.e., immediate before electricity in HH: 1 2 3

* Codes: Very difficult (to bear expenses) =1, Difficult =2, Not difficult = 3

608. How would you rank your household's economic strength in meeting/bearing health care related expenses of members – last five years?

		Code(s) *	
2001	1	2	3
2000	1	2	3
1999	1	2	3
1998	1	2	3
1997	1	2	3

Incase of electrified household, situation in year (________) i.e., immediate before electricity in HH: 1 2 3

* Codes: Very difficult (to bear expenses) = 1, Difficult = 2 , Not difficult = 3

609. Think back to the situation when your household confronted economic crisis last (during last five years). What were the two major crises and what were done to cope each crises? Last crises in __________ year (check 605)

Nature of crises: (use codes)		
Nature of coping: (use codes)		

Crises code: Death of earning member =01, High expenditure due to illness = 02, Loss of crops =03, Land dispute = 05, Theft/robbery =06, Social injustice =07, Loss of Business =04, Death/Disease of Livestock=08, River bank erosion=9, Flood/cyclone=10, Others (specify)______=11

Coping code: Utilized saving =01, Land sale =02, Sale of durable asset =03, Mortgaging land =04, Loan =05, Disinvestment =06, Sale of livestock=07, Disintegration of family=08, Engaging school going children to work=09, Public/NGO assistance =10, Others _______________ (specify) =11

610. Has anyone from this household migrated (out) during the last 5 years?
Yes =1, No =2 (skip to 701)

611. How many members of the household migrated?
__________ #, male _______ , Female _____

612. Persons migrated by reasons (number only):
i) Marriage: ____ , ii) Education: ____ ,iii) Job: _____

VII. HEALTH, HYGIENE, SANITATION

[**Interviewer**: Ask this section to Women Respondent in order to judge knowledge status (knows or do not know) – use guideline. [Do not prompt answer].

701. Women's knowledge about crucial public health issues and source of knowledge

Health Issues	Knowledge knows =1,	DK =2	Source of knowledge (main source) *					
01. What is/are the symptoms of diarrhea?	1	2	1	2	3	4	5	☐☐
02. How to prepare ORS (labon-gur-sarbat)?	1	2	1	2	3	4	5	☐☐
03. What is/are the symptoms of ARI?	1	2	1	2	3	4	5	☐☐
04. Vaccination is given to children against how many diseases?	1	2	1	2	3	4	5	☐☐
05. Where to go to for child vaccination/EPI?	1	2	1	2	3	4	5	☐☐
06. Where to go to for ANC Checkup?	1	2	1	2	3	4	5	☐☐
07. What are the five danger signs of pregnancy?	1	2	1	2	3	4	5	☐☐
08. Where to go to for EOC services (Emerg. obs. care)?	1	2	1	2	3	4	5	☐☐
09. Why PNC check up is needed (benefit)?	1	2	1	2	3	4	5	☐☐
10. Whether knows relationship between iodized salt and goitre	1	2	1	2	3	4	5	☐☐
11. What are the three STDs?	1	2	1	2	3	4	5	☐☐
12. Where to go to for STD treatment?	1	2	1	2	3	4	5	☐☐
13. What is HIV/AIDS?	1	2	1	2	3	4	5	☐☐
14. How HIV transmission can be stopped?	1	2	1	2	3	4	5	☐☐
15. What happens if there is arsenic in drinking water?	1	2	1	2	3	4	5	☐☐
16. What can be done to avoid arsenic problem?	1	2	1	2	3	4	5	☐☐
17. Why night blindness in children happens?	1	2	1	2	3	4	5	☐☐
18. Where to go to for treatment of TB?	1	2	1	2	3	4	5	☐☐
19. Where to go to for treatment of Leprosy?	1	2	1	2	3	4	5	☐☐
20. Why use of sanitary latrine is necessary?	1	2	1	2	3	4	5	☐☐

* Source of knowledge codes: Radio =1, TV =2, Health-FP Worker =3, PBS worker/advisor =4, Others =5

702. Information about sickness and treatment status of family members during last twelve months

Interviewer: Fill in this box using information from Section II

Total # HH members = ,	Male = ,	Female =	☐☐☐☐☐☐
Children <5 Yrs = ,	Boys = ,	Girls =	☐☐☐☐☐☐

Name sick: Male = 1, Female = 2	Age	Sickness/disease (code)*	Treatment availed from (code) **	
1. ☐				☐ ☐☐ ☐☐ ☐
2. ☐				☐ ☐☐ ☐☐ ☐
3. ☐				☐ ☐☐ ☐☐ ☐
4. ☐				☐ ☐☐ ☐☐ ☐
5. ☐				☐ ☐☐ ☐☐ ☐

(*Record multiple sickness*)
* Sickness/disease **code**: Diarrhea =01, ARI =02, Chicken pox = 03, TB =04, Tetanus=05, ENT =06, Whooping cough =07, Typhoid =08, General fever =09, Pain =11, Gastric/acidity =12, Other (specify) ______________ = 13
** Treatment availability **code**: MBBS doctor =1, Paramedic/nurse/MA =2, Homeopath =3, Kabiraj/Ayurved =4,Village doctor/palli chikitchak =5, Quack =6, Spiritual =7,Did nothing =8

703. Who attended the last (child) delivery
TT BA =1, UTBA =2, MBBS =3, FWV/Nurse/MA/SACMO =4,
Neighbor/Relative =5, Other (specify) ______________ = 6,
Not applicable =9 (skip to 707) ☐

704. Whether availed ANC check-up by <u>medically competent person</u> during last pregnancy
Yes =1, No = 2, NA = 9 (skip to 706) ☐
[**Interviewer:** Medically competent persons include MBBS doctor, nurse, midwife, FWV, MA, SACMO]

705. Whether availed PNC check-up by a medically competent person after
the last child birth? Yes =1, No = 2, NA = 9 (skip to 707) ☐

706. Whether TT immunization taken in last delivery?
Yes = 1, No = 2, NA =9 ☐

707. <u>Birth History</u> (women respondent) (The sum of last two rows may not be equal to that of first row)
Number of children ever born = , Boy = , Girl = ☐☐ ☐☐ ☐☐
Number died = , Boy = , Girl = ☐☐ ☐☐ ☐☐
Still birth = , Boy = Girl = ☐☐ ☐☐ ☐☐

708. [Infant Mortality] whether there was any childbirth (not still birth) during last twelve months?
Yes = 1 No = 2 ☐
Child: Alive = 1 , Died = 2 ☐
Still birth should not be considered

709. Interviewer: Obtain following information from household who are not in the sample and where there was child birth during last 12 months. For each sample household with electricity select two households with electricity (who are not in sample) where there was child birth in the last 12 months. For each sample household without electricity select two non-electrified household where there was child birth in the last 12 months. And then, enquire about child's status (who was born during last 12 months) – whether alive or dead. Do not include still birth in any stage.]

Households electrified = 1 , Household non-electrified = 2 ☐

born, last year = , # died (of those born last year) = ☐ ☐

Interviewer: Ensure no double counting.

710. Child Immunization (EPI)
Have 11-23 months age child = 1 , Do not have 11-23 months age child = 2 (skip to 712) ☐

Sex : Boy =1, Girl = 2 ☐

711. Child (11-23 months age) immunization status:[Full immunization includes 3 doses of DPT, Polio, 1 measles and 1 BCG]

Fully immunized = 1 , Partially immunized = 2, Not immunized = 3 ☐

712. Any maternal morbidity associated with last pregnancy? [Incase of no pregnancy, skip to 714]

	Yes	No	Whether treated by medically competent personnel * (Yes =1, No =2)			
During pregnancy =	1	2	1	2	9	☐ ☐
During delivery =	1	2	1	2	9	☐ ☐
In 42 days after delivery =	1	2	1	2	9	☐ ☐

(* *medically competent* personnel include MBBS doctor, nurse, midwife, paramedic, FWV, MA, SACMO; exclude TBAs, quacks, spiritual healers)

713. Vitamin A Capsule : Children <5 years and VAC status

Name	Boy	Girl	Whether VAC taken during last 6 months Yes	No	
1. ___________________________	1	2	1	2	☐ ☐
2. ___________________________	1	2	1	2	☐ ☐
3. ___________________________	1	2	1	2	☐ ☐

714. **Interviewer**: Check whether there is at least one woman in the household who is Currently married woman of reproductive age (15-49 yrs) = 1
Not CMWRA = 2 (skip to 719) ☐

715. Whether currently using (she/husband) family planning? ☐
Yes = 1, No = 2 (skip to 718)

716. Method currently using:
Oral pill = 1, Condom = 2, Injectable = 3, IUD = 4, Norplant = 5, Tubectomy = 6, Vasectomy = 7, Traditional = 8 ☐

717. What prompted most the FP use
Radio = 1, TV = 2, Health FP Worker = 3,
Others (specify) __________________ = 4(skip to 719) ☐

718. Whether intend (she/husband) to use FP in the future? ☐
Yes = 1, No = 2, God knows = 3 , DK = 8

719. Source of drinking water : Tubewell =1, Well =2, Pond/tank/river =3 ☐

720. Availability of type of Latrine facility in the household : ☐
Hygienic (Sanitary, water sealed closed) =1, Un-hygienic =2, Open =3

721. What hand washing material(s) is usually used after defecation? ☐
Soap = 1, Ash/mud=2, Nothing (only water) = 3 (skip to 723)

722. What prompted you most to use the hand washing materials after defection? ☐
Radio = 1 , TV = 2 , Health worker = 3 , Neighbor = 4 , Others (specify) = 5

723. Whether regularly use soap for bathing? Yes = 1, No = 2 (skip to 801) ☐

724. Whether influenced by TV advertisement for using this`soapbrand'? ☐
Yes = 1, No = 2, DK =9

VIII. EDUCATION (Literacy, Enrolment and Quality)

Interviewer: ***Check with Section II***

801. Number of household members 5 years and above who can read bangla alphabets, write name, and have basic numeracy? ___________) ☐☐
(Total number of members 5 years and above? _________) ☐☐

802. Number of household members 15 years and above who can read bangla alphabets, write name, and have basic numeracy? _________ ☐☐
(Total number of members 15 years and above ______) ☐☐

803. Number of household members between 5 and 24 years of age who are now enrolled in primary, secondary and tertiary education/schools? ______ ☐☐
(Total number of members 5 - 24 years of age ________) ☐☐

804. Marks obtained in the last final examination: boy and girl (age 10 – 18)
(if not applicable, skip to 901)
Boy: Class ______, Marks obtained: _______, (out of _______), ☐☐ ☐☐
Girls: Class ______, Marks obtained: ______, (out of _______), ☐☐ ☐☐

IX. HOUSEHOLD ALLOCATION OF TIME (Just one usual day: average of last one week)

901. Now I would like to ask you about how do you and some other members of your household pass time between sunset and bed time.

Members	Time between 6.00 evening and sleep (min)	Type of activity performed (use activity code) and time against each activity (write activity code and then use bracket to write **time in minutes**)		Activities which are new after electricity (use code) and time to such activities (in minutes)		Activities which are not new after electricity but for which more time is available after electricity (use code)		Activities which generate income (use code) and time to such activities (in minutes)		Amount of extra hours/ time available after electricity (minute)
1	2	3		4		5		6		7
		Activity	Time	Activity	Time	Activity	Time	Activity	Time	
HH head										
Spouse										
Senior most male student										
Senior most female student										

[**Interviewer:** Columns 4-7 are not applicable, if no electricity in the household]

Activity codes: Study=01, Sewing=02, Teaching kids=03, Watching TV=04, Late night news BTV, ETV (11:00-11:30) =05, Radio =06, Business = 07, Net making=08, Threshing=09, Mat/basket etc making = 10, Weaving and related = 11, Attending socio-cultural functions = 12, Performing religious activities =13, Cooking =14, Eating =15, Cleaning utensil =16, Bed preparation =17, Visiting neighbours =18, Gossiping =19, Other (specify) __________ = 20.

X. WOMEN'S EMPOWERMENT AND CHANGING STATUS
(Gender Part, in-addition to others in different sections)

Interviewer: Ask this section to Women Respondent

1001. Apart from doing household work, do you (or any other female member of HH) do any other work (for cash or kind), such as agricultural work, making things (for sale), selling things in the market, or anything else? (if the respondent herself is engaged in IGA, do not ask for others in the HH, otherwise ask for others female members in HH).

Yes = 1, No =2 (skip to 1007) ☐

1002. What are those work/activities?

____

____

____

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☐☐

1003. How `much did you (she) earn last year?

_________________ Tk. (cash and kind combined) ☐☐☐☐☐☐

1004. Who takes decision as to spend the money earn by you (her) ?
Yourself only = 1, Husband only = 2, Jointly = 3 ☐

1005. Do you work outside home? Yes = 1, No = 2 (skip to 1007) ☐

1006. Do you face wage discrimination? Yes = 1, No = 2 ☐

1007. Are you a member of a credit group? ☐
Yes = 1 , No = 2 (skip to 1010)

Which organization? ___________________________ ☐

1008. Have you taken credit during last 5 years? ☐
Yes = 1, No = 2 (skip to 1010)

1009. Amount credit/loan taken during last 5 years? _____________________ Tk. ☐☐☐☐☐☐☐

1010. Do you have any savings? Yes = 1, No = 2 (skip to 1012) ☐

1011. Can you use the money that you have saved for the purpose as you chose? ☐
Yes = 1, No = 2

1012. Involvement of women in income generation activities: (IGA includes work outside home, agriculture, making things for sale, selling things in market, and similar activities having earning/income connotations)
(a) Number of women in the HH who were engaged in IGA, last year: ____ ☐

(b) Approximate total person days in last year women in the HH involved in IGA: _____ person day ☐☐☐☐

1013. Can you do the following alone or can't do alone (including can't do at all)?

Activities	Can do alone	Can't do alone	
1. Visit to nearest health complex	1	2	☐
2. Visit to nearest shop	1	2	☐
3. Visit to nearest bazar/hat	1	2	☐
4. Visit to neighboring village/relatives	1	2	☐
5. Visit to neighbor	1	2	☐
6. Go to cinema	1	2	☐
7. Attend Women's Group Meeting (Credit group or others)	1	2	☐
8. Go outside for work (for earning)	1	2	☐

1014. Does your husband ever consult you on major decisions of the family ?
(Major decisions include purchase/sale land, construction/repair house, purchase/sale livestock, marriage, health, education, etc.)
Always = 1, Some times = 2, Never = 3, Not currently married = 4 ☐

1015. If a son/daughter of yours fall sick, who would you first go to for advice or treatment?

For son: Traditional healer = 1, Govt. hospital/clinic=2, Private qualified doctor = 3, Homeopath =4, Quack =5, Spiritual/religious healers = 6, Do nothing = 7 ☐

For daughter Traditional healer = 1, Govt. hospital/clinic=2, Private qualified doctor = 3, Homeopath =4, Quack =5, Spiritual/religious healers = 6, Do nothing = 7 ☐

1016. Do you have school going children who has stopped going to school (dropped out)? ☐
Yes = 1 No = 2
How many = _____ , of which boy(s) = ____ , girl(s) = ____ ☐ ☐ ☐

1017. Do you have school going boy and/or girl child in this household? ☐
Yes = 1 No = 2
What would be the school attendance rate during last school month?
Boy: ________ % Girl _________ % ☐☐☐ ☐☐☐

1018. What do you use most for cooking?
Electric burner = 1, Kersoene=2, Earth burner=3, Gas =4, Other (specify) _______ =5 ☐

1019. What instrument/equipment do you use for rice husking?
Dhenki=1, Rice husking mills=2, Diesel-run (mobil) machine =3, Other (specify) _______ =4 ☐

1020. What do you do for spice grinding?
Use grinding mill=1, Use grinding machine=2, Buy powdered spices=3, Hire worker (women)=4, Do myself (as before manually) = 5, Other (specify) __________________ =6 ☐

1021. Do women in your household work on handicrafts, sewing etc. at night for generation of income? Yes = 1, No = 2 ☐

1022. ***Interviewer check:*** *Electrified household = 1, Non-electrified household = 2* (skip to 1028) ☐

1023. Do you think that your (women's) workload for household chores has reduced due to electricity? a) Yes = 1No = 2 ☐

b) Average hours/day worked for HH:

Now: _______ hrs; Before: ______ hrs. ☐☐ ☐☐

1024. Do you have more free (leisure) time than before electrification?

Yes = 1 No = 2 ☐

How many more hours per day (on average): _____ minute. ☐☐☐

1025. Do you listen to radio more now a days than before electrification?

Yes = 1 No = 2 ☐

How many hours per day (on average): ______ minute. ☐☐☐

before electrification: ______ hrs ☐☐☐

1026. Do you watch TV now a days more than before electrification?

Yes = 1 No = 2 ☐

How many more hours per day (on average) _____minute.

(before electrification: ______minute.) ☐☐☐

1027. Do you (or other woman in the HH) assist children with their education now more than before electrification? ☐☐☐

Yes = 1 No = 2 ☐

How many more hours per day (on average): ______ minute. ☐☐☐

(before electrification: ______ minute. ☐☐☐

1028. Does your family tend to arrange marriage with dowry? Yes =1, No = 2 ☐

1029. Do you think that the practice of dowry has a negative impact on women's situation?

Yes = 1, No = 2, Not sure/DK = 8 ☐

XI. Modernization: Social and Cultural Dimensions

(Perception, Radio, TV) (Ask to female respondent)

1101. How many years of schooling a boy and a girl should have (in years)

Boy _____ yrs, Girls ______ yrs ☐☐ ☐☐

1102. Is it better to educate girls at home or at school?

At home =1, At school =2 ☐

1103. What do you think should be the ideal age at marriage for a boy and for a girl? (in years)

Boy _____ yrs, Girls ______ yrs ☐☐ ☐☐

1104. Should a girl/a boy be consulted for her consent regarding the choice of her groom/bride

Boy: Yes = 1, No = 2 ; Girls: Yes = 1, No = 2 ☐ ☐

1105. Should an unmarried girl of 18 years who wants to work be allowed to take job outside her village? Yes =1, No = 2 ☐

1106. How many children should a family have (ideal family size? ______ # ☐

1107. What should be the spacing between child births? _______ years ☐

1108. Do you listen to Radio? Yes =1, No = 2 (skip to 112) ☐

1109. How long do you listen to radio? ______ minutes per day ☐☐☐

(Ask even if there is no radio at home)

1110. What do you listen to in Radio? (*circle all answers mentioned*) ☐

Folk song =1, Modern song =2, News =3, Drama =4, Health-Nutrition related =5, ☐

Agr. related = 6, Cinema ad. =7, Other entertainment = 8 , Not applicable =9 ☐

☐

1111. What are the areas (subject issues) on which you have learnt from radio listening and subsequently (knowledge gained) used/practiced/disseminated (which were found useful in life)?

(*circle all appropriate answer mentioned*) ☐☐

Value of good health = 01, Value of Education =02, Value of female education =03, Utility of family planning =04, Development of knowledge base through national/international news =05, Improvement in agricultural practice =06, Knowledge about modern fishing = 07, Knowlwdge about integrated pest management =08, Govt. program about distribution of khas land =09, Prohibition of dowry =10, Laws about divorce =11, Legal tools to combat violence against women =12, Local governance issues =13, Women's Right issues =14, Issues of human rights =15, Others (specify) _______ = 16

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1112. Do you watch TV? Yes = 1 , No = 2 (skip to 1117)

1113. How long do you watch TV? ______ minutes per day (on average)

1114. What do you watch on the TV?

(*circle all answers mentioned*)

Folk song =1, Modern song =2, News =3, Drama =4, Health-Nutrition related =5,
Agr. related = 6, Cinema =7, Other entertainment = 8 , Not applicable = 9

1115. Which cultural programs do you enjoy <u>most</u> which are shown on the TV?

(*circle all answers mentioned*)

Bangla drama/drama serial =1, Film =2, English drama/drama serial =3

1116. What are the areas (subject/issues) you have learnt from TV watching and subsequently (knowledge gained) used/practiced/disseminated (which were found useful in life)?

(*circle all answers mentioned*)

Value of good health = 01, Value of Education =02, Value of female education =03,
Utility of family planning =04, Development of knowledge base through national/
International news =05, Improvement in agricultural practice =06, Knowledge about
modern fishing = 07, Knowlwdge about integrated pest management =08,
Govt. program about distribution of khas land =09, Prohibition of dowry =10,
Laws about divorce =11, Legal tools to combat violence against women =12,
Local governance issues =13, Women's Right issues =14, Issues of human rights =15,
Equal rights for boys and girls through Mina Cartoon = 16, Others = ________(spicify)=17

1117.Whether knows about the following, and main/major source of information

Issues	Knows =1, DK =2		Source of information *					
1. Equality of men and women in terms of access to resources	1	2	1	2	3	4	5	9
2. Equality of men and women in terms of employment, wage (non-discrimination)	1	2	1	2	3	4	5	9
3. Women trafficking: punishable criminal offense	1	2	1	2	3	4	5	9
4. Child trafficking: punishable criminal offense	1	2	1	2	3	4	5	9
5. Acid throwing: punishable criminal offense	1	2	1	2	3	4	5	9
6. Informed choice in Family Planning use	1	2	1	2	3	4	5	9
7. Equal rights of men and women to vote and participate in election	1	2	1	2	3	4	5	9
	1	2	1	2	4	4	5	9

(**Source codes:** Radio = 1, TV = 2, Neighbor/relative = 3, NGO =4, Govt-worker =5)

1118. Was there any marriage event in your household during the last 5 years ?
Yes =1, No = 2 (skip to 1120)

1119. Who was given marriage to and where?

	Yes	No	Electrification status of destination household: electrified = 1	Non-electrified =2
Boy/son	1	2	1	2
Girl/daughter	1	2	1	2

1120. If you are to arrange marriage for your son or daughter, other things being equal (eg, economic status, educational qualification, employment status etc) what type of household you will choose – electrified or non-electrified

	electrified	non-electrified
For son:	1	2
For daughter:	1	2

XII. ELECTRICITY USE: DIRECT ISSUES

Household with electricity = 1 , Household without electricity = 2 (skip to 1401)

1201. How much did you spend to get electricity connection:

To PBS: _____________ Tk.
Wiring materials: _____________ Tk.
Labor charge: _____________ Tk.
Others: _____________ Tk.
(specify)

1202. How many electric bulbs/tubes of each type do you use for lighting?

Bulb/tube	#s	Watt (generally used)
Tungsten bulb		
Fluorescent tube		

☐☐ ☐☐☐
☐☐ ☐☐☐

1203. How many hours are they used each night?
___________ hrs. ☐☐

1204. What type of lighting did you use before electricity?
Lantern = 1, Kupee = 2 ☐

1205. How long did you use that per night? ___________ hrs. ☐☐

1206. Item and source of electrical appliances purchased: ______________________

1. Within 1 year of receiving connection: Item* ☐☐☐☐ , Source ** ☐☐☐☐
2. 1-2 years after receiving a connection: Item* ☐☐☐☐ , Source ** ☐☐☐☐
3. 5 years after receiving connection: Item* ☐☐☐☐ , Source ** ☐☐☐☐

* Item code: TV =1, Cassette player =2, Iron =3, Refrigerator =4, Fan =5, Charger =6, Mobile phone = 7 , Other ______ (specify) = 8`
** Source code: Village market =1, Nearest thana/district town =2 ,
Nearest division town/city =3, Others (specify) ______________________ = 4

1207. What appliances do you plan to buy in the coming year? ____________
(*use above item code; if no such plan write* ‘ 9’ ☐☐☐

1208. What are the things you can do now with electricity which you could not without it?
(multiple answers)
Can light house =1, Can do HH chores =2, Can watch TV =3, Can listen radio =4, Can iron cloths =5, Can use fan for comfort =6, Can use Refrigerator for food preservation =7, Can generate income = 8 ,Others (specify) ______ = 9
☐☐☐☐☐

1209. What would be the major problems to your HH if the electricity supply failed (interrupted) for sustained period? (multiple answers)
Children’s study affected = 1, Women’s drudgery increased = 2 , Discomfort due to no fan =3 , Affects TV viewing = 4 , Disturbance in sleeping at night during Summer = 5, Unnecessary delay in dinner = 6, Others (specify) ________________ = 7
☐☐☐☐☐

1210. How has an electricity connection affected your daily life?
Significantly =1, Marginally =2, No change =3 ☐

1211. Has electricity affected children’s study?
Yes = 1, No = 2 (skip to 1213) ☐

1212. Was there any improvement in education in terms of the following:

	Yes	No	
More attention and willingness to study:	1	2	☐
Better exam. results:	1	2	☐
Higher school attendance:	1	2	☐
Less dropout:	1	2	☐

1213. Has electricity affected habits (recreational and other) in terms of the following

	Yes	No	
Reading	1	2	☐
Watching TV	1	2	☐
Listening Radio	1	2	☐
VCR	1	2	☐
Playing cards/chess	1	2	☐
Adda	1	2	☐
Cultural Program	1	2	☐

☐

1214. Has it enabled longer working hours? Yes = 1, No =2 ☐

1215. Has your electricity supply ever been disconnected for non-payment?
Yes = 1, No =2 ☐

1216. Did you ever had trouble in paying bill? Yes = 1, No =2 (skip to 1218)

1217. What were the major troubles? ☐
Did not get bill in time = 1, Got incorrect bill = 2 ,
Couldn't pay due to want of money =3 , Others (specify) ________________ = 4

Irregularity of electricity/load shedding and willingness to pay (for quality service)

1218. Is power supply regular? Yes =1 (skip to 1222), No = 2 ☐

1219. Is power failure an almost routine event? ☐
Almost daily affairs =1, Seasonal =2 (skip to 1221),
Occasional = 3 (skip to 1222)

1220. If failure is almost daily affairs, does it happen at? ☐
Day time (5-12) = 1, Afternoon (12-6) =2,
Evening (6-10) = 3, Late night (10-4) = 4

1221. If failure is seasonal
a. What is the season of maximum incidence of failure? ☐
Summer = 1, Winter = 2, Monsoon = 3
b. What is the time of most failure? ☐
Day time = 1, Afternoon =2, Evening = 3, Late night = 4

1222. If electricity is available 24 hours without any voltage fluctuation (as compared to current services) – will you pay more than now? ☐
Yes =1, No = 2 (skip to 1301)

1223. How much more you are willing to pay? ☐☐☐
______ % higher than now.

XIII. LOCAL GOVERNANCE, DEMOCRATIZATION AND PBS

1301. Are you a member of PBS? Yes =1 , No = 2 (skip to 1306) ☐

1302. Do you know the eligibility criteria for directorship in the PBS Board? ☐
Knows =1, Do not know =2

> Interviewer: The eligibility criteran to be elected as a Director (highest 15 constituences) are as follows: must be a member; at least SSC passed; age 30 – 70 years; not convicted for criminal offense; permanent residence of the area; not an office bearer of political party; not an elected chairman/member of local government. Any three on above would be treated as having knowledge about eligibility criteria.

1303. Did you ever cast your vote for election of PBS Director ? Yes =1, No = 2

1304. When did you last attend an AGM? ______ months back ☐☐

1305. Name 3 major issues reviewed and discussed in that AGM
1. ______________________________ ☐
2. _______________________________ ☐
3. _______________________________ ☐

1306. What role elected directors of PBS play in PBS management? ☐☐☐☐☐
[
(*circle all answers mentioned*)
Policy making = 1, Ensure transparency in management =2,
Minimize mismanagement =3, Represent other members in PBS = 4,
Know nothing about role = 8, Others (specify) ___________= 5

1307. Are the Board Members accountable to the members? ☐
Yes =1, No = 2 (skip to 1309)

1308. How are they accountable? (*circle all answers mentioned*) ☐☐☐☐☐
Respond to members query =1 , Answerable to members in AGM =2 ,
Consult members before framing policy decisions =3 , Share audit report = 4,
others (specify) _________________ = 5

1309. Do you know any of the Board members? Yes =1 No = 2 ☐

> Interviewer: Please collect the name from PBS. Name (________________________)

1310. Do you know any of the local PBS village Advisor? Yes =1, No = 2 ☐

1311. What role does a lady advisor play in PBS? ☐
Mobilize female members = 1, Collect savings from female members =2,
Other (specify) ____________________ = 3

1312. Do you think that PBSs are playing useful role for members? ☐
Yes =1, No = 2 (skip to 1401)

1313. What useful role PBS play? ☐ ☐ ☐ ☐ ☐
(*multiple responses possible*)
Facilitate peoples participation =1, Facilitate women's empowerment (women as billing assistant)=2, Help consensus-building (among diverse members) = 3, Foster group spirit =4, Accelerate accountability = 5, Help achieve transparency = 6, Others (specify) ____________________ = 7

XIV. OVERALL SOCIAL ENVIRONMENT, PROTECTIVE SECURITY

1401. Would you agree that electrification has generated employment opportunity markedly significantly? Yes = 1, No = 2 (skip to 1403) ☐

1402. Why do you agree? (*multiple responses possible*) ☐ ☐ ☐ ☐ ☐ ☐
Local trade & business activities expanded =1, Unemployed youth got employment opportunities =2, Small and cottage industries has been established =3, Scopes for employment in crop agriculture have been broadened = 4, Opportuininty for poultry raising =5, Scopes for work at night =6, Increased scopes for income/earning from multiple sources = 7 Others (specify) _________________ = 8

1403. Would you agree that security has increased due to electrification at household level? ☐
Yes = 1, No = 2 (skip to 1405)

1404. What is/are the reason(s) *(multiple responses possible)* ☐ ☐ ☐ ☐
Have light all night =1, Theft and robbery become difficult =2 , There is street light =3 , There is light outside house = 4 , Other (specify) ______________________ = 5

1405. Would you agree that security of mobility at night has increased due to lighting? ☐
Yes = 1, No = 2 (skip to 1407)

1406. What is/are the reason(s)? ☐ ☐ ☐
Everything is distinctly visible = 1 , Less fear of snakes = 2 ,
Others (specify) ___________________ = 3

1407. Would you agree that TV influences social value/norm? ☐
Yes = 1, No = 2 (**Interview end**)

1408. What according to you are the positive impacts of TV in terms of social value? ☐ ☐ ☐ ☐ ☐ ☐ ☐
(*multiple responses possible*)
Rapid flow/supplies of news/information =1,
Enhancement of recreational opportunities = 2,
Strengthening knowledge-base about rights and responsibilities =3,
Inspiration for changing social-economic-cultural status = 4,
Broadening opportunities for children's education = 5,
Improving health, hygiene and nutrition related knowledge = 6,
Others (specify) ________________= 7.

Interviewers: Give thank to the respondents for their invaluable time, hospitality and cooperation extended throughout the interview process. Wish them all the bests in life.

Annex-B2

SERIAL # ☐☐☐

SAMPLE ID ☐☐☐☐☐☐

Irigation Equipment and Agriculture Interview Schedule (IEAIS)

Economic and Social Impact Evaluation Study
of
Rural Electrification Program in Bangladesh

Questionnaire on Irrigation Equipment and Agriculture
(Questionnaire 2)

Study undertaken for

NRECA International Ltd.

Partners with the REB and USAID for the Rural
Power for Poverty Reduction (RPPR) Program

Human Development Research Centre
Road # 8/A, House #59, Dhanmondi R/A, Dhaka –1209
Phone: 8116972, Fax: 880-2-8620229
email: hdrc@bangla.net

Dhaka, May 2002

Respondent Consent Form

Interviewer – read this before the actual interview. Interview should be conducted only after the informed consent of the interviewee.
Interviewer, read the following: We have come to you, as part of the process to conduct Economic and Social Impact Study of Rural Electrification Program in Bangladesh. We are conducting the study on behalf of REB under the auspices of NRECA (explain NRECA, USAID/TA). We are deployed by a Research Firm named Human Development Research Centre (address Dhanmondi Rd. 8/A, House 59).
We will collect information on irrigation pump, landownership and agricultural production (including output, employment, cost, etc.), and other issues related to benefits of rural electrification.
This study has national significance, because it is based on your information that the impact of REP will be judged, critically. Thus, we would highly appreciate if you would kindly share with us the relevant information we are looking for in this study. All information provided by you will be confidential and shall not be used for any purpose other than this research study. Are you willing to participate in this survey?
Respondent willing 1, Respondent unwilling 2, (Go to next sample respondent)
After respondent agrees, proceed with the questionnaire interview (set convenient date and time, if additional time is required).

1. SAMPLE IDENTIFICATION

Sample ID ☐☐ ☐ ☐☐☐
PBS T S

(Reference Period: 1 Baisakh – 30 Chaitra, 1408 BY; 14 April 2001 – 13 April, 2002)
[**PBS Code:** 01=Barisal PBS-2, 02=Bogra, 03=Brahmanbaria, 04=Chittagong PBS-2, 05=Comilla PBS-1, 06=Cox's Bazar, 07=Dhaka PBS-1, 08=Dinajpur PBS-1, 09=Faridpur, 10=Feni, 11=Gopalganj, 12=Jessore PBS-2, 13=Magura, 14=Meherpur, 15=Mymensingh PBS-1, 16=Naogaon, 17= Natore PBS-2, 18=Netrokona, 19=Nilphamari, 20=Norsingdi PBS-1, 21=Rajshahi, 22=Sirajgnj, 23=Sylhet PBS-1]. ☐☐

Nature of irrigation:
(Electrified Irrigation Pump=1, Non electrified Pump=2), No-irrigation = 3 (Skip to Farmer Section) ☐

Irrigation equipment type: DTW-E =1, STW-E=2, LLP-E=3, DTW-D=4, STW-D=5, LLP-D= 6, TR =7, No irrigation =8, (Skip to Farmer section) ☐

Name of PBS: ☐☐

1. Name of the connection holder: ___________________________ ☐☐☐
2. Irrigation equipment sample #. ☐☐
3. Irrigation equipment electricity status: Electrified =1, Non-electrified = 2 ☐
   ↓
   (Year of electrification___________) ☐☐☐☐
4. PBS Account No. ___________________ ☐☐☐☐☐☐☐
5. Electrification status of village: Electrified =1, Village Non-electrified = 2 ☐
   where pump is installed
   ↓
   (Year of electrification___________) ☐☐☐☐
6. Division: _______________ ☐ 7. District: ____________________ ☐☐
8. Upazilla: _______________ ☐ 9. Union/Ward: ________________ ☐
10. Village/Mahalla/Para __________ ☐

INTERVIEW INFORMATION

Interview call	1	2	3	4
Date				
Respondent: Male/ Female Name of the Respondent				
Result Code *				
Interviewer's Name (code)				

* Result Codes: Completed =1, Deferred = 2,Other= 3 (specify) _______________

Name of Supervisor: _________________________________ Date: _____________________
Re interviewed or spot checked by (name): _____________________ Date: _______________

Coder's name: ____________________________________ Date: ___________________
Editor's name: ____________________________________ Date: ___________________

2. BACKGROUND CHARACTERISTICS

Information on Pump

(Investigation Period refers to previous Bangla-Year (1408) and includes all crops harvested during 1 Baisakh – 30 Chaitra, 1408 BY; 14 April 2001 – 13 April, 2002 irrespective of their time of sowing.)

201	Name of Pump Owner____________________________ [Address : District _____, Upazila______, Union______,Village/Para____ **Type of ownership:** Individual =1, Cooperative = 2, Leased =3, Others =4 **Respondent's Status:** Owner =1, Manager =2, Others=3	☐☐☐ ☐
202a	What type of pump you use for irrigation? Deep tube well = 1 , Shallow tube well = 2 , Low lift Pump = 3 ,	☐

202b	When did you install the pump? _____________ year	☐☐☐☐
203a	What is the source of energy for this pump? Electricity =1, Diesel = 2(skip to 205)	☐
203b	When did you energize the pump with electricity? ________________ year	☐☐☐☐
204	Load of Electricity (as per Customer Meter Order) (in KW) ___________	☐☐☐☐
205	Capacity of the Pump (HP) _____________	☐☐
206	a. Depth of the well (ft.) _____________ feet b. Diameter of the pipe (inch) ___________ inch	☐☐☐ ☐☐
207	Did you switch over from one type of pump to another? (I mean from diesel engine to electricity motor or the reverse)? Yes = 1 No = 2 (skip to 211)	☐
208	What was the source of energy for the previous pump? Electricity = 1, Diesel = 2, Manual = 3, Others (specify) _________ 4	☐
209	Capacity of the previous pump (HP) ____________	☐☐☐
210	Why did you switch over? Less Costly = 1, Reliable = 2, Easy to operate = 3, Higher longevity of motor = 4, Less trouble = 5 , (Skip to 212) Easy to repair = 6 , Others (specify) = 7___________	☐ ☐ ☐ ☐ ☐
211	Why did you not switch over? Costly = 1, No electricity = 2, No demand =3 , Reliable = 4, Less trouble = 5 , Easy to repair = 6 , Others (specify) = 7 __________________	☐ ☐ ☐
212	**(Interviewer check:** electrified pump=1 (skip to 213), non-electrified pump =2) Do you intend to switch over to electricity? Yes =1, No =2 Why: ____ ____	☐ ☐ ☐ ☐ ☐
213	How did you irrigate before installation of the pump ? (*multiple responses possible*) By other electrified irrigation pump = 1, Diesel Pump = 2, Manual irrigation from river or cannel/traditional = 3, No irrigation = 8	☐ ☐ ☐
214	What is the price of the pump machine? ________________ Tk.	☐☐☐☐☐☐☐
215	What is the installation cost of the pump ? a. Material ____________ Tk. b. Labour ____________ Tk.	☐☐☐☐☐ ☐☐☐☐☐
216	How many days the pump was used last year (1408 BY)?	☐☐☐
217	What was the cost of energy for the pump last year (1408 BY)? Tk. ________________	☐☐☐☐☐☐
218	What was the cost of lubricant for the pump last year (1408 BY)? _________________ Tk.	☐☐☐☐☐
219a	What was the cost of regular maintenance for the pump last year (1408 BY)? _________________ Tk	☐☐☐☐☐
219b	Do you use capacitor? Yes = 1 No = 2 What is the price of capacitor?________________ What is the utility of the capacitor? Increases efficiency=1, Reduces electricity bill=2, Others (specify) __________________ = 3	☐ ☐☐☐☐ ☐
220	How many times the pump broke-down last year (1408 BY)? No breakdown =1 One time = 2, Two times =3, Three times = 4 , Four times = 5, Five and more times = 6	☐
221	What was the repairing cost last year (1408 BY)? _______________ Tk	☐☐☐☐☐
222	How many days lost due to breakdown of the pump last year (1408 BY)? ________ days	☐☐☐

223	Do you use the pump engine/motor for any other purpose? Yes = 1 , No = 2 (skip to 225)	☐
224	What are those purposes 1=Rice husking, 2 = Boat roaring, 3=Oil crushing, 4 =Transportation, 5 =Others	☐ ☐ ☐
225	What was the command area of the irrigation pump last year? (a) Gross irrigated area ______________ decimal (b) Net irrigated area ______________ decimal (c) Area covered now, but not irrigated before installation of the pump ______ decimal (d) Crops in the command area cultivated using irrigation (use crop code) ____ , ____ , ____ , ____ , ____ , ____ , ____ , _____ , _____ (e) Crops cultivated now but not cultivated before installation of the pump (use crop code) ____ , ____ , ____ , ____	☐☐☐☐☐ ☐☐☐☐☐ ☐☐☐☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐
226	Amount of land of the pump owner within the command area _______ decimal	☐☐☐☐☐
227	Did you sale water to others? Yes = 1 No = 2 (Skip to 232)	☐
228	What is the mode of payment? In Cash = 1 , In Kind = 2 , Cash and kind = 3 , Others (specify) ________ = 4	☐
229	a. If in cash, what is the rate per acre? ______________ Tk. (Skip to 232) b. Total income eared in cash : ______________ Tk.	☐☐☐☐ ☐☐ ☐☐ ☐☐☐☐☐☐
230	If in kind, what is the sharing proportion? 1/3 = 1, 1/4 =2 , 1/5 = 3, others = 4 (specify) ____ ____	☐ ☐ ☐ ☐
231	What is the price of your share of crops? _______________Tk.	☐☐☐☐☐
232	Number of workers in the pump? a. Regular: _____ person, b. Casual: _____ person	☐ ☐
233	How many months the workers worked in the pump last year (1408 BY)? a. Regular (Seasonal): ___________ b. Casual: _________	☐☐☐☐ ☐☐☐☐
234	Total wages paid to the workers last year (1408 BY)? __________ Tk.	☐☐☐☐☐
235	How many days the machine had not to operate due to rain last year (1408 BY)?	☐☐
236	How many days the machine did not operate due to power failure/diesel crisis last year (1408 BY)? ____________ days	☐☐☐
237	How many days the machine did not operate due to any other reason last year (1408 BY)? __________ days	☐☐☐
238	Total income from the pump last year (1408 BY)? ___________ Tk	☐☐☐☐
239	Total expenditure of the pump last year (1408 BY)? ____________ Tk	☐☐☐☐☐

Sample Plot user ID ☐☐☐☐☐
PBS T Plot

3.	**Information of the farmer: whether this farmer is owner of this :** (This farmer is sample plot owner) Yes = 1, No = 2		☐
301.	Name of the farmer (plot ow ner)/share cropper ______________________________________		☐☐ ☐
302.	Name of Respondent ______________________________		
303.	Division: _______________ Thana :________________ Ward : ________________	District : ________________ Union: _________________ Village/Para: ______________	☐ ☐ ☐ ☐ ☐ ☐
304.	Farmer Category Owner-cultivator = 1, Farm Manager = 2 , Share Cropper = 3 , Other (specify) = 4 ____________________ a. Self cultivated own land : _____________ decimal b. Land leased in/mortgaged in: ________________ decimal c. Land shared in: _______________ decimal d. Land shared out: _____________ decimal e. Mortgaged/leased out: _____________ decimal f. Total operated farm land (a+b+c-d-e): ______________ decimal		☐ ☐☐☐☐☐ ☐☐☐☐☐ ☐☐☐☐☐ ☐☐☐☐☐ ☐☐☐☐☐ ☐☐☐☐☐

305. Total operated farm land and Irrigation related Questions:

Type of land	Operated farm land (decimal)	Irrigation code (amount in decimal):							
		DTW-E (1)	STWE (2)	LLP E (3)	DTW-D (4)	STW-D (5)	LLP-D (6)	TR (7)	No Irrigation (8)
Single crop									
Double crop									
Triple crop									
Quadruple									
Pentacle crop									

306. Agriculture (crop) production

(All Crops <u>harvested</u> during 1 Baisakh–30 Chaitra, 1408 BY;14 April 2001–13 April, 2002 irrespective of their time of sowing).

SL #	Crop code *	Irrigation Code**	Own land under cultivation (by self) (decimal)	Area shared in **(decimal)**	Area leased/mortgaged in **(decimal)**	Total operated farm land **(decimal)**	Area shared out	Production from operated farm land (maund)	Unit price **(decimal)**	Share from shared out land (maund)	Price of by product (Tk.)
1	2	3	4	5	6	7	8	9	10	11	12

Crop Code:
Cereals: 1=Aus (Local Broadcast), 2=Aus (HYV Transplant), 3=Aus (HYV Broadcast), 4=Aman (Local Broadcast), 5=Aman (Local Transplant), 6=Aman (HYV-Transplant), 7=Boro (Local Transplant), 8=Boro (HYV Transplant), 9=Wheat; **Fibre:** 10=Jute; **Sugar Crop:** 11=Sugarcane; **Pulses:** 12 Masur, 13 Mung, 14 Other pulse; **Oilseeds:** 15=Mustard, 16=Sunflower, 17 = Other oilseed; **Vegetables:** 18=Bottle Gourd, 19=Bitter Gourd, 20=Cucumber, 21=Cauliflower, 22=Radish, 23=Lal Shak/ Danta, 24=Bean, 25=Tomato, 26=Onion, 27=Brinjal, 28=Potato, 29=Chilly, 30=Other vegetables; **Fruits:** 31=Melon, 32=Banana, 33=Other fruits; **Drugs and Narcotics:** 34 = Tobacco; 35=Other crops

Irrigation code: Irrigated with DTW electrified = 1, Irrigated with STW electrified = 2, Irrigated with LLP electrified = 3 , Irrigated with DTW diesel = 4, Irrigated with STW diesel = 5,: Irrigated with LLP diesel = 6, Traditional Irrigation = 7, No-irrigation = 8

306. Sample plot

Sample Plot Size: ....Decimal, Plot ownership: Own =1, Sharing-in =2, Mortgaged in =3, Leased in (Khas) =4 (Ref. time: Baishakh-1 – Chaitra 30, 1408: 14th April –13th April 2002)		☐☐☐☐ ☐
308	How many times crop produced in the plot? _________time (if no irrigation, skip to 313)	☐
309	What are the crops under irrigation? (use crop code) _____, _____, _____, _____, _____, _____,	☐☐ ☐☐ ☐☐ ☐☐ ☐☐
310.	What is the mode of payment for the irrigation in above plot? In cash = 1, In kinds = 2	☐
311.	a. If in cash, rate per acre(per crop): ______________Tk lac. b. If in kind, what is the proportion of production had to pay to the pump owner? 1/3 =1, 1/4 = 2, 1/5 = 3, Others = 4 (specify)	☐☐☐☐
312.	Loss of crop due to disruption/dislocation (for any reason) of irrigation of the plot? Maund _______ Value _________	☐ ☐☐
313.	Loss of crop due to natural calamity? Maund _____ Value _________	☐☐☐☐☐ ☐☐ ☐☐☐☐☐

314. Production, Employment and Cost of inputs

Items of information	**Crop 1**	**Crop 2**	**Crop 3**	**Crop 4**	**Crop 5**
A. General					
1. Crop season (use season code)					
2. Crop name (use crop name code)					
3. Amount of land under this crop (decimal)					
4. Time between land preparation and harvesting (Bangla & English month)					
5. Total days plot engaged					
6. a. Quantity produced b. Unit Price (Tk./Maund) c. Total price of by products (Tk.)					
7. Irrigation status (use irrigation code)					
B. Employment and cost					
B.1 Employment/Labour status (Person days)					
(a) Seed bed preparation (Person hour)					
Family labor male (FLM)					
Family labor female (FLF)					
Hired labor male (HLM)					
Hired labor female (HLF)					
(b) Land preparation					
Draft power (pair days)					
Own					
Hired					
Power Tiller (days):					
Own					
Hired					

Items of information	**Crop 1**	**Crop 2**	**Crop 3**	**Crop 4**	**Crop 5**
Labor:					
Family labor male (FLM)					
Family labor female (FLF)					
Hired labor male (HLM)					
Hired labor female (HLF)					
(c) Sowing (Transplant/broadcast) (Person hour)					
Family labor male (FLM)					
Family labor female (FLF)					
Hired labor male (HLM)					
Hired labor female (HLF)					
d) Weeding/ thinning (Person hour)					
Family labor male (FLM)					
Family labor female (FLF)					
Hired labor male (HLM)					
Hired labor female (HLF)					
e) Pesticide (Person hour)					
Family labor male (FLM)					
Family labor female (FLF)					
Hired labor male (HLM)					
Hired labor female (HLF)					
f) Fertilizing (Person hour)					
Family labor male (FLM)					
Family labor female (FLF)					
Hired labor male (HLM)					
Hired labor female (HLF)					
(g) Irrigation (Person hour) (if no irrigation, go to h)					
Family labor male (FLM)					
Family labor female (FLF)					
Hired labor male (HLM)					
Hired labor female (HLF)					
(h) Harvesting					
Family labor male (FLM)					
Family labor female (FLF)					
Hired labor male (HLM)					
Hired labor female (HLF)					
(i) Carrying/Transport					
Family labor male (FLM)					
Family labor female (FLF)					
Hired labor male (HLM)					
Hired labor female (HLF)					
(J) Threshing					
Family labor male (FLM)					
Family labor female (FLF)					
Hired labor male (HLM)					
Hired labor female (HLF)					
(k) Drying/ Winnowing					
Family labor male (FLM)					
Family labor female (FLF)					
Hired labor male (HLM)					
Hired labor female (HLF)					
B.2. Daily rate for hired labour (Tk.) :					
(a) Seedbed preparation					
Male					
Female					
(b) Land preparation					
Male					
Female					
(c) Sowing					
Male					
Female					
(d) Weeding/ thinning					
Male					
Female					

Items of information	**Crop 1**	**Crop 2**	**Crop 3**	**Crop 4**	**Crop 5**
(e) Pesticide					
Male					
Female					
(f) Fertilizing					
Male					
Female					
(g) Irrigation					
Male					
Female					
(h) Harvesting					
Male					
Female					
(i) Carrying/transporting					
Male					
Female					
(j) Threshing					
Male					
Female					
(k) Drying/winnowing					
Male					
Female					
C. Cost of inputs (in Tk.)					
c.1 Seed/seedling:					
Quantity (Kg.)					
Value (Tk.)					
c.2. Land preparation: draft power/power tiller (excluding labour)					
c.3 Fertilizer:					
Urea:					
Quantity (Kg.)					
Price (Tk.)					
TSP:					
Quantity (Kg.)					
Price (Tk.)					
MP/Gypsum:					
Quantity (Kg.)					
Price (Tk.)					
Organic:					
Quantity (Kg.)					
Price (Tk.)					
c.4 Pesticide:					
Name/quantity:					
Price (Tk.)					
c.5 Herbicide/weadicide:					
Name/quantity:					
Price (Tk.)					
c.6 Irrigation (Tk.):					
Cost of irrigation where labor cost included: Yes=1 No=2					
Cost of irrigation paid in Tk. or in kind Cash=1 Kind=2 Combination of both = 3					
Cash (Tk.)					
Kind (maund)					
c.7. LABOR (Cost):					
c 7.1 Seed bed preparation					

Items of information	**Crop 1**	**Crop 2**	**Crop 3**	**Crop 4**	**Crop 5**
c.7.2 Land preparation					
c.7.3 Sowing					
c.7.4 Weeding/thinning					
c.7.5 Pesticide					
c.7.6 Fertilizer					
c.7.7 Irrigation					
c.7.8 Hervesting					
c.7.9 Carrying/transporting					
c.7.10 Threasing/winnowing					
c.7.11 Drying/ winnowing					
c.7.12Other (Spicify)					
C.8. Miscelleneous (cost)					
c.8.1 Transportation					
c.8.2 Payment for draft power/power tiller					
Total Expenditure:					

Season Code:
Rabi* =1, Kharif** =2, Rabi + Kharif =3 All Season =4

*Rabi crops: Rabi crops are sown in winter and harvested in the spring or early summer

**Kharif crops: Kharif crops are grown in the spring or summer season and harvested in late summer or in early winter

Crop Code:
Cereals: 1=Aus (Local Broadcast), 2=Aus (HYV Transplant), 3=Aus (HYV Broadcast), 4=Aman (Local Broadcast), 5=Aman (Local Transplant), 6=Aman (HYV-Transplant), 7=Boro (Local Transplant), 8=Boro (HYV Transplant), 9=Wheat; **Fibre:** 10=Jute; **Sugar Crop:** 11=Sugarcane; **Pulses:** 12 Masur, 13 Mung, 14 Other pulse; **Oilseeds:** 15=Mustard, 16=Sunflower, 17 = Other oilseed; **Vegetables:** 18=Bottle Gourd, 19=Bitter Gourd, 20=Cucumber, 21=Cauliflower, 22=Radish, 23=Lal Shak/ Danta, 24=Bean, 25=Tomato, 26=Onion, 27=Brinjal, 28=Potato, 29=Chilly, 30=Other vegetables; **Fruits:** 31=Melon, 32=Banana, 33=Other fruits; **Drugs and Narcotics:** 34 = Tobacco; 35=Other crops

Irrigation code: Irrigated with DTW electrified = 1, Irrigated with STW electrified = 2, Irrigated with LLP electrified = 3 , Irrigated with DTW diesel = 4, Irrigated with STW diesel = 5,: Irrigated with LLP diesel = 6, Traditional Irrigation = 7, No-irrigation = 8

Annex-B3

Industrial Unit Interview Schedule
(IUIS)

Economic and Social Impact Evaluation Study
of
Rural Electrification Program in Bangladesh

Study undertaken for

NRECA International Ltd.

Partners with the REB and USAID for the Rural
Power for Poverty Reduction (RPPR) Program

Human Development Research Centre
Road # 8/A, House #59, Dhanmondi R/A, Dhaka –1209
Phone: 8116972, Fax: 880-2-8620229
email: hdrc@bangla.net

Dhaka, May 2002

Respondent Consent Form:

Interviewer – read this before the actual interview. Interview should be conducted only after the informed consent of the interviewee. Interviewer, read the following: We have come to you, as part of the process to conduct Economic and Social Impact Study of Rural Electrification Program in Bangladesh. We are conducting the study on behalf of REB under the auspices of NRECA (explain NRECA, USAID/TA). We are deployed by a Research Firm named Human Development Research Centre (address Dhanmondi Rd. 8/A, House 59).

We will collect information about industries of both electrified and non-electrified (including input and output structure, capital, technology, asset, revenue, cost-structure, wage etc) and many other issues regarding industrial growth.

This study has national significance, because it is based on your information that the impact of REP will be judged, critically. Thus, we would highly appreciate if you or your manager or any well informed staff of your industry (as applicable) would member(s) of the household (as applicable) would kindly share with us the relevant information we are looking for in this study. All information provided by you will be confidential and shall not be used for any purpose other than this research study. Are you willing to participate in this survey?

Respondent willing 1, Respondent unwilling 2, (Go to next sample respondent)

After respondent agrees, proceed with the questionnaire interview (set convenient date and time, if additional time is required).

Sample ID # ☐☐☐☐☐

I. SAMPLE IDENTIFICATION

1. Name of the Industry :
2. Major production (item):
3. Year of establishment __________ Year

4. Electrified = 1 , Non-electrified = 2
   (Year electrified___________)
5. # workers : ________________
6. Division: _______________ ☐ 7. District: __________________
8. Upazila: ______________ ☐☐☐ 9. Union/Ward: _______________
10. Village/Mahalla/Para __________ ☐☐ 11. PBS _____________

[**PBS Code:** 1=Bogra, 2=Barisal PBS-2, 3=Brahmanbaria, 4=Chittagong PBS-2, 5=Comilla PBS-1, 6=Cox's Bazar, 7=Dhaka PBS-1, 8=Dinajpur PBS-1, 9=Faridpur, 10=Feni, 11=Gopalanj, 12=Jessore PBS-2, 13=Magura, 14=Meherpur, 15=Mymensing PBS-1, 16=Natore PBS=2, 17=Naogaon, 18=Nilphamari, 19=Norsingdi PBS-1, 20=Pabna PBS-1, 21=Rajshahi, 22= Sirajgang, 23=Sylhet PBS-1]

INTERVIEW INFORMATION

Interview call	1	2	3	4
Date				
Respondent: Male Female (Name)				
Result Code *				
Interviewer's Name (code)				

* Result Codes: Completed =1, Deferred = 2, Dwelling vacant = 3, Other ___________ (specify) = 4

Name of Supervisor: _______________________________ Date: _____________________

Re interviewed or spot checked by (name): ____________________ Date: ______________

Coder's name: __________________________________ Date: __________________

Editor's name: __________________________________ Date: __________________

1.	Name of the Respondent: ___________________________(M = 1, F= 2) i. Age : _________ years, ii. Marital Status: Married = 1, Unmarried = 2 iii. No. of Children: __________	☐ ☐☐ ☐ ☐☐
2.	Designation: Owner =1 , Owner cum-manager = 2, Manager = 3	☐
3.	Type of electricity connection: i) GP=1 (general power) – Less than 750 KV, ii) LP = 2 (large power) – 750 KV and above, No connection = 3, iii) Date of permanent connection: _______________	☐
4.	Type of Industrial units – i) Category (Major product) .... ii) Size: Cottage=1, Small = 2, Medium = 3, Large = 4, [mainly with family members =1, with maximum 10 member =2, Labour from 11 to 49 = 3, with 50 labours and above = 4]	☐☐ ☐☐ ☐
5.	Why did the owner decide to invest in industry? Reasons:	☐☐☐
6.	What was the owner previous occupation	☐☐
7.	What was the initial investment? Initial investment .... Tk. ....Year	☐☐☐☐ ☐☐
8.	How many workers were employed in the beginning? (in ____ yr.) Skilled: ____ Persons/unskilled _____ person Skilled workers: 1) Technician : Number: ______ 2) Machine operator ______, 3) Cleaner ________ 4) Ironman _______, 5) Dyingman ________, 6) Others (specify) ________	☐☐☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐
9.	Total output produced in the beginning (in year) .... i) Output produced ....in mound/ton/unit, ii)Amount processed ....in mound/ton/unit	☐☐☐☐ ☐☐☐☐

10. Total (sale) revenue earned in the beginning in ...... year
i) From output sale ..... Tk. in 1st year, ii) From processing charge .... Tk. in 1st year
For example, rice mill or oil mill owner – gets money for processing 1 mound or 1 Kg. (rice or oil-seed)
☐☐☐☐
☐☐☐☐☐☐
☐☐☐☐☐☐

11. Industry is electricity driven =1 [skip to 13]
Industry is diesel driven =2, Industry using manual power = 3
☐

12. Problem with manual power/diesel...... ....
☐☐☐

13. Advantage with electricity compared to diesel driven machine:-..... ....

(Also ask the respondent about the problems of diesel driven machine even if the owner do not switch over from diesel to electricity.)
☐☐☐

14. Cost of establishing the industrial unit in the beginning:

i) Preparatory expenditure:

Licence fee ....Tk., b) Tax paid against capital ....Tk., c) Others specify).........Tk

ii) Land purchase ....Tk.

iii) Construction of building and structure ....Tk.

iv) Purchase of machine and equipment ....Tk.

v) Gas, water, and electricity connection ....Tk.

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☐☐☐☐☐☐

15. What was the size of your industry five years ago in terms of number of employees (if 5 years is not applicable ask for earliest year applicable)

Type of employee	Full time		Part time	
	Male	Female	Male	Female
Skilled				
Unskilled				

16. Total out put sold/processed

First year(19......)... Mound/ton/unit (specify......), 3rd year ....Mound/ton/unit (specify......)

5th year ....Mound/ton/unit (specify......), Last year(2001)......Mound/ton/unit (specify......)

☐☐☐☐☐☐
☐☐☐☐☐☐
☐☐☐☐☐☐
☐☐☐☐☐☐

17. What is the present size of your industry in terms of number of employees.

Type of employee	Full time		Part time	
	Male	Female	Male	Female
Skilled				
Unskilled				

18. Total (sale) revenue earned– last year? ___________________________Tk.
☐☐☐☐☐☐☐☐

19. Type of raw material: Primary or semi-finished product (wheat or flour).
Primary raw material = 1, (Name.............), Semi-finished product = 2 (Name..................)
☐ ☐☐
☐ ☐☐

20. If the answer of 19, is 2, then is it produced by another unit in the same area? Yes=1, No=2
☐

21. Whether the output directly goes to the : Consumer Direct = 1(skip to 23) Export = 2,
(skip to 23), Processing = 3, Partly export/Partly process=4, Partly export/Partly consume=5, (skip to 23), Partly direct consumer/party processing = 6
☐

22. If the ans. of the Q.21 – is 3 or 4 or 6 (processing) what is that industry where output is sold and where it is located?

Name of that industry / industries	Location			
	Within Thana=1	Outside thana=2	Outside district=3	☐ ☐
1)	1	2	3	☐ ☐
2)	1	2	3	☐ ☐
3)	1	2	3	

23. Did you expand your industry in the past? Yes = 1, No =2 (Skip to 26)
☐

If yes, then-
1) Set-up another unit to produce raw material which was previously purchased
Yes = 1 No = 2
Set-up another unit for further processing Yes = 1 No = 2
3) Set-up a new unit to produce dissimilar product : Yes = 1, No =2 If `Yes' then,
(a) Type of goods (industry type):______, b) Fixed capital (market value) _______ in Tk.
(c) Value of output _______in Tk.

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☐
☐ ☐ ☐ ☐
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☐☐☐☐☐☐

24. If the answer of the Q. 23(1) or 23(2) is yes, then what were the changes : output, revenue fixed capital, and employment in last year:
i) Type of goods ...., ii) Output ....Tk, iii) Revenue : ....Tk,
iv) Value of raw materials ....Tk, v) employees: ....person

☐ ☐ ☐
☐☐☐☐☐
☐☐☐☐☐
☐☐☐☐☐
☐☐☐

Year	Output in mound/ton/ unit	Fixed capital (cost of land, machine, Building) (Tk)	Employment			
			Skilled		Un-skilled	
			Male	Female	Male	Female
One year after investment						
5th year after investment						
Last year						

25. Cost of Expansion:
i) Additional cost during 1st expansion ....Tk ☐☐☐☐☐☐
ii) Additional cost during 2nd expansion ....Tk ☐☐☐☐☐☐
ii) Additional cost during 3rd expansion ....Tk ☐☐☐☐☐☐

26. Do you have any plan towards backward linkage expansion i.e. producing the raw materials which is produced by another unit or towards forward linkage i.e. extend its operation for further processing which is done by another firm.
Backward linkage plan: Yes = 1 No =2, Forward linkage plan: Yes = 1 No =2 ☐ ☐

27. Percentage of output sold:

	%	
i) To direct consumer ii) Within the Thana	....	☐☐ ☐☐
iii) Out side the Thana iv) Export Others	....	☐☐ ☐☐

28. Whether with the growth of this type of industry and industrialization in the area following service have expanded or not?

		Services expanded with the growth of this type of industry		Services expanded with industriali-zation in the area			
		Yes	No	Yes	No		
i	Shop	1	2	1	2	☐	☐
ii	Fax, e-mail, Telephone	1	2	1	2	☐	☐
iii	Technical Training Centre	1	2	1	2	☐	☐
iv	Computer	1	2	1	2	☐	☐
v	Photocopying	1	2	1	2	☐	☐
vi	School, College	1	2	1	2	☐	☐
vii	Clinic	1	2	1	2	☐	☐
viii	MBBS Doctor	1	2	1	2	☐	☐
ix	Diagnostic Centre	1	2	1	2	☐	☐
x	Restaurant	1	2	1	2	☐	☐
xi	Hotel	1	2	1	2	☐	☐
xii	Mobile phone	1	2	1	2	☐	☐
xiii	Bank	1	2	1	2	☐	☐
xiv	Repairing workshop	1	2	1	2	☐	☐
xv	Bus/Tempo stoppage	1	2	1	2	☐	☐
xvi	Lunch ghat	1	2	1	2	☐	☐

29. Do your workers purchase industrial goods from this industry and the industries of this area?
i) Workers purchase goods of the own industry : Yes = 1, No = 2 ☐
ii) Workers purchase goods of other industry : Yes = 1, No = 2 ☐

30. No. of Machine Operators and Technician are working:

i) No. of Machine Operator in the beginning	i) No. of Machine Operator now	☐☐ ☐☐☐
ii) No. of Technician in the beginning	ii) No. of Technician now	☐☐ ☐☐☐

31. Do you have any display centre of your product? Yes = 1, No = 2 ☐
If `yes', do the wholesale traders from other areas come and purchase? ☐
Yes = 1, No = 2

32. In which places are the electricity used. ☐☐☐ ☐
Lighting = 1 ; Running of machine =2; Ironing = 3; Preserving raw materials = 4
Preserving output = 5; Cleaning rooms and machines = 6; Other = 7

33. **COST ESTIMATION** (Last Year)

33.1 Labor		Total Number	Tk./day	Salary/Wage*Tk./week	Tk./month
Skilled (Full time)	Male				
	Female				
Unskilled (Full time)	Male				
	Female				
Skilled (Part time)	Male				
	Female				
Unskilled (Part time)	Male				
	Female				

	Total Labor hours for average day (24 hrs)_________________hrs (Interviewer: consider full-time, part time, seasonality, shifts etc)	
	*Salary/wage: Tk/day or Tk/week or Tk/month – use whichever is easy and applicable	
	33.2 Fuel cost _____________ Tk./Month	
	33.3 Electricity cost _____________ Tk./Month	☐☐☐☐☐
	33.4 Interest against loan _____________ Tk./Year	☐☐☐☐☐
	33.5 Purchase of raw material i) Cost of primary raw materials in ....Tk./month ii) Cost of auxiliary/secondary raw materials in ....Tk./month	☐☐☐☐☐ ☐☐☐☐☐
	33.6 Tax _____________ Tk./Year	☐☐
	33.7 Depreciation ______________ Tk./Year/	☐☐☐☐☐
	33.8 Unforeseen costs (bribe, toll, fee) donation ________Tk./Year	☐☐☐☐
	33.9 Loss Incurred by load shedding/power interruption? i) Average loss of hours per week .... hours ii) Loss in production: per hours (Tk)................ per month (Tk) .... iii) Loss due to deterioration quality: ....Tk/month iv) Loss due to restarting the equipment ....Tk/per month	☐☐ ☐☐☐☐☐☐ ☐☐☐☐☐☐ ☐☐☐☐☐
34.	Total volume of output sold last year__________mound/ton/unit (specify _________) Total volume of output processed last year________ mound/ton/unit	☐☐☐☐☐ ☐☐☐☐☐
35.	Value of total output last year (produced and processed) ---------------- Tk.	☐☐☐☐☐
36.	Working days and hours industry was open: i) Last year: # working days industry was open: ------------- days ii) Average hours/day industry was open: ---------------- hrs./days	☐☐☐ ☐☐
37.	Environmental degradation : i) Nature: <u>Yes</u> <u>No</u> Chemical - 1 2 Smoke - 1 2	☐ ☐
38.	Method of waste disposal: <u>Yes</u> <u>No</u> Air - 1 2 Water - 1 2 Land 1 2	☐ ☐ ☐
39.	In which season the factory needs maximum labor input Season: _______, # additional labor: ______hour/day_____	☐ ☐☐☐ ☐
40.	Industry electricity driven =1 (Skip to 46) Industry diesel not electricity driven = 2 Other = 4 (Skip to 46)	☐
41.	Are you willing to change your shift to take the advantage of lower rate (not the peak rate)? Yes = 1 No = 2	☐
42.	What do the labour do during load shedding? ____________________________	☐
43.	Do you let the machine run by diesel driven generator during load shedding? Yes = 1 No = 2	☐
44.	What is the cost differentiation : i) Machine run by diesel / generator .... Tk./hour ii) Machine run by electricity ....Tk./hour	☐☐☐ ☐☐☐
45.	Number of accidents (due to electricity or diesel machines) in last year # ___________	☐☐
46.	Loss incurred in the last year by destruction of machine and equipment due to accidents: _________________ Tk.	☐☐☐☐☐
47.	Did you expand your <u>unit</u> through sub-contracting arrangement? Yes = 1 No = 2 (Skip to 49)	☐ ☐
48.	What is produced under the sub-contracting arrangements, and who is producing? <u>Product</u> <u>Produced by (Name of the industry)</u> ____________________ _______________________	☐ ☐ ☐ ☐ ☐ ☐
49.	How many industries of the type same as yours were operating at the inception of (PBS) RE connection? ___________#	☐☐

50.	How many units were set-up within a year following the RE? No. Units...............	☐☐☐
51.	The number of unit of same type increased during i) .... 2nd year, ii)...................... 3rd year iii)...................... 4th year iv) .... 5th year	☐☐ ☐☐ ☐☐ ☐☐
52.	How many industries of the same types are operating now? .... Units	☐☐
53.	What was the type of fastest growing industry:	☐
54.	What is the average size of these industries? Cottage = 1 (run by family members), Small = 2 (run with maximum 10 workers) Medium = 3 (run by 11 to 49 workers), Large = 4 (run by 50 – and above)	☐ ☐
55.	What are the reasons behind growth of that type ?	☐☐☐
56.	Whether the centre enjoys good transport linkages with the district centre and other important towns and commercial areas? Distance from the industry to – (i) Nearest Pucca Road ------- Km, ii) Nearest Highway ----- Km, iii) Nearest Rail station------ Km iv) Nearest River port------ Km, v) Nearest Sea port ------ Km, vi) Nearest Airport ----- Km	☐☐☐☐ ☐☐ ☐☐☐☐ ☐☐
57.	Do you have easy access to credit institutions? Yes = 1 No = 2	☐
58.	Do you have outstanding loan? Yes = 1 No = 2	☐

THANK THE RESPONDENT
FOR INTERVIEW

Annex-B4

Commercial Unit Interview Schedule
(CUIS)

Economic and Social Impact Evaluation Study
of
Rural Electrification Program in Bangladesh

Questionnnaire for Commercial Unit
(Questionnaire 4)

Study undertaken for
NRECA International Ltd.
Partners with the REB and USAID for the Rural
Power for Poverty Reduction (RPPR) Program

Human Development Research Centre
Road # 8/A, House #59, Dhanmondi R/A, Dhaka –1209
Phone: 8116972, Fax: 880-2-8620229
email: hdrc@bangla.net

Dhaka, May 2002

Respondent Consent Form

Interviewer – read this before the actual interview. Interview should be conducted only after the informed consent of the interviewee. Interviewer read the following: We have come to you, as part of the process to conduct Economic and Social Impact Study of Rural Electrification Program in Bangladesh. We are conducting the study on behalf of REB under the auspices of NRECA (explain NRECA, USAID/TA). We are deployed by a Research Firm named Human Development Research Centre (Dhanmondi Rd. 8/A, House-59, Dhaka 1209).

This study has national significance, because it is based on your information that the impact of REP will be judged, critically. Thus, we would highly appreciate if you would kindly share with us the relevant information we are looking for in this study. All information provided by you will be confidential and shall not be used for any purpose other than this research study. Are you willing to participate in this survey?

Respondent willing 1, Respondent unwilling 2, (Go to next sample respondent)

After respondent agrees, proceed with the questionnaire interview (set convenient date and time, if additional time is required).

SAMPLE IDENTIFICATION

1. Name of the Respondent: ____

2. Sample CU No. _____________ 3. Converted CU No. ☐☐ ☐☐ ☐☐☐
PBS EL T CU

4. Electricity Status: Electrified 1 Non electrified 2

(Year electrified _______ , PBS ACC #
↓

5. Division: ______________ 6. District: ________________

7. Upazila:_______________ 8. Union/Ward:______________

9. Village/Mahalla/Para _________ 10. PBS ______________

[**PBS Code:** 01=Barisal PBS-2, 02=Bogra, 03=Brahmanbaria, 04=Chittagong PBS-2, 05=Comilla PBS-1, 06=Cox's Bazar, 07=Dhaka PBS-1, 08=Dinajpur PBS-1, 09=Faridpur, 10=Feni, 11=Gopalganj, 12=Jessore PBS-2, 13=Magura, 14=Meherpur, 15=Mymensingh PBS-1, 16=Naogaon, 17= Natore PBS-2, 18=Netrokona, 19=Nilphamari, 20=Norsingdi PBS-1, 21=Rajshahi, 22=Sirajgnj, 23=Sylhet PBS-1].

