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SOUTHERN SUDAN RURAL ELECTRIFICATION PROJECT (SSREP) EVALUATION

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Finally, we certainly wish to recognise the kind efforts and responsiveness of NRECA's other key staff, including Dan Waddle and Francis Mills IV whom we have "met" only by email. Their prompt and frequent assistance in responding to questions and providing documents was essential to our work.

We have assembled this report relying on input from all of these people. We recognise that in a large, complex project such as the Southern Sudan Rural Electrification Project (SSREP), it is difficult to get a full and completely accurate picture of every historical event and each bit of analytical data. Any mistakes of interpretation of the data provided are those of the authors. Despite the possibilities of small misinterpretations (particularly possible given the brief timetable for producing this report), we are however confident that our conclusions and recommendations remain robust.

EXECUTIVE SUMMARY

Electric service in Southern Sudan exists in few communities, and where it does exist, it is extremely limited. The Southern Sudan Rural Electrification Program (SSREP) implemented by the National Rural Electric Cooperative Association (NRECA) International was designed to bring affordable and sustainable electric power to cities and towns of southern Sudan by demonstrating the possibilities of establishing an efficient, effective and sustainable electrification system through a pilot project in Yei. A concomitant objective of the work in Yei was to bring increased security and public safety to the town through rapid implementation of a system of public street lighting.

Under the SSREP project, NRECA was to play multiple roles in Southern Sudan's electric sector. With respect to the design and construction of the electric power system in Yei, NRECA was to act as the program management agency responsible for the design, procurement, and operation of the electric generation and distribution system, albeit for a pre-defined period of no more than three years. In addition to the work in Yei, NRECA was also to provide technical assistance activities in Juba. In this area of work, NRECA was to provide management and technical assistance with the goal of assisting in improving the operational and managerial capacities of the utility management and staff, as the Juba electric utility makes the transition from National Electricity Corporation ownership and operation to more direct GOSS management and operation.

With respect to the overall GOSS electrification program, NRECA was tasked with providing more general technical assistance to the GOSS initially through completion of feasibility studies, and by providing periodic input with regard to engineering and construction standards, as well as materials and operational guidelines. According to the Cooperative Agreement, SSREP had four program components. [1]

Component 1: Design, construction and mobilization including: official registration and community coordination; demographic surveys and tariff analysis; design, procurement and construction of the distribution system; and preparation of land and buildings for the new utility.

Component 2: Expansion of the distribution system in Yei to connect high priority consumers; new powerhouse site preparation and construction; NRECA compound preparation and construction; and develop Feasibility Studies for GOSS state capitals.

Component 3: Expansion of residential service system operation including: hiring and training of operations staff; beginning commercial service; expansion of service connections; and evaluate power generation and utility management of Juba electric utility.

Component 4: Capacity building and institutional strengthening including: design of effective utility management in Yei, Juba and other utilities; identify specific regional capacity building courses and training programs for Sudanese utility personnel; develop long-term strategic options for electrification in Southern Sudan; and design and implement software applications for improved utility management.

USAID/Sudan implemented SSREP through a Cooperative Agreement with NRECA International in June 2005. As stated in the Cooperative Agreement the goals of the SSREP included:

1. Reduce the cost and increase the quality of electricity services to new utility users

[1] Of NRECA's expenditures of approximately $6.4 million (see Reference 11), $4.9 is estimated (by both NRECA and AID) as having gone to support the Yei effort (Components 1 and 2 in the list). This $4.9 million was supplemented by $0.4 million in support from the NRECA Foundation, making the total commitment to Yei approximately $5.3 million.

2. Increase economic opportunities for local industry, commerce and agriculture

3. Increase the capability of Southern Sudanese to manage and operate an effective small rural electric utility

4. Generate employment opportunities

More specifically, SSREP was expected to achieve the following results:

1. The introduction and provision of street lighting as a measure of public security in Yei town

2. The provision of reliable and affordable electricity that would facilitate operations and expansion of businesses in Yei town

3. Feasibility studies for electrification of several other Southern Sudanese towns

4. The provision of technical support, training, and capacity building for the Juba electric utility and the GOSS electrification program

The SSREP Cooperative Agreement was completed in late March 2008 and NRECA is preparing to handoff the project on May 27, 2008.

Evaluation of the SSREP was conducted from May 10 to May 24, 2008. The Evaluation Team was requested to assess what NRECA has accomplished with regard to the stated objectives of SSREP and to make recommendation and draw lessons learned. Specifically, the evaluation team was asked to answer the following evaluation questions:

1. ***US Objectives****:* Does the project support overall USAID / USG Sudan goals?

2. ***Defined Project Objectives*****:** Did the project itself achieve its stated objectives?

3. ***Gender Issues*****:** What was the project's gender impact?

4. ***Cost and Economic Sustainability*****:** Were the cost levels of the project high or low? Is the cost of power affordable for consumers? Does the tariff reflect full costs and will it lead to a financially sustainable utility?

5. ***Replicability*****:** Is the approach taken in Yei suitable for replication or expansion?

6. ***Alternative Options*****:** Do the feasibility studies (or other documents etc) suggest that alternative options such as solar / hydro etc might be better options in special circumstances?

7. ***Project Value*****:** Was the project Value for Money?

8. *Were there **Other Lessons** to be learned from the project**?***

Note that each of these questions is somewhat further amplified in the body of the report.

The evaluation team's overall conclusion is that the Yei electrification pilot project is not financially/economically sustainable under the current level of tariffs and current (lack of) operating subsidies provided by the Government. As such, it should not be replicated "as is" in other parts of Sudan. The evaluation team's findings, conclusions and recommendations are detailed below.

Findings

- The Yei street lighting was completed on schedule albeit at higher cost than originally expected. The higher cost was due at least in part to the difficulty and expense of obtaining local supplies (e.g., at least some utility poles were in fact ultimately imported from the US)

- NRECA created the Yei Electric Cooperative (YECO) which at the approximate time of the Project completion Report (March, 2008) was providing service to 54% (or 380) of the originally targeted number of customers. Of the commercial customers served approximately 10% are female-owned enterprises, a rate approximately reflective of the actual make-up in Yei.

- NRECA has completed one sector study and seven feasibility studies out of a target of nine studies. However, the feasibility studies were completed too early to fully incorporate lessons learned from the Yei pilot project.

- NRECA has provided technical assistance and training to the Juba utility. However, there was problem with the uptake and "ownership" of the work, i.e., low expression of interest from the Juba utility staff.

- NRECA did not have an explicit gender approach; however, as noted above, a representative sample of female-owned businesses in Yei are being served.

- Analysis of the stated costs upon which NRECA's tariffs (both original and current) are based shows that they understate the actual cost of providing service. In particular, the costs used do not reflect full capital-related charges (i.e., full and appropriate depreciation and / or amortization of capital investment). Overall, current tariffs are below the full economic cost of service, even on a non-profit basis.

- Current tariffs, although higher than forecasted customers' Willingness to Pay (WTP) average rates, are not set sufficiently high enough to recover the full cost of electric generation.

- The overall cost of YECO electric generation is dominated by fuel costs. The cost structure of YECO shows that fuel cost is approximately 72% of total costs. This suggests that tariffs will not "naturally" decrease very much if and as more customers are added to the system. If proper depreciation charges were to be added to YECO's costs, the proportion of fuel costs would decrease, but of course total costs would rise.

- Billing and collection are quite good (despite the fact, noted above, that billings to currently connected customers are above the originally forecasted average willingness to pay rates). However, two major customers – Street Lighting and the Hospital are not paying their bills. YECO has no currently effective alternative mechanism for recovering the cost of serving these customers, apart from increasing the cost to paying customers. This results on an extra burden on paying customers, one that currently disproportionately impacts smaller customers.

- According to interviews, customers are generally pleased with the reliability and availability of the electric service. However, there is unhappiness with the approach of paying for public services such as the hospital or street lighting.

- Most customers also do not understand the Cooperative concept and there are signs that many customers are abusing the system by connecting their neighbors and friends to their lines and thus avoiding connection fees.

Conclusions

- The cash flows of YECO indicate that YECO is not financially viable and sustainable in the long run. As a commercial utility YECO faces challenges under its current conditions. Its tariffs – both as originally set and subsequently revised – are not adequate to provide for long-run sustainability of the utility. There is inadequate cash flow to build any reserves to fund rehabilitation, repair and replacement of existing equipment, and probably also insufficient funds to allow for significant future expansion. These facts create concerns regarding the long run sustainability of the operation and whether it should be replicated "as is" elsewhere.

- While the project is replicable from a technical point of view, it is by any standard a sub-scale operation and is not commercially viable. It is heavily reliant on subsidies and grants.

- The Feasibility Studies indicate that YECO can be replicated from a technical point of view. However, they do not provide options and alternatives for creating financially and economically sustainable electric systems. They make strong (and untested) assumptions regarding the availability and implementation of capital and operating cost subsidies.

- Electrification of Yei has provided a considerable "public good" to the residents. There are indications that street lighting has reduced street crime significantly from incidence of 35 per day to 1 or 2 per day. Hour of business operations has also been extended by four to five hours per day as a result of the street lighting and lighting of commercial establishments. There is also anecdotal evidence that some students are using the street light to read and complete their homework.

- NRECA's technical assistance to the Government of Southern Sudan (GOSS) was successful and continues to be actively built on by the GOSS. Assistance to the Juba utility, on the other hand, was not successful.

Recommendations

- The GOSS's electrification plans and strategies should incorporate costs and experience drawn from the Yei pilot project. The Feasibility Studies completed by NRECA should be updated to reflect lessons learned from YECO.

- The GOSS should also develop a coherent and well-articulated approach to funding future development, including defining whether and how either capital and / or operating cost subsidies will be determined and administered.

- Tariffs should be fully cost reflective, i.e., should include proper depreciation charges related to the investment of creating YECO. These should be included in the tariffs regardless of source of funding for this initial investment. Any capital and / or operating subsidies provided to offset these costs for the benefit of consumers should then be specifically reflected in the interest of transparency and to aid in planning, budgeting and developing utility services.

- USAID should consider whether alternative options to the creation of "YECO-like" utilities might be more efficient and sustainable in the long run to deliver the majority of public benefits resulting from electrification. One alternative, for example, might be to provide public services (e.g., street lighting, service to vital institutions) via only a dedicated "micro-net", leaving provision of more commercial services to be provided separately.

- As the desire for electrification extends to smaller or less dense areas than Yei, a further array of options including, solar, wind and micro-hydro or hybrid systems should be examined.
- YECO itself should be sustained if the original investment is not to be cannibalized. This could be accomplished through either a program of GOSS subsidies or a revision to the tariff levels.
- USAID should continue to support YECO, by authorizing a needs assessment. This may including:
    1. Training for Members of the Board on Utility Governance
    2. Training on revenue protection, particularly to prevent customer abuse of the system
    3. Customer outreach and education
    4. Programs to empower women & youth
    5. Assistance on the legal framework to enable utilities to prosecute abusive customers

Lessons Learned

- It does not seem that NRECA had conducted situation assessment prior to project implementation with respect to scoping the availability and quality of local resources, conditions of local infrastructure and the local cost of doing business. Consequently NRECA found the local material quality substandard and had to import material from the United States at greater cost. This was one cause for cost overruns.
- The “Design & Build While Connecting” approach worked well and facilitated quicker operations and customer uptake than originally planned.

1. INTRODUCTION & BACKGROUND

This report provides an evaluation of the "Southern Sudan Rural Electrification Project (SSREP)" as implemented by NRECA International throughout the period from June 2005 through approximately the end of March, 2008. The report assesses the implementation and outputs of the project within the framework of a set of Evaluation Questions identified collectively among the authors of the Report, colleagues at the USAID/Sudan SUPPORT Project implemented by Management Systems International, and USAID.

The assessment has been made on the basis of interviews, document reviews, and analysis of data provided by NRECA throughout the course of a two-week field work in Juba and Yei. The evaluation was conducted by Tom Sherwood, team leader and Kirby Owen both of whom have long years of experience and expertise in the energy and utility sector. Brief background summaries of these evaluators are provided in Annex 3. The information and analysis has been discussed in draft form with colleagues from MSI and USAID in the course of preparing this evaluation report. A summary presentation of the key findings and initial (draft) conclusions and recommendations was given at the out-briefing with USAID and MSI near the end of the field work. The draft report reflects many of the comments received in that out-briefing session.

1.1 Background

The Southern Sudan Rural Electrification Project began implementation through a Cooperative Agreement with NRECA International (NRECA) in June 2005. NRECA concluded its work in the early second quarter of 2008; this evaluation report focuses on this work.

The original goals of the SSREP included:

1. Reduce the cost and increase the quality of electricity services to new utility users
2. Increase economic opportunities for local industry, commerce and agriculture
3. Increase the capability of Southern Sudanese to manage and operate an effective small rural electric utility
4. Generate employment opportunities

The SSREP objectives were:

1. The introduction and provision of street lighting as a measure of public security in Yei town
2. The provision of reliable and affordable electricity that would facilitate operations and expansion of businesses in Yei town
3. Feasibility studies for electrification of several other Southern Sudanese towns
4. The provision of technical support, training, and capacity building for the Juba electric utility and the GOSS electrification program

These goals and objectives were derived from the broadly prevailing electricity situation throughout Southern Sudan. Electric service in Southern Sudan exists in few communities, and where it does exist, it is extremely limited. The SSREP is designed to support infrastructure development and institutional strengthening in Yei and Juba and, in a more general sense, to facilitate a program of technically-,

financially-, and institutionally-sustainable investments, which can be made in state capitals in Southern Sudan. The two infrastructure support activities in Yei and Juba were indicative of several future investments that will be financed through GOSS budget allocations, in addition to the Multi-Donor Trust Fund that has been established to support public service investments.

USAID awarded a Cooperative Agreement to NRECA International in June 2005 to implement the SSREP. The original Agreement focused on development of a public lighting and electric generation/distribution system in the town of Yei, Southern Sudan. This would be followed by expansion of the distribution system, implementation of a series of feasibility studies to evaluate the electrification requirements of the ten Southern Sudanese state capitals, and capacity building for electric sector institutions in Yei and Juba. The feasibility studies were intended to evaluate the technical, financial and institutional options to facilitate the creation of sustainable electric power generation, transmission and distribution systems, and to identify the obstacles that must be overcome to establish an aggressive and sustainable program of investments. Taken together, the results of these studies were intended to enable USAID, the GOSS, and other donor agencies to devise a cogent and thoughtful plan of action to support investment, administration, and sustenance of these future electric power systems that will be operated in various communities throughout Southern Sudan.

In December 2005, the Agreement was modified to expand the scope of services to provide emergency assistance to the electric utility providing service to Juba. This activity was later modified to include development of a national electric sector policy proposal to the Government of Southern Sudan (GOSS).

During the first few months of Program implementation and during the period when the public lighting project was being implemented in Yei, it became apparent that material, equipment, and shipping costs in East Africa, in general, and Southern Sudan, more specifically, were increasing at alarming rates. Moreover, shortages in global metals markets resulted in higher costs for conductor, transformers, generators, line hardware, and other materials required to build the electric generation/distribution system in Yei. Lastly, rising fuel costs also affected shipping costs for ocean and overland freight. Complications associated with difficulties with communications in East Africa also had the effect of increasing overall project management costs.

The result of these upward pressures on project costs was noted quite early in the Program implementation cycle. While costs were rising, concerns were shared with USAID in mid-2006, and later again in November of 2007. USAID requested clarification of budget adjustments submitted to the Mission in February that set the stage for a Program review meeting in April 2007. During the meeting, USAID informed NRECA that no additional funding would be available to finance cost overruns, and that the Mission required an analysis of how NRECA could bring Program activities to a successful conclusion without additional financing from USAID**.** NRECA's project completion report for the Yei work was completed in late March, 2008.

2. EVALUATION QUESTIONS & METHODOLOGY

2.1 Methodology

We have followed an evaluation methodology consisting of four broad steps:

1. Define Evaluation Questions (EQs): The EQs are the focus areas for the evaluation. They are derived from the "Evaluation Purposes and Objectives" in USAID's Scope of Work, as well as from discussions with USAID and MSI colleagues. We have summarised the EQs for this evaluation in Section 2.2 below.