Division Code: 1= Dhaka, 2 = Chittagong, 3 = Rajshahi, 4 = Khulna, 5 = Barisal, 6 = Sylhet

District Code: 01 = Dhaka, 02 = Faridpur, 03 = Gopalgonj, 04 = Mymensigh, 05 = Norsingdi, 06 = Netrokina, 07 = Brahmanbaria, 08 = Chittagong, 09 = Comilla, 10 = Cox's Bazar, 11 = Feni, 12 = Bogra, 13 = Dinajpur, 14 = Naogaon, 15 = Natore, 16 = Nilphamari, 17 = Rajshahi, 18 = Sirajgonj, 19 = Jessore, 20 = Magura, 21 = Meherpur, 22 = Barisal, 23 = Sylhet

INTERVIEW INFORMATION

Interview call	1	2	3
Date			
Respondent: (Name)			
Result Code *			
Interviewer's Name (code)			

* Result Codes: Completed = 1, Deferred = 2, Refused = 3,
Vacant = 4, Other ___________ (specify) = 5

Name of Supervisor: _____________________________ , Date: ________________

Re interviewed or
spot checked by (name): __________________________ , Date: ________________

Coder's name: _________________________________ , Date: ________________

Editor's name: _________________________________ , Date: ________________

1. Both	**Interview: observe and write-down** Is there eelctricity in the area Yes = 1 No=2	☐
2. Both	Is the shop/institution attached to the marketplace or dettached? Attached =1 Detached =2	☐
3. Both	Type of Trade: Retail =1 Wholesale = 2 (skip to 4 3)	☐

4. Both	**Interview:** The code of this question is linked to question # 42 Type of retail store = Type of Code: Grossary = 1, Stationery = 2, Tea stall = 3, Farmecy = 4, Electric goods = 5, Confectionary = 6, Ready made Garments = 7, Bedding shop = 8, Seloon = 9, Furniture = 10 Crocary shop = 11, Jewellery shop = 12, Phone-Fax shop = 13, Battery charge shop = 14, Mobile charge shop = 15, Photo-Studio = 16, Variety store = 17, Others _______________Specify = 18			☐☐
5. Both	The owner = 1 / The Employee = 2 Name: __________________			
6. Both	In which year the shop was established? ------------------ year			☐☐☐☐
7. Both	**Interviewer**: The shop is electrified =1, . The shop is non-electrified=2 [Skip to10]			☐
8. El.	In which year this area got electricity connection? ------------- year			☐☐☐☐☐
9. El.	For how many years the shop is electrified? Since______________			☐☐
10. Both	Observe both in electrified and non-electrified shops the equipments that are being used and how those equipments are conntributiong to the business.			☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
	Euipments	Yes	No	
	Bulb	1	2	
	Tubelight	1	2	
	Ceiling fan/Table fan	1	2	
	TV	1	2	
	Radio	1	2	
	Casette Player	1	2	
	Fridge	1	2	
	Patromax	1	2	
	Hurricane Lantern	1	2	
	Indiginous lamp	1	2	
	Indiginous fan	1	2	
	Others _________________Specify	1	2	
	What are the possible impacts of these equipments on business? ____ ____ ____ ____ ____			☐ ☐ ☐ ☐ ☐
11. El.	**Interviewer:** Is there fridge in the shop=1, No fridge on the shop =2 [Skip to 17]			☐
Interviewer: Try to know from the owner of the shop that has got a fridge, whether the fridge and thereby electricity is contributing to his business and to what extent?				
12. El.	Why do you use fridge?	Yes	No	
	1. Commodities are kept	1	2	☐
	2. Commodities are better kept	1	2	☐
	3. Unsold goods remain unspoiled	1	2	☐
	4. The shop becomes attractive	1	2	☐
13. El.	What items do you stock in the fridge?			
	1. Soft drink	1	2	☐
	2. Ice creame/Chocolate	1	2	☐
	3. Milk/Yougurt	1	2	☐
	4. Sweets	1	2	☐
	5. Others _________ (Specify)	1	2	☐
14. El.	a. How much do you earn everyday from selling goods from the fridge? ÑÑÑ Amount (Tk.)			☐☐☐
	b. Do you have the fridge right from the beginning of the shop? Yes = 1 No = 2 [skip to 16]			☐
	c. How much you had been earning from selling those goods before there was fridge?			☐☐☐

15. El.	Were you selling those goods before electricity was there? Yes = 1 No = 2 [skip to 16] a. Is there any difference in sale between now and then? Yes = 1 No = 2 b. How much you were able to make in a week then and how much you are making now? Then ÑÑÑÑÑÑÑÑÑÑÑÑÑÑ (Tk.) Now ÑÑÑÑÑÑÑÑÑÑÑÑÑÑ (Tk.)	☐ ☐ ☐☐☐☐☐ ☐☐☐☐☐
16. El.	Are you selling anything from your shop, which is only possible because of electricity? Yes =1 No = 2 [skip to 18] ↓ What are those? ÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑ ÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑ	☐ ☐☐☐☐☐
17. El.	When there was no electricity in the area, was this shop in operation? Yes = 1No = 2 [skip to 18] a. Please narrate the business pattern of that time? The shop and the market were open for lesser times 1. Sale was lower 2. Fewer people were around 3. Less profit 4. Fewer customers 5. Other ÑÑÑÑÑÑÑÑÑÑ (specify)	☐ ☐ ☐ ☐ ☐ ☐ ☐
	b. 1. Monthly sale was then --------------- (Tk.) 2. Monthly sale is now ------------------ (Tk.) Others ------------------ (Specify)	☐☐☐☐☐☐ ☐☐☐☐☐☐ ☐☐☐☐☐☐
18. Both	What is the approximate value of your present stock. ____________________ (Tk.)	☐☐☐☐☐☐☐
19. Both	Who supplied capital for your shop? Supply code: Self = 1, Wife = 2, Family = 3 Others ------------ (Specify)	☐
20. Both	When do you usually open and close the shop? _____ Open, ______Close, ______Total openning hour	☐☐☐☐ ☐☐☐
21. El.	When there was no electricity what time you used to open up and closed down? _____ Open, ______Close, ______Total openning hour	☐☐ ☐☐ ☐☐☐
22. El.	How long the shop remains open after the sunset? Before electricity ____, Now ___,Total openning hour____	☐☐ ☐☐ ☐☐☐
23. El.	It seems, after the advent of electricity .... you are open more. How much you are making on an average daily = 1 weekly=2 Daily average sale ___________(Tk.) Weekly average sale ___________ (Tk.)	☐☐☐ ☐ ☐☐☐☐☐☐ ☐☐☐☐☐☐
24. El.	How much is your average monlthly bill for electricity? _____________ (Tk.)	☐☐☐☐
25. El.	Do you pay the bill regularly? Yes= 1 No = 2 Worth paying? How? 1 Extra sale absorb the electricity cost 2. More business is there as a result of electricity 3. Others ---------------- (specify) If no, why 1. Lower turnover 2. Low profit 3. Need to trave for paying the bill. 4. Others ______ (specify)	☐ ☐ ☐ ☐ ☐ ☐
26. N-el.	Had there been electricity, how much more you would have make? __________ (%)	☐☐☐
27. N-el.	Do you want electricity connection? Yes = 1 No = 2 [skip to 32]	☐
28. N-el.	What would be your benefit if there is electricity connection? 1. Lights can be switched on 2. Electric fan can be used 3. Fridge can be used 4. Sale will increase 5. More business hours 6. More customers 7. More profit 8. Others ------------ (specify)	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
29. N-el.	Do you have any idea how much you need to pay approximately for getting electricity connection? ----------------------- (Tk.)	☐☐☐

30. N-el.	Is it worth investing from the business point of new? Yes = 1 No = 2	☐
31. N-el.	If there is electricity in the area, would you take connection first at home, or in shop or simultaneously in both the places?	☐
32. Both	On an avarage, how many customers in a day visit your shop? ÑÑÑÑÑÑÑÑÑÑ (Person)	☐☐☐☐
33. Both	Are you open throughout the week? Yes = 1 No = 2	☐
34. Both	Do you yourself own shop or take help from the members of your family or there are hired employees? Self =1, Family assistance =2, Self and family assistance = 3, Self and employee = 4 No. of employees :------------, Female .... male	☐ ☐☐ ☐☐ ☐☐
35. Both	Do you watch TV, listen to Radio or Read in Newspapers? Watch TV: Yes = 1 No = 2 Listen to Radio: Yes = 1 No = 2 Read in Newspapers: Yes = 1 No = 2	☐ ☐ ☐

36\. Both

Businesswise do you gain anything from watching TV,
Listening to Radio or reading in Newspapers?

	TV		Radio		Newspaper		
	Yes	No	Yes	No	Yes	No	
1. Able to know about new goods	1	2	1	2	1	2	☐☐☐
2. Able to know new opportunities	1	2	1	2	1	2	☐☐☐
3. Ideas get clearer	1	2	1	2	1	2	☐☐☐
4. Exposure to ad.	1	2	1	2	1	2	☐☐☐
5. Others (specify)	1	2	1	2	1	2	☐☐☐☐

37. Both	Do you own a cellular phone? Yes = 1 No = 2	☐
38. Both	Do you have shop other than this? Yes = 1 No = 2	☐
39. Both	How much have you made from this shop? Last week ------------------- (Tk.) Last year -------------------- (Tk.)	☐☐☐☐☐☐ ☐☐☐☐☐☐
40. Both	How much do you spend in a month on the followings? 1. Rent for shop --------------- (Tk.) 2. Salary for employee --------------- (Tk.) 3. Electric /fuel --------------- (Tk.) 4. Tax, gratitude --------------- (Tk.) 5. Transport -------------- (Tk.) 6. Entertainment --------------- (Tk.) 7. Others --------------- (Tk.)	 ☐☐☐☐☐☐☐ ☐☐☐☐☐☐☐ ☐☐☐☐☐☐☐ ☐☐☐☐☐☐☐ ☐☐☐☐☐☐☐ ☐☐☐☐☐☐☐ ☐☐☐☐☐☐☐
41. Both	Do you take any step to promote your shop? Entertainment =1 Papers are available =2 TV / Radio / Player =3 Credit facility = 4 Get-together =5 Others ____________ = 6 (specify)	☐ ☐ ☐ ☐ ☐
42. Both	Please observe and list the items that are stocked in Grocery store, Stationery store, Restaurant, Pharmacy and shop of electrical goods. In case of non-electrified areas, please observe and list barber-shop instead of shop of electrical goods.	

Schedule for Wholesale Store

43. Both	**Commudity Code:** Grocery =01, Stationery = 02, Pharmacy = 03, Cloths =04, Ciment/Rod= 05, Fruits= 06, Books/Papers= 07, Wood= 08, Tools = 09, Others _______________ (specify)	☐☐ ☐☐ ☐☐ ☐☐ ☐☐
44. Both	Whether the area is electrified or not? (Observe and write down) Yes = 1 No = 2	☐
45. Both	When was the shop established? _________________________	☐☐☐☐

46. Both	Is the shop electrified? Yes = 1 No =	☐
47. El.	In which year this area got electricity connection? ----------------- year	☐☐☐☐
48. El.	For how many years the shop is electrified? Since______________	☐☐
49. Both	Oberve both in electrified and non-electrified shops the equipments that are being used and how those equipments are conntributiong to the business.	
	Euipments — Yes — No Bulb 1 2 Tubelight 1 2 Ceiling fan/Table fan 1 2 TV 1 2 Radio 1 2 Casette Player 1 2 Fridge 1 2 Patromax 1 2 Hurricane Lantern 1 2 Indiginous lamp 1 2 Indiginous fan 1 2 Others _________________ (Specify) 1 2	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
50. Both	When do you usually open and close the shop? Open, Close, Total openning hour	☐☐ ☐☐ ☐☐☐
51. El.	When there was no electricity what time you used to open up and closed down? _____ Open, ______Close, ______Total opening hour	☐☐ ☐☐ ☐☐☐
52. El.	How long the shop remains open after the sunset? Before electricity ____, Now ___,Total openning hour____	☐☐ ☐☐ ☐☐☐
53. El.	It seems, after the advent of electricity .... you are open more. How much you are making on an average Daily = 1 Weekly=2 Daily average sale ___________(Tk.) Weekly average sale ___________ (Tk.)	☐☐☐ ☐ ☐☐☐☐☐ ☐☐☐☐☐☐
54. El.	How much is your average monlthly bill for electricity? _____________ (Tk.)	☐☐☐☐
55. El.	Do you pay the bill regularly? Yes= 1 No = 2 ↓ Worth paying ↓ If no, why 1. Extras lase absorv the electricity act 2. More business is there ass a result of electricity 3. Others ---------------- (specify) 1. Lower turnover 2. Low profit 3. Need to trave for paying the bill. 4. Others ----------(specify)	☐ ☐ ☐ ☐ ☐ ☐
56. El.	Are you selling anything from your shop, which is only possible because of electricity? Yes =1 No = 2 [skip to 18] ↓ What are those? ÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑ ÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑ ÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑÑ	☐ ☐ ☐ ☐
57. Both	What is the approximate value of your present stock ---------------- (Tk.)	☐☐☐☐☐☐☐
58. Both	Who supplied capital for your shop? Supply code: Self = 1, Wife = 2, Family = 3 Others ------------ (Specify)	☐
59. Both	Do you have shop other than this? Yes = 1 No = 2	☐
60. Both	How much have you made from this shop? Last week ------------------- (Tk.) Lasy year -------------------- (Tk.)	☐☐☐☐☐☐ ☐☐☐☐☐☐
61. Both	How much do you spend in a month on the followings? 1. Rent of shop --------------- (Tk.) 2. Salary for employee --------------- (Tk.) 3. Electric/fuel --------------- (Tk.) 4. Tax, gratitude --------------- (Tk.) 5. Transport --------------- (Tk.) 6. Entertainment --------------- (Tk.) 7. Others --------------- (Tk.)	☐☐☐☐☐ ☐☐☐☐☐ ☐☐☐☐☐ ☐☐☐☐☐ ☐☐☐☐☐ ☐☐☐☐☐ ☐☐☐☐☐

62. N-el.	Had there been electricity, how much more you would have make? __________ (%)	☐☐☐
63. N-el.	Do you want electricity connection? Yes = 1 No = 2 [skip to 32]	☐
64. N-el.	What would be your benefit if there is electricity connection? 1. Lights can be switched on 2. Electric fan can be used 3. Fridge can be used 4. Sale will encrease 5. More business hours 6. More customers 9. More profit 10. Others ------------ (specify)	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
65. N-el.	Do you have any idea how much you need to pay approximately for getting electricity connection? ----------------------- (Tk.)	☐☐☐
66. N-el.	Is it worth investing from the business point of new? Yes = 1 No = 2	☐
67. N-el.	If there is electricity in the area, would you take connection first at home, or in shop or simultaneously in both the places?	☐
68. Both	Do you take any step to promote your shop? Entertainment =1 Papers are available =2 TV / Radio / Player =3 Credit facility = 4 Get-together =5 Others ___________ (specify) = 6	☐ ☐ ☐ ☐ ☐

THANK THE RESPONDENT
FOR INTERVIEW

Annex-B5

Focus Group Discussion (FGD) Guideline for Household

B5.1. Household With Electricity (Male)

1. Opinion about the impact of electricity connection on the price of land.
2. Opinion about the relationship between the establishment of poultry/dairy farm and electricity connection.
3. Occupations of the villagers and impact of electrification on the wage structure. Opinion about the relationship between electrification and the opportunity of new sources of income.
4. Opinion about the relationship between migration and electrification. The increasing or decreasing trend of migration, period i.e. (seasonal or permanent) and causes of migration
5. Opinion about the use pattern of NGO or government loan with the facility of electricity connection.
6. Villagers' awareness of main diseases such as diahorrea, TB, AIDS, etc. Description of medical facilities that are available to the villagers. Opinion about the impact of Radio/ TV on raising awareness about various issues such as health and sanitation, family planning.
7. Opinion about the contribution of rural electrification program in alleviating poverty, and improving the socio-economic situation of the village.
8. Description of the perception of males about physical and mental violence against women, women's participation in household decision –making. Impact of radio/ TV on such issues.

B5.2. Household With Electricity (Female)

1. Women's awareness of various fundamental rights. Women's opinion about family planning, dowry and the age of marriage of boys and girls. Impact of Radio/ TV on the changing socio-economic situation of women.
2. Description of various types of violence against women such as physical and mental torture, violence due to unpaid dowry and women and child trafficking. Opinion about justice for women in the village shalish.
3. Opinion about women's choice of spending savings and participation in household decision-making.
4. Opinion about the opportunity to work outside the household and the wage structure. Opinion about the impact of electrification on the workload in the household.
5. Opinion about women's participation in the Pally Bidhut Samity (PBS), women's opportunity to exercise voting rights independently. Opinion about the impact of Radio/ TV on such issues.
6. Opinion about the opportunity to visit nearby bazaar, shops and neighbor's house.
7. Women's awareness of main diseases such as diahorrea, TB, AIDS, reproductive diseases etc. Description of medical facilities that are available to women. Opinion about male-female discrimination in the household in terms of medical facilities. Opinion about the impact of Radio/ TV on raising awareness about various issues such as health and sanitation, family planning.
8. Opinion about women's awareness of women and child trafficking, acid throwing etc. Women's attitude towards equality in job, wage, inheritance, voting rights etc.

B5.3. Household Without Electricity (Male)

1. Opinion about the price of land without electricity connection in the village.
2. Opinion about the problems in establishing poultry/dairy farm and without electricity.
3. Occupations of the villagers. Opinion about the opportunity of new sources of income without electricity.
4. Opinion about the increasing or decreasing trend of migration, period i.e. (seasonal or permanent) and causes of migration. Opinion about whether migration has increased due to the lack of electricity connection.
5. Opinion about health issues, birth control and family planning etc.
6. Opinion about the causes of not having electricity connection in household. Opinion about whether the main cause of not having electricity is poverty.
7. Description of the perception of males about physical and mental violence against women, women's participation in household decision –making.

B5.4. Household Without Electricity (Female)

1. Women's awareness of various fundamental rights. Women's opinion about family planning, dowry and the age of marriage of boys and girls.
2. Description of various types of violence against women such as physical and mental torture, violence due to unpaid dowry and women and child trafficking. Opinion about justice for women in the village shalish.
3. Opinion about women's choice of spending savings and participation in household decision-making.
4. Opinion about the opportunity to work outside the household and the wage structure. Opinion about whether the workload in the household has increased due to not having electricity.
5. Opinion about the opportunity to visit near-by bazaar, shops and neighbor's house.
6. Opinion about the women's awareness of health and sanitation. Opinion about the impact of Radio/ TV on raising awareness about various issues such as health and sanitation, family planning etc.
7. Opinion about women's awareness of women and child trafficking, acid throwing, voting rights, right to property inheritance etc.

Annex-B6

Focus Group Discussion (FGD) Guidelines for Irrigation Equipment and Agriculture

Utility of Electricity in Agriculture: Perceptions and Experiences

- Perception about the role of electricity in agricultural production
- Experiences of people (Positive and Negative)

Possible areas related to agriculture where electricity can be used

- Irrigation, harvesting, threshing, drying, winnowing, and any other areas where electricity can be used (possible uses, future directions, etc.)
- Problems in terms of use of electricity in any kind of agri related activities
- Benefit of electricity use (direct, indirect)

Electricity driven Irrigation and Non-electerified irrigation

- Possible advantages of electricity and non-electricity driven irrigation equipment use
- Possible disadvantages of electricity and non-electricity driven irrigation equipment use

Irrigation Equipment Owners' Satisfaction

- Satisfaction with the performance of irrigation equipment
- Satisfaction with the availability of energy supply
- Satisfaction over interactions with the energy supplying agencies/ organizations

Pest Management and Electricity

- Relationship with irrigation and fertilizer and pesticide use
- Farmers awareness of the use of pest management
- Electricity and pest management

Threashing-winnowing and Electricity

- Direct and indirect uses
- Positive/negative effects

Environmental Issues

- Environment pollution and use of electrified/diesel irrigation pump
- Types of environment pollution (water, air, sound, forest resources, health hazards etc.) and relationship with electrified/diesel irrigation pump

- Perception about differences in the use of fertilizer, pesticide or herebicide etc. between electrified and non-electrified irrigation areas.

- Perception about any negative impacts of the use of such fertilizers and pesticides on soil/water/air/forest resources in electric/diesel driven irrigated areas.

Productivity Cost

- Productivity of different crops with electrified and diesel driven irrigation and perceived reasons.

- Cost of various inputs per acre of cultivated land with electrified/non-electrified irrigation and perceived reasons.

- Cost of various inputs per acre of cultivated land with no irrigation

(Inputs include seed bed preparation, labor, saving/ sawing/transplanting, weeding, harvesting, threshing etc.)

Employment

- Nature of employment in agriculture with electrified/non-electrified irrigation pump

- Agricultural labors and job opportunity in connection with electrified irrigation/ non-electrified irrigation

- Increase and decrease of farmers/labors' workload due to electrified irrigation/non-ledctrified irrigation.

- Nature of employment in agriculture with no irrigation.

Maintenance Cost

- Average cost of maintenance of electrified irrigation pump

- Average cost of maintenance of non-electrified irrigation pump

- Cost of lubricant, changes of filters and parts

- The breakdown of irrigation equipment and their cost per year, duration of repairing, losses due to frequently repairing, etc.

Annex-B7

B7.1. Focus Group Discussion (FGD) Guidelines for Industrial Units: Electrified Industries

1. Name of the participants at the FGD, age, type of industries they own (what type of goods they produce, since when and size of their industries).

2. Growth of industry along with the connection of electricity; type of the growth of industries (agro-processing industries, textile etc.) cause and extend of growth of new industries which did not exist earlier.

3. Changes take place in type, number, labour (employment generation) production, and wages due to electricity.

4. Expansion/increase/development of services like repairing workshop, laundry, telephone, computer centre, technical training centre, resulted from the growth of industries.

5. Expansion of health facilities (Hospital, Clinic, MBBS Doctor) educational institution, (school/college) institution for entertainment such as cinema following the growth of industries: your opinion.

6. Usually, with growth of industrial infrastructure, the area (Thana, Union Council) turns into an attractive centre connecting the district and commercial centres: Your opinion on this issue.

7. Expansion of industries and associated services contain migration from the locality to the large cities: your opinion.

8. As it has been told by many that rural electrification has inspired people to invest in industries: your opinion.

9. Development of different inter-dependent industries, auxiliary industries and supporting services create an industrial cluster. Do you think that such cluster has been created in this area (Thana, Union, Wards).

10. There has been a relation between industrial development and environment in which the latter is affected by the industrial wastage: your opinion in this regard.

11. Your opinion and suggestions in various issues regarding electricity (these issues are for example: load-shedding, up-down of voltage, repairing of electricity line in quickest possible time in case of non-functioning of electricity line, rate, etc).

12. Your opinion and suggestions regarding paying non-paying of high rate in case qualitative increase in supply (increase in quality).

13. Your opinion about the role of electricity in future industrialization (what role can RE Play).

B7.2. Focus Group Discussion FGD Guidelines for Industrial Units: Non-electrified Industries

1. Name of the participants at the FGD, age, type of industries they own (what type of goods they produce, since when and size of their industries).

2. Growth of industries along with the connection of electricity; type of the growth of industries/agro-processing industries, textile etc). Cause and extent of growth of new industries which did not exist earlier.

3. There has been cost differentiation in production between electrified and non-electrified industries: your opinion in this regard.

4. Your view about the advantages of non-electrified/diesel-driven industries.

5. Please say something about the advantages of electrified industries.

6. If there are available supply of electricity, your intention about taking or non-taking of electricity connection.

7. It is said that the people have become more enthusiastic about investing in industries: your view in this regard.

8. Do you think that with the beginning of the supply of electricity no body intends anymore to invest in industrial venture: your opinion.

9. Non-electrified industries cause more environmental damage than electrified: your opinion.

10. Your opinion about the role of Rural Electrification in future industrialization.

Annex: B8

Focus Group Discussion (FGD) Guideline for Commercial Units

1. How was business before there was electricity ....
2. Has business picked up or gone down after electricity ....
3. Which trades has gained more from electricity ....
4. Exactly how businesses has gained from electricity ……………….
5. What is the percentage increase in the volume of business after the advent of business ......
6. What are the electrical gadgets that shop-woners are using..........
7. How those gadgets are contributing to their business.
8. Is there any trade or business which is solely dependent on electricity. ....
9. What is the nature and extent of those businesses. ....
10. What are the problems that shop-owners face when there is load-shedding. ....
11. How do they face those problem of load-shedding. ....
12. Are shop-owners happy with the state of their business or do they want to proser more. How is that possible. ....
13. Is business spread throughout the day or is concentrated in part(s) of the day. ....
14. Is there any business, which is not being possible as there is no electricity in the area.........

Annex: B9

Issues of Group Discussion
with
Members of Board of Directors, General Managers and other officials of PBS

Issues for discussion

(a) Capacity building in rural areas

- Skill development
- Institutional development
- Networking
- Resource mobilization
- Systems to check corruption

(b) Governance

- Participation of beneficiaries
- Decentralization of responsibilities
- Decentralization of power and participation in decision making
- Equal rights
- Local level decision making
- Transparency and accountability (as pillars of empowerment for local governance) (decision making, implementation, financial etc.)
- Women's participation

(c) Sustainability

- Organizational sustainability
- Management sustainability
- Financial Sustainability
- Cultural friendly approach

Annex: B10

Secondary Data Compilation Format

PBS (Name) ____________________

(Code) ______________

A. Organizational and Technical Status

1. Date of Registration ____________________
2. Geographical area (Sq. Km.) ____________________
3. Total population ____________________
4. No. of Thanas in the Service area ____________________
5. No. of Unions in the Service area ____________________
6. No. of Villages in the Service area ____________________
7. No. of Municipalities in the Service area ____________________
8. No. of Sub-stations in the Service area ____________________
9. Length of distribution line needed to cover the service area(Km) ____________________

10. Electrification Status

Electrification Status	**1998**	**1999**	**2000**	**2001**	**As on 30 April 2002**
Number of Unions					
Number of Villages					
Length of targeted distribution line (Km)					
Length of energized distribution line (Km)					

11. Financial Status

Investment (in Tk.)					
Percent of system loss					
Revenue (in Tk.)					
Percent collection					

B. Customer Status

1. **Connection Status**

Category	Connection facilities created					No. of customers connected					% of staked connection					No of customers billed				
	1998	1999	2000	2001	As on 30 April '02	1998	1999	2000	2001	As on 30 April '02	1998	1999	2000	2001	As on 30 April '02	1998	1999	2000	2001	As on 30 April '02
Domestic																				
Commercial																				
Irrigation																				
Industrial																				
Charitable organizations																				
Street Lights																				

2. No. of applicants not yet connected (upto 30 April 2002) ____________________

3. No. of customers paid membership fees before connection ____________________

4. No. of complaint centres ____________________

5. Type of complaints ________________

____

____

6. Complaints and their resolutions

Complaints and resolution	**1998**	**1999**	**2000**	**2001**	**As on 30 April 2002**
Number of complaints					
Number of complaints resolved					

C. Employment Status

1. PBS Staff

Employment	**1998**	**1999**	**2000**	**2001**	**As on 30 April 2002**
No. of officials i) Male					
ii) Female					

2. Board of Directors (by occupation) (use separate sheet)

3. Number of Female Advisor(s) ____________________

4. Number of Village Advisor(s) ____________________

5. Number of Village Electricians ____________________

6. Number of Meter Readers ____________________

7. Number of Billing Assistants ____________________

Annex: B11

Secondary Data Collection Format

(Village Level)

PBS: ____________________, Upazila ______________________
Union: ___________________, VILLAGE______________________
Electrified 1 **Non-electrified** 2

		1998	1999	2000	2001	As on 30 April 2002
A.	Population Size (in '000)					
1.	- Male					
2.	- Female					
B.	Administration Units					
1.	Size (Sq. Km)					
2.	No. of Households					
C	Social and Commercial Infrastructure					
1.	Schools					
2.	Colleges					
3.	Night schools					
4.	NGOs					
5.	Cooperative Societies					
6.	Bank/Credit institutions					
7.	Hat(s)					
8.	Bazar(s)					
9.	Shops (with electricity)					
10.	Shops selling electrical equipment					
11.	Places of worship					
	i) Mosques					
	ii) Temples					
	iii) Churches					
	iv) Pagodas					
D.	Transportation and Communication					
1.	Road (in Km)					
	i) Pucca					
	ii) Semi-pucca					
	iii) Kacha					
2.	Bridges					
3.	Culverts					
4.	Distance from growth center (Commercial Centers, Industrial Centers, Upazila Health Complex, etc.)					
	i) Distance from Commercial Center (in Km.)					
	ii) Distance from Industrial Center (in Km.)					
	iii) Distance from Upazila Health Complex (in Km.)					
E	Employment Status					
1.	No. of persons employed in NGOs					
	i) Male					
	ii) Female					
2.	No. of Medical personnel					
	i) Doctors					
	ii) Paramedics					
	iii) Mid-wives					
3.	No. of Teachers					
	i) Primary level					
	ii) Secondary level					
	iii) Higher Secondary level					
	iv) Tertiary level					

		1998	1999	2000	2001	As on 30 April 2002
4.	Number of graduates					
	i) Bachelor degree holder(s)					
	ii) Masters degree holder(s)					
5.	Number of Electricians (PBS)					
6.	Number of local people employed in PBS (PBS)					
	i) Male					
	ii) Female					
F.	Industrial Unit					
1.	No. of Industries					
	i) Cottage (home based, household labor)					
	ii) Small (no. of workers: 1-9)					
	iii) Medium (no. of workers: 10-49)					
G.	Irrigation Unit					
1.	No. of irrigation equipments					
	i) Electricity driven					
	ii) Diesel – driven					
H.	Assets					
1.	No. of TVs					
2.	No of power tillers					
3.	No. of motor cycles					
4.	Agricultural land					
	i) Cultivated Land					
	ii) Crops (name)					
	iii) Area irrigated (% total)					
I.	Essay on changes during last 5 years (main features) (those related to electricity and or road infrastructure)					

Sources of Information: *Local elites, school teachers, Union council, UNO, Block Supervisor, Upazila Statistical Office, Upazila Education office, PBS etc.*

Annex: B12

Secondary Data Collection Format

(Union Level)

PBS: ____________________, Upazila ______________________

Union: __________________

		1998	1999	2000	2001	As on 30 April 2002
A.	**Population Size (in ‘000)**					
3.	- Male					
4.	- Female					
B.	**Administration Units**					
1.	Size (Sq. Km)					
2.	No. of Villages					
C	**Social and Commercial Infrastructure**					
1.	Schools					
2.	Colleges					
3.	Night schools					
4.	Hospitals					
5.	Health and Family Welfare Centers					
6.	NGOs					
7.	Cooperative Societies					
8.	Bank/Credit institutions					
9.	Hat(s)					
10.	Bazar(s)					
11.	Shops (with electricity)					
12.	Shops selling electrical equipment					
D.	**Transportation and Communication**					
1.	Road (in Km)					
	i) Pucca					
	ii) Semi-pucca					
	iii) Kacha					
2.	Street lights					
3.	Bridges					
4.	Culverts					
E	**Employment Status**					
1.	Number of Electricians *(PBS)*					
2.	Number of local people employed in PBS *(PBS)*					
	i) Male					
	ii) Female					
F.	**Industrial Unit**					
1.	No. of Industries					
	i) Cottage (home based, household labor)					
	ii) Small (no. of workers: 1-9)					
	iii) Medium (no. of workers: 10-49)					
	iv) Large (no. of workers: 50+)					
G.	**Essay on changes during last 5 years (main features) (those related to electricity and or road infrastructure)**					

Sources of Information: Union Councils, (Chairman, Member) UNO, Agriculture Block Supervisor, Family Planning Inspector, Upazilla level relevant officials etc.

Annex: B13

Secondary Data Collection Format

(Upazila Level)

PBS: ____________________, Upazila _______________________

		1998	1999	2000	2001	As on 30 April 2002
A.	**Population Size (in '000)**					
5.	- Male					
6.	- Female					
B.	**Administration Units**					
1.	Size (Sq. Km)					
2.	No. of Villages					
3.	No. of Unions					
C	**Social and Commercial Infrastructure**					
1.	Schools					
2.	Colleges					
3.	Night schools					
4.	Hospitals					
5.	Health and Family Welfare Centers					
6.	NGOs					
7.	Cooperative Societies					
8.	Bank/Credit institutions					
9.	Hat(s)					
10.	Bazar(s)					
E	**Employment Status**					
1.	No. of Teachers					
	i) Primary level					
	ii) Secondary level					
	iii) Higher Secondary level					
	iv) Tertiary level					
2.	Number of graduates					
	i) Bachelor degree holder(s)					
	ii) Masters degree holder(s)					
3.	Number of Electricians *(PBS)*					
F.	**Industrial Unit**					
1.	No. of Industries					
	i) Cottage (home based, household lebor)					
	ii) Small (no. of workers : 1-9)					
	iii) Medium (no. of workers : 10-49)					
	iv) Large (no. of workers : 50+)					

Source of information: *Upazilla level officials, PBS etc.*

Annex: B14

SDCF for Industries Connected by PBSs (67)

PBS: _______________

(Name of PBS)

(As on May 2002)

Total number of Industries =
of which

A. By Large Power (LP) and General Power(GP)
Number of LP Connection =
Number of GP Connection =

B. By size category:

Cottage =
(manual labour within family, own premise)

Small Industry =
(with upto 9 worker)

Medium Industry =
(with 10-49 workers)

Large Industry =
(with 50+ workers)

C. By type of industry (Census of Manufacturing Industries Code)

Industry Code	Major industry group	**Small**		**Medium**		**Large**		**Total**	
		# in-dus-tries	**# emplo-yees**	**# in-dus-tries**	**# emplo-yees**	**# in-dus-tries**	**# emplo-yees**	**# in-dus-tries**	**# emplo-yees**
311-312	**Food Manufacturing industries:**								
3112	Dairy products								
3113	Fruits and vegetables								
3114	Fish and sea foods								
3115	Hydrogenated veg.oils								
3116	Edible oils								
3117	Inedibile veg. Oils								
3118	Grain milling								
3119	Rice milling								
3121	Grain mill products								
3122	Bakery products								
3123	Sugar factories								
3124	Manufacture of gur								
3125	Confectioneries								
3126	Tea, coffee products								
3127	Tea and coffee blending								
3128	Edible salt								
3129	Misc. Food products								

Industry Code	Major industry group	Small		Medium		Large		Total	
		# in-dus-tries	**# emplo-yees**	**# in-dus-tries**	**# emplo-yees**	**# in-dus-tries**	**# emplo-yees**	**# in-dus-tries**	**# emplo-yees**
313	**Beverage industries:**								
3131	Dist. Rectified spirits								
3134	Soft drink manufacturing								
314	**Tobacco manufacturing:**								
3141	Cigarettes manufacturing								
3142	Chroots manufacturing								
3143	Bidies manufacturing								
3144	Tobacco stemm, redrying								
3145	Zarda and quivam								
3149	Tobacco manufac								
315	**Animal feeds/by-products:**								
3151	Prepared animal feeds								
3152	Bone crushing								
321-322	**Textile:**								
3211	Cotton textiles								
3212	Woolen textile								
3213	Jute textiles								
3214	Silk, synthetic textiles								
3215	Narrow fabrics								
3216	Handloom textiles								
3217	Dyeing, bleching textiles								
3222	Made up textile goods								
3223	Knitting mills								
3224	Carpets and rugs								
3225	Cordage, rope and twine								
3226	Spooling and thread ball								
3229	Textile manufacturing								
323	**Wearing apparels including readymade garments (except footwear):**								
3231	Readymade germants								
324	**Leather and its, products:**								
3241	Tanning and finishing								
3242	Fur dressing and dyeing								
3243	Leather products								
325	**Footwear:**								
3251	Leather footwear								
326	**Jute pressing and bailling:**								
3261	Ginning, baling of cotton								
3263	Jute pressing and baling								
327	**Embro of textile goods:**								
3271	Embroidery of textile								
331	**Wood and wood products:**								
3311	Saw and plannning mills								
3312	Plywood and its products								
3313	Wooden structural products								
3314	Hardboard and is products								
3315	Struct. Products of bamboo								
3316	Cork and its products								
3318	Bamboo and can products								
3319	Wood and cork products								
332	**Wooden furniture:**								
3321	Wooden furniture mfg.								

Industry Code	Major industry group	Small		Medium		Large		Total	
		# industries	**# employees**	**# industries**	**# employees**	**# industries**	**# employees**	**# industries**	**# employees**
3323	Cane and bamboo furniture								
341	**Paper and paper products:**								
3411	Pulp and paper mfg.								
3412	Paper board manufacturing								
3413	Articles of pulp, paper								
342	**Printing and publishing:**								
3421	Printing of newspaper								
3422	Printing of book map etc.								
3423	Priniting, publishing books								
3424	Cards and stationery								
3425	Book binding, other arts								
3429	Photo typesetting								
351	**Drugs and pharmaceutical:**								
3511	Allopatich and medicines								
3512	Unani medicines								
3513	Ayure-vedic medicines								
3514	Homeopathic, biochemical								
352	**Chemical industries:**								
3521	Acids, alkalites and salts								
3522	Dyes, colours and pigments								
3523	Compressed liquified gas								
3524	Fertilizer manufacturing								
3525	Pesticides, insecticides								
3526	Resins, plastic materials								
3529	Industrial chemicals								
353	**Other chemical industries:**								
3531	Paints and varnishes								
3532	Perfumes and cosmetics								
3533	Soap and detergents								
3535	Matches manufacturing								
3536	Ink (all kinds) – mfg.								
3537	Candle manufacturing								
3539	Chemical products								
354-355	**Petroleum refineries and products:**								
354	Petroleum refining								
355	Misc, petroleum products								
356	**Rubber products:**								
3561	Mfg. Of tyres and tubes								
3562	Rebuilding of tyres, tubes								
3569	Mfg. Of rubber products								
357	**Plastic products:**								
3571	Mfg. Of plastic footwear								
3572	Polythene products mfg.								
3579	Misc. Plastic products								
361	**Pottery and chinaware:**								
3611	Mfg. Of earthenwares								
3612	China, ceramic products								
3619	Pottery, china, earthenware								
362	**Glass products:**								
3621	Glass manufacturing								
3622	Glass products mfg.								

Industry Code	Major industry group	Small		Medium		Large		Total	
		# industries	# employees	# industries	# employees	# industries	# employees	# industries	# employees
369	**Non-metallic products:**								
3691	Bricks, tiles, clay products								
3692	Cement manufacturing								
3693	Cement products mfg.								
3694	Lime, plaster, their prod.								
3695	Referactories mfg.								
3699	Non-metalic nineral								
371	**Iron and steel:**								
3711	Iron and steel mills								
3712	Iron and steel foundries								
3713	Iron ans steel re-roling								
3719	Iron and steel sndustries								
372	**Non-ferrous metal industries:**								
3722	Basi c copper, copper alloy								
381-382	**Fabricated metal products:**								
3811	Culturies manufacturing								
3812	Hand and edge tools mfg.								
3813	Razors and blades mfg.								
3814	Furniture and fixtures								
3815	Structural metal products								
3816	Metal stamping etc.								
3817	Heating, cooking equipment								
3818	Wire products mfg.								
3819	Utensils mfg. – alluminium								
3821	Utensils – copper/brass								
3822	Utensils – steel								
3823	Metal barrels ans drums								
3824	Tin cans and tinware								
3825	Metal trunks mfg.								
3826	Bolts, nuts and rivets								
3827	Plumbing eqipments								
3829	Fabricated metal products								
383	**Machinery except electrical:**								
3831	Engines, turbines prod.								
3832	Agri. Machinery equipment								
3833	Metal, wood work machinery								
3834	Textile machinery								
3835	Industrial machinery								
3837	Mfg. Of sewing machinery								
3839	Machinery and equipment								
384	**Electrical machinery:**								
3841	Elec. Ind. Machniery app.								
3842	Radio and television								
3843	Electrical appliances								
3844	Inslated wire and cables								
3845	Electric bulbs and tubes								
3846	Batteries manufacturing								
3847	Electronic components								
3849	Electrical apparatus								
385	**Transport equipment:**								
3851	Ship building, repairing								

Industry Code	Major industry group	Small		Medium		Large		Total	
		# in-dus-tries	**# emplo-yees**	**# in-dus-tries**	**# emplo-yees**	**# in-dus-tries**	**# emplo-yees**	**# in-dus-tries**	**# emplo-yees**
3852	Boat building, repairing								
3853	Railroad equipment mfg.								
3854	Motor vehicles production								
3856	Cycles and padicabs mfg.								
3857	Ship breaking, disvantling								
3858	Animal, hard drawn carts								
386	**Measuring instruments/SCINTIFIC, PRESISION ETC.:**								
3861	Mfg. Of dental instruments								
3863	Weights and scales mfg.								
387	**Photographic and optical goods:**								
3871	Photocopying equipment								
3872	Prod. Of optical goods								
389	**Mfg. Of sports goods:**								
3893	Sports goods manufacture								
391	**Decorative handicrafts:**								
3911	Wood, bamboo handicrafts								
3912	Paper product handicraft								
3914	Ceramic, glass and china								
3915	Metal decor. Handicrafts								
393-394	**Other manufacturing industries:**								
3931	Jewellery, precious metals								
3933	Mucisal instruments prod.								
3935	Toys, non-power driven								
3936	Manufacture of pencils								
3937	Mfg. Od pen, ball pen								
3938	Umbrella, walking sticks								
3939	Button, studs, hooks mfg.								
3941	Signs and advertisment								
3943	Bangles (except precious)								
3944	Other mfg. (brooms/brushes)								

Annex: B15

Guidelines for Household Interview Schedule

Annex B15-A: Household Schedule (ESIES/REP)

Guideline: Calculation Procedure for Column no. 9 of Question no. 401 (%Net income attributable to electricity)
Please write the calculation behind the questionarrre (as has been said during training)

01. **Agricultural crop**:

Example 1: Suppose 300 decimals of land of the household is being cultivated under electrical irrigation. Before the arrival of electricity 250 decimal of land was cultivated, i.e., 300-250=50 decimals of land was not cultivated earlier.

Now, the question is that, What percentage of land is attributable to electricity ?
Answer:
Procedure 1: Previously the amount of crop was 114 mounds, and now it is 198 mounds. It means that, the amount of currently produced crop in comparison to the previous one is 42.4% higher.

198-114
42.4% [--------------X 100%]
198

So, we can write 42.45 in column no.9.
Procedure 2: Previously the number of crop was 2, and now it is 3.
In comparison to the previous one the amount of land cultivated is 33.3% higher.

3-2
33.3% [--------------X 100]
3

So, we can write 33.35 in column no. 9.

Example 2: When the amount of total land cultivated is the same 300 decimal, you can use the abovementioned procedure.
(You can think of devising other procedure)

02. **Wage, Labour and Agriculture:**

Example: Suppose someone reports that, his previous income was Taka 5,000, and now it is Taka 12,500.
Question: What percentage of the income is due to electricity?
Answer 1: Ask whether there has been any change in annual working days due to electrically operated irrigation facility? Suppose the answer is, in the previous year there was 100 days work, now due to electrically operated irrigation facility it is 182 days.

Calculation procedure: In comparison to previous situation working time has increased by

182-100
45.2% [--------------X 100]
182

So, we can write 45.2% in column no. 9.
(You can use other procedure, as- percentage increase in income.

05. **Poultry:**

Example: Suppose used to rear 10 hens regularly, and now with the help of electricity (bulb, vaccine in the market etc.) rear 50 hens regularly.
Question: What percentage of net income is due to electricity?

50-10
Answer: 80% [--------------X 100]
50

09.	**Fish Cultivation:**
	Example: Suppose there was fish cultivation even earlier, but some of the fishes were stolen that time, or did not cultivate fish due to fear of stealing. But now, due to the facility of electricity it is not being stolen. What percentage of former net income was stolen earlier. You can set the percentage of column no. 9 with that. Or, the answer may be the incremental amount of current income as a percentage of former income, which may also be put in column no. 9.
10.	**Sale of water for irrigation:**
	Example: If the irrigation equipment for sale of water is runned by electricity, in that case 100% of the net income is due to electricity. So, you should write '100' in column no.9. Or, comparing with diesl the additional portion can be written in column no. 9. In this case, you can discuss with the peoples who has done 'irrigation schedule'.
11.	**Business/Shop:**
	Example: Suppose the annual net income (column 5) is 20,000 Taka. **Question:** What proportion of it is due to electricity? **Calculation Procedure**: Ask the followings, 1. In comparison to earlier the shops are open after evening for how many hours? Suppose previously it closed at 7 P.M. and closes at 10 P.M. The easiest percentage will be 10-7 30% [----------X 100] 10 Or suppose, previous sale was Taka 700 on average, and now it is 1500 Taka. If the whole amount of increment is due to electricity, then in percentage (for column no. 9) it will be 1500-700 53.3% [---------- -X 100] 10 2. But actually it may be due to new roads. In that case you should take the same type of shop where there is no electricity but have roads. Suppose, the sale has increased there by 20%. In that case in the present example the contribution of electricity will be 53.3-20= 33.3% (In column no. '9' you should write 33.3%)
12.	**Rent: Room/Shop**
	Example: Suppose there was no electricity in room-shop earlier, at that time the monthly rent was 400 taka, and now after coming electricity it is 700 taka. 700-400 Calculation procedure for contribution of electricity: [-----------X 100] = 42.9% 700
13.	**Transport: Van-Rickshaw**
	Example : Suppose the previous income was Taka 350 per week, and now after electrical connection in hat-bazars it is taka 650. Definitely there has been some increase in income due improve in condition of roads. But, it is also due to electrical connection in the hat-bazars also. In this case you can follow example of 11.2. Alternatively, as second procedure ask how much kilometers of road you drive rickshaw-van now? Suppose previously he used to drive 15 Km. and now it is 25 Km. In this the contribution of electricity may be 25-15 40% [---------- -X 100] 25 . Or, the percentage of column no. '9' can also be determined by comparing it to the earlier and the present figure of average number carrying of passengers.

Annex B15-B

Conversion Guideline for Years of Schooling

(By types of Educational Institutions)

Q. 201 HHIS

Code No.	General Class	Madrasah Class
01	Class I	Dakhil Nahum, Kharizi, Kariani, Madrasah/Ebtedai Class I
02	Class II	Dakhil Duam/Ebtedai Class II
03	Class III	Dakhil Haftam/Ebtedai Class III
04	Class IV	Dakhil Shasam/Ebtedai Class IV
05	Class V	Dakhil Panjam/Ebtedai Class V
06	Class VI	Dakhil Saharam/ Dakhil Class VI
07	Class VII	Dakhil Hastam/ Dakhil Class VII
08	Class VIII	Dakhil Chuam/ Dakhil Class VIII
09	Class IX	Dakhil Awal/ Dakhil Class IX
10	SSC/'O' level	Dakhil
12	Paramedics/ Diploma Engineer/ HSC/ 'A' level	Alim/ Alem Jamatul Yazdaham
14	B.A.	Fazel (F.M.)/Ullah
15	B.A. (hons.)	
16	M.A.	Title/ Kamil (M.M.) Mawlana
17	MBBS Doctor/ BSC Engineer/ Advocate/ PhD	

Annex B15-C

Definition of Public Health Issues
(Section VII:HHIS)

01. Diarrhoea

Loose motion for more than three times a day is termed as diarrhoea.

02. ORS

Oral saline can also be prepared in absence of ORS packet in the house. It can be prepared using one hand tight feast of white or red sugar and one 3 finger amount of salt dissolved within half a Litre or half Seer (2 full glass) of water.

03. Acute Respiratory Infection (ARI)

Parents should know that children having cough should be taken fast to health centre or doctor or trained health worker if the following condition prevails:

- difficulty in breathing
- child takes more frequent breathing than normal
- if there is in-drawing of the chest in the child
- unable to drink milk or water.

04. Vaccine

Children should be immunized against 6 dangerous diseases- Polio, Tetanus, Whooping Cough, Measles, Diptheria, and Tuberculosis.

06. Antenatal care (ANC)

It is very much needed to examine the mothers at pregnancy and postpartum to have physical examinations by the health worker or doctor. If physically examined pregnant women and her family can know necessary information about health care during pregnancy and safe child birth. Pregnant women should go to nearest health centre, clinic or doctor for antenatal care.

07. Danger Signs of Pregnancy

The 'Five Danger Signs' through which the pregnant or postpartum women are are recognized as facing risk are:

1. Pervaginal bleeding before delivery or excessive bleeding after delivery;
2. Swelling of hands and legs, severe headache and/or blurring of vision or convulsion;
3. High fever and/or foul smelling vaginal discharge;
4. Labour pain for more than 12 hours; and
5. Showing parts of the baby other than the head of the foetus.

08. EOC: Emergency Obstetric Care

If pregnant or postpartum women shows any of the following conditions, the family should bring her to the nearest health care center or doctor.

09. Postnatal care (PNC)

If the mother takes the help of trained health worker or doctor after delivery she and her child can get rid of the normally practiced 'harmful practices'. In addition, trained health worker or doctors can identify the complications for which the pregnant women need immediate treatment. They should take PNC to the nearest health care center or clinic.

10. Iodine

Iodine is important for normal structure and development of brain. The whole population of Bangladesh has the risk of suffering from Iodine deficiency. In 67 percent of population there is deficiency of iodine and half of the population suffers from goitre of various degrees. When someone suffers from goitre, his/her neck protrudes in front. It is most visible form of iodine deficiency.

With intake of iodine 'goitre of primary level' heals. But, if the goitre is huge in size, it cannot be cured.

11/12. Sexually Transmitted Diseases (STD)

Three main STDs are- Syphilis, Gonorrhea, and AIDS. Someone should go to health centre, hospital, NGO or private clinics for treatment of STDs.

13/14. HIV/AIDS

AIDS is caused by infection with HIV. HIV infection is caused by unprotected sexual activities with HIV infected person, HIV infected blood, and from HIV-infected mother to her foetus. HIV can be protected through trusted relationship of two male and female partners, use of condom during sexual intercourse, use blood or blood products after proper screening, and use needle and syringe, skin pricking instrument or any other for treatment after proper sterilization.

15/16. Arsenic

If someone takes arsenic with drinking water for a long time he develops black spots on the skin, even cancer and death.

Arsenicosis can be prevented by drinking and using arsenic free water in cooking for a long period. We should examine all the tubewells of the area for arsenic. Contact the nearest Public Health Engineering Department for examination of water.

17. Night-blindness

Nightblindness is caused by deficiency of Vitamin-A. Coloured vegetables, pumpkin, carrot, egg, and coloured fishes contains Vitamin A.

18. Tuberculosis

The main stretegy of treatment of is DOTS- which means that, patient will take specific drugs in direct supervision of a doctor, trained health worker or trained social workers. These doctors and workers are insured to health department of the country. Directly supervised treatment for primary stage is 2 to 3 3 months. Treatment of tuberculosis is available in Thana Health Complex, TB Hospital and Clinic.

19. Leprosy

Leprosy can be cured using multi-drug therapy (MDT). MDT is the combination of three medicines. MDT is available free of cost al over Bangladesh.

There are 600 Leprosy-treatment center all over Bangladesh. For this reason, treatment of leprosy is available anywhere in Bangladesh. The leprosy patient can stay at house during the treatment. there is no danger in it. So, he/she does not need to be separated from his family or the neighbours or admission in the hospital.

20. Use of Sanitary Latrine

Sanitary latrine is used to prevent various infectious diseases including helminthiasis, cholera, typhoid, jaundice etc.) and to prevent foul smell.

Q. 709.

TT

TT should be given to all women aged 15 to 49 years. TT is completed in 5 doses. If TT is given in full doses, a woman remains free of disease for the whole period of child-birth. When a mother fully immunized her child is saved from tetanus for some week after birth.

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Chapter 4: Impact on Household; Tables 4.2 – 4.8.9b

Social-Economic-Demographic Profile of Sample Households: Table 4.2--4.2.7(b)

Table 4.2: Distribution of electrified households by year of connection at their household

Year of connection (year proceeding survey in 2002)	% electrified households in the sample
1979 (23 years)	.3
1980 (22 years)	.4
1981 (21 years)	.4
1982 (20 years)	.7
1983 (19 years)	.2
1984 (18 years)	.7
1985 (17 years)	.8
1986 (16 years)	.8
1986 (15 years)	2.2
1988 (14 years)	.8
1989 (13 years)	1.4
1990 (12 years)	3.2
1991 (11 years)	1.7
1992 (10 years)	5.5
1993 (09 years)	1.7
1994 (08 years)	3.1
1995 (07 years)	5.0
1996 (06 years)	7.0
1997 (05 years)	10.9
1998 (04 years)	14.1
1999 (03 years)	14.8
2000 (02 years)	8.8
2001 (01 year)	11.4
2002 (00 years)	4.2
Total	100
Year groups (since electricity in household)	
= 3 yrs.	39.2
4 – 6 yrs.	32.0
7 – 9 yrs.	9.9
10 – 12 yrs.	10.4
13 – 15 yrs.	4.3
16+	4.2
Total	100
Mean (year)	5.54
Mode (year)	3.00
N	1380

Table 4.2.1: Social, economic and demographic profiles of sample households. (Summary table)

Components	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Demographic			
1. Average household size	6.0	5.4	5.7
Male	3.1	2.8	3.0
Female	2.9	2.6	2.7
2. Household population (%)	100	100	100
Male	52.3	51.4	52.7
Female	47.7	48.6	47.3
3. Mean age of household population (in yrs.)	25.98	23.96	24.82
4. # female per 100 males (missing women)	91.2	94.6	89.8
Dependency ratio [# (0-14)+(65+) ÷ (15-64)]	0.64	0.73	0.68
Education			
6. Literacy rate (%, 7 yrs. and above)	70.8	54.3	56.4
Mean years of schooling (for those 7 years and above)	5.4	3.6	3.9
Male	6.2	4.1	4.4
Female	4.6	3.2	3.3
8. Adult literacy rate (% 15 years and above)	73.2	54.9	57.3
Economic			
Employment and Occupation			
9. Average number of persons employed/ involved in income generation activities:			
All	1.8	1.7	1.9
Male	1.6	1.5	1.7
Female	0.2	0.2	0.2
10. Average # of IGA activities mentioned as primary and secondary occupations per hh	2.2	2.1	2.4
11. Household heads primary occupation (%)			
Agriculture (01, 03, 09)	35.8	44.7	47.2
Non-farm activities	64.2	55.3	52.8
Agricultural land and dwelling			
12. Average # of dwelling rooms per HH	2.4	1.7	2.0
13. Average size of dwelling rooms (sq.ft.) per HH	635.3	373.4	439.7
14. Average present market value of dwelling rooms (Tk.)	74158.6	27192.0	42957.4
% owning agricultural land	78.8	59.1	72.9
Average land ownership (decimal)	178.2	74.2	147.8

[Literacy rate = Class 3 and above]

Table 4.2.2: Educational status of household members (% hh population age 7 years and above): Overall Literacy Rate

Educational status	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
Illiterate	11.6	22.9	17.0	24.0	31.6	27.7	23.1	32.7	27.6
Informal education (non-formal, adult literacy, night-school	1.3	1.7	1.5	2.7	3.5	3.1	1.5	2.3	1.9
Up to primary level (class 5)	36.1	37.4	36.7	42.2	42.6	42.4	43.2	41.4	42.3
Up to junior secondary level (Class 8)	16.7	19.0	17.8	16.2	13.6	14.9	13.0	14.2	13.6
Up to class 10	21.0	14.6	18.0	11.8	7.0	9.5	13.7	8.1	11.1
SSC	.7	.4	.6	.1	.3	.2	.1	.1	.1
HSC	6.2	2.4	4.4	1.3	.5	.9	2.3	.8	1.6
Graduate and +	6.4	1.6	4.1	1.8	.8	1.3	3.3	.4	1.9
Total N	100 3750	100 3401	100 7151	100 977	100 924	100 1901	100 1768	100 1571	100 3339
Literacy rate (overall) (age 7 and above)*	75.8	65.2	70.8	58.4	49.9	54.3	62.2	49.8	56.4
Levels (%) Primary	36.1	37.4	36.7	42.2	42.6	42.4	43.2	41.4	42.3
Secondary **	38.4	34	36.4	28.1	20.9	24.6	26.8	22.4	24.8
Above ***	12.6	4	8.5	3.1	1.3	2.2	5.6	1.2	3.5

* Literacy rate = Class 3 and above (Population Census uses '7' years and above for estimating literacy rate

** Secondary=Up to class-8+Upto class –10+ SSC

*** Above=HSC+Graduate and +

Table 4.2.3: Pattern of primary enrollment (age 6 to 12 years) by landownership groups (ownership of cultivable land)

Land ownership group	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
Landless (0 to 49 decimals)	88.2	90.1	89.1	76.4	85.1	80.9	74.1	80.9	77.4
Marginal (50-149 decimals)	83.8	89.7	86.6	89.1	96.6	93.3	86.7	86.2	86.5
Small (150-249 decimals)	88.9	87.6	88.3	90.0	81.0	85.4	73.7	82.5	78.2
Medium (250-749 decimal)	82.7	87.9	85.3	95.7	88.2	92.5	84.6	93.3	88.7
Large (750 decimals and above)	94.1	86.7	89.4	0.0	100.0	100.0	100.0	92.3	96.2
All	86.2	89.0	87.6	82.5	87.9	85.3	79.5	84.6	82.1

Table 4.2.4: Pattern of adult literacy by landownership groups (% for age 15 years and above)

(Literacy rate)

Land ownership group	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non- electrified villages)		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
Landless (0 to 49 decimals)	75.3	57.9	67.0	50.5	40.7	45.9	53.2	37.3	45.9
Marginal (50-149 decimals)	78.4	61.1	70.4	70.8	52.3	62.3	65.9	50.2	58.5
Small (150-249 decimals)	81.9	67.7	75.2	76.9	57.7	67.3	77.3	55.6	67.4
Medium (250-749 decimal)	86.8	74.2	81.0	77.3	54.0	66.7	77.0	62.1	70.4
Large (750 decimals and above)	92.0	76.5	85.0	80.0	75.0	77.8	78.0	74.2	76.4
All	80.6	64.8	73.2	61.7	47.2	54.9	64.6	48.6	57.3

Table 4.2.5: Sample distribution by size of the households (% total households)

Household size	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non- electrified villages)
Less than 4	10.2	16.6	12.3
4 to 5	39.1	38.5	40.3
6 to 7	30.0	31.1	32.2
8 and above	20.7	13.8	15.2
Total	100	100	100
Average hh size	6.0	5.4	5.7
N	1380	421	690

Table 4.2.6: Age distribution of the members of sample households

Age group (in years)	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non- electrified villages)		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
1 – 5	11.3	12.1	11.7	14.9	14.7	14.8	12.3	13.2	12.7
6 – 14	21.4	22.8	22.1	22.0	25.9	23.9	22.2	25.2	23.6
15 – 29	30.3	29.7	30.0	27.5	27.6	27.6	28.9	27.6	28.3
30 – 44	17.1	17.7	17.4	16.9	17.6	17.3	18.5	18.9	18.7
45 – 59	10.9	11.1	11.0	11.4	9.2	10.3	10.6	9.1	9.9
60 +	9.0	6.6	7.9	7.3	4.9	6.1	7.5	6.0	6.8
All ages	100	100	100	100	100	100	100	100	100
Mean age (yrs)	26.6	25.3	26.0	24.8	23.1	24.0	25.6	24.0	24.8
Total population	4328	3952	8280	1180	1114	2294	2065	1856	3921
Total HH	1380			421			690		

Table 4.2.7: Occupational structure of the HH Member (all members)

Occupation	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non- electrified villages)	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
Cultivation	10.3	4.2	11.7	3.6	12.6	4.1
Homemaker (housewife)	24.1	0.6	22.8	0.6	23.1	0.5
Agri-laborer	0.7	0.3	1.5	1.1	1.9	0.8
Non-agri-laborer	1.6	0.4	2.2	1.0	3.1	0.9
Salaried job	5.1	0.2	3.4	-	3.0	0.2
Mason	0.3	0.0	0.7	0.1	0.6	0.0
Carpenter	0.2	0.0	0.2	-	0.6	0.0
Rickshaw/van puller	0.5	0.1	2.3	0.3	0.9	0.3
Fisherman	0.1	0.0	0.3	0.1	0.4	0.1
Boatman	0.1	-	-	0.1	0.1	0.0
Blacksmith	0.1	-	-	0.0	0.0	
Potter	0.0	-	-	-	0.3	0.1
Cobbler	0.0	-	-	0.0	0.0	0.0
Shopkeeper	0.9	0.2	0.6	0.1	0.6	0.2
Petty trader	2.1	1.0	2.4	1.0	2.8	1.4
Business	2.9	0.5	1.0	0.3	1.5	0.2
Tailor	0.4	0.1	0.3	0.1	0.4	0.1
Umbrella Repairer	-	-	-	-	-	0.0
Driver	0.6	-	0.7	-	0.5	-
Cottage Industry	0.7	0.7	0.8	1.1	0.6	1.4
Medical (MBBS) doctor	0.0	-	0.0	0.0	-	-
Village doctor/Quack	0.2	0.0	0.0	-	0.1	0.0
Homeopath	0.1	-	-	-	0.1	-
Imam	0.1	0.0	0.1	-	0.2	-
Retired service holder	0.7	0.0	0.5	-	0.5	-
Student	30.1	0.1	26.4	0.2	25.7	0.1
Unemployed	3.2	0.0	3.9	-	3.7	-
Children	11.6	0.0	15.2	-	14.0	-
Disabled	0.3	-	0.1	-	0.3	-
Clerk	1.2	0.3	0.9	0.4	1.0	0.1
Retired	1.3	0.0	1.9	-	1.5	0.0
Tution	0.1	0.1	0.0	0.0	0.1	0.1
Poultry/Nursery	0.0	0.1	-	0.1	0.0	0.3
No secondary occu.		90.9		89.5		88.9
N (all members)	8280		2294		3921	

Table 4.2.7(b): Occupational structure of the HH Head

Occupation	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non- electrified villages)	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
Cultivation	34.1	15.4	39.4	10.7	41.2	13.5
Homemaker (housewife)	13.3	0.6	7.4	0.7	9.7	0.4
Agri-laborer	1.4	0.7	4.8	3.1	4.3	3.5
Non-agri-laborer	1.9	1.1	5.2	3.3	3.6	3.2
Salaried job	10.6	0.4	2.9	-	4.6	0.4
Mason	0.4	0.1	1.4	-	0.4	-
Carpenter	0.2	0.1	0.5	-	0.6	-
Rickshaw/van puller	1.2	0.3	6.9	1.4	2.3	0.4
Fisherman	0.3	0.1	0.5	0.2	1.7	0.4
Boatman	0.1	-	-	0.2	0.3	0.1
Blacksmith	0.2	-	-	-	0.1	-
Potter	0.1	-	-	-	0.3	0.1
Cobbler	-	-	-	0.2	-	-
Shopkeeper	1.7	0.8	1.4	0.7	1.4	0.9
Petty trader	5.4	3.3	6.4	3.1	8.6	4.9
Business	6.5	2.3	3.3	1.0	4.1	1.0
Tailor	0.6	0.1	0.2	-	0.1	-
Umbrella Repairer	-	-	-	-	-	0.1
Driver	1.4	-	2.4	-	0.6	-
Cottage Industry	1.1	0.7	1.2	0.5	0.7	1.6
Medical (MBBS) doctor	-	-	-	-	-	-
Village doctor/Quack	0.7	0.2	0.2		0.3	0.1
Homeopath	0.4	-	-	-	0.1	-
Imam	0.4	0.2	0.2	-	0.6	-
Retired service holder	2.8	0.1	1.4	-	2.0	-
Student	0.4	0.1	-	0.2	-	-
Unemployed	2.4	0.1	1.7	-	2.3	-
Children	-	-	-	-	-	-
Disabled	0.7	-	0.5	-	0.3	-
Clerk	3.6	0.4	3.1	1.4	3.2	0.3
Retired	7.9	0.1	8.8	-	6.1	0.1
Tution	0.1	0.1	0.2	-	0.3	-
Poultry/Nursery	0.1	-	-	-	-	0.1
No occupation		72.8		73.2		68.6
N (HH head)	1380		421		690	

Table 4.2.8: Village profile: Average of all sample villages

	Indicators	1998		1999		2000		2001		As on 30 April 2002	
		EL	NEL	EL	NEL	EL	NEL	EL	NEL	EL	NEL
A.	**Population Size**										
1.	Male	1892.32	1233.40	1835.31	1267.20	1953.46	1304.67	1813.25	1382.93	1937.83	1143.68
2.	Female	1764.44	1107.53	1764.44	1138.47	1779.22	1175.87	1687.45	982.89	1857.95	1097.17
3.	**Total**	**3656.76**	**2340.97**	**3599.75**	**2405.67**	**3732.68**	**2480.54**	**3500.7**	**2365.82**	**3795.78**	**2240.85**
B.	**Administration Units**										
1.	Size (Sq. Km)	2.71	2.31	2.76	2.38	2.74	2.38	2.62	2.32	2.73	2.33
2.	No. of Households	455.63	298.41	475.40	306.29	491.95	316.35	485.53	321.72	492.47	385.06
C	**Social and Commercial Infrastructure**										
1.	Schools	2.03	1.83	2.05	1.91	2.24	1.91	2.38	2	2.34	1.71
2.	Colleges	1.29	0	1.14	0	1.14	0	1.13	0	1.29	0
3.	Night schools	2.78	2	3.25	2	2	2	3.60	0.67	2.33	1
4.	NGOs	3.97	4.75	3.68	4.	4.19	5.38	4.90	4.80	4.22	4.36
5.	Cooperative Societies	4.54	3.20	4.59	3.20	4.82	3.50	5.07	3.82	5.61	3.73
6.	Bank/Credit institutions		2	2.18	2	2.36	2	2.31	1	2.82	1
7.	Hat(s)	1.17	2	1.17	2	1.22	2	1.22	2	1.22	2
8.	Bazar(s)	1.46	1	1.55	1	1.60	1.0	1.45	1	1.64	1
9.	Shops (with electricity)	28.23	0	30.65	0	33	0	36.28	0	38.94	0
10.	Shops selling electrical equipment	14.44	0	16.80	0	23.53	0	21.18	0	6.95	0
11.	Places of worship										
	i) Mosques	3.39	3.36	3.75	3.67	4.05	4.09	4.58	4.18	4.41	4.42
	ii) Temples	1.63	1.40	1.95	1.50	2.06	1.50	2.06	1.50	1.95	1.75
	iii) Churches	4	0	4	0	4	0	4	0	4	0
	iv) Pagodas	3.75	0	3.75	0	3.75	0.	3.93	0	3.93	0
D.	**Transportation and Communication**										
1.	Road (in Km)										
	i) Pucca	1.69	1.75	1.94	1.75	2.03	3.83	2	3.25	2.01	3.25
	ii) Semi-pucca	2.05	0.63	1.88	0.63	1.80	0.63	1.72	0.73	1.89	0.75
	iii) Kacha	4.45	3.83	4.35	3.45	4.54	3.45	4.39	3.22	4.59	3.83
2.	Bridges	3.43	4	3.86	2.83	7.09	2.86	6.56	2.86	4.12	3.13
3.	Culverts	4.87	3.42	4.32	2.74	5.09	3.4	4.97	3.32	5.73	4.11
4.	Distance from growth center (Commercial Centers, Industrial Centers, Upazila Health Complex, etc.)										
	1) Distance from Commercial Center (in Km.)	4.25	3.14	3.87	4.50	4.30	1.50	6.40	0	5.08	1
	ii) Distance from Industrial Center (in Km.)	7.60	9.44	6.63	8.38	7.41	10	10	0	1.83	0
	iii) Distance from Upazila Health Complex (in Km.)	6.31	10.8	7.36	12.5	6.5	5.5	11.33	0	6	4

	Indicators	1998		1999		2000		2001		As on 30 April 2002	
		EL	NEL	EL	NEL	EL	NEL	EL	NEL	EL	NEL
E	**Employment Status**										
1.	No. of persons employed in NGOs										
	i) Male	6.73	4.11	7.59	5.22	9.43	5.18	10.97	5.8	6.18	5.8
	ii) Female	4.68	2	0.57	2.6	5.26	3	6.38	3	6.8	4
2.	No. of Medical personnel										
	i) Palli Chikitshak	2.08	2	1.93	2	1.94	2	2	2.67	1.89	2
	ii) Paramedics	1.68	1.86	1.86	1.86	1.91	1.88	2.24	2.11	2.14	2.11
	iii) Mid-wives	2.5	1.43	2.74	1.43	2.82	1.22	2.87	1.56	2.84	1.78
3.	No. of Teachers										
	i) Primary level	6.97	3.27	6.68	3.40	7.03	3.25	7.54	3.33	7.63	3.5
	ii) Secondary level	5.03	3.14	5.03	3	5.2	3.43	6.45	2.7	6.38	2.9
	iii) Higher Secondary level	4.3	3.33	4.24	3.33	4.24	2.6	4.74	2.5	5.05	2
4.	Number of graduates										
	i) Bachelor degree holder(s)	26.13	9.43	28.57	9.86	29.44	10.69	30.8	10.88	31.59	11.81
	ii) Masters degree holder(s)	8.39	3.91	9.47	4.09	9.51	4.36	12.83	5	9.45	4.91
5.	Number of Electricians *(PBS)*	2.16	3	2.1	3	2.08	6	2.1	6	2.07	1
6.	Number of local people employed in PBS *(PBS)*										
	i) Male	1.88	2	2.29	2	3	2	3.29	2	3.63	2
	ii) Female	1.5	1	1.2	1	1.33	1	1.6	1	1.33	1
F.	**Industrial Unit**										
1.	No. of Industries										
	i) Cottage *(home based,* ii) *household labor)*	26.33	45.71	33.75	46.57	44.26	50.43	43.95	47.25	48	47.38
	ii) Small *(no. of workers: 1-9)*	8.17	6.8	9.81	7.2	10.21	8	12.19	7.33	12	6.29
G.	**Irrigation Unit**										
1.	No. of irrigation equipment's										
	i) Electricity driven	6.63	3	7.41	3	8.34	3	8.73	2	8.11	1.1
	ii) Diesel – driven	13.87	15.93	15.91	22.82	16.55	22.25	18.61	22.31	18.38	23.92
H.	**Assets**										
1.	No. of TVs	42.15	7.38	49.48	10.42	50.68	13.17	63.62	13.86	71.1	15
2.	No of power tillers	3.77	4.67	4.31	4.83	4.71	4.44	5.69	4.94	5.45	4.94
3.	No. of motor cycles	4.67	6.63	5.78	8.29	6.24	8.13	7.2	7.9	7.43	8
4.	Agricultural land										
	i) Cultivated Land	6367.1	4257.4	6559.33	4981.07	6937.33	4456.24	9159.34	7543.88	7632.24	5289.07

Sources of Information: *Local elites, school teachers, Union council, UNO, Block Supervisor, Upazila Statistical Office, Upazila Education office, PBS etc.*

Note: *EL: Electrified Village, NEL: Non-Electrified Village*

Table 4.2.9: Union Profile[1]: Average of all Unions of the sample villages

Indicators		1998		1999		2000		2001		As on 30 April 2002	
		EL	NEL	EL	NEL	El	NEL	El	NEL	EL	NEL
A. Population Size											
1.	Male	21,462.32	14,957.40	20,760.16	14,808.50	20,525.41	13,662.90	25,577.47	16,413.92	22,885.11	18,647.36
2.	Female	20,377.50	14,565.33	19,827.97	13,856.92	19,354.62	13,172.90	24,756.03	14,653.42	22,150.13	16,872.50
3.	**Total**	**41839.82**	**295222.73**	**40588.13**	**28665.42**	**39880.03**	**26835.8**	**50333.5**	**31067.34**	**45035.24**	**35519.86**
B.	**Administration Units**										
1.	Size (Sq. Km)	22.11	22.37	22.27	23.51	21.27	28.26	21.63	22.25	20.97	20.43
2.	No. of Villages	21.23	18.93	20.92	19.46	20.28	23.00	20.90	18.57	20.55	20.63
C	**Social and Commercial Infrastructure**										
1.	Schools	15.05	15.12	15.07	15.41	15.14	17.81	16.71	18.12	17.24	18.59
2.	Colleges	0.43	0.65	0.48	0.65	0.58	3.00	0.57	0.76	0.60	0.76
3.	Night schools	0.88	0.18	0.24	0.18	0.26	2.56	3.29	6.94	0.38	0.71
4.	Hospitals	0.24	0.18	0.24	0.18	1.47	2.44	0.26	0.29	0.31	0.29
5.	Health and Family Welfare Centers	1.52	2.29	1.71	1.88	1.91	3.75	2.05	2.12	2.17	2.82
6.	NGOs	4.14	3.41	4.29	3.18	4.81	6.44	5.26	3.94	5.50	4.41
7.	Cooperative Societies	15.88	10.12	16.36	10.65	16.93	9.63	18.36	12.06	18.67	12.47
8.	Bank/Credit institutions	1.21	1.18	1.19	1.12	1.88	3.44	1.31	1.18	1.26	1.24
9.	Hat(s)	2.64	3.53	2.48	3.35	2.65	5.44	2.69	3.71	2.81	3.94
10.	Bazar(s)	1.79	2.59	1.60	2.53	1.63	4.88	1.79	2.76	1.71	3.18
11.	Shops (with electricity)	262.65	217.79	199.47	210.33	231.97	221.58	225.70	222	222.03	269.80
12.	Shops selling electrical equipment	6.67	3.53	5.17	3.71	5.63	7.19	6.62	5.18	11.02	6.06
A. D. Transportation and Connection											
1.	Road (in Km)										
	i) Pucca	10.17	7.54	10.60	6.90	10.42	8.89	10.66	7.29	11.39	7.56
	ii) Semi-pucca.	4.64	1.40	4.19	1.40	4.49	4.14	82.40	2.13	195.67	2.34
	iii) Kacha	29.92	107.97	28.80	20.38	28.21	17.41	31.17	20.44	30.57	109.65
2.	Street lights	2.94	0.29	3.04	0.29	2.99	2.69	3.15	0.94	3.20	0.94
3.	Bridges	8.00	7.47	6.64	7.59	7.00	9.50	8.64	9.76	9.50	10.35
4.	Culverts	24.24	31.47	25.57	32.76	26.02	38.88	32.69	41.12	33.81	43.24
E	**Employment Status**										
	Number of Electricians *(PBS)*	2.33	3.18	2.60	3.29	2.79	6.69	3.10	4.12	3.36	4.59
F. Industrial Unit											
1.	No. of Industries										
	i) Cottage (home based, household labor)	17.10	157.18	17.83	164.35	19.95	185.19	22.26	179.41	28.64	204.12
	ii) Small (no. of workers: 1-9)	14.45	16.29	15.05	18.41	16.44	19.13	18.17	23.65	19.62	24.53
	iii) Medium (no. of workers: 10-49)	1.90	4.65	1.67	4.88	1.84	8.25	2.17	6.18	2.48	6.41
	iv) Large (no. of workers:50+)	0.57	0.12	0.60	0.06	0.60	2.38	0.64	0.06	0.62	0.12

Sources of Information: Union Councils, (Chairman, Member) UNO, Agriculture Block Supervisor, Family Planning Inspector, Upazilla level relevant officials etc.

Note: EL: Electrified Village, NEL: Non- Electrified Village

[1] Unions include those unions in which non-electrified villages were sampled. Some unions had electricity in some villages; some had electricity in many villages; some had electricity only in a few villages some had no electrified villages. Thus, union profile may not be very useful in understanding union-wise distinctions in terms of electrification.

Table 4.2.10: Twenty years' growth trend of REB: 1983-2002

Items	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1. # PBS	13	17	18	20	33	33	33	36	39	39	40	40	45	45	53	53	54	55	67	67
2. # Villages electrified (cumulative UTM)	1793	2593	3220	3843	5361	5909	7250	8545	9847	1030	12075	13566	16484	17914	20520	22822	26221	28187	32505	35672
3. Km. of lines energized (1 Mile=1.609 Km.) Cumulative UTM	6350	9079	11447	13636	19199	22070	26799	32825	38927	43329	48312	53485	63387	70748	80804	91914	102514	111126	128420	141736
4. Service connected (Total con. cum) (up to this month):total	3279 (100%)	108491 (100%)	153821 (100%)	196926 (100%)	269308 (100%)	325338 (100%)	396115 (100%)	495565 (100%)	610330 (100%)	708962 (100%)	798441 (100%)	930599 (100%)	1174571 (100%)	1398926 (100%)	1712439 (100%)	2005390 (100%)	2379202 (100%)	2751403 (100%)	3395721 (100%)	4058362 (100%)
4.1 Domestic	2852 (86.98%)	85670 (78.97%)	119384 (77.61%)	150167 (76.26%)	210713 (78.24%)	256253 (78.77%)	314993 (79.52%)	398587 (80.43%)	492615 (80.71%)	571923 (80.67%)	642416 (80.46%)	752545 (80.87%)	952540 (81.10%)	1141339 (81.59%)	1404842 (82.04%)	1658842 (82.72%)	1972140 (82.89%)	2285859 (83.08%)	2781544 (81.91%)	3413825 (84.12%)
4.2 Commercial	355 (10.83%)	16161 (14.90%)	24279 (15.78%)	33538 (17.03%)	42190 (15.67%)	48933 (15.04%)	56173 (14.18%)	67877 (13.70%)	79947 (13.10%)	90847 (12.81%)	102802 (12.88%)	118178 (12.70%)	146893 (12.51%)	168861 (12.07%)	204330 (11.93%)	234654 (11.70%)	278630 (11.71%)	322609 (11.73%)	393248 (11.58%)	456528 (11.25%)
4.3 Irrigation	22 (0.77%)	3858 (4.50%)	5780 (4.84%)	6848 (4.56%)	8177 (3.88%)	10753 (4.20%)	14337 (4.55%)	16870 (4.23%)	22546 (4.58%)	28254 (4.94%)	32302 (5.03%)	35735 (4.75%)	45497 (4.78%)	54734 (4.80%)	62094 (4.42%)	65380 (3.94%)	72809 (3.69%)	79889 (3.49%)	91193 (3.28%)	103980 (3.05%)
4.4 Industry	23 (0.70%)	1975 (1.82%)	2891 (1.88%)	4432 (2.25%)	5711 (2.12%)	6629 (2.04%)	7675 (1.94%)	8998 (1.82%)	11494 (1.88%)	13768 (1.94%)	16387 (2.05%)	19143 (2.06%)	24132 (2.05%)	27930 (2.00%)	34691 (2.03%)	39771 (1.98%)	48262 (2.03%)	55137 (2.00%)	65831 (1.94%)	73827 (1.82%)
4.5 Street Light	27 (0.82%)	827 (0.76%)	1487 (0.97%)	1941 (0.99%)	2517 (0.93%)	2770 (0.85%)	2937 (0.74%)	3233 (0.65%)	3728 (0.61%)	4170 (0.59%)	4534 (0.57%)	4998 (0.54%)	5509 (0.47%)	6062 (0.43%)	6482 (0.38%)	6733 (0.34%)	7361 (0.31%)	7909 (0.29%)	9124 (0.27%)	10202 (0.25%)
5. Irrigation # connection	22 (100%)	3858 (100%)	5780 (100%)	6848 (100%)	8177 (100%)	10753 (100%)	14337 (100%)	16870 (100%)	22546 (100%)	28254 (100%)	32302 (100%)	35735 (100%)	45497 (100%)	54734 (100%)	62094 (100%)	65380 (100%)	72809 (100%)	79889 (100%)	91193 (100%)	103980 (100%)
DTW																			17458 (19.14%)	18983 (18%)
STW																			66552 (73%)	77500 (75%)
LLP																			7183 (7.88%)	7497 (7.21%)
6. Industry # connections	23 (100%)	1975 (100%)	2891 (100%)	4432 (100%)	5711 (100%)	6629 (100%)	7675 (100%)	8998 (100%)	11494 (100%)	13768 (100%)	16387 (100%)	19143 (100%)	24132 (100%)	27930 (100%)	34691 (100%0	39771 (100%)	48262 (100%)	55137 (100%)	65831 (100%)	73827 (100%)
LP																			534 (0.81%)	669 (0.81%)
GP																			65297 (99.19%)	73158 (99.19%)
7. MWH consumed TM	5409 (100%)	9121 (100%)	12601 (100%)	13515 (100%)	19909 (100%)	23883 (100%)	26317 (100%)	31272 (100%)	33407 (100%)	40110 (100%)	47021 (100%)	55744 (100%)	79646 (100%)	85634 (100%)	100768 (100%)	120525 (100%)	172839 (100%)	210010 (100%)	267349 (61 PBS) (100%)	330377 (63 PBS) (100%)
Domestic	1214 (22..44%)	2107 (23.10%)	3284 (26.06%)	3364 (24.89%)	5698 (28.62%)	6974 (29.20%)	6984 (26.54%)	10766 (34.43%)	11504 (34.44%)	13816 (34.45%)	18837 (40.06%)	21998 (39.46%)	32771 (41.15%)	38078 (44.47%)	41963 (41.64%)	52747 (43.76%)	78745 (45.56%)	93810 (44.67%)	121152 (45.31%)	159077 (48.15%)
Commercial	220 (4.07%)	539 (5.91%)	974 (7.73%)	1125 (8.32%)	1654 (8.31%)	1987 (8.32%)	2261 (8.59%)	2573 (8.23%)	2385 (7.14%)	2691 (6.71%)	3604 (7.66%)	3977 (7.13%)	5672 (7.12%)	6302 (7.36%)	6857 (6.80%)	6771 (5.62%)	11674 (6.75%)	13769 (6.56%)	17610 (6.58%)	20682 (6.26%)

Items	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Irrigation	1055 (19.50%)	1187 (13.01%)	653 (5.18%)	956 (7.07%)	1216 (6.11%)	783 (3.28%)	726 (2.76%)	515 (1.65%)	649 (1.94%)	2640 (6.58%)	1268 (2.70%)	1182 (2.12%)	3840 (4.82%)	1909 (2.23%)	2897 (2.87%)	3243 (2.69%)	2691 (1.56%)	2140 (1.02%)	2497 (0.93%)	4734 (1.43%)
Industry	2901 (53.63%)	5254 (57.60%)	7624 (60.50%)	7982 (59.06%)	11243 (56.47%0	14027 (58.73%)	15241 (57.91%)	17314 (55.37%)	18647 (55.82%)	20833 (51.94%)	23166 (49.27%)	18422 (33.05%)	37175 (46.68%)	38962 (45.50%)	48645 (48.27%)	56340 (46.75%)	79205 (45.83%)	93696 (44.62%)	115333 (43.13%)	144951 (43.87%)
Street Light	20 (0.37%)	34 (0.37%)	66 (0.52%)	88 (0.65%)	98 (0.49%)	113 (0.47%)	106 (0.40%)	104 (0.33%)	122 (0.37%)	130 (0.32%)	148 (0.31%)	165 (0.30%)	189 (0.24%)	214 (0.25%)	216 (0.21%)	201 (0.17%)	267 (0.15%)	283 (0.13%)	356 (0.13%)	420 (0.12%)
Office use	-	-	-	-	-	-	-	-	-	-	-	-	-	168 (0.20%)	189 (0.19%)	223 (0.19%)	267 (0.15%)	222 (0.11%)	401 (0.14%)	514 (0.15%)
8. MWH consumed year to date:	-	-	-	-	-	-	-	-	480767 (100%)	576135 (100%)	651832 (100%)	765156 (100%)	1050451 (100%)	1170170 (100%)	1240651 (100%)	1434932 (100%)	1989179 (100%)	2459545 (100%)	3130637 (100%)	3894903 (100%)
Domestic	-	-	-	-	-	-	-	-	140428 (29.21%)	168129 (29.18%)	199751 (30.64%)	245226 (32.05%)	322852 (30.73%)	415597 (35.52%)	470552 (37.93%)	586464 (40.87%)	793220 (39.88%)	1005193 (40.87%)	1230450 (39.30%)	1659876 (42.62%)
Commercial	-	-	-	-	-	-	-	-	28110 (5.85%)	30806 (5.35%)	36205 (5.55%)	43132 (5.64%)	57822 (5.50%)	68909 (5.89%)	74324 (5.99%)	87902 (6.13%)	118532 (5.96%)	149454 (6.08%)	180646 (5.77%)	129398 (3.32%)
Irrigation	-	-	-	-	-	-	-	-	111550 (23.20%)	144293 (25.04%0	145531 (22.33%)	157298 (20.56%)	273307 (26.02%)	241968 (20.68%)	212063 (17.09%)	191473 (13.34%)	312132 (15.69%)	232158 (9.44%)	370926 (11.85%)	257172 (6.60%)
Industry	-	-	-	-	-	-	-	-	199301 (41.45%)	231303 (40.15%)	268601 (41.21%)	317575 (41.50%)	394332 (37.54%)	441432 (37.72%)	479048 (38.61%)	564262 (39.32%)	759923 (38.20%)	1034560 (42.06%)	1340323 (42.81%)	1648661 (42.33%)
Street Light	-	-	-	-	-	-	-	-	1379 (0.29%)	1605 (0.28%)	1745 (0.27%)	1925 (0.25%)	2138 (0.20%)	2431 (0.21%)	2620 (0.21%)	2538 (0.18%)	2652 (0.13%)	3464 (0.14%)	4119 (0.13%)	4796 (0.12%)
Office use	-	-	-	-	-	-	-	-	-	-	-	-	-	168 (0.01%)	189 (0.02%)	223 (0.02%)	267 (0.01%)	322 (0.01%)	401 (0.01%)	514 (0.01%)
9. Amount billed TM(Tk.'000)	-	-	-	-	-	-	-	84580 (TMA)	110243 (TMA)	130456 (TMA)	150198 (TMA)	175106 (TMA)	234115 (TMA)	264962 (TMA)	297965 (TMA)	370649 (TMA)	511582 (TMA)	650349 (TMA)	873745 (TM)	112919 (TM)
10. Power purchase TM(TK "000)	-	-	-	-	-	-	-	48695	58774	68530	79163	90765	121885	142072	202343	242547	360655	4748412	676654	809590
11. MWH purchased SM, TM	-	-	-	-	-	29690	32267	38129	41658	48543	55989	64272	95200	100770	125320	144766	214744	255813	358972	397143
12. MWH Sold TM, SM	5409	-	12601	13515	19909	23883	26317	31272	33407	40110	47021	55744	89646	85634	100768	120525	172839	210010	294054	333617
13. System loss (%)	19.12	26.3 (15 PBS)	19.45	21.6 (17 PBS)	16.63	19.39	18.26	17.8	19.61	17.17	15.81	13.08	16.18	15.02	19.59	16.74	19.51	17.91	18.08	16

source(s): Compiled by the study team based on information obtained from Management information System(MIS), Rate and contracts REB/PBS, Directorate of Finance, REB. All data relate to the month of June of the relevant year.

Note: 1. UTM = up to this month
2. This includes all domestic connections plus C.I con. cum.
3. CUM = cumulative
4. TM = This month
5. Con = Connection
6. LP = Large Power
7. GP = General power
8. TMLY = This month of last year
9. YTD = Year to Date
10.TMA = Twelve Month Average

Impact on Income
Tables 4.3.1- 4.3.11

Table 4.3.1: Distribution of households by reported sources of income

(% reported source)

Source of income	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non- electrified villages)
01. Crop Agriculture	83.8	73.2	81.3
02. Wage labor: Agriculture	5.0	17.3	17.0
03. Wage labor: Non-agriculture	14.1	25.2	23.3
04. Livestock	28.5	26.6	29.1
05. Poultry	42.5	37.5	42.5
06. Trees/nurseries	11.6	8.3	10.4
07. Kitchen/home gardening	8.6	6.2	10.7
08. Fruit/vegetables	20.2	15.4	21.9
09. Pisciculture/Fisheries	23.0	16.9	19.3
10. Selling water: DTW, STW, LLP	12.8	4.8	13.0
11. Business/shops	34.9	25.2	30.1
12. Rent: house, shop,	7.0	1.2	2.0
13. Agr. implements	7.0	3.8	4.5
14. Salaried employment	26.5	14.3	16.1
15. Transport: van, rickshaw, boat, motorcycle, cycle	5.4	12.8	6.7
16.Cottage industry	7.0	8.1	10.3
17. Industries	0.9	0.2	0.6
18. Remittances	13.9	4.5	8.0
19. Insurance	1.8	0.5	0.9
20. Dividend	0.5	0.7	1.2
21. Gifts	15.0	10.5	12.9
22. Gratuity/Pension	2.2	0.2	1.2
23. Others: FFW, female stipend, plantation on khas land	14.9	15.2	15.4
Average number of sources reported	3.9	3.3	3.8
N	1380	421	690

Table 4.3.2: Average annual income (net)[1>] of households by sources (year April 2001-April 2002)

Source of income	HH with Electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)		All Categories	
	Net income (Tk.)	% of total income	Net income (Tk.)	% of total income	Net income (Tk.)	% of total income	Net income (Tk.)	% of total income
01. Crop Agriculture	18452.0	19.85	9781.2	23.79	18622.3	32.95	17033.7	22.99
02. Wage labor: Agriculture	747.4	0.80	1844.6	4.49	2083.5	3.69	1302.9	1.76
03. Wage labor: Non-agriculture	3328.4	3.58	5446.9	13.25	5609.5	9.92	4318.3	5.83
04. Livestock	3257.6	3.50	1682.9	4.09	1773.5	3.14	2580.4	3.48
05. Poultry	776.4	0.84	409.8	1.00	517.6	0.92	642.7	0.87
06. Trees/nurseries	1304.9	1.40	474.9	1.16	747.5	1.32	1010.2	1.36
07. Kitchen/home gardening	821.9	0.88	130.1	0.32	674.6	1.19	664.2	0.90
08. Fruit/vegetables	1117.9	1.20	1809.7	4.40	1115.7	1.97	1234.2	1.67
09. Pisciculture/Fisheries	1853.3	1.99	1142.4	2.78	1233.1	2.18	1561.4	2.11
10. Selling water: DTW, STW, LLP	3121.9	3.36	246.0	0.60	1069.0	1.89	2067.2	2.79
11. Business/shops	20113.4	21.64	6577.9	16.00	9003.6	15.93	14748.4	19.90
12. Rent: house, shop,	1957.8	2.11	183.8	0.45	308.8	0.55	1201.2	1.62
13. Agr. implements	694.1	0.75	254.8	0.62	346.1	0.61	523.5	0.71
14. Salaried employment	12584.1	13.54	4831.2	11.75	5910.6	10.46	9425.2	12.72
15. Transport: van, rickshaw, boat, motorcycle, cycle	1332.5	1.43	2924.7	7.11	1105.1	1.96	1538.6	2.08
16.Cottage industry	1026.0	1.10	645.1	1.57	1272.0	2.25	1029.8	1.39
17. Industries	345.7	0.37	42.8	0.10	337.4	0.60	292.2	0.39
18. Remittances	13127.2	14.12	1962.5	4.77	3708.3	6.56	8631.3	11.65
19. Insurance	101.6	0.11	0.0	0.00	32.2	0.06	65.2	0.09
20. Dividend	185.3	0.20	35.7	0.09	195.3	0.35	162.8	0.22
21. Gifts	5468.0	5.88	153.5	0.37	221.7	0.39	3116.6	4.21
22. Gratuity/Pension	720.5	0.78	1.2	0.00	187.7	0.33	451.3	0.61
23. Others: FFW, female stipend, plantation on khas land	525.0	0.56	528.0	1.28	448.3	0.79	504.2	0.68
Total	92962.9	100.00	41109.6	100.00	56523.5	100.00	74105.6	100.00
Average # of sources applicable to the sample category	3.9		3.3		3.8		3.7	
N	1380		421		690		2491	

Note: Net or operating income of the household refers to gross income minus cost incurred in earning the gross income.

Table 4.3.3: Average annual income (net) of households by broad categories

Broad categories of income sources	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Taka	%	Taka	%	Taka	%
Agricultural	30842.5	33.2	17301.4	42.1	27435.5	48.5
Non-agricultural	62120.3	66.8	23808.2	57.9	29088.0	51.5
Total (Tk.)	92962.9	100.0	41109.6	100.0	56523.5	100.0
N	1384		421		690	

Table 4.3.4: Cost per 100 Tk. gross income by sources of income

Source of income	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non- electrified villages)
01. Crop Agriculture	38.1	40.3	37.2
02. Wage labor: Agriculture	9.1	8.2	9.6
03. Wage labor: Non-agriculture	18.5	16.2	15.8
04. Livestock	34.3	32.6	32.8
05. Poultry	36.7	26.4	26.6
06. Trees/nurseries	7.9	10.8	6.9
07. Kitchen/home gardening	15.0	23.9	24.1
08. Fruit/vegetables	19.8	12.9	27.8
09. Pisciculture/Fisheries	29.4	22.2	24.2
10. Selling water: DTW, STW, LLP	23.4	55.9	55.1
11. Business/shops	51.8	45.1	39.7
12. Rent: house, shop	16.0	10.4	9.3
13. Agr. implements	35.7	33.0	42.0
14. Salaried employment	15.9	19.7	17.2
15. Transport: van, rickshaw, boat, motorcycle, cycle	26.9	24.7	19.7
16.Cottage industry	51.4	51.3	41.9
17. Industries	59.8	10.0	17.2
18. Remittances	15.6	0.9	4.5
19. Insurance	73.3	100.0	27.0
20. Dividend	61.0	77.0	20.5
21. Gifts	0.0	0.0	0.0
22. Gratuity/Pension	11.7	0.0	2.7
23. Others: FFW, female stipend, plantation on khas land	24.9	12.5	19.3
Average (all sources)	33.4	30.9	30.5
N	1380	421	690

Table 4.3.5: Distribution of household annual income (net) by income groups

(% distribution)

Income group (in Tk.)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	All Categories
<=24,000	19.3	39.2	27.4	24.9
24,001 – 34,000	10.4	16.2	15.9	12.9
34,001 – 44,000	11.1	12.6	13.2	11.9
44,001 – 54,000	8.2	9.5	11.7	9.4
54,001 – 64,000	8.3	6.7	7.2	7.7
64,001 – 74,000	7.4	3.6	4.5	5.9
74,001 – 84,000	5.4	3.1	3.0	4.3
84,001 – 94,000	5.1	1.9	3.2	4.0
94,001 -104,000	2.9	1.9	2.0	2.5
104,001 and above	22.0	5.5	11.7	16.3
Total	100	100	100	100
Alll average (Tk.)	92962.9	41109.6	56523.5	74105.6
N	1380	421	690	2491

[Note: Tk. 44,000 refers to estimated mid-point of lower and upper limits of household poverty line measured using CBN method]

Table 4.3.6: Average annual household income (net) by landownership groups.

(in Tk.)

Land ownership groups	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Average	n	Average	n	Average	N
1. Landless (<50 decimal) (and functionally landless)	58863.7	486	35104.4	243	38989.2	319
2. Marginal (50-149 decimal)	101918.4	370	44341.2	107	46171.0	178
3. Small (150-249 decimal)	110820.2	195	47402.1	39	76469.8	78
4. Medium (250-749 decimal)	108683.7	288	67986.5	31	84578.6	91
5. Large (750 +)	220985.5	41	76000.0	1	195164.7	24
All average (in Tk.)	92962.9	1380	41109.6	421	56523.5	690

Table 4.3.7: Distribution of household annual income (net) by deciles

(% of total)

Decile household	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	All Categories
1st decile	1.1	1.4	1.6	1.2
2nd decile	2.2	3.1	3.0	2.5
3rd decile	3.2	4.1	4.0	3.4
4th decile	4.2	5.3	5.1	4.5
5th decile	5.3	6.7	6.2	5.6
6th decile	6.6	8.2	7.6	6.9
7th decile	8.1	9.9	9.0	8.5
8th decile	10.2	12.6	11.3	10.7
9th decile	14.3	16.3	16.1	14.9
10th decile	44.8	32.4	36.2	41.8
All	100 (128288794.5)	100 (17307149.7)	100 (39001228.0)	100 (184597172.2)
N	1380	421	690	2491

Table 4.3.8: Percentage of households' reporting some relationship of income by sources with electricity

Source(s) of income	% reported income's relation-ship with electricity in HH (HH with electricity)	% reported income's relationship with the availability of electricity outside household			% reported the source of income as absolutely new to the HH which emerged with electricity			% reported the source not new to the household but income enhanced due to electricity		
		HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. Crop Agriculture	14.1	42.4	31.6	6.8	1.4	0.7	0.4	41.5	29.0	5.8
2. Wage labor: Agriculture	0.1	1.7	4.3	3.0	0.2	0.2	0.0	1.1	3.6	2.6
3. Wage labor: Non-agriculture	1.0	6.4	9.3	2.9	1.4	0.7	0.1	4.6	7.4	2.2
4. Livestock	7.2	2.0	2.6	0.0	0.5	0.2	0.0	5.7	2.1	0.0
5. Poultry	12.7	8.0	4.0	0.6	0.9	0.0	0.0	13.2	3.6	0.6
6. Trees/nurseries	1.2	1.2	0.5	0.0	0.1	0.0	0.0	1.2	0.2	0.0
7. Kitchen/home gardening	1.1	0.4	0.0	0.1	0.2	0.0	0.0	1.0	0.0	0.0
8. Fruit/vegetables	4.2	0.9	0.5	0.0	0.1	0.0	0.0	4.2	0.2	0.0
9. Pisciculture/Fisheries	5.2	3.9	0.5	0.7	0.0	0.2	0.0	7.8	0.2	0.6
10. Selling water: DTW, STW, LLP	0.5	4.3	0.2	0.4	2.2	0.2	0.3	1.7	0.0	0.1
11. Business/shops	4.4	20.4	8.8	6.8	2.6	0.5	0.3	17.7	6.9	5.4
12. Rent: house, shop,	1.4	4.6	1.0	0.6	0.7	0.0	0.0	4.4	1.0	0.6
13. Agr. implements	0.1	0.7	0.5	0.0	0.3	0.0	0.0	0.4	0.5	0.0
14. Salaried employment	0.5	5.9	5.9	1.6	1.9	2.4	0.3	3.0	3.1	0.7
15. Transport: van, rickshaw, boat, motorcycle, cycle	0.1	1.7	5.7	1.3	0.1	1.0	0.0	1.3	4.5	1.2
16. Cottage industry	5.1	1.4	1.0	0.3	1.5	0.5	0.0	3.1	0.0	0.0
17. Industries	0.1	0.6	0.2	0.3	0.4	0.2	0.1	0.1	0.0	0.0
18. Remittances	0.1	1.4	0.2	0.3	0.5	0.0	0.0	0.3	0.0	0.3
19. Insurance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20. Dividend	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21. Gifts	0.6	0.4	0.2	0.0	0.1	0.0	0.0	0.3	0.2	0.0
22. Gratuity/Pension	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
23. Others: FFW, female stipend, plantation on khas land	0.4	0.6	0.7	0.3	0.1	0.0	0.0	0.5	0.7	0.3
% hh reported at least one source of income related to electricity	40.8	66.2	59.1	21.3	13.6	6.9	1.6	62.9	50.4	16.7
N	1380	1380	421	690	1380	421	690	1380	421	690

Table 4.3.9: Source wise estimated share of the annual income (net) which can be attributed to electricity (based on sample respondents detailed information by sources)

Source(s) of income	Annual average income (net) (in Tk.)				% share of income attributable to electricity				Annual amount of income (in Tk.) attributable to electricity			
	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	All	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	All	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	All
1. Crop Agriculture	18452.0	9781.2	18622.3	17033.7	13.8	10.1	0.8	9.5	2538.8	991.2	147.5	1614.9
2. Wage labor: Agriculture	747.4	1844.6	2083.5	1302.9	9.3	7.3	4.1	6.5	69.7	135.1	85.2	85.0
3. Wage labor: Non-agriculture	3328.4	5446.9	5609.5	4318.3	23.9	16.3	5.4	15.6	794.2	889.1	302.0	673.9
4. Livestock	3257.6	1682.9	1773.5	2580.4	30.8	10.2	0.0	22.6	1002.2	171.4	0.0	584.2
5. Poultry	776.4	409.8	517.6	642.7	36.3	4.5	0.2	24.8	281.6	18.5	1.1	159.4
6. Trees/nurseries	1304.9	474.9	747.5	1010.2	5.3	1.0	0.0	3.8	68.7	4.7	0.0	38.9
7. Kitchen/home gardening	821.9	130.1	674.6	664.2	24.4	0.0	0.2	16.8	200.6	0.0	1.0	111.4
8. Fruit/vegetables	1117.9	1809.7	1115.7	1234.2	6.8	0.3	0.0	3.5	75.9	5.2	0.0	42.9
9. Pisciculture/Fisheries	1853.3	1142.4	1233.1	1561.4	22.8	1.8	5.6	16.4	422.1	20.6	68.9	256.4
10. Selling water: DTW, STW, LLP	3121.9	246.0	1069.0	2067.2	7.3	4.8	1.9	6.5	227.2	11.9	20.7	133.6
11. Business/shops	20113.4	6577.9	9003.6	14748.4	31.3	11.9	7.2	25.7	6286.8	783.9	646.2	3794.3
12. Rent: house, shop,	1957.8	183.8	308.8	1201.2	29.8	18.3	12.8	28.3	584.2	33.7	39.5	340.3
13. Agr. implements	694.1	254.8	346.1	523.5	3.9	5.6	0.0	3.3	27.0	14.3	0.0	17.4
14. Salaried employment	12584.1	4831.2	5910.6	9425.2	9.3	20.2	5.0	9.5	1169.7	978.1	295.2	895.1
15. Transport: van, rickshaw, boat, motorcycle, cycle	1332.5	2924.7	1105.1	1538.6	8.9	18.1	10.5	12.2	119.0	528.4	115.8	187.3
16.Cottage industry	1026.0	645.1	1272.0	1029.8	60.9	35.3	3.2	38.4	624.8	228.0	40.1	395.8
17. Industries	345.7	42.8	337.4	292.2	66.5	100.0	64.4	66.6	229.7	42.8	217.4	194.7
18. Remittances	13127.2	1962.5	3708.3	8631.3	2.9	0.0	1.5	2.7	386.8	0.0	54.3	229.3
19. Insurance	101.6	0.0	32.2	65.2	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0
20. Dividend	185.3	35.7	195.3	162.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21. Gifts	5468.0	153.5	221.7	3116.6	0.3	4.6	0.0	0.4	17.8	7.1	0.0	11.1
22. Gratuity/Pension	720.5	1.2	187.7	451.3	0.1	0.0	0.0	0.1	0.6	0.0	0.0	0.3
23. Others: FFW, female stipend, plantation on khas land	525.0	528.0	448.3	504.2	19.4	15.6	5.3	15.2	101.6	82.4	23.7	76.8
All average	92962.9	41109.6	56523.5	74105.6	16.4	12.0	3.6	13.3	15229.0	4946.5	2058.6	9843.0
N	1380	421	690	2491	1380	421	690	2491	1380	421	690	2491

Table 4.3.10: Factors considered in estimating the contribution of electricity to income by sources

Source(s)	**Factors considered in estimating the contribution of electricity in enhanced/incremental income (factors responsible for electricity-mediated income increase)**
1. Crop Agriculture:	1. Increased production due to electrified irrigation. 2. Cropping intensity increased. 3. Become possible to cultivate now previously fallow land. 4. Less expenditure due to electrified irrigation. 5. Income increased due to electrified irrigation compared to before electricity.
2.Wage Labour Agriculture:	1. Demand increased due to increase cropping intensity. 2. Wage income increased compared to before electricity. 3. Price of wage labour increased due to establishment of new industrial and commercial units.
3. Wage Labor: Non-Agri:	1. Increased due to expansion of market places and economic activities after electrification. 2. More time for work (days & hours) is available after electricity. 3. Increased income of wage labour due to over time at night (eg Mason, industries, shops and establishment) 4. Absolutely new type of work has emerged with electricity (electrician, poultry raising, Pisciculture, job in PBS etc.).
4. Live stock:	1. Stealing cattle stopped due to electricity, which gave incentive for livestock raising. 2. More production of high breed cow (Australian) and milk due to security, availability of vaccine, feed, fodder, fan and lighting; and demand for & price of milk increased after electricity. 3. Increased selling/production of cattle after connection of electricity.
5. Poultry :	1. Income increased due to increased poultry selling after electricity. 2. Increased poultry rearing/production rate due to electricity. 3. Stealing of poultry stopped due to electricity in HH which gave impetus for increased protection. 4. Income increased by selling of eggs after electricity. 5. Did not rearing of poultry because of death and stealing before electrification of HH, Absolutely new to the HH & emerged with electricity. 6. Attack of poultry birds by dog/ fox stopped after electricity. 7. Death of poultry stopped (reduced) due to vaccination facilities. 8. Emergence of new poultry farm after electricity.
6. Trees/ Nurseries:	1. Absolutely new to the HH and emerged with electricity. 2. Stealing of trees/nurseries stopped due to lighting. 3. Selling increased of trees/nurseries after electricity.
7. Kitchen/home gardening:	1. Stealing of vegetable stopped after electrification of the HH. 2. Income increased from selling of vegetables after electricity. 3. Awareness about benefits home/kitchen gardening in applying of modern cultivation methods learned from TV/radio.
8.Fruits/vegetables:	1. Increased production of fruits/vegetables due to less attacks by birds for lighting. 2. Stealing fruits/vegetables stopped due to electricity in HH. 3. Production of vegetables increased due to electricity–powered irrigation.
9. Pisciculture/ Fisheries:	1. Income increased due to round- the – year availability of water in the pond using electrified pump. 2. Stealing of fish stopped due to lighting at night (electricity). 3. Income and production from fisheries increased due to awareness through Radio & TV. 4. Insect killed due to lighting in the pond, as a result less food expenditure to cultivate fish. 5. Price of fish increased due to good communication after electricity.
10. Selling water :	1. Income increased from selling water using electrified pumps. 2. Absolutely new to the HH and emerged with electricity (DTW, STW & LLP).
11. Business/ Shops	1. Increased business hours at night after electrification. 2. Income increased due to electricity powered Refrigerator. 3. Increased selling and customer at night after electricity. 4. Market expansion has taken place after electrification of the market place and surroundings. 5. New business enterprises emerged after electrification (eg Photocopy, rice husking mill, potato stock business by cold storage, establishment of new shops etc.). 6. Increased business days and hours after electrification. 7. Selling goods increased due to availability of fan, light, cassette player etc. after electrification.
12. Rent:House, Shop	1. Increased rents of shop / house after electrification.
13. Agri. Implement:	1. Increased demand for agricultural implement due to electricity irrigation and thereby increased income. 2. Increased use of agri. implements at night due to electricity.
15. Transport:(Van, Rickshaw, Boat, Motorcycle, Cycle)	1. Increased income after electricity as compared to before electricity. 2. Driving more path (increased km of movement) after evening due to electrification of villages. 3. Increased passengers, passenger hours after electricity.
16.Cottage industries:	1. Increased income of handicrafts at night due to electricity. 2. Working time increased after electricity. 3. New cottage industries emerged in many households.
17. Industry/ Factory:	1. New industry/factory established. 2. Diesel driven industries switched over to electricity, which generated more employment and earning. 3. Expenditure saving in rice husking due to switch over to electricity from diesel machine.
18. Remittances:	-------
19. Insurance:	-------
20. Dividend:	---------
21. Gifts:	1. Visiting of relatives with gifts increased due to facilities improved of electrification of HH.
22. Gratuity/ Pension :	1. Due to the development of good communication after electricity of this village, some people save expenditure to withdraw their pension
23. Others	1. Private tuition at night (100%), new after electricity.

Table 4.3.11: Distribution of methods/basis for estimating contribution of electricity in increasing income by sources

(a) For households with electricity

Source of income	Direct financial	Amount of land	Amount of production	Multiple use of same land	Person day/work day/ work hrs.	Amount of production (non-crop)	Km./ # of passengers	Others	Total
1. Crop Agriculture	290	14	276	15	7	8		10	620
2. Wage labor: Agriculture	14	-	-	-	8	-	1	10	33
3. Wage labor: Non-agriculture	60	-	-	-	25	1	2	-	88
4. Livestock	57	-	-	-	5	24	-	7	93
5. Poultry	131	-	1	-	1	80	-	1	214
6. Trees/nurseries	14	-	-	-	1	3	-		18
7. Kitchen/home gardening	12	-	-	-	-	5	-		17
8. Fruit/vegetables	57	1	3	1	-	3	-	1	66
9. Pisciculture /Fisheries	97	-	-	-	-	12	1	1	111
10. Selling water: DTW, STW, LLP	43	2	-	-	2	3	-	4	54
11. Business/shops	168		1	3	110	3	3	4	292
12. Rent: house, shop,	67	1	-	-	2	2	-	1	73
13. Agr. implements	8	-	-	1	1	-	-	-	10
14. Salaried employment	55	-	-	-	8	-	1	7	71
15. Transport: van, rickshaw, boat, motorcycle, cycle	15	-	-	-	3	-	4	-	22
16.Cottage industry	41	-	-	-	24	4	-	-	69
17. Industries	6	-	-	-		-	-	-	6
18. Remittances	9	-	-	-	1	-	-	4	14
19. Insurance		-	-	-	-	-	-	-	0
20. Dividend		-	-	-	-	-	-	-	0
21. Gifts	6	-	-	-	-	1	-	-	7
22. Gratuity/Pension	1	-	-	-	-		-	-	1
23. Others: FFW, female stipend, plantation on khas land	4	-	-	-	5	-	-	-	9

(b) For households without electricity in electrified villages

Source of income	Direct financial	Amount of land	Amount of production	Multiple use of same land	Person day/work day/ work hrs.	Amount of production (non-crop)	Km./ # of passengers	Others	Total
1. Crop Agriculture	62	2	60	2	-	-	-	4	130
2. Wage labor: Agriculture	8	-	-	-	9	-	-	-	17
3. Wage labor: Non-agriculture	16	-	-	1	17	1	1	-	36
4. Livestock	9	-	2	-	2	-	-	-	13
5. Poultry	7	-	-	-	-	11	-	-	18
6. Trees/nurseries	2	-	-	-	-	-	-	-	2
7. Kitchen/home gardening		-	-	-	-	-	-	-	0
8. Fruit/vegetables	2	-	-	-	-	-	-	-	2
9. Pisciculture /Fisheries	1	-	-	-	-	1	-	-	2
10. Selling water: DTW, STW, LLP	1	-	-	-	-	-	-	-	1
11. Business/shops	20	-	-	-	12	-	-	1	33
12. Rent: house, shop,	4	-	-	-	-	-	-	-	4
13. Agr. implements	2	-	-	-	-	-	-	-	2
14. Salaried employment	17	-	-	-	-	-	-	-	17
15. Transport: van, rickshaw, boat, motorcycle, cycle	7	-	-	-	10	-	5	1	23
16. Cottage industry	2	-	-	-	-	-	-	-	2
17. Industries	1	-	-	-	-	-	-	-	1
18. Remittances	-	-	-	-	-	-	-	-	0
19. Insurance	-	-	-	-	-	-	-	-	0
20. Dividend	-	-	-	-	-	-	-	-	0
21. Gifts	1	-	-	-	-	-	-	-	1
22. Gratuity/Pension		-	-	-	-	-	-	-	0
23. Others: FFW, female stipend, plantation on khas land	2	-	-	-	1	-	-	-	3

(c) For households without electricity in <u>non-electrified villages</u>

Source of income	Direct finan-cial	Amount of land	Amount of pro-duction	Multiple use of same land	Person day/work day/ work hrs.	Amount of production (non-crop)	Km./ # of pass-engers	Others	Total
1. Crop Agriculture	31	1	12	-	-	-	-	-	44
2. Wage labor: Agriculture	7	-	-	-	12	-	-	-	19
3. Wage labor: Non-agriculture	11	-	-	-	6	-	1	-	18
4. Livestock	-	-	-	-	-	-	-	-	0
5. Poultry	3	-	-	-	-	1	-	-	4
6. Trees/nurseries	-	-	-	-	-	-	-	-	0
7. Kitchen/home gardening	1	-	-	-	-	-	-	-	1
8. Fruit/vegetables	-	-	-	-	-	-	-	-	0
9. Pisciculture /Fisheries	1	-	-	-	1	2	-	-	4
10. Selling water: DTW, STW, LLP	3	-	-	-	-	-	-	-	3
11. Business/shops	19	-	-	-	19	-	-	5	43
12. Rent: house, shop,	4	-	-	-	-	-	-	-	4
13. Agr. implements	-	-	-	-	-	-	-	-	0
14. Salaried employment	7	-	-	-	-	-	-	-	7
15. Transport: van, rickshaw, boat, motorcycle, cycle	5	-	-	-	4	-	-	-	9
16. Cottage industry	-	-	-	-	-	-	-	-	0
17. Industries	1	-	-	-	-	-	-	-	1
18. Remittances	2	-	-	-	-	-	-	-	2
19. Insurance	-	-	-	-	-	-	-	-	0
20. Dividend	-	-	-	-	-	-	-	-	0
21. Gifts	-	-	-	-	-	-	-	-	0
22. Gratuity/Pension	-	-	-	-	-	-	-	-	0
23. Others: FFW, female stipend, plantation on khas land	1	-	-	-	1	-	-	-	2

Table 4.3.12: Percentage of households by their reporting about employment by occupation: All members

Occupation	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non- electrified villages)	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
Cultivation	10.3	4.2	11.7	3.6	12.6	4.1
Homemaker (housewife)	24.1	0.6	22.8	0.6	23.1	0.5
Agri-laborer	0.7	0.3	1.5	1.1	1.9	0.8
Non-agri-laborer	1.6	0.4	2.2	1.0	3.1	0.9
Salaried job	5.1	0.2	3.4	-	3.0	0.2
Mason	0.3	0.0	0.7	0.1	0.6	0.0
Carpenter	0.2	0.0	0.2	-	0.6	0.0
Rickshaw/van puller	0.5	0.1	2.3	0.3	0.9	0.3
Fisherman	0.1	0.0	0.3	0.1	0.4	0.1
Boatman	0.1	-	-	0.1	0.1	0.0
Blacksmith	0.1	-	-	0.0	0.0	-
Potter	0.0	-	-	-	0.3	0.1
Cobbler	0.0	-	-	0.0	0.0	0.0
Shopkeeper	0.9	0.2	0.6	0.1	0.6	0.2
Petty trader	2.1	1.0	2.4	1.0	2.8	1.4
Business	2.9	0.5	1.0	0.3	1.5	0.2
Tailor	0.4	0.1	0.3	0.1	0.4	0.1
Driver	0.6	-	0.7	-	0.5	-
Cottage Industry	0.7	0.7	0.8	1.1	0.6	1.4
Medical (MBBS) doctor	0.0	-	0.0	0.0	-	-
Village doctor/Quack	0.2	0.0	0.0	-	0.1	0.0
Homeopath	0.1	-	-	-	0.1	-
Imam	0.1	0.0	0.1	-	0.2	-
Retired service holder	0.7	0.0	0.5	-	0.5	-
Student	30.1	0.1	26.4	0.2	25.7	0.1
Unemployed	3.2	0.0	3.9	-	3.7	-
Children	11.6	0.0	15.2	-	14.0	-
Disabled	0.3	-	0.1	-	0.3	-
Clerk	1.2	0.3	0.9	0.4	1.0	0.1
Retired	1.3	0.0	1.9	-	1.5	0.0
Tution	0.1	0.1	0.0	0.0	0.1	0.1
Poultry/Nursery	0.0	0.1	-	0.1	0.0	0.3
No occupation		90.9	-	89.5	-	88.9
N (all members)	8280		2294		3921	

Table 4.3.13: Percentage of households by their reporting about male-female involvement in income-generating activities

Occupation	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non- electrified villages)	
	Male	Female	Male	Female	Male	Female
Cultivation	60.7	1.3	63.4	0.2	70.1	1.7
Homemaker (housewife)	0.0	5.9	0.2	9.3	0.1	9.7
Agri-laborer	3.8	0.7	7.6	0.7	10.3	0.4
Non-agri-laborer	9.2	0.4	10.7	1.2	15.2	2.3
Salaried job	26.8	3.7	16.2	2.1	14.2	2.8
Mason	1.9	0.1	3.3	0.2	3.3	0.0
Carpenter	1.2	0.0	1.0	0.2	3.2	0.0
Rickshaw/van puller	2.8	0.0	12.6	0.0	4.8	0.3
Fisherman	0.4	-	1.4	-	2.5	-
Boatman	0.4	0.1	0.0	0.0	0.4	0.0
Blacksmith	0.4	-	0.0		0.1	-
Potter	0.0	0.2	0.0	0.0	1.7	0.1
Cobbler	0.1	-	0.0	-	0.1	-
Shopkeeper	5.4	-	3.1	-	3.5	-
Petty trader	12.7	0.2	13.1	0.0	15.4	0.3
Business	17.5	0.1	5.7	0.0	8.3	0.0
Tailor	1.9	0.5	1.4	0.2	1.9	0.6
Driver	3.4	0.1	3.8	0.2	2.5	0.1
Cottage Industry	2.3	1.7	2.6	1.9	1.6	1.6
Medical (MBBS) doctor		0.1	-	0.2	-	0.0
Village doctor/Quack	1.2	-	0.2	-	0.7	-
Homeopath	0.5	0.1	0.0	0.0	0.1	0.1
Imam	0.4	-	0.5	-	0.9	-
Clerk	4.8	2.5	3.3	1.4	3.8	2.0
Retired	0.0	0.0	0.0	0.0	0.0	0.1
Tution	0.4	0.0	0.2	0.0	0.1	0.1
Poultry/Nursery	0.0	0.0	0.0	0.0	0.0	0.0
N	1380		421		690	

Table 4.3.14: Mean number of persons reported employed (involvement in income generation activities) by respondent households

Employment status	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Average number of persons employed/involved in IGA			
All	1.8	1.7	1.9
Male	1.6	1.5	1.7
Female	0.2	0.2	0.2
Househlld heads, primary occupation			
Agricultural activities	35.8	44.7	47.2
Non-agricultural activities	64.2	55.3	52.8
N	1380	421	690

Table 4.3.15: Percentage of women reported involvement in income generation activities (for cash and/or kind) by type of those activities

Incomes generation activities	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Reported involvement (%):	24.1	27.3	28.4
N	1380	421	690
Areas of involvement/type of work:			
Handicrafts	27.9	31.3	29.1
Poultry/dairy rearing	58.0	56.5	60.2
Service (Teachers/Nurse)	9.0	6.1	9.2
Vegetables gardening	3.6	1.7	2.0
Agri-work	2.7	7.0	5.1
Tailoring/Shop keeper	4.2	3.5	8.2
TTBA	.3	.9	-
others	3.0	2.6	2.0
n	333	115	196

Table 4.3.16: Women's income generation activities: average number of women involved and person days of involvement in last year

Number of women involved and total person days per household: last year	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Average number of women who are engaged in IGA	.28	.32	.34
Average number of total person days women were engaged in IGA in the HH	22.45	29.76	33.21
N	1380	421	690

4.3.4. Impact on Expenditure

Table 4.3.17: Annual (last year) average household expenditure on food and non-food items

Broad items of expenses	HH with Electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Food (in Tk)	44511.6	32516.1	36454.2
Non-food (in Tk)	50040.7	28810.5	31827.6
Total (in Tk.)	94552.3	61326.6	68281.8
% distribution of expenses			
Food	47.1	53.0	53.4
Non-food	52.9	47.0	46.6
Total	100	100	100
N	1380	421	690

Table 4.3.18: Annual average household expenditure (last year) by major items

Items of expenditure	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	in Tk.	% of total	in Tk.	% of total	in Tk.	% of total
1. Food	44511.6	47.1	32516.1	53.0	36454.2	53.4
2. Fuel and electricity	6534.0	6.9	4338.2	7.1	4616.2	6.8
3. Toiletries	2187.3	2.3	1540.3	2.5	1645.4	2.4
4. Transport	4497.3	4.8	2625.5	4.3	3652.3	5.3
5. Apparels	6782.8	7.2	4135.6	6.7	4710.6	6.9
6. Housing and related	9025.0	9.5	6570.4	10.7	5374.5	7.9
7. Health care	4324.6	4.6	3012.2	4.9	2999.1	4.4
8. Education	3260.4	3.4	1386.0	2.3	1746.3	2.6
9. Socio-cultural and religious	5543.9	5.9	1125.1	1.8	2632.0	3.9
10. Entertainment	300.0	0.3	173.6	0.3	265.6	0.4
11. Tax, debt service, litigation	3876.5	4.1	2962.8	4.8	2838.3	4.2
12. Kitchen utensils	277.4	0.3	175.5	0.3	195.5	0.3
13. Furniture/fixture	1275.5	1.3	429.5	0.7	613.9	0.9
14. Electrical equipment	1180.6	1.2	165.2	0.3	176.9	0.3
15. Personal wearing/ornaments	975.2	1.0	170.6	0.3	361.1	0.5
Total	94552.3	100	61326.6	100	68281.8	100
N	1380		421		690	

Table 4.3.19: Annual Per Capita Expenditure on major items

(in Tk./person)

Items of expenditure	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. Food	7418.6	5967.4	6415.0
2. Fuel and electricity	1089.0	796.2	812.3
3. Toiletries	364.6	282.7	289.6
4. Transport	749.5	481.8	642.7
5. Apparels	1130.5	759.0	828.9
6. Housing and related	1504.2	1205.8	945.8
7. Health care	720.8	552.8	527.8
8. Education	543.4	254.4	307.3
9. Socio-cultural and religious	924.0	206.5	463.2
10. Entertainment	50.0	31.9	46.7
11. Tax, debt service, litigation	646.1	543.7	499.5
12. Kitchen utensils	46.2	32.2	34.4
13. Furniture/fixture	212.6	78.8	108.0
14. Electrical equipment	196.8	30.3	31.1
15. Personal wearing/ornaments	162.5	31.3	63.6
Total	15758.7	11254.8	12015.9
N (HH member)	1380(8280)	421(2294)	690(3921)

Table 4.2.20: Annual recurrent and capital expenditure by households

Recurrent and capital expenditure	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	Tk/HH	Tk. /person	% total	Tk/HH	Tk. /person	% total	Tk/HH	Tk. /person	% total
Recurrent expenses	72675.5	12112.6	76.9	49903.0	9158.3	81.4	56285.2	9904.8	82.4
Capital expenses	21876.8	3646.1	23.1	11423.6	2096.5	18.6	11996.6	2111.1	17.6
Total	94552.3	15758.7	100	61326.6	11254.8	100	68281.8	12015.9	100
N	1380			421			690		

Note: Methodology for estimation is presented in section 4.3.5

Table 4.3.21: Selected indicators of living standards by households

Selected indicators of living standards	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. % adult hh members having at least two pieces of:			
Lungi/dhuttee (male)	66.0	65.0	65.0
Saree (female)	49.3	42.4	44.5
2. % adult hh members having at least one winter cloth (sweater/jacket, chador, shawl)	3.9	2.1	3.3
3. % adult hh members having shoe	14.8	12.4	16.3

Table 4.3.22: Selected indicators of living standards by Landless households (including the marginal ones)

Selected indicators of living standards	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. % adult hh members having two pieces of:			
Lungi/Dhuttee (male)	58.4	57.8	55.1
Saree (female)	44.9	38.4	38.5
2. % adult hh members having at least one winter cloth (sweater/jacket, chador, shawl)	2.2	1.8	1.9
3. % adult hh members having shoe	13.2	8.7	11.9

Table 4.3.23: Average daily intake of food by households

Food Items	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	Physical unit (gm)	Taka	% Total Tk.	Physical unit (gm)	Taka	% Total Tk.	Physical unit (gm)	Taka	% Total Tk.
01. Rice	2827.1	35.3	29.0	2528.4	31.0	34.8	2769.6	34.0	34.1
02. Atta/Wheat Flour	159.5	1.8	1.5	104.9	1.2	1.3	115.2	1.3	1.3
03. Fish	312.9	17.8	14.6	215.2	11.2	12.5	245.5	13.2	13.2
04. Meat	160.3	12.5	10.3	90.0	6.8	7.7	100.7	8.1	8.1
05. Egg (#)	1.4	4.1	3.4	1.1	3.0	3.4	1.2	3.3	3.3
06. Milk	407.1	6.1	5.0	243.7	3.7	4.1	304.6	4.3	4.3
07. Pulses	116.3	4.1	3.4	90.8	3.1	3.5	98.8	3.3	3.3
08. Vegetables	790.4	6.7	5.5	679.8	5.6	6.3	734.8	6.0	6.0
09. Potato	510.3	4.9	4.0	489.6	4.5	5.1	489.2	4.6	4.6
10. Edible oil	116.7	4.9	4.0	80.7	3.5	3.9	92.1	3.9	3.9
11. Spices	92.2	5.6	4.6	62.9	3.8	4.3	70.4	4.6	4.6
12. Fruits	252.3	8.8	7.2	148.2	4.9	5.5	183.3	6.1	6.1
13. Salt	120.9	1.2	1.0	96.2	1.0	1.1	111.0	1.2	1.2
14. Sugar	63.2	2.1	1.7	37.5	1.2	1.4	43.4	1.4	1.4
15. Gur	43.0	0.9	0.7	33.7	0.7	0.7	36.4	0.8	0.8
16. Others	0.0	5.2	4.3	0.0	3.9	4.4	0.0	3.9	3.9
Total	5973.5	121.9	100	4902.8	89.1	100	5396.2	99.9	100

Table 4.3.24: *Per Capita* daily intake of food by major food items

(in gm)

Food Items	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
01. Rice	471.2	464.0	487.4
02. Atta/Wheat Flour	26.6	19.3	20.3
03. Fish	52.2	39.5	43.2
04. Meat	26.7	16.5	17.7
05. Egg (#)	0.2	0.2	0.2
06. Milk (litre)	67.9	44.7	53.6
07. Pulses	19.4	16.7	17.4
08. Vegetables	131.7	124.8	129.3
09. Potato	85.0	89.9	86.1
10. Edible oil	19.5	14.8	16.2
11. Spices	15.4	11.5	12.4
12. Fruits	42.0	27.2	32.3
13. Salt	20.1	17.7	19.5
14. Sugar	10.5	6.9	7.6
15. Gur	7.2	6.2	6.4
Total	995.6	899.8	949.6
Total per capita expenditure (Tk./person)	20.3	16.3	17.6
N	1380	421	690

(Protein includes fish, meat, milk and egg)

Table 4.3.25: Food consumption of household members in terms of K-Calories: Selected indicators

Food Consumption K-Calorie	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. Monthly household consumption (K-Calories)	419794.1	353449.5	388422.5
2. Average monthly per person food consumption (K-Calories)	71154.9	66245.2	69359.1
3. Average per person daily food intake (K. Calories)	2371.8	2208.2	2312.0
4. % population with daily food intake:			
Less than 2122 K-Cal. (Absolute poor)	39.9	51.2	43.4
Less than 1805 K-Cal. (Hard core poor)	21.8	27.1	23.1

Note: *Bangladesh Nutrition Council proposed = 2280 (normative bundle); BBS uses 2122; Most studies use 2112 K. Cal; `extreme poverty' corresponds to 1805 K. Cal (Sen: 20-22)*
<2122 K.Cal = Absolute poor; <1805 K.Cal = Hardcore poor (HIES 2000: 55)

Table 4.3.26: Average annual household expenditures on health care and education by male-female

Health and education expenses		HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
		Tk.	% Total	Tk.	% Total	Tk.	% Total
1. Health:	Male	2376.2	54.9	2057.5	68.3	1946.6	64.9
	Female	1948.4	45.1	954.7	31.7	1052.4	35.1
	Both	4324.6	100.0	3012.2	100.0	2999.1	100.0
2. Education:	Male	2136.6	65.5	791.2	57.1	1069.1	61.2
	Female	1123.9	34.5	594.8	42.9	677.3	38.8
	Both	3260.4	100.0	1386.0	100.0	1746.3	100.0
N		1380		421		690	

[Note: Male/female here refers to all members irrespective of the member for which the actual cost was incurred].

Table 4.3.27: *Per capita* annual expenditure on health and education for male and female members

(in Tk.)

Health and education			HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1.	Health:	Male	396.0	381.0	341.5
		Female	324.7	176.8	184.6
		Both	720.8	557.8	526.1
2.	Education:	Male	356.1	146.5	187.6
		Female	187.3	110.1	118.8
		Both	543.4	256.7	306.4
N			1380	421	690

Table 4.3.28: Average annual household expenditure on items of entertainment

(in Tk.)

Items of entertainment	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. Books/Newspapers/Journals	87.2	19.7	34.2
2. Cinema/Theater	31.6	52.4	36.8
3. Sports	18.8	11.3	10.0
4. Video/Audio Cassettes	31.6	5.3	18.6
5. Photo	36.7	20.0	20.7
6. License (renewal) of TV/VCP/Radio	59.6	1.5	8.4
7. Battery	27.9	63.4	102.2
8. Others	6.6	.0	34.6
Average per household (Tk.)	300	173.6	265.6
Average per person (Tk.)	50.0	32.1	46.6
N	1380	421	690

Table 4.3.29: Average annual (last year) household expenditure on various electrical equipments/appliances

Items of electrical appliances	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Average no. purchased last year	Amount spent (Tk.)	Average no. purchased last year	Amount spent (Tk.)	Average no. purchased last year	Amount spent (Tk.)
1. Radio	.0333	15.6	.0333	9.6	.0464	12.1
2. TV	.0920	547.3	.0095	111.6	.0145	84.5
3. Cassette Recorder	.0514	112.2	.0143	29.5	.0159	30.8
4. VCP/VCR	.0065	42.6	.0000	.0	.0029	24.6
5. Musical instruments	.0536	4.3	.0071	8.6	.0029	3.1
6. Computer	.0014	55.8	NA	NA	NA	NA
7. Fan	.2406	276.9	NA	NA	NA	NA
8. Camera	.0116	19.4	.0000	.0	.0101	15.7
9. Iron	.0283	17.6	.0000	.0	.0188	4.4
10. Others	.1558	88.8	.0024	2.4	.0058	1.7
Total average (Tk)	1,180.6		165.2		176.9	
N	1380		421		690	

Table 4.3.30: Monthly household consumption of different types of fuel

Types of fuel	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electri-fied villages)	
	Quantity	Cost (Tk.)	Quantity	Cost (Tk.)	Quantity	Cost (Tk.)
1. Biomass fuel(firewood, cowdung,leaves, straw)		362.4		290.8		308.8
2. Kersoene (ltr)	1.6	28.3	3.3	64.8	4.1	69.8
3. Gas/LPG Cylinder		8.9		.0		.0
4. Electricity (KWh)	42.1	137.0		NA		NA
5. Others		7.9		6.0		6.1
Average	544.5		361.5		384.7	
N	1380		421		690	

4.3.5 Impact on Surpluses and Savings
Tables : 4.3.31 — 4.3.33

Table 4.3.31: Annual average surplus[1>] of households by income groups.

(in Tk.)

Income groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
<=44,000	-31527.6	-21580.4	-22712.5
44,001 – 64,000	-10863.2	-157.4	-1544.7
64,001 – 84,000	272.8	16206.1	12207.9
84,001 -104,000	10220.0	9792.5	14306.1
104,001 and above	155284.6	81314.6	99689.7
Average	20287.4	-8793.4	238.4
N	1380	421	690

[1>] *Note: Surplus includes sum total of operating unit's income minus food consumption expenditure and other direct family maintenance costs (excluding capital expenses)(see figure in the text, section 4.3.5)*

Table 4.3.32: Annual average surplus[1>] of households by land ownership groups.

(in Tk.)

Land ownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	-2392.9	-5584.9	-8935.0
Marginal 50 – 149 decimals)	36155.6	-7468.5	-5425.2
Small (150-249 decimals)	32140.0	-18569.4	15550.6
Medium (250-749 decimal)	22798.2	-25159.7	8295.6
Large (750 decimals and above)	71920.3	-41591.1	83856.7
Average surplus (Tk)	20287.4	-8793.4	238.4
N	1380	421	690

[1>] *Note: Surplus' includes sum total of operating units income minus food consumption expenditure and other direct family maintenance costs (excluding capital expenses)(see figure in the text, section 4.3.5)*

Table 4.3.33: Annual average household savings[1>] by income groups.

(in Tk.)

Income groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
<=44,000	11698.1	1636.1	3679.9
44,001 – 64,000	16958.0	23290.6	10558.1
64,001 – 84,000	18158.5	38595.9	13016.3
84,001 -104,000	30758.0	27320.1	17439.7
104,001 and above	75379.1	26342.8	68418.1
Average Savings (Tk)	28892.5	9917.7	14007.0
N	1380	421	690

[1>] *Note: Savings include capital expenses plus inventory plus lending minus borrowing (see figure in the text, section 4.3.5))*

Table 4.3.33 (b): Annual average household savings[1>] by land ownership groups.

(in Tk.)

Land ownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	17762.3	4054.1	5375.9
Marginal 50 – 149 decimals)	25124.3	12294.3	9661.7
Small (150-249 decimals)	32344.8	9179.4	20504.6
Medium (250-749 decimal)	31550.2	48862.6	30363.4
Large (750 decimals and above)	159742.6	2000.0	77821.5
Average surplus (Tk)	28892.5	9917.7*	14007.0
N	1380	421	690

1> Note: Savings include capital expenses plus inventory plus lending minus borrowing (see figure in the text, section 4.3.5)

** To be considered with caution due to low cell frequency (only 8 cases)*

4.3.6 Impact on Credit
Tables : 4.3.34— 4.3.35

Table 4.3.34: Distribution of households by their loan taking/credit receiving status in the last year

Loan/credit taking status/source(s)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
% hh reported receipt of credit during last year	44.6	48.7	45.8
% hh reported receipt of credit by source:			
Krishi Bank (BKB)	7.6	6.4	8.4
Commercial Bank	4.1	3.6	1.7
BRDB	0.5	0.5	0.4
NGO	16.7	24.0	21.3
Money lender	3.0	4.3	3.3
Friend/relative/Neighbor	13.6	13.5	14.5
Other	4.1	3.1	2.0
% hh reported receipt of credit by broad source:			
Institutional (BKB+CB+BRDB+NGO)	28.9	34.4	31.9
Non-institutional source	20.7	20.9	19.9
N	1380	421	690

Table 4.3.35: Average amount of credit taken by households by source (last year)

Source(s) of credit	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	Average amount for receiving hhs (Tk)	% of total	Average amount for all hhs (Tk)	Average amount for receiving hhs (Tk)	% of total	Average amount for all hhs (Tk)	Average amount for receiving hhs (Tk)	% of total	Average amount for all hhs (Tk)
Institutional	10732.1	52.3	4782.8	5492.2	57.1	2674.3	6550.3	56.2	2999.9
Krishi Bank (BKB)	4042.4	19.7	1801.5	1286.3	13.4	626.4	2692.7	23.1	1233.2
Commercial Bank	2556.8	12.4	1139.4	990.2	10.3	482.2	443.0	3.8	202.9
BRDB	112.2	0.5	50.0	73.2	0.8	35.6	98.1	0.8	44.9
NGO	4020.7	19.6	1791.8	3142.4	32.7	1530.2	3316.5	28.4	1518.8
Non-institutional	9805.2	47.7	4369.7	4129.8	42.9	2010.9	5107.6	43.8	2339.1
Money lender	1665.0	8.1	742.0	721.5	7.5	351.3	743.7	6.4	340.6
Friend/relative/ Neighbor	6998.4	34.1	3118.8	3042.4	31.6	1481.5	4206.0	36.1	1926.2
Other	1141.8	5.6	508.8	365.9	3.8	178.1	157.9	1.4	72.3
Total	20537.3	100.0	9152.5	9622.0	100.0	4685.3	11657.9	100.0	5339.0
N	1380			421			690		

4.3.7 Impact on Ownership, Property and Assets
Tables : 4.3.36 — 4.3.47 (d)

Table 4.3.36: Pattern of household ownership of cultivable land in 2002 (own land includes cultivated by own, leased out, rented out, mortgaged out).

(in Tk.)

Land ownership group	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
1. %HH having own cultivable land	78.8			59.1			72.9		
2. Land ownership groups:	% HH	average (dec)	% land	% HH	average (dec)	% land	% HH	average (dec)	% land
Landless (0 to 49 decimals)	35.2	11.0	2.2	57.7	7.5	5.9	46.2	10.7	3.3
Marginal (50-149 decimals)	26.8	92.8	14.0	25.4	89.6	30.7	25.8	94.6	16.5
Small (150-249 decimals)	14.1	193.7	15.4	9.3	182.7	22.8	11.3	191.1	14.6
Medium (250-749 decimal)	20.9	403.3	47.2	7.4	366.6	36.4	13.2	414.2	37.0
Large (750 decimals)	3.0	1278.1	21.3	.2	1320.0	4.2	3.5	1213.4	28.6
All	100	178.2	100.0	100	74.2	100.0	100	147.8	100
N	1380	245962		421	31226		690	101971	

Note: This table refers to own cultivable land only.

Table 4.3.37: Distribution of household land ownership (own cultivable land) by deciles: Year 2002 (present situation)

(% of total)

Decile households	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1st decile	.0	.0	.0
2nd decile	.0	.0	.0
3rd decile	1.0	.0	.1
4th decile	2.7	.0	1.5
5th decile	4.4	2.0	3.1
6th decile	6.4	5.3	5.4
7th decile	9.4	9.0	7.8
8th decile	13.2	14.0	11.6
9th decile	19.4	21.4	18.9
10th decile	43.4	48.3	51.6
Total	100 (245962)	100 (31226)	100 (101971)
N	1380	421	690

Table 4.3.38: Distribution of household land ownership (own cultivable land) by deciles: Year 1997 (Five year, back)

(% of total)

Decile households	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1st decile	.0	.0	.0
2nd decile	.0	.0	.0
3rd decile	.6	.0	.0
4th decile	2.4	.0	1.2
5th decile	4.3	1.9	3.0
6th decile	6.4	5.1	5.3
7th decile	9.0	8.5	8.2
8th decile	13.4	14.3	12.4
9th decile	20.1	22.5	19.2
10th decile	43.7	47.6	50.6
Ttoal	100.0 (216354)	100.0 (28442)	100.0 (92167)
N	1380	421	690

Table 4.3.39: Changes in the inequality (degree of inequality) situation in terms of land ownership (cultivable land) during the last five years

Distribution Category	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2000	% change	1997	2000	% change	1997	2000	% change
Top 10 %	43.7	43.4	-0.7	47.6	48.3	1.5	50.6	51.6	2.0
Top 40 %	86.2	85.4	-0.9	92.9	92.7	-0.2	90.4	89.9	-0.6
Bottom 40 %	3.0	3.7	23.3	0.0	0.0	0.0	1.2	1.6	33.3
Bottom 10 %	0	0	0	0	0	0	0	0	0
Gini Ratio	0.62	0.61	-1.6	0.69	0.68	-1.4	0.67	0.67	0.0
N	1380			421			690		

Table 4.3.40: Changes in the inequality situation of households during the last five years: Land ownership (poverty dimension)

(Gini Coefficients)

Year	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1997	0.62	0.69	0.67
2002	0.61	0.68	0.67
% Change	-1.6	-1.4	0.0

Note: AB to estimate.