2. Define and Execute Fact-Finding Approaches: There are three main fact finding approaches:

    - Review of NRECA Documents: The principal documents reviewed include all of NRECA's Quarterly Reports, the Project Completion Report for the work in Yei, the Feasibility Studies, and the Willingness to Pay Study. NRECA also furnished some financial and operating information in various spreadsheets or in response to email communications. All of these sources are referenced throughout the text and / or in Annex 2. Where necessary, we have clarified various points drawn from these documents through interviews with NRECA staff.

    - Interviews: With the guidance and assistance from MSI/SUPPORT project and USAID colleagues, we have conducted interviews with a variety of actors and stakeholders. The full list of interviewees, and where appropriate interview summaries, are included in the Annex. The various topics collectively covered in planned interview questions are set out in Section 2.3 below.

    - Quantitative Data Requests: For several specific issues (typically including various operating and financial statistics of YECO), we have submitted quantitative data requests to various interviewees. These requests are included in the information provided in Section 2.3 below.

3. Analysis & Synthesis; Form Conclusions and Recommendations: The information collected in step 2 is analyzed within the context of the EQs, also bringing in views and data from authors' experience. From this, assessments of each EQ are made, and additional conclusions and observations are made (in draft form).

4. Obtain and Appropriately Reflect Draft Review Feedback: Feedback from MSI/SUPPORT project staff and USAID colleagues was obtained on the initial (draft) Analysis / Conclusions / Recommendations (as provided in both two separate outbrief sessions with AID in Juba, as well as in an initially submitted draft report) and was considered and as appropriate, incorporated into a final report.

This methodology was implemented over the course of a two week mission by the authors to Juba and Yei. The activities for the field work are shown in the Calendar below.

NRECA Evaluation Calendar, May 2008

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
4	5	6	7	8	9	10 Arrival in Juba Meeting with MSI COP
11	12 **Morning:** TPM **Afternoon:** - Meeting with USAID CTO/EG Team Leader,	13 • Start Field Work in Juba& Met with: • Eng. Samuel Taban, Dir. Of Power Supply • Eng. Raymond Pitya, Undersecretary Ministry of Housing • Lewis Gore, Juba Electric Utility	14 • Continue Field work in Juba; document review	15 • Continue field work & Document Review	16 • Fly to **Yei** and meet with • NRECA staff • Managing Director, YECO (Ben Alel) • YECO customers	17 Continue Field Work in Yei • Yei County Executive • Meet with County Engineer • YECO interim Board Return to Juba
18	19 • Draft Report	20 • Draft Report	21 • Out-brief USAID CTO, and MSI	22 Debrief with USAID Mission Management, CTO, and MSI	23 Submit draft report to SUPPORT	24 Respond to Initial comments from MSI / Support; Depart Juba

Note: The calendar shows principal activities as actually occurred (which in some cases differed slightly from as originally planned). Only activities during in-country period are shown.

2.2 Evaluation Questions

We have identified 8 broad Evaluation Questions (EQs). These include:

1. US Objectives: Does the project support overall USAID / USG Sudan goals? In particular,
   - Does it help legitimise the Government of South Sudan?
   - Does it provide a "peace dividend" (e.g., improved security due to street lighting)

2. Defined Project Objectives: Did the project itself achieve its stated objectives? Was the process used by the Implementation Partner (NRECA) adequate in terms of planning and responsiveness to meet these objectives, particularly in the face of changing facts on the ground?

   We note that the objectives for NRECA broadly can be categorised into three areas[2]:

   1. Electrification in Yei: This includes two separately-identified objectives: the introduction and provision of street lighting as a security measure in Yei, and the provision of reliable and affordable electricity to facilitate commercial business operations and development in Yei

   2. Feasibility studies for electrification of other Southern Sudanese towns

   3. Technical support and capacity building for Juba electric utility and GOSS electrification programme

3. Gender Issues: What was the project's gender impact? To what extent did the project address the differing needs of men and women? How is NRECA defining and addressing gender equity?

4. Cost and Economic Sustainability: Were the cost levels of the project high or low? Is the cost of power affordable for consumers? Does the tariff reflect full costs and will it lead to a financially sustainable3 utility?

5. Replicability: Is the approach taken in Yei suitable for replication or expansion?

6. Alternative Options: Do the feasibility studies (or other documents etc) suggest that alternative options such as solar / hydro etc might be better options in special circumstances?

7. Project Value: Was the project Value for Money? Were the Technical Assistance portions of the project well received and utilized? Was the electrification of Yei accomplished efficiently in terms of cost and was it the best way to serve consumers?

8. Other Lessons Learned: Were there key Success and Failure Stories, or examples of Best and Worst Practices?

[2] See, e.g., the Scope of Work for this Evaluation, p. 3 See also Ref 1, 11

[3] By "financially sustainable" here and elsewhere throughout this report, we mean to address the question of whether, under current tariffs and tariff structures (which include fuel cost adjustment mechanisms), and with the current absence of well-defined and implemented future capital and / or operating subsidies, it could be expected that the utility will generate adequate cash flows to both support its current operations and to perform the necessary refurbishments and (eventually) replacements of its capital equipment so that it will last in a stable long-run condition. By "current" we refer to the conditions in place as of the time of NRECA's Project Completion Report (of which this evaluation report is in partial response), which we understand are broadly the same as those in place at the time of the evaluation team's mission to Juba / Yei.

2.3 Fact Finding: Interview Topics and Data Requests

In order to address the evaluation questions, it is necessary to define specific topics to be discussed in interviews and specific data to be requested. We have identified 14 general areas of interview topics, each of which are intended to help address one or more of the evaluation questions ("EQs"). The broad topics are:

1. General Overview of NRECA Project, including project elements, timing etc.
2. NRECA Feasibility Studies
3. NRECA Technical Support / Capacity Building for Juba Utility
4. Approach to Gender Issues
5. General Lessons Learned & Anecdotes
6. General structure of the "Yei Utility" (YECO)
7. Overview of the Tasks Undertaken in Yei
8. Yei Utility Organisation (high level)
9. Production / Usage Statistics & Financial Statements for the Yei Utility
10. Calculation of the Delivered Cost of Energy from the Yei Utility
11. Metering / Billing & Collection
12. Tariffs / Finances of Yei Utility
13. Yei Street Lighting
14. Demand, and Use of Energy by Yei Commercial Enterprises Generally

The attached matrix (see below) shows the generally anticipated relationship of these topic areas to the various evaluation questions. Within each of these broad topical areas, there are of course numerous specific sub-topics or specific questions which were addressed in various interviews; other topics often arose as well. In addition, several written questions and requests for data were submitted to NRECA staff and generally answered through email exchanges.

2.4 Data Issues

The authors have prepared this report on the basis of a combination of document reviews, interviews, and data and answers provided by interlocutors in response to written requests for information or questions posed in writing. We have reviewed the information obtained from these various source to ensure that it appears to be internally consistent and consistent with our understanding of feasibility and likelihood based on our experience in the energy utility sectors of many developing countries. We have not, however, audited (or, in many cases, multiple-sourced) the information provided to us. Furthermore, apart from the customers selected for interviews (which selection was largely made from a list drawn up by us,

with on-the –spot modifications agreed to by us), the selection of interviewees was made by NRECA and/or USAID, not the authors.

Matrix of Relationships: Principal Relationship of Fact Finding / Interview Topics to Evaluation Questions

Fact Finding / Interview Topics ➔	2.3.1	2.3.2	2.3.3	2.3.4	2.3.5	2.3.6	2.3.7	2.3.8	2.3.9	2.3.10	2.3.11	2.3.12	2.3.13	2.3.14
Evaluation Question:														
1 US Objectives	✓		✓										✓	
2 Defined Project Objectives	✓	✓	✓			✓	✓	✓		✓			✓	✓
3 Gender Issues	✓			✓										
4 Cost and Economic Sustainability		✓				✓	✓	✓	✓	✓	✓	✓		✓
5 Replicability		✓			✓	✓	✓	✓	✓	✓	✓		✓	
6 Alternative Options		✓								✓				✓
7 Project Value	✓	✓	✓			✓				✓		✓		✓
8 General Lessons Learned	✓				✓									✓

3. FINDINGS FOR EACH EVALUATION QUESTION

In this Section, we summarise the relevant finding of facts for each evaluation question. We note that the process of organisation of individual "findings" to individual evaluation question has some degree of organisational artificiality, since some findings have relevance to multiple EQs, or to recommendations to be drawn later from the analysis of the conclusions. Where individual findings are significant for multiple EQs, we note this, but where they are less significant (or indirect), we do not.

3.1 Principal Findings Relevant to EQ1: US Objectives

3.1.1 The implementation of the Yei street lighting and the creation of YECO appears to be viewed as a combination of efforts and activities led both by GOSS and by USG / USAID.

Throughout our interviews with participants and stakeholders, there appears to a mix of views regarding how they themselves perceive the responsibility and credit for the work, and what they believe regarding the perceptions of other people. The mix of responsibility and credit is split between GOSS and the USG / USAID.[4]

3.1.2 Yei street lighting dramatically improved public safety within the street lighting zone.

All interviewees agreed that public safety within the street lighting zone has been dramatically improved. Anecdotal reports from several sources appear to agree that the rate of crimes against persons (muggings, etc) within the zone fell from an incidence of 30 – 35 incidents per night to zero or one per night. One interviewee pointed out that this might mean that the criminal activities were simply fully or partially displaced to other locations; however the creation of a much lower crime rate in the town center through street lighting was positively remarked upon by all.5

3.1.3 Yei street lighting and electrification generally has allowed some Yei businesses to productively keep longer hours, and has allowed some expansion of commercial activity.

Several interviewees (including customers) noted that it was now feasible for some businesses in the lighting zone to stay open longer hours since people now appeared to be more willing to be out at night within the lighting zone. Also, there was a general increase in commercial activity, to which credit was perceived as due in least at part to both lighting and electrification (as well as to the general growth in Yei's overall population over the past three years).[6]

3.1.4 Additional testimonials in Yei support the social benefits of both the street lighting and provision of electricity to public services

While in Yei, the authors learned several additional positive social benefits of the new service. These include[7]:

- There are stories that now one can see children reading schoolbooks in the evening under the street lights.

[4] Ref Interviews 2, 3, 4, 5
[5] Ref Interviews 1, 2, 5, 7, 13, 14
[6] Ref Interviews 2, 3, 4, 7, 13, 14
[7] Ref Interviews 2, 5, 14

- The provision of electric service to the Hospital is credited with assisting in helping the Hospital perform vital functions.

- During the night the team was in Yei, electric service (and street lights) was switched off at the normal time of midnight. But it was learned the following morning that at about 2:00 am, the police had entered into hot pursuit of a criminal suspect in the city centre. One of their team contacted NRECA staff to turn on the street lights to assist the chase. The street lights were quickly turned on, providing illumination to assist the policy for another approximately two hours. (Unfortunately, the suspect was apparently not apprehended)

In addition to these testimonials heard by the Evaluation Team, USAID's project CTO has informed the team that very senior GOSS officials have also "applauded the efforts" of the US Government in assisting the reconstruction efforts in Southern Sudan, and have specifically noted the Yei Electric Cooperative (see item 3.2.3 below) has been the first utility to be inaugurated since the formation of GOSS.[8]

3.1.5 GOSS has begun to take concrete, proactive steps in developing electricity sector policy, assisted by the project.

GOSS appears to be continuing to move forward with the development of both its overall sector policy and the relevant legal and regulatory framework. These efforts are clearly linked to the policy papers developed within NRECA's work. These efforts also appear to demonstrate GOSS's taking of responsibility for this sector development program.[9]

3.2 Principal Findings Relevant to EQ2: Defined Project Objectives

3.2.1 Yei Street Lighting was Completed, Meeting an Accelerated Schedule.

At the start of the project in early July 2005, NRECA was informed by USAID that it was desired to have Yei street lighting in place by September 30, 2005. This resulted in requiring a faster-than-expected planning, procurement, and construction process by NRECA. By the date of the official inauguration of the system (1 October, 2005), a street lighting circuit of 23 street lights was fully functional. (Ref 1, pp 3-4) During the 4th quarter of 2005, operations of the lighting circuit were turned over to locally hired NRECA staff.[10]

3.2.2 The Yei Business (YECO) Served 380 Customers by the end of the Project, slightly fewer than the originally targeted number. The collection record indicates that the service was perceived as generally affordable for the quantities consumed at the prices charged.

Design and build-out of the Yei distribution system began in latter 2005, following the construction of the street lighting system[11]. Customers began being connected in April 2006 and by March 2008 the customers connected to the system numbered 380:

[8] Email, 5 June 2008, from B. Magaya to S. Taddesse; see item 3.
[9] Ref 14; Interviews 2, 3, 4
[10] Ref 2 p 3
[11] Ref 2, p3

Table 1: YECO Customers as of March, 2008

Customer Class	No. of Customers	Average Energy Consumption per Customer March 2008 (kWh)	Total Energy Consumption by Customer Class March 2008 (kWh)	Percent of Total Energy Consumption by Customer Class
Residential	34	72.82	2,480	3 %
Commercial Excl. Gemtel)	318	116.22	36,960	41 %
Gemtel	1	28,570.00	28,570	31 %
NGO	6	435.67	2614	3 %
Industrial	4	445.25	1780	2 %
Institutional	16	94.90	1520	2 %
Street Lighting	1	17,009.00	17,009	9%

Sources: Compilation and analysis of data from YECO "Form 1" revenue data and "Copy of Customer Type Summary", Excel spreadsheet developed by NRECA (provided by USAID / MSI to the evaluation team). Total energy consumption by customer class rounded to nearest 10.

The total customer numbers achieved was less than the original target level of 700[12]; NRECA recognises that customer growth was "much slower than originally planned". [13] We do note, however, that on-site interviews indicated that a more-or-less continuous number of applicants were continuing to be connected, and that YECO had materials on hand at the moment to continue to connect these applicants.[14]

The business's record of collecting payment from non-Government customers (see the Finding regarding "Collections" under sub-section 3.5 below) was generally good, showing empirically that at the prices charged, the level of energy consumed was considered affordable. We note, however, that this statement must be considered together with the question of whether YECO is and will remain a viable commercial entity at current prices and / or current consumption levels. These issues are addressed by Findings in sub-section 3.5 below.

3.2.3 The "Yei Electric Cooperative" (YECO) was Formed (though not yet officially registered) with a Local Board and staff

In April 2006, an Advisory Council made up of local stakeholders was formed as a first step in the transition of the Yei operations from a Technical Assistance project activity to a more formal locally-managed operating business. By 2007 a decision was made to use a Cooperative form of organisation, and in March 2008, the registration documents for YECO were submitted to GOSS.[15]

We note that at the time of writing of this report, the registration documents have still not been approved by GOSS. In addition, the Yei River County authorities appear to be displeased with the cooperative form of ownership / business arrangements and have made known their desire to find an alternative structure.[16]

At the time of project close, YECO had 3 managerial employees, 2 administrative employees and 7 technical staff. The organisation also employed 4 people as guards / cooks / cleaners.[17]

[12] Ref 1, p2
[13] Ref 12 p17
[14] In comments on the draft version of this report, both the USAID CTO and NRECA were eager to point out that connections have indeed continued to grow. By 31 May 2008 the total had apparently reached 427 customers. (See NRECA comments and B. Magaya comments transmitted with B. Magaya 5 June 2008 email)
[15] Ref 12 pp 10 – 13
[16] Ref Interview 14

Although YECO has been established and staffed, NRECA notes that it apparently is still not fully mature in a managerial or operational sense:

> NRECA views this project as a success, but it should be remembered that institutions like YECO require several years of support to gain their footing, and to establish a solid base of skilled management and staff. YECO still requires physical expansion to reach certain economies of scale and to serve emerging loads.[18]

3.2.4 Seven Feasibility Studies and One Sector Policy Paper were Completed

NRECA's final quarterly report summarised the work on the Feasibility Studies:

> Seven feasibility studies were completed and presented in the fourth quarter of 2006. A total of nine feasibility studies were originally planned, but two were not completed in Yambio (due to peace and order problems), and in Warrup, due to the failure by the GOSS to identify the state capital to NRECA.[19]

We provide further comments on these feasibility studies in the discussion of findings related to "Alternative Options" below.