Table 4.3.40 (b): Position of average household in terms of valuation of cultivable own land during the last five years (inter temporal variations, Blue 52)

(Tk. at present market value)

Year	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1997	399816.78	198435.61	289704.06
2002	458779.65	193419.90	304220.23
% Change	14.7	-2.5	5.0

Table 4.3.41: Changes in the percent of households reported ownership on various type of land assets: 1997-2002 (also tenancy status)

(% reported ownership)

Type of assets	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% change	1997	2002	% change	1997	2002	% change
1. Own Cultivable land	76.4	78.8	3.1	58.7	59.1	0.7	70.7	72.9	3.1
2. Agriculture land: leased out/ mortgaged out	23.4	39.6	69.2	13.3	24.5	84.2	14.3	26.5	85.3
3. Own pond	49.3	53.6	8.7	37.1	40.1	8.1	36.4	41	12.6
4. Own ditch/fallow	19.6	20.6	5.1	10.9	11.9	9.2	20.1	21	4.5
5. Own homestead	93.9	99.2	5.6	92.9	96.2	3.6	93	98.6	6.0
6. Kitchen gardening	24.8	27.1	9.3	21.1	22.6	7.1	24.9	27.4	10.0
N	1380			421			690		

Table 4.3.42: Changes in the average land ownership of households by type of land during last five years: 1997-2002

(average ownership in decimals)

Type of assets	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% change	1997	2002	% change	1997	2002	% change
1. Own Cultivable land	156.8	178.2	13.7	67.6	74.2	9.8	133.6	147.8	10.6
2. Agriculture land: leased out/ mortgaged out	39.1	61.5	57.1	11.5	18.8	62.8	23.7	34.3	44.4
3. Own pond	12.3	14.2	15.3	4.0	4.9	23.9	5.2	6.0	15.0
4. Own ditch/fallow	5.3	5.2	-1.1	1.8	2.0	14.6	4.9	5.0	1.2
5. Own homestead	19.3	21.5	11.2	14.9	16.0	7.6	16.4	17.6	7.6
6. Kitchen garden	3.3	3.4	4.6	2.1	2.3	11.0	2.4	2.7	13.3
Average*	197.0	222.5	13.0	90.3	99.5	10.2	162.5	179.1	10.2
N	1380			421			690		

**Note: item 2 is excluded because it is included in item 1.*

Table 4.3.42 (b): Changes in the (agricultural) operational land holding[1>] during the last five years : 1997-2002

(in decimal)

Type of assets	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% change	1997	2002	% change	1997	2002	% change
1. Own Cultivable land	156.8	178.2	13.6	67.6	74.2	9.8	133.6	147.8	10.6
2. Agriculture land: leased out/ mortgaged out	39.1	61.5	57.3	11.5	18.8	63.5	23.7	34.3	44.7
3. Leased in/rented in/ mortgaged in agr-land	21.1	27.6	30.8	22.7	37.5	65.2	24	27.4	14.2
operational land	138.8	144.3	4.0	78.8	92.9	17.9	133.9	140.9	5.2

[1>] *Note: Operational land holding = Own land under own cultivation **minus** land leased out/ rented out/mortgaged out **plus** land leased in/mortgaged in /rented in.*

Table 4.3.43: Changes in the household land ownership status (by types of various land assets) during the last five years in terms of market value (in Tk)

(in Tk)

Type of assets	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% change	1997	2002	% change	1997	2002	% change
1. Own Cultivable land	399816.8	458779.7	14.7	198435.6	193419.9	-2.5	289704.1	304220.2	5.0
2. Agriculture land: leased out/ mortgaged out	92828.8	165427.6	78.2	24673.5	49723.2	101.5	45540.5	72538.7	59.3
3. Own pond	33019.0	42748.4	29.5	30539.0	35945.6	17.7	19657.7	21594.9	9.9
4. Own ditch/fallow	11958.4	12583.2	5.2	7257.2	7456.7	2.7	9062.6	8689.4	-4.1
5. Own homestead	149259.4	157339.1	5.4	97245.0	92992.3	-4.4	86536.1	102949.5	19.0
6. Kitchen gardening	20698.0	21966.3	6.1	11259.6	11762.5	4.5	10077.0	10719.8	6.4
Average*	614751.5	693416.6	12.8	344736.5	341577.0	-0.9	415037.4	448173.8	8.0
N	1380			421			690		

**Note: Item 2 is excluded because of its inclusion in the item # 1.*

Table 4.3.44: Changes in the household economic strength in terms of dwelling and non-dwelling rooms during the last five years: 1997 – 2002

(average per hh)

Dwelling and -dwelling rooms	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% change	1997	2002	% change	1997	2002	% change
Dwelling rooms:									
1. Average number	1.9	2.4	26.3	1	1.7	17.0	1.7	2.0	17.6
2. Average space (sq. ft)	513.4	635.3	23.8	334.0	373.4	11.8	367.3	439.7	19.7
3. Present market value (in Tk)	67634.6	74158.6	9.6	21594.9	27192.0	25.9	31684.1	42957.4	35.6
4. Average number of rooms with electricity	0.0	2.3	100.0		0.0	0.0		0.0	0.0
Non-dwelling rooms (kitchen, cowshed, store, cottage, Industry etc):									
1. Average number	1.7	2.2	28.2	1.3	1.6	23.3	1.6	1.9	22.4
2. Average space (sq. ft)	186.2	242.1	30.0	125.6	153.8	22.4	149.1	172.8	15.9
3. Present market value (in Tk)	7240.1	11106.4	53.4	2519.4	3825.4	51.8	4006.1	5382.0	34.3
4. Average number of rooms with electricity		0.9	100.0						
Average total valuation of dwelling plus non-dwelling rooms	74874.7	85264.9	13.9	24114.3	31017.3	28.6	35690.2	48339.4	35.4
N	1380			421			690		

Table 4.3.45: Changes in the household economic strength in terms of possession (ownership) of animal assets (livestock and poultry) during the last five years: 1997 - 2002

(average per hh)

Livestock and poultry	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% change	1997	2002	% change	1997	2002	% change
Cow									
1. Average number	1.1	1.3	11.9	1.4	0.9	-35.7	1.9	1.2	-36.8
2. Market value (Tk)	7654.5	9125.4	19.2	7880.8	6134.9	-22.2	11557.5	8175.7	-29.3
3. Number raised /fattened for sale	0.0	0.2	100.0	0	0.2	100.0	0	0.2	100.0
Buffalo									
1. Average number	0.0	0.0	-45.0	0	0	0.0	0.1	0	-100.0
2. Market value (Tk	548.8	158.2	-71.2	223.3	187.6	-16.0	552.2	219.6	-60.2
3. Number raised /fattened for sale	0	0	0.0	0	0	0.0	0	0	0.0
Calf									
1. Average number	0.3	0.5	66.7	0.4	0.4	0.0	0.4	0.4	0.0
2. Market value (Tk)	889	1192.4	34.1	860.6	762.2	-11.4	950.4	911.8	-4.1
3. Number raised /fattened for sale	0	0.1	100.0	0	0.1	100.0	0	0.1	100.0
Goat/sheep									
1. Average number	0.7	0.8	14.3	0.9	0.8	-11.1	1.1	0.9	-18.2
2. Market value (Tk)	678.5	679.4	0.1	724.7	682.2	-5.9	1004.7	667	-33.6
3. Number raised /fattened for sale	0	0.3	100.0	0	0.2	100.0	0	0.3	100.0
Poultry birds									
1. Average number	8.1	11.7	44.4	8.4	11.1	32.1	9.3	10.3	10.8
2. Market value (Tk)	657.9	801.7	21.9	574	568.6	-0.9	650.7	662.6	1.8
3. Number raised /fattened for sale	0	3.2	100.0	0	2.2	100.0	0	2.4	100.0
Others									
1. Average number	0.2	0.2	0.0	0.2	0.1	-50.0	0.2	0.1	-50.0
2. Market value (Tk)	6.7	9.9	47.8	12.9	9.6	-25.6	5.2	5	-3.8
3. Number raised /fattened for sale									
All Livestock/Poultry: Average market value/hh	10435.4	11967.0	14.7	10276.3	8345.2	-18.8	14720.7	10641.6	-27.7
N	1380			421			690		

Table 4.3.45(b): Changes in the percent of households reporting ownership of selected agricultural equipments, household durables, and other capital assets: 1997-2002

Types of assets	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% change	1997	2002	% change	1997	2002	% change
1. Power tiller	2.7	5.1	89.2	2.4	1.9	-20.0	3.3	3.3	0.0
2. Plough	31.9	25.5	-20.0	28.7	25.2	-12.4	35.8	32.0	-10.5
3. Irrigation equipment	10.9	19.9	82.1	5.5	7.8	43.5	11.3	19.1	69.2
4. Thresher	5.9	9.8	64.6	2.4	3.8	60.0	3.3	4.8	43.5
5. Dhenki	24.4	17.5	-28.5	18.5	15.2	-17.9	22.3	19.4	-13.0
6. Sugarcane crashing machine	1.1	0.9	-13.3	0.5	0.2	-50.0	0.1	0.4	200.0
7. Boat (traditional)	2.8	2.0	-26.3	2.6	3.3	27.3	2.6	2.0	-22.2
8. Boat (engine)	0.2	0.4	66.7	0.5	0.2	-50.0	0.6	0.7	25.0
9. Bullock carts	5.1	2.0	-61.4	3.1	1.7	-46.2	2.6	1.9	-27.8
10. Rickshaw/van	3.1	4.7	51.2	7.8	10.0	27.3	3.6	6.2	72.0
11. Motorcycle	2.6	4.1	58.3	0.2	0.5	100.0	1.0	1.3	28.6
12. Bicycle	39.5	48.8	23.5	23.5	28.5	21.2	33.8	45.7	35.2
13. Sewing machine	4.9	9.9	101.5	1.2	2.1	80.0	1.4	3.0	110.0
14. Fan	4.1	77.0	1763.2	0.5	2.1	350.0	0.7	2.0	180.0
15. Iron	2.2	27.9	1141.9	0.0	0.2	-	0.6	1.2	100.0
16. Toaster	0.0	0.3	-	0.0	0.0	-	0.0	0.0	-
17. Oven	0.0	0.2	-	0.2	0.2	0.0	0.0	0.0	-
18. Juice machine	0.1	2.3	1500.0	0.2	0.2	0.0	0.1	0.1	0.0
19. Heater	0.1	0.6	700.0	0.0	0.0	-	0.0	0.0	-
20. Refrigerator	0.0	4.9	-	0.0	0.0	-	0.0	0.0	-
21. Mobile phone	0.0	3.6	-	0.0	0.5	-	0.0	0.3	-
22. TV	6.4	51.2	702.3	2.4	6.2	160.0	3.8	10.0	165.4
23. Radio	20.3	24.6	21.1	18.1	22.6	25.0	23.2	32.6	40.6
24. Cassette Player	10.4	42.9	314.0	5.9	10.5	76.0	9.1	14.9	63.5
25. VCP/VCR	0.1	2.7	1750.0	0.0	0.2	-	0.3	0.4	50.0
26. Camera	1.5	6.0	295.2	0.7	1.4	100.0	1.3	2.5	88.9
27. Tubewell	55.1	73.5	33.2	35.4	53.0	49.7	45.7	61.9	35.6
28. Furniture	87.8	93.1	6.1	77.4	87.4	12.9	80.7	88.4	9.5
29. Handloom	1.0	1.0	0.0	1.0	1.0	0.0	1.2	1.0	-12.5
30. Rice Mill	0.6	1.4	137.5	0.5	0.2	-50.0	0.7	0.6	-20.0
31. Shop/godown	9.4	14.2	50.8	4.3	5.2	22.2	4.6	8.4	81.3
32. Industrial Unit	0.3	1.8	525.0	0.2	0.5	100.0	0.3	0.4	50.0
33. Raw materials	2.8	6.4	131.6	2.1	3.6	66.7	2.9	4.2	45.0
34. Cash in hand (capital)	29.1	41.2	41.6	19.7	31.1	57.8	24.1	33.5	39.2
35. Other investments	2.9	5.4	87.5	2.4	4.5	90.0	3.0	3.8	23.8
36. Others	3.3	7.2	117.4	2.6	4.5	72.7	3.6	6.5	80.0
37. Photostat machine	0.2	0.3	33.3	0.0	0.0	-	0.1	0.1	0.0
38. Deckset	0.0	0.1	-	0.0	0.0	-	0.0	0.0	-
39. Bus	0.0	0.1	-	0.0	0.0	-	0.0	0.0	-
40. Brick field	0.1	0.0	-100.0	0.0	0.0	-	0.0	0.0	-
N	1380			421			690		

Table 4.3.45 (c): Changes in the households economic strength in terms of agricultural equipments, household durables, and other capital assets during the last five years (1997 - 2002)

(average per hh)

Type of assets	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% change	1997	2002	% change	1997	2002	% change
1. Power tiller : Number	0.0	0.1	85.7	0.0	0.0	-25.0	0.0	0.0	11.5
Market value (Tk)	498.5	1187.8	138.3	205.7	312.9	52.1	636.8	653.9	2.7
2. Plough : Number	0.5	0.4	-18.1	0.3	0.3	-13.6	0.4	0.4	-15.1
Market value (Tk)	164.0	118.6	-27.7	83.3	70.0	-16.0	99.9	109.0	9.1
3. Irrigation equipment: Number	0.1	0.2	75.3	0.1	0.1	38.5	0.1	0.2	73.2
Market value (Tk)	1631.3	3148.5	93.0	596.2	1581.0	165.2	1205.6	2490.4	106.6
4. Thresher : Number	0.1	0.1	61.8	0.0	0.0	60.0	0.1	0.0	-5.6
Market value (Tk)	117.3	259.1	120.8	30.6	59.9	95.3	61.3	115.8	88.9
5. Dhenki : Number	0.2	0.2	-28.6	0.2	0.2	-17.7	0.2	0.2	-13.4
Market value (Tk)	94.0	52.3	-44.4	56.7	45.4	-19.9	73.3	61.3	-16.3
6. Sugarcane crashing machine : Number	0.0	0.0	-8.8	0.0	0.0	-50.0	0.0	0.0	200.0
Market value (Tk)	93.8	89.5	-4.6	33.3	10.7	-67.9	0.7	10.1	1300.0
7. Boat (traditional) : Number	0.0	0.0	-27.5	0.0	0.0	27.3	0.0	0.0	-26.3
Market value (Tk)	107.2	90.7	-15.5	30.9	36.6	18.5	163.0	108.7	-33.3
8. Boat (engine) : Number	0.0	0.0	100.0	0.0	0.0	-50.0	0.0	0.0	21.3
Market value (Tk)	5.7	22.4	297.2	51.1	19.0	-62.8	134.8	96.1	-28.7
9. Bullock carts : Number	0.1	0.0	-65.4	0.0	0.0	-46.2	0.0	0.0	-27.8
Market value (Tk)	198.4	65.4	-67.1	81.5	53.4	-34.4	53.7	45.9	-14.4
10.Rickshaw/van : Number	0.1	0.1	8.6	0.1	0.1	60.6	0.0	0.1	67.6
Market value (Tk)	145.9	299.1	104.9	235.2	524.9	123.2	124.2	203.2	63.6
11.Motorcycle : Number	0.0	0.0	61.1	0.0	0.0	0.0	0.0	0.0	12.5
Market value (Tk)	1013.8	2191.7	116.2	19.0	237.5	1150.0	459.4	626.1	36.3
12.Bicycle : Number	0.4	0.6	30.1	0.2	0.3	25.5	0.4	0.5	32.6
Market value (Tk)	625.4	969.5	55.0	281.5	370.1	31.5	475.1	751.1	58.1
13.Sewing machine : Number	0.1	0.1	119.8	0.0	0.0	80.0	0.0	0.0	84.6
Market value (Tk)	179.5	287.8	60.4	29.2	146.6	401.6	31.2	65.4	110.0
14.Fan : Number	0.1	1.7	2153.4	0.0	0.0	300.0	0.0	0.0	137.5
Market value (Tk)	80.4	1743.2	2068.2	7.8	28.4	262.1	10.7	27.8	159.5
15.Iron : Number	0.0	0.3	1219.4	0.0	0.0	-	0.0	0.0	100.0
Market value (Tk)	14.6	179.6	1132.7	0.0	2.4	-	1.2	8.5	622.0
16. Toastter: Number	0.0	0.0	-	0.0	0.0	-	0.0	0.0	-
Market value (Tk)	0.0	5.7	-	0.0	0.0	-	0.0	0.0	-
17. Oven : Number	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	-
Market value (Tk)	0.0	8.2	-	3.8	1.9	-50.0	0.0	0.0	-
18. Juice machine : Number	0.0	0.0	1550.0	0.0	0.0	0.0	0.0	0.0	0.0
Market value (Tk)	2.2	40.4	1756.7	2.9	2.9	0.0	2.9	2.9	0.0
19.Heater : Number	0.0	0.0	700.0	0.0	0.0	-	0.0	0.0	-
Market value (Tk)	0.5	19.1	3655.7	0.0	0.0	-	0.0	0.0	-
20.Refrigerator : Number	0.0	0.1	-	0.0	0.0	-	0.0	0.0	-
Market value (Tk)	0.0	792.6	-	0.0	0.0	-	0.0	0.0	-
21.Mobile phone : Number	0.0	0.0	-	0.0	0.0	-	0.0	0.0	-
Market value (Tk)	0.0	546.7	-	0.0	1109.3	-	0.0	39.1	-
22.TV : Number	0.1	0.5	697.8	0.0	0.1	170.0	0.0	0.1	165.4
Market value (Tk)	337.7	3026.9	796.4	88.7	265.9	199.7	169.1	422.7	149.9
23.Radio : Number	0.2	0.3	20.3	0.2	0.2	28.9	0.2	0.3	38.1
Market value (Tk)	84.5	121.5	43.9	65.2	84.5	29.6	86.9	108.6	24.9

Type of assets	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% change	1997	2002	% change	1997	2002	% change
24.Cassette Player : Number	0.1	0.5	307.1	0.1	0.1	76.0	0.1	0.2	63.1
Market value (Tk)	204.9	974.9	375.8	116.2	228.7	96.9	176.2	223.1	26.7
25.VCP/VCR : Number	0.0	0.0	1850.0	0.0	0.0	-	0.0	0.0	50.0
Market value (Tk)	9.1	189.1	1971.2	0.0	2.4	-	6.5	32.6	400.0
26.Camera : Number	0.0	0.1	309.5	0.0	0.0	166.7	0.0	0.0	41.7
Market value (Tk)	86.9	136.8	57.5	9.5	36.8	287.5	30.0	54.2	80.7
27.Tubewell : Number	0.6	0.8	37.0	0.4	0.6	45.1	0.5	0.6	34.6
Market value (Tk)	837.6	1315.5	57.1	458.3	860.5	87.8	650.2	1165.6	79.3
28.Furniture : Number	6.2	9.4	52.9	3.7	5.4	46.7	4.5	6.4	43.5
Market value (Tk)	7910.9	15151.8	91.5	2857.1	4829.7	69.0	3957.7	5784.2	46.2
29.Handloom : Number	0.1	0.1	20.3	0.0	0.0	180.0	0.1	0.1	14.3
Market value (Tk)	136.7	304.6	122.9	70.1	95.0	35.6	78.3	116.7	49.1
30.Rice Mill : Number	0.0	0.0	150.0	0.0	0.0	-50.0	0.0	0.0	-20.0
Market value (Tk)	255.8	1358.7	431.2	142.5	118.8	-16.7	144.9	121.7	-16.0
31.Shop/godown : Number	0.1	0.3	104.2	0.0	0.1	22.2	0.1	0.1	69.4
Market value (Tk)	7806.2	25714.3	229.4	1118.8	1234.9	10.4	1724.1	2650.6	53.7
32.Industrial Unit : Number	0.0	0.0	500.0	0.0	0.0	0.0	0.0	0.0	50.0
Market value (Tk)	129.0	1064.5	725.3	47.5	38.0	-20.0	2181.2	333.3	-84.7
33.Raw materials :	0.0	0.0	-	0.0	0.0	-	0.0	0.0	-100.0
Market value (Tk)	438.5	2059.7	369.7	433.5	572.3	32.0	235.5	345.5	46.7
34.Cash in hand (capital) :									
Market value (Tk)	7387.3	11932.1	61.5	1211.4	2807.3	131.7	4993.6	7663.4	53.5
35.Other investments:									
Market value (Tk)	1483.4	4464.5	201.0	673.4	971.1	44.2	513.3	675.1	31.5
36.Others : Market value (Tk)									
Market value (Tk)	796.0	4452.2	459.3	669.5	662.1	-1.1	157.0	251.9	60.4
Photostat machine Number	0.0	0.0	200.0	0.0	0.0	-	0.0	0.0	0.0
Market value (Tk	10.3	134.9	1211.3	0.0	0.0	-	2.6	2.6	0.0
Deckset Number	0.0	0.0	-	0.0	0.0	-	0.0	0.0	-
Market value (Tk)	0.0	2.2	-	0.0	0.0	-	0.0	0.0	-
Brick field Number	0.0	0.0	-100.0	0.0	0.0	-	0.0	0.0	-
Market value (Tk)	108.7	0.0	-100.0	0.0	0.0	-	0.0	0.0	-
Bus Number	0.0	0.0	-	0.0	0.0	-	0.0	0.0	-
Market value (Tk)	0.0	32.6	-	0.0	0.0	-	0.0	0.0	-
All assets : Average Market value /hh	32995.9	84554.6	156.3	9710.1	17420.9	79.4	18641.0	25367.4	36.1
N	1380			421			690		

Table 4.3.46: Changes in the overall economic strength of households in terms of own assets during the last five years (1997-2002) (property valuation)

(present market value:Tk / household)

Type of assets	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% change	1997	2002	% change	1997	2002	% change
1. Cultivable land	399816.8	458779.7	14.7	198435.6	193419.9	-2.5	289704.1	304220.2	5.0
2. Pond	33019.0	42748.4	29.5	30539.0	35945.6	17.7	19657.7	21594.9	9.9
3. Ditch/fallow	11958.4	12583.2	5.2	7257.2	7456.7	2.7	9062.6	8689.4	-4.1
4. Homestead	149259.4	157339.1	5.4	97245.0	92992.3	-4.4	86536.1	102949.5	19.0
5. Kitchen gardening	20698.0	21966.3	6.1	11259.6	11762.5	4.5	10077.0	10719.8	6.4
6. Dwelling rooms	67634.6	74158.6	9.6	21594.9	27192.0	25.9	31684.1	42957.4	35.6
7. **Non-dwelling rooms**	7240.1	11106.4	53.4	2519.4	3825.4	51.8	4006.1	5382.0	34.3
8. All Livestock/Poultry	10435.4	11967.0	14.7	10276.3	8345.2	-18.8	14720.7	10641.6	-27.7
9. Other Capital assets	32995.9	84554.6	156.3	9710.1	17420.9	79.4	18641.0	25367.4	36.1
All assets (average hh)	733057.4	875203.2	19.4	388837.2	398360.4	2.4	484089.4	532522.2	10.0
N	1380			421			690		

Table 4.3.47: Pattern of distribution of households iby asset group at present (now) and 5 years ago

(% households)

Assets group(s):	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% (point) change: 2002 compared to 1997	1997	2002	% (point) change: 2002 compared to 1997	1997	2002	% (point) change: 2002 compared to 1997
Tk. <=50,000	6.4	3.7	-42.0	21.4	19.7	-7.8	15.2	11.4	-24.8
Tk. 50,001-100,000	9.2	7.5	-18.9	14.3	14.5	1.7	12.0	13.3	10.8
Tk. 100,001-150,000	7.1	5.1	-28.6	10.7	9.7	-8.9	7.5	6.8	-9.6
Tk. 150,001-200,000	5.9	5.7	-2.5	7.1	7.1	0.0	7.8	8.4	7.4
Tk. 200,001-250,000	5.5	6.1	10.5	5.7	5.2	-8.3	6.4	5.9	-6.8
Tk. 250,001-300,000	6.2	5.8	-7.0	5.2	3.8	-27.3	7.4	4.8	-35.3
Tk. 300,001-350,000	5.3	4.2	-20.5	5.2	6.2	18.2	4.1	5.4	32.1
Tk. 350,001-400,000	3.7	3.6	-2.0	4.3	5.5	27.8	4.3	5.5	26.7
Tk. 400,001-450,000	4.9	4.1	-14.9	3.3	4.3	28.6	3.0	4.8	57.1
Tk. 450,001-500,000	3.3	3.6	8.9	3.1	3.6	15.4	2.6	2.8	5.6
Tk. 500,001-550,000	2.0	2.8	40.7	1.2	2.4	100.0	2.3	2.6	12.5
Tk. 550,001-600,000	2.8	4.0	41.0	2.6	1.9	-27.3	2.8	2.5	-10.5
Tk. 600,001-650,000	3.0	2.8	-9.5	1.9	1.0	-50.0	2.5	1.2	-52.9
Tk. 650,001-700,000	3.0	3.0	0.0	1.0	1.4	50.0	1.3	2.3	77.8
Tk. 700,001-750,000	2.0	1.6	-21.4	2.1	1.2	-44.4	3.0	1.6	-47.6
Tk. 750,001-800,000	2.0	2.6	28.6	1.4	0.7	-50.0	1.0	1.6	57.1
Tk. 800,001-850,000	2.1	2.6	24.1	1.0	0.7	-25.0	1.4	1.4	0.0
Tk. 850,001-900,000	1.2	2.0	64.7	0.2	0.7	200.0	1.9	1.9	0.0
Tk. 900,001-950,000	1.9	2.2	19.2	0.5	-	-	1.3	1.3	0.0
Tk.950,001-1000,000	1.2	1.4	17.6	0.7	1.4	100.0	1.0	1.0	0.0
Tk.1000,001 and above	21.2	25.6	20.5	7.1	9.0	26.7	11.0	13.5	22.4
Total	100	100		100	100		100	100	
Average assets value (Tk)	733057.4	875203.2	19.4	388837.2	398360.4	2.4	484089.4	532522.2	10.0
N	1380			421			690		

Note: *Assets including movable and non-movable assets, such as agricultural land, pond, ditches, homestead with dwelling and non-dwelling rooms, livestock, poultry (and other animal assets),other capital assets (agricultural, household, business, industry) etc.*

Table 4.3.47(b): Changes in the average total assets (in Tk) by asset groups during last five years

Assets group(s):	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	1997	2002	% (point) change: 2002 compared to 1997	1997	2002	% (point) change: 2002 compared to 1997	1997	2002	% (point) change: 2002 compared to 1997
Tk.250,000 (<u>Low</u>)	34.1	28.0	-17.9	59.1	56.3	-4.7	49.0	45.9	-6.3
Tk.250,001-750000 (<u>Medium</u>)	36.2	35.4	-2.2	29.9	31.1	4.0	33.3	33.3	0.0
750001 –and above (<u>High</u>)	29.7	36.5	22.9	10.9	12.6	15.6	17.7	20.7	16.9
Average assets value (Tk)	733057.4	875203.2	19.4	388837.2	398360.4	2.4	484089.4	532522.2	10.0
N	1380			421			690		

Table 4.3.47(c): ALL Capital assets Group movement: Present-past

	Asset group(s)	Year 1997	HE	WE-EV	WE-NEV
Valuation of capital assets - 2002	Tk 250000 (<u>Low</u>)	250000 (<u>Low</u>)	92.5	94.5	93.7
		250001-750000(<u>Medium</u>)	5.9	5.1	6.3
		750001-above (<u>High</u>)	1.6	0.4	-
	Total		100 (387)	100(237)	100(317)
	Tk 250001-750000 (<u>Medium</u>)	250000 (<u>Low</u>)	18.6	19.1	14.8
		250001-750000(<u>Medium</u>)	77.1	78.6	80.4
		750001-above (<u>High</u>)	4.3	2.3	4.8
	Total		100 (489)	100(131)	100(230)
	Tk 750001-above (<u>High</u>)	250000 (<u>Low</u>)	4.2	-	4.9
		250001-750000(<u>Medium</u>)	19.8	20.8	17.5
		750001-above (<u>High</u>)	76.0	79.2	77.6
Total			100(504)	100(53)	100(143)

Table 4.3.47(d): ALL Capital assets Group movement: Past -present

	Asset group(s)	Year 2002	HE	WE-EV	WE-NEV
Valuation of capital assets - 1997	Tk 250000 (<u>Low</u>)	250000 (<u>Low</u>)	76.2	90.0	87.9
		250001-750000(<u>Medium</u>)	19.4	10.0	10.1
		750001-above (<u>High</u>)	4.5	-	2.1
	Total		100 (470)	100(249)	100(338)
	Tk 250001-750000 (<u>Medium</u>)	250000 (<u>Low</u>)	4.6	9.5	8.7
		250001-750000(<u>Medium</u>)	75.4	81.7	80.4
		750001-above (<u>High</u>)	20.0	8.7	10.9
	Total		100 (500)	100(126)	100(230)
	Tk 750001-above (<u>High</u>)	250000 (<u>Low</u>)	1.5	2.2	-
		250001-750000(<u>Medium</u>)	5.1	6.5	9.0
		750001-above (<u>High</u>)	93.4	91.3	91.0
Total			100(410)	100(46)	100(122)

4.4.1: Impact on Education: Table 4.4.1 - 4.4.11

Table 4.4.1: Educational status of household members (% hh population age 7 years and above) and overall literacy rate

Educational status	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
Illiterate	11.6	22.9	17.0	24.0	31.6	27.7	23.1	32.7	27.6
Informal education (non-formal, adult literacy, night-school	1.3	1.7	1.5	2.7	3.5	3.1	1.5	2.3	1.9
Up to primary level (class 5)	36.1	37.4	36.7	42.2	42.6	42.4	43.2	41.4	42.3
Up to junior secondary level (Class 8)	16.7	19.0	17.8	16.2	13.6	14.9	13.0	14.2	13.6
Up to class 10	21.0	14.6	18.0	11.8	7.0	9.5	13.7	8.1	11.1
SSC	.7	.4	.6	.1	.3	.2	.1	.1	.1
HSC	6.2	2.4	4.4	1.3	.5	.9	2.3	.8	1.6
Graduate and above	6.4	1.6	4.1	1.8	.8	1.3	3.3	.4	1.9
Total N	100 3750	100 3401	100 7151	100 977	100 924	100 1901	100 1768	100 1571	100 3339
Literacy rate (age 7 and above)	75.8	65.2	70.8	58.4	49.9	54.3	62.2	49.8	56.4
Levels (%) Primary	36.1	37.4	36.7	42.2	42.6	42.4	43.2	41.4	42.3
Secondary	38.4	34.0	36.4	28.1	20.9	24.6	26.8	22.4	24.8
Above	12.6	4	8.5	3.1	1.3	2.2	5.6	1.2	3.5

[Census Literacy = 7 years and above]

Table 4.4.1(b): Percentage of respondents reporting that all the children of their hhs in the age group 6-15 years go to school

Children 6-15 in school	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
% reporting all 6-15 go to school	93.5	89.5	86.7
N*	1024	313	520

N* = Number of households having children in the age group 6-15 years.

Table 4.4.2: Overall literacy rate by landownership groups (age 7 yrs and above)

Land ownership groups	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
Landless (0 to 49 decimals)	70.1	60.7	65.6	49.3	43.4	46.5	51.2	41.3	46.6
Marginal (50-149 decimals)	73.0	62.4	68.1	66.4	52.7	59.6	65.3	53.0	59.2
Small (150-249 decimals)	77.2	66.5	72.0	70.9	66.0	68.4	72.5	52.1	62.9
Medium (250-749 decimal)	83.8	72.4	78.4	71.7	57.5	65.1	74.2	60.3	67.9
Large (750 decimals)	88.6	74.8	81.9	80.0	80.0	80.0	78.4	70.0	74.6
Average rate	75.8	65.2	70.8	58.4	49.9	54.3	62.2	49.8	56.4

Table 4.4.3: Adult literacy rate by sex (age 15 years and above)

Sex: male/female	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Male	80.6	61.7	64.6
Female	64.8	47.2	48.6
Both	73.2	54.9	57.3
Mean years of schooling (ALL)	5.98	3.82	4.15
Mean years of schooling (literate only)	8.07	6.79	7.07

Table 4.4.3(b): Adult literacy rate by landownership status of households (age 15 yrs and above)

Land ownership group	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non- electrified villages)		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
Landless (0 to 49 decimals)	75.3	57.9	67.0	50.5	40.7	45.9	53.2	37.3	45.9
Marginal (50-149 decimals)	78.4	61.1	70.4	70.8	52.3	62.3	65.9	50.2	58.5
Small (150-249 decimals)	81.9	67.7	75.2	76.9	57.7	67.3	77.3	55.6	67.4
Medium (250-749 decimal)	86.8	74.2	81.0	77.3	54.0	66.7	77.0	62.1	70.4
Large (750 decimals and above)	92.0	76.5	85.0	80.0	75.0	77.8	78.0	74.2	76.4
All	80.6	64.8	73.2	61.7	47.2	54.9	64.6	48.6	57.3

Table 4.4.4: Gross enrolment ratio by sex
(% 5-25 years who are now enrolled in schools/college)

Sex: male/female	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Male	64.7	51.0	51.3
Female	62.5	58.9	57.0
Both	63.7	54.9	54.0
Mean years of schooling	5.31	3.96	4.09
N (Member)	3794	1085	1824

Table 4.4.5: Average annual and per capita household expenditure on education by male-female

Male-female	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Tk.	% total	Tk.	% total	Tk.	% total
Annual household expenditure						
Male	2136.6	65.5	791.2	57.1	1069.1	61.2
Female	1123.9	34.5	594.8	42.9	677.3	38.8
Both	3260.4	100	1386.0	100	1746.3	100
N	1380		421		690	
Per capita annual household expenditure						
Male	2343.8		1224.7		1505.4	
Female	1502.8		875.5		1069.4	
Both	1964.8		1045.7		1299.9	

Quality of Education: Tables 4.4.6-4.4.11

Table 4.4.6: Educational quality attainment: Average marks obtained in the last final examination by (grade) class and sex.

(% total marks obtained)

Grade/Class	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Boy	Girl	Boy	Girl	Boy	Girl
5	57.0	56.1	57.0	51.0	51.7	53.3
6	50.6	51.1	46.8	45.4	50.2	48.5
7	52.4	51.2	51.5	48.4	52.1	47.4
8	55.5	53.8	55.4	47.7	51.2	46.3
9	52.4	51.5	52.1	49.2	52.0	50.1
10	54.9	53.9	54.4	45.2	52.0	51.6
All grades average	53.8	53.0	53.6	48.3	52.4	49.6

Table 4.4.7: Households reporting about school dropout of children

Dropout of school	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
% HH reported dropout	19.6	24.7	28.3
Boys	15.8	20.0	22.2
Girl	8.3	8.1	11.3
N	1380	421	690

Table 4.4.8: (Average) School attendance rate for boys and girls (by sex) (last school month)

Sex	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Boys	85.3 (763)	79.8 (190)	84.3 (333)
Girl	86.2 (708)	85.4 (207)	79.7 (327)
Both	85.7 (1471)	82.7 (397)	82.0 (660)

N: Only those reported school attendance.*

Table 4.4.9: Whether women in **electrified** hh **assist** children with their education now more than before electrification

Selected indicators	Value
1. Number of hh reported having school going children	74.1
2. % women reported to give more time in assisting children's education compared to before electricity	50.5
N	1380
3. Average per day time devoted in assisting (min):	
Now	81.27
Before	44.29
Additional/extra time	37.0
% change (now compared to before)	83.5
N*	697

Table 4.4.10: Respondents reporting about improvement in education due to availability of electricity in HH (Electrified Household)

Selected indicators	Value
1. % reported electricity affected educational performance (n = 1380)	93.8
2. % reported about specific performance indicators: (n =1294)	
a) Attention and willingness to education have increased	98.9 (92.7)
b) Exam. result has improved	83.3 (78.1)
c) Attendance rate has improved	74.5 (69.9)
d) Dropout has decreased	58.5 (54.8)

Note: Parentheses against ' value' indicate % of total households/all respondents.

Table 4.4.11: Comparison of students time use pattern for study at night: electrified vis-a-vis non-electrified households

Male/female students	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. Average time spent on **study** after sunset (at night: between 6.00 evening and sleep) (in minutes)			
Male student	126.1 (n =824)	108.9 (n = 189)	112.0 (n =349)
Female student	125.9 (n=703)	97.3 (n=197)	106.2(n=323)
Both	126.0 (n =1527)	103.0 (n =386)	109.2 (n =672)

4.4.2. Impact on Health: Tables: 4.4.12 - 4.4.40

Table 4.4.12: Percentage distribution of women reported having knowledge about crucial public health issues

Public health issue(s)/area(s)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
01. Symptom of diarrhea	95.5	88.8	88.4
02. Preparation of ORS (LGS)	94.4	85.5	87.4
03. Symptoms of ARI	63.0	42.5	37.5
04. Child vaccination against 6 diseases	72.2	55.1	50.6
05. Place to go to for child's vaccination	92.3	83.4	82.8
06. Place to go to for ANC checkup	83.3	64.4	59.0
07. Five danger signs of pregnancy	46.6	22.6	20.6
08. Place to go to for EOC	74.9	50.1	47.0
09. Need for PNC checkup	53.1	22.1	24.5
10. Prevention of goitre using iodized salt	57.2	29.5	29.1
11. Three STDs (name)	22.9	6.9	5.4
12. Place to go to for STD treatment	26.7	11.2	7.8
13. (What is) HIV/AIDS	58.7	26.4	22.8
14. How HIV transmission can be stopped	51.3	21.9	19.6
15. Effect of arsenic in drinking water	69.1	43.2	38.0
16. Avoidance of arsenic problem	58.0	34.4	28.0
17. Reason for nightblindness in child	67.9	48.5	43.5
18. Place to go to for TB treatment	59.6	37.1	33.6
19. Place to go to for Leprosy treatment	48.8	30.4	23.8
20. Necessity to use sanitary latrine	85.7	72.7	66.7
N	1380	421	690

Table 4.4.13: Percentage distribution of women by their reporting about the main source of knowledge by specific public health issues

Public health issue(s)/area(s)	HH with electricity						HH without electricity (in electrified villages)						HH without electricity (in non-electrified villages)					
	Main sources of knowledge						Main sources of knowledge						Main sources of knowledge					
	Radio	TV	HFP Worker	PBS worker/advisor	Other	Total	Radio	TV	HFP Worker	PBS worker/advisor	Other	Total	Radio	TV	HFP Worker	PBS worker/advisor	Other	Total
01. Symptom of diarrhea	11.0	46.4	30.1	0.5	12.1	100	12.1	17.0	51.8	0.8	18.3	100	15.7	11.5	51.9	1.5	19.4	100
02. Preparation of ORS (LGS)	8.9	43.0	38.0	0.5	9.6	100	10.2	16.4	60.5	1.1	11.9	100	13.4	10.7	58.1	1.2	16.7	100
03. Symptoms of ARI	5.8	50.0	31.2	0.2	12.8	100	10.9	20.6	46.9		21.7	100	11.8	14.5	53.7		20.0	100
04. Child vaccination against 6 diseases	7.4	49.8	39.1	0.1	3.5	100	8.8	23.2	61.0	0.9	6.1	100	12.7	12.1	65.7	1.4	8.1	100
05. Place to go to for child's vaccination	3.9	36.3	53.8	0.6	5.5	100	4.4	16.9	69.1	0.6	9.0	100	7.4	9.0	73.1	0.5	9.9	100
06. Place to go to for ANC checkup	3.7	39.5	49.2	0.8	6.8	100	5.7	17.4	63.6	1.1	12.1	100	7.3	9.6	68.3	1.0	13.9	100
07. Five danger signs of pregnancy	9.0	53.5	29.0	0.5	8.0	100	15.4	22.0	46.2	2.2	14.3	100	11.6	13.8	58.7	1.4	14.5	100
08. Place to go to for EOC	5.6	43.3	41.8	0.4	9.0	100	6.8	18.9	58.7	1.0	14.6	100	8.2	9.8	60.9	1.6	19.6	100
09. Need for PNC checkup	7.1	51.6	33.1	0.4	7.8	100	11.6	26.7	52.3	1.2	8.1	100	15.9	14.6	57.3	1.8	10.4	100
10. Prevention of goitre using iodized salt	13.5	64.9	14.4	0.1	7.1	100	22.5	31.7	29.2	1.7	15.0	100	24.6	20.4	33.5	2.1	19.4	100
11. Three STDs (name)	6.7	68.3	13.1		11.9	100	14.3	42.9	28.6		14.3	100	22.2	27.8	27.8		22.2	100
12. Place to go to for STD treatment	5.7	61.7	23.8	0.3	8.5	100	4.4	37.8	40.0	2.2	15.6	100	19.6	25.5	35.3		19.6	100
13. (What is) HIV/AIDS	10.1	80.2	5.4		4.4	100	21.8	55.5	8.2	0.9	13.6	100	37.3	28.1	18.3	2.0	14.4	100
14. How HIV transmission can be stopped	10.4	79.5	5.3	0.3	4.6	100	23.9	50.0	13.0	2.2	10.9	100	35.3	27.8	18.8	1.5	16.5	100
15. Effect of arsenic in drinking water	10.2	68.6	12.2	0.6	8.3	100	18.0	38.8	27.5	1.7	14.0	100	18.8	21.2	31.8	3.1	25.1	100
16. Avoidance of arsenic problem	10.0	68.3	13.1	0.5	8.1	100	23.4	30.5	30.5	0.7	14.9	100	22.8	23.9	28.3	1.6	23.4	100
17. Reason for nightblindness in child	11.7	56.5	23.3	0.1	8.4	100	19.5	28.2	38.5		13.8	100	20.3	15.8	40.9	1.7	21.3	100
18. Place to go to for TB treatment	7.4	52.1	26.1	0.6	13.7	100	13.2	20.5	37.1	2.0	27.2	100	11.0	16.7	51.3	1.8	19.3	100
19. Place to go to for Leprosy treatment	8.1	53.8	24.9	0.3	12.9	100	13.6	22.4	37.6	4.0	22.4	100	10.7	18.2	47.8	1.9	21.4	100
20. Necessity to use sanitary latrine	10.2	48.8	27.6	0.3	13.0	100	11.6	21.6	41.2	2.0	23.6	100	19.4	10.8	46.6	0.9	22.3	100

Table 4.4.13(b): Source-co-efficient: Contribution by major sources of knowledge (about public health issue)

Public health issues	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Radio	0.08	0.14	0.17
TV	0.56	0.28	0.17
HFP Worker	0.27	0.42	0.46
PBS worker/advisor	0.00	0.01	0.01
Other	0.09	0.15	0.18
Total	1.00	1.00	1.00

Table 4.4.14: Percentage distribution of women reported having knowledge about crucial public health issues by number of such issues

Public health issue(s)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
% reported knowledge about:			
No issue	.1	1.2	1.3
Upto 5 issues	7.3	22.6	27.4
6-10 issues	23.0	45.4	46.2
11-15 issues	38.1	23.8	18.6
16-20 issues	31.4	7.1	6.5
Total	100	100	100
Average number of issues reported	12.8	8.8	8.2
N	1380	421	690

Table 4.4.15: Women's knowledge about twenty crucial public health issues: Overall knowledge coefficients by HH electrification status

Public health issues	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. Overall knowledge coefficient*	0.6406	0.43835	0.40805
2. % points gap from ideal knowledge (coefficient being 1)	0.3594	0.56165	0.59195
N	1380	421	690

Table 4.4.16: Women's overall knowledge coefficient on twenty crucial public health issues by economic status of households (landownership status)

Landownership status (cultivable land)	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Overall knowledge coefficient	% points gap from ideal	Overall knowledge coefficient	% points gap from ideal	Overall knowledge coefficient	% points gap from ideal
Landless (0 to 49 decimals)	0.61	0.39	0.41	0.59	0.36	0.64
Marginal (50-149 decimals)	0.65	0.35	0.45	0.55	0.42	0.58
Small (150-249 decimals)	0.66	0.34	0.50	0.50	0.45	0.55
Medium (250-749 decimal)	0.66	0.34	0.52	0.48	0.47	0.53
Large (750 decimals)	0.72	0.28	0.70	0.30	0.59	0.41
All categories	0.64	0.36	0.44	0.56	0.41	0.59
N	1380		421		690	

Table 4.4.17: Incidence of sickness (illness) among family members during last twelve months (last year)

Incidence of illness	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Male	1504	404	711
Female	1506	381	634
All	3010	785	1345
Average # sick/ill per HH	2.2	1.9	1.9
Average number of children <5 yrs. sick/ill per HH	0.3	0.3	0.3

Table 4.4.18: Pattern of sickness (disease pattern) among family members during last year (reported by the respondents)

Diseases/sickness	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	% reported	% of total sickness	% reported	% of total sickness	% reported	% of total sickness
Diarrhea	12.0	5.5	15.4	8.3	13.0	6.7
ARI	12.4	5.7	10.9	5.9	9.4	4.8
Chicken pox	3.5	1.6	2.6	1.4	3.9	2.0
TB	1.8	0.8	1.4	0.8	1.4	0.7
Tetanus	0.3	0.1	0.5	0.3	0.1	0.1
ENT	10.6	4.9	8.1	4.3	7.0	3.6
Whooping cough	4.3	2.0	3.1	1.7	3.5	1.8
Typhoid	12.8	5.8	10.0	5.4	10.1	5.2
General fever	68.6	31.5	58.4	31.3	66.1	33.9
Pain	34.6	15.9	30.9	16.6	35.7	18.3
Gastric/acidity	24.3	11.2	22.3	12.0	20.6	10.6
Skin and VD	15.1	6.9	9.5	5.1	11.3	5.8
Accidents/Fractures	1.8	0.8	1.4	0.8	1.3	0.7
Skin diseases	0.9	0.4	0.5	0.3	1.2	0.6
Heart diseases	4.6	2.1	4.3	2.3	2.8	1.4
Weakness/paralysis	1.8	0.8	0.7	0.4	1.2	0.6
Diabetes	1.2	0.5	0.7	0.4	0.7	0.4
Jandice	0.9	0.4	1.2	0.6	2.0	1.0
Tumer	0.4	0.2	0.7	0.4	0.1	0.1
Kidney problems	0.9	0.4	1.0	0.5	0.6	0.3
Utrerine Infection	0.4	0.2	0.0		0.0	
Others	4.3	2.0	2.9	1.5	2.8	1.4
DK	0.6	0.3	0.0	0.0	0.1	0.1
Total (N)	1380	100 (n=3010)	421	100 (n=785)	690	100 (n=1345)

Table 4.4.19: Pattern of nature of availing treatment while sick during last year (treatment pattern by sex)

Treatment availed from	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
Did nothing	.7	.4	.5	1.0	1.3	1.1	2.0	1.4	1.7
Treatment availed from:									
MBBS doctor	55.0	49.2	52.1	41.3	33.9	37.7	42.9	36.6	39.9
Paramedic/nurse/MA	4.1	5.1	4.6	5.0	6.8	5.9	3.5	3.3	3.4
Homeopath	2.8	4.2	3.5	5.2	5.8	5.5	4.9	6.8	5.8
Kabiraj/Ayurved	1.2	1.6	1.4	1.7	1.8	1.8	2.0	3.8	2.8
Village doctor/Palli Chikitchak	25.6	30.5	28.0	30.0	37.8	33.8	29.7	35.2	32.3
Quack	9.9	8.8	9.3	15.1	11.3	13.2	14.2	12.5	13.4
Spiritual	.8	.2	.5	.7	1.3	1.0	.8	.5	.7
Treated by:									
Medically competent persons	59.0	54.3	56.7	46.3	40.7	43.6	46.4	39.9	43.3
Not competent persons	40.3	45.3	42.8	52.7	58.0	55.3	51.6	58.7	54.9
N (total number of reported sick persons)	1504	1506	3010	404	381	785	711	634	1345

Table 4.4.20: Incidence of sickness and treatment availed during last year by landownership status

Landownership group	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Average # persons sick	% availed services from medically competent persons[1>]	Average # persons sick	% availed services from medically competent persons	Average # persons sick	% availed services from medically competent persons
Landless (0 to 49 decimals)	2.2	54.7	1.9	39.0	2.0	42.5
Marginal (50-149 decimals)	2.2	58.9	1.8	44.1	1.9	39.2
Small (150-249 decimals)	2.1	58.3	1.7	53.7	1.8	49.3
Medium (250-749 decimal)	2.2	55.2	1.9	63.3	2.1	42.8
Large (750 decimals)	2.2	64.0	2.0	100.0	2.3	64.3
All	2.2	56.7	1.9	43.6	1.9	43.3

[1>] *Note: Medically competent persons (MCH) include MBBS doctor, FWV, Nurse, MA, SACMO.*

Table 4.4.21: Percentage distribution of respondents by their reporting about persons attended the last child delivery (delivery care assistance)

Person(s) attended last child delivery	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Types			
TTBA	23.7	18.0	14.1
UTBA	39.1	45.1	51.4
MBBS	5.2	1.0	1.5
FWV/Nurse/MA/SACMO	7.1	4.0	2.3
Neighbor/relative	24.5	31.1	30.7
Other	.5	.8	
Total	100	100	100
% reported delivery by medically competent person[1>]	12.3	5.0	3.8
% reported delivery by trained[2>] person (above + TTBA)	36.0	23.1	17.9
N (number reported last delivery)	1325	399	659

[1>] *Note: Medically competent persons (MCH) include MBBS doctor, FWV, Nurse, MA, SACMO.*

[2>] *Trained persons include MCP plus TTBAs.*

Table 4.4.21(b): Percentage distribution of respondents by landownership groups by their reporting about share of last deliveries (child) attended by trained persons

Landownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	30.4	18.9	14.7
Marginal (50-149 decimals)	36.3	24.5	14.5
Small (150-249 decimals)	43.6	33.3	24.0
Medium (250-749 decimal)	35.3	36.7	28.4
Large (750 decimals)	67.5		25.0
All groups average	36.0	23.1	17.9

Table 4.4.22: ANC, PNC, TT immunization: Status of accessing/availing services of medically competent persons for ANC checkup during last pregnancy, for PNC checkup after the last delivery, and received TT immunization in last delivery

ANC/PNC checkup by medically competent persons	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. % availed ANC checkup during last pregnancy	45.7	30.8	25.3
2. % received TT in last delivery	75.2	68.9	66.6
3. % availed PNC checkup after last delivery/child birth	28.4	13.0	17.1
N (number reported last pregnancy/delivery)	1325	399	659

Table 4.4.23: Status of accessing ANC, PNC checkups and TT immunization (in last delivery) by landownership groups

Landownership groups	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	% availed ANC checkup	% availed PNC checkup	% received TT	% availed ANC checkup	% availed PNC checkup	% received TT	% availed ANC checkup	% availed PNC checkup	% received TT
Landless (0 to 49 decimals)	40.9	25.6	73.7	27.6	10.5	66.7	22.1	15.1	66.2
Marginal (50-149 decimals)	43.4	24.5	74.1	29.4	16.7	70.6	27.7	17.9	68.2
Small (150-249 decimals)	54.8	34.6	77.7	35.9	15.4	69.2	22.7	21.3	65.3
Medium (250-749 decimal)	47.8	31.3	75.5	53.3	16.7	80.0	31.8	19.3	67.0
Large (750 decimals)	65.0	45.0	90.0				33.3	16.7	62.5
All categories	45.7	28.4	75.2	30.8	13.0	68.9	25.3	17.1	66.6
N (number reported last pregnancy/delivery)	1325			399			659		

Table 4.4.24: Maternal morbidity and treatment by medically competent persons: percentage reported maternal morbidity associated with last pregnancy and treatment of the same by medically competent persons

Timing of maternal morbidity (MM), and status of treatment by medically competent persons (MCP)	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	%	N	%	N	%	N
% reported MM during pregnancy	12.5	1283	10.7	391	13.7	621
of those reported treatment by MCP	82.0	161	52.4	42	48.2	85
% reported MM during delivery	11.8	1284	12.8	391	13.1	625
of those reported treatment by MCP	82.1	151	54.0	50	54.9	82
% reported MM in 42 days after delivery	7.9	1281	9.2	390	8.9	621
of these treatment by MCP	80.2	101	47.2	36	61.8	55

Table 4.4.25: Maternal morbidity (MM) and treatment by medically competent persons (MCP) by landownership groups

Landownership group	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	% reported any MM in last pregnancy	% availed treatment of MCP in MM	% reported any MM in last pregnancy	% availed treatment of MCP in MM	% reported any MM in last pregnancy	% availed treatment of MCP in MM
Landless (0 to 49 decimals)	21.3	79.2	21.1	56.3	21.3	57.4
Marginal (50-149 decimals)	20.2	75.7	26.3	53.8	27.0	52.3
Small (150-249 decimals)	21.0	89.7	18.4	71.4	26.0	57.9
Medium (250-749 decimal)	22.3	83.6	10.0	0.0	30.1	44.0
Large (750 decimals)	32.5	100.0	-	-	12.5	66.7
All	21.5	81.7	21.3	54.8	24.2	53.9

Table 4.4.26: Infant mortality rate (last twelve months preceding interviews)

Childbirth and infant death (age less than 1yr.)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. Total number of childbirth during last 12 mo's (still births excluded)	1850	465	831
2. Infant death during last 12 mo's	79	25	48
3. Infant mortality ratio (infant deaths/1000 live births)	42.7	53.8	57.8

Note: ***Against each sample household two non-sample household of the same category (as the sample household) having incidence of child birth during the last 12 mo's were enquired. For later households enquiry was made about child birth and alive/dead status of those born during the last 12 months. Still births were not considered; and possibility of double counting was avoided through checking and rechecking by the filed supervisions and quality control officers.***

Table 4.4.27: Immunization (EPI) status of children (11-23 months) by sex

Sex/immunization status	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Boy			
Fully immunized	64.5	48.6	31.7
Partially immunized	32.7	45.7	61.0
Not immunized	2.8	5.7	7.3
Total	100.0	100	100
n	107	35	41
Girl			
Fully immunized	56.2	60.6	40.9
Partially immunized	39.3	36.4	52.3
Not immunized	4.5	3.0	6.8
Total	100	100	100
n	89	33	44
All (Boy & Girl)			
Fully immunized	60.7	54.4	36.5
Partially immunized	35.7	41.2	56.5
Not immunized	3.6	4.4	7.1
Total	100	100	100
n	196	68	85

Table 4.4.27(b): Immunization status of 11-23 months children by landownership group of households

Landownership group	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	Fully immunized	Partially immunized	Not immunized	Fully immunized	Partially immunized	Not immunized	Fully immunized	Partially immunized	Not immunized
Landless (0 to 49 decimals)	52.2	40.3	7.5	40.0	52.5	7.5	28.9	57.9	13.2
Marginal (50-149 decimals)	61.2	38.8		82.4	17.6		50.0	50.0	
Small (150-249 decimals)	65.4	34.6		80.0	20.0		36.4	63.6	
Medium (250-749 decimal)	66.7	29.4		50.0	50.0		27.3	63.6	
Large (750 decimals)	100.0						66.7	33.3	
All categories	60.7	35.7	3.6	54.4	41.2	4.4	36.5	56.5	7.1

Table 4.4.27(c): Full immunization status of 11-23 months children by sex by landless and marginal landownership groups

Landless and marginal/sex	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless			
Boy	64.7	35.0	21.4
Girl	39.4	45.0	33.3
Marginal			
Boy	61.3	77.8	55.6
Girl	61.1	87.5	46.2

Table 4.4.28: Status of intake of Vit-A Capsule to prevent nightblindness by children <5 years during last 6 month

Number by sex and by intake of VAC in last 6 months	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Boy			
Number	381	126	189
Number taken VAC in last 6 month	358	111	163
% taken VAC	94.0	88.1	86.2
Girl			
Number	422	124	181
Number taken VAC in last 6 month	355	103	157
% taken VAC	84.1	83.1	86.7
Both			
Number	803	250	370
Number taken VAC in last 6 month	713	214	320
% taken VAC	88.8	85.6	86.5

Table 4.4.29: Percentage of children <5 years of age who were given VAC during last 6 mo's to prevent nightblindness by landownership groups

Landownership groups	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)		
	% given VAC during 6 months			% given VAC during 6 months			% given VAC during 6 months		
	Boy	Girl	Both	Boy	Girl	Both	Boy	Girl	Both
Landless (0 to 49 decimals)	91.9	82.8	87.1	85.0	78.3	81.9	85.2	81.9	83.5
Marginal (50-149 decimals)	98.8	86.0	91.8	87.5	91.2	89.7	88.0	91.7	89.8
Small (150-249 decimals)	96.2	80.3	87.6	100.0	100.0	100.0	81.3	93.3	87.1
Medium (250-749 decimal)	91.8	85.4	88.6	100.0	80.0	89.3	84.6	94.7	88.9
Large (750 decimals)	92.9	92.9	92.9				100.0	80.0	92.9
All categories	94.0	84.1	88.8	88.1	83.1	85.6	86.2	86.7	86.5

Table 4.4.30: Contraceptive prevalence rate by methods (current use of Family Planning)

Contraceptive use status/method	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
FP Method			
Oral Pill	45.1	40.1	38.4
Condom	5.8	3.1	2.4
Injectable	8.7	9.7	11.1
IUD	.6	.8	.2
Norplant	.2	.8	.8
Tubectomy	3.4	3.9	5.0
Vasectomy			.2
Traditional	3.9	4.5	3.7
All	**67.7**	**62.8**	**61.7**
Method by group			
Clinical	12.9	15.2	17.3
Non clinical	54.8	47.7	44.5
Longer acting (IUD, Tub., Vas., Norp.)	4.2	5.5	6.2
Non-user	**32.3**	**37.2**	**38.3**
All	100	100	100
MWRA (N)	1231	382	622

Table 4.4.30 (b): Contraceptive method mix

Methods	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
FP Method			
Oral Pill	66.5	63.8	62.2
Condom	8.6	5.0	3.9
Injectable	12.8	15.4	18.0
IUD	.8	1.3	.3
Norplant	.4	1.3	1.3
Tubectomy	5.0	6.3	8.1
Vasectomy			.3
Traditional	5.8	7.1	6.0
All	100	100	100
Method by group			
Clinical	19.0	24.3	28.0
Non clinical	80.9	75.9	72.1
Longer acting (IUD, Tub., Vas., Norp.)	6.2	8.9	10.0
All	100	100	100
MWRA (N)*	834	240	384

N=those reported FP method use*

Table 4.4.31: Contraceptive prevalence rate (CPR) and total fertility rate (TFR) by landownership groups

Landownership group	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	CPR	TFR*	CPR	TFR*	CPR	TFR*
Landless (0 to 49 decimals)	65.7	2.7	63.0	2.9	55.0	3.4
Marginal (50-149 decimals)	66.4	2.6	62.9	2.9	71.3	2.3
Small (150-249 decimals)	70.9	2.3	70.3	2.4	59.1	3.1
Medium (250-749 decimal)	68.8	2.5	50.0	3.7	67.1	2.6
Large (750 decimals)	83.8	1.5	**	**	61.9	2.9
All	67.7	2.5	62.8	2.9	61.7	2.9

* *TFR has been estimated using Mauldin's estimation methodology (see: Maulding WP, C Olson, D Gupta, J Gowley and M Schaub 1992: Contraceptive Requirements and Logistics Management in Pakistan, UNFPA, NY).*

** *Not reported due to low cell frequency.*

Table 4.4.32: Self-reported most influential factor prompted current use of FP (what prompted most the FP use) (Most important agent prompted/influenced FP use)

Most influential factor(s) prompted FP use	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Radio	5.2	3.8	4.7
TV	22.5	6.7	5.5
Health FP Worker	64.7	80.0	81.3
Husband/self	6.6	9.2	6.8
Relative/neighbour	0.5	0.4	1.6
MBBS doctors	0.4		0.3
NR	0.1		
All	100	100	100
N (Current users)	834	240	384

Table 4.4.33: Self-reported intention/non intention to use FP in the future (for those who are not using currently)

Intention/non intention status	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Intend to use	33.2	38.0	26.5
Not-intend to use	37.8	31.7	42.4
God knows	8.3	9.2	5.0
Don't know	20.7	21.1	26.1
All	100	100	100
# Current non-users (MWRA)	397	142	238

Table 4.4.33 (b): % Current non-users reported intention to use FP in the future or answered "God knows" about the future intention by landownership status

Landownership	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
% reported intention to use			
Landless	32.9	42.0	32.3
Marginal	36.0	30.6	16.3
Small	25.0	36.4	14.8
Medium	35.0	35.7	29.6
Large	33.3	-	25.0
% answered "God knows"			
Landless	4.7	4.9	4.7
Marginal	10.5	19.4	2.0
Small	6.3	-	7.4
Medium	13.8	14.3	11.1
Large	-	-	-

Table 4.4.34: Percentage of respondents by their reporting about source of drinking water

Source(s) of drinking water	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Tubewell	99.1	99.3	99.0
Well	.7	.5	.9
Pond/tank/river	.3	.2	.1
Total	100	100	100
N	1380	421	690

Table 4.4.35: Availability of latrine facility by type

Type of latrine	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Hygienic (Sanitary, water sealed closed)	61.1	29.0	31.7
Un-hygienic	33.7	51.8	47.5
Open	5.2	19.2	20.7
Total	100	100	100
N	1380	421	690

Table 4.4.35 (b): Availability of (access to) hygienic latrine in the households by landownership group

Landownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	52.5	24.3	27.3
Marginal (50-149 decimals)	58.4	24.3	26.4
Small (150-249 decimals)	68.7	38.5	34.6
Medium (250-749 decimal)	71.5	67.7	47.3
Large (750 decimals)	78.0	100.0	62.5
All	61.1	29.0	31.7

Table 4.4.35 (c): Percentage of households using open space for defecation by landownership groups

Landownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless	6.8	26.7	29.2
Marginal	6.8	11.2	20.2
Small	71.5	67.7	47.3
Medium	2.4	3.2	4.4
Large	-	-	-
All	5.2	19.2	20.7

Table 4.4.36: Percentage distribution of respondents by their reporting about type of hand washing materials usually use after defecation

Hand washing material(s) usually use after defecation	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Soap	65.5	29.0	32.8
Ash/mud	29.8	53.9	50.3
Nothing (only water)	4.7	17.1	17.0
Total	100	100	100
N	1380	421	690

Table 4.4.37: Self-reported influential factor/agent that prompted most in taking decision about type of hand washing material use after defecation

Most influential factor/agent	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Radio	11.7	14.3	15.7
TV	40.4	13.2	9.6
Health worker	24.1	41.5	38.9
Neighbor	17.3	25.5	30.7
Other	6.5	5.4	5.1
Total	100	100	100
N	1315	349	573

Table 4.4.37 (b): Percentage reported use of soap or ash/mud as handwashing material after defecation by landownership groups

Landownership group/handwashing materials	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless:			
Soap	60.7	25.9	25.7
Ash/mud	33.5	55.6	52.4
Marginal:			
Soap	64.9	27.1	28.7
Ash/mud	31.1	57.9	53.9
Small:			
Soap	69.2	46.2	46.2
Ash/mud	25.1	35.9	39.7
Medium:			
Soap	70.1	35.5	47.3
Ash/mud	26.4	51.6	47.3
Large:			
Soap	78.0	100.0	58.3
Ash/mud	19.5		41.7

Table 4.4.38: Percentage of respondents in landless and marginal landowning household reported the choice of use of soap or ash/mud was influenced by TV

Landless/marginal and choice of soap/ash/mud use prompted by TV	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless:			
Soap	43.4	12.7	11.0
Ash/mud	23.3	8.1	4.2
Marginal:			
Soap	51.7	37.9	7.8
Ash/mud	21.7	12.9	3.1

Table 4.4.39: Percentage of respondents by their reporting about regular use of soap for bathing by landownership groups

(% reported regular use)

Landownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	83.3	56.8	58.6
Marginal (50-149 decimals)	81.6	63.6	61.8
Small (150-249 decimals)	85.6	76.9	78.2
Medium (250-749 decimal)	83.7	83.9	73.6
Large (750 decimals)	90.2	100.0	83.3
All groups combined	83.5 (1380)	62.5 (421)	64.5 (690)

Table 4.4.40: Percentage reported that regular soap use for bathing was influenced by TV advertisement of the 'soap brand' in use

Influence of TV advertisement	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Yes	53.4	30.4	22.7
No (including do not know)	46.6	69.6	77.3
Total	100	100	100
N[1>]	1152	263	445

N= Only those reported regular use of soap for bathing

4.4.3: Impact on gender dimensions: Women's empowerment and changing status and modernization effects: Tables 4.4.41- 4.4.65(G)

Table 4.4.41: Percentage of households reported women's participation in income generation activities (IGA)

Involvement in IGA	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Involved	24.1	27.3	28.4
Not involved	75.9	72.7	71.6
Total	100	100	100
N	1380	421	690

Table 4.4.41(b): Percentage households reported women's involvement in handicraft, sewing **works at night** for income generation by landownership groups

Landownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	13.8	6.6	8.8
Marginal (50-149 decimals)	10.0	4.7	5.6
Small (150-249 decimals)	8.7		2.6
Medium (250-749 decimal)	9.4		2.2
Large (750 decimals)	14.6		4.2
Overall average	11.2	5.0	6.2
N	1380	421	690

Table 4.4.41(c): Percentage of households reported women's participation in IGA by landownership groups.

Landownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	24.7	28.0	28.8
Marginal (50-149 decimals)	25.9	29.0	31.5
Small (150-249 decimals)	25.1	17.9	24.4
Medium (250-749 decimal)	21.5	29.0	24.2
Large (750 decimals)	14.6		29.2
Overall average	24.1	27.3	28.4
N	1380	421	690

Table 4.4.41(d): Pattern of women's income generation activities (reported percentages for those involved in IGA)

Income generation activities: Type/category	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Handicrafts	27.9	31.3	29.1
Poultry/dairy rearing	58.0	56.5	60.2
Service (Teachers/Nurse)	9.0	6.1	9.2
Vegetables gardening	3.6	1.7	2.0
Agri-work	2.7	7.0	5.1
Household work/Home making	6.3	9.6	9.2
Tailoring/Shop keeper	4.2	3.5	8.2
TTBA	.3	.9	
Others	3.0	2.6	2.0
N	333	115	196

N = only those reported women's involvement in IGA

Table 4.4.42: Average number of women involved in IGA (last year) by landownership status of household

Landownership groups	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported	All	Reported	All	Reported	All
Landless (0 to 49 decimals)	1.19	.30	1.21	.34	1.18	.34
Marginal (50-149 decimals)	1.11	.28	1.20	.34	1.17	.35
Small (150-249 decimals)	1.24	.32	1.17	.18	1.21	.29
Medium (250-749 decimal)	1.23	.26	1.22	.35	1.19	.27
Large (750 decimals)	1.00	.12		.00	1.75	.58
Overall average	1.18 (332)	.28 (1380)	1.20 (113)	.32 (421)	1.21 (193)	.34 (690)

Table 4.4.42(b): Average number of person day's women was involved in IGA during last year by landownership status of households

Landownership groups	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported	All	Reported	All	Reported	All
Landless (0 to 49 decimals)	121.09	30.15	133.72	37.42	140.86	40.62
Marginal (50-149 decimals)	68.01	17.09	92.73	26.00	85.47	25.45
Small (150-249 decimals)	67.45	17.64	38.67	5.95	127.53	31.06
Medium (250-749 decimal)	94.02	20.24	46.67	13.55	86.33	19.92
Large (750 decimals)	147.40	17.98	-	.00	148.38	49.46
Overall average (person days in last year)	93.32	22.45	110.86	29.76	118.72	33.21
N	332	1380	113	421	193	690

Table 4.4.43: Women's earning (cash and kind combined) in the last year (% distribution by earner groups)

Income	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported	ALL	Reported	ALL	Reported	ALL
Less than Tk. 1000	35.1	84.3	40.0	83.6	34.2	81.3
1000-5000	42.6	10.3	40.0	10.9	34.7	9.9
5001 – 10,000	11.7	2.8	8.7	2.4	16.8	4.8
10,001 & +	10.5	2.5	11.3	3.1	14.3	4.1
Mean income	5271.18	1271.96	3667.85	1001.91	5393.70	1532.12
N	333	1380	115	421	196	690

Table 4.4.43(b): Share of women's earning (cash and kind combined) to the household earning in the last year by landownership groups

Landownership groups	HH with electricity			HH without electricity (in electrified villages)			HH without electricity (in non-electrified villages)`		
	Average of last year income			Average of last year income			Average of last year income		
	Women (Tk.)	HH Total (Tk.)	% Women to HH	Women (Tk.)	HH Total (Tk.)	% Women to HH	Women (Tk.)	HH Total (Tk.)	% Women to HH
Landless (0-49 dec)	1452.5	58863.7	2.5	1395.5	35104.4	4.0	1985.5	38989.2	5.1
Marginal (50-149 dec)	824.8	101918.4	0.8	577.2	44341.2	1.3	1313.0	46171	2.8
Small (150-249 dec)	1250.0	110820.2	1.1	266.4	47402.1	0.6	1358.5	76469.8	1.8
Medium (250-749 dec)	1137.1	108683.7	1.0	340.3	67986.5	0.5	550.8	84578.6	0.7
Large (750 dec)	4219.5	220985.5	1.9	.0	76000	0.0	1416.7	195164.7	0.7
Overall average (Tk.)	1272.0	92962.9	1.4	1001.9	41109.6	2.4	1532.1	56523.5	2.7
N	1380			421			690		

Table 4.4.44: Percentage distribution of income earning women by their reporting about decision making independence (freedom) to spend their earnings
(who decides/commands over spending women's earning)

Decision maker(s)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Woman herself	22.8	20.9	14.8
Husband only	6.6	13.9	25.0
Jointly with household	70.6	65.2	60.2
Total	100	100	100
N	333	115	196

Table 4.4.44(b): State of women empowerment in terms of independence/freedom in spending income earned by women (only those reported **she alone** decides) by landownership group

Decision maker(s)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	25.0	20.6	21.7
Marginal (50-149 decimals)	19.8	19.4	7.1
Small (150-249 decimals)	22.4	14.3	10.5
Medium (250-749 decimal)	25.8	33.3	13.6
Large (750 decimals)	-	-	-
Overall average (%)	22.8	20.9	14.8

Table 4.4.45: Percentage distribution of women who worked outside home by their reporting about wage discrimination

(% reported wage discrimination)

Wage discrimination	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Yes	29.8	57.7	51.4
No	70.2	42.3	48.6
Total	100	100	100
N	47	26	37

Table 4.4.45(b): Percentage reported existence of wage discrimination by those women who worked outside home by landownership status

(% reported wage discrimination)

Landownership status	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	46.4	71.4	61.5
Marginal (50-149 decimals)	33.3		25.0
Small (150-249 decimals)	-	-	-
Medium (250-749 decimal)	-	-	100.0
Large (750 decimals)	-	-	
Overall average (%)	29.8	57.7	51.4
N	47	26	37

Table 4.4.46: Women's reporting about membership in credit group

Membership status in credit group		HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Member		24.5	34.7	28.7
of which:	GO	12.7	12.3	16.2
	NGO	87.3	87.7	83.8
Not member		75.5	65.3	71.3
Total		100	100	100
N		1380	421	690

Table 4.4.46(b): Percentage distribution of women by landownership groups by membership in credit groups.

(% in the LG who are member)

Membership status in credit group	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	34.2	44.0	38.2
Marginal (50-149 decimals)	28.1	23.4	27.5
Small (150-249 decimals)	15.9	20.5	17.9
Medium (250-749 decimal)	12.5	19.4	11.0
Large (750 decimals)	2.4	-	12.5
Overall	24.5	34.7	28.7
n	1380	421	690

Table 4.4.46(c): Distribution of women in the credit groups by type of organization.

(multiple responses)

Credit organization: Type	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Gremeen Bank	23.4	19.9	25.3
ASA	20.1	19.9	11.6
BRAC	20.7	22.6	30.8
BRDB/Anser VDP/Social welfare	8.3	8.2	11.1
PROSHIKA	6.5	7.5	5.6
DUTCH-Bangladesh/KARITAS	3.3	1.4	.5
Krishi bank/Commercial Bank	4.4	4.1	5.1
Other NGO(Nizera kari, TMSS)	11.5	15.8	7.6
Local Samity	1.2	.7	.5
Others	.6	-	2.0
N	338	146	198

Table 4.4.46(d): Percentage and amount of credit taken by female members during last five years

Credit amount (last five years)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
No amount	12.4	8.2	10.1
Upto Tk.5000	24.0	28.8	31.3
5001-10,000	23.7	21.2	19.2
Tk.10001-20,000	18.6	21.9	21.7
Tk. 20,001+	21.3	19.9	17.7
Average amount (in Tk.): ALL Only those who have taken	19146.75 21863.51	15000.00 16343.28	13547.98 15070.22
Average amount from NGO (in Tk.): Only those who have taken	22488.89	16017.09	15270.97
N	338	146	198

Table 4.4.46(e): Annual average amount of credit taken by women by landownership groups (average of last five years)

Landownership group	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	5071.2	7331.3	4968.7
Marginal (50-149 decimals)	5024.3	1859.8	3778.1
Small (150-249 decimals)	8110.3	3859.0	3435.9
Medium (250-749 decimal)	1967.0	1903.2	1065.9
Large (750 decimals)	0.0	0.0	2500.0
Overall average: - all household - those reported receipt of credit	4689.6 21863.51	5201.9 16343.28	3887.7 15070.22

Table 4.4.47: Women's reporting about own savings

Having savings	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Yes	39.8	38.0	36.1
No	60.2	62.0	63.9
Total	100	100	100
N	1380	421	690

Table 4.4.47(b): Distribution of women by landownership groups by status of own savings

(% reported having savings)

Landownership group	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	40.9	46.5	41.1
Marginal (50-149 decimals)	44.3	29.9	37.1
Small (150-249 decimals)	40.5	23.1	24.4
Medium (250-749 decimal)	32.3	19.4	29.7
Large (750 decimals)	34.1	-	25.0
All	39.8	38.0	36.1

Table 4.4.47(c): Women's choice of using savings independently

Independent choice	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Yes	78.9	61.9	68.3
No	21.1	38.1	31.7
Total	100	100	100
N	549	160	249

Table 4.4.47(d): Relative independence enjoyed by women in spending the savings according to her choice by landownership groups

(% reported enjoying independence)

Landownership group(s)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	74.9	59.3	66.4
Marginal (50-149 decimals)	75.6	59.4	63.6
Small (150-249 decimals)	83.5	77.8	89.5
Medium (250-749 decimal)	89.2	100.0	77.8
Large (750 decimals)	78.6		50.0
All	78.9	61.9	68.3

Table 4.4.48: Women's spatial mobility: Percentage of women reported visit to selected facilities **alone**

(multiple responses)

Special mobility: areas	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Visit to health complex	70.7	68.4	62.9
Visit to shop	62.1	58.2	56.4
Visit to bazar	32.0	24.7	20.4
Visit to relatives	77.0	72.2	64.5
Visit to neighbor	92.8	94.1	92.9
Go to Cinema	5.9	3.3	2.8
Attend to women's group meeting	36.2	33.3	28.0
Go outside for work	14.1	13.3	7.7
N	1380	421	690

Table 4.4.48(b): Women's mobility score (co-efficient) by landownership groups

Landownership group(s)	Mobility scores (co-efficents)		
	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	0.492	0.451	0.439
Marginal (50-149 decimals)	0.506	0.473	0.397
Small (150-249 decimals)	0.473	0.446	0.412
Medium (250-749 decimal)	0.483	0.496	0.398
Large (750 decimals)	0.399	0.500	0.427
All	0.488	0.459	0.419
N	1380	421	690

Note: Women's mobility score ranges between 0 and 1, where `0' meaning absolute no mobility (i.e; women cannot do the work/visit facilities* ***alone****) and `1' meaning 100% independence/freedom in mobility (i.e; women can do all the works/visit facilities alone. Eight mobility items include: (1) Visit to nearest health complex, (2) Visit to nearest shop, (3) Visit to nearest bazar/hat, (4) Visit to neighboring village/ relatives, (5) Visit to neighbor, (6) Go to cinema, (7) Attend Women's Group Meeting (Credit group or others), (8) Go outside for work (for earning). All items carry equal weight; value for each item ranges from 0 to 1 (0% to 100 %). Mobility score is weighted score.