In addition to the Feasibility Studies, during Q4 2006, GOSS requested that SSREP develop an electric policy and sector strategy for Southern Sudan. This was approved by USAID and a draft report was prepared and distributed in January 2007. Following review and comment, the document was ultimately adopted by the Council of Ministers in May 2007 and served at least in part as the basis for the Electricity Act, 2007.[20]

3.2.5 Technical Assistance was provided to the Juba utility, though problems appeared with uptake and "ownership" of the work.

Technical assistance specific to the Juba electric utility began during the 2nd quarter of 2006. Efforts included assistance in evaluating generation alternatives and managing the generation operations; procurement, implementation and training on a utility MIS system which included various components such as a customer database, billing system, etc; evaluation of the utility management structure. This was supplemented by the addition of a specific generation advisor for the Juba utility in the latter half of 2006.[21]

From almost the beginning of this work, NRECA itself noted what appeared to be some slow uptake of the efforts by the Juba utility. For example, once the MIS system was up and running, the Juba management declined to use the generated invoices. At that time, NRECA noted ". . . it appears that the utility management is not motivated to take ownership of the new software and institutionalize its use". Senior, well-informed observers after the fact characterised the technical assistance efforts as ineffective due to the reluctance of the management to use it.[22] The resistance to the TA efforts, efforts to improve organizational efficiency, and even to receive training were also noted by NRECA and described by its staff on the ground.[23]

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[17] Ref 12, pp 10 – 13
[18] Ref 12, p18
[19] Ref 11, p 4
[20] Ref 8, p9
[21] Ref 4 – 11
[22] Ref Interview 2
[23] Ref Interview 5

3.2.6 NRECA appeared to be quite reasonably responsive to changes in project planning and / or needs.

We understand that NRECA used fairly standard planning tools to program its work. The results of the work as it unfolded over time illustrate the more important fact that NRECA appears to have been able to effectively manage its responses to a continually changing work environment as well as to sometimes changing external priorities. A good example of this is the acceleration of the initial build-out of the Yei Street Lighting circuit, which was at the very start of the project pushed much further forward in time (by external requests) than in NRECA's originally proposed schedule.[24]

3.3 Principal Findings Relevant to EQ3: Gender Issues

3.3.1 NRECA did not appear to have a written "Gender Strategy" document, but certainly appears to have been sensitive to the needs of women from the beginning.

From the beginning of its work in Yei, NRECA was aware of the need of addressing gender issues. Efforts were made to recruit female surveyors (for field surveys), accounting, and finance personnel. Female trainees were actively recruited as well. Also, NRECA tracked customer applications by gender (as well as by Sudanese / non-Sudanese).[25]

Additionally, Yei activities have maintained a focus on gender balance, both by including a representative of the women's groups on the YECO Board of Advisors and by giving special attention to female applications for electricity

3.3.2 Direct employment of females at YECO is low. However, the majority of technical positions are traditionally male (as they involve physical labour, e.g., linespersons)

Despite the efforts (noted above) to attract and recruit female employees, today YECO has only one female professional employee and one non-professional employee (of a total employment of 16 people at YECO as noted earlier). We recognise that the core technical jobs at YECO (e.g., lines people) do tend to be male-dominated in utilities around the world. NRECA also noted its difficulties in attracting qualified female applicants for any and all positions.[26]

3.3.3 YECO commercial customers include an approximately proportional number of woman-owned businesses

NRECA estimates that about 10% of its commercial customers today are female owned. This rate is reported to be about representative of Yei businesses as a whole. [27]

3.3.4 There was representation of Women's groups within the initial Advisory Council

An initial Advisory Council for what was to become YECO was formed in April 2006. This 5-person council included one female member, specifically representing women's groups.[28] We note that today, this original Advisory Council has been replaced by an interim board of five members which has no female representative, though this board will itself be replaced by a board elected by the Cooperative itself, once the Cooperative is formally created.

[24] Ref 1 – 12; Interview 5; email (with response to written questions) from F. Mills 15 May
[25] Ref Interview 5, email (with response to written questions) from F. Mills 15 May
[26] Ref 12, Interview 5, email (with response to written questions) from F. Mills 15 May
[27] Ref Interview 5
[28] Ref 12, p10

3.4 Principal Findings Relevant to EQ4: Cost and Economic Sustainability

3.4.1 Material costs were substantially higher than originally expected and problems appeared with logistics / delivery

From almost the very beginning of the work, NRECA noted that costs of materials were substantially more expensive than expected. As early as their 2nd quarterly report, they noted:

> The materials purchased during the third quarter of calendar 2005 were approximately 100% higher than NRECA normally expects to pay for materials . . . [29]

Later in the project they noted:

> Cost control for construction materials, overland transportation, housing, and other major expense categories for the Yei project is causing increasing concern. Costs have been and continue to be much higher than anticipated, as it appears that suppliers in Kenya and Uganda charge a "Sudan premium " for any and all construction materials, conductor, line hardware, poles, transformers, as well as transport services destined for Yei.[30]

General logistics also appears to have been "extremely trying at times"[31].

The difficulties with material costs and delivery logistics appears probably to be due in part not just to higher-than-expected prices in the world market or a "Sudan premium", but possibly also due to the fact that NRECA was ordering materials in lower-than-standard lot sizes due to the small scale of the Yei operation. In its very first quarterly report, NRECA noted specifically with regard to delivery schedules:

> With the material lists complete and the specifications developed, local and international suppliers were identified in an effort to assure that the materials could be purchased and delivered to Yei with sufficient time to ensure construction by September 30. This process proved to be quite problematic due to the fact that most materials are imported by larger utilities in greater quantities than were needed for the Yei distribution system.[32]

In addition to higher-than-expected materials costs, of course, YECO's operating costs also increased substantially over time due in part to the rise in fuel prices. We note that early in the project (October – December 2005) diesel fuel was apparently priced above $1.00/liter[33], though net of tax it was apparently about $1.00/liter (which level was used in the base case of the initial tariff study; see Ref 3, p 7). By the time of writing of the Project Completion Report (late March 2008), diesel was priced at $1.39 / liter.[34]

[29] Ref 2, p 6
[30] Ref 5, p 13
[31] Ref 1 p 4
[32] Ref 1, p 3
[33] Ref 2, p 5
[34] We note that the Project Completion Report (Ref 12) identifies the price of diesel as being $0.82 / liter "prior to commercial operation". It is unclear how this compares in time to the statement in the second quarterly report (which was also at a time prior to commercial operation) that diesel was in excess of $1 / liter. However, the most relevant point is that the original tariff calculations were made on an assumption of $1 / liter, with revised calculations (apparently implemented October 2007) described in the Project Completion Report based on $1.20 / liter against a project completion current price of $1.39 / liter. (Ref 12, Annex 9, p 8)

3.4.2 Operating costs were high in part because YECO was a subscale utility

The original target size for YECO – 700 customers – was quite small in comparison to what is generally recognised as (even the low range of) the minimum efficient size for an operating energy utility. We will discuss this further in our overall conclusions in the following Section. However, this fact was certainly recognised by NRECA. In their Project Completion Report, they state:

> Perhaps the biggest challenge has been to keep operating costs as low as possible, due to the negative economy of scale facing YECO as an extremely small electric utility.[35]

And,

> Smaller utilities must dedicate a disproportionately high amount of resources on utility administration, commercialization of energy services, and maintenance, due to the smaller economies of scale upon which they operate.[36]

Interviews with NRECA staff suggest that they believe that "about 5,000 customers" is the minimum efficient scale for a rural utility, though the precise number depends on the physical density of customers and their usage characteristics.[37] The experience of the authors suggests that certainly for investor-owned utilities, the minimum efficient scale is substantially larger even than that.

3.4.3 YECO's overall cost of service is dominated by fuel costs. The average per-kWh cost of service reflecting proper amortisation of investment(i.e., depreciation charges)[38] is quite high at today's fuel prices – perhaps as much as$0.92 – $1.15 / kWh

In March 2008, YECO's overall cost of operating services was driven 78% by fuel prices based on revenue less the non-paying hospital and street-lighting. At current (at the time of writing this report) fuel prices have risen from the then $1.39 per liter to $1.51, and forecasted 2008 overall operating costs (without amortisation of investment) average $0.71/kWh. Proper amortisation of the full investment costs of establishing YECO would add from $0.124 to $0.443 / kWh to this value depending on the rate of depreciation used and whether the project is considered from the point of view of USAID's entire investment or only on the basis of the installed equipment.

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[35] Ref 12, p 11

[36] Ref 12, p 15

[37] Ref Interview 5

[38] In various comments received on the draft version of this report, we became aware of some confusion caused by our use of the term "amortisation of investment" here and elsewhere throughout this report. As used throughout this report, we intend it to refer what is typically called in the US "depreciation" of capital investment; "amortisation" is often used in British or European jargon as an equivalent term. There is further room for semantic confusion however since some cooperative or municipal utilities, particularly in the US, do not include "depreciation" among their operating costs to be recovered through tariffs, but instead structure tariff levels in such a way so as to earn a "margin" which serves as the analogue to depreciation charges.

All of these are broadly semantic nuances. For the purposes of this report, it is necessary to understand that in order for the utility to be sustainable, it must somehow recover a "return of capital invested" from either its ratepayers or through other means (e.g., future capital subsidies). The overall amount of capital invested to be recovered over time would encompass both the cost of physical assets as well as any properly amortisable start-up or other costs. This amount of cash is necessary to fund the ongoing refurbishment and, ultimately, replacement of capital equipment and future implementation costs. All of the analysis we present here is focused on this question. NRECA itself summarised its own approach (and confirmed that the level of capital recovery included in its "cost of service" tariff could not be considered adequate to provide for long run sustainability) in Reference 3, Annex 1, page 6, numbered paragraph 1.

Projected monthly costs based on current fuel prices show that the overall average cost to the customers will continue to rise from current levels in 2008

Table 2: Example of YECO Average Cost of Service

2008 Forecast Monthly Costs of Operation	At $1.39/liter	At $1.50/liter
Labor	$5,608	$5,608
Non-Labor Operating costs	$3,000	$3,000
O&M	$3,600	$3,600
Fuel	$34,831	$37,588
Other Operating	$2,267	$2,267
Monthly Amortization of Investment	$0	$0
Total Monthly Operating Costs	$49,306	$52,063
Cost per kWh	$0.67	$0.71

Sources: Compilation and analysis of data from "Southern Sudan Rural Electrification Project Completion Report for Yei Electric", Annex "Proposed Tariff Adjustment for the Yei Electric Cooperative", Table 5 - Projected Operating Costs and Fuel Usage therein.

We calculate current fuel costs at 78% of operating costs when based on collected revenue after taking into account the defaulting hospital and street-lighting. Thus doubling the number of customers and spreading the fixed costs among them equally, would only reduce the per customer cost of service some 11%. While generator efficiencies would increase up to a point with higher loads, overheads will also increase as the customer base grows.

Adding amortization of the original establishment / investment costs of the Yei operations would add from $0.125 / kWh to $0.443 / kWh to the values shown in the above table. The derivation of these numbers is set out in further discussion below.

Finally, it should be noted that when the unpaid debt of the hospital and the street-lighting is expensed, our calculations show that YECO only realized some $0.34 per kWh delivered.

3.4.4 At current tariffs, consumer average bills are greater than estimated in the Willingness to Pay (WTP) study. This may slow the uptake of service in the future, after the high-willingness consumers are connected. The projections and assumptions in the WTP study also show some variance from actual experience.

The table below shows the average monthly bills by customer class for the month of March 2008 compared to the average amounts predicted in the Willingness to Pay Study[39] below[40].

[39] Reference 13

[40] GEMTEL has been deliberately removed from the list because this one customer would skew the data, account as it does for one third of the load. Additionally, the embedded fuel price for this round of billing was $1.39 per liter. Current fuel costs stand at $1.51 per liter. Fuel accounts for approximately 90% of the running cost of the utility.

Table 3: Forecasted Willingness to Pay vs. YECO Average Bills

Customer Type	2006 Forecasted WTP ($)	March 31, 2008 Average Monthly Bill ($)
Residential	9.50	48.87
Commercial	15.38	77.15
Industrial	17.11	250.94
NGOs	600.00	248.45
Institutional	170.00	230.36

Sources: Compilation and frequency analysis of data from: "Copy of Customer Type Summary" Excel spreadsheet developed by NRECA (provided by USAID / MSI to the evaluation team) and "Yei Willingness to Pay Assessment", NRECA International, July 2006.

Thus the existing customer base of Residential, Commercial and Industrial users is now paying several multiples of the overall potential population's forecasted ability to pay, with Compounds paying less and Institutions slightly more.

There are several additional points to note regarding the above-referenced Willingness to Pay study:

Forecasted Consumption in the WTP study: Forecasted consumption patterns are significantly higher for the bulk of the customers (Residential and Commercial), while the remaining customers, mostly a small number of larger customers, are using in some cases much less than predicted.

Table 4: Projected Consumption by Customer Class vs. YECO Actual (March 2008)

Customer Type	WTP Predicted Consumption kWh/Mo.	March 2008 Avg Actual kWh/month
Residential	20	72.82
Commercial	50	116.22
Industrial	1,800	435.67
NGOs	500	445.25
Institutional	500	94.90

Sources: Reference 13; Compilation and frequency analysis of data from: "Copy of Customer Type Summary" Excel spreadsheet developed by NRECA (provided by USAID / MSI to the evaluation team) and "Yei Willingness to Pay Assessment", NRECA International, July 2006.

Forecasted Customer Numbers in the WTP study: The predicted number of customers at project completion by customer class differed from the actual numbers, particularly with respect to Residential customers – who comprise the bulk of the remaining un-served forecasted demand. There also were a statistically significant lower number of Industrial and Compound/NGO customers:

Table 5: Predicted Number of Customers vs. YECO Actual (March 2008)

Customer Type	Predicted Number of Customers	Actual Number of Customers March 2008
Residential	450	34
Commercial	198	318
Industrial	2	6
NGOs	17	4
Institutional	25	16

Sources: Reference 13; Compilation and frequency analysis of data from: "Copy of Customer Type Summary" Excel spreadsheet developed by NRECA (provided by USAID / MSI to the evaluation team) and "Yei Willingness to Pay Assessment", NRECA International, July 2006.

3.4.5 The upper limit of "willingness to pay" could not be empirically estimated in the field visit, though at least one example of high willingness for a particular service was observed.

We note that the Scope of Work for this evaluation assignment posed the question: "What is the upper limit of what local community members are willing to pay per unit of electric use?"

While conducting interviews and performing our analysis we were sensitive to the question of what the upper limited was on a customer's willingness to pay for each of the customer classes. We found this to be an impossible question to answer with any accuracy empirically, since such a question can only be really answered based on a new, updated Willingness to Pay study, which we consequently have recommended to be carried out.

We did observe, however, that some (in fact, many) people are willing to pay 1 SDG (Sudanese Pound) to charge a mobile telephone. The 1 SDG corresponds approximately to the energy charge in the current tariff for 1kWh of energy (the tariff also of course includes fixed charges). Discussions with NRECA staff indicated that the energy required to charge a mobile telephone would typically be less than even a tenth of a kWh. This can be taken as an empirical example of high consumer willingness to pay for certain high-value services, albeit in small consumption quantities.[41]

We have also observed, that under the tariff regime in effect in March 2008, only 34 residential customers have signed up for service; this is in stark contrast to the originally targeted 450 residential customers. Thus in that important sector it may be that the overall willingness to pay for full service has already been exceeded, at least for some potential customers[42]. The analysis above related to Willingness to Pay and average customer bills also suggest this.