Table 4.4.49: Status of women's participation in decision making process: Whether husband consult on major decisions of the family

Frequency of consultation on major decision making	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Always	50.4	35.4	37.5
Some times	39.1	44.7	45.5
Never	5.1	14.0	11.3
Not currently married	2.5	3.8	3.5
NR	2.9	2.1	2.2
Total	100	100	100
N	1380	421	690

Note: *Only major decisions of the family were considered. Those include purchase/sale land, construction/repair houses, purchase/sale livestock, marriage, health, and education.*

Table 4.4.50: Women's participation in decision making on major family affairs**:** scores by landownership groups

Landownership group(s)	Score for participation in family decisions		
	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	.68	.55	.61
Marginal (50-149 decimals)	.70	.61	.60
Small (150-249 decimals)	.66	.60	.56
Medium (250-749 decimal)	.73	.65	.63
Large (750 decimals)	.84	.50	.54
All	.70	.58	.60

Note: *Participation score (co-efficient) ranges between 0 and 1, where `0' denotes `never consulted', `1' denotes consulted `always', and 0.5 denotes consulted `some times'. The participation score value is an weighted one. One minus the actual (constructed) score equals to the value indicating gap between the ideal and the actual situations. The hgiher is the gap the lower is the extent of participation.*

Table 4.4.51: (Health care disparity) Respondents reporting about who would they go first to for advice or treatment in case of sickness by sex

Medical Treatment: Facilities/persons	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Boys	Girls	Boys	Girls	Boys	Girls
Traditional healer	10.2	10.8	12.1	10.5	12.8	11.3
Govt. hospital/clinic	22.5	20.0	16.4	13.8	11.7	11.3
Private qualified doctor	25.6	22.9	15.0	13.5	18.8	17.4
Homeopath	2.8	3.3	6.2	5.9	5.4	5.5
Quack	38.0	42.1	48.7	53.7	50.4	53.2
Spiritual/religious healers	.1	.3	.5	1.2	.3	.4
Do nothing	.7	.6	1.2	1.4	.6	.9
Total	100	100	100	100	100	100
N	1380	1380	421	421	690	690

J. Equipments used for cooking, etc

Table 4.4.52: Equipment used most for cooking

Equipment for cooking	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Electric burner	.1	.2	-
Kerosene	.6	-	.3
Earth burner	95.7	96.4	96.2
Gas	1.8	.5	.1
Others	1.8	2.9	3.3
Total	100	100	100
N	1380	421	690

Table 4.4.53: Equipment used for rice husking

Equipment for rice husking	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Dhenki	3.1	6.7	2.5
Rice husking mills	78.4	71.3	55.7
Diesel run (mobile) machine	12.0	11.6	32.3
Others	6.5	10.5	9.6
Total	100	100	100
N	1380	421	690

Table 4.4.54: Equipment used for grinding spices

Equipment for grinding of spices	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Grinding mills	19.8	13.5	7.4
Grinding machine	8.3	8.6	5.7
By powdered species	14.3	10.0	11.2
Hire women worker	3.6	4.5	4.8
Do myself (manually as before)	54.0	62.7	70.3
Others	0.1	0.7	0.7
Total	100	100	100
N	1380	421	690

I. Electrified Households and Empowerment Issues

Table 4.4.55: **Electrified households** reporting about selected women's empowerment issues: reduction in hh workload, more leisure time to enjoy, more time for radio listening and TV watching, more time to assist children's education

Empowerment issues		**Value**
Women's household workload (hhwl)		
% reported reduction in hhwl		69.5
Average time/day hhwl reduced (hrs) : (now compared to before electricity)	All	0.82
	Only reported HH	1.36 (959)
Women's leisure time (LT)		
% reported increase in LT		72.5
Average time/day lt increased (minute):	All	73.53
	Only reported HH	99.67 (1000)
Women's time to radio listening (RL)		
% reported more time available for RL		30.4
Average time/day spent more for RL (min) :	All: Now	21.09
	All: Before	7.67
	Reported: Now	67.52
	Reported: Before	23.79
Women's time for watching TV (WTV)		
% reported more time available for WTV		65.3
Average time/day WTV more than before (min):	All: Now	59.14
	All: Before	5.28
	Reported: Now	89.30
	Reported: Before	7.91
Women's time for assisting children for education (ACE))		
% reported more time available for ACE		50.5
Average time/day devoting in ACE (minute):	All: Now	41.05
	All: Before	22.37
	Reported: Now	81.27
	Reported: Before	44.29
N		1380

m. Knowledge about gender equality issues

Table 4.4.56: Percentage of women reported having knowledge about selected gender equality issues

Gender equality issues	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. Equality of men and women in terms of access to resources	72.9	46.1	42.0
2. Equality of men and women in terms of employment, wage (non discrimination)	72.0	49.4	38.7
3. Women trafficking: Punishable criminal offence	80.4	48.5	37.0
4. Child trafficking: Punishable criminal offences	80.9	49.6	36.8
5. Acid throwing: Punishable criminal offence	80.9	49.9	39.7
6. Informed choice in family planning use	85.0	70.5	63.3
7. Equal rights of women and men to vote and participate in election	89.3	77.7	74.9
N	1380	421	690

Table 4.4.56(b): Main/major source of knowledge about selected gender equality issues

Gender equality issues	HH with electricity					HH without electricity (in electrified villages)					HH without electricity (in non-electrified villages)				
	Radio	TV	Neigbor/relative	NGO	Govt. worker	Radio	TV	Neigbor/relative	NGO	Govt. worker	Radio	TV	Neigbor/relative	NGO	Govt. worker
1. Equality of men and women in terms of access to resources	11.8	67.0	14.4	3.3	3.5	19.1	34.0	34.0	8.2	4.6	23.8	22.1	33.1	14.5	6.6
2. Equality of men and women in terms of employment, wage (non discrimination)	10.3	74.0	9.6	3.1	3.0	22.1	43.8	21.6	6.3	6.3	30.0	23.2	26.6	14.6	5.6
3. Women trafficking: Punishable criminal offence	10.0	69.2	14.6	3.3	2.9	17.2	34.8	31.4	9.8	6.9	29.8	20.0	31.4	12.2	6.7
4. Child trafficking: Punishable criminal offence	9.6	69.4	14.3	3.7	3.0	14.8	36.8	31.1	9.1	8.1	30.3	17.7	33.1	11.4	7.5
5. Acid throwing: Punishable criminal offence	9.2	72.3	12.4	3.2	2.9	17.6	40.0	27.6	6.7	8.1	27.0	23.0	32.8	10.2	6.9
6. Informed choice in family planning use	9.8	41.8	24.1	4.5	19.8	12.1	18.5	33.0	8.8	27.6	18.3	11.9	34.1	9.4	26.3
7. Equal rights of women and men to vote and participate in election	11.2	60.2	18.7	2.4	7.5	15.0	29.7	36.4	4.9	14.1	23.6	15.1	41.0	6.2	14.1

[Only those reported having knowledge about specific issues]

Table 4.4.56(c): Women's knowledge score (coefficient) of gender equality issues by landownership groups

Landownership group	Knowledge score (co-efficient) of gender equality issues		
	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	0.794	0.533	0.442
Marginal (50-149 decimals)	0.805	0.614	0.471
Small (150-249 decimals)	0.796	0.516	0.456
Medium (250-749 decimal)	0.811	0.618	0.568
Large (750 decimals)	0.840	1.000	0.643
Overall score	0.802	0.560	0.475

[Note: Individual issue value is either 0 or 1. The methodology is similar to that of presented under Table 4.4.48(a)]

n. Marriage with/without dowry

Table 4.4.57: Whether family tend to arrange marriage: prevalence of dowry

Tendency to arrange marriage with dowry	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Yes	15.1	18.5	23.9
No	84.9	81.5	76.1
Total	100	100	100
N	1380	421	690

Table 4.4.57(b): Women’s perception about negative impact of dowry on women’s situation

Negative impact of dowry on women’s situation	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Yes	88.8	80.0	79.4
No	4.9	7.4	8.1
DK	6.3	12.6	12.5
Total	100	100	100
N	1380	421	690

Table 4.4.58: Perception towards male/female education by landownership groups

(years of schooling)

Sex/Landownership group	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Boys	Girls	Boys	Girls	Boys	Girls
Landless (0 to 49 decimals)	13.03	10.73	11.87	9.38	11.71	9.03
Marginal (50-149 decimals)	13.81	11.40	12.59	10.00	12.46	9.32
Small (150-249 decimals)	13.90	11.56	13.28	10.85	12.99	9.56
Medium (250-749 decimal)	14.02	11.69	14.00	11.32	13.41	10.63
Large (750 decimals)	14.80	12.61	12.00	10.00	14.42	11.83
All group	13.62	11.28	12.34	9.82	12.37	9.47
N	*1380*	*1380*	*421*	*421*	*690*	*690*

Table 4.4.58 (b): Perception towards education by levels of education

(% women's reporting)

Level of education	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Boys	Girls	Boys	Girls	Boys	Girls
Primary	.5	6.3	3.3	14.5	2.6	19.1
Secondary	13.7	50.3	28.5	62.5	30.4	60.1
Higher secondary	18.4	14.9	23.3	10.2	22.8	10.0
Graduation	39.2	16.6	31.1	6.2	29.1	7.2
Post graduation	28.2	12.0	13.8	6.7	15.1	3.5
Total	100	100	100	100	100	100

Table 4.4.59: Perception towards place of girl's education

(% reporting)

Girls' education	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
At home	1.9	3.6	4.5
At school	98.1	96.4	95.5
Total	100	100	100
N	1380	421	690

Table 4.4.60: Perception about ideal age at marriage (in per cent)

Age at marriage (in years)	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Boys	Girls	Boys	Girls	Boys	Girls
10-12	.2	.9	1.2	1.2	.3	1.9
13-15	.1	4.4	.5	12.8	.6	14.8
16-18	1.3	49.9	2.6	58.7	3.5	54.2
19-21	15.1	34.2	26.1	22.6	23.8	22.9
22-24	13.0	5.7	14.7	2.1	13.8	3.0
25-27	46.2	4.4	38.2	1.9	40.4	2.3
28+	24.0	.5	16.2	.2	17.4	.6
DK			.5	.5	.3	.3
Total	100	100	100	100	100	100
% reported 18+ for girls		87.0		69.8		69.6
% reported 21+ for boys	87.8		72.7		74.9	
N	1380	1380	421	421	690	690

Table 4.4.60 (b): Perception about groom and bride's consent regarding their choice of marriage

(% reporting)

Groom/bride's consent for marriage	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Boys	Girls	Boys	Girls	Boys	Girls
Consulted	89.1	80.0	81.7	67.7	79.0	65.7
Not consulted	10.9	20.0	18.3	32.3	21.0	34.3
Total	100	100	100	100	100	100
N	1380	1380	421	421	690	690

Table 4.4.61: Perception about young girl's/women's job outside the village

(% reporting)

Allow to work outside the village	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Yes	52.7	39.4	37.8
No	47.3	60.6	62.2
Total	100	100	100
N	1380	421	690

Table 4.4.61 (b): Perception about permitting young girl/woman to work outside village by landownership groups

Landownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	46.1	36.6	35.7
Marginal (50-149 decimals)	56.8	43.0	39.3
Small 150-249 decimals)	53.3	38.5	28.2
Medium (250-749 decimal)	56.9	51.6	48.4
Large (750 decimals)	61.0		45.8
All	52.7	39.4	37.8

Table 4.4.62: Perception about ideal family size

(% Reporting)

Number of children a couple should have	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1	.2	.5	.6
2	71.3	61.8	59.3
3	17.7	24.2	22.9
4	9.9	11.9	16.1
5&+	.9	1.7	1.2
Total	100	100	100
Mean size	2.40	2.53	2.59
N	1380	421	690

Table 4.4.62 (b): Perception about mean ideal family size (number of children a couple should have) by landownership groups

Landownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	2.37	2.53	2.66
Marginal (50-149 decimals)	2.41	2.42	2.54
Small (150-249 decimals)	2.44	2.77	2.62
Medium (250-749 decimal)	2.40	2.58	2.42
Large (750 decimals)	2.37	2.00	2.50
All	2.40	2.53	2.59

Table 4.4.62 (c): Perception about spacing between child births

(% reporting)

Birth spacing (in years)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1	2.0	1.4	2.0
2	12.3	17.6	18.4
3	21.2	23.8	26.2
4	19.1	16.6	15.8
5	45.4	40.6	37.5
Total	100	100	100
Mean (years)	4.02	3.86	3.75
N	1380	421	690

Table 4.4.62 (d): Perception about mean years of spacing between child births by landownership groups

Landownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	3.98	3.81	3.66
Marginal (50-149 decimals)	3.94	3.82	3.83
Small (150-249 decimals)	4.01	3.87	3.73
Medium (250-749 decimal)	4.17	4.29	3.88
Large (750 decimals)	4.22	5.00	4.04
Overall mean	4.02	3.86	3.75

Radio

Table 4.4.63: Distribution of respondents having radio at home and whether listens to radio

Possession of radio and listening status	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Possession of radio			
Possess	24.6	22.6	32.6
Not possess	75.4	77.4	67.4
Total	100	100	100
N			
Listening status			
Listens	39.1	33.0	38.8
Not listens	60.9	67.0	61.2
Total	100	100	100
N	1380	421	690

Table 4.4.63 (b): Average time per day spent on radio listening

Average time/day (in minutes)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Don't listen	60.9	67.0	61.2
Upto 60	27.4	22.6	27.2
61-120	9.2	7.1	9.9
121-180	2.0	1.7	.6
181+	.5	1.7	1.2
Total	100	100	100
Average listening minutes: All	27.13	25.39	26.65
Only those who listens	69.47(539)	76.91 (139)	68.60 ((268)
N	1380	421	690

Table 4.4.63 (c): Average time spent on radio listening by women by landownership groups

(in minutes)

Landownership groups	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported	All	Reported	All	Reported	All
Landless (0 to 49 decimals)	75.9	30.46	78.6	20.39	72.4	23.61
Marginal (50-149 decimals)	69.7	30.15	67.1	28.85	66.4	25.74
Small (150-249 decimals)	63.4	25.69	75.7	29.10	65.0	26.67
Medium (250-749 decimal)	63.0	20.57	101.0	48.87	68.7	38.52
Large (750 decimals)	50.0	13.41	0.0	.00	57.5	28.75
Overall	69.5	27.13	76.9	25.39	68.6	26.65

Table 4.4.63 (d): Radio programs listened usually

(% reported listening: multiple responses)

Programs	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported HH	All HH	Reported HH	All HH	Reported HH	All HH
Folk song	38.4	15.0	51.8	17.1	46.3	18.0
Modern song	53.6	20.9	51.1	16.9	38.8	15.1
News	46.8	18.3	38.1	12.6	34.7	13.5
Drama	56.6	22.1	52.5	17.3	59.7	23.2
Health-nutrition related	51.8	20.2	46.8	15.4	49.3	19.1
Agriculture-related	10.6	4.1	12.9	4.3	13.8	5.4
Cinema ad.	27.5	10.7	38.1	12.6	30.6	11.9
Other entertainment	7.6	3.0	13.7	4.5	12.7	4.9
NA		60.9		67.0		61.2
N	539	1380	139	421	268	690

Table 4.4.63 (e): Modernization effect through radio listening: Percentage reported areas of knowledge gained through radio listening which were perceived as useful in life

(multiple responses)

Areas of knowledge	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported	All	Reported	All	Reported	All
Value of good health	63.6	24.9	56.1	18.5	53.7	20.9
Value of education	51.9	20.3	55.4	18.3	48.9	19.0
Value of female education	42.5	16.6	31.7	10.5	37.7	14.6
Utility of family planning	61.0	23.8	63.3	20.9	57.5	22.3
Development of knowledge-base through news	16.1	6.3	14.4	4.8	12.7	4.9
Improvement in Agriculture practice	10.4	4.1	10.8	3.6	11.6	4.5
Knowledge of modern fishing	9.3	3.6	10.8	3.6	5.6	2.2
Knowledge of pest management	1.3	.5	.7	.2	2.6	1.0
Govt. program for the distribution of *Khas* land	2.4	.9	3.6	1.2	1.9	.7
Prohibition of dowry	48.2	18.8	51.8	17.1	42.9	16.7
Laws about divorce	28.4	11.1	25.2	8.3	22.0	8.6
Legal tools to combat violence against women	31.9	12.5	26.6	8.8	26.1	10.1
Local governance issues	2.2	.9	4.3	1.4	.7	.3
Women's rights issues	20.2	7.9	12.2	4.0	12.3	4.8
Issues of human rights	7.6	3.0	4.3	1.4	3.4	1.3
Others	.9	.4	.7	.2	1.9	.7
NA		60.9		67.0		61.2
Mean number of issues reported	4.0	1.6	3.7	1.2	3.4	1.3
N	539	1380	139	421	268	690

Table 4.4.63 (f): Knowledge-score (coefficient) attributable to radio listening (total effect of 15 knowledge issues) by landownership groups

Landownership group(s)	Knowledge -score attributable to radio listening					
	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported	All	Reported	All	Reported	All
Landless (0 to 49 decimals)	.25	.10	.22	.06	.22	.07
Marginal (50-149 decimals)	.27	.12	.29	.12	.22	.08
Small (150-249 decimals)	.31	.12	.23	.09	.25	.10
Medium (250-749 decimal)	.26	.09	.27	.13	.23	.13
Large (750 decimals)	.20	.05	.	.00	.27	.13
Overall score	.27	.10	.25	.08	.23	.09

[Note: Each of the 15 items carry either '0' or 1 score. Knowledge score is sum total of scores obtained divided by 15]

TV

Table 4.4.65: Distribution of respondent having TV at home and whether watches TV

Possession of TV and watching TV	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Possession of TV			
Possess	51.2	6.2	10.0
Not possess	48.8	93.8	90.0
Total	100	100	100
N	1380	421	690
Watching TV			
Watches	70.1	30.2	17.4
Not watches	29.9	69.8	82.6
Total	100	100	100
N	1380	421	690

Table 4.4.65 (b): Average time per day spent on TV watching

Average time/day (in minutes)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Don't watch	29.9	69.8	82.6
Upto 60	31.1	24.0	11.7
61-120	31.2	4.5	3.9
121-180	6.8	1.7	1.6
181+	1.0	-	.1
Total	100	100	100
Average watching minutes:			
All	64.58	17.71	12.54
Only those who watch	92.17 (967)	58.69 (127)	72.08 (120)
N	1380	421	690

Table 4.4.65 (c): Average time per day spent on TV watching by landownership groups

(in minutes)

Landownership groups	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported	All	Reported	All	Reported	All
Landless (0 to 49 decimals)	90.2	59.21	63.0	19.17	57.7	9.41
Marginal (50-149 decimals)	93.6	66.80	45.6	13.64	69.8	10.98
Small (150-249 decimals)	97.9	67.26	45.9	12.95	95.9	13.53
Medium (250-749 decimal)	91.8	68.21	85.6	24.84	83.8	19.34
Large (750 decimals)	79.9	70.12	60.0	60.00	110.0	36.67
Overall	92.2	64.58	58.7	17.71	72.1	12.54

Table 4.4.65 (d): TV programs watched usually

(% reported watching: multiple responses)

Programs	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported	All	Reported	All	Reported	All
Folk song	23.3	16.3	13.4	4.0	12.5	2.2
Modern song	31.9	22.3	18.9	5.7	30.0	5.2
News	49.3	34.6	27.6	8.3	38.3	6.7
Drama	80.6	56.4	73.2	22.1	73.3	12.8
Health-nutrition related	42.5	29.8	28.3	8.6	28.3	4.9
Agriculture-related	9.0	6.3	14.2	4.3	17.5	3.0
Cinema	70.9	49.7	82.7	24.9	75.0	13.0
Other entertainment	14.5	10.1	12.6	3.8	15.0	2.6
NA		29.9		69.8		82.6
N	967	1380	127	421	120	690

Table 4.4.65 (e): TV cultural programs enjoy most

(% responses: multiple responses)

TV Programs	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported	All	Reported	All	Reported	All
Bangla drama/drama serial	80.9	56.7	72.4	21.9	66.7	11.6
Film	65.6	45.9	71.7	21.6	70.0	12.2
English drama/drama serial	5.7	4.0	5.5	1.7	1.7	.3
NA		29.9		69.8		82.6
N	967	1380	127	421	120	690

Table 4.4.65 (f): Modernization effect through TV viewing/watching: Percentage reported areas of knowledge gained through TV watching/viewing which were found/perceived useful in life

(multiple responses)

Areas of knowledge	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported	All	Reported	All	Reported	All
Value of good health	58.0	40.7	55.9	16.9	53.3	9.3
Value of Education	53.9	37.8	48.8	14.7	48.3	8.4
Value of female education	44.8	31.4	43.3	13.1	41.7	7.2
Utility of family planning	58.8	41.2	60.6	18.3	61.7	10.7
Dev..of knowledge base through news	16.9	11.8	7.9	2.4	11.7	2.0
Improvement in agricultural practice	11.9	8.3	8.7	2.6	12.5	2.2
Knowledge about modern fishing	8.2	5.7	5.5	1.7	5.0	0.9
Knowl. integrated pest management	2.8	2.0	.8	0.2	2.5	0.4
Govt. prog. about distr. of khas land	2.8	2.0	2.4	0.7	.8	0.1
Prohibition of dowry	44.6	31.2	38.6	11.6	33.3	5.8
Laws about divorce	24.2	17.0	24.4	7.4	9.2	1.6
Legal tools to combat VAW	39.1	27.4	28.3	8.6	25.8	4.5
Local governance issues	2.4	1.7			.8	0.1
Women's Right issues	22.3	15.7	15.7	4.8	20.0	3.5
Issues of human rights	12.6	8.8	7.1	2.1	7.5	1.3
Mina Cartoon	32.1	22.5	29.9	9.0	35.0	6.1
Others	.2	0.1	.8	0.2	1.7	0.3
NA		29.9		69.8		82.6
Mean number of areas reported	**4.35**	**3.1**	**3.79**	**1.1**	**3.71**	**0.6**
N	967	1380	127	421	120	690

Table 4.4.65 (g): Knowledge-score (coefficient) attributable to TV watching/viewing (total effect of 16 knowledge areas) by landownership groups

Landownership group(s)	Knowledge -score attributable to radio listening					
	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Reported	All	Reported	All	Reported	All
Landless (0 to 49 decimals)	.25	.16	.21	.06	.18	.03
Marginal (50-149 decimals)	.29	.21	.29	.09	.25	.04
Small (150-249 decimals)	.29	.20	.17	.05	.30	.04
Medium (250-749 decimal)	.28	.21	.34	.10	.29	.07
Large(750 decimals)	.26	.23	.13	.13	.27	.09
Overall score	.27	.19	.24	.07	.23	.04

Note: Each of the 16 items carry either '0' or 1 score. Knowledge score is sum total of scores obtained divided by 16

Table 4.4.65 (h): Preference of electrified or non-electrified households in arranging marriage of offspring (other things remaining equal)

(% respondent)

Preference	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Son	Daughter	Son	Daughter	Son	Daughter
Electrified	98.6	98.5	95.2	95.2	97.5	97.5
Non-electrified	1.4	1.5	4.8	4.8	2.5	2.5
Total	100	100	100	100	100	100

Impact on household time allocation: Tables 4.4.66 - 4.4.71(b)

Table 4.4.66: Daily average time between sunset (6 PM) and sleep by selected members of household (minutes/day after sunset)

Household member	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	Difference between electrified and non-electrified (%)	
				Village with electricity	Village without electricity
Husband	252.3 (1357)	207.1(415)	193.7(679)	21.8	30.2
Wife	235.2(1276)	185.1(400)	182.2(649)	27.1	29.1
Senior Student :					
Male	237.5(824)	186.4(189)	189.0(349)	27.4	25.6
Female	232.1(703)	177.5(197)	177.9(323)	30.6	30.4

Table 4.4.66 (b): Daily average amount of extra/additional time available after sunset due to electricity in the households with electricity

Household members	Additional time available after electricity: minutes/evening
Husband	105.0
Wife	94.7
Senior Student :	
Male	97.4
Female	95.0

Table 4.4.67: Activity wise daily average time spent after sunset (between 6 PM and bed time) by selected members of household

Household Head: Male/Husband (minutes/evening)

Activities: detailed/broad categories	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)		Difference between electrified and non-electrified (%)	
	Minutes	% total	Minutes	% total	Minutes	% total	Village with electricity	Village without electricity
Detailed Activities								
Study	3.8	1.5	0.9	0.4	1.7	0.9	338.3	121.6
Sewing	0.8	0.3	0.3	0.1	0.0	0.0	188.0	0.0
Teaching kids	7.6	3.0	4.3	2.1	6.8	3.5	78.2	12.2
Watching TV	51.0	20.2	18.5	8.9	10.1	5.2	175.7	404.9
Late night news BTV, ETV	4.2	1.7	0.3	0.2	0.3	0.1	1250.3	1589.5
Radio	5.3	2.1	5.7	2.8	6.2	3.2	-7.9	-14.8
Business	42.9	17.0	26.5	12.8	22.3	11.5	62.0	92.2
Net making	0.6	0.2	0.4	0.2	0.1	0.0	71.3	600.5
Threshing	0.9	0.4	0.5	0.3	1.0	0.5	77.9	-8.5
Mat/basket etc making	1.7	0.7	1.6	0.8	1.8	0.9	2.3	-8.2
Weaving and related	0.0	0.0	0.0	0.0	0.2	0.1	0.0	-80.0
Attending socio-cultural functions	5.9	2.3	4.9	2.4	5.8	3.0	19.1	1.6
Performing religious activities	26.1	10.3	18.6	9.0	21.8	11.2	40.5	19.7
Cooking	3.5	1.4	1.3	0.7	1.6	0.8	157.9	112.9
Eating	25.1	9.9	25.1	12.1	24.6	12.7	-0.2	1.7
Cleaning utensil	1.3	0.5	1.5	0.7	0.9	0.5	-16.2	37.1
Bed preparation	4.8	1.9	5.5	2.7	6.4	3.3	-12.6	-24.4
Visiting neighbours	13.7	5.4	19.2	9.3	17.8	9.2	-28.3	-22.7
Gossiping	43.6	17.3	51.2	24.7	52.5	27.1	-14.9	-16.9
Rickshaw/van pulling	9.1	3.6	20.0	9.7	11.4	5.9	-54.5	-19.9
Poultry/dairy rearing	0.3	0.1	0.7	0.3	0.4	0.2	-55.3	-34.1
Broad categories of activity								
Income generating (02+07+08+09+10+11+20+21)	56.4	22.4	50.0	24.1	37.3	19.3	12.9	51.3
Socio-cultural dev.	161.2	63.9	123.6	59.7	122.8	63.4	30.5	31.2
a. Radio/TV (4+5+6)	60.5	24.0	24.5	11.8	16.5	8.5	146.7	266.3
b. Study/Assist(1+3)	11.4	4.5	5.1	2.5	8.5	4.4	122.1	34.2
c. Socialization (12+13+18+19)	89.3	35.4	93.9	45.4	97.8	50.5	-4.9	-8.7
Household chore (14+ 15+ 16+ 17)	34.6	13.7	33.5	16.2	33.6	17.3	3.4	3.2
Total	**252.3**	**100.0**	**207.1**	**100.0**	**193.7**	**100.0**	**21.8**	**30.2**
N	**1357**		**415**		**679**			

Table 4.4.67 (b): Activity wise daily average time spent after sunset (between 6 PM and bed time) by selected members of household

Household Head/Elder: Female/Wife (minutes/evening)

Activities: detailed/broad categories	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)		Difference between electrified and non-electrified (%)	
	Minutes	% total	Minutes	% total	Minutes	% total	Village with electricity	Village without electricity
Detailed Activities								
Study	2.7	1.2	2.6	1.4	2.9	1.6	4.1	-7.1
Sewing	2.5	1.1	0.4	0.2	0.2	0.1	564.8	978.6
Teaching kids	14.9	6.3	5.3	2.9	7.9	4.3	181.9	88.5
Watching TV	50.8	21.6	10.5	5.7	7.9	4.3	386.0	542.0
Late night news BTV, ETV	1.1	0.5	0.1	0.0	0.0	0.0	1378.6	0.0
Radio	3.1	1.3	3.6	2.0	3.6	2.0	-14.1	-13.0
Business	1.5	0.6	0.4	0.2	0.4	0.2	240.3	245.1
Net making	0.1	0.0	0.5	0.3	0.0	0.0	-82.5	0.0
Threshing	0.4	0.2	0.2	0.1	0.5	0.3	171.7	-23.3
Mat/basket etc making	2.0	0.9	1.9	1.0	2.5	1.4	6.4	-19.2
Weaving and related	0.3	0.1	0.3	0.2	0.1	0.1	9.7	256.0
Attending socio-cultural functions	0.5	0.2	0.5	0.3	0.9	0.5	0.3	-42.9
Performing religious activities	24.1	10.2	20.9	11.3	23.3	12.8	15.4	3.5
Cooking	45.2	19.2	37.7	20.4	37.5	20.6	20.1	20.7
Eating	28.9	12.3	28.6	15.4	30.0	16.5	1.2	-3.8
Cleaning utensil	11.8	5.0	7.9	4.3	10.2	5.6	49.1	16.2
Bed preparation	11.2	4.8	13.7	7.4	11.4	6.3	-18.3	-2.1
Visiting neighbours	3.8	1.6	6.0	3.3	5.1	2.8	-36.5	-25.0
Gossiping	30.0	12.8	43.8	23.7	37.3	20.5	-31.5	-19.6
Poultry/dairy rearing	0.1	0.1	0.3	0.2	0.4	0.2	-58.2	-71.9
Broad categories of activity								
Income generating (02+07+08+09+10+11+20+21)	7.0	3.0	4.0	2.2	4.2	2.3	74.0	64.3
Socio-cultural dev.	131.1	55.7	93.2	50.4	88.9	48.8	40.6	47.5
a. Radio/TV (4+5+6)	55.1	23.4	14.2	7.6	11.5	6.3	289.1	379.3
b. Study/Assist (1+3)	17.6	7.5	7.9	4.3	10.8	5.9	123.2	62.7
c. Socialization (12+13+18+19)	58.4	24.8	71.2	38.5	66.6	36.5	-17.9	-12.2
Household chore (14+ 15+ 16+ 17)	97.2	41.3	87.8	47.5	89.1	48.9	10.6	9.0
Total	**235.2**	**100.0**	**185.1**	**100.0**	**182.2**	**100.0**	**27.1**	**29.1**
N	**1276**		**400**		**649**			

Table 4.4.67 (c): Activity wise daily average time spent after sunset (between 6 PM and bed time) by selected members of household

Senior Most Male student (minutes/evening)

Activities: detailed/broad categories	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)		Difference between electrified and non-electrified (%)	
	Minutes	% total	Minutes	% total	Minutes	% total	Village with electricity	Village without electricity
Detailed Activities								
Study	126.1	53.1	108.9	58.4	112.0	59.2	15.8	12.6
Sewing	0.0	0.0	0.3	0.2	0.0	0.0	-100.0	0.0
Teaching kids	1.9	0.8	0.3	0.2	0.9	0.5	484.9	96.4
Watching TV	51.7	21.8	21.1	11.3	11.8	6.2	145.4	338.1
Late night news BTV, ETV	1.2	0.5	0.2	0.1	0.2	0.1	668.4	609.4
Radio	2.1	0.9	0.8	0.4	3.2	1.7	163.8	-34.8
Business	2.2	0.9	0.8	0.4	0.2	0.1	182.1	819.3
Threshing	0.0	0.0	0.0	0.0	0.1	0.0	0.0	-100.0
Mat/basket etc making	0.5	0.2	0.5	0.3	0.2	0.1	-3.2	168.2
Attending socio-cultural functions	0.2	0.1	0.5	0.3	0.2	0.1	-50.3	37.7
Performing religious activities	3.0	1.3	2.4	1.3	2.5	1.3	27.7	19.9
Eating	22.8	9.6	24.4	13.1	23.3	12.3	-6.9	-2.1
Cleaning utensil	0.4	0.2	0.6	0.3	0.4	0.2	-34.2	7.5
Bed preparation	3.6	1.5	3.9	2.1	4.2	2.2	-8.4	-15.4
Visiting neighbours	4.6	1.9	4.2	2.3	6.1	3.3	8.3	-25.9
Gossiping	16.9	7.1	17.3	9.3	23.0	12.2	-2.5	-26.6
Poultry/dairy rearing	0.3			0.1	0.6	0.3	75.8	-56.7
Broad categories of activity								
Income generating (02+07+08+09+10+11+20+21)	3.0	1.3	1.7	0.9	1.1	0.6	70.6	159.9
Socio-cultural dev.	207.7	87.5	155.7	83.5	160.0	84.6	33.5	29.9
a. Radio/TV (4+5+6)	55.0	23.2	22.0	11.8	15.2	8.0	149.8	262.4
b. Study/Assist (1+3)	128.0	53.9	109.2	58.6	112.9	59.7	17.2	13.4
c. Socialization (12+13+18+19)	24.7	10.4	24.4	13.1	31.9	16.9	1.4	-22.4
Household chore (14+ 15+ 16+ 17)	26.8	11.3	29.0	15.5	27.9	14.7	-7.6	-.40
Total	**237.5**	**100.0**	**186.4**	**100.0**	**189.0**	**100.0**	**27.4**	**25.6**
N	**824**		**189**		**349**			

Table 4.4.67 (d): Activity wise daily average time spent after sunset (between 6 PM and bed time) by selected members of household

Senior Most Female student (minutes/evening)

Activities: detailed/broad categories	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)		Difference between electrified and non-electrified (%)	
	Minutes	% total	Minutes	% total	Minutes	% total	Village with electricity	Village without electricity
Detailed Activities								
Study	125.9	54.3	97.3	54.8	106.2	59.7	29.4	18.6
Sewing	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Teaching kids	0.8	0.3	1.7	1.0	1.2	0.7	-54.3	-36.3
Watching TV	50.6	21.8	18.5	10.4	7.4	4.2	173.0	585.5
Late night news BTV, ETV	0.7	0.3	0.1	0.0	0.1	0.0	1357.2	855.7
Radio	1.6	0.7	1.5	0.9	1.9	1.0	3.7	-15.1
Business	0.1	0.0	0.0	0.0	0.6	0.3	0.0	-83.1
Threshing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mat/basket etc making	0.3	0.1	0.0	0.0	0.3	0.2	0.0	22.5
Attending socio-cultural functions	0.1	0.0	0.2	0.1	0.7	0.4	-25.3	-83.3
Performing religious activities	3.0	1.3	2.5	1.4	3.3	1.8	20.0	-8.2
Cooking	1.7	0.7	2.1	1.2	1.8	1.0	-18.6	-2.8
Eating	22.6	9.8	23.7	13.3	23.2	13.1	-4.5	-2.5
Cleaning utensil	1.5	0.6	1.7	1.0	2.0	1.1	-11.9	-23.8
Bed preparation	5.5	2.4	5.9	3.3	6.7	3.8	-6.1	-17.9
Visiting neighbours	1.9	0.8	3.5	2.0	3.4	1.9	-45.7	-44.0
Gossiping	13.9	6.0	17.3	9.7	18.6	10.4	-19.9	-25.3
Poultry/dairy rearing	1.4	0.6	1.6	0.9	0.7	0.4	-10.1	117.7
Broad categories of activity								
Income generating (02+07+08+09+10+11+20+21)	2.1	0.9	1.6	0.9	1.5	0.9	31.5	36.4
Socio-cultural dev.	198.6	85.6	142.7	80.3	142.7	80.2	39.2	39.1
a. Radio/TV (4+5+6)	52.9	22.8	20.1	11.3	9.3	5.2	163.2	467.8
b. Study/Assist (1+3)	126.7	54.6	99.0	55.8	107.4	60.4	28.0	18.0
c. Socialization (12+13+18+19)	18.9	8.2	23.5	13.2	26.0	14.6	-19.5	-27.1
Household chore (14+ 15+ 16+ 17)	31.4	13.5	33.4	18.8	33.7	18.9	-6.1	-6.9
Total	**232.0**	**100.0**	**177.6**	**100.0**	**177.9**	**100.0**	**30.6**	**30.4**
N	**703**		**197**		**323**			

Table 4.4.67 (e): Activity wise daily average time spent after sunset (between 6 PM and bed time) by selected members of landless household

Household head Male: Landless household (minutes/evening)

Activities: detailed/broad categories	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)		Difference between electrified and non-electrified (%)	
	Minutes	% total	Minutes	% total	Minutes	% total	Village with electricity	Village without electricity
Detailed Activities								
Study	1.9	0.8	0.4	0.2	0.7	0.3	394.4	180.8
Sewing	1.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Teaching kids	6.0	2.4	4.2	2.0	4.3	2.3	40.5	37.5
Watching TV	47.2	19.1	18.5	8.9	8.4	4.4	154.4	464.3
Late night news BTV, ETV	3.3	1.3	0.4	0.2	0.3	0.1	672.5	1179.4
Radio	5.6	2.3	3.3	1.6	3.1	1.6	67.4	81.6
Business	44.9	18.2	26.8	12.8	27.5	14.3	67.7	63.3
Net making	0.7	0.3	0.3	0.1	0.0	0.0	158.3	0.0
Threshing	0.5	0.2	0.7	0.3	1.1	0.6	-18.8	-52.2
Mat/basket etc making	2.7	1.1	2.0	1.0	3.2	1.7	36.2	-16.9
Weaving and related	0.0	0.0	0.0	0.0	0.1	0.0	0.0	-100.0
Attending socio-cultural functions	4.2	1.7	5.6	2.7	2.4	1.3	-25.1	71.9
Performing religious activities	23.9	9.7	14.6	7.0	19.0	9.9	64.3	26.2
Cooking	4.4	1.8	1.7	0.8	1.6	0.8	154.3	170.8
Eating	25.0	10.1	25.1	12.0	24.2	12.6	-0.3	3.5
Cleaning utensil	1.6	0.7	1.2	0.6	1.6	0.8	31.4	0.7
Bed preparation	5.1	2.1	6.2	3.0	8.4	4.4	-16.8	-38.9
Visiting neighbours	11.7	4.7	19.3	9.2	13.6	7.1	-39.3	-13.8
Gossiping	43.7	17.7	48.1	23.1	54.3	28.3	-9.1	-19.4
Rickshaw/van pulling	13.5	5.5	29.4	14.1	18.1	9.4	-54.0	-25.3
Poultry/dairy rearing	0.1	0.1	0.9	0.4	0.2	0.1	-85.7	-20.5
Broad categories of activity								
Income generating (02+07+08+09+10+11+20+21)	63.9	25.8	60.0	28.7	50.3	26.2	6.5	27.1
Socio-cultural dev.	147.4	59.6	114.5	54.9	106.0	55.2	28.7	39.1
a. Radio/TV (4+5+6)	56.0	22.6	22.3	10.7	11.7	6.1	151.2	379.3
b. Study/Assist (1+3)	7.8	3.2	4.6	2.2	5.0	2.6	69.6	56.7
c. Socialization (12+13+18+19)	83.6	33.8	87.6	42.0	89.3	46.5	-4.6	-6.4
Household chore (14+ 15+ 16+ 17)	36.2	14.6	34.2	16.4	35.8	18.6	5.7	1.0
Total	**247.5**	**100.0**	**208.7**	**100.0**	**192.0**	**100.0**	**18.6**	**28.9**
N	**474**		**237**		**314**			

Table 4.4.67 (f): Activity wise daily average time spent after sunset (between 6 PM and bed time) by selected members of landless household

Household head Female/wife: Landless household (minutes/evening)

Activities: detailed/broad categories	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)		Difference between electrified and non-electrified (%)	
	Minutes	% total	Minutes	% total	Minutes	% total	Village with electricity	Village without electricity
Detailed Activities								
Study	2.1	0.9	3.1	1.7	2.6	1.4	-33.3	-19.2
Sewing	2.7	1.1	0.4	0.2	0.3	0.2	577.0	766.2
Teaching kids	13.0	5.5	3.9	2.2	5.3	2.9	229.7	146.6
Watching TV	47.6	20.3	11.0	6.0	5.8	3.2	331.6	717.8
Late night news BTV, ETV	1.3	0.6	0.1	0.1	0.0	0.0	889.2	0.0
Radio	3.6	1.5	2.4	1.3	1.9	1.1	49.9	90.1
Business	1.5	0.7	0.5	0.3	0.3	0.2	206.0	350.3
Net making	0.0	0.0	0.7	0.4	0.0	0.0	-100.0	0.0
Threshing	0.3	0.1	0.0	0.0	0.9	0.5	0.0	-68.4
Mat/basket etc making	3.5	1.5	2.4	1.3	3.9	2.2	44.0	-9.1
Weaving and related	0.6	0.2	0.5	0.3	0.0	0.0	5.0	0.0
Attending socio-cultural functions	0.3	0.1	0.6	0.3	0.4	0.2	-55.0	-38.0
Performing religious activities	22.9	9.8	20.4	11.2	23.8	13.2	12.2	-3.8
Cooking	40.0	17.1	34.7	19.0	38.1	21.2	15.6	5.2
Eating	29.4	12.5	27.8	15.2	30.7	17.1	5.5	-4.3
Cleaning utensil	16.8	7.2	9.4	5.1	9.8	5.4	79.9	72.7
Bed preparation	11.9	5.1	15.1	8.2	13.2	7.4	-20.9	-10.1
Visiting neighbours	3.5	1.5	4.7	2.6	5.1	2.8	-24.2	-30.3
Gossiping	33.3	14.2	44.7	24.4	37.8	21.0	-25.5	-12.1
Poultry/dairy rearing	0.2	0.1	0.3	0.2	0.1	0.0	-34.3	236.0
Broad categories of activity								
Income generating (02+07+08+09+10+11+20+21)	8.8	3.7	4.9	2.7	5.5	3.0	79.4	60.7
Socio-cultural dev.	127.5	54.4	90.9	49.8	82.7	46.0	40.2	54.2
a. Radio/TV (4+5+6)	52.5	22.4	13.6	7.4	7.7	4.3	287.1	580.4
b. Study/Assist (1+3)	15.0	6.4	7.0	3.8	7.8	4.3	113.7	92.3
c. Socialization (12+13+18+19)	59.9	25.6	70.3	38.5	67.2	37.3	-14.8	-10.7
Household chore (14+ 15+ 16+ 17)	98.2	41.9	86.9	47.6	91.8	51.0	13.0	7.0
Total	**234.4**	**100.0**	**182.7**	**100.0**	**179.9**	**100.0**	**28.3**	**30.3**
N	**436**		**229**		**293**			

Table 4.4.68: Average daily amount of time after sunset (evening) spent on activities which can be attributable to electricity by household members: Household with electricity

Activities/members	Value (Minutes/evening)
Household head Male/Husband	
a) Activities which are new after electricity	53.2
b) Activities which are not new after electricity but for which more time is available after electricity	51.8
Total	**105**
Household head: Female/wife	
a) Activities which are new after electricity	52.4
b) Activities which are not new after electricity but for which more time is available after electricity	42.2
Total	**94.6**
Senior most male student	
a) Activities which are new after electricity	41.3
b) Activities which are not new after electricity but for which more time is available after electricity	56.1
Total	**97.4**
Senior most female student	
a) Activities which are new after electricity	40.7
b) Activities which are not new after electricity but for which more time is available after electricity	54.2
Total	**94.9**

Table 4.4.69: Daily average study time available at night (between sunset and bed time) for senior most male and female students by landownership groups

(Minutes/evening)

Student/landownership group	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	Difference between electrified and non-electrified (%)	
				Village with electricity	Village without electricity
Senior most male student					
Landless	221.6	172.0	175.5	28.8	26.3
Marginal	236.8	198.5	183.0	19.3	29.4
Small	248.1	207.0	200.6	19.8	23.6
Medium	246.5	201.7	206.9	22.2	19.2
Large	280.4	180.0	238.1	55.8	17.8
Average	237.5	186.4	189.0	27.4	25.6
N	**824**	**189**	**349**	**-**	**-**
Senior most female student					
Landless	219.3	167.9	164.3	30.6	33.5
Marginal	224.8	187.0	185.7	20.2	21.1
Small	240.8	194.2	180.7	24.0	33.3
Medium	248.5	187.3	191.8	32.7	29.6
Large	264.1	NA	197.2	NA	33.9
Average	232.0	177.5	177.9	30.6	30.4
N	**703**	**197**	**323**	**-**	**-**

Table 4.4.70: Activities that are new after electricity and time (average minutes per evening) devoted to those activities by selected household members

(Only for household with electricity)

(Average minutes per evening)

Activities new after electricity	Husband	Wife	Male student	Female student
Study	0.6	0.5	2.9	2.9
Sewing	0.4	1.4	0.0	0.0
Teaching kids	0.6	1.2	0.4	0.3
Watching TV	37.9	39.9	35.0	35.8
Late night news BTV, ETV	3.0	0.8	0.9	0.3
Radio	1.5	0.8	0.6	0.6
Business	3.8	0.2	0.4	0.0
Net making	0.3	0.0	0.0	0.0
Threshing	0.4	0.0	0.0	0.0
Mat/basket etc making	0.6	0.5	0.0	0.0
Weaving and related	0.0	0.0	0.0	0.0
Attending socio-cultural functions	0.1	0.0	0.0	0.0
Performing religious activities	0.0	0.1	0.0	0.0
Cooking	0.4	4.5	0.0	0.1
Eating	0.0	0.0	0.0	0.0
Cleaning utensil	0.1	0.9	0.0	0.2
Bed preparation	0.0	0.1	0.0	0.1
Visiting neighbours	0.5	0.3	0.5	0.1
Gossiping	1.1	1.2	0.6	0.2
Rickshaw/van pulling	1.7	0.0	0.0	0.0
Poultry/dairy rearing	0.0	0.0	0.1	0.1
Broad categories of activity				
Income generating (02+07+08+09+10+11+20+21)	7.2	2.1	0.5	0.1
Socio-cultural dev.	45.3	44.8	40.9	40.2
a. Radio/TV (4+5+6)	42.4	41.5	36.5	36.7
b. Study/Assist (1+3)	1.2	1.7	3.3	3.2
c. Socialization (12+13+18+19)	1.7	1.6	1.1	0.3
Household chore (14+ 15+ 16+ 17)	0.5	5.5	0.0	0.4
Total	**53.2**	**52.4**	**41.3**	**40.7**
N	**1357**	**1276**	**824**	**703**

Table 4.4.70 (b): Activities that are new after electricity and time (average minutes per evening) devoted to those activities by selected household members (Only for household with electricity)

(Landless household)

(Average minutes per evening)

Activities new after electricity	Husband	Wife	Male student	Female student
Study	0.0	0.6	2.2	2.5
Sewing	0.6	1.5	0.0	0.0
Teaching kids	0.3	1.1	0.4	0.5
Watching TV	33.4	36.1	26.6	32.2
Late night news BTV, ETV	2.5	0.9	0.2	0.3
Radio	2.2	1.0	0.8	0.9
Business	2.1	0.2	0.0	0.0
Net making	0.4	0.0	0.0	0.0
Threshing	0.1	0.0	0.0	0.0
Mat/basket etc making	0.8	0.9	0.0	0.0
Attending socio-cultural functions	0.1	0.0	0.0	0.0
Performing religious activities	0.0	0.0	0.1	0.0
Cooking	0.1	4.7	0.0	0.0
Eating	0.1	0.0	0.0	0.0
Cleaning utensil	0.2	1.0	0.0	0.3
Bed preparation	0.0	0.1	0.0	0.0
Visiting neighbours	0.7	0.3	0.8	0.0
Gossiping	1.2	1.1	0.6	0.0
Rickshaw/van pulling	2.0	0.0	0.0	0.0
Broad categories of activity				
Income generating (02+07+08+09+10+11+20+21)	6.0	2.6	0.0	0.0
Socio-cultural dev.	40.4	41.1	31.7	36.4
a. Radio/TV (4+5+6)	38.1	38.0	27.6	33.4
b. Study/Assist (1+3)	0.3	1.7	2.6	3.0
c. Socialization (12+13+18+19)	2.0	1.4	1.5	0.0
Household chore (14+ 15+ 16+ 17)	0.4	6.1	0.0	0.3
Total	**46.8**	**49.8**	**31.7**	**36.7**
N	**474**	**436**	**270**	**237**

Table 4.4.71: Activities which are not new after electricity but for which more time is available after electricity

(Only for household with electricity)

(Average minutes per evening)

Activities not new but for which more time available after electricity	Husband	Wife	Male student	Female student
Study	1.0	1.3	45.5	45.1
Sewing	0.3	0.4	0.0	0.0
Teaching kids	2.7	5.4	0.4	0.1
Watching TV	5.1	4.0	3.9	4.1
Late night news BTV, ETV	0.4	0.1	0.2	0.0
Radio	1.2	0.7	0.4	0.3
Business	13.6	0.5	0.3	0.0
Net making	0.1	0.0	0.0	0.0
Threshing	0.1	0.1	0.0	0.0
Mat/basket etc making	0.5	0.8	0.1	0.0
Weaving and related	0.0	0.1	0.0	0.0
Attending socio-cultural functions	1.6	0.1	0.1	0.0
Performing religious activities	4.2	3.5	0.1	0.2
Cooking	1.1	12.4	0.0	0.2
Eating	1.5	2.4	1.1	1.6
Cleaning utensil	0.4	1.3	0.0	0.2
Bed preparation	0.2	0.8	0.1	0.1
Visiting neighbours	3.8	0.9	1.1	0.4
Gossiping	10.8	7.4	2.6	1.9
Rickshaw/van pulling	3.0	0.0	0.0	0.0
Poultry/dairy rearing	0.2	0.1	0.1	0.1
Broad categories of activity				
Income generating (02+07+08+09+10+11+20+21)	17.8	2.0	0.5	0.1
Socio-cultural dev.	30.8	23.8	54.4	52.1
a. Radio/TV (4+5+6)	6.7	4.8	4.5	4.4
b. Study/Assist (1+3)	3.7	6.7	45.9	45.2
c. Socialization (12+13+18+19)	20.4	11.9	4.0	2.5
Household chore (14+ 15+ 16+ 17)	3.2	16.9	1.2	2.1
Total	**51.8**	**42.2**	**56.1**	**54.2**
N	**1357**	**1276**	**824**	**703**

Table 4.4.71 (b): Activities which are not new after electricity but for which more time is available after electricity (only for household with electricity)

(Landless household)

(Average minutes per evening)

Activities not new but for which more time available after electricity	Husband	Wife	Male student	Female student
Study	0.6	1.4	43.9	43.9
Sewing	0.4	0.6	0.0	0.0
Teaching kids	2.5	4.4	0.2	0.0
Watching TV	5.4	4.6	6.0	5.0
Late night news BTV, ETV	0.3	0.0	0.2	0.0
Radio	0.8	0.8	0.7	0.5
Business	16.4	0.8	0.1	0.0
Net making	0.1	0.0	0.0	0.0
Threshing	0.0	0.1	0.1	0.0
Mat/basket etc making	0.9	1.4	0.1	0.1
Weaving and related	0.0	0.4	0.0	0.0
Attending socio-cultural functions	1.1	0.1	0.0	0.0
Performing religious activities	3.6	2.8	0.0	0.0
Cooking	1.5	12.3	0.0	0.2
Eating	1.3	2.5	0.9	0.9
Cleaning utensil	0.5	1.1	0.0	0.0
Bed preparation	0.1	0.5	0.1	0.1
Visiting neighbours	2.8	0.9	0.7	0.2
Gossiping	10.7	7.7	1.8	1.4
Rickshaw/van pulling	5.0	0.0	0.0	0.0
Poultry/dairy rearing	0.2	0.0	0.0	0.0
Broad categories of activity				
Income generating (02+07+08+09+10+11+20+21)	23.0	3.3	0.3	0.1
Socio-cultural dev.	30.9	22.7	53.5	51.0
a. Radio/TV (4+5+6)	12.2	5.4	6.9	5.5
b. Study/Assist (1+3)	3.1	5.8	44.1	43.9
c. Socialization (12+13+18+19)	15.6	11.5	2.5	1.6
Household chore (14+ 15+ 16+ 17)	3.5	16.4	1.0	1.2
Total	**54.1**	**42.4**	**54.9**	**52.4**
N	**474**	**436**	**270**	**237**

Impact on social environment and protective security: Tables 4.4.72 - 4.4.76(b)

Table 4.4.72: Distribution of respondents about creation of significant employment generation opportunity due to electricity, and reasons for agreement

Employment generation effect of electricity	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	All
Statement: electricity created significant employment generation opportunity:				
Agrees	96.9	94.5	94.6	95.9
Do not agree	3.1	5.5	5.4	4.1
Total	100	100	100	100
N	1380	421	690	2491
Reasons for agreeing (all) (multiple responses)				
1. Local trade & business activities expanded	57.8	48.0	48.7	53.6
2. Unemployed youth got employment opportunities	56.8	51.1	49.1	53.7
3. Small and cottage industries has been established	31.3	23.5	27.8	29.0
4. Scopes for employment in crop agriculture have been broadened	51.2	51.3	57.2	52.9
5. Opportunity for poultry raising has increased	29.2	29.0	28.6	29.0
6. Scopes for work at night became possible	64.1	64.1	59.1	62.7
7. Increased scopes for income/earning from multiple sources	27.6	25.2	25.9	26.7
8. Others	.4	.5	.6	.5
NA/DK	3.0	5.0	4.9	3.9
N	1380	421	690	2491
Reasons for agreeing (only those agreed)			(multiple responses)	
1. Local trade & business activities expanded	59.5	50.5	51.1	55.7
2. Unemployed youth got employment opportunities	58.6	53.8	51.8	55.9
3. Small and cottage industries has been established	32.3	24.9	29.1	30.2
4. Scopes for employment in crop agriculture have been broadened	52.8	54.3	60.5	55.2
5. Opportunity for poultry raising has increased	30.1	30.2	30.2	30.2
6. Scopes for work at night became possible	66.0	67.3	62.0	65.2
7. Increased scopes for income/earning from multiple sources	28.4	26.4	27.3	27.8
8. Others	.5	.5	.6	.5
N	1337	398	653	2388

Table 4.4.73: Distribution of respondents confirming whether "electrification at household level has increased (improved) protective security" and reasons for confirming so

Protective security effect of electricity	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	All
Statement : Whether household electricity increases/increased protective security				
Yes	99.1	98.3	94.9	97.8
No	.9	1.7	5.1	2.2
Total	100	100	100	100
N	1380	421	690	2491
Reasons reported for increased security due to HH electricity: (multiple responses)				
1. Light available throughout the night	86.1	80.2	78.5	83.0
2. Theft and robbery became difficult	75.5	65.9	78.5	73.3
3. Availability of road side light	39.4	44.7	73.3	39.6
4. There is light just outside house (front side and backyard)	35.8	32.4	36.8	35.7
5. Others	.5	.7	37.9	.5
n	1367	414	655	2436

Table 4.4.74: Distribution of respondents by their agreement with the statement that "Security of mobility at night has increased due to electricity" and reasons thereof

Security of mobility at night	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	All
Statement : Whether agree that security of mobility at night has increased due to electricity				
Agrees	99.6	99.5	95.1	98.4
Do not agree	.4	.5	4.9	1.6
Total	100	100	100	100
N	1380	421	690	2491
Reasons for confirming the statement (multiple responses)				
1. Everything is distinctively visible	99.1	95.2	94.4	97.1
2. Less fear of snakes (other reptiles/insects)	35.2	37.0	35.5	35.6
3. Others	1.3	3.3	1.4	1.7
DK/NR	1.0	1.7	2.0	1.4
N	1375	419	656	2450

Table 4.4.75: Distribution of respondents by their agreement with the statement that "TV influences social values/norms" and stated positive impact of TV in terms of social value

TV influences social norms/values	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	All
Statement : TV influences social norms/values				
Agrees	89.6	78.9	74.2	83.5
Do not agree	10.4	21.1	25.8	16.5
Total	100	100	100	100
N	1380	421	690	2491
TV-mediated positive impacts in changing social norms/values (ways, nature, indications, mediates)				
1. Rapid flow/supplies of news/information	73.3	65.1	71.3	71.5
2. Enhancement of recreational opportunities	70.1	65.1	68.6	68.9
3. Strengthening of knowledge-base about rights and responsibilities	28.6	23.2	26.8	27.3
4. Inspiration for changing social-economic-cultural status	34.4	26.8	30.7	32.3
5. Broadening opportunities for children's education	73.5	68.1	72.3	72.4
6. Improving health, hygiene and nutritional related knowledge	51.5	44.9	43.2	48.4
7. Others	.2	.6	.4	.3
DK/NR	.4	.6	.2	.4
n	1236	332	512	2080

Table 4.4.76: Distribution of respondents by their confirmation/agreement representing various economic categories (landownership groups) with various issues of economic-cultural environment and protective security associated with availability of electricity

Issues of economic, socio-cultural environment and protective security	Landless	Marginal	Small	Medium	Large	All
1. % confirmed electricity generates significant extent of employment opportunity	95.5	95.6	96.8	96.3	97.0	95.9
2. % agrees electricity at household level increases/improves protective security	96.5	98.6	98.4	99.3	98.5	97.8
3. % said – security of mobility at night increases(d) due to electricity	96.9	99.4	99.7	99.0	100.0	98.4
4. % agrees – TV influences social norms/values in a positive way	79.7	84.6	86.5	88.0	90.9	83.5

Table 4.4.76 (b): Distribution of respondents from various landowning landless/marginal/small/ medium/large landowning households by their confirmation/agreement with various issues of economic, socio-cultural environment and protective security associated with availability of (mediated through) electricity

Landless

Issues of economic, socio-cultural environment and protective security	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. % confirmed electricity generates significant extent of employment opportunity	97.3	94.7	93.4
2. % agrees electricity at household level increases/improves protective security	99.6	97.9	90.6
3. % said – security of mobility at night increases(d) due to electricity	99.6	99.6	90.9
4. % agrees – TV influences social norms/values in a positive way	88.1	77.8	68.3

Marginal

Issues of economic, socio-cultural environment and protective security	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. % confirmed electricity generates significant extent of employment opportunity	95.4	97.2	94.9
2. % agrees electricity at household level increases/improves protective security	99.2	99.1	97.2
3. % said – security of mobility at night increases(d) due to electricity	100.0	100.0	97.8
4. % agrees – TV influences social norms/values in a positive way	91.4	78.5	74.2

Small

Issues of economic, socio-cultural environment and protective security	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. % confirmed electricity generates significant extent of employment opportunity	99.0	87.2	96.2
2. % agrees electricity at household level increases/improves protective security	97.9	97.4	100.0
3. % said – security of mobility at night increases(d) due to electricity	100.0	97.4	100.0
4. % agrees – TV influences social norms/values in a positive way	88.2	82.1	84.6

Medium

Issues of economic, socio-cultural environment and protective security	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. % confirmed electricity generates significant extent of employment opportunity	96.9	93.5	95.6
2. % agrees electricity at household level increases/improves protective security	99.0	100.0	100.0
3. % said – security of mobility at night increases(d) due to electricity	99.0	100.0	98.9
4. % agrees – TV influences social norms/values in a positive way	89.9	83.9	83.5

Large

Issues of economic, socio-cultural environment and protective security	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
1. % confirmed electricity generates significant extent of employment opportunity	95.1	100.0	100.0
2. % agrees electricity at household level increases/improves protective security	97.6	100.0	100.0
3. % said – security of mobility at night increases(d) due to electricity	100.0	100.0	100.0
4. % agrees – TV influences social norms/values in a positive way	95.1	100.0	83.3

Impact on demographics Tables 4.5.1- 4.5.6

Birth, # Children ever born/died

Table 4.5.1: History of child birth: Distribution of households by number of children ever born and died

(% distribution)

Ever born and died	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Number ever born			
0	3.2	5.9	3.6
1	7.8	6.4	6.5
2	17.8	15.2	19.1
3	19.4	17.1	17.7
4	13.2	13.1	13.2
5	10.8	14.3	11.4
6	8.3	9.5	9.3
7	5.9	6.7	7.2
8	4.7	5.0	3.8
9	3.8	2.6	2.3
10 and above	5.0	4.3	5.8
Total	100	100	100
Number died			
0	71.0	61.8	65.1
1	16.7	25.4	20.6
2	7.5	7.8	8.7
3	2.8	2.6	2.5
4	1.4	1.7	1.2
5	.3	.7	1.3
6	.3		.4
7	.1		
8			.1
9	.1		.1
Total	100	100	100
N	1380	421	690

Table 4.5.1(b): Average number of children ever born and died by sex

Ever born and died/sex	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)	All
Average # ever born				
Male	2.19	2.20	2.28	2.21
Female	2.11	2.06	2.02	2.08
All	4.30	4.26	4.30	4.29
Average # died				
Male	.26	.33	.32	.29
Female	.24	.26	.29	.26
All	.50	.59	.62	.55
Average # still birth				
Male	0.06	0.16	0.05	0.08
Female	0.03	0.05	0.03	0.03
All	0.09	0.22	0.09	0.11
Average # alive				
Male	1.93	1.87	1.96	1.93
Female	1.87	1.80	1.73	1.82
All	3.80	3.67	3.69	3.75
% ever born who are alive	88.44	86.09	85.78	87.37
# died per 100 live birth (death ratio)	11.63	13.85	14.42	12.82
N	1380	421	690	2491

Table 4.5.1(c): Selected birth and death-related rates and ratios by landownership groups

Selected birth and death rates and ratios/landownership groups	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless			
1. Average # ever-born	4.08	4.11	4.27
2. % ever born still alive	88.30	85.79	83.91
3. % ever born female who died	11.78	12.65	16.08
4. Average # died per 100 live birth	11.7	14.2	16.1
Marginal			
1. Average # ever-born	4.28	4.07	3.76
2. % ever born still alive	87.26	85.52	87.16
3. % ever born female who died	13.02	14.68	12.85
4. Average # died per 100 live birth	12.7	14.5	12.8
Small			
1. Average # ever-born	4.43	5.31	4.54
2. % ever born still alive	89.69	85.99	86.44
3. % ever born female who died	10.23	10.64	12.58
4. Average # died per 100 live birth	10.3	14.0	13.6
Medium			
1. Average # ever-born	4.55	4.55	4.78
2. % ever born still alive	89.09	90.78	88.51
3. % ever born female who died	10.58	10.00	10.64
4. Average # died per 100 live birth	10.9	9.2	11.5
Large			
1. Average # ever-born	4.68	11.00*	6.25
2. % ever born still alive	89.58	81.82*	85.33
3. % ever born female who died	6.59	20.00*	19.72
4. Average # died per 100 live birth	10.4	18.2*	14.7

* *Should not be considered in the analysis due to small number of observations*

Table 4.5.2: Dependency ratio of households by landownership groups

Landownership group(s)	HH with electricity	HH without electri-city (in electrified villages)	HH without electri- city (in non-electrified villages)	All
Landless (0 to 49 decimals)	0.68	0.79	0.72	0.71
Marginal (50-149 decimals)	0.65	0.67	0.74	0.68
Small (150-249 decimals)	0.64	0.59	0.63	0.63
Medium (250-749 decimal)	0.58	0.83	0.59	0.60
Large (750 decimals)	0.57	0.25	0.54	0.55
All categories	0.64	0.73	0.68	0.66

c: T F R

Table 4.5.3: Total fertility rate by landownership groups

Landownership group	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Landless (0 to 49 decimals)	2.7	2.9	3.4
Marginal (50-149 decimals)	2.6	2.9	2.3
Small (150-249 decimals)	2.3	2.4	3.1
Medium (250-749 decimal)	2.5	3.7	2.6
Large (750 decimals)	1.5	0.4	2.9
Overall*	2.5	2.9	2.9

Source: Derived from Table 4.4.31 * **Note:** The more actual figures will be 2.54, 2.87 and 2.94 respectively. It is appropriate to use double digits after the decimal.

d. Migration

Table 4.5.4: Percentage of households reported (any) migration (out) during the last 5 years by land ownership groups

Landownership group	HH with electricity		HH without electricity (in electrified villages)		HH without electricity (in non-electrified villages)	
	Within group	All	Within group	All	Within group	All
Landless (0 to 49 decimals)	29.6	32.7	18.5	52.3	25.4	41.8
Marginal (50-149 decimals)	30.3	25.4	14.0	17.4	26.4	24.2
Small (150-249 decimals)	36.4	16.1	25.6	11.6	32.1	12.9
Medium (250-749 decimal)	34.0	22.2	51.6	18.6	35.2	16.5
Large (750 decimals)	39.0	3.6	*	*	37.5	4.6
Overall	32.0 (1380)	100 (441)	20.4 (421)	100 (86)	28.1 (690)	100 (194)

Note: Not reported due to small cell frequency

Table 4.5.5: Number of persons migrated-out during the last five years

Migrated out	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electri-fied villages)
All Sample			
Number migrated out:			
Male	262	37	80
Female	341	79	167
Both	603	116	247
Per-household migration out (# persons)			
All household			
Male	.19	.09	.12
Female	.25	.19	.24
Both	.44	.28	.36
N	1380	421	690
Only those reported migration out (# persons)			
Male	.59	.43	.41
Female	.77	.92	.86
Both	1.37	1.35	1.27
n	441	86	194

Table 4.5.5(b): Migration-out by landownership groups: Average number of migration-out persons during last 5 years per household

Land ownership group(s)	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electrified villages)
Average number of persons/hh migrated in last 5 years: All household			
Landless (0 to 49 decimals)	.39	.26	.31
Marginal (50-149 decimals)	.41	.16	.31
Small (150-249 decimals)	.48	.38	.38
Medium (250-749 decimal)	.49	.68	.54
Large (750 decimals)	.63	.00	.63
Overall	.44	.28	.36
Average number of persons/hh migrated out in last 5 years: Only those hh reported migration out			
Landless (0 to 49 decimals)	1.33	1.40	1.21
Marginal (50-149 decimals)	1.34	1.13	1.17
Small (150-249 decimals)	1.32	1.50	1.20
Medium (250-749 decimal)	1.45	1.31	1.53
Large (750 decimals)	1.63		1.67
Overall	1.37	1.35	1.27
% migrated-out in search of job:			
Landless (0 to 49 decimals)	36.1	20.6	17.3
Marginal (50-149 decimals)	32.0	17.6	27.3
Small (150-249 decimals)	31.9	26.7	16.7
Medium (250-749 decimal)	31.0	47.6	26.5
Large (750 decimals)	26.9	0.0	33.3
Overall	32.8	25.9	22.3
% migrated-out for education:			
Landless (0 to 49 decimals)	2.1	4.8	4.1
Marginal (50-149 decimals)	3.3	11.8	1.8
Small (150-249 decimals)	8.5	0.0	10.0
Medium (250-749 decimal)	10.6	0.0	14.3
Large (750 decimals)	19.2	0.0	0.0
Overall	6.1	4.3	6.1
% migrated-out for marriage:			
Landless (0 to 49 decimals)	61.8	74.6	78.6
Marginal (50-149 decimals)	64.7	70.6	70.9
Small (150-249 decimals)	59.6	73.3	73.3
Medium (250-749 decimal)	58.5	52.4	59.2
Large (750 decimals)	53.8	0.0	66.7
Overall	61.0	69.8	71.7

Table 4.5.6: Reasons for migration (last five years) (only those reported migration)

Reasons for migration-out	HH with electricity	HH without electricity (in electrified villages)	HH without electricity (in non-electri-fied villages)
Marriage:	61.0	69.8	71.7
Education	6.1	4.3	6.1
Job	32.8	25.9	22.3
Total	100	100	100

Impact on Direct Users: Consumer preferences, demand, benefits, supply issues, and willingness to pay
Table 4.6.1 - 4.6.16(b)

Only those having electricity connections at household

Table 4.6.1: Average expenditure on getting electricity connections at home (domestic connection) by items of expenses by landownership groups (in Tk.)

Expense items	Landless	Marginal	Small	Medium	Large	All
1. PBS	281.86 (2000)	224.50 (1950)	220.92 (2000)	263.87 (2000)	253.54 (1000)	253.28 (2000)
2. Wiring materials	885.12 (6000)	900.33 (8776)	1103.02 (7500)	992.27 (6500)	1260.98 (7000)	953.52 (8776)
3. Labor charge	201.06 (3000)	199.78 (2000)	249.36 (2000)	233.82 (2500)	317.56 (4000)	217.84 (4000)
4. Others	43.95 (2000)	53.90 (4000)	30.77 (800)	64.74 (3000)	252.44 (8000)	55.29 (8000)
Total (average)	1411.98	1378.51	1604.07	1554.71	2084.51	1479.92
N	486	370	195	288	41	1380

Note: Figures in parentheses indicate range.

Table 4.6.2: Type and number of bulb/tubes used currently (at the time of interviewing) by landownership group of households

Type & number in use	Landless	Marginal	Small	Medium	Large	All
Tungsten bulb						
% reported:	**97.9**	**99.2**	**98.5**	**99.7**	**100.0**	**98.8**
Watt 25	23.0	27.0	24.1	26.0	29.3	25.1
Watt 40	21.6	24.1	27.7	29.2	26.8	24.9
Watt 60	50.2	45.4	42.6	42.0	39.0	45.8
Watt 100	3.1	2.7	4.1	2.4	4.9	3.0
% reported use of Fluorescent tube	21.2	18.9	22.1	26.0	39.0	22.2
Average # bulbs/HH:						
Watt 25	0.7	0.9	0.9	1.1	1.5	0.9
Watt 40	0.7	0.9	1.0	1.2	1.5	0.9
Watt 60	1.7	1.7	1.8	1.9	2.4	1.8
Watt 100	0.1	0.1	0.2	0.1	0.3	0.1
All	3.1	3.6	3.9	4.3	5.7	3.7
Average # tubes/HH	.31	.44	.52	.51	1.32	.45
N	486	370	195	288	41	1380
Total # bulbs:						
Watt 25	316	335	180	306	61	1198
Watt 40	352	316	204	341	63	1276
Watt 60	806	644	348	555	99	2452
Watt 100	45	44	33	38	12	172
All	1519	1339	765	1240	235	5098
Total # Tubes:						
Watt 25	12	9	12	12	0	45
Watt 40	123	144	86	127	54	534
Watt 60	11	0	4	2	0	17
Watt 100	7	9	0	7	0	23
All	153	162	102	148	54	619
N	486	370	195	288	41	1380

Table 4.6.3: Hours of lighting of bulb at night by landownership groups

Hours at night	Landless	Marginal	Small	Medium	Large	All
2	1.4	1.6	1.0	2.1		1.5
3	11.1	11.6	10.8	7.3		10.1
4	44.0	40.5	32.3	34.0	29.3	38.9
5	25.9	27.3	33.3	38.2	43.9	30.4
6	13.4	15.1	17.9	16.3	24.4	15.4
7	3.1	3.0	4.1	2.1	2.4	3.0
8	1.0	.8	.5			.7
Average use at night (hrs)	4.52	4.55	4.71	4.66	5.00	4.60
N	486	370	195	288	41	1380

Table 4.6.4: Type of lighting used in the past, before electricity, in the household by landownership group (proxy of consumer preference about energy use)

Type of lighting used before electricity	Landless	Marginal	Small	Medium	Large	All
% reported types: Lantern	49.6	44.9	50.8	58.0	75.6	51.0
Kupee	50.4	55.1	49.2	42.0	24.4	49.0
Average time used lantern/Kupee at night (hrs.)	2.92	3.03	3.12	3.19	3.46	3.05
N	486	370	195	288	41	1380

Electrical appliances : Purchased & plan

Table 4.6.5: Percentage of electrified households already purchased electrical appliances and intend to purchase (have plan) in the future by landownership groups

Electrical Appliances	Landless		Marginal		Small		Medium		Large		All	
	% reported purchase	% intend to purchase in future	% reported purchase	% intend to purchase in future	% reported purchase	% intend to purchase in future	% reported purchase	% intend to purchase in future	% reported purchase	% intend to purchase in future	% reported purchase	% intend to purchase in future
TV	39.5	35.8	46.5	30.3	48.2	25.1	56.9	18.8	61.0	12.2	46.9	28.6
Cassette player	27.6	18.1	31.6	14.3	31.8	14.4	26.7	14.6	31.7	9.8	29.2	15.6
Iron	13.6	16.9	16.2	12.7	24.6	11.3	20.5	13.2	26.8	9.8	17.7	14.0
Refrigerator	3.3	28.8	4.3	30.5	7.7	34.9	6.3	35.4	9.8	41.5	5.0	31.9
Fan	61.5	24.5	69.7	19.2	72.8	18.5	75.7	12.5	85.4	7.3	69.0	19.2
Charger light	3.5	9.7	1.1	16.8	3.6	16.4	4.5	16.3	9.8	12.2	3.3	14.0
Mobile phone	1.0	3.1	.8	5.4	3.1	8.2	1.4	9.4	7.3	9.8	1.5	5.9
Others	4.1	3.3	3.5	3.5	2.1	4.6	4.5	5.9	4.9	7.3	3.8	4.2
No plan		15.0		17.3		13.3		21.5		17.1		16.8
No response	21.4	6.0	17.8	6.8	14.4	6.2	11.1	6.3	7.3	12.2	16.9	6.4
N	486	486	370	370	195	195	288	288	41	41	1380	1380

Table 4.6.5 (b): Percent of households by timing of purchase of electrical appliances and by landownership group

Landownership groups/timing of purchase	Landless	Marginal	Small	Medium	Large	All
Appliances purchased within 1 year of receiving connection:						
TV	19.5	15.9	25.1	31.9	36.6	22.5
Cassette	9.9	13.2	14.4	11.1	17.1	11.9
Iron	3.7	3.5	7.2	8.3	12.2	5.4
Refrigerator	1.0	1.6	1.5	1.4	2.4	1.4
Fan	36.6	46.5	51.8	52.4	63.4	45.5
Charger light	.8	.3	.5	1.4	2.4	.8
Mobile phone	.2		.5			.1
Others	.2	1.4		2.4		.9
NR	58.0	50.5	41.0	42.7	31.7	49.6
Appliances purchased after 5 years of receiving connection:						
TV	10.9	13.5	8.7	11.5	12.2	11.4
Cassette	6.8	8.4	5.1	4.5	4.9	6.4
Iron	5.1	5.4	4.1	5.6	12.2	5.4
Refrigerator	1.4	1.9	2.1	2.8	4.9	2.0
Fan	11.5	12.2	12.8	12.5	24.4	12.5
Charger light	1.9		1.5	2.1	7.3	1.5
Mobile phone	.8	.5	3.1	1.0	7.3	1.3
Others	1.9	.8	.5	2.1		1.4
NR	76.3	77.0	76.9	72.9	68.3	75.7
N	486	370	195	288	41	1380

Table 4.6.5 (c): Average number of electrical appliances purchased per 100 electrified household by landownership groups

Name of the Capital Assets	Landless	Marginal	Small	Medium	Large	Total
	Average	Average	Average	Average	Average	Average
Fan	132.9	147.0	190.8	214.9	341.5	168.2
Iron	19.8	26.8	43.1	36.1	63.4	29.6
Toster	0.4	0.0	0.5	0.3	0.0	0.3
Juice machine	1.4	3.0	4.6	1.4	4.9	2.4
Refrigerator	2.3	4.3	8.7	5.6	22.0	5.0
Mobile phone	2.7	4.1	6.7	3.5	22.0	4.3
TV	41.6	49.7	58.5	64.6	97.6	52.6
Cassette Player	40.3	48.9	48.7	49.0	53.7	46.0
N	486	370	195	288	41	1380
Name of the Capital Assets						
Fan	646	544	372	619	140	2321
Iron	96	99	84	104	26	409
Toster	2	0	1	1	0	4
Juice machine	7	11	9	4	2	33
Refrigerator	11	16	17	16	9	69
Mobile phone	13	15	13	10	9	60
TV	202	184	114	186	40	726
Cassette Player	196	181	95	141	22	635
N	486	370	195	288	41	1380

Table 4.6.5 (d): Distribution of purchase of electrical appliances by source of purchase/procurement

	Landless	Marginal	Small	Medium	Large	Total
Source(s) of purchase						
Village market	8.4	10.8	9.7	8.0	12.2	9.3
Nearest thana/district town	56.8	62.2	64.6	73.3	78.0	63.4
Nearest division town/city	18.9	20.3	23.1	18.8	26.8	20.1
Others (specify)	4.9	5.7	4.6	2.1	2.4	4.4
(88) Not purchased	21.8	18.1	15.4	11.5	7.3	17.3
N	486	370	195	288	41	1380

d. Things which were impossible without electricity

Table 4.6.6: Activities/things that can be performed now (with electricity) which could not be done before (electricity)

(multiple responses)

Activities/benefits	% reported benefit
1. Can light house	92.0
2. Can do HH chores	66.2
3. Can watch TV	57.5
4. Can listen Radio	19.3
5. Can iron cloths	19.1
6. Can use fan for comfort	71.4
7. Can use refrigerator for food preservation	2.8
8. Can generate income	16.2
9. Others	.9
N	1380
% reported at least 1 benefit	100.0
% reported at least 2 benefits	97.2
% reported at least 3 benefits	78.0
% reported at least 4 benefits	47.9
% reported at least 5 benefits	22.2

e. Problems if supply interrupted for sustained period

Table 4.6.7: Percentage distribution of responses about major problems in the household if electricity supply interrupted (fails) for a sustained period

(multiple responses)

Problems in the HH if supply interrupted for sustained period	Landless	Marginal	Small	Medium	Large	All
1. Children's study affects	80.0	86.2	86.7	91.3	95.1	85.4
2. Women's drudgery increases	36.6	41.9	42.1	45.1	43.9	40.8
3. Discomfort due to no fan	64.4	70.8	76.4	78.1	90.2	71.4
4. Affects TV viewing	34.6	43.0	44.6	50.3	65.9	42.5
5. Difficult to sleep at night during summer	43.2	43.5	48.2	51.7	58.5	46.2
6. Unnecessary delay in dinner	53.7	52.4	51.3	44.8	39.0	50.7
7. Others	1.9	2.7	3.6	1.7	2.4	2.3
N	486	370	195	288	41	1380

f. Effects (benefits) of electricity on selected aspects of life (quality of life), standard of living

Table 4.6.8: Perception about extent of change in daily life-standard by landownership groups

Extent of change	Landless	Marginal	Small	Medium	Large	All
Significantly	73.0	74.9	76.4	73.6	73.2	74.1
Marginally	25.7	24.6	22.6	26.0	26.8	25.1
No change	1.2	.5	1.0	.3		.8
Total	100	100	100	100	100	100
N	486	370	195	288	41	1380

Table 4.6.9: Effect of electricity on children's study and improvement in education by landownership groups

Effect on children's study	Landless	Marginal	Small	Medium	Large	All
Whether benefited children's study:						
Yes	92.0	94.9	95.9	93.8	95.1	93.8
No	8.0	5.1	4.1	6.3	4.9	6.2
Total	100	100	100	100	100	100
N	486	370	195	288	41	1380
% reported specific improvement in children's education (multiple responses)						
1. More attention and willingness to study	98.7	98.6	100.0	98.9	100.0	98.9
2. Better exam resulting	81.4	83.8	79.7	86.7	94.9	83.3
3. Higher school attendance	69.8	75.5	73.8	81.1	76.9	74.5
4. Less dropout	54.8	58.4	58.8	63.3	66.7	58.5
N	447	351	187	270	39	1294

Table 4.6.10: Distribution of respondents confirming changes in habits (recreational and others) mediated-through electricity by landownership groups.

(multiple responses)

Areas of changes in habits	Landless	Marginal	Small	Medium	Large	All
1. Reading	93.0	96.2	94.9	95.8	95.1	94.8
2. Watching TV	86.2	88.6	83.1	87.8	92.7	87.0
3. Listening Radio	60.7	59.7	56.9	53.8	68.3	58.7
4. VCR	33.5	37.6	38.5	43.4	36.6	37.5
5. Playing cards/chess	18.9	23.8	25.1	26.4	14.6	22.5
6. Adda/gossiping	47.9	54.6	62.6	51.7	51.2	52.7
7. Cultural programs	38.9	42.7	37.9	45.5	51.2	41.5
n	486	370	195	288	41	1380

Table 4.6.11: Whether household members work for a longer duration after electrification

Work longer hours than before	Landless	Marginal	Small	Medium	Large	All
Yes	86.4	92.2	92.3	91.3	92.7	90.0
No	13.6	7.8	7.7	8.7	7.3	10.0
Total	100	100	100	100	100	100
N	486	370	195	288	41	1380

g. Problems related to (experience of) disconnection, trouble in paying bill (reasons/type)

Table 4.6.12: Percentage of respondents reported ever disconnection for non-payment of bills by landownership group

Line ever disconnected for non-payment of bill	Landless	Marginal	Small	Medium	Large	All
Yes	16.0	12.4	10.3	9.7	9.8	12.8
No	84.0	87.6	89.7	90.3	90.2	87.2
Total	100	100	100	100	100	100
N	486	370	195	288	41	1380

Table 4.6.13: Percentage of respondents reported ever having trouble in paying bills by landownership group

Ever had trouble in paying bills	Landless	Marginal	Small	Medium	Large	All
Yes	28.4	25.4	14.9	18.8	9.8	23.1
No	71.6	74.6	85.1	81.3	90.2	76.9
Total	100	100	100	100	100	100
N	486	370	195	288	41	1380

Table 4.6.13 (b): Percentage of respondents reported ever having trouble in paying bills by major troubles by landownership group

Nature of major troubles	Landless	Marginal	Small	Medium	Large	All
1. Did not get bill in time	8.7	11.7	27.6	24.1	25.0	14.1
2. Get incorrect bill	10.9	12.8	6.9	29.6		14.1
3. Couldn't pay due to want of money	79.0	67.0	65.5	40.7	50.0	67.4
4. Others	5.1	11.7	6.9	11.1	25.0	8.5
NR	.7	2.1				.9
n*	138	94	29	54	4	319

n: only those reported ever trouble in bill payment*

h. Regularity/irregularity in power supply : nature, seasonality

Table 4.6.14: Extent, frequency, and timing of power failure

Extent, frequency and timing of power failure	Values
I. % reported about regularity in power supply:	
Regular	16.8
Irregular	83.2
Total	100
N	1380
II. % those reported irregular power supply by frequency of failure :	
Almost daily affairs	72.3
Seasonal	9.8
Occasional	17.9
Total	100
N	1148
iii. % those said irregularity as an almost daily affairs by timing of such irregularity (most failure):	
Day time (5-12)	.1
Afternoon (12-6)	.7
Evening (6-10)	98.3
Late night (10-4)	.8
Total	
N	830
IV. % those said power failure as seasonal by season of maximum failure and timing of most failure:	
Season	
Summer	90.1
Winter	4.5
Monsoon	5.4
Total	100
N	943
Timing	
Daytime	1.5
Afternoon	3.1
Evening	90.8
Late night	4.7
Total	100
N	943

i. Willingness to pay more with quality services: no power fluctuations, available round the clock etc.

Table 4.6.15: Percentage distribution of customers about their willingness to pay more (WTP) for electricity with better quality of services* than now by landownership group

Willing to pay more	Landless	Marginal	Small	Medium	Large	All
Willing	40.7	44.6	49.7	47.2	53.7	44.8
Not willing	59.3	55.4	50.3	52.8	46.3	55.2
Total	100	100	100	100	100	100
N	486	370	195	288	41	1380

Note: Better quality of services meaning no power fluctuations and available round-the-clock

Table 4.6.16: Customers distribution according to the extent they have expressed their willingness-to-pay (WTP) more than now if quality services are assured

Extent of willingness-to-pay more (WTPM) than now (%)	Landless	Marginal	Small	Medium	Large	All
(Not willing) 0	59.3	55.4	50.3	52.8	46.3	55.2
1 – 10	24.7	25.7	29.2	30.6	24.4	26.8
11 – 20	9.3	13.2	11.3	9.7	22.0	11.1
21 – 30	2.7	2.2	4.6	3.1	2.4	2.9
31 – 40	.8		.5	.3		.4
41 – 50	1.6	1.9	.5	1.7	2.4	1.6
51 – 60		.3				.1
61 – 70				.3		.1
71 – 80			.5	.3		.1
81+	1.6	1.4	3.1	1.0	2.4	1.7
Total	100	100	100	100	100	100
Mean WTP more	6.80	7.18	9.30	7.20	9.68	7.42
N	486	370	195	288	41	1380
How much more willing to pay? % Higher than now.						
0	59.3	55.4	50.3	52.8	46.3	55.2
2	2.9	1.4	0.5	2.8	2.4	2.1
3	0.4	0.3				0.2
4	0.2			0.3		0.1
5	8.6	11.1	13.3	13.5	7.3	10.9
6	0.2					0.1
7	0.2		0.5		2.4	0.2
8				0.3		0.1
9			0.5			0.1
10	12.1	13.0	14.4	13.5	12.2	13.0
11	0.4			0.7	2.4	0.4
12	0.8	0.8		0.3	2.4	0.7
13	0.2					0.1
15	2.1	5.9	5.1	2.8	2.4	3.7
16	0.2			0.3		0.1
17	0.2	0.3				0.1
19	0.2					0.1

Extent of willingness-to-pay more (WTPM) than now (%)	Landless	Marginal	Small	Medium	Large	All
20	5.1	6.2	6.2	5.6	14.6	5.9
21		0.3				0.1
25	2.1	1.1	3.1	1.7	2.4	1.9
26	0.4		0.5			0.2
30	0.2	0.8	1.0	1.4		0.7
31	0.2					0.1
33	0.4			0.3		0.2
40	0.2		0.5			0.1
50	1.6	1.9	0.5	1.7	2.4	1.6
55		0.3				0.1
66				0.3		0.1
76				0.3		0.1
80			0.5			0.1
90			0.5		2.4	0.1
100	1.6	1.4	2.6	1.0		1.5
Total	100	100	100	100	100	100

Table 4.6.16 (b): Customers distribution according to the extent they have expressed their willingness-to-pay (WTP) more than now if quality services are assured

Monthly bill and WTPM	Landless	Marginal	Small	Medium	Large	All
1. Average monthly expenditure for electricity: bill only	127.08	130.48	138.26	148.67	227.13	137.05
2. Average WTPM compared to current monthly bill	6.80	7.18	7.30	7.20	9.68	7.42
3. Average amount per month willing to pay if quality assured (no fluctuation and available round the-clock)	135.72	139.85	151.12	155.37	249.12	147.22

4.7 Demand for electricity and reasons for not having electricity Tables : 4.7.1 — 4.7.4 (b)

Table 4.7.1: Percentage of respondents without electricity by their willingness to have electricity in the hh by land ownership groups (demand for electricity)

Land ownership group(s)	Willingness to have electricity in household								
	WE-EV			WE-NEV			ALL		
	Willing	Unwilling	Total (N)	Willing	Unwilling	Total (N)	Willing	Unwilling	Total (N)
Landless	87.7	12.3	100 (243)	95.6	4.4	100 (319)	92.2	7.8	100 (562)
Marginal	88.8	11.2	100 (107)	96.1	3.9	100 (178)	93.3	6.7	100 (285)
Small	94.9	5.1	100 (39)	100.0		100 (78)	98.3	1.7	100 (117)
Medium	93.5	6.5	100 (31)	98.9	1.1	100 (91)	97.5	2.5	100 (122)
Large	100.0		100 (1)	95.8	4.2	100 (24)	96.0	4.0	100 (25)
All	89.1	10.9	100 (421)	77.0	23.0	100 (690)	93.8	6.2	100 (1111)

Table 4.7.1(b): Percent of those expressed willingness to have electricity at their households by reasons of such willingness by land ownership groups

(multiple responses)

Reasons behind willingness	Landless	Marginal	Small	Medium	Large	All
1. To increase agriculture production through irrigation	26.0	49.3	66.1	70.8	66.7	42.5
2. Poultry raising	22.9	35.1	34.8	36.7	33.3	29.2
3. For prosperous business (long work hours, Refrigerators, TV)	16.9	11.6	20.0	33.3	33.3	18.1
4. Awareness raising through TV viewing	38.8	49.3	62.6	58.3	75.0	47.2
5. Fan for comfort	69.9	75.0	72.2	67.5	79.2	71.4
6. Light for additional educational hours for children	64.9	73.1	67.8	80.8	79.2	69.5
7. More security	45.0	46.6	43.5	45.0	66.7	45.8
8. Quality leisure time/more recreation	18.3	17.5	20.0	21.7	29.2	18.9
9. Wellbeing of members healths	20.6	17.9	13.9	19.2	25.0	19.1
Others	4.5	4.5	6.1	3.3		4.4
N	515	268	115	120	24	1042

Table 4.7.2: (Household without electricity in electrified villages) Reasons as to why neighbour have electricity but the household does not have

(multiple response)

Reasons for not having electricity	% reported
1. Is not in PBS master plan/was not in PBS plan/don't know about PBS plan	16.7
2. Paid money, but not yet connect	14.9
3. Completed wiring, but not yet connected	6.3
4. Submitted membership fee long ago, but not yet connected	15.7
5. Non-cooperation from the neighbours	3.3
6. Financial insolvency	50.9
7. Hassles to get connected	23.8
8. Hassles of regular payment of bill	12.9
9. Unwilling to use electricity	6.3
10. No need	3.0
11. Others	1.0
N	395

Table 4.7.3: Knowledge among those not having electricity by their reporting about **one time amount** of money required to get electricity connection

Tk. Reported	% reported such amount
<1000	16.6
1000 – 1500	27.4
1501 – 2000	5.9
2001 – 2500	1.0
2501 – 3000	3.0
3001 – 3500	.1
3501 – 4000	.5
4001 +	3.3
DK	42.3
Total Average amount reported (Tk)*	100 1703.30 (641)
N	1111

[those reported amount (Tk.)*

Note: One time amount (investment) includes membership fee, wearing materials, wearing charges, GD. (guaranteed deposit)

Table 4.7.4: Knowledge about approximate monthly bill for domestic use of electricity

Monthly bill (in Tk.)	% reported
<50	1.0
50 – 100	44.9
101 – 150	9.9
151 – 200	4.0
201 – 250	.9
250 – 300	.4
301 – 350	.1
351 +	.5
DK	38.3
Total Average amount reported (Tk)*	100 101.95 (685)
N	1111

** those reported amount (Tk.)*

Table 4.7.4 (b): Knowledge* among those not having electricity about the **per unit tariff** for electricity (domestic connection) by landownership groups

Land ownership group(s)	Knowledge about per unit tariff								
	WE-EV			WE-NEV			ALL		
	Knows	Don't know	Total (N)	Knows	Don't know	Total (N)	Knows	Don't know	Total (N)
Landless	11.9	88.1	100 (243)	3.8	96.2	100 (319)	7.3	92.7	100 (562)
Marginal	16.8	83.2	100 (107)	5.6	94.4	100 (178)	9.8	90.2	100 (285)
Small	15.4	84.6	100 (39)	7.7	92.3	100 (78)	10.3	89.7	100 (117)
Medium	22.6	77.4	100 (31)	13.2	86.8	100 (91)	15.6	84.4	100 (122)
Large		100.0	100 (1)	16.7	83.3	100 (24)	16.0	84.0	100 (25)
All	14.3	85.7	100 (421)	6.4	93.6	100 (690)	9.4	90.6	100 (1111)

* *Note:* *Per unit tariff varies by PBS. Information by PBS was obtained first, and then in line with that the knowledge situation was ascertained.*

IMPACT ON POVERYT REDUCTION AND HUMAN DEVELOPMENT

Income Poverty: Tables 4.8.1 - 4.8.9 (b)

Table 4.8.1: Incidence of poverty (head count ratio) by direct calories intake method by hh electricity status

(% population below poverty line)

Poverty lines	Household with electricity	Household without electricity (in electrified villages)	Household without electricity (in non-electrified villages)
Poverty line 1: Less than 2122 K-Cal. **(Absolute poor)**	39.9	51.2	43.4
Poverty line 2: Less than 1805 K-Cal. **(Hard core poor)**	21.8	27.1	23.1

[Note: Methodological details with technical notes are presented in the next pages]

Table 4.8.1(b): Population (%) below poverty line using different head count methods

Current survey and National Data Categories	% population below poverty line			
	Direct calories intake method		Cost of Basic needs methods (using consumption)	
	Absolute poor	Hard core poor	Lower poverty line (Tk 571/person/ month)	Upper poverty line (Tk 683/person/ month)
Household with electricity	39.9	21.8	22.3	36.3
Household without electricity (in electrified villages)	51.2	27.1	47.9	61.2
Household without electricity (in non-electrified villages)	43.4	23.1	35.0	51.8
Bangladesh National Data (HIES 2000)*				
National	44.3	20.0	33.7	49.8
Rural	42.3	18.7	37.4	53.0
Urban	52.5	25.0	19.1	36.6

* *Source: HIES 2000, BBS December 2001*

[Note: Methodological details with all relevant technical notes are presented in the next pages.]

Technical Notes on Measurement of Poverty

In estimating incidence of poverty both Direct Calorie Intake (DCI) method and Cost of Basic Need (CBN) methods have been used. It may be mentioned that the Govt, BBS has used DCI method in estimating poverty upto HES 1991-92; the CBN method was first introduced in HES 1996-96.

Incidence of poverty calculated using DCI method: Two types of poverty measure have been estimated: absolute poverty based on intake of 2122 kilo-calorie (or less) of energy per capita per day, and hard core poverty based on per capita per day intake of 1805 K. Cal. (or less) of energy.

Food items: Conversion from physical units to energy (K. Cal.)

Item		Unit	K. Calorie	Remarks
01.	Rice	100 gm	346	Average of 3 types
02.	Ata/wheat flour	100 gm	344	Average of 2 types
03.	Fish	100 gm	112.1	Average of 17 types
04.	Meat	100 gm	113.7	Average of 3 type
05.	Egg (#)	1	177	Average of 2 type
06.	Milk	100 gm	67	Cow milk
07.	Pulses	100 gm	338	Average of 8 type
08.	Vegetables	100 gm	35.2	Average of 11 type
09.	Potato	100 gm	97.0	1 type
10.	Edible oil	100 gm	900	Average of 3 type
11.	Spices	100 gm	73.0	Average of 5 type
12.	Fruits	100 gm	58.6	Average of 18 type
13.	Sugar	100 gm	398	1 type
14.	Gur	100 gm	398	1 type
15.	Tea/coffee	100 gm	-	-

Note: Estimates based on value provided by Food & Nutrition Institute (Dhaka University) and approved by Bd. National Nutrition Council, *"Deshio Khadodrobber Pushtiman"* (Food values of national food items in Bangladesh): 1992: 2-33

Cost-of-basic needs (CBN) method: According to CBN method, to be considered as poor, a household must have a per capita expenditure below a given poverty line (HIES 2000:55-57). Three steps are usually followed to estimate what is a cost a household to meet its basic needs:

Step 1: Estimating the cost of fixed bundle consisting 11 items (rice, wheat, pulses, milk, oil, meat, fresh water fish, potato, other vegetables, sugar and fruits). It provides minimal nutritional requirements corresponding to 2122 K. Cal per day per person, the same threshold used to identify the absolute poor with the DCI method. Prices for each item in the bundle are usually estimated for fourteen geographic areas (HIES 2000: 57). However for the purpose of the present study (we have considered 11 because these areas are relevant to our sample areas; Dhaka, Chittagong and Khulna Metropolitan Areas are excluded).

Step 2: Computing two non-food allowances for non-food consumption. The lower allowances for non-food consumption are estimated by taking the amount spent on non-food items by those households whose total consumption was equal to their food poverty line, i.e; these households spend less than on food than the food poverty line (or they spend on non-food items bare essential). The upper allowances for non-food consumption are estimated by taking the amount spent on non-food items by those households whose food expenditure is equal to the food poverty line (these households do meet their food requirement).

Step 3: The third step in the estimation of the poverty lines consists simply in adding to the food poverty lines the lower and upper non-food allowances to yield the total lower and upper poverty lines.

Year 2000 CBN poverty lines (with composite price index) (HIES 2000: 57)
(Taka per person per month)

	Area	ZL	ZU
01.	Dhaka urban (other than SMA)	521	629
02.	Rural Dhaka	548	659
03.	Rural Faridpur, Tangail, Jamalpur	540	591
04.	Urban Chttagong (other than SMA)	694	818
05.	Rural Sylhet, Comilla	572	738
06.	Rural Noakhali, Chittagong	582	719
07.	Rural Barisal , Patuakhali	546	616
08.	Rural Khulna, Jessore, Kushtia	527	624
09.	Urban Rajshahi	557	726
10.	Rural Rajshahi, Pabna	586	690
11.	Rural Bogra, Rangpur, Dinajpur	510	582
	Average 11 areas:	562	672
	(Adjusted Inflation Rate for year 2000-2001 2001:	571	683

Source: GED/PC, GoB: Performance of Bd. Economy;
July 2001, p.14: 1.59%)

(Also, see CPI-consumer price index in statistical Pocketbook 2000: 331-33 Published: BBS Jan. 2002)

In order to estimate the poverty incidences using CBN method, the household expenditure on basic needs items were considered. These include expenses on food, clothing (apparels), housing, medicine (health care expenses), and education. ZL is the lower poverty line; ZU is the upper poverty line. The money value for 2000 (provided for 11 geographic areas in HIES 2000). ZL corresponds to the households below Tk. 562 per person per month as food and non-food expenditure; and ZU corresponds to the households below Tk. 672 per person per month as food and non-food expenditure. For national rural (for 2000), ZL=37.4% and ZU = 53.0% (HIES 2000: 20). The values estimated by us using 2001 inflation rate is ZL=Tk 571, and ZU=Tk 683. Since, the expenditure (food and non-food) data in the present survey were obtained for year 2001, the inflation adjusted same year's ZL and ZU money values were applied.

Perception about income poverty dimensions: self assessment scoring/ranking

Table 4.8.2: Trend in self-assessed economic status of household: 1997-2002

(% reported by respondents)

Economic status of household	Households with electriciy					HH without electricity (in electrified villages)					HH without electricity (in non-electrified villages)				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Poor	13.6	13.8	11.4	10.2	10.3	47.0	48.5	42.0	40.9	40.1	30.3	32.0	27.8	25.4	24.6
Lower middle	37.3	37.8	35.7	35.1	35.2	34.7	32.8	37.1	35.6	36.6	39.9	38.8	42.3	42.3	41.3
Middle	38.4	37.7	41.2	42.0	42.1	17.3	17.6	19.5	22.1	22.1	25.5	25.1	25.2	26.8	28.4
Upper Middle	9.2	9.3	10.1	10.9	10.5	.7	1.0	1.0	1.0	1.0	2.6	2.2	2.8	3.8	3.9
Rich	1.4	1.4	1.5	1.8	1.9	.2	.2	.5	.5	.2	1.7	1.9	1.9	1.7	1.7
All	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
N	1380					421					690				

Table 4.8.2 (b): Aggregate score of self-assessed economic status of households for the last five years (1997 - 2001)

Sample category	Aggregate economic status score[1>]
1. Household with electricity	2.5
2. Household without electricity (in electrified villages)	1.8
3. Household without electricity (in non-electrified villages)	2.1

Note: [1>] *Aggregate economic status score ranges between 1 and 5, '1' being 'poor' and '5' being 'rich'. Aggregate economic status has been estimated as sum total of individual year's score divided by five years total observations (sum of 'n').*

Table 4.8.3: Trend in self-assessed categorization of household in terms of food availability status: 1997-2002

(% reporting)

Food availability Categorization	Households with electricity					HH without electricity (in electrified villages)					HH without electricity (in non-electrified villages)				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Always deficit	10.0	10.8	8.5	7.2	8.2	27.1	27.8	24.2	23.0	22.3	20.0	22.2	20.0	16.1	16.2
Occasionally deficit	24.1	24.8	21.5	18.8	18.9	33.3	36.3	32.8	27.8	30.4	25.9	27.8	27.1	25.5	25.8
Neither deficit not surplus (breakeven)	48.6	47.5	52.2	52.8	50.1	34.9	31.1	37.8	42.8	40.6	43.5	39.6	40.7	45.5	44.9
Surplus	17.3	17.0	17.8	21.2	22.8	4.8	4.8	5.2	6.4	6.7	10.6	10.4	12.2	12.9	13.0
All	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
N	1380					421					690				

Table 4.8.3 (b): Aggregate score of self-assessed food availability status of households for the last five years (1997 - 2001)

Sample category	Aggregate food availability status score[1>]
1. Household with electricity	2.8
2. Household without electricity (in electrified villages)	2.2
3. Household without electricity (in non-electrified villages)	2.5

Note: [1>] Aggregate food availability status score ranges between 1 and 4, '1' being 'always deficit' and '4' being 'surplus'. Aggregate score is sum total of individual year's score divided by five years total observations (sum of 'n').

Table 4.8.4: Trend in incidences of economic crisis faced by households during last 5 years: 1997-2001

(% reporting)

Faced economic crisis	Households with electricity					HH without electricity (in electrified villages)					HH without electricity (in non-electrified villages)				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Yes	8.6	19.7	15.9	12.4	21.5	13.1	26.4	20.2	16.9	24.9	7.7	24.3	15.2	13.9	23.9
No	91.4	80.3	84.1	87.6	78.5	86.9	73.6	79.8	83.1	75.1	92.3	75.7	84.8	86.1	76.1
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
N	1380					421					690				

Note: Economic crisis has been defined as facing of economic hardship, health related, ceremony, flood/cyclone, draught, etc.

Table 4.8.4 (b): Aggregate score for household economic crisis for the last five years (1997 - 2001)

Sample household category	Aggregate economic crisis score[1>]
1. Household with electricity	0.844
2. Household without electricity (in electrified villages)	0.797
3. Household without electricity (in non-electrified villages)	0.830

Note: [1>] Aggregate economic crisis score ranges between 1 and 0, '1' being no crisis and '0' being crisis faced. The closer the value to '1' the better. Aggregate crisis score has been estimated as sum total of individual year's crisis score divided by five years total observations (sum of 'n').

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Table 4.8.4 (c): Pattern of nature of economic crisis faced by respondent households during last five years (reported were last two crises)

(% reported: multiple responses)

Nature of crisis (crisis due to/associated with)	Households with electricity					HH without electricity (in electrified villages)					HH without electricity (in non-electrified villages)				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Death of earning member	4.2	1.8	3.7	8.2	3.0	3.6		2.2			1.9	2.2	1.5		2.7
High expenditure due to illness	34.7	29.0	40.2	48.0	61.8	43.6	33.3	53.3	83.3	54.1	58.5	23.2	38.8	37.1	63.4
Loss of crops	22.9	35.5	29.9	11.2	11.1	38.2	41.0	37.8	6.7	9.8	13.2	47.1	40.3	29.0	9.8
Loss of Business	14.4	8.3	11.0	10.2	6.5		11.5	4.4	3.3	4.9	1.9	2.9	6.0	1.6	2.7
Land dispute	1.7	2.8	2.4	7.1	2.5	3.6	6.4	2.2		4.9		2.9	1.5	1.6	
Theft/robbery	4.2	1.4	1.8		2.0	3.6	5.1		3.3	1.6			1.5		.9
Social injustice	3.4	3.7	5.5	6.1	4.5	1.8	1.3	6.7	3.3	9.8	1.9	3.6	7.5	4.8	6.3
Death/Disease of Livestock	2.5	3.2	2.4	3.1	2.0		3.8	2.2	3.3		1.9	2.2	3.0	3.2	1.8
River bank erosion		.9				1.8						.7		1.6	1.8
Flood/cyclone	22.9	29.0	11.6	7.1	4.0	18.2	29.5	6.7	3.3	4.9	22.6	34.8	3.0	9.7	4.5
Daughter marriage/dowry	1.7	2.3	2.4		2.5			2.2		1.6	1.9	2.9	3.0	8.1	.9
Loan/repayment			1.2		1.5	1.8	2.6	2.2			1.9			1.6	
Performing Hazz		.5	.6	1.0	.5										.9
Construction of new house	.8	.9													
Others	13.6	9.2	11.6	13.3	12.1	3.6	5.1	8.9	16.7	13.1	15.1	5.1	13.4	17.7	13.4
N	118	217	164	98	199	55	78	45	30	61	63	138	67	62	112

[n = only those reported nature of crisis]

Table 4.8.4 (d): Pattern of crisis coping mechanisms reported by respondents

(% reported: multiple responses)

Crisis coping mechanisms	Households with electricity					HH without electricity (in electrified villages)					HH without electricity (in non-electrified villages)				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Utilized saving	20.3	28.1	28.7	29.6	32.7	23.6	26.9	22.2	13.3	14.8	13.2	23.2	20.9	21.0	20.5
Land sale	16.1	12.0	14.0	14.3	12.6	16.4	5.1		10.0	11.5	5.7	10.1	20.9	16.1	13.4
Sale of durable asset	12.7	12.0	5.5	6.1	8.5	7.3	14.1	11.1	10.0	13.1	17.0	13.8	10.4	11.3	9.8
Mortgaging land	12.7	18.0	18.9	14.3	8.5	9.1	11.5	17.8	6.7	14.8	9.4	8.7	7.5	11.3	5.4
Loan	46.6	53.5	44.5	42.9	41.2	45.5	67.9	48.9	53.3	39.3	43.4	52.9	46.3	43.5	48.2
Disinvestment	.8	.5	4.3	2.0	4.0	1.8	2.6					2.2			1.8
Sale of livestock	12.7	12.9	15.2	12.2	10.6	20.0	17.9	26.7	26.7	8.2	15.1	21.7	31.3	19.4	16.1
Disintegration of family	1.7	1.4	1.2	1.0	.5	3.6	1.3	4.4				.7	4.5	1.6	.9
Engaging school going children to work	4.2	1.4	2.4	2.0		5.5		2.2	3.3	4.9	3.8		3.0	3.2	2.7
Public/NGO assistance	5.9	5.1	4.9	2.0	3.0	1.8	6.4	8.9	3.3	3.3	7.5	5.1	3.0	1.6	2.7
Others	12.7	7.4	7.3	4.1	7.5	7.3	2.6	6.7	3.3	11.5	15.1	6.5	9.0	6.5	8.0
NR				1.0	1.0					1.6	1.9	.7		1.6	
N	118	217	164	98	199	55	78	45	30	61	63	138	67	62	112

[n = only those reported nature of crisis]

Table 4.8.5: Trend in the incidences of distress sale to cope with poverty/crisis during last five years: 1997 – 2001

(% reported)

Incidence of distress sale to cope with crisis/poverty	Households with electricty					HH without electricity (in electrified villages)					HH without electricity (in non-electrified villages)				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Yes	3.4	7.4	6.0	4.3	9.0	2.9	8.3	6.7	5.0	10.9	3.5	10.6	8.8	6.7	10.4
No	96.6	92.6	94.0	95.7	91.0	97.1	91.7	93.3	95.0	89.1	96.5	89.4	91.2	93.3	89.6
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
N	1380					421					690				

Table 4.8.5 (b): Aggregate score for distress sales to cope with poverty/crisis for the last five years (1997-2001)

Sample household category	Aggregate distress sale score[1>]
1. Household with electricity	0.940
2. Household without electricity (in electrified villages)	0.932
3. Household without electricity (in non-electrified villages)	0.920

Note: [1>] *Aggregate distress sale score ranges between 1 and 0, '1' being no incidence of distress sale and '0' being distress sale. The higher the value toward '1' the better. Aggregate distress sale score has been estimated as sum total of individual year's divided by five years total observations (sum of 'n').*

Consumption poverty

Table 4.8.6: Incidence of poverty (Head count ratio) using CBN method (in %) by HH electricity status

(% population below poverty line)

Poverty line using consumption*	Household with electricity	Household without electricity (in electrified villages)	Household without electricity (in non-electrified villages)	All households
Lower poverty line (ZL)	22.3	47.9	35.0	29.8
Upper poverty line (ZU)	36.3	61.2	51.8	44.5

***> Can be measured using income.** Expenses considered: Food, apparels, housing, health and education.*

Note: ZL is the lower poverty line; ZU is the upper poverty line. ZL corresponds to the hhs below Tk. 562 per person per month as food and non-food expenditure; and ZU corresponds to the hhs below Tk. 672 per person per month as food and non-food expenditure (as described in technical notes for CBN in Annex after Table 4.8.1.a). For national rural (for 2000), ZL=37.4% and ZU=53.0% (HIES 2000:20). The values estimated by us using 2001 inflation rate 1.59% are ZL=Tk 571, and ZU=Tk 683.

Table 4.8.7: Human Development Index: Bangladesh

Indicators	National (2000)
A. Adult Literacy rate (%) (AL) (15 yrs. and above)	
Observed/actual	56
Maximum	100
Minimum	0
B. Combined gross enrolment ratio (CER) (5-24 yrs.)	
Observed/actual	69
Maximum	100
Minimum	0
C. Life expectancy (LE) at birth (Infant mortality rate as proxy)	
Observed/actual	61
Maximum	85
Minimum)	25
D. Percapita income (as proxy of percapital real GDP: PPP)	
Observed/actual = 1632	1632
Maximum = 6154	6154
Minimum = 100	100
E. Indexed LE	**0.6000**
F. Indexed AL	**0.5600**
G. Indexed CC	**0.6900**
H. Indexed Educational Attainment (EA)	**0.6029**
I. Indexed Adjusted Income	**0.2531**
Human Development Index	0.4853

Table 4.8.8: Trends in self-assessed ranking of households' economic strength in meeting/bearing health care related expenses: 1997-2001

Rank of difficulty in meeting/bearing health care related expenses	Households with electricity					HH without electricity (in electrified villages)					HH without electricity (in non-electrified villages)				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Very difficult	11.2	12.8	10.7	11.9	14.0	24.5	27.3	24.7	24.9	26.6	17.8	21.6	19.7	16.7	22.3
Difficult	33.9	33.8	32.8	29.9	30.4	39.4	38.7	38.7	36.6	37.3	34.5	35.9	35.2	37.4	34.1
Not difficult	54.9	53.4	56.4	58.3	55.7	36.1	34.0	36.6	38.5	36.1	47.7	42.5	45.1	45.9	43.6
All	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
N	1380					421					690				

Table 4.8.8 (b): Aggregate score of ranking of self-assessed economic strength of household in meeting bearing health care related expenses for the last five years (1997 - 2001)

Sample hh category	Aggregate score of ranking of economic strength in meeting health expenses[1>]
1. Household with electricity	3.6
2. Household without electricity (in electrified villages)	2.8
3. Household without electricity (in non-electrified villages)	3.2

Note: [1>] *Aggregate ranks score ranges between 1 and 5, 1 being very difficult 2 being difficult and 5=not difficult. The aggregate rank score has been estimates as sum total of individual years value divided by five years total observations (sum of 'n').*

Table 4.8.9: Trends in self-assessed ranking of household's economic strength in meeting/bearing educational expenses of members/children: 1997-2001

Rank of difficulty in bearing/ meeting educational expenses	Households with electricity					HH without electricity (in electrified villages)					HH without electricity (in non-electrified villages)				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Very difficult	6.6	8.8	7.2	7.1	7.2	15.9	17.8	16.4	15.9	15.9	10.6	14.1	10.6	8.3	8.4
Difficult	25.9	24.9	24.1	23.8	24.6	24.7	24.2	25.7	25.7	27.6	21.2	20.9	25.5	26.5	26.5
Not difficult	46.7	46.1	49.5	51.2	51.8	28.3	27.6	29.0	30.2	29.7	37.5	34.6	35.5	39.0	40.4
NA	20.8	20.2	19.1	17.8	16.3	31.1	30.4	29.0	28.3	26.8	30.7	30.4	28.4	26.2	24.6
All	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
N	1380					421					690				

Table 4.8.9 (b): Aggregate score of ranking of self-assessed household's economic strength in meeting/bearing educational expenses for members/children (1997 - 2001)

Rank of difficulty in bearing/meeting educational expenses	Aggregate score of ranking of economic strength in meeting/bearing educational expenses[1>]
1. Household with electricity	3.0
2. Household without electricity (in electrified villages)	2.1
3. Household without electricity (in non-electrified villages)	2.5

Note: [1>] *Aggregate ranks score ranges between 1 and 5, 1 being very difficult 2 being difficult and 5=not difficult. The aggregate rank score has been estimates as sum total of individual years value divided by five years total observations (sum of 'n').*

Chapter 5: Impact on Irrigation and Agriculture (Tables 5.1 – 5.35

Table 5.1: Distribution of sample irrigation equipment by year of installation

Year of installation	Electrified				Non-electrified (Diesel)			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D
Before independence (31 years and above)	1.8	.0	15.2	1.8	.0	.0	.0	.0
1972 (30 Years)	.9	.0	6.1	.8	.0	.0	.0	.0
1973 (29 Years)	3.6	.8	3.0	1.8	.0	.0	.0	.0
1974 (28 Years)	.0	.0	3.0	.3	.0	.0	.0	.0
1975 (27 Years)	2.7	1.3	15.2	2.9	.0	.0	.0	.0
1976 (26 Years)	9.9	.4	.0	3.1	4.5	.0	.0	1.4
1977 (25 Years)	.9	.8	.0	.8	.0	.0	.0	.0
1978 (24 Years)	5.4	.4	.0	1.8	4.5	4.9	.0	4.1
1979 (23 Years)	10.8	.4	3.0	3.7	9.1	.0	.0	2.7
1980 (22 Years)	9.9	2.9	12.1	5.7	4.5	2.4	10.0	4.1
1981 (21 Years)	2.7	.8	3.0	1.6	4.5	2.4	.0	2.7
1982 (20 Years)	1.8	3.3	3.0	2.9	9.1	2.4	.0	4.1
1983 (19 Years)	2.7	2.5	.0	2.3	4.5	2.4	.0	2.7
1984 (18 Years)	6.3	5.0	3.0	5.2	18.2	.0	.0	5.5
1995 (17 Years)	6.3	8.4	.0	7.0	4.5	2.4	.0	2.7
1986 (16 Years)	.0	2.9	.0	1.8	.0	.0	.0	.0
1987 (15 Years)	.0	2.5	.0	1.6	.0	2.4	10.0	2.7
1988 (14 Years)	.9	3.3	6.1	2.9	.0	2.4	.0	1.4
1989 (13 Years)	2.7	3.3	3.0	3.1	.0	.0	.0	.0
1990 (12 Years)	9.0	8.4	3.0	8.1	.0	2.4	10.0	2.7
1991 (11 Years)	3.6	2.5	.0	2.6	4.5	2.4	.0	2.7
1992 (10 Years)	3.6	5.4	.0	4.4	4.5	4.9	.0	4.1
1993 (9 Years)	.0	.8	.0	.5	.0	2.4	.0	1.4
1994 (8 Years)	2.7	2.1	.0	2.1	4.5	9.8	10.0	8.2
1995 (7 Years)	.9	3.8	.0	2.6	9.1	2.4	.0	4.1
1996 (6 Years)	1.8	5.4	.0	3.9	4.5	4.9	10.0	5.5
1997 (5 Years)	.9	6.3	6.1	4.7	4.5	7.3	.0	5.5
1998 (4 Years)	.9	7.5	3.0	5.2	.0	9.8	10.0	6.8
1999 (3 Years)	1.8	8.4	6.1	6.3	.0	17.1	20.0	12.3
2000 (2 Years)	2.7	5.0	3.0	4.2	.0	4.9	10.0	4.1
2001(1Year)	2.7	2.9	.0	2.6	4.5	9.8	10.0	8.2
2002 (less than one year)	.0	2.1	3.0	1.6	.0	.0	.0	.0
Total	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Duration of installation (years)								
1-5	8.1	32.6	21.2	24.5	9.1	48.8	50.0	37.0
6-10	9.0	17.6	.0	13.6	22.7	24.4	20.0	23.3
11-15	16.2	20.1	12.1	18.3	4.5	9.8	20.0	9.6
16-20	17.1	22.2	6.1	19.3	36.4	7.3	.0	15.1
21-25	30.6	5.0	18.2	13.6	22.7	9.8	10.0	13.7
26-30	17.1	2.5	27.3	8.9	4.5	.0	.0	1.4
31 and above	1.8	.0	15.2	1.8	.0	.0	.0	.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean year of Installation	18	11	20	14	16	8	8	10
N	111	239	33	383	22	41	10	73

Table 5.2: Distribution of sample electrified irrigation equipment by year of electrification

Year of electrification	Electrified			
	DTW-E	STW-E	LLP-E	All-E
Before 1980 (23 years and above)	1.8	.0	15.2	1.8
1980 (22 Years)	.9	.4	3.0	.8
1981 (21 Years)	3.6	.4	6.1	1.8
1982 (20 Years)	4.5	1.3	.0	2.1
1983 (19 Years)	1.8	.8	6.1	1.6
1984 (18 Years)	2.7	2.1	3.0	2.3
1995 (17 Years)	1.8	2.5	.0	2.1
1986 (16 Years)	4.5	2.9	.0	3.1
1987 (15 Years)	3.6	3.3	.0	3.1
1988 (14 Years)	1.8	1.3	.0	1.3
1989 (13 Years)	3.6	3.3	3.0	3.4
1990 (12 Years)	8.1	5.9	15.2	7.3
1991 (11 Years)	1.8	2.1	6.1	2.3
1992 (10 Years)	8.1	7.9	.0	7.3
1993 (9 Years)	7.2	2.1	.0	3.4
1994 (8 Years)	.9	1.3	.0	1.0
1995 (7 Years)	8.1	3.3	6.1	5.0
1996 (6 Years)	14.4	7.1	3.0	8.9
1997 (5 Years)	.9	6.7	.0	4.4
1998 (4 Years)	.0	12.6	6.1	8.4
1999 (3 Years)	7.2	12.1	15.2	11.0
2000 (2 Years)	3.6	9.2	3.0	7.0
2001(1Year)	9.0	8.8	6.1	8.6
2002 (less than one Year)	.0	2.5	3.0	1.8
Total	100.0	100.0	100.0	100.0
Duration of Electrification (years)				
1-5	18.9	50.6	33.3	39.9
6-10	36.9	22.2	9.1	25.3
11-15	19.8	17.6	27.3	19.1
16-20	18.9	8.8	6.1	11.5
21-25	4.5	.8	9.1	2.6
26-30	.9	.0	15.2	1.6
Total	100.0	100.0	100.0	100.0
Mean year of electrification	10	7	12	9
N	111	139	33	383

Table 5.3: Technical description of motor/engine of the pumps by type of irrigation equipment

Items of technical description	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D
HP (Horse power)								
1-3	.0	18.0	.0	11.2	.0	7.3	10.0	5.5
4-5	.9	70.7	12.1	45.4	.0	29.3	20.0	19.2
6-10	.0	2.1	3.0	1.6	4.5	36.6	10.0	23.3
11-15	1.8	5.4	60.6	9.1	.0	14.6	10.0	9.6
16-20	24.3	.4	18.2	8.9	18.2	.0	40.0	11.0
21-25	59.5	.4	3.0	17.8	40.9	.0	.0	12.3
26-30	13.5	.0	.0	3.9	27.3	.0	.0	8.2
31+	.0	2.9	3.0	2.1	9.1	12.2	10.0	11.0
Total	100	100	100	100	100	100	100	100
Mean	24	7	16	13	25	14	17	18
Depth of the well (feet)								
1- 50	.9	5.0	75.8	9.9	.0	4.9	90.0	15.1
51-100	1.8	49.4	21.2	33.2	4.5	48.8	10.0	30.1
101-150	6.3	22.6	3.0	16.2	.0	34.1	.0	19.2
151-200	38.7	11.7	.0	18.5	40.9	7.3	.0	16.4
201-250	20.7	6.3	.0	9.9	27.3	4.9	.0	11.0
251-300	24.3	3.3	.0	9.1	27.3	.0	.0	8.2
301+	7.2	1.7	.0	3.1	.0	.0	.0	.0
Total	100	100	100	100	100	100	100	100
Mean	222	121	39	143	214	107	29	128
Diameter of pipe (inch)								
1-3	1.8	6.7	.0	1.0	.0	24.4	30.0	4.7
4	4.5	74.9	3.0	2.0	9.1	65.9	.0	48.3
5-6	19.8	17.6	87.9	3.0	13.6	7.3	70.0	24.3
7-8	63.1	.8	6.1	4.0	68.2	2.4	.0	19.3
9-10	8.1	.0	.0	5.0	9.1	.0	.0	2.3
11+	2.7	.0	3.0	6.0	.0	.0	.0	1.0
Total	100	100	100	100	100	100	100	100
Mean	7.5	4.1	6.4	5.3	7.5	3.9	4.7	5.1
Load of electricity (KW)								
Up to 10 KW	.9	42.7	6.1	27.4	NA	NA	NA	NA
11-20	51.4	2.1	21.2	18.0	NA	NA	NA	NA
21-30	18.0	.8	6.1	6.3	NA	NA	NA	NA
31-100	1.8	1.7	12.1	2.6	NA	NA	NA	NA
101-300	2.7	12.1	.0	8.4	NA	NA	NA	NA
301-1000	.0	31.0	6.1	19.8	NA	NA	NA	NA
1001+	19.8	2.9	33.3	10.4	NA	NA	NA	NA
Don’t know	5.4	6.7	15.2	7.0	NA	NA	NA	NA
Total	100	100	100	100	NA	NA	NA	NA
Mean	979	858	1948	987	NA	NA	NA	NA
N	111	239	33	383	22	41	10	73

Table: 5.4: Cost of irrigation equipment including installment by type
(price, material cost and labor cost)

Items	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D
Price of the Machine								
1- 2500	.0	3.3	3.0	2.3	.0	.0	.0	.0
2601-5000	.0	.8	12.1	1.6	.0	4.9	.0	2.7
5001-7500	.0	14.6	6.1	9.7	4.5	24.4	10.0	16.4
750110000	.0	14.6	9.1	9.9	.0	31.7	30.0	21.9
10001-15000	8.1	24.7	21.2	19.6	13.6	22.0	30.0	20.5
16001-20000	18.0	26.8	12.1	23.0	4.5	4.9	20.0	6.8
20001-25000	30.6	11.7	21.2	18.0	9.1	2.4	10.0	5.5
25001-50000	21.6	3.3	12.1	9.4	27.3	9.8	.0	13.7
50001-75000	13.5	.0	3.0	4.2	9.1	.0	.0	2.7
75001-100000	6.3	.0	.0	1.8	18.2	.0	.0	5.5
100001-150000	.0	.0	.0	.0	13.6	.0	.0	4.1
150001+	1.8	.0	.0	.5	.0	.0	.0	.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean Taka	36387	14149	18170	20940	52479	12478	13220	24635
Material cost								
1- 2500	.9	9.6	9.1	7.0	.0	12.2	40.0	12.3
2601-5000	6.3	33.5	27.3	25.1	.0	43.9	30.0	28.8
5001-7500	3.6	21.8	12.1	15.7	.0	22.0	30.0	16.4
750110000	16.2	16.7	27.3	17.5	18.2	17.1	.0	15.1
10001-15000	9.9	13.0	15.2	12.3	4.5	4.9	.0	4.1
16001-20000	26.1	4.6	6.1	11.0	22.7	.0	.0	6.8
20001-25000	5.4	.4	3.0	2.1	.0	.0	.0	.0
25001-50000	26.1	.4	.0	7.8	27.3	.0	.0	8.2
50001-75000	3.6	.0	.0	1.0	22.7	.0	.0	6.8
75001-100000	1.8	.0	.0	.5	4.5	.0	.0	1.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean Taka	23108	7148	8482	11889	36386	5465	3580	14525
Labor cost								
1- 2500	23.4	63.2	72.7	52.5	13.6	70.7	100.0	57.5
2601-5000	17.1	27.6	21.2	24.0	22.7	22.0	.0	19.2
5001-7500	8.1	5.4	.0	5.7	4.5	2.4	.0	2.7
750110000	10.8	2.5	3.0	5.0	.0	4.9	.0	2.7
10001-15000	18.0	1.3	3.0	6.3	27.3	.0	.0	8.2
16001-20000	9.9	.0	.0	2.9	18.2	.0	.0	5.5
20001-25000	8.1	.0	.0	2.3	.0	.0	.0	.0
25001-50000	3.6	.0	.0	1.0	13.6	.0	.0	4.1
50001-75000	.9	.0	.0	.3	.0	.0	.0	.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean Taka	10449	2626	2106	4848	12830	2142	980	5203
N	111	239	33	383	22	41	10	73

Table 5.5: Percentage distribution of total installation cost of sample irrigation equipment by types

(%)

Cost (Taka)	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D
5001-7500	.0	1.3	.0	.8	.0	.0	.0	.0
750110000	.0	5.0	.0	3.1	.0	4.9	20.0	5.5
10001-15000	.0	20.1	21.2	14.4	.0	43.9	30.0	28.8
16001-20000	.0	11.3	15.2	8.4	.0	14.6	20.0	11.0
20001-25000	1.8	16.3	9.1	11.5	.0	14.6	20.0	11.0
25001-50000	35.1	44.4	51.5	42.3	18.2	19.5	10.0	17.8
50001-75000	25.2	1.7	.0	8.4	9.1	2.4	.0	4.1
75001-100000	23.4	.0	3.0	7.0	13.6	.0	.0	4.1
100001-150000	9.9	.0	.0	2.9	54.5	.0	.0	16.4
150001+	4.5	.0	.0	1.3	4.5	.0	.0	1.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N	111	239	33	383	22	41	10	73

Table 5.6: Average Price, installation cost and per acre installation cost of sample irrigation equipment by types

(in Taka)

Cost	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D
Price of equipment	36387	14149	18170	20940	52479	12478	13220	24635
Material cost	23108	7148	8482	11889	36386	5465	3580	14525
Labor cost	10449	2626	2106	4848	12830	2142	980	5203
Total installation cost	69944	23923	28758	37677	101695	20084	17780	44363
Installation cost per acre of total irrigated land	1069.48	1868.98	611.87	1215.39	2801.52	2183.04	950.80	2372.35

Table 5.7: Land of the pump owner in the command area

(%)

Own land (decimals)	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D
<50	6.5	4.5	12.9	5.8	.0	15.0	.0	8.8
51-75	7.5	7.6	9.7	7.7	15.8	7.5	22.2	11.8
76-100	18.7	10.7	6.5	12.7	15.8	10.0	33.3	14.7
101-150	10.3	22.8	12.9	18.2	5.3	20.0	11.1	14.7
151-200	17.8	13.4	9.7	14.4	15.8	15.0	.0	13.2
201-250	1.9	5.8	12.9	5.2	5.3	5.0	.0	4.4
251-300	10.3	7.6	16.1	9.1	21.1	10.0	33.3	16.2
301-500	16.8	17.4	16.1	17.1	15.8	5.0	.0	7.4
501-1000	4.7	8.9	3.2	7.2	.0	12.5	.0	7.4
1001+	5.6	1.3	.0	2.5	5.3	.0	.0	1.5
Mean	289	255	209	261	255	221	157	222
Total	100	100	100	100	100	100	100	100
N	107	224	31	362	19	40	9	68

Table 5.8: Operation days irrigation equipment were in use in 1408 (Bangla year)

(%)

Days	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D %	LLP-D %	All-E
<60	.0	2.9	3.0	2.1	.0	2.4	40.0	6.8
61- 90 days	9.9	25.9	42.4	22.7	9.1	34.1	30.0	26.0
91- 120 days	52.3	45.2	27.3	45.7	59.1	41.5	20.0	43.8
121 – 150	23.4	19.7	21.2	20.9	22.7	9.8	10.0	13.7
151 – 180	5.4	3.8	3.0	4.2	.0	7.3	.0	4.1
181+	9.0	2.5	3.0	4.4	9.1	4.9	.0	5.5
Total	100	100	100	100	100	100	100	100
Mean days	130	114	112	118	128	117	82	115
N	111	239	33	383	22	41	10	73

Table 5.9: Net land currently irrigated last year

(%)

Land (in acre)	Electrified pump				Non-electrified (diesel)			
	DTWE	STWE	LLPE	All-E	DTWD	STWD	LLPD	All-D
1-10	.0	59.4	9.1	37.9	18.2	73.2	50.0	53.4
11-20	.9	33.1	18.2	22.5	9.1	22.0	20.0	17.8
21-30	8.1	6.3	12.1	7.3	18.2	4.9	20.0	11.0
31-40	25.2	.8	12.1	8.9	18.2	.0	.0	5.5
41-50	18.0	.0	6.1	5.7	18.2	.0	.0	5.5
51-60	19.8	.0	21.2	7.6	4.5	.0	10.0	2.7
61-70	9.0	.0	6.1	3.1	9.1	.0	.0	2.7
71-80	4.5	.0	6.1	1.8	4.5	.0	.0	1.4
81-91	6.3	.4	9.1	2.9	.0	.0	.0	.0
91-100	4.5	.0	.0	1.3	.0	.0	.0	.0
101+	3.6	.0	.0	1.0	.0	.0	.0	.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean (acre)	57.0	11.0	42.0	27.0	33.9	7.7	17.9	17.0
N	111	239	33	383	22	41	10	73

Table 5.10: Total Land currently irrigated by type of equipment

(%)

Land (in acre)	Electrified pump				Non-electrified (diesel)			
	DTWE	STWE	LLPE	All-E	DTWD	STWD	LLPD	All-D
1-10	.0	50.6	9.1	32.4	4.5	63.4	50.0	43.8
11-20	.9	35.6	12.1	23.5	18.2	26.8	10.0	21.9
21-30	4.5	10.5	12.1	8.9	22.7	9.8	30.0	16.4
31-40	18.0	2.5	6.1	7.3	18.2	.0	.0	5.5
41-50	22.5	.0	12.1	7.6	18.2	.0	.0	5.5
51-60	17.1	.4	21.2	7.0	4.5	.0	10.0	2.7
61-70	7.2	.0	6.1	2.6	9.1	.0	.0	2.7
71-80	6.3	.0	9.1	2.6	4.5	.0	.0	1.4
81-91	9.0	.4	12.1	3.9	.0	.0	.0	.0
91-100	4.5	.0	.0	1.3	.0	.0	.0	.0
101+	9.9	.0	.0	2.9	.0	.0	.0	.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	65.4	12.8	47.0	31.0	36.3	9.2	18.7	18.7
N	111	239	33	383	22	41	10	73

Table 5.11: Land currently irrigated but not irrigated before installation of the electric pump.