Finally, we note that whatever future analysis is undertaken in this area, the issue of "what is the upper level of payment" should be linked to quantities of energy taken at various levels of payment, since many consumers face an array of potential uses of electricity, some of which have higher value to them than others (e.g., charging a mobile telephone versus listening to the radio purely for entertainment). From the point of view of making future evaluations of any new utility's prospective potential commercial

[41] Ref Interview 12; discussion with NRECA staff

[42] Note that there is not necessarily any contradiction between a person being willing to pay a very high cost for small consumption of a perceived high-value use, while at the same time possibly declining to subscribe for service (if it is available to him). If the person has only a small amount of high value uses (or only a small overall amount of money), he may find it economically sensible to purchase that service from a vendor (such as a mobile phone charging kiosk) rather than incur the fixed charges of connecting to the system and the monthly fixed charges set in the tariff.

viability, it will be necessary to have an estimate not simply of the upper limit of willingness to pay, but of the overall relationship between price of service and quantity demanded.

3.4.6 Current YECO operating results do not show sufficient cash flow for sustainable operations, let alone future investment

On an accrual accounting basis, the Cooperative is only making a small net operating margin

Table 6: Selected YECO Form 1 Financial Data

	YEI ELECTRIC COOPERATIVE	
	SDD FORM 1 - FINANCIAL AND STATISTICAL REPORT	
	FOR THE MONTH ENDING	31-Mar-2008
PART A. STATEMENT OF OPERATIONS (US$)		
	ITEM	CURRENT MONTH
1	Electricity Sales Revenue	42,419.05
2	Connections Fees	6,818.69
3	**Operating Revenues (1 + 2)**	**$49,237.73**
		0.00
4	Power Production Expense	35,448.37
5	Cost of Purchased Power	0.00
6	Distribution Expense - Operation	0.00
7	Distribution Expense - Maintenance	0.00
8	Consumer Accounts Expense	2,782.07
9	Administrative and General Expense	975.81
10	**Total Operation & Maintenance Expense (4 thru 9)**	**$39,206.26**
11	**Net Operating Margin (3 less 10)**	**$10,031.47**
12	Membership Fees	$0.00

Source: YECO Form 1, March 2008

The above table shows a small positive net operating margin (line 11). However, if uncollected amounts from the hospital and street-lighting are deducted (some $7,280), the net operating margin largely disappears.

Moreover, YECO's balance sheet will be adversely impacted when the overdue accounts have been expensed. Currently they are still being carried as assets. According to NRECA, "Standard practice is to report collection rates on time periods longer than 30 days. Typically, uncollected accounts are not written off until they are at least 90 days past due." Unpaid accounts receivable over 90 days old are large (almost $72,000), which would erase fully 7 months of operating margin at current rates.

Table 7: Current YECO Accounts Receivable

Aged Accounts Receivable		
Current Month	$	55,383
Over 30 Days	$	7,483
Over 60 Days	$	6,371
Over 90 Days	$	71,860
Total Due at Month-End (4 thru 7)	**$**	**141,096**

Source: YECO Form 1, March 2008

Cash Flow from operations is only just slightly positive.

The Company has not prepared a cash flow statement, but anecdotally YECO is running a small current cash flow surplus[43], and will run into difficulties if something unexpected happens. The small surplus thus leaves the company vulnerable to shocks and is not sufficient to fund investment. Rather one priority use that was suggested is to increase fuel inventories.

Cash collections from sales do not generate sufficient cash to finance system investment or equipment replacement.

The Company does not amortize investments; rather it provides for a 2.5% reserve against replacement (implying in effect a 40 year amortization rate) and NRECA is of the view that, because the amounts to set up the system were donated they should not be subject to amortization in any event. NCERA states "if we assume that it is as high as $1.5 million, and if we use a depreciation life of 30 years for the distribution system (the generators should have a depreciation life of 15 years, but they are worth about $225,000 only), then the depreciation allowance for the project would be about $4,200 per month. On the basis of 100,000 kWh sold per month at present, this would result in a depreciation allowance per kWh of $0.042."[44]

System investment to establish Yei was over $5.3 million, which is normally capitalized, no matter the source, under US and International accounting practice.

Actual investment in the project from the sponsor's point of view can be determined as the overall cost of technical assistance, construction and equipment, which amount can be calculated by deducting the non-associated YEI costs of $1.5 million from the value of the final spend for SSREP of over $6.8 million, yielding at net cost of starting up YECO of $5,319,004. Assuming the depreciation rates and kWh sold as above, this would equate to a depreciation allowance of over $14,000 month or $0.14 per kWh.

The mechanism in place to fund system expansion or replacement of worn out equipment is insufficient.

NRECA has de facto assumed a 50 year amortization schedule, providing as it does for a 2% revenue uplift in the customer tariff. In 2003, In contrast by way of an example, Lahmeyer International, when evaluating the rural diesel generation islands for the Ugandan system under a World Bank contract[45], determined that 5 to 7 years of continuous operation for a diesel generator (10 years if run under an intermittent regime) was a proper stand for local conditions.[46] Thus if the system for system values of $1.5 million or $5.3 million (depending on your point of view), the incremental cost per kWh that should be recovered in the tariff and is not ranges from $0.125 to $0.443.

The Current YECO Tariff is below the economic cost of service

NRECA's initial tariff study was completed in May 2006[47]. It included several "Tariff Scenarios". Scenario 1 was described as "cost of service". NRECA describes the tariff as being adequate to cover all cash needs of operations, including fuel provided at $1.00 / liter. The structure and level of the proposed tariff was:

[43] Reference Interview 5
[44] Source "Excerpts from Final Report and Questions – Response" by NRECA
[45] "Uganda – Privatization - UEB – Rural Diesel Generation Report, Calculation of Value (OCV) of Diesel Power Stations", Lahmeyer International, May 2002.
[46] Also, this point was generally agreed in Interview 5
[47] Ref 3

Table 8: NRECA Initial Tariff Study, "Scenario 1 – 'Cost of Service'" Tariff

Customer Class	Fixed Charge $ / month	Energy Charge $ / kWh
Residential	1.70	0.39
Commercial	3.80	0.39
Compounds	135.00	0.42
Institutional	35.00	0.42
Small Industry	35.00	0.42
Street Lights	850.00	0.39

NRECA's description of this tariff notes that the tariff "cannot be considered a full cost recovery tariff"[48] because it does not recover full amortization of investment (depreciation). Instead, the tariff was designed to cover a lesser amount of money intended to fund future asset replacement, based on a factor of 2% of the annual system value. This amount would be equivalent to a 50 year asset depreciation lifetime, which is (as noted in one of the above discussions) clearly not realistic. NRECA noted this, saying

> A 2% reserve is equivalent to assuming that assets have a life of 50 years which is clearly not the case, so this level of revenue recovery is clearly inadequate for the long term . . . [49]

We note this point in advance of our comparison of this already-below-full-economic-cost (even on a non-profit basis) tariff to the first tariff which was actually approved and implemented for the NRECA customers.

In October 2006, NRECA agreed with GOSS and implemented a tariff that was uniform for all customers, rather than differentiated by the six customer classes in the tariff proposal described above. The tariff was:

Table 9: Initially Approved Tariff

Customer Class	Fixed Charge $ / month	Energy Charge $ / kWh
All	2.10	0.45

The points to observe about this are as follows. First, apart from the original proposal for the residential customer class (which has always been a very small customer group for NRECA / YECO), the monthly fixed charge is less – in several cases many times less – than the original proposal. The energy charge of $0.45 / kWh is somewhat greater, but by the time of this tariff approval, fuel prices had already increased from the assumed $1 / liter. In fact, this same level of energy charge would remain in place until October 2007 when a new base energy charge was set to a level equivalent to the then-current $1.20 / liter[50].

From these points we can conclude that the tariff approved in October 2006 certainly did not recover the "requested" level of fixed operating costs through its fixed cost component, and probably did not recover

[48] Ref 3 p 6
[49] Ref 3 p 6
[50] Ref 12, Annex 9, p 8

full fuel costs via its energy component. **Thus, the initially approved tariff was effectively below the already-below-full-cost tariff proposed in the "Scenario 1" of NRECA's tariff analysis.**

As noted above, the energy component of the original tariff was adjusted in October 2007, though fuel costs continued to increase following that adjustment. In February 2008, a "fuel adjustment" mechanism was put in place to (at least in theory) allow YECO to true up the energy charge to each month's actual cost. Thus, only from about February 2008 forward would YECO's tariffs be able to keep up with the steadily increasing price of fuel. On the fixed cost side, however, no changes were made (apart from introducing a higher fixed charge for 1 customer – Gemtel), doubtless leaving the overall tariff still below the full economic cost of service (even on a non-profit basis, and even compared to the already-below-cost tariff proposed with the equivalent of 50 year amortization periods for equipment).