(%)

Land (in acre)	Electrified				Diesel			
	DTWE	STWE	LLPE	All-E	DTWD	STWD	LLPD	All-D
1-10	20.7	74.5	27.3	54.8	18.2	80.5	50.0	57.5
11-20	15.3	21.3	9.1	18.5	22.7	19.5	20.0	20.5
21-30	6.3	2.5	18.2	5.0	13.6	.0	20.0	6.8
31-40	19.8	.8	18.2	7.8	13.6	.0	.0	4.1
41-50	13.5	.0	6.1	4.4	18.2	.0	.0	5.5
51-60	16.2	.0	9.1	5.5	9.1	.0	10.0	4.1
61-70	5.4	.4	6.1	2.3	4.5	.0	.0	1.4
71-80	2.7	.0	3.0	1.0	.0	.0	.0	.0
81-90	.0	.4	3.0	.5	.0	.0	.0	.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean (acre)	34.1	8.8	31.5	18.1	29.2	6.6	17.1	14.9
N	111	239	33	383	22	41	10	73

Table 5.12: Land use intensity under irrigation by type of equipment

	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	ALL-E	DTW-D	STW-D	LLP-D	ALL-D
Mean net area: Irrigated (acre)	57	11	42	27	33.9	7.7	17.9	17
Mean total area: Irrigated (acre)	65.4	12.8	47	31	36.3	9.2	18.7	18.7
Land use intensity under irrigation	114.7	116.4	111.9	114.8	107.1	119.5	104.5	110.0

Table 5.13: Land under different crops in sample plots by type of irrigation equipment

(in acres)

Crop	Electrified				Non-electrified (diesel)				No Irrigation
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D	
Aus- LB	.0	.0	.5	.5	.0	.0	.0	.0	2.0
Aus- HT	1.7	2.9	.3	4.9	.4	.7	.0	1.1	1.9
Aus- HB	.0	1.9	.0	1.9	.7	.0	.0	.7	.2
Aman-LB	.0	2.4	.0	2.4	.0	.0	.0	.0	3.7
Aman-HT	2.4	.9	.0	3.3	.0	.0	.2	.2	38.2
Aman- HB	7.6	22.7	.9	31.1	2.1	7.0	.0	9.2	38.2
Boro- LB	5.1	14.0	1.3	20.4	.9	2.2	.8	3.9	5.5
Boro- HT	32.1	68.9	10.3	111.4	6.4	11.8	1.2	20.0	2.3
Wheat	1.1	1.0	.0	2.0	.0	.5	.0	.5	2.4
Jute	1.0	.7	.0	1.7	.0	.0	.0	.0	7.5
Sugarcane	.0	.0	.0	.0	.0	.0	.0	.0	5.8
Masur	.0	.3	.0	.3	.0	.0	.0	.0	4.0
Mustard	.1	1.1	.0	1.2	.0	.0	.3	.3	15.1
Cauliflower	.0	.1	.0	.1	.0	.0	.0	.0	.0
Radish	.0	.0	.0	.0	.0	.0	.0	.0	.6
Bean	.0	.0	.0	.0	.1	.0	.0	.1	.0
Tomato	.6	.2	.0	.7	.0	.0	.0	.0	.4
Onion	.0	.0	.0	.0	.0	.0	.0	.0	1.0
Brinjal	.0	.0	.0	.0	.0	.0	.0	.0	.6
Potato	1.0	5.1	.0	6.2	.3	1.1	.0	1.3	.1
Chilly	.3	.0	.0	.3	.0	.3	.0	.3	.0
Melon	.0	.2	.0	.2	.0	.0	.0	.0	.0
Total	53.0	122.4	13.7	189.0	10.9	23.6	2.5	37.4	130.0
Land as %age to group total	28.0	64.7	7.3	100	29.5	63.8	6.7	100	100
# of equipment as %age of total	28.9	62.4	8.6	100	30.1	56.2	13.7	100	NA

Table 5.14: Land under different crops as percentage of total land under respective type of irrigation equipment

(%)

Crop	Electrified				Diesel				No Irri-gation
	DTW-E	STW-E	LLP-E	ALL-E	DTW-D	STW-D	LLP-D	ALL-D	
Aus- LB	0.0	0.0	3.8	0.3	0.0	0.0	0.0	0.0	1.5
Aus- HT	3.2	2.4	2.3	2.6	3.7	3.0	0.0	2.9	1.5
Aus- HB	0.0	1.6	0.0	1.0	6.4	0.0	0.0	1.9	0.2
Aman-LB	0.0	2.0	0.0	1.3	0.0	0.0	0.0	0.0	2.9
Aman-HT	4.5	0.7	0.0	1.7	0.0	0.0	8.0	0.5	29.5
Aman- HT	14.3	18.5	6.8	16.5	19.3	29.7	0.0	24.5	29.5
Boro- LB	9.6	11.4	9.8	10.8	8.3	9.3	32.0	10.4	4.2
Boro- HT	60.6	56.3	77.4	59.1	58.7	50.0	48.0	53.2	1.8
Wheat	2.1	0.8	0.0	1.1	0.0	2.1	0.0	1.3	1.9
Jute	1.9	0.6	0.0	0.9	0.0	0.0	0.0	0.0	5.8
Sugarcane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5
Masur	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	3.1
Mustard	0.2	0.9	0.0	0.6	0.0	0.0	12.0	0.8	11.7
Cauliflower	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Radish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Bean	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.3	0.0
Tomato	1.1	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.3
Onion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Brinjal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Potato	1.9	4.2	0.0	3.3	2.8	4.7	0.0	3.5	0.1
Chilly	0.6	0.0	0.0	0.2	0.0	1.3	0.0	0.8	0.0
Melon	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Land under Rice culture	92.3	92.9	100.0	93.3	96.3	91.9	88.0	93.4	71.0
Land under Boro and Aman HT culture	84.5	86.3	94.0	86.4	86.2	89.0	80.0	88.0	35.5
Land under Boro culture	70.2	67.7	87.2	69.9	67.0	59.3	80.0	63.6	6.0

Table 5.15: Yield of different crops in sample plots by type of irrigation equipment

(Maunds)

Crop	Electrified				Diesel				No Irrigation
	DTW-E	STW-E	LLP-E	ALL-E	DTW-D	STW-D	LLP-D	ALL-D	
Aus- LB	.0	.0	15.0	15.0	.0	.0	.0	.0	47.0
Aus- HT	79.0	109.0	9.0	197.0	14.0	24.0	.0	38.0	63.0
Aus- HB	.0	70.0	.0	70.0	20.0	.0	.0	20.0	5.0
Aman-LB	.0	56.0	.0	56.0	.0	.0	.0	.0	86.0
Aman- HT	99.0	30.0	.0	129.0	.0	.0	5.0	5.0	1202.5
Aman- HB broadcast	319.0	927.0	47.0	1293.0	89.0	243.0	.0	332.0	1217.0
Boro-LB	258.0	655.0	63.0	976.0	39.0	94.0	35.0	168.0	209.0
Boro- HT	1875.0	3894.0	556.0	6325.0	365.0	609.0	61.0	1035.0	91.0
Wheat	33.0	29.0	.0	62.0	.0	10.0	.0	10.0	50.0
Jute	29.0	20.0	.0	49.0	.0	.0	.0	.0	174.0
Sugarcane	.0	.0	.0	.0	.0	.0	.0	.0	2245.0
Masur	.0	6.0	.0	6.0	.0	.0	.0	.0	55.0
Mustard	2.0	19.0	.0	21.0	.0	.0	4.0	4.0	182.5
Cauliflower	.0	10.0	.0	10.0	.0	.0	.0	.0	.0
Radish	.0	.0	.0	.0	.0	.0	.0	.0	26.0
Bean	.0	.0	.0	.0	7.0	.0	.0	7.0	.0
Tomato	33.0	15.0	.0	48.0	.0	.0	.0	.0	25.0
Onion	.0	.0	.0	.0	.0	.0	.0	.0	26.0
Brinjal	.0	.0	.0	.0	.0	.0	.0	.0	35.0
Potato	230.0	783.0	.0	1013.0	32.0	123.0	.0	155.0	10.0
Chilly	10.0	.0	.0	10.0	.0	10.0	.0	10.0	.0
Melon	.0	80.0	.0	80.0	.0	.0	.0	.0	.0

Table 5.16: Productivity (yield per acre) of different crops by type of irrigation equipment

(in maund)

Crops	Electrified				Diesel				No Irrigation
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D	
Aus LB			28	28					23
Aus HT	45	38	30	40	35	37		36	32
Aus HB		37		37	30			30	28
Aman LB		24		24					21
Aman HT	42	34		40			29	29	31
Aman HB	42	41	55	42	42	35		36	32
Boro LB	51	47	47	48	47	43	42	43	38
Boro HT	58	56	54	57	56	52	50	52	40
Wheat	31	30		30		20		20	21
Jute	28	29		28					23
Sugarcane									389
Masur		20		20					16
Mustard	20	19		19			13	13	12
Cauliflower		100		100					
Radish									55
Bean					100			100	
Tomato	60	94		68					63
Onion									26
Brinjal									58
Potato	225	147		160	195	137		137	120
Chilly	30			30		30		30	
Melon		500		500					

Note: Round figure are given due to convenience

Table 5.17: Productivity of different crops per irrigation equipment by type of equipment

(in maund)

Crops	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D
Aus LB	0.0	0.0	50.0	2.6	0.0	0.0	0.0	0.0
Aus HT	94.2	11.7	32.4	32.2	47.0	10.2	0.0	19.5
Aus HB	0.0	7.6	0.0	11.5	69.7	0.0	0.0	10.7
Aman LB	0.0	6.1	0.0	9.7	0.0	0.0	0.0	0.0
Aman HT	123.6	3.0	0.0	21.1	0.0	0.0	43.4	2.7
Aman HB	392.8	97.1	175.8	214.8	294.2	95.6	0.0	164.9
Boro LB	320.2	68.6	216.5	160.7	141.6	36.8	251.3	83.6
Boro HT	2298.7	403.6	1964.4	1044.3	1193.3	239.2	448.8	517.3
Wheat	42.6	3.1	0.0	10.2	0.0	3.9	0.0	4.9
Jute	34.8	2.2	0.0	7.8	0.0	0.0	0.0	0.0
Sugarcane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Masur	0.0	0.5	0.0	1.2	0.0	0.0	0.0	0.0
Mustard	2.6	2.2	0.0	3.5	0.0	0.0	29.2	1.9
Cauliflower	0.0	1.3	0.0	3.1	0.0	0.0	0.0	0.0
Radish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bean	0.0	0.0	0.0	0.0	32.7	0.0	0.0	5.6
Tomato	43.2	2.4	0.0	8.4	0.0	0.0	0.0	0.0
Onion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brinjal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potato	279.6	79.0	0.0	163.7	198.2	59.2	0.0	89.7
Chilly	11.8	0.0	0.0	1.9	0.0	3.6	0.0	4.5
Melon	0.0	12.8	0.0	15.5	0.0	0.0	0.0	0.0

Table 5.18: Production of different crops by type of irrigation equipment as percentage of production under no irrigation

Crops	Electrified				Diesel				No Irrigation
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D	
Aus LB			121.7	121.7					100
Aus HT	140.6	118.8	93.8	125.0	109.4	115.6		112.5	100
Aus HB		132.1		132.1	107.1			107.1	100
Aman LB		114.3		114.3					100
Aman HT	135.5	109.7		129.0			93.5	93.5	100
Aman HB	131.3	128.1	171.9	131.3	131.3	109.4		112.5	100
Boro LB	134.2	123.7	123.7	126.3	123.7	113.2	110.5	113.2	100
Boro HT	145.0	140.0	135.0	142.5	140.0	130.0	125.0	130.0	100
Wheat	147.6	142.9		142.9		95.2		95.2	100
Jute	121.7	126.1		121.7					100
Masur		125.0		125.0					100
Mustard	166.7	158.3		158.3			108.3	108.3	100
Tomato	95.2	149.2		107.9					100
Potato	187.5	122.5		133.3	162.5	114.2		114.2	100
Relative Productivity Index of crops under irrigation and no irrigation	1.4	1.3005	1.076747	1.2939	1.2899	1.12927	1.09352	1.09621	1.0000

Table 5.19: Production under electrified irrigation as % of production under respective diesel powered equipment

Crops	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D
Aus LB								
Aus HT	128.571	102.7		111.11	100	100		
Aus HB	0			123.33	100			100
Aman LB								
Aman HT			0	137.93	100			100
Aman HB	100	117.14		116.67	100	100		100
Boro LB	108.511	109.3	111.9048	111.63	100	100	100	100
Boro HT	103.571	107.69	108	109.62	100	100	100	100
Wheat		150		150		100		100
Jute								
Masur								
Mustard			0	146.15			100	100
Tomato			0	146.15			100	100
Potato	115.385	107.3		116.79	100	100		100
Chilly		0		100		100		100
Relative Productivity Index (base productivity of respective diesel)	111.2	138.8	143.9	124.5	100.0	100.0	100.0	100.0

Table 5.20: Cropping intensity of land by type of irrigation equipment

	Electricity				Diesel				No Irrigation
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D	
Cropping intensity	195	197	154	193	186	195	171	191	181

Table 5.21: Break downs and operation days lost in 1408 B.Y. by type of irrigation equipment

Items	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D
Number of break downs								
No break down	61.3	63.2	60.6	62.4	45.5	39.0	40.0	41.1
One break down	34.2	25.1	30.3	28.2	31.8	31.7	40.0	32.9
Two break downs	4.5	9.2	9.1	7.8	13.6	14.6	10.0	13.7
Three break downs	.0	2.5	.0	1.6	4.5	12.2	.0	8.2
Four break downs	.0	.0	.0	.0	.0	2.4	.0	1.4
Five break downs	.0	.0	.0	.0	4.5	.0	10.0	2.7
Total	100	100	100	100	100	100	100	100
Days lost due to break down								
No Loss	52.3	66.5	54.5	61.4	22.7	35.0	40.0	31.5
1 -10	42.3	32.2	36.4	35.5	50.0	62.5	50.0	57.5
11-20	2.7	.4	9.1	1.8	13.6	2.5	10.0	6.8
21+	2.7	.8		1.3	13.6			4.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	4	2	3	3	9	3	3	5
N	**111**	**239**	**33**	**383**	**22**	**41**	**10**	**73**

Table 5.22: Annual operation cost of unit net area of land (in acre) by equipment (last year)

Cost items	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-E
Energy								
401-500	10.8	17.1	45.4	17.8	4.5	9.7	40	12.3
500-750	27.0	25.9	39.4	27.4	9.1	17.1	10.0	13.7
751-1000	35.1	24.3	12.1	26.4	9.1	14.6	10.0	12.3
1001-1500	19.8	20.9	.0	18.8	50.0	22.0	30.0	31.5
1501-2000	7.2	10.0	3.0	8.6	22.7	19.5	.0	17.8
20001-2500	.0	1.7	.0	1.0	4.5	17.1	10.0	12.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	876.7	888.0	543.5	855.0	1229.7	1265.2	841.8	1196.5
Lubricants								
1-50	100.0	94.1	90.9	95.6	86.4	24.4	70.0	49.3
51-100	.0	5.4	6.1	3.9	9.1	29.3	10.0	20.5
101-200	.0	.0	3.0	.3	4.5	31.7	.0	19.2
201-300	.0	.4	.0	.3	.0	9.8	10.0	6.8
301-400	.0	.0	.0	.0	.0	4.9	10.0	4.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	5.1	19.4	12.3	14.7	25.5	107.9	81.1	79.4
Maintenance								
1-50	59.5	34.3	72.7	44.9	40.9	24.4	60.0	34.2
51-100	22.5	22.2	18.2	21.9	9.1	24.4	10.0	17.8
101-200	10.8	19.7	6.1	15.9	27.3	14.6	10.0	17.8
201-300	1.8	13.4	3.0	9.1	18.2	9.8	.0	11.0
301-400	1.8	4.6	.0	3.4	4.5	9.8	.0	6.8
401-500	.9	2.9	.0	2.1	.0	4.9	.0	2.7
500-750	1.8	2.1	.0	1.8	.0	9.8	20.0	8.2
751-1000	.0	.4	.0	.3	.0	2.4	.0	1.4
1001-1500	.0	.4	.0	.3	.0	.0	.0	.0

Cost items	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-E
3001+	.9	.0	.0	.3	.0	.0	.0	.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	318.1	135.8	45.3	180.8	108.4	203.1	176.7	170.9
Repairing cost								
1-50	25.0	17.3	46.7	23.0	11.8	22.2	50.0	22.0
51-100	19.2	29.6	13.3	24.3	17.6	18.5	16.7	18.0
101-200	32.7	21.0	26.7	25.7	17.6	22.2	.0	18.0
201-300	13.5	8.6	.0	9.5	23.5	14.8	16.7	18.0
301-400	5.8	13.6	6.7	10.1	11.8	3.7	.0	6.0
401-500	1.9	6.2	.0	4.1	11.8	3.7	.0	6.0
500-750	1.9	2.5	.0	2.0	.0	.0	.0	.0
751-1000	.0	.0	.0	.0	5.9	14.8	16.7	12.0
1001-1500	.0	1.2	6.7	1.4	.0	.0	.0	.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	140.5	186.4	163.9	168.0	251.7	253.8	241.2	251.6
Wages of the employee								
1-50	3.6	.9	.0	1.6	.0	2.6	.0	1.4
51-100	7.2	2.6	.0	3.7	.0	.0	.0	.0
101-200	17.1	3.4	30.3	9.8	13.6	5.3	10.0	8.6
201-300	18.9	10.3	12.1	13.0	13.6	13.2	10.0	12.9
301-400	30.6	15.9	21.2	20.7	31.8	5.3	20.0	15.7
401-500	6.3	21.9	21.2	17.2	9.1	7.9	20.0	10.0
500-750	12.6	24.0	6.1	19.1	18.2	13.2	20.0	15.7
751-1000	3.6	11.2	3.0	8.2	9.1	21.1	20.0	17.1
1001-1500	.0	7.3	3.0	4.8	4.5	21.1	.0	12.9
1501-2000	.0	1.3	3.0	1.1	.0	10.5	.0	5.7
20001-2500	.0	.4	.0	.3	.0	.0	.0	.0
2501-3000	.0	.9	.0	.5	.0	.0	.0	.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	322.0	671.5	404.8	545.2	449.4	781.8	489.4	635.5
Total operational cost								
1-750	11.7	7.5	27.2	10.4	4.5	4.9	30	8.2
751-1000	10.8	7.9	21.2	9.9	.0	.0	.0	.0
1001-1500	42.3	31.4	42.4	35.5	13.6	26.8	10.0	20.5
1501-2000	24.3	23.0	.0	21.4	27.3	.0	40.0	13.7
20001-2500	7.2	17.6	3.0	13.3	40.9	24.4	.0	26.0
2501-3000	1.8	7.5	3.0	5.5	9.1	14.6	.0	11.0
3001+	1.8	5.0	3.0	3.9	4.5	29.3	20.0	20.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	1587.6	1761.0	1080.5	1652.1	2007.5	2467.9	1733.7	2228.6
N	**111**	**239**	**33**	**383**	**22**	**41**	**10**	**73**

Table: 5.23: Operational cost per acre of total irrigated land by type of irrigation equipment

(in Taka)

Items	Electrified				Diesel			
	DTWE	STWE	LLPE	All-E	DTWD	STWD	LLPD	All-D
Energy cost per acre	876.7	888.0	535.5	855.0	1229.7	1265.2	841.8	1196.5
Cost of Lubricant/ acre	5.1	19.4	12.3	14.7	25.5	107.9	81.1	79.4
Cost of Maintenance/ acre	118.1	135.8	45.5	122.9	108.4	203.1	176.7	170.9
Cost of Repairing / acre	140.5	186.4	163.9	168.0	251.7	253.8	241.2	251.6
Wages/ acre	322.0	671.5	404.8	545.2	449.4	781.8	489.4	635.5
Operation Cost per acre	1587.6	1761.0	1080.5	1652.1	2007.5	2467.9	1733.7	2228.6
N	111	239	33	383	22	41	10	73

Table 5.24: Cost of production of different crops per acre by type of irrigation equipment

(Taka)

Crops	Electrified				Non-electrified				No Irrigation
	DTWE	STW-E	LLP-E	ALL-E	DTW-D	STW-D	LLP-D	ALL-D	
Aus LB	-	-	7033	7033	-	-	-	-	4395
Aus HT	7480	6775	9020	7162	5275	4792	.	4976	6539
Aus HB	-	9826	.	9826	5833	.	.	5833	6422
Aman LB	-	4296	.	4296	.	.	.	.	3932
Aman HT	6092	8352	.	6704	.	.	6753	6753	4850
Aman HB	7247	6303	4593	6486	6458	6123	.	6202	4830
Boro LB	7389	6940	9173	7198	8862	7670	8559	8124	4990
Boro HT	9516	9609	9160	9541	9111	9784	11365	9647	7476
Wheat	6593	3951	.	5350	.	4270	.	4270	3892
Jute	7119	6289	.	6783	.	.	.	.	6170
Sugarcane	.	.	.	.	.	.	.	.	15481
Masur	.	5640	.	5640	.	.	.	.	2478
Mustard	4280	5486	.	5387	.	.	6400	6400	3534
Cauliflower	.	10800	.	10800	.	.	.	.	.
Radish	.	.	.	.	.	.	.	.	2791
Bean	.	.	.	.	11713	.	.	11713	.
Tomato	5865	9406	.	6663	.	.	.	.	10893
Onion	.	.	.	.	.	.	.	.	1225
Brinjal	.	.	.	.	.	.	.	.	7347
Potato	15001	13493	.	13743	13313	10140	.	10539	16444
Chilly	8409	.	.	8409	.	13548	.	13548	.
Melon	.	11406	.	11406	.	.	.	.	.

Table 5.25: Cost of product of different crops per mound by type of irrigation equipment

(Taka)

Crops	Electrified				Diesel				No Irrigation
	DTW-E	STW-E	LLP-E	ALL-E	DTW-D	STW-D	LLP-D	ALL-D	
Aus LB			251.18	251.18					191.09
Aus HT	166.22	178.29	300.67	179.05	150.71	129.51		138.22	204.34
Aus HB		265.57		265.57	194.43			194.43	229.36
Aman LB		179.00		179.00					187.24
Aman HT	145.05	245.65		167.60			232.86	232.86	156.45
Aman HB	172.55	153.73	83.51	154.43	153.76	174.94		172.28	150.94
Boro LB	144.88	147.66	195.17	149.96	188.55	178.37	203.79	188.93	131.32
Boro HT	164.07	171.59	169.63	167.39	162.70	188.15	227.30	185.52	186.90
Wheat	212.68	131.70		178.33		213.50		213.50	185.33
Jute	254.25	216.86		242.25					268.26
Sugarcane									39.80
Masur		282.00		282.00					154.88
Mustard	214.00	288.74		283.53			492.31	492.31	294.50
Cauliflower		108.00		108.00					
Radish									50.75
Bean					117.13			117.13	
Tomato	97.8	100.1		98.0					172.9
Onion									47.12
Brinjal									126.67
Potato	66.67	91.79		85.89	68.27	74.01		76.93	137.03
Chilly	280.30			280.30		451.60		451.60	
Melon		22.81		22.81					

Table 5.26: Cost of product of different crops per mound under electricity as percentage of cost per mound under diesel powered irrigation and no irrigation

(Taka)

Crops	Cost of production under ALL-E as % of cost of diesel powered	Cost of production under ALL-E as % of cost of no irrigation
Aus LB		131.45
Aus HT	129.54	87.62
Aus HB	136.59	115.79
Aman LB		95.60
Aman HT	71.97	107.13
Aman HB	89.64	102.31
Boro LB	79.37	114.20
Boro HT	90.23	89.56
Wheat	83.53	96.22
Jute		90.30
Masur		182.08
Mustard	57.59	96.27
Tomato		56.67
Potato	111.66	62.68
Chilly	62.07	

Table 5.27: Employment generated per irrigation equipment

	Electrified				Diesel			
	DTW-E	STW-E	LLP-E	All-E	DTW-D	STW-D	LLP-D	All-D
Full Time	2	1	2	2	2	1	1	1
Casual employee	26	4	7	10	23	4	5	10
Total employee	28	5	9	12	26	5	6	11
Full time person days	260	114	224	236	256	117	82	115
N	111	239	33	383	22	41	10	73

Table 5.28: Irrigation equipment owner’s response about employment of staff by type

	Electrified pump				Non-electrified			
	DTWE	STWE	LLPE	All-E	DTWD	STWD	LLPD	All-D
Full time staff								
1	15.3	82.8	15.2	56.9	22.7	82.9	90.0	64.2
2	43.2	15.1	60.6	27.4	31.8	17.1	10.0	20.9
3	27.0	2.2	15.2	10.6	40.9	.0	.0	13.4
4	13.5	.0	6.1	4.5	4.5	.0	.0	1.5
5	.9	.0	.0	.3	.0	.0	.0	.0
6	.0	.0	3.0	.3	.0	.0	.0	.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	2	1	2	2	2	1	1	1
Casual employment during irrigation season								
1-10	42.0	74.8	50.0	59.7	50.0	82.4	50.0	65.7
11-20	17.3	18.4	25.0	18.4	7.1	.0	25.0	5.7
21-40	7.4	4.9	16.7	6.6	7.1	5.9	25.0	8.6
41-60	3.7	1.9	.0	2.6	7.1	11.8	.0	8.6
61-80	11.1	.0	.0	4.6	7.1	.0	.0	2.9
81-100	18.5	.0	8.3	8.2	21.4	.0	.0	8.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	26	4	7	10	23	4	5	10
Total employee for the pump								
1-10	46.8	82.4	75.8	71.5	54.5	92.7	80.0	79.5
11-20	14.4	11.7	12.1	12.5	18.2	.0	10.0	6.8
21-40	12.6	4.6	9.1	7.3	.0	2.4	10.0	2.7
41-60	3.6	1.3	.0	1.8	9.1	4.9	.0	5.5
61-80	4.5	.0	.0	1.3	.0	.0	.0	.0
81-100	18.0	.0	3.0	5.5	9.1	.0	.0	2.7
101+	.0	.0	.0	.0	9.1	.0	.0	2.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	28	5	9	12	26	5	6	11
N	111	239	33	383	22	41	10	73

Table 5.29: Employment of different crops per acre by type of irrigation equipment

(person-days)

Crops	Electrified				Diesel				No Irri-gation
	DTW-E	STW-E	LLP-E	ALL-E	DTW-D	STW-D	LLP-D	ALL-D	
Aus LB	.	.	36	36	.	.	.	.	31
Aus HT	46	59	87	56	43	48	.	46	59
Aus HB	.	52	.	52	51	.	.	51	47
Aman LB	.	34	.	34	.	.	.	.	32
Aman HT	48	49	.	49	.	.	47	47	42
Aman HB	54	55	55	55	46	48	.	48	37
Boro LB	44	42	54	43	45	46	61	49	42
Boro HT	54	58	60	57	51	51	69	52	49
Wheat	34	35	.	35	.	27	.	27	26
Jute	62	65	.	63	.	.	.	.	54
Sugarcane	.	.	.	.	.	.	.	.	68
Masur	.	26	.	26	.	.	.	.	23
Mustard	15	33	.	31	.	.	45	45	24
Cauliflower	.	181	.	181	.	.	.	.	.
Radish	.	.	.	.	.	.	.	.	13
Bean	.	.	.	.	108	.	.	108	.
Tomato	45	119	.	62	.	.	.	.	78
Onion	.	.	.	.	.	.	.	.	19
Brinjal	.	.	.	.	.	.	.	.	46
Potato	55	48	.	49	110	48	.	56	81
Chilly	35	.	.	35	.	111	.	111	.
Melon	.	114	.	114	.	.	.	.	.

Table 5.30: Gross return for different crops under various type of irrigation equipment

(Taka)

Crops	Electrified				Diesel				No Irrigation
	DTWE	STW-E	LLP-E	ALL-E	DTW-D	STW-D	LLP-D	ALL-D	
Aus LB	-	-	467	467	-	-	-	-	1738
Aus HT	4790	4020	11680	4759	4975	5070	-	5034	2502
Aus HB	-	1078	-	1078	985	-	-	985	800
Aman LB	-	2244	-	2244	-	-	-	-	3179
Aman HT	4986	896	-	4150	-	-	1135	2365	2350
Aman HB	4147	4644	10367	4710	4966	3397	-	2701	2487
Boro LB	6228	5421	3141	4133	2928	3725	2571	1957	1324
Boro HT	5596	5127	4614	5214	4006	3396	2655	3563	3026
Wheat	3500	6414	-	4871	-	3730	-	3730	3050
Jute	5939	6211	-	6049	-	-	-	-	3623
Sugarcane	-	-	-	-	-	-	-	-	2321
Masur	-	11027	-	11027	-	-	-	-	4816
Mustard	9800	5100	-	5487	-	-	2267	2267	3659
Cauliflower	-	1200	-	1200	-	-	-	-	-
Radish	-	-	-	-	-	-	-	-	5936
Bean	-	-	-	-	7137	-	-	7137	-
Tomato	6135	37469	-	13196	-	-	-	-	7857
Onion	-	-	-	-	-	-	-	-	9175
Brinjal	-	-	-	-	-	-	-	-	16820
Potato	48970	14684	-	20371	10687	6950	-	7422	8000
Chilly	833	-	-	833	-	4634	-	4634	-
Melon	-	39844	-	39844	-	-	-	-	-

Table 5.31: Cost-Return Ratio of per acre production of different crops by type of irrigation equipment

Crops	Electrified				Diesel				No Irrigation
	DTWE	STW-E	LLP-E	ALL-E	DTW-D	STW-D	LLP-D	ALLD	
Aus LB			1.066401	1.066401					1.395449
Aus HT	1.640374	1.593358	2.2949	1.664479	1.943128	2.058013		2.011656	1.382627
Aus HB		1.109709		1.109709	1.168867			1.168867	1.124572
Aman LB		1.522346		1.522346					1.808494
Aman HT	1.81845	1.10728		1.619033			1.168073	1.350215	1.725773
Aman HB	1.572237	1.736792	3.25713	1.726179	1.768969	1.554793		1.435505	1.80207
Boro LB	1.842875	1.781124	1.342418	1.574187	1.330399	1.485658	1.300386	1.240891	1.644088
Boro HT	1.588062	1.533562	1.503712	1.546484	1.439688	1.347097	1.233612	1.369338	1.404762
Wheat	1.530866	2.623386		1.910467		1.873536		1.873536	1.783659
Jute	1.834246	1.987597		1.891788					1.587196
Sugarcane									1.149926
Masur		2.955142		2.955142					2.943503
Mustard	3.28972	1.929639		2.018563			1.354219	1.354219	2.035371
Cauliflower		1.111111		1.111111					
Radish									3.126836
Bean					1.609323			1.609323	
Tomato		4.983521		2.980489					1.721289
Onion									8.489796
Brinjal									3.28937
Potato	4.264449	2.088268		2.482282	1.802749	1.685404		1.704241	1.4865
Chilly	1.099061			1.099061		1.342043		1.342043	
Melon		4.493249		4.493249					

Table 5.32: Cost gross return Ratio per mound of production of different crops per acre by type of irrigation equipment

Crops	Electrified				Diesel				No Irrigation
	DTW-E	STW-E	LLP-E	ALL-E	DTW-D	STW-D	LLP-D	ALL-D	
Aus LB			1.066401	1.066401					1.395449
Aus HT	1.640374		2.576	1.112627					1.05955
Aus HB		1.037397	0	0.988852	0.776033			0.817343	0.912921
Aman LB		0.924661		0.924661					1.31284
Aman HT	1.81845	0.998165		0.99578					0.797356
Aman HB	1.572237	0.981618		0.98239				0.786561	1.007407
Boro LB	1.842875	0.985019	0.963235	0.885551	0.922247	0.974265		0.947985	0.793731
Boro HT	1.588062	1.000543	0.973565	1.096573	0.93375	0.956459	1.058113	1.083588	1.216102
Wheat	1.530866	1.312975	0	1.316157	0	1.578149	0	1.574565	1.25908
Jute	1.834246	1.247567		1.34513					1.28802
Sugarcane									0.107481
Masur									9.961542
Mustard	3.28972	0.668576		0.686765					1.314871
Cauliflower		0.215379		0.209674					
Tomato	2.046036								
Onion									1.344
Brinjal									1.041681
Potato	4.264449								0.488873
Chilly	1.099061			1.444881	0	4.858463		4.622857	
Melon	.			0.33272					

Table 5.33: Reasons for switching to electricity by type of irrigation equipment

(multiple responses)

Switched to alternative sources	DTW-E	STW-E	LLP-E	All-E
Yes	83.8	56.9	63.6	54.8
N	93	136	21	250
No	16.2	43.1	36.4	34.7
N	18	103	12	133
Total	111	239	33	383
Reasons for switching				
Less costly	22.9	22.4	16.7	22.2
Reliable	15.7	14.0	9.3	14.4
Easy to operate	26.8	30.9	33.3	29.3
Higher longevity of motor	14.1	14.9	20.4	14.9
Less trouble	9.8	15.2	14.8	12.8
Easy to repair	10.1	1.2	3.7	5.3
More land cab be irrigated and more production	.7	1.5	1.9	1.1
Total	100.0	100.0	100.0	100.0
N	93	136	21	250

Table 5.34: Reasons for not switching to electricity as alternative to existing power sources

(multiple responses)

Reasons	Not switching from electricity				Not switching from diesel				Total
	DTWE	STWE	LLPE	All-E	DTWD	STWD	LLPD	All-D	
Costly	.0	2.2	30.0	5.1	.0	14.0	21.4	11.4	7.0
No electricity	.0	5.8	.0	4.5	81.8	48.8	21.4	53.2	19.5
No demand	45.0	39.4	10.0	36.7	9.1	16.3	21.4	15.2	30.1
Reliable	10.0	17.5	15.0	16.4	4.5	14.0	7.1	10.1	14.5
Less trouble	5.0	13.1	5.0	11.3	.0	.0	7.1	1.3	8.2
Easy to repair	10.0	15.3	35.0	16.9	.0	.0	7.1	1.3	12.1
Not portable	.0	2.2	.0	1.7	4.5	2.3	7.1	3.8	2.3
No responding	30.0	4.4	5.0	7.3	.0	4.7	7.1	3.8	6.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N	18	103	12	133	22	41	10	73	206

Table 5.35: Future intention to switch from diesel to electricity driven irrigation equipment and reasons

(multiple responses)

Intention to switch and reasons	DTWD	STWDE	LLPD	All-D
Intend to switch	86.4	68.3	30.0	68.5
N	19	28	3	50
No Intention to switch	13.6	31.7	70.0	31.5
	3	13	7	23
Total	100	100	100	100
N	22	41	10	73
Reasons for switching in future				
Less cost of pump, fuel and maintenance	44.2	37.5	50.0	40.8
Easy to operate and more reliable	9.3	23.2	25.0	17.5
More land can be irrigated	20.9	21.4	25.0	21.4
Less manpower required	2.3	.0	.0	1.0
Reduce physical labor	7.0	10.7	.0	8.7
Scarcity of diesel during season	11.6	.0	.0	4.9
Non electrified pump is less durable, frequent break down and repairing and replacement of spares	4.7	7.1	.0	5.8
Total	100.0	100.0	100.0	100.0
N	19	28	3	50

Chapter 6: Impact on Industrial Developments (Tables 6.1-6.38)

Table 6.1: Summary information of all industries connected through REP in 2002 (May 2002) : Number of industries by size and number of employees

Major industry group	Small		Medium		Large		Total	
	# industries	# employees	# industries	# employees	# industries	# employees	# industries	# employees
Total	49822	263092	8466	197343	1655	417855	59943	878290

Source: Prepared by the authors based on data obtained from all 67 PBSs using specially designed data collection instrument for the purpose of the present study (See. Annex B-14, SDCF)

Table 6.2: Detailed Information about size and type of industries connected through RE in 67 PBSs: Status as on may 2002

Industry[1>] Code	Major industry group	Small		Medium		Large		Total	
		# industries	# employees	# industries	# employees	# industries	# employees	# industries	# employees
311-312	**Food Manufacturing industries:**	28797	157058	3490	74499	259	54904	32546	286461
3112	Dairy products	1887	10516	83	1496	31	2725	2001	14737
3113	Fruits and vegetables	2	7	22	735	0	0	24	742
3114	Fish and sea foods	182	1104	86	1347	43	3672	311	6123
3115	Hydrogenated veg.oils	10	80	1	25	0	0	11	105
3116	Edible oils	729	3296	84	937	5	440	818	4673
3117	Inedibile veg. Oils	289	1416	55	1158	7	605	351	3179
3118	Grain milling	489	2073	81	2048	13	1679	583	5800
3119	Rice milling	23656	131196	2756	60782	37	1990	26449	193968
3121	Grain mill products	23	110	6	89	1	100	30	299
3122	Bakery products	279	1794	97	1898	5	796	381	4488
3123	Sugar factories	3	10	0	0	6	3300	9	3310
3124	Manufacture of gur	12	69	1	28	0	0	13	97
3125	Confectioneries	92	642	62	516	2	270	156	1428
3126	Tea, coffee products	0	0	0	0	62	35400	62	35400
3127	Tea and coffee blending	0	0	0	0	0	0	0	0
3128	Edible salt	10	102	37	1145	4	238	51	1485
3129	Misc. Food products	1134	4643	119	2295	43	3689	1296	10627
313	**Beverage industries:**	155	935	11	353	5	1197	171	2485
3131	Dist. Rectified spirits	5	29	1	45	0	0	6	74
3134	Soft drink manufacturing	150	906	10	308	5	1197	165	2411
314	**Tobacco manufacturing:**	23	144	40	1318	14	2564	77	4026
3141	Cigarettes manufacturing	0	0	7	146	1	150	8	296
3142	Chroots manufacturing	0	0	0	0	4	1495	4	1495

Industry$^{1>}$ Code	Major industry group	Small		Medium		Large		Total	
		# in-dus-tries	# emplo-yees	# in-dus-tries	# emplo-yees	# in-dus-tries	# emplo-yees	# in-dus-tries	# emplo-yees
3143	Bidies manufacturing	10	80	13	700	1	200	24	980
3144	Tobacco stemm, redrying	10	61	20	400	1	150	3	186
3145	Zarda and quivam	2	8	4	130	0	0	6	138
3149	Tobacco manufac	10	50	15	312	7	569	32	931
315	**Animal feeds/by-products:**	507	1164	34	442	37	5986	578	7592
3151	Prepared animal feeds	497	1144	32	404	37	5986	566	7534
3152	Bone crushing	10	20	2	38	0	0	12	58
321-322	**Textile:**	3267	25413	3191	90533	815	209318	7273	325264
3211	Cotton textiles	2359	18871	1938	56946	462	80426	4759	156243
3212	Woolen textile	0	0	4	147	50	34416	54	34563
3213	Jute textiles	3	40	16	665	39	45907	58	46612
3214	Silk, synthetic textiles	2	16	28	736	7	2150	37	2902
3215	Narrow fabrics	197	1560	107	2840	13	1551	317	5951
3216	Handloom textiles	510	3719	620	16528	91	8249	1221	28496
3217	Dyeing, bleching textiles	14	88	32	1210	57	11290	103	12588
3222	Made up textile goods	60	382	60	1360	1	200	121	1942
3223	Knitting mills	56	427	154	3536	54	17806	264	21769
3224	Carpets and rugs	5	23	0	0	3	303	8	326
3225	Cordage, rope and twine	2	20	198	5940	6	1200	206	7160
3226	Spooling and thread ball	7	28	10	163	2	632	19	823
3229	Textile manufacturing	52	239	24	462	30	5188	106	5889
323	**Wearing apparels including readymade garments (except footwear):**	0	0	18	963	218	92746	236	93709
3231	Readymade germants	0	0	19	978	218	92746	237	93724
324	**Leather and its, products:**	4	23	22	576	12	2208	38	2807
3241	Tanning and finishing	1	7	10	215	4	563	15	785
3242	Fur dressing and dyeing	0	0	0	0	3	1300	3	1300
3243	Leather products	3	16	12	361	5	345	20	722
325	**Footwear:**	16	158	5	158	23	4217	44	4533
3251	Leather footwear	16	158	5	158	23	4217	44	4533
326	**Jute pressing and bailling:**	14	49	7	172	4	705	25	926
3261	Ginning, baling of cotton	14	49	3	52	1	115	18	216
3263	Jute pressing and baling	0	0	4	120	3	590	7	710
327	**Embro of textile goods:**	138	941	16	468	4	725	158	2134
3271	Embroidery of textile	138	941	16	468	4	725	158	2134
331	**Wood and wood products:**	5707	26735	391	5751	7	741	6105	33227
3311	Saw and plannning mills	5646	26389	349	5092	0	0	5995	31481
3312	Plywood and its products	24	196	13	130	0	0	37	326
3313	Wooden structural products	19	97	7	101	1	125	27	323
3314	Hardboard and is products	1	5	18	327	5	536	24	868
3315	Struct. Products of bamboo	0	0	4	101	0	0	4	101
3316	Cork and its products	0	0	0	0	1	80	1	80
3318	Bamboo and can products	0	0	0	0	0	0	0	0

Industry$^{1>}$ Code	Major industry group	Small		Medium		Large		Total	
		# in-dus-tries	# emplo-yees	# in-dus-tries	# emplo-yees	# in-dus-tries	# emplo-yees	# in-dus-tries	# emplo-yees
3319	Wood and cork products	17	48	0	0	0	0	17	48
332	**Wooden furniture:**	1211	7137	197	2342	3	300	1411	9779
3321	Wooden furniture mfg.	1206	7131	182	2230	0	0	1388	9361
3323	Cane and bamboo furniture	5	6	15	112	3	300	23	418
341	**Paper and paper products:**	5	33	25	679	21	2412	51	3124
3411	Pulp and paper mfg.	1	5	0	0	10	1300	11	1305
3412	Paper board manufacturing	2	16	23	645	11	1112	36	1773
3413	Articles of pulp, paper	2	12	2	34	0	0	4	46
342	**Printing and publishing:**	223	800	37	478	3	680	263	1958
3421	Printing of newspaper	7	93	0	0	0	0	7	93
3422	Printing of book map etc.	13	103	0	0	1	520	14	623
3423	Priniting, publishing books	53	253	34	411	0	0	87	664
3424	Cards and stationery	37	37	0	0	1	100	38	137
3425	Book binding, other arts	65	246	3	67	1	60	69	373
3429	Photo typesetting	48	68	0	0	0	0	48	68
351	**Drugs and pharmaceutical:**	5	283	21	541	17	3091	43	3915
3511	Allopatich and medicines	4	275	15	496	16	3021	35	3792
3512	Unani medicines	1	8	0	0	0	0	1	8
3513	Ayure-vedic medicines	0	0	6	45	1	70	7	115
3514	Homeopathic, biochemical	0	0	0	0	0	0	0	0
352	**Chemical industries:**	55	249	20	807	13	1951	88	3007
3521	Acids, alkalites and salts	0	0	1	14	3	1047	4	1061
3522	Dyes, colours and pigments	2	16	1	45	1	60	4	121
3523	Compressed liquified gas	0	0	8	648	0	0	8	648
3524	Fertilizer manufacturing	52	232	8	70	2	152	62	454
3525	Pesticides, insecticides	0	0	0	0	1	150	1	150
3526	Resins, plastic materials	1	1	0	0	1	65	2	66
3529	Industrial chemicals	0	0	2	30	5	477	7	507
353	**Other chemical industries:**	47	309	33	818	12	1319	92	2446
3531	Paints and varnishes	0	0	0	0	0	0	0	0
3532	Perfumes and cosmetics	0	0	2	45	5	602	7	647
3533	Soap and detergents	13	70	10	211	3	413	26	694
3535	Matches manufacturing	0	0	14	422	0	0	14	422
3536	Ink (all kinds) – mfg.	0	0	1	10	1	60	2	70
3537	Candle manufacturing	6	30	0	0	0	0	6	30
3539	Chemical products	28	209	6	130	3	244	37	583
354-355	**Petroleum refineries and products:**	15	96	38	1138	1	150	54	1384
354	Petroleum refining	2	9	15	103	0	0	17	112
355	Misc, petroleum products	13	87	23	1035	1	150	37	1272
356	**Rubber products:**	5	40	26	767	10	1702	41	2509
3561	Mfg. Of tyres and tubes	0	0	2	30	0	0	2	30
3562	Rebuilding of tyres, tubes	1	4	9	335	0	0	10	339
3569	Mfg. Of rubber products	4	36	15	402	10	1702	29	2140

Industry[1>] Code	Major industry group	Small		Medium		Large		Total	
		# in-dustries	# emplo-yees	# in-dustries	# emplo-yees	# in-dustries	# emplo-yees	# in-dustries	# emplo-yees
357	**Plastic products:**	15	109	45	1176	27	2925	87	4210
3571	Mfg. Of plastic footwear	1	9	5	133	0	0	6	142
3572	Polythene products mfg.	0	0	5	170	11	1200	16	1370
3579	Misc. Plastic products	14	100	35	873	16	1725	65	2698
361	**Pottery and chinaware:**	27	420	1	15	11	1143	39	1578
3611	Mfg. Of earthenwares	25	416	0	0	3	150	28	566
3612	China, ceramic products	0	0	1	15	8	993	9	1008
3619	Pottery, china, earthenware	2	4	0	0	0	0	2	4
362	**Glass products:**	0	0	2	50	1	60	3	110
3621	Glass manufacturing	0	0	1	20	1	60	2	80
3622	Glass products mfg.	0	0	1	30	0	0	1	30
369	**Non-metallic products:**	8	47	134	2817	77	11152	219	14016
3691	Bricks, tiles, clay products	7	45	118	2211	48	6613	173	8869
3692	Cement manufacturing	1	2	14	523	21	2739	36	3264
3693	Cement products mfg.	0	0	2	83	8	1800	10	1883
3694	Lime, plaster, their prod.	0	0	0	0	0	0	0	0
3695	Referactories mfg.	0	0	0	0	0	0	0	0
3699	Non-metalic nineral	0	0	0	0	0	0	0	0
371	**Iron and steel:**	931	2050	66	1834	22	9295	1019	13179
3711	Iron and steel mills	46	234	57	1651	13	7410	116	9295
3712	Iron and steel foundries	154	466	6	143	4	1585	164	2194
3713	Iron ans steel re-roling	237	720	3	40	5	300	245	1060
3719	Iron and steel sndustries	494	630	0	0	0	0	494	630
372	**Non-ferrous metal industries:**	0	0	1	20	0	0	1	20
3722	Basi c copper, copper alloy	0	0	1	20	0	0	1	20
381-382	**Fabricated metal products:**	7455	33250	521	7167	14	1430	7990	41847
3811	Culturies manufacturing	0	0	0	0	0	0	0	0
3812	Hand and edge tools mfg.	337	1032	0	0	0	0	337	1032
3813	Razors and blades mfg.	0	0	0	0	0	0	0	0
3814	Furniture and fixtures	1666	9439	46	974	4	400	1716	10813
3815	Structural metal products	2752	13217	396	5467	0	0	3148	18684
3816	Metal stamping etc.	48	260	6	67	0	0	54	327
3817	Heating, cooking equipment	3	21	0	0	0	0	3	21
3818	Wire products mfg.	2	14	2	22	0	0	4	36
3819	Utensils mfg. – alluminium	5	8	6	80	1	90	12	178
3821	Utensils – copper/brass	0	0	0	0	0	0	0	0
3822	Utensils – steel	0	0	0	0	0	0	0	0
3823	Metal barrels ans drums	0	0	5	12	0	0	5	12
3824	Tin cans and tinware	0	0	0	0	3	225	3	225
3825	Metal trunks mfg.	22	77	17	36	0	0	39	113
3826	Bolts, nuts and rivets	11	100	15	217	3	380	29	697
3827	Plumbing eqipments	0	0	6	67	0	0	6	67
3829	Fabricated metal products	2609	9082	22	225	3	335	2634	9642

Industry[1>] Code	Major industry group	**Small**		**Medium**		**Large**		**Total**	
		# in-dus-tries	# emplo-yees	# in-dus-tries	# emplo-yees	# in-dus-tries	# emplo-yees	# in-dus-tries	# emplo-yees
383	**Machinery except electrical:**	716	3808	37	407	7	2685	760	6900
3831	Engines, turbines prod.	9	54	0	0	2	140	11	194
3832	Agri. Machinery equipment	70	293	8	95	1	800	79	1188
3833	Metal, wood work machinery	30	121	11	80	1	325	42	526
3834	Textile machinery	20	160	0	0	0	0	20	160
3835	Industrial machinery	63	330	5	70	2	120	70	520
3837	Mfg. Of sewing machinery	0	0	0	0	0	0	0	0
3839	Machinery and equipment	524	2850	13	162	1	1300	538	4312
384	**Electrical machinery:**	212	607	31	982	18	2249	261	3838
3841	Elec. Ind. Machniery app.	91	455	2	43	0	0	93	498
3842	Radio and television	62	7	4	145	5	455	71	607
3843	Electrical appliances	3	21	12	333	3	275	18	629
3844	Inslated wire and cables	0	0	3	67	1	60	4	127
3845	Electric bulbs and ubes	2	14	5	208	5	559	12	781
3846	Batteries anufacturing	54	110	5	186	4	900	63	1196
3847	Workshop	238	714					238	714
3848	Cold storage	7	420					7	420
3849	Ice cream	1	10	6	72			7	82
3850	Others	18	90					18	90
Total		49822	263092	8466	197343	1655	417855	59943	878290

Source: Prepared by the authors based on data obtained form all 67 PBSs using specially designed data collection instrument for purpose of the present study (See: Annex B-14, SDCF)

Note: 1> Industry code used in line with census of Manufacturing Industries Code, Government of Bangladesh.

Table 6.3: Percentage distribution of respondent by sex, age and marital status by size type of industries

Indicator	Electrified					Non-electrified				All
	Cottage	Small	Medium	Large	All	Cottage	Small	Medium	All	
Sex:										
Male	88.5	100.0	100.0	100.0	97.4	75.0	100	100.0	91.5	95.5
Female	11.5				2.6	25.0			8.5	4.5
Age										
<30	26.9	19.4	16.1	16.7	19.7	20.0	22.6	25.0	22.0	20.5
31-40	30.8	36.1	35.5	20.8	31.6	10.0	29.0	25.0	22.0	28.4
41-50	30.8	25.0	22.6	29.2	26.5	40.0	35.5	25.0	35.6	29.5
51-60	11.5	8.3	22.6	25.0	16.2	25.0	12.9		15.3	15.9
61+		11.1	3.2	8.3	6.0	5.0		25.0	5.1	5.7
Marital Status										
Married	96.2	94.4	93.5	100.0	95.7	100.0	90.3	87.5	93.2	94.9
Unmarried	3.8	5.6	6.5		4.3		9.7	12.5	6.8	5.1
Total	100	100	100	100	100	100	100	100	100	100
N	26	36	31	24	117	20	31	8	59	176

Table 6.4: Percentage distribution of electricity driven industries by type of connection

Type of electricity	Cottage	Small	Medium	Large	All
GP (General power)	96.2	94.4	83.9	58.3	84.6
LP (Large power)	3.8	5.6	16.1	41.7	15.4
Total	100	100	100	100	100
N	26	36	31	24	117

Table 6.5: Year of Establishment of sample Industries

Year of Establishment	Electrified					Non-electrified				All
	Cottage	Small	Medium	Large	All	Cottage	Small	Medium	All	
1978	11.5	5.6	3.2	16.7	8.5	20.0	3.2	12.5	10.2	9.1
1979	-	-	3.2	-	.9	-	-	-	-	.6
1980	7.7	2.8	-	-	2.6	10.0	3.2	-	5.1	3.4
1981	-	-	-	4.2	.9			-		.6
1982	-	-	-	4.2	.9	10.0	3.2	-	5.1	2.3
1983	-	2.8	-		.9	-		-		.6
1984	3.8	5.6	-	4.2	3.4	-	6.5	-	3.4	3.4
1985	3.8	2.8	-	-	1.7	-		-		1.1
1986	7.7	-	6.5	-	3.4	-	3.2	-	1.7	2.8
1987	-	-	6.5	4.2	2.6	-	3.2	-	1.7	2.3
1988	-	-	3.2	4.2	1.7	5.0		-	1.7	1.7
1989	-	13.9	12.9		7.7	-	3.2	-	1.7	5.7
1990	-		3.2	4.2	1.7	-	3.2	12.5	3.4	2.3
1991	3.8	2.8	3.2	8.3	4.3	5.0	6.5	-	5.1	4.5
1992	7.7		3.2		2.6	5.0	3.2	-	3.4	2.8
1993	3.8	2.8		8.3	3.4		3.2	12.5	3.4	3.4
1994	11.5	2.8	3.2	4.2	5.1	10.0	9.7	-	8.5	6.3
1995	-	13.9	3.2	8.3	6.8		9.7	-	5.1	6.3
1996	7.7	8.3		4.2	5.1	5.0	3.2	12.5	5.1	5.1
1997	7.7	2.8	19.4	4.2	8.5	10.0	9.7	12.5	10.2	9.1
1998	3.8	16.7	6.5	8.3	9.4	15.0	3.2	-	6.8	8.5
1999	7.7	11.1	19.4	12.5	12.8	5.0	9.7	37.5	11.9	12.5
2000	11.5	5.6	-	-	4.3	-	9.7	-	5.1	4.5
2001	-	-	3.2	-	.9	-	3.2	-	1.7	1.1
N	26	36	31	24	117	20	31	8	59	176

Table 6.6: Percentage distribution of industries by size by major types

Major types	Electrified					Non-electrified				All
	Cottage	Small	Medium	Large	All	Cottage	Small	Medium	All	
Rice		41.7	22.6	16.7	22.2		74.2	12.5	40.7	28.4
Weaving	11.5	2.8	19.4	29.2	14.5	25.0	3.2	50.0	16.9	15.3
Saw/wood	3.8	11.1	9.7		6.8			12.5	1.7	5.1
Furniture /carpentry	23.1	-	-	-	5.1	5.0	-	-	1.7	4.0
Handicrafts (Bamboo, Cane, Straws etc)	34.6	-	6.5	-	9.4	50.0	6.5	-	20.3	13.1
Wealding / Lathe machine	3.8	16.7	3.2	-	6.8	-	3.2	-	1.7	5.1
Wheat(Flower mill)	-	-	6.5	-	1.7	-		-	-	1.1
Oil mill	-	5.6	3.2		2.6	5.0	3.2	-	3.4	2.8
Ginning	-	2.8		8.3	2.6		-	-	-	1.7
Twisting	-		3.2	12.5	3.4		-	-	-	2.3
Musical instruments	3.8	2.8	-	-	1.7	5.0	-	-	1.7	1.7
Metal goods	-		-	-		-	6.5	-	3.4	1.1
Water filter	-	2.8	-		.9	-	-	-	-	.6
Printing	-		-	4.2	.9	-	-	-	-	.6
Sugar factory	-		-	4.2	.9	-	-	-	-	.6
Pump	-	2.8	-	4.2	1.7	-	-	-	-	1.1
Poultry	7.7		-		1.7	-	3.2	-	1.7	1.7
Rice tried		2.8	-		.9	-	-	-	-	.6
Rope/ Door/ Mat	3.8	-	6.5	-	2.6	5.0	-	-	1.7	2.3
Biscuit	-		-	8.3	1.7	-	-	12.5	1.7	1.7
Fish try	-		3.2	4.2	1.7	-	-	-	-	1.1
Fish mail	-	2.8	-		.9	-	-	-	-	.6
Aluminum goods	-		-	4.2	.9	-	-	-	-	.6
Broiler (chicken)	3.8		3.2		1.7	-	-	-	-	1.1
Rice boiler	-		3.2		.9	-	-	-	-	.6
Soap case	-		3.2		.9	-	-	-	-	.6
Bag	-		-			5.0	-	-	1.7	.6
Spices turmeric)	3.8		-		.9		-	-	-	.6
Paint	-	2.8	-		.9	-	-	-	-	.6
Ayurbedi	-		3.2	4.2	1.7	-	-	-	-	1.1
Cement	-		3.2		.9	-	-	-	-	.6
Sweet	-		-			-	-	12.5	1.7	.6
Ice cream	-	2.8	-		.9	-	-	-	-	.6
Total	100	100	100	100	100	100	100	100	100	100
N	26	36	31	24	117	20	31	6	59	176

Table 6.7: Percentage distribution of industries by major industry group (in line with CMI code)

Major industry Group	Electrified					Non-electrified			
	Cottage	Small	Medium	Large	All	Cottage	Small	Medium	All
Food manufacturing $^{1>}$	15.4	55.6	41.9	33.2	38.5	5.0	80.6	37.5	49.2
Textile $^{2>}$	11.5	5.6	22.6	50.0	20.5	25.0	3.2	50.0	16.9
Wood/wood products $^{3>}$	30.8	13.8	9.7	-	13.5	10.0	-	12.5	5.1
Metal/ Metal products $^{4>}$	3.8	22.2	3.2	8.4	10.3	-	9.7	-	5.1
Handicrafts $^{5>}$	38.5	-	16.2	-	12.8	60.0	6.8	-	23.7
Other $^{6>}$	-	2.8	6.4	8.4	4.4	-	-	-	-
Total	100	100	100	100	100	100	100	100	100
N	26	36	31	24	117	20	31	8	59

Notes:

1. Food manufacturing Industries include the following: Rice, mill, Wheat/flour, Oil mill, Sugar factory, Poultry, Rice fry, Biscuit factory, Broiler chicken, Rice boiler, Spices, Sweet factory , Ice-cream factory.

2. Textile: Weaving, Ginning, Twisting ; 3 . Wood /Wood products: Saw/ wood, Furniture, Musical instruments

4. Metal/ Metal products: Welding / lathe, Metal goods, Water filter, Pump, Aluminum goods; 5 Handicrafts: Handicrafts, Rope/ Mat, Soap case, Bag; Printing, Paint, Ayurbedi, Cement

Table 6.8: Percentage distribution of respondents by their statement about the reasons which prompted them to invest in industry

(multiple responses)

Reasons for investing in industries	Electrified					Non-electrified				All
	Cottage	Small	Medium	Large	Total	Cottage	Small	Medium	Total	
Prior experience	7.7	8.3	6.5	8.3	7.7		9.7		5.1	6.8
Considering the increasing demand	57.7	63.9	41.9	50.0	53.8	40.0	54.8	50.0	49.2	52.3
Generating employment opportunity	15.4	22.2	29.0	33.3	24.8	15.0	9.7	25.0	13.6	21.0
Availability of raw materials	11.5	13.9	19.4	20.8	16.2	5.0	9.7	25.0	10.2	14.2
Possibility of more profit	69.2	50.0	64.5	62.5	60.7	45.0	58.1	50.0	52.5	58.0
REB create opportunity	11.5	5.6	12.9	8.3	9.4		6.5	-	3.4	7.4
Paternal business	38.5	22.2	16.1	20.8	23.9	20.0	32.3	37.5	28.8	25.6
Less capital more profit	7.7	-	-	4.2	2.6	15.0			5.1	3.4
Local thriving business	-	2.8	9.7	8.3	5.1	-	3.2	-	1.7	4.0
Less risk	7.7	2.8	3.2	-	3.4	-	-	-	-	2.3
DK	-	-	3.2	4.2	1.7	-	3.2	-	1.7	1.7
N	**26**	**36**	**31**	**24**	**117**	**20**	**31**	**6**	**59**	**176**

Table 6.9: Percentage distribution of respondents statement about their occupation before investing in current industry

Previous Occupation	Electrified					Non-electrified				
	Cottage	Small	Medium	Large	Total	Cottage	Small	Medium	Total	All
Agriculture /cultivation	15.4	22.2	16.1	-	14.5	10.0	32.3	-	20.3	16.5
Service	7.7	8.3	12.9	20.8	12.0	15.0	16.1	12.5	15.3	13.1
Textile business	7.7	8.3	12.9	29.2	13.7	20.0		37.5	11.9	13.1
Business (General and Seasonal)	11.5	13.9	29.0	33.3	21.4	5.0	16.1	25.0	13.6	18.8
Agri-business	3.8	11.1	3.2	-	5.1	5.0	3.2		3.4	4.5
Timber (Wood) business		-	3.2	-	0.9	5.0		12.5	3.4	1.7
Petty trade (Handicraft)	7.7	2.8	-	-	2.6	10.0	3.2	-	5.1	3.4
Pharmacy	-	2.8	3.2	8.3	3.4		-	-		2.3
Student	11.5	5.6	3.2	-	5.1	10.0	3.2	-	5.1	5.1
Carpenter	7.7	-	-	-	1.7	-	-	-		1.1
Blacksmith	-	-	-	-		-	6.5	-	3.4	1.1
Fish trader	3.8	-	-	-	0.9	-	-	-		.6
Oil trader	-	5.6	-	-	1.7	-	-	-		1.1
Stationary shop	3.8	-	3.2	-	1.7	-	3.2	12.5	3.4	2.3
Boat man	-	-	-	-		-	3.2	-	1.7	.6
House wife	3.8	-	-	-	0.9	10.0	-	-	3.4	1.7
Pottery	-	-	-	-		-	3.2	-	1.7	.6
Non- agri-labor	-	8.3	-	-	2.6	-	3.2	-	1.7	2.3
Technical mechanic	-	2.8	-	-	0.9	-	3.2	-	1.7	1.1
Industrialist	-	-	6.5	-	1.7	-	-	-	-	1.1
Driver	11.5	-	-	-	2.6	-	-	-	-	1.7
Water filter	-	2.8	-	-	0.9	-	-	-	-	.6
Foreign	-	2.8	--	4.2	1.7	-	3.2	-	1.7	1.7
Same business	3.8	-	6.5	4.2	3.4	5.0	-	-	1.7	2.8
Leader	-	2.8		-	0.9	5.0	-	-	1.7	1.1
Total	100	100	100	100	100	100	100	100	100	100
N	26	36	31	24	117	20	31	8	59	176

Table 6.10: Percentage distribution of industries by mode of operations by electrification status

Power Source	Electrified					Non-electrified				All
	Cottage	Small	Medium	Large	Total	Cottage	Small	Medium	Total	
Electricity	38.5	100.0	96.8	95.8	84.6	-	- -	-	-	56.3
Diesel	-	-	- -	-	- -	-	77.4	25.0	44.1	14.8
Manual	61.5	-	3.2	4.2	15.4	100.0	22.6	75.0	55.9	29.0
Total	100	100	100	100	100	100	100	100	100	100
N	26	36	31	24	117	20	31	8	59	176

Table 6.11: Percentage distribution of respondents by their responses about the problems with diesel driven/manual machine

(Multiple responses)

Problems in diesel driven machine	Non-electrified			
	Cottage	Small	Medium	Total
More physical labor	55.0	80.6	100.0	74.6
Environment pollution	-	16.1	12.5	10.2
High cost	-	54.8	25.0	32.2
More accident	5.0	16.1	12.5	11.9
Poor service	-	32.3	-	16.9
Health hazard	25.0	12.9	-	15.3
It needs more time	25.0	9.7	37.5	18.6
Poor quality of goods	20.0	12.9	12.5	15.3
Don’t know	25.0	-	-	8.5
N	20	31	8	59

Table 6.12: Percentage distribution of respondents by their responses about the advantage with electricity driven machine

(Multiple responses)

Advantage with electricity	Non-electrified			
	Cottage	Small	Medium	Total
Less labor	5.0	41.9	25.0	27.1
Less time	-	38.7	25.0	23.7
Pollution free	-	3.2	12.5	3.4
Low cost	5.0	41.9	25.0	27.1
High quality	5.0	22.6	12.5	15.3
More options	-	12.9	-	6.8
More profit	-	19.4	-	10.2
Don’t know	90.0	19.4	62.5	49.2
N	20	31	8	59

Table 6.13: Growth in volume and value of electrified industries during last five years

Unit of measurement	Five years ago	Last year	% Change
Output Ton	33378.9	59523.33	78
Output piece or unit other then ton or mound	1694632770	3748904030	121
Total value ton+ piece /unit (in Tk)	10,74243923*	4237356865	294.5

[* at market price of 5 years ago]

Table 6.14: Growth in volume and value of non- electrified industries during last five years

Unit of measurement	Five years ago	Last year	% Change
Output Ton	8213.11	8913.8	8.0
Output piece or unit other then ton or mound	493452	491260	-0.44
Total value ton+ piece /unit (in Tk)	19124200	35521535	85.0

Table: 6.15: Total expenditure and volume of output (Tk).

Output and cost	Electrified		Non-electrified		Total	
	N	Sum	N	Sum	N	Sum
Total cost in Year	117	2735927887	59	29860837	176	2765788724
Total volume of output in a year (in Tk)	117	4237356865	59	35521535	176	4272878400
Cost / output	-	0.65	-	0.84	-	0.65

Table 6.16: Growth in employment by electrified and non-electrified industries (Skilled, unskilled, Male/ Female): *Employment status five years ago.*

	Electrified					Non-electrified				ALL
	Cottage	Small	Medium	Large	Total	Cottage	Small	Medium	Total	
Full time skilled:	58	69	304	2615	3046	39	46	63	148	3194
Male	35	65	292	2459	2851	24	46	53	123	2974
Female	23	4	12	156	195	15	0	10	25	220
Full time unskilled:	18	64	225	1198	1505	7	29	34	70	1575
Male	15	51	151	872	1089	4	20	21	45	1134
Female	3	13	74	326	416	3	9	13	25	441
Par time skilled:	1	7	11	38	57	4	3	3	10	67
Male	0	7	9	34	50	1	2	3	6	56
Female	1	0	2	4	7	3	1	0	4	11
Par time unskilled:	3	25	30	97	155	4	5	22	31	186
Male	2	20	17	45	84	1	2	2	5	89
Female	1	5	13	52	71	3	3	20	26	97
Average	3.1	4.6	18.4	164.5	40.7	2.7	2.7	15.3	4.4	28.5
Total	80	165	570	3948	4763	54	83	122	259	5022
N	26	36	31	24	117	20	31	8	59	176

Table 6.17: Present Employment status and working hours

	Electrified					Non-electrified				ALL
	Cottage	Small	Medium	Large	ALL	Cottage	Small	Medium	All	
Full Time Skilled: Male										
No. of employees	39	65	381	2940	3425	26	50	51	127	3552
Total working hour	115701	193849	1199088	7280632	8789270	76870	122682	141252	340804	9130074
Full Time Skilled: Female										
No. of employees	20	5	20	855	900	15	6	10	31	931
Total working hour	52510	10315	38424	2075040	2176289	38680	14496	22100	75276	2251565
Full Time Unskilled: Male										
No. of employees	14	64	189	894	1161	5	24	27	56	1217
Total working hour	41064	189546	512932	2193564	2937106	17390	57414	82252	157056	3094162
Full Time unskilled: Female										
No. of employees	4	13	104	281	402	5	10	14	29	431
Total working hour	11985	45340	249920	705040	1012285	16950	23520	53452	93922	1106207
Part Time skilled: Male										
No. of employees	0	16	10	39	65	2	2	10	14	79
Total working hour	0	24260	12672	59310	96242	2880	1275	22400	26555	122797
Part Time skilled: Female										
No. of employees	1	1	7	7	16	30	1	20	51	67
Total working hour	720	1360	8400	18680	29160	21600	2250	27000	50850	80010
Part Time unskilled: Male										
No. of employees	2	14	19	60	95	0	3	4	7	102
Total working hour	4180	25260	14400	87870	131710	0	2640	8960	11600	143310
Part Time unskilled: Female										
No. of employees	1	5	8	64	78	11	3	0	14	92
Total working hour	1460	16260	11760	104260	133740	7600	4230	0	11830	145570
Staff-Male										
No. of employees	3	6	37	963	1009	1	0	3	4	1013
Total working hour	13580	16752	115840	1942216	2088388	3780	0	11100	14880	2103268
Staff-Female										
No. of employees	0	0	0	129	129	0	0	0	0	129
Total working hour	0	0	0	286832	286832	0	0	0	0	286832
Total # of employees	84	189	775	6232	7280	95	99	139	333	7613
Total working hour (year)	**241200**	**522942**	**2163436**	**14753444**	**17681022**	**185750**	**228507**	**368516**	**782773**	**18463795**
Average # of Employees	**3.2**	**5.3**	**25.0**	**259.7**	**62.2**	**4.8**	**3.2**	**17.4**	**5.6**	**43.3**
Average working hour (year)	**9276.9**	**14526.2**	**69788.3**	**614726.8**	**151119.8**	**9287.5**	**7371.2**	**46064.5**	**13267.3**	**104907.9**
Average working days per year (8 hour=1 day)	**1160**	**1816**	**8724**	**76841**	**18890**	**1161**	**921**	**5758**	**1658**	**13113**
No. of Industries	**26**	**36**	**31**	**24**	**117**	**20**	**31**	**8**	**59**	**176**

Table 6.18: Growth in employment in electrified industries during last five years

Labor force by type	Labor force five years ago (person)				Labor for at present (person)				% growth of all labor	% growth of male labor	% growth of female labor
	Total	male	female	Female to male ratio	Total	male	female	female to male ratio			
All type of labor	4763	4074	689	1:5.9	7280	5755	1525	1:3.7	52.84	41.26	121.33
Skilled labor force	3103	2901	202	1:14.36	5544	4499	1045	1:4.3	78.60	55.08	417.32

Table 6.19: Growth in employment in non-electrified industries during last five years

Labor force by type	Labor force five years ago (person)				Labor for at present (person)				% growth of all labor	% growth of male labor	% growth of female labor
	Total	male	female	Female to male ratio	Total	male	female	female to male ratio			
All type of labor	259	179	80	1:2.2	333	208	125	1:1.6	28.57	16.20	56.26
Skilled labor force	158	129	29	1:4.9	223	141	82	1:1.7	41.13	11.03	170.97

Table 6.20: Total working hours of the labors: Male and female (last year).

Working hours by type	Electrified					Non-lectrified				
	Total hours (amount)	Male	% of total	Female	% of total	Total hours (amount)	Male	% of total	Female	% of total
All type of working hours	17681022	14042716	79.42	3638306	20.58	782773	550895	70.38	291878	29.26

Table 6.21: Percentage distribution on industries by size having backward and forward linkage

Linkage	Electrified				Non-electrified		
	Cottage	Small	Medium	Large	Cottage	Small	Medium
Backward	-	-	1	2	-	-	-
Forward	1	3	3	6	-	1	1

Table 6.22: Number of reported diversified industries by type and by size

Type of industries	Electrified				Non-electrified
	Cottage	Small	Medium	Large	Small
Twisting	-	1	-	4	-
Cutting	-	-	1	-	-
Jamdani bed cover	1	-	-	-	-
Gas cylinder	-	1	-	-	-
Boiled paddy	-	-	1	-	-
Prawn fry	-	-	-	1	-
Turmeric/ pepper	-	1	-	-	-
Flour / Sujee/ Shemai	-	1	-	1	1
Steel fumiture	1	-	-	-	-
N	2	4	2	6	1

Table 6.23: Percentage distribution of industries by size using raw materials by type

Raw materials by type	Electrified					Non-electrified			
	Cottage	Small	Medium	Large	Total	Cottage	Small	Medium	Total
Primary	73.1	69.4	71.0	50.0	66.7	65.0	80.6	37.5	69.5
Processed or semi- finished	26.9	30.6	29.0	50.0	33.3	35.0	19.4	62.5	30.5
N	26	36	31	24	117	20	31	8	59

Table 6.24: Percentage distribution of electrified and non-electrified industries using processed/finished raw materials by sources

Whether the processed /semi finished goods is produced by other industries in the locality.	Electrified				Non-electrified		
	Cottage	Small	Medium	Large	Cottage	Small	Medium
Yes	11.5	5.6	16.7	22.7	5.0	9.7	25.0
No	73.1	39.4	73.3	54.5	65.0	80.6	37.5

Table 6.25: Percentage distribution of **output sold** to various market

Raw materials by type	Electrified					Non-electrified			
	Cottage	Small	Medium	Large	Total	Cottage	Small	Medium	Total
Consumer direct	92.3	91.7	83.9	70.8	85.5	100.0	100.0	87.5	98.3
Export	-	2.8	6.5	16.7	6.0	5.0	-	-	1.7
Processing	-	5.6	9.7	20.8	8.5			12.5	1.7
Partly direct consumer /partly processing	-	2.8	9.7	-	3.4	-	-	-	-
Partly export / partly consume	7.7	5.6	6.5	-	5.1	-	-	-	-
N	26	36	31	24	117	20	31	8	59

Table 6.26: Number of industries by type and by size operating under **sub-contracting** arrangement by size of industries

	Electrified			Non-electrified	All
	Cottage	Small	Large	Small	
Name of Products:					
Cloth	1	1	3	1	6
Handicrafts	-	2	-	-	2
Spare parts	-	1	-	-	1
Gate/Grill/Windows/Doors	-	1	-	-	1
Others	1	1	-	-	2
Name of industries:					
Name of owners	-	-	1	1	1
Textile Mills	1	1	1	-	3
Knitting	-	1	2	-	3
Handloom	1	-	-	-	1
Commercial source	-	1	-	-	1
Company	-	1	-	-	1-
N	2	4	5	1	10

Table 6.27: Percentage distribution of respondent according to their reporting about uses of products

Indicator	Electrified					Non-electrified				All
	Cottage	Small	Medium	Large	All	Cottage	Small	Medium	All	
Workers purchase goods of the own industry										
Yes	26.9	41.7	41.9	37.5	37.6	25.0	48.4	37.5	39.0	38.1
No	73.1	58.3	58.1	62.5	62.4	75.0	51.6	62.5	61.0	61.9
Workers purchase good of other industry										
Yes	15.4	50.0	54.8	50.0	43.6	20.0	32.3	37.5	28.8	38.6
No	84.6	50.0	45.2	50.0	56.4	80.0	67.7	62.5	72.2	61.4
N	26	36	31	24	117	20	31	8	59	176

Table 6.28: Respondent’s reporting about fastest growing industries by type after RE

Type of industries by	% Reported the type
Rice/Oil/Flour	31.8
Textile Mill	19.9
Printing	1.7
Ginning	.6
Handicrafts	13.6
Workshop	8.5
Blacksmith	.6
Musical instruments	.6
Carpenter	4.5
Saw Mill	2.8
Don’t know	15.3
N	176

Table 6.29: Respondent’s reporting about fastest growing industries by size after RE

Size of industries	% reported the size
Cottage	22.2
Small	43.8
Medium	24.4
Large	5.7
DK	4.0
Total	100
N	176

Table 6.30: Growth of industries by type in the years following RE (within the locality/Thana)

Type of Industry	No. of unit of all type before RE	# after Yr.1 of RE	# 2nd year of RE	# 3rd year of RE	# in 4th year of RE	# in 5th year of RE	# current Year
Rice/Oil/Flour	82	68	68	65	77	144	366
Textile Mill	1,364	998	1,044	603	541	650	4,436
Printing	12	33	12	20	22	25	33
Ginning	1	1	1	1	.0	1	1
Handicrafts	398	426	110	57	33	51	825
Workshop	19	36	33	36	33	22	67
Blacksmith	1	-	-	-	-	-	1
Musical instruments	4	4	2	3	3	4	4
Carpenter	57	9	37	52	22	100	188
Saw Mill	11	8	13	2	3	3	29
Total	2,055	1,699	1,356	856	735	1,001	6,129

Table 6.31: Growth of industries by size in the years following RE (within the locality/thana)

Size of Industry	No. of unit of all type before RE	# after Yr.1 of RE	# 2nd year of RE	# 3rd year of RE	# in 4th year of RE	# in 5th year of RE	# current Year
Cottage	869	536	157	109	53	136	1,695
Small	143	129	126	136	142	220	1,307
Medium	491	472	537	477	377	407	2,051
Large	552	562	536	134	163	238	1,076
Total	2,055	1,699	1,356	856	735	1,001	6,129

Table 6.32: Percentage distribution of respondents by their reporting about the causes of fastest growing industries

(Multiple responses)

Causes	Percentage reported
Less capital/More profit	11.4
High demand	31.3
Skilled labour force	14.2
Availability of electricity	7.4
Availability of capital	4.5
Infrastructure	10.2
Located near the large market	8.0
High profit	18.8
Availability of cheap labour	8.5
Availability of raw materials	30.1
DK/NR	18.8
N	176

Table 6.33: Percentage distribution of respondents reported expansion of various types of support services following the establishment of their **own industrial units**

Services by type	Reporting by	
	Electrified	Non-electrified
Shop	73.5	57.6
Fax, e-mail, Telephone	34.2	5.1
Technical Training Centre	6.0	3.4
Computer Training	12.0	-
Photocopying	16.2	3.4
School, College	17.1	8.5
Clinic	6.0	1.7
MBBS Doctor	10.3	-
Diagnostic Centre	4.3	1.7
Restaurant	39.3	23.7
Hotel	18.8	3.4
Entertainment (cinema)	9.4	3.4
Mobile phone	45.3	11.9
Bank	26.5	6.8
Repairing workshop	36.8	16.9
Bus/Tempo stoppage	42.7	18.6
Lunch ghat	2.6	-
N	117	59

Table 6.34: Respondents reporting about the growth of services sector due to overall industrial growth

Services by type	Percent reported
Shop	82.9
Fax, e-mail, Telephone	61.5
Technical Training Centre	41.9
Computer Training	50.4
Photocopying	56.4
School, College	55.6
Clinic	41.9
MBBS Doctor	47.9
Diagnostic Centre	37.6
Restaurant	65.0
Hotel	58.1
Entertainment (cinema)	44.4
Mobile phone	68.4
Bank	59.8
Repairing workshop	66.7
Bus/Tempo stoppage	65.0
Lunch ghat	31.6
N	117

Table 6.35: Average distance between industrial center (by electrification status) and selected transport points, transportation linkage with import station and ports

(in km)

Transport points	Electrified	Non-electrified	Overall
Nearest pacca road	1.5	1.6	1.6
Nearest high way	2.4	3.2	2.6
Rail station	14.8	18.3	15.9
River port	14.7	9.4	12.9
Sea port	46.6	52.4	48.5
Air port	54.6	48.8	52.7
N	117	59	176

Table 6.36: Percentage distribution of industries by electrification status and size reported enjoying credit facilities

Enjoying credit facilities	Electrified					Non-electrified				All
	Cottage	Small	Medium	Large	All	Cottage	Small	Medium	All	
Yes	69.2	63.9	93.5	91.7	78.6	50.0	71.0	87.5	66.1	74.4
No	30.8	36.1	6.5	8.3	21.4	50.0	29.0	12.5	33.9	25.6
Total	100	100	100	100	100	100	100	100	100	100
N	26	36	31	24	117	20	31	8	59	176

Table 6.37: Percentage distribution of industries by their nature of environmental degradation

Nature of degradation	Electrified					Non-electrified			
	Cottage	Small	Medium	Large	All	Cottage	Small	Medium	All
Chemical	7.7	13.9	12.9	33.3	16.2	10.0	3.2	12.5	6.8
Smoke	11.5	27.8	32.3	54.2	30.8	5.0	61.3	50.0	40.7
N	26	36	31	24	117	20	31	8	59

Table 6.38: Percentage distribution of respondent reported about method of waste disposal

Method of waste disposal	Electrified					Non-electrified			
	Cottage	Small	Medium	Large	All	Cottage	Small	Medium	All
Air	15.4	30.6	19.4	54.2	29.1	10.0	45.2	50.0	33.9
Water	7.7	16.7	19.4	33.3	18.8	-	9.7	12.5	6.8
Land	23.1	41.7	38.7	20.8	32.5	25.0	25.8	12.5	23.7
N	26	36	31	24	117	20	31	8	59

Chapter 7: Impact on Commercial Activities
Tables 7.1 — 7.45

Table 7.1: Distribution of observation as to whether the shop is attached or detached to marketplace

Status	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Attached	301	88.3	62	52.5	363	79.1	54	91.5	5	50	59	85.5
Detached	40	11.7	56	47.5	96	20.9	5	8.5	5	50	10	14.5
Total	341	100	118	100	459	100	59	100	10	100	69	100

Table 7.2: Distribution of respondent about the type of trade

Electrification Status	Retail		Wholesale	
	Number	percentage	Number	percentage
Electrified	341	74.3	59	85.5
Non-electrified	118	25.7	10	14.5
Total	459	100	69	100

Table 7.3: Distribution of respondent about the type of store

Type	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Grocery shop	138	40.5	38	32.2	176	38.3	34	57.6	8	80.0	42	60.9
Stationery	98	28.7	30	25.4	128	27.9	18	30.5	2	20.0	20	29.0
Pharmacy	33	9.7	18	15.3	51	11.1	-	-	-	-	-	-
Electric goods	31	9.1			31	6.8	-	-	-	-	-	-
Confectionery (Beverages)	40	11.7	18	15.3	58	12.6	-	-	-	-	-	-
Saloon	1	0.3	14	11.9	15	3.3	-	-	-	-	-	-
Medicine	-	-	-	-	-	-	7	11.9	-	-	7	10.1
Total	341	100	118	100	459	100	59	100	10	100	69	100

Table 7.4: Distribution of respondent about the year the shop was established.

Year	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Upto -1980	39	11.4	2	1.5	41	9.1	11	18.7	-	-	11	15.9
1981- 1990	81	23.7	19	16.1	100	21.7	21	35.5	2	20.0	23	33.4
1991 – 2000	181	53.2	82	69.8	263	57.4	26	44.1	7	70.0	33	47.8
2001 –2002	40	11.7	15	12.6	55	12.0	1	1.7	1	10.0	2	2.9
Total	341	100	118	100	459	100	59	100	10	100	69	100

Table 7.5: Distribution of respondent about the electrification status of stores

Status	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Electrified	341	100.0	NA	NA	341	74.3	59	100	NA	NA	59	85.5
Non-electrified	NA	NA	118	100	118	25.7	NA	NA	10	100	10	14.5
Total	341	100	118	100	459	100	59	100	10	100	69	100

NA: Not Applicable

Table 7.6: Distribution of years the shops got electrified.

Year	Retail	Wholesale
Upto 1979	5.9	13.6
1980-1984	4.7	6.8
1985-1989	15.8	13.5
1990-1994	15.2	25.4
1995-1999	36.4	37.3
2000-2002	22.0	3.4
Total	400	59

Table 7.7: Distribution as to when the area or the market place was electrified

Year	Retail		Wholesale	
	N	%	N	%
1966 –76	49	14.3	14	23.3
1977 –86	115	33.6	17	28.9
1987 –96	133	38.8	22	37.5
1997 - Onwards	44	13.3	6	10.3
Total	341	100	59	100

Table 7.8: Distribution as to how long the shop is electrified

Year	Retail		Wholesale	
	N	%	N	%
< 2 Years	50	14.7	1	1.7
2-4 years	104	30.5	11	18.6
5 years and above	187	54.8	47	79.7
Total	341	100	59	100

Table 7.9: Distribution of electrical equipment's being used in the shops.

(Multiple)

Equipments	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Electric Bulb	275	80.6	NA	NA	275	59.9	47	79.7	NA	NA	47	68.1
Tube-light	278	81.5	NA	NA	278	60.6	54	91.5	NA	NA	54	78.3
Ceiling fan/Table fan	313	91.8	NA	NA	313	68.2	55	93.2	NA	NA	55	79.7
TV	53	15.5	4	3.4	57	12.4	7	20.0	2	11.9	9	13.0
Radio	44	12.9	26	22.0	70	15.3	7	20.0	2	11.9	9	13.0
Cassette Player	85	24.9	12	10.2	97	21.1	9	15.3	4	40.0	13	18.8
Refrigerator	68	19.9	NA	NA	68	14.8	8	13.6	NA	NA	8	11.6
Patromax	13	3.8	22	18.6	35	7.6	4	6.8	3	30.0	7	10.1
Hurricane Lantern	20	5.9	100	84.7	120	26.1	3	5.1	9	90.0	12	17.4
Indiginous lamp	9	2.6	54	45.8	63	13.7	1	1.7	2	20.0	3	4.3
Indiginous fan (Hand-Fan)	55	16.1	101	85.6	156	34.0	10	16.9	9	90.0	19	27.5
Others	65	19.1	18	15.3	83	18.1	11	18.6	2	20.0	13	18.8
N	341		118		459		59		10		69	

Table 7.10: Distribution of reasons as to why fridge is there at shops

(Multiple)

Reasons	Electrified	
	N	%
Product can be stored	56	82.4
Can be stored properly	56	82.4
Unsold products are kept unspoiled	50	73.5
The shop becomes attractive	49	72.1
N*	68	

Table 7.11: Distribution as to what items are kept inside the fridge

(Multiple)

Items	Electrified	
	N	%
Soft drinks	62	91.2
Ice cream /chocolate	23	33.8
Milk/Yogurt	32	47.1
Sweets	13	19.1
Others	19	27.9
N*	68	100

Table 7.12: Distribution as to whether shops have got the fridge right from the beginning

Status	Electrified	
	N	%
Yes	23	33.8
No	45	66.2
N*	68	100

Table 7.13: Distribution as to how much is earned daily, solely because of the items from fridge

Amount (Tk)	Retail			
	How much is made solely because of the fridge		How much was being made before there was fridge	
	N	%	N	%
Low-100	7	10.3	19	42.3
101-200	10	14.7	9	28.8
201- above	51	75.0	13	28.9
Average (in Tk)	**383.04**		**192.78**	
Total*	68	100	45	100

Table 7.14: Distribution as to whether those (as mentioned in Table 7.13) items were being sold before electricity was available.

Response	Retail	
	Electrified	
	N	%
Yes	17	25.0
No	51	75.0
N*	68	100

Table 7.15: Percentage distribution of responses about the existence of shop when there was no electricity

Status	Retail
Yes	21.1
No	78.9
N	341

Table7.16: Percentage distribution of opinions about the condition of business when there was no electricity in the area.

(Multiple)

Condition	Retail
1. Less business	88.9
2. Less sale	75.0
3. Less customers	76.4
4. Less profit	55.6
5. Less buyers	79.2
6. Others	12.5
N	72

Table 7.17: Distribution as to how much sale is being made daily now (after electricity) and how much was being made daily then (before electricity).

Amount (Tk)	Retail			
	At present		Before	
	N	%	N	%
Upto1000	2	11.7	10	58.8
1001-2000	3	17.7	6	35.3
2001 above	12	70.6	1	5.9
Average (in Tk)	**2947.06**		**1250.59**	
Total*	17	100	17	100

Table 7.18: Distribution as to the extent of monthly sale in shops when there was no electricity in the area and after the area got electrified.

Turnover (Tk)	Retail			
	At present		Before	
	N	%	N	%
Upto10000	6	8.4	23	32.4
10001-20000	17	24.0	17	23.9
20001above	48	67.6	31	43.7
Average (in Tk)	**56218.31**		**31790.14**	
Total*	71	100	71	100

Table 7.19: Distribution of stock in hand

Amount (Tk)	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Upto 50000	179	52.3	102	86.5	281	61.2	4	6.8	4	40.0	8	11.3
50001-100000	80	23.5	13	11.0	93	20.3	3	5.1	4	40.0	7	9.8
100001 above	82	24.2	3	2.5	85	18.5	52	88.1	2	20.0	54	78.9
Average (in Tk)	**107362.46**		**27062.71**		**86718.95**		**499915.25**		**85300.00**		**439826.09**	
Total	341	100	118	100	459	100	59	100	10	100	69	100

Table 7.20: Distribution as to the sources of supply of capital for shops

(Multiple)

Sources	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Owner Himself	195	57.2	81	68.6	276	60.1	31	52.5	8	80.0	39	56.5
Wife	6	1.8	1	0.8	7	1.5	-	-	-	-	-	-
Family	136	39.9	36	30.5	172	37.5	27	45.8	2	20.0	29	42.0
Relatives	13	3.8	1	0.8	14	3.1	1	1.7	-	-	1	1.4
Bank loan	18	5.3	1	0.8	19	4.1	5	8.5	-	-	5	7.2
NGO loan/money lender	2	0.6	2	1.7	4	0.9	4	6.8	-	-	4	5.8
Total	341		118		459		59		10		69	

Table 7.21: Distribution with respect to opening and closing hours of shop along with total hours of business

Business Hours	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Opening time (1 day=24 hours)												
5 AM	14	4.1	6	5.1	20	4.4	-	-	-	-	-	-
6 AM	83	24.3	36	30.5	119	25.9	7	11.9	3	30.0	10	14.5
7 AM	122	35.8	36	30.5	158	34.4	34	57.6	5	50.0	39	56.5
8 AM	95	27.9	32	27.1	127	27.7	15	25.4	2	20.0	17	24.6
9 AM	21	6.2	6	5.1	27	5.9	3	5.1	-	-	3	4.3
10 AM	2	.6	-	-	2	.4	-	-	-	-	-	-
12 AM	3	.9	-	-	3	.7	-	-	-	-	-	-
14 PM	1	.3	-		1	.2	-	-	-	-	-	-
16 PM	-	-	1	.8	1	.2	-	-	-	-	-	-
17 PM	-	-	1	.8	1	.2	-	-	-	-	-	-
Closing time (1 day=24 hours)												
18 PM	-	-	1	.8	1	.2	-	-	-	-	-	-
19 PM	3	.9	27	22.9	30	6.5	-	-	3	30.0	3	4.3
20 PM	32	9.4	61	51.7	93	20.3	3	5.1	2	20.0	5	7.2
21 PM	100	29.3	18	15.3	118	25.7	16	27.1	5	50.0	21	30.4
22 PM	144	42.2	11	9.3	155	33.8	25	42.4	-	-	25	36.2
23 PM	51	15.0			51	11.1	14	23.7	-	-	14	20.3
24 PM	11	3.2	-	-	11	2.4	1	1.7	-	-	1	1.4
Total Business hours in an average day (1 day=24 hours) (Closing-Opening)												
5 hour	-	-	1	.8	1	.2	-	-	-	-	-	-
6 hour	-	-	1	.8	1	.2	-	-	-	-	-	-
8 hour	1	.3	-	-	1	.2	-	-	-	-	-	-
10 hour	1	.3	1	.8	2	.4	-	-	-	-	-	-
11 hour	2	.6	11	9.3	13	2.8	-	-	-	-	-	-
12 hour	28	8.2	28	23.7	56	12.2	3	5.1	4	40.0	7	10.1
13 hour	48	14.1	36	30.5	84	18.3	5	8.5	1	10.0	6	8.7
14 hour	93	27.3	19	16.1	112	24.4	18	30.5	3	30.0	21	30.4
15 hour	82	24.0	15	12.7	97	21.1	17	28.8	2	20.0	19	27.5
16 hour	46	13.5	5	4.2	51	11.1	15	25.4	-	-	15	21.7
17 hour	28	8.2	1	.8	29	6.3	1	1.7	-	-	1	1.4
18 hour	11	3.2	-	-	11	2.4	-	-	-	-	-	-
19 hour	1	.3	-	-	1	.2	-	-	-	-	-	-
Average	**14.5**		**13.0**		**14.1**		**14.7**		**13.3**		**14.5**	
Total	341	100	118	100	459	100	59	100	10	100	69	100

Table 7.22: Distribution with responses about opening and closing hours of shops along with total hours of business before there was electricity.

Business Hours	Retail		Wholesale	
	Electrified		Electrified	
	N	%	N	%
Opening time (1 day=24 hours)				
5 AM	4	5.6	-	-
6 AM	19	26.4	2	11.1
7 AM	31	43.1	7	38.9
8 AM	11	15.3	6	33.3
9 AM	7	9.7	3	16.7
Closing time (1 day=24 hours)				
18 PM	-	-	1	5.6
19 PM	19	26.4	2	11.1
20 PM	37	51.4	6	33.3
21 PM	13	18.1	6	33.3
22 PM	2	2.8	3	16.7
23 PM	1	1.4		
Total Business hour in an average day (1 day=24 hours) (Closing-Opening)				
9 hour			1	5.6
10 hour	2	2.8	1	5.6
11 hour	8	11.1	1	5.6
12 hour	16	22.2	3	16.7
13 hour	23	31.9	6	33.3
14 hour	11	15.3	2	11.1
15 hour	8	11.1	4	22.2
16 hour	3	4.2	-	-
17 hour	-	-	-	-
18 hour	1	1.4	-	-
Average (hrs)	**13.3**		**12.9**	
Total*	72	100	18	100

Table 7.23: Distribution as to how long shops remain open after sunset (6:30 PM)

Time	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<60 min	3	.9	28	23.7	31	6.8			3	30.0	3	4.3
61-120 min	32	9.4	61	51.7	93	20.3	3	5.1	2	20.0	5	7.2
121-180 min	100	29.3	18	15.3	118	25.7	16	27.1	5	50.0	21	30.4
181-above	206	60.4	11	9.3	217	47.3	40	67.8			40	58.0
Average (min.)	**192.4**		**95.6**		**167.5**		**203.9**		**102.0**		**189.1**	
Total	341	100	118	100	459	100	59	100	10	100	69	100

Table 7.24: Distribution as to how long the shop used to remain open after sunset (6:30 PM) when there was no electricity

Time	Retail		Wholesale	
	Electrified		Electrified	
	N	%	N	%
< 60 min	19	5.6	2	5.1
61-120 min	37	10.9	6	10.2
121-180 min	13	3.8	6	10.2
181-above	3	.9	3	5.1
Not applicable	269	78.9	41	69.5
Average (min.)	**90.8(72)**		**116.7(18)**	
Total	341	100	59	100

Table 7.25: Distribution of additional time the electrified shops remain open after sunset

Additional Time	Retail		Wholesale	
	Electrified		Electrified	
	N	%	N	%
< 60 min	24	33.3	9	50.0
61-120 min	35	48.6	6	33.3
121-above	13	18.1	3	16.7
Average (min)	**107.5**		**96.7**	
Total*	72	100	18	100

Table 7.26: Distribution of weekly extra income as a result of extra working hours due to electricity

Amount	Retail	Wholesale
	Electrified	Electrified
Average (in Tk)	**2317.68**	**6055.56**
Total*	72	18

Table 7.27: Distribution of electricity bills paid monthly by the shop owners

Payment	Retail		Wholesale	
	Electrified		Electrified	
	N	%	N	%
Upto 100	41	12.0	1	1.7
101-200	140	41.1	12	20.3
201-300	75	22.0	15	25.4
301-400	29	8.5	13	22.0
401-above	56	16.4	18	30.5
Average (in Tk)	**295.70**		**397.27**	
Total	341	100	59	100

Table 7.28: Distribution of perception about percentage increment in sale had there been electricity in shop.

Percentage range	Retail		Wholesale	
	Non-electrified		Non-electrified	
	N	%	N	%
Upto 25	26	22.0	2	20.0
26-50	62	52.5	5	50.0
51-75	14	11.9	2	20.0
76-100	6	5.1	1	10.0
101 above	10	8.5		
Average (%)	**64.75**		**46.00**	
Total	118	100	10	100

Table 7.29: Distribution of responses as to whether electricity connection is desired

Status	Retail		Wholesale	
	Non-electrified		Non-electrified	
	N	%	N	%
Yes	118	100	10	100
No	-	-	-	-
Total	118	100	10	100

Table 7.30: Distribution of perceived gain from electricity connection in shops

(Multiple)

Sources				
	Retail		Wholesale	
	Non-electrified		Non-electrified	
	N	%	N	%
Bulbs will be there	118	100.0	10	100.0
Fan will be there	118	100.0	10	100.0
Freeze will be there	58	49.2	5	50.0
Sale will increase	101	85.6	9	90.0
Working hour will increase	106	89.8	10	100.0
More customers will be there	101	85.6	8	80.0
More profit will be earned	99	83.9	10	100.0
Business development	14	11.9	-	-
Social development	7	5.9	-	-
Educational/recreational	1	0.8	-	-
Total	118	100	10	100

Table 7.31: Distribution about perceived cost to be incurred for having electricity connection

Amount (Tk)	Retail		Wholesale	
	Non-electrified		Non-electrified	
	N	%	N	%
Upto 250	3	2.5	-	-
251-500	13	11.0	-	-
501-750	7	5.9	-	-
751-1000	25	21.2	6	60.0
1001 above	70	59.3	4	40.0
Is it worth investing from the business point of view?				
Yes	117	99.2	10	100
No	1	.8	-	-
Total	118	100	10	100

Table 7.32: Distribution of responses as to priority for having electricity connection

Place	Retail		Wholesale	
	Non-electrified		Non-electrified	
	N	%	N	%
Home	3	2.5	-	-
Shop	46	39.0	3	30.0
Both	69	58.5	7	70.0
Total	118	100	10	100

Table 7.33: Distribution of average number of customers in a day in a shop

Customer	Retail					
	Electrified		Non-electrified		Total	
	N	%	N	%	N	%
Upto 50	82	24.0	38	32.2	120	26.1
51-100	122	35.8	37	31.4	159	34.6
101-150	69	20.2	20	16.9	89	19.4
151-200	34	10.0	16	13.6	50	10.9
201-250	9	2.6	5	4.2	14	3.1
251 above	25	7.3	2	1.7	27	5.9
Average	**123.65**		**105.34**		**118.94**	
Total	341	100	118	100	459	100

Table 7.34: Distribution as to whether shops are open throughout the week

Response	Retail					
	Electrified		Non-electrified		Total	
	N	%	N	%	N	%
Yes	322	94.4	112	94.9	434	94.6
No	19	5.6	6	5.1	25	5.4
Total	341	100	118	100	459	100

Table 7.35: Distribution as to who usually operates the shops

Who	Retail					
	Electrified		Non-electrified		Total	
	N	%	N	%	N	%
Alone	74	21.7	50	42.4	124	27.0
With family assistance	21	6.2	6	5.1	27	5.9
Both	127	37.2	45	38.1	172	37.5
With employee	119	34.9	17	14.4	136	29.6
Total	341	100	118	100	459	100

Table 7.36: Distribution of number and sex of employees

Employee	Retail		
	Electrified	Non-electrified	Total
Average-Male	2.28	1.59	2.19
Average-Female	.15	.12	.15
Average-Both	2.45	1.71	2.35
N*	119	17	136

Table 7.37: Distribution of response about watching TV, listening to Radio and reading Newspapers

Media	Retail					
	Electrified		Non-electrified		Total	
	N	%	N	%	N	%
TV						
Yes	214	62.8	48	40.7	262	57.1
No	127	37.2	70	59.3	197	42.9
Radio						
Yes	175	51.3	84	71.2	259	56.4
No	166	48.7	34	28.8	200	43.6
Newspaper						
Yes	181	53.1	35	29.7	216	47.1
No	160	46.9	83	70.3	243	52.9
Total	341	100	118	100	459	100

Table 7.38: Distribution of opinion as to how media exposure is helpful for business

Opinion	Retail								
	TV		Total	Radio		Total	Newspaper		Total
	Electri-fied	Non-electri-fied		Electri-fied	Non-electri-fied		Electri-fied	Non-electri fied	
1. Able to know about new product	87.9	91.7	88.5	83.4	78.6	81.9	78.5	82.9	79.2
2. Able to know about opportunities	59.3	52.1	58.0	56.6	45.2	52.9	58.6	65.7	59.7
3. Able to clarify about new product	70.1	62.5	68.7	64.0	56.0	61.4	64.1	71.4	65.3
4. Able to watch/listen advertisement	87.9	91.7	88.5	56.0	47.6	53.3	72.4	77.1	73.1
5. Others	21.5	27.1	22.5	22.3	26.2	23.6	33.7	22.9	31.9
N*	214	48	262	175	84	259	181	35	216

Table 7.39: Distribution of responses as to whether there are shops other then this one

Status	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Yes	63	18.5	23	19.5	86	18.7	4	6.8	2	20.0	6	8.7
No	278	81.5	95	80.5	373	81.3	55	93.2	8	80.0	63	91.3
Total	341	100	118	100	459	100	59	100	10	100	69	100

Table 7.40: Distribution about owning a cell-phone by the retailers

Status	Retail	
	Electrified	Non-electrified
Yes	14.1	3.4
No	85.9	96.6
N	341	118

Table 7.41: Distribution of responses as to how much has been sold in the last week

Amount (Tk)	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Upto 15000	235	68.9	111	94.1	346	75.5	5	8.4	6	60.0	11	15.9
15001- 30000	81	23.7	5	4.2	86	18.8	10	17.0	4	40.0	14	20.4
30001 - 45000	15	4.4	1	0.9	16	4.2	12	20.3	-	-	12	17.4
45001 above	10	3.0	1	0.8	11	1.5	32	54.3	-	-	32	46.3
Average (in Tk)	**13427.54**		**6713.47**		**11701.48**		**53902.37**		**13750.00**		**48083.19**	
Total	341	100	118	100	459	100	59	100	10	100	69	100

Table 7.42: Distribution of responses as to how much is spent per month on different heads of account

Status	Retail			Wholesale		
	Electrified	Non-electrified	Total	Electrified	Non-electrified	Total
Rent for shop	13.9	9.0	13.3	16.4	7.6	16.0
Salary for employees	32.8	16.1	30.8	29.7	3.6	28.5
Electricity/Fuel cost	13.2	21.9	14.2	11.0	22.2	11.5
Tax, gratification	3.7	3.0	3.6	3.4	4.8	3.5
Transportation, conveyance	17.3	36.5	19.5	23.4	46.2	24.4
Entertainment cost	14.8	11.0	14.4	12.9	12.3	12.9
Others	4.3	2.6	4.1	3.2	3.3	3.2
Average (in Tk)	**3515.3**	**1360.5**	**2961.3**	**5752.5**	**1646.0**	**5157.4**
Total	**100**	**100**	**100**	**100**	**100**	**100**
N	341	118	459	59	10	69

Table 7.43: Distribution of responses as to ways that are taken to promote sale

(Multiple)

Status	Retail						Wholesale					
	Electrified		Non-electrified		Total		Electrified		Non-electrified		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Entertainment	299	87.7	91	77.1	390	85.0	54	91.5	8	80.0	62	89.9
Newspaper	87	25.5	26	22.0	113	24.6	32	54.2	2	20.0	34	49.3
TV / Radio/Player	116	34.0	44	37.3	160	34.9	-	-	-	-	-	-
Credit sale	284	83.3	105	89.0	389	84.7	15	25.4	4	40.0	19	27.5
Get-together	175	51.3	60	50.8	235	51.2	42	71.2	6	60.0	48	69.6
Use electrical equipments like bulbs to attract customers	51	15.0	17	14.4	68	14.8	-	-	-	-	-	-
Use sign boards	5	1.5	2	1.7	7	1.5	18	30.5	2	20.0	20	29.0
Maintaining quality of the product	2	0.6	-	-	2	0.4	-	-	-	-	-	-
Well behaviour with the customers	1	0.3	-	-	1	0.2	-	-	-	-	-	-
Publicity	-	-	-	-	-	-	8	13.6	-	-	8	11.6
Total	341	100	118	100	459	100	59	100	10	100	69	100

Table 7.44: Distribution as to whether there is Fridge in the drugstores or not.

Status	Electrified
Yes	13.3
No	86.7
Total	100

Table 7.45: Distribution of perception about percentage contribution of Fridge to total turnover in drugstores

Percentage	%
10	42.9
11	14.3
15	14.3
50	14.3
60	14.3
Total	100

Chapter 8: PBS: Model of Local Governance and Democratization
Tables 8.1-8.10

Table 8.1: Distribution of respondents by membership in PBS

Membership status	% respondents
Member	88.8
Not member	11.2
Total	100
N	1380

Table 8.2: Distribution of PBS members by their knowledge about eligibility criteria for directorship in the PBS Board

Knowledge about eligibility criteria for directorship in the PBS Board	% respondents
Knows	29.6
Don't know	70.4
Total	100
N	1225

Note1>: The eligibility criterion to be elected as a Director (highest 15 constituencies) are as follows: must be a member; at least SSC passed; age 30 – 70 years; not convicted for criminal offense; permanent residence of the area; not an office bearer of political party; not an elected chairman/member of local government. Mentioning about any three of these was treated as having knowledge about eligibility criteria.

Table 8.3: Distribution of PBS members by their reporting about ever casting vote for election of PBS director

Ever casted vote for election of PBS director	% respondents
Ever casted vote	35.0
Never casted vote	65.0
Total	100
N	1225

Table 8.4: Distribution of members by whether or not attended last AGM

Whether attended last AGM	% respondents
Attended	23.9
Not attended	76.1
Total	100
N	1225

Table 8.5: Distribution of those attended last AGM by their reporting about major issues reviewed and discussed in AGM

Issues discussed	% respondents
Improvement of client services (load shading)	41.0
Regular bill payment and providing error-free bill	53.2
To protect unauthorized use and meter/wire stealing	24.2
More utilization in agriculture	13.7
Increasing clients and improving services	15.7
Socio-economic impact of electricity	9.6
Discussion on revenue-expenditure of PBS	25.9
Increasing communication	4.4
Accountability	11.3
n	293

Note: Each respondent was asked to mention about 3 major issues

Table 8.6: Distribution of respondents' reporting about the role elected directors of PBS play in PBS management

(Multiple responses)

Role played by directors	% respondents
1. Policy making	27.5
2. Ensure transparency in management	25.9
3. Minimize mismanagement (if any)	25.5
4. Represent other members in PBS	13.0
5. Others	1.2
6. Know nothing about role	60.3
N	1380

Table 8.6(b): Distribution of PBS members ignorant about the roles of PBS Director by their knowledge on eligibility criteria for PBS directorship, status of ever casting of vote in PBS Director election and attendance in last AGM

(Multiple responses)

knowledge on eligibility criteria for PBS directorship, status of ever casting of vote in PBS-Director election and attendance in last AGM	% respondents
1. Knowledge on eligibility criteria for PBS directorship	8.6
2. Status of ever casting of vote in PBS Director election	20.6
3. Attendance in last AGM	11.7
N	695

Table 8.7: Distribution of respondents by their ideas about whether the Board Members are accountable to the members and nature of accountability

Whether accountable and nature of accountability	% respondents
I. % reported Board Members are :	
Accountable	53.7
Not accountable	46.3
Total	100
N	1380
II. Nature of accountability of Board members	
1. Respond to the members query	85.8
2. Answerable to members in AGM	60.1
3. Consult members before framing policy decisions	35.5
4. Share audit report	17.3
5. Others	1.2
6. DK/NR	.9
n	741

Table 8.8: Distribution of respondents by whether they know the local board member, local village advisor, and role of lady advisor

Knowledge about local board member, local village advisor, and role of lady advisor	HH with electricity
I. Knowledge about Local Board Member :	
Knows	42.5
Don't know	57.5
Total	100
N	1380
II. Knowledge about local village advisor:	
Knows	26.1
Don't know	73.9
Total	100
N	1380
III. Knowledge about the role of lady advisor in PBS:	(multiple responses)
1. Mobilize female member	31.7
2. Collect savings from female members	22.1
3. Others	5.8
4. DK/NR	55.9
N	1380

Table 8.9: Distribution of respondents by their perception about the role of PBS

Perception about PBS	HH with electricity
I. Perceive that PBS plays useful role for members:	
Yes	70.0
No	30.0
Total	100
N	1380
II. Perception about nature of useful role PBS play: (multiple responses)	
1. Facilitate people's participation	64.1
2. Facilitate women's empowerment (women as billing assistant)	42.4
3. Help consensus-building (among members with diverse opinion)	43.8
4. Foster group spirit	21.0
5. Accelerate accountability	28.7
6. Help achieve transparency	19.0
7. Others	1.4
N	966

Table 8.10: Complains and their resolutions: Annual Average of 23 Sample PBSs

Complains and resolution	1998	1999	2000	2001	2002
Number of complains	4836	6588	7200	7147	4671
Number of complains resolved	4810	6424	6988	7003	4379

Source: Obtained from secondary data collection format for PBS (see SDCF-PBS.6)

Note: Average number of complains and their resolutions from 23 PBSs show decimal numbers. Decimal points are deleted in the table.

Chapter 9: Statistical Inferential Analysis: Tables 9.1 — 9.19

Table 9.1: Estimation Results of censored Tobit

Dependent Variable: Total time (in minute) after 6.00pm spent for human capital formation (H9C3_T)
HH head (Male)

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.182652	0.177072	-1.031516	0.3023
HH size(Mem_tot)	-0.298791	1.431516	-0.208724	0.8347
HH member involved in IGA (IGA_mem)	0.168448	2.789407	0.060388	0.9518
Adult literacy rate (A15_mem)	0.187347	0.079530	2.355681	0.0185
Valuation of capital assets (PPR_Cost)	6.72E-06	2.63E-06	2.560163	0.0105
HH net income (INC_Net)	1.97E-05	1.37E-05	1.434453	0.1514
Expenditure on Bio-mass fuel (V502_B1)	0.003251	0.010032	0.324037	0.7459
Expenditure on Kerosin oil (V502B2_V)	0.073202	0.045004	1.626571	0.1038
HH electrification status (HES)	39.32158	7.488686	5.250798	0.0000
Village electrification status (Vill_ES)	15.23623	7.716638	1.974464	0.0483
C	180.4020	11.06900	16.29794	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.2: Estimation Results of censored Tobit

Dependent Variable: Total time (in minute) in income generating activities ((HH_HHI)
HH head (Male)

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.435455	0.217459	-2.002465	0.0452
HH size(Mem_tot)	-0.481792	1.756137	-0.274347	0.7838
HH member involved in IGA (IGA_mem)	5.055068	3.414128	1.480633	0.1387
Adult literacy rate (A15_mem)	-0.006649	0.097337	-0.068311	0.9455
Valuation of capital assets (PPR_Cost)	3.13E-06	3.14E-06	0.998150	0.3182
HH net income (INC_Net)	1.79E-05	1.57E-05	1.143411	0.2529
Expenditure on Bio-mass fuel (V502_B1)	-0.009463	0.012390	-0.763745	0.4450
Expenditure on Kerosin oil (V502B2_V)	0.018073	0.053885	0.335407	0.7373
HH electrification status (HES)	6.278897	9.129514	0.687758	0.4916
Village electrification status (Vill_ES)	13.84612	9.495126	1.458235	0.1448
C	47.99501	13.65972	3.513616	0.0004

[Note: Parentheses indicate the name of the variables/fields]

Table 9.3: Estimation Results of censored Tobit

Dependent Variable: Total time (in minute) in socio-cultural activities (HH_HH234) after 6.00pm.
HH head (Male)

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	0.281312	0.129716	2.168681	0.0301
HH size(Mem_tot)	0.796557	1.049451	0.759023	0.4478
HH member involved in IGA (IGA_mem)	-3.796147	2.043685	-1.857501	0.0632
Adult literacy rate (A15_mem)	0.237757	0.058277	4.079802	0.0000
Valuation of capital assets (PPR_Cost)	1.44E-06	1.92E-06	0.746532	0.4553
HH net income (INC_Net)	-1.10E-06	1.00E-05	-0.109818	0.9126
Expenditure on Bio-mass fuel (V502_B1)	-0.003301	0.007349	-0.449115	0.6533
Expenditure on Kerosin oil (V502B2_V)	0.023563	0.032947	0.715196	0.4745
HH electrification status (HES)	30.48749	5.494131	5.549102	0.0000
Village electrification status (Vill_ES)	1.803557	5.660193	0.318639	0.7500
C	94.50366	8.110402	11.65215	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.4: Estimation Results of censored Tobit

Dependent Variable: Total time (in minute) in household formation chore activities (HH_HH5) after 6.00pm HH head (Male)

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.037349	0.039156	-0.953862	0.3402
HH size(Mem_tot)	-0.617139	0.316856	-1.947692	0.0515
HH member involved in IGA (IGA_mem)	-0.957795	0.617476	-1.551145	0.1209
Adult literacy rate (A15_mem)	-0.046190	0.017595	-2.625147	0.0087
Valuation of capital assets (PPR_Cost)	4.72E-07	5.81E-07	0.812428	0.4165
HH net income (INC_Net)	-1.89E-06	3.03E-06	-0.624602	0.5322
Expenditure on Bio-mass fuel (V502_B1)	0.012979	0.002220	5.845157	0.0000
Expenditure on Kerosin oil (V502B2_V)	0.032480	0.009990	3.251172	0.0011
HH electrification status (HES)	2.459503	1.656327	1.484915	0.1376
Village electrification status (Vill_ES)	-0.187151	1.706120	-0.109694	0.9127
C	35.83284	2.447996	14.63762	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.5: Estimation Results of censored Tobit

Dependent Variable: Total time (in minute) after 6.00pm spent for human capital formation (S9C3_T) Spouse (Female)

Regressors	Coefficient	Std. Error	t-Statistic	Prob.
Age of HH head (VII_Age)	-0.040572	0.137243	-0.295625	0.7675
HH size(Mem_tot)	1.321929	1.109745	1.191200	0.2337
HH member involved in IGA (IGA_mem)	3.081261	2.162458	1.424888	0.1543
Adult literacy rate (A15_mem)	0.292590	0.061648	4.746146	0.0000
Valuation of capital assets (PPR_Cost)	6.59E-07	2.04E-06	0.323687	0.7462
HH net income (INC_Net)	1.46E-05	1.07E-05	1.368307	0.1713
Expenditure on Bio-mass fuel (V502_B1)	0.005141	0.007778	0.661023	0.5087
Expenditure on Kerosin oil (V502B2_V)	0.065689	0.034920	1.881146	0.0601
HH electrification status (HES)	35.67135	5.806902	6.142922	0.0000
Village electrification status (Vill_ES)	6.763156	5.982480	1.130494	0.2584
C	137.1060	8.578962	15.98165	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.6: Estimation Results of censored Tobit

Dependent Variable: Total time (in minute) in income generating activities (HH_SS1) after 6.00pm Spouse (Female)

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.486513	0.466659	-1.042545	0.2972
HH size(Mem_tot)	-14.42508	4.029976	-3.579447	0.0003
HH member involved in IGA (IGA_mem)	39.38331	7.337724	5.367239	0.0000
Adult literacy rate (A15_mem)	0.129686	0.204717	0.633489	0.5264
Valuation of capital assets (PPR_Cost)	4.15E-06	6.86E-06	0.605881	0.5446
HH net income (INC_Net)	-6.01E-05	7.45E-05	-0.807605	0.4193
Expenditure on Bio-mass fuel (V502_B1)	-0.029254	0.029950	-0.976758	0.3287
Expenditure on Kerosin oil (V502B2_V)	0.046498	0.114687	0.405433	0.6852
HH electrification status (HES)	48.82440	20.18903	2.418362	0.0156
Village electrification status (Vill_ES)	-3.283648	21.20719	-0.154837	0.8770
C	-236.8831	34.18885	-6.928665	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.7: Estimation Results of censored Tobit

Dependent Variable: Total time (in minute)in socio-cultural after 6.00pm (HH_SS234) Spouse (Female)

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	0.022211	0.101865	0.218044	0.8274
HH size(Mem_tot)	2.148263	0.822962	2.610405	0.0090
HH member involved in IGA (IGA_mem)	1.979919	1.605521	1.233194	0.2175
Adult literacy rate (A15_mem)	0.183690	0.045722	4.017510	0.0001
Valuation of capital assets (PPR_Cost)	5.35E-06	1.50E-06	3.555675	0.0004
HH net income (INC_Net)	1.45E-05	7.86E-06	1.840556	0.0657
Expenditure on Bio-mass fuel (V502_B1)	-0.006905	0.005769	-1.196787	0.2314
Expenditure on Kerosin oil (V502B2_V)	0.022707	0.025776	0.880937	0.3784
HH electrification status (HES)	26.06124	4.308108	6.049348	0.0000
Village electrification status (Vill_ES)	6.926879	4.442388	1.559269	0.1189
C	50.42422	6.368967	7.917174	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.8: Estimation Results of censored Tobit

Dependent Variable: Total time (in minute) in household chore activities after 6.00pm (HH_SS5) Spouse (Female)

Regressors	Coefficient	Std. Error	t-Statistic	Prob.
Age of HH head (VII_Age)	-0.013009	0.115592	-0.112543	0.9104
HH size(Mem_tot)	0.325287	0.934678	0.348020	0.7279
HH member involved in IGA (IGA_mem)	-1.034261	1.821321	-0.567863	0.5702
Adult literacy rate (A15_mem)	0.116223	0.051923	2.238386	0.0253
Valuation of capital assets (PPR_Cost)	-5.04E-06	1.71E-06	-2.940358	0.0033
HH net income (INC_Net)	2.68E-07	8.98E-06	0.029859	0.9762
Expenditure on Bio-mass fuel (V502_B1)	0.012886	0.006551	1.967180	0.0493
Expenditure on Kerosin oil (V502B2_V)	0.037621	0.029411	1.279138	0.2010
HH electrification status (HES)	6.755887	4.890839	1.381335	0.1673
Village electrification status (Vill_ES)	-0.462390	5.038718	-0.091767	0.9269
C	74.47295	7.225595	10.30683	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.9: Estimation Results of censored Tobit

Dependent Variable: Total time (in minute) after 6.00pm spent for human capital formation (M9C3_T) senior most male student

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.328819	0.288252	-1.140733	0.2540
HH size(Mem_tot)	29.33250	2.322504	12.62969	0.0000
HH member involved in IGA (IGA_mem)	-31.67251	4.473335	-7.080291	0.0000
Adult literacy rate (A15_mem)	0.675247	0.128995	5.234659	0.0000
Valuation of capital assets (PPR_Cost)	6.91E-06	4.09E-06	1.689773	0.0911
HH net income (INC_Net)	-2.61E-05	2.34E-05	-1.114706	0.2650
Expenditure on Bio-mass fuel (V502_B1)	0.042975	0.015540	2.765489	0.0057
Expenditure on Kerosin oil (V502B2_V)	-0.059245	0.073095	-0.810523	0.4176
HH electrification status (HES)	61.35914	12.28482	4.994714	0.0000
Village electrification status (Vill_ES)	-23.15370	12.76341	-1.814069	0.0697
C	-114.6027	18.32979	-6.252264	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.10: Estimation Results of censored Tobit

Dependent Variable: Time (in minute) in income generating activities after 6.00pm (HH_MSI) Senior most male student

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.006966	0.024820	-0.280667	0.7790
HH size(Mem_tot)	0.139312	0.200052	0.696379	0.4862
HH member involved in IGA (IGA_mem)	-0.004317	0.390004	-0.011069	0.9912
Adult literacy rate (A15_mem)	-0.001760	0.011156	-0.157736	0.8747
Valuation of capital assets (PPR_Cost)	1.57E-08	3.70E-07	0.042366	0.9662
HH net income (INC_Net)	-2.39E-06	2.35E-06	-1.018426	0.3085
Expenditure on Bio-mass fuel (V502_B1)	-0.000819	0.001415	-0.579023	0.5626
Expenditure on Kerosin oil (V502B2_V)	0.001811	0.006265	0.288981	0.7726
HH electrification status (HES)	1.026297	1.053576	0.974108	0.3300
Village electrification status (Vill_ES)	0.237668	1.089218	0.218201	0.8273
C	0.251831	1.593451	0.158041	0.8744

[Note: Parentheses indicate the name of the variables/fields]

Table 9.11: Estimation Results of censored Tobit
Dependent Variable: Time (in minute) in socio-cultural activities after 6.00pm (HH_MS234)
Senior most male student

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.220460	0.255032	-0.864440	0.3873
HH size(Mem_tot)	25.72493	2.054230	12.52290	0.0000
HH member involved in IGA (IGA_mem)	-28.14224	3.957445	-7.111215	0.0000
Adult literacy rate (A15_mem)	0.649533	0.114234	5.685971	0.0000
Valuation of capital assets (PPR_Cost)	5.99E-06	3.61E-06	1.656351	0.0977
HH net income (INC_Net)	-2.01E-05	2.05E-05	-0.981368	0.3264
Expenditure on Bio-mass fuel (V502_B1)	0.037402	0.013740	2.722167	0.0065
Expenditure on Kerosin oil (V502B2_V)	-0.049510	0.064625	-0.766109	0.4436
HH electrification status (HES)	56.79947	10.87600	5.222461	0.0000
Village electrification status (Vill_ES)	-20.84338	11.30730	-1.843356	0.0653
C	-111.0109	16.23925	-6.835964	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.12: Estimation Results of censored Tobit
Dependent Variable: Time (in minute) after 6.00pm (HH_MS5)
Senior most female student

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.113384	0.046153	-2.456685	0.0140
HH size(Mem_tot)	4.217870	0.371041	11.36767	0.0000
HH member involved in IGA (IGA_mem)	-4.361859	0.714047	-6.108647	0.0000
Adult literacy rate (A15_mem)	0.042258	0.020516	2.059763	0.0394
Valuation of capital assets (PPR_Cost)	5.43E-07	6.59E-07	0.824651	0.4096
HH net income (INC_Net)	-5.58E-06	4.06E-06	-1.376847	0.1686
Expenditure on Bio-mass fuel (V502_B1)	0.007558	0.002473	3.056569	0.0022
Expenditure on Kerosin oil (V502B2_V)	-0.015172	0.011771	-1.288916	0.1974
HH electrification status (HES)	3.816097	1.951313	1.955656	0.0505
Village electrification status (Vill_ES)	-2.942242	2.018684	-1.457505	0.1450
C	-11.15128	2.910840	-3.830950	0.0001

[Note: Parentheses indicate the name of the variables/fields]

Table 9.13: Estimation Results of censored Tobit
Dependent Variable: Time (in minute) after 6.00pm spent for human capital formation (F9C3_T)
senior most female student

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.541295	0.309088	-1.751264	0.0799
HH size(Mem_tot)	34.50044	2.518272	13.70005	0.0000
HH member involved in IGA (IGA_mem)	-40.48017	4.813931	-8.408964	0.0000
Adult literacy rate (A15_mem)	0.605881	0.138881	4.362602	0.0000
Valuation of capital assets (PPR_Cost)	1.27E-06	4.41E-06	0.287816	0.7735
HH net income (INC_Net)	1.96E-05	2.17E-05	0.902367	0.3669
Expenditure on Bio-mass fuel (V502_B1)	-0.013381	0.017159	-0.779865	0.4355
Expenditure on Kerosin oil (V502B2_V)	0.049639	0.074724	0.664300	0.5065
HH electrification status (HES)	26.67595	13.01662	2.049377	0.0404
Village electrification status (Vill_ES)	0.222483	13.50831	0.016470	0.9869
C	-129.6422	19.75941	-6.561037	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.14: Estimation Results of censored Tobit
Dependent Variable: Time (in minute) in income generating activities after 6.00pm (HH_FS1)
Senior most female student

Regressors	Coefficient	Std. Error	t-Statistic	Prob.
Age of HH head (VII_Age)	-0.014235	0.011086	-1.284101	0.1992
HH size(Mem_tot)	0.243101	0.089637	2.712048	0.0067
HH member involved in IGA (IGA_mem)	-0.510548	0.174668	-2.922960	0.0035
Adult literacy rate (A15_mem)	0.002969	0.004979	0.596181	0.5511
Valuation of capital assets (PPR_Cost)	5.37E-08	1.64E-07	0.326682	0.7439
HH net income (INC_Net)	-9.16E-07	8.61E-07	-1.063168	0.2878
Expenditure on Bio-mass fuel (V502_B1)	-0.001329	0.000628	-2.115143	0.0345
Expenditure on Kerosin oil (V502B2_V)	-0.000654	0.002821	-0.231810	0.8167
HH electrification status (HES)	0.328927	0.469041	0.701276	0.4832
Village electrification status (Vill_ES)	-0.064618	0.483223	-0.133722	0.8936
C	1.336113	0.692948	1.928157	0.0539

[Note: Parentheses indicate the name of the variables/fields]

Table 9.15: Estimation Results of censored Tobit
Dependent Variable: Time (in minute) in socio-cultural activities after 6.00pm (HH_FS234)
Senior most female student

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.474779	0.266578	-1.781016	0.0749
HH size(Mem_tot)	29.08669	2.170340	13.40190	0.0000
HH member involved in IGA (IGA_mem)	-33.40800	4.147685	-8.054615	0.0000
Adult literacy rate (A15_mem)	0.536027	0.119822	4.473547	0.0000
Valuation of capital assets (PPR_Cost)	1.56E-06	3.80E-06	0.410738	0.6813
HH net income (INC_Net)	2.03E-05	1.87E-05	1.089334	0.2760
Expenditure on Bio-mass fuel (V502_B1)	-0.012897	0.014801	-0.871389	0.3835
Expenditure on Kerosin oil (V502B2_V)	0.049495	0.064394	0.768623	0.4421
HH electrification status (HES)	28.60586	11.23412	2.546338	0.0109
Village electrification status (Vill_ES)	0.667198	11.67033	0.057170	0.9544
C	-118.2625	17.05598	-6.933785	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.16: Estimation Results of censored Tobit
Dependent Variable: Time (in minute) in household chore activities after 6.00pm (HH_FS5)
Senior most female student

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	-0.060497	0.060499	-0.999977	0.3173
HH size(Mem_tot)	6.126922	0.493027	12.42715	0.0000
HH member involved in IGA (IGA_mem)	-7.559313	0.943454	-8.012381	0.0000
Adult literacy rate (A15_mem)	0.075307	0.027191	2.769608	0.0056
Valuation of capital assets (PPR_Cost)	-3.11E-07	8.68E-07	-0.358039	0.7203
HH net income (INC_Net)	9.25E-07	4.21E-06	0.219631	0.8262
Expenditure on Bio-mass fuel (V502_B1)	0.001031	0.003335	0.309287	0.7571
Expenditure on Kerosin oil (V502B2_V)	0.004674	0.014587	0.320386	0.7487
HH electrification status (HES)	-2.151052	2.542871	-0.845915	0.3976
Village electrification status (Vill_ES)	-0.414519	2.624786	-0.157925	0.8745
C	-23.31194	3.860813	-6.038091	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.17: Estimation Results of censored Tobit Model for expenditure on kerosene

Dependent Variable: Household Expenditure on Kerosene oil (V502B2_V)

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	0.105303	0.105808	0.995224	0.3196
HH size(Mem_tot)	3.897877	0.848200	4.595471	0.0000
HH member involved in IGA (IGA_mem)	-2.001583	1.663414	-1.203298	0.2289
Adult literacy rate (A15_mem)	0.111967	0.047377	2.363325	0.0181
Valuation of capital assets (PPR_Cost)	1.62E-06	1.58E-06	1.024994	0.3054
HH net income (INC_Net)	-4.72E-06	8.21E-06	-0.575542	0.5649
Expenditure on Bio-mass fuel (V502_B1)	0.027747	0.005955	4.659591	0.0000
HH electrification status (HES)	-44.66270	4.300657	-10.38509	0.0000
Village electrification status (Vill_ES)	-3.175973	4.587208	-0.692354	0.4887
C	30.21023	6.561974	4.603832	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.18: Estimation Results of censored Tobit Model for expenditure on Education

Dependent Variable: Household Expenditure on Education (HH_ETN)

Regressors	Coefficient	Std. Error	z-Statistic	Prob.
Age of HH head (VII_Age)	4.830369	8.254351	0.585191	0.5584
HH size(Mem_tot)	902.7064	66.87872	13.49766	0.0000
HH member involved in IGA (IGA_mem)	-1092.849	127.8095	-8.550606	0.0000
Adult literacy rate (A15_mem)	31.66895	3.716927	8.520197	0.0000
Valuation of capital assets (PPR_Cost)	0.000801	0.000118	6.808954	0.0000
HH net income (INC_Net)	0.001088	0.000603	1.804068	0.0712
Expenditure on Bio-mass fuel (V502_B1)	0.191540	0.454541	0.421392	0.6735
Expenditure on Kerosin oil (V502B2_V)	3.195651	2.013264	1.587299	0.1124
HH electrification status (HES)	1204.063	349.0035	3.450004	0.0006
Village electrification status (Vill_ES)	-380.9169	362.1400	-1.051850	0.2929
C	-5377.941	520.6639	-10.32901	0.0000

[Note: Parentheses indicate the name of the variables/fields]

Table 9.19: Estimation Results of censored Tobit Model for Health Care Expenditure

Dependent Variable: Household Health care Expenditure (HH_HCAR)

Regressors	Coefficient	Std. Error	t-Statistic	Prob.
Age of HH head (VII_Age)	46.71725	14.39803	3.244698	0.0012
HH size(Mem_tot)	322.1872	116.4224	2.767400	0.0057
HH member involved in IGA (IGA_mem)	-346.2019	226.8616	-1.526049	0.1271
Adult literacy rate (A15_mem)	17.78723	6.467431	2.750277	0.0060
Valuation of capital assets (PPR_Cost)	0.000520	0.000214	2.434793	0.0150
HH net income (INC_Net)	0.000776	0.001118	0.694245	0.4876
Expenditure on Bio-mass fuel (V502_B1)	1.299807	0.815953	1.592993	0.1113
Expenditure on Kerosin oil (V502B2_V)	4.811711	3.663412	1.313450	0.1892
HH electrification status (HES)	353.6583	609.1970	0.580532	0.5616
Village electrification status (Vill_ES)	282.6492	627.6166	0.450353	0.6525
C	-2525.949	900.0113	-2.806574	0.0050

[Note: Parentheses indicate the name of the variables/fields]

ANNEX-D

SOME ENVIRONMENTAL ASPECTS OF RURAL ELECTRIFICATION PROGRAM

Annex-D

SOME ENVIRONMENTAL ASPECTS OF RURAL ELECTRIFICATION PROGRAM

Introduction

The functioning of a modern economy and contemporary society is dependent on the availability of electricity and the reliability of supply. Rural Electrification Program in Bangladesh are mainly focused on providing income generation activities leading to improved security of living. However, prudent use of natural resources, and development, which safeguards the quality of country's environment and wildlife, is at the heart of sustainable development goal of the government. Electricity generation is traditionally associated with burning fossil fuels. This gives rise to the emission of greenhouse gases (notably carbon dioxide) and acidifying gases (Sulphur dioxide and Nitrogen oxides) which contribute to public health problems and environmental degradation. REB activities however are limited to the transmission and distribution of electricity and to some extent construction of substations.

The environmental appraisal in this project intends to assess the overall impacts of the project activities both direct and indirect on the environment, trends of environmental changes and identify potentially important environmental issues that require compliance to the national legislation. Since human and social component of the environment is dealt separately under this project, environment here will deal on the impact of REB activities on the natural physicochemical and biological environment only.

Direct Impact

The main scope of the REB project works is the construction of medium and low voltage distribution lines and establishment of substations. The sitting of the transmission and distribution lines requires land occupation for tower construction (both agriculture and homesteads), loping or cutting of trees, use of hazardous chemicals in equipment and poles used for distribution cables. Poles and towers are usually erected on roadsides when serving a village and along roads and across fields (including paddy fields) when transporting power along the medium voltage (11 kV') lines from substations. Minor and temporary land disturbances occur arising out of laying of new distribution lines and only in cases where such lines do not follow existing way-leave along roads, streams, etc. The works will also involve some clearance of vegetation along the right of the way (ROW). In some instances trees will have to be cut and in others branches will need removal.

The right to construct such works on public and private property is provided in the Electricity Act of 1910 and the Rural Electrification Board Ordinance of 1977. Both enactments require compensation to be made to affected persons for damages incurred during the execution of the works. Being located in the tropical deltaic landscape the damaged trees or lopped branches are quickly regenerated. There has been no significant damage to the natural vegetation and disturbance to wildlife habitat due to the construction of transmission line and towers.

There have been widespread concerns expressed about possible health effects near equipment emitting electromagnetic fields (EMF) given off by power lines and other electrical and electronic equipment. Researchers are divided on the definitive interpretation of their results whether the EMF given off by power lines and other electrical equipment affect health. However, some have shown that electromagnetic fields might, for example, contribute to cancer and cardiac problems.

International guidelines and national safety standards for EMF are set on the basis of the current scientific knowledge in order to ensure that the fields of intervention are not harmful to health. At present they are based on prevention of acute effects. Guideline limits incorporate a large safety margin and therefore do not represent a precise delineation between safety and hazard. Thus, even exposures above the guideline limits are not necessarily harmful to health. Normal exposure levels are generally much lower than the guideline limits. However, science cannot, in principle, prove absolute safety as any risk assessment will be associated with some degree of uncertainty. Accordingly, further development of guidelines is a continuous process as our knowledge about health effects of EMF is advanced.

Uses of preservatives (CCA) in the wooden electric poles were earlier wrongly attributed to be the source of arsenic contamination in the ground water in Bangladesh. Recent studies (NRECA,1997) proved that arsenic content in the ground water near the REB poles are not increased than the other areas of the same locality. The scientists are also in agreement that the sources of arsenic contamination are geological with mobilization of arsenic contamination due some geo-chemical process.

Polychlorinated biphenyls (PCBs) are sometimes used in transformers. PCB products range in consistency from thin, light-colored oils to yellow, viscous resins. The use and servicing of equipment containing PCBs are regulated in different countries of the world, depending upon the concentration of PCBs present. The U.S. Environmental Protection Agency (EPA), under the Toxic Substances Control Act (TSCA), regulates the use, storage and disposal of PCBs with concentrations of 50 parts per million (ppm) or more. Use of PCB dielectrict fluid and location of the transformers, power pole storage areas and repair facilities using PCB or any other hazardous chemicals are highly restricted and required to be the subject to regular inspection. Construction of sub-stations also requires occupation of lands. These activities are undertaken mostly on government or community donated lands.

Indirect Impacts

Induced development out of the electricity supply to the rural and urban areas has profound positive benefit in the local economy and also like all other development activities it has some inherent environmental problems. The indirect effects are due to induced development such as loss of natural wild lands and wetlands due to land use change, increased pollution load in the soil and water due to increased use of agrochemicals, lowering of ground water table due to increased abstraction of ground water for irrigation, increased pollution load in air, water and soil due to industrialization and accelerated urbanization, increased demand for natural ecosystem products such as timber for improved housing, fish and other agriculture products due to increased population.

Framework Conditions for Environmental Safeguard

Policy and Legislations:

It is important that the environmental impacts of all forms of Electrification are minimised, through the use of mitigating technologies and regulatory safeguards, so that the quality of environmental health and precious natural features is maintained and enhanced. In tackling environmental problems of the country, various environmental legislations have been made time to time in Bangladesh. Here, like in some other countries environmental issues are handled by different sectoral legislations. Policies, strategies adopted on environment conservation and on sectoral issues – all have given conservation, protection and preservation of the environment a paramount importance.

- The Fourth Five Year Plan (1990-1995) explicitly articulated the need for integrating environmental considerations into economic development planning and the plan period witnessed the following major developments.
- Commitments made by the GOB in signing and ratifying various international conventions;
- Emergence of non-government organizations (NGOs) and expert groups that have become active in the environmental forum;
- Adoption of the Environment Policy in 1992 and enhancement of the Environment Protection Act. 1995. and enactment of Environment Conservation Rules 1997.
- Establishment of Environmental Courts in Divisional Head quarters.

As such all future project must comply with all the relevant national legislations in general and in particular to the Environment Conservation Act '95 and Environment Conservation Rules '97. At present there are one set of formal EIA guidelines (for industries) in Bangladesh. However, for most proponents planning an industrial project it is currently mandatory under section 12 of the Environmental Protection Act, 1995 and the subsequent environment conservation rules 1997, to obtain an “environmental clearance letter” from the Department of Environment. At present there are environmental standards in operation in Bangladesh also Promulgated under the Environment Conservation Rules 1997.

There are standards prescribed for varying water sources, ambient air, noise, odor, industrial effluent and emission discharges, vehicular emission etc. No industry is given electricity connection without obtaining environmental clearance from the Department of Environment that provide legal safeguard in protecting the environment. However, adequate protection of environment will depend on the strict adherence to these rules by the DOE and REB. Working with Schedule 9 of the Electricity Act 1989, to develop **standards of best practice** which will reduce the impact of constructing, operating and decommissioning generating plant, and of installing transmission lines, on wildlife and natural features.

Besides there are a number of framework legislation with rule making powers that safeguards the protection of forest, fisheries and other bio-diversity resources. These are:

Bangladesh Wildlife (Preservation) Act 1973-This law provides for the preservation, conservation and management of wildlife in Bangladesh.

The Bangladesh Forest Act 1927- The government may stop any public or private way or watercourse in the interest of preservation of the forest. The relevant section of the Acts prohibited in such forests - (1) Any person who, in a reserved forest - fells, girdles, lops, taps or burns any tree or strips off the bark or leaves from, or otherwise damages, the same is liable to be punished under this Act.

The Protection and Conservation of Fish Act 1950. The Protection and Conservation of Fish Rules 1985. The East-Bengal Protection and Fish Conservation Act, 1950 as amended by the Protection and Conservation of Fish (Amendment) Ordinance, 1982 and the Protection and Conservation of Fish (Amendment) Act, 1995 provides provisions for the protection and conservation of fish in inland waters of Bangladesh.

Proposed Institutional Arrangements for the EA Process in the REB

According to the existing legal mandate the onus of addressing the Environmental Impact Assessment and compliance to the environmental standards lie with the REB. The REB is in the process of strengthening the institutional capacity of the REB. According to the plan, the actual preparation of the EA will be undertaken initially by a national consultant who will be assisted by PBS staff, until such time that the PBSs will develop adequate capacity to undertake the E-A themselves. Training would be provided for PBS staff to strengthen their capacity in this regard. The Environmental and Social Assessment Framework will be used by the PBSs as the basis for preparation of the EAs and will be submitted to REB for review and approval.

The REB has recently entrusted the Timber Products Division to simultaneously look after the Environmental Compliance Cell, under the supervision of the REB has recently established an Environmental Compliance Cell, headed by the Chief Engineer (Planning) and consisting of two officials with post graduate degrees in Natural Resources. Capacity building of the Environmental Compliance Cell will be provided under the proposed project in the form of a national consultant for a limited period and training in environmental impact assessment and monitoring for the permanent staff of the Cell. REB's Environmental Compliance Cell will review the EAs submitted by the PBSs to ensure that the EAs conform to the agreed Environmental and Social Framework as well as to the technical quality of the assessment. The Chairman of REB has identified a Board Member who will be finally responsible to signing off on the adequacy of the EA, which will then be submitted to DER as required under the Environmental Conservation Act of 1995.

ANNEX-E

TERMS OF REFERENCE (TOR)

Annex-E

Terms of Reference (ToR)

Consulting Services for the Design and Implementation on an Economic and Social Impact Evaluation Study of the Rural Electrification program

A. Introduction and Scope

The Rural Electrification Program in Bangladesh began in 1978. The program is based on the concept of member-owned, Palli Bidyut Samities (PBSs) similar to the rural electric cooperatives that exist in the United States. The PBSs are organized under the Rural Electrification Board (REB) which is under the Power Division of the Ministry of Energy and Mineral Resources, the People's Republic of Bangladesh. The National Rural Electrification Cooperative Association (NRECA) has been providing technical assistance to the REB since the beginning of the program.

Currently 67 PBSs have been organized (with 61 under commercial operation). Several donors have participated in the rural electrification program including: Canada Finland, Japan, Kuwait, Saudi Arabia, the United States, Netherlands, Norway, the Asian Development Bank, Islamic Development Bank and the World Bank.

The Rural Electrification Program has experienced rapid growth since its inception in 1978. Consistent with such growth is the creation of areas that should be reviewed for applicability in the present environment of the Bangladesh RE Program. One of the areas is socio-economic impact evaluation of the Rural Electric Program, as this is of significant interest to many door agencies and the GoB.

The Rural Power for Poverty Reduction (RPPR) Program, which is the current technical assistance being funded by USID through NRECA includes an activity related to the development of a system for measuring socio-economic impact of electricity to rural areas. While this system is currently under development, it has been determined that a new impact assessment study should be completed, as the mot recent one was published in February 1996.

B. Objectives of Consulting Services Subcontract

These objectives will outline the targeted areas of interest of REB and its RPPR partners to be provided under a consulting subcontract, The objectives for the TOR are as follows:

1. The subcontractor (SC) will reconfirm the intended objectives and identify important unintended or broader impacts of the Rural Electric Program in Bangladesh concluding with consensus by the major shareholders.[1>] In order to finalize consensus the SC will review project documents, conduct interviews with REB, local representatives of NRECA, and USAID, (Dhaka) in order to reconfirm the objectives of the Rural Electric Program in Bangladesh. A written document containing a joint and acceptable purpose of the Rural Electric Program will be presented to the mentioned organizations in order to set the basis for determining this Economic and Social Impact Study of the Rural Electrification Program in Bangladesh.

   <u>Schedule of Activities</u> This objective is to be completed by the and of the second (2nd) week. Ten (10) copies of the written report will be provided.

2. Based on the conclusions and consensus in objective number one, the SC will define indicators of impact and identify testable hypotheses linking RE and project interventions to the explicit and implicit goals established. The results will quantify the goals and specify how they will be measured. Each goal will have a narrative summary, measurable indicators, means of verification, and

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[1>] The objectives of REP (in ToR objective B.1) was termed as “intended” and “unintended”. Later on, a meeting was held between the Core-team and NRECA (on 31st March 2002) to review the draft Report 1. After much brainstorming about the essence/contents of the two categories, namely “intended” and “unintended” objectives, it was resolved that from now on, the “intended” objective will be termed synonymously as “direct” objective; and the term “unintended” objective will be replaced by “indirect” objective or broader impacts.

important assumptions. A joint meeting between RPPR Program partners (REB,USID and NRECA/IL) will be convened in order to obtain consensus on the goals and associated information.

3. The SC is responsible to recommend the optimum representation of the "universe" based on a statistical sampling that can validate the study findings on the economic and social impact of the Rural Electrification Program in Bangladesh.

Schedule of Activities Objectives 2 and 3 are to be completed by the end of the sixth (16th) week. Ten (10) copies of the written report will be provided.

4. The SC is responsible for complete of the following with necessary input from the RPPR Program partners:

- Design appropriate methodology
- Prepare required data collection tools (questionnaires, etc.)
- Develop system for data collection including training of enumerators, etc.
- Conduct field work for data collection
- Prepare software for developing database and for data analysis
- Build database from fieldwork
- Analyze data in light of defined intent of study

Schedule of Activities Objective is to be completed by the end of the fifteenth (15th) week. Ten (10) copies of the written report to include examples of surveys and associated information will be provided.

5. The SC is responsible for the development of a "draft" Economic and Social Impact Report to be reviewed by RPPR Program partners that will explain the explicit and implicit impact of the Rural Electrification Program in Bangladesh.

Schedule of Activities Objective is to be completed by the end of the eighteenth (18th) week. Ten (10) copies of the "draft" Economic and Social Impact Report will be provided.

6. The SC is responsible to coordinate with concern REB/PBS personnel during the implementation of the study in order to provide through understanding of the overall process used for conducting the study.

Implementation of Subcontract

The contract will be performed over a twenty (20) week period, beginning on the dare established in the contract. Scheduled work to begin not later than November 20, 2001. An eight hour (8) work day and a five (5) day work week is followed. The amount paid under this agreement is for hours actually spent performing duties covered in the contract. The SC shall be directly responsible to NRECA for the completion of the work as well as to the RPPA partners. The SC will receive limited assistance from REB and PBS personnel and NRECA expatriate advisors, but some additional assistance ill be made available from local professional in the NRECA’s socio-economic unit. The SC will be responsible for all in-country travel arrangements. All administrative support, photo copying and computer equipment needed by the SC shall be the responsible of the SC.

Subcontractors Qualifications and Experience Requirements

The SC position requires extensive experience in the development and completion of successful economic and social impact studies. The preferred candidates will have an understanding of the Rural Electrification Program in Bangladesh. The SC will submit examples of work performed on other projects concerning design and implementation of the economic and social impact studies. The SC should be an excellent writer and communicator. All reports shall be written in English. All documentation, report s and computer programs developed are the property of the RPPR projects.

ANNEX-F

STUDY PERSONNEL

CORE TEAM

Team Leader/Project Director

Abul Barkat, Ph.D
Socio-economist, Poverty Analyst, Research Methodologist

Consultants

Sayeedul Haque Khan, *Ph.D.*	Market and Qualitative Analyst
Matiur Rahman, *Ph.D.*	Statistician, Sampling and Modeling Expert
Shafiq uz Zaman*, Ph.D.*	Industrial Economist
Avijit Podder*, Ph.D.*	Agricultural Development and Demographic Analyst
Sadeka Halim*, Ph.D.*	Sociologist, Gender Specialist
Nazmun Nahar Ratna, *MSS, MEcDev.*	Development Economist
Murtaza Majid, *MBBS, Dip in MCH-FP*	Public Health Expert
Ansarul Karim*, Ph.D.*	Agro- Environmental Expert
Shafiqul Islam*, Ph.D.*	Electrical Engineer
AKM Maksud*, MSS*	Local Governance and Field Coordination Specialist
Md. Nazrul Islam*. M.Sc*	Systems Analyst

FIELD SURVEY TEAM

Quantitative Survey Team

Quality Control Officers

1. Mr. A.S.M. Obaidur Rahman	2. Mr. G.B.M. Shaiqul Abedin
3. Mr. Suruzzzman	4. Mr. Mominur Rahman
5. Mr. Enamul Haque	6. Mr. Faizul Haque
7. Mr. Noor Mohammad	8. Mr. Nasir Uddin
9. Mr. Abdus Samad	10. Mr. Abdul Hamid
11Mr. Niaz Morshed Khan	12. Mr. Hafizur Rahman

Field Supervisors

1. Mr. Abdul Karim	2. Mr. Khalilur Rahman
3. Mr. Forhad Hossain	4. Mr. Faruk Uddin
5. Mr. Harunur Rashid	6. Mr. Abdul Quayyum
7. Mr. A.T.M. Al Fattha	8. Mr. Ferdous Alam Ripon
9. Mr. Aslam	10. Mr. Feroz Ifteakhar
11. Mr. Niaz Morshed Khan	12. Mr. Nasir Uddin
13 Mr. Mozahed Uddin	14. Mr. Mrinal Kranti Halder
15. Mr. Kazi Azharul Islam	16. Mr. Tipu Sultan
17 Mr. S.M. Mozzammel Haque	18 Mr. Muslem Uddin
19 Mr. Khabiruzzaman	20 Mr. Abdus Sabur
21 Mr. A.S.M. Hasinnor Rahman	22 Mr. Mizanur Rahman
23 Mr. Abdul Wahed	

Field Enumerators

1. Mr. Moklesur Rahman	2. Ms. Arifa Jahan
3. Mrs. Ringku Mistry	4. Ms. Ayesha Sultana
5. Mr. Masudur Rahman	6. Ms. Minati Rani Bala
7. Ms. Shilpi Akhter	8. Mr. Fuad Hossain
9. Mrs. Kamrun Nahar Sheikh	10. Mr. Baharuddin
11.Mr. Hafizur Rahman	12. Mr. Hafizur Rahman
13. Ms. Afroza Jahan	14. Ms. Farzana Parvin
15. Ms. Rokeya Akhter	16. Mrs. Rubina Parveen
17. Ms. Tarana Zaman	18. Ms. Jesmin Ara Parvin
19. Ms. Afroza Ahkter Mona	20. Mrs. Shirina Khatun
21. Ms. Jerin Sultana	22. Ms. Nilufa Khatun
23. Mr. Omar Faruk Prodhan	24. Ms. Ratna Sharmin Jhara
25. Ms. Anisa Jahan	26. Ms. Kaniz Farhana
27. Mr. Salam Uddin	28. Mr. Sirajul Islam (1)
29. Mr. Abdullah Al Mamun	30. Ms. Sanchita Barua
31. Mr. Farhadul Alam	32. Ms. Tarana Zaman
33. Mr. Nazrul Islam	34. Mr. Premanunda Sarker
35. Ms. Shahana Tasnim	36. Mr. Obaidur Rahman
37. Ms. Humayra Taslim	38. Mr. Ajoy Kumar Saha
39. Ms. Tauhida Akhter	40. Ms. Luna Naznin
41. Mr. Kamruzzaman Khan	42. Mr. Serajul Islam (2)
43. Ms. Papia Sultana	44. Ms. Rozina
45. Ms. Umme Salma Akhter	46. Mrs. Asmat Ara Asma
47. Mr. Asad Chowdhury	48. Mr. S'ad Abdul Wasea
49. Ms. Masuda Bhuiyan	50. Ms. Taherunnahar
51. Mr. Latif Khan	52. Mr. Elias Hossain Sarker
53. Mr. Moniruzzaman Khan	54. Mr. Shafiqul Islam
55. Mrs. Shammi Akhter	56. Ms. Bilkis Akhter
57. Ms. Fahmida Sharmin	

QUALATITAIVE SURVEY (FGD/GD) TEAM

FGD Facilitators

1. Abul Barkat	2. Sayeedul Haque Khan
3 Mati ur Rahman	4. Sadeka Halim
5. Shafiq uz Zaman	6. Avijit Poddar
7. Nazmun Nahar Ratna	8. Murtaza Majid
9. AKM Maksud	10. Ansarul Karim
11. Shafiqul Islam	12. Ms.Aloha Begum
13. Ms. Hasina Banu	14. Ms. Ms. Noor Absa
15. Ms. Hasina Begum	16. Mr. Mahbubul Islam
17. Mr. Shahanewaz	18. Mr. Forhad Ali
19. Mr. Shahajan Mia	20. Mr.Matiur Rahman
21. Mr.Jahangir Alam	

FGD Organizer-cum-Note-takers

1. Mr. Rezaur Rahman Khan	2. Ms. Nurun Nahar
3 Mr. Firoj Kabir	4. Ms.Hasna Hena
5. Ms. Kabita Talukder	6. Ms. Nurun Nahar
7. Mr. A.Z.H. Abu Zafar	8. Ms. Dil Afroz
9. Mr. Amitesh Roy	10. Mr. Nurul Islam
11. Ms. Momtaz Begum	

Data Recorder-cum-transcribers

1. Ms. Ringku Mistry	2. Ms. Ratna Sharmin Jhara
3 Mr. Masudur Rahman	4. Ms. Jerin Sultana
5. Ms. Masud Karim	6 Ms. Afroza Akhter Mona

Data Processing Staff

1. Mr. Nazrul Islam, Systems Analysts/Programmer
2. Mr. Saiful Alam, Computer Programmer

Registration Assistants

1. Mr. Shakawat Hossain	2. Mr. Abul Kalam

Coders and Code-Verifiers

1 Mr. Forhad Hossain	2 Ms. Anisa Jahan
3 Mr. Ferdous Alam Ripon	4 Mr. Premananda Sarker
5. Ms. Humayra Taslim	6 Ms. Asmat Ara Asma
7 Ms. Masuda Bhuiyan	8 Mr. Abdul Wahed
9. Mr. Atoqur Rahman	10. Mr. Masud Karim
12. Mr. Zahangir Alam	13. Mr. Abdus Sabur Khan
14. Mr. Asad Chowdhury	15. Mr. Aslam Uddin

Editors and Edit- Verifiers

1 Mr. Enamul Haque	2 Mr. G.B.M Shaiqul Abedin
3. Mr. Mominur Rahman	4 .Ms Farzana Parvinm Kanok
5. Ms. Tauhida Akhter	6 Ms. Umme Salma Akhter
7. Ms. Ringku Mistry	8. Mr. Abdul Quayyum
9. Mr. Faizul Haque	10. Mr. Bahar Uddin
11. Mr. Rabindra Nath Chowdhury	12. Tarana Zaman

Data Entry Operators

1. Mr. Munir Uddin	2. Mr. Rezaul Kabir
3. Mr. Didar Uddin	4. Mr. Aminur Rahman

Administrative Support Staff

1. Mr. Sabed Ali, Administrative Assistant
2. Mr. Abu Taleb, Accountant
3. Mr. Mozammel Haque, Computer Operator
4. Mrs. Mahmuda Rahman, Secretary

ANNEX-E

TERMS OF REFERENCE (TOR)

ANNEX-F

STUDY PERSONNEL