We note also that in November 2007, two surcharges (both of which had both a fixed and variable cost component) were added to the tariff to provide for collection of street lighting and public service customers' bills. These surcharges did not make the intended level of tariff recovery "higher" for YECO; they simply rearranged who was paying for the services consumed by street lighting and public service customers. The effect of these surcharges as a burden on paying customers – particularly smaller customers – is noted in a discussion below.

Full YECO Financial Statements and separation of costs by function are not yet available at the time of writing of this report.

Much of the above discussion is based on segments of YECO financial information. We believe that the information we have acquired is adequate for the analysis we have done, and especially to draw the conclusions which we have drawn. However, we note that full YECO balance sheet and income items are not complete yet. NRECA advises that they are "still working on the asset value of the distribution system, power plant, and labor cost for the distribution system.[51]" Thus the derivation of a precise full cost recovery tariff[52] is problematic at the present time, and it is also not possible at the present time to separate out specific costs attributable to generation / distribution / retailing & customer service etc.

Sponsor investment in YECO per consumer is very high

From the Sponsor's point of view the cost of customer served at the project completion date is very high. While the number of beneficiaries far exceeds the number of customers, the ability of the utility to operate is predicated on paying customers, particularly so since replicating this project elsewhere is under consideration as are possible alternatives. Taking the original targeted number of customers and the final number of customers, and dividing by the original SSREP budget and the final SSREP budget (each less the non Yei expenditures) respectively, the budgeted and actual costs per customer were derived.

[51] From: "Excerpts from Final Report and Questions – NRECA Response", May 15, 2008

[52] I.e., one which reflects the full economic costs of providing service – including full operating costs as well as capital-related charges (i.e., depreciation of physical assets and amortisation of other investment or properly included start-up costs)

Table 10: Estimate of YECO Investment per Customer Served

Customers Connected	Total
Target	693
Actual at 3/31/2008	380
Budgeted Investment per Customer Served	$4,787.15
Actual Investment per Customer Served	$13,997.38

Sources: Third Quarterly Report, Annex, Tariff Options and Subsidy Implications for Yei and other Communities in Southern Sudan – Table I Load Projection Yei Utility; and calculation based on "Eleventh Quarterly Report - Southern Sudan Rural Electrification Project -January through March 2008", Table 3. Summary of estimated expenditures for SSREP.

Under the current tariff, energy (fuel) charges dominate customers' bills. This disabuses the commonly-held belief that growth in customer numbers alone can significantly reduce customers' bills.

The current tariff[53] includes a monthly fixed charge (4.20 Sudanese pound / month) for all customers (apart from the largest 3-phase industrial customers) and a 1.085 SDG/ kWh energy charge. It also includes additional charges relating to the collection of bad debts of non-paying customers (Street Lighting and Public Services).

Under this tariff, an average commercial customer consuming 110 kWh / month would be presented with a monthly bill of approximately 152 SDG, as set out in the table below.

Table 11: Example of Current Tariff Charges for a Typical (110 kWh / month) Commercial Customer (all values in Sudanese Pounds)

Fixed Charges	SDG Total	Percent of Total Invoice
Basic (SDG / Month)	4.20	
Street Light (SDG / Month)	8.00	
Public Service (SDG / Month)	10.00	
Total – Fixed Charges	22.20	14.6%
Energy (Variable) Charges		
Basic + Fuel Adj @ SDG 1.085 / kWh	119.35	
Str Light + PS Adj @ SDG 0.0945 / kWh	10.395	
Total – Energy (Variable) Charges	129.745	85.4%
Total Invoice	151.945	100%

As can be seen from the table, the invoice comprises approximately 85% variable (energy-related) costs and only about 15% fixed costs. It is true that an increase of customer numbers would allow the utility to recover its fixed costs over a larger consumer base, reducing the fixed charge to each customer (presuming that the utility wishes to collect the same level of fixed charges). If we ignore for the moment the fact that increasing customer numbers will increase overall fixed costs which need to be collected (if only due to the new investment and maintenance costs of the new connections), then we could see that doubling the number of customers would result in halving the fixed charge to each customer. Unfortunately, because customers' bills are energy-dominated, this does not result in halving the overall

[53] see Ref 12, Annex 9, p 8

customer's bill – in the example above, a 50% reduction in fixed costs (which would be a generous estimate of the effect of doubling customer numbers, itself a significant achievement) would reduce the total bill by only 7.3%.

Tariff surcharges related to non-paying customers hit the smallest customers hardest

The above table serves to illustrate another important point. This point is related to the manner in which YECO is collecting the costs of serving non-paying customers (Street Lighting and Public Services; see discussion below as well) from paying customers. For the commercial customer in the example above, these extra charges (which appear partially in the fixed charges and partially in the energy charges) amount to 18.7% of the customer's bill. This alone is a significant impact. However, for a smaller customer, the impact is greater still. For example, for a typical residential customer consuming 73 kWh per month, the increase in cost to the customer is 24% of his invoice; at the small end of residential consumption, the burden is greater still. This suggests that the mechanism employed by YECO places the largest proportional burden on the smallest customers – who are likely to be those with the least ability to pay.

Collections are quite good, except for certain public services, which collectively represent large usage.

There are collection problems from certain Government accounts, though other accounts apparently showed better commercial discipline. Problems with collections from Government accounts (for service to Government buildings and also for street lighting) were first noted in the 2nd quarter of 2006, and generally appears to have continued throughout the project. NRECA attempted to resolve this issue through negotiation with the Government over the course of the project, but by project completion, the issue had apparently not been satisfactorily resolved.

In the Project Completion Report[54] , NRECA summarised the situation:

> In addition to the lower than anticipated total sales, revenue has been impacted by other factors as well. The County has not been consistent in paying for streetlights and electricity provided for their own use. As of 1st September 2007, the unpaid electric street lighting bill was in excess of US $45,000.[55]

Also, in NRECA's final quarterly report (for the Quarter ended March 2008), roughly coincident with timing of the above quotation, NRECA noted:

> Continuing payment difficulties with County offices and the traffic police was resolved in March after service was disconnected. However, the hospital's pattern of ignoring billing requests continued, and decisions with regard to payment for street lighting have not yet been resolved.[56]

As noted above, the most recent tariff in place in Yei today imposes a surcharge in order to collect old bad debts and continuing non-payments (from Street Lighting and the Hospital) from other (paying) customers. Reports from Yei indicate that "customers are furious" at this development.[57] The tariff surcharge is substantial: it increases the monthly fixed charge paid by all consumers by about a factor of

[54] Ref 12
[55] Reference 12, Annex 9, p 3
[56] Ref 11, p 5
[57] Email from Myk Manon to Sam Taddesse, 14 May 2008.

5, and further adds 10% to energy (per-kWh) charges.[58] We note also that NRECA describes the current situation with the County and the Police as persistent "slow payers".[59]

The collection experience with other customers can be inferred to be significantly better than with the Government sector. In their final report, NRECA cites overall collection rates as "over 95%"[60] and attributes this to "aggressive commercial practices that have included prompt disconnections on those occasions when consumers have failed to pay bills".[61]

Customers are generally pleased with the Service. However many are unhappy with the approach to paying for public use (Street Lighting and Hospital), and most seem to not yet fully understand the Cooperative concept.

The team interviewed seven customers in Yei. These ranged from very small (e.g., a battery-charging kiosk consuming about 20kWh / month), to the largest (Gemtel, consuming about one-third of all of YECO's output). All agreed that the electricity service was good and power quality high. All also felt the price to be very high, though for most (not all), it was still viewed as either cheaper and / or more convenient than running their own small-scale generators.

There were many comments noting unhappiness at the surcharges for Street Lighting and the Hospital. Several customers did not understand the source of the surcharges, and most did not understand the organisational and institutional characteristics of the cooperative arrangement. Regarding the latter, we note that NRECA has attempted some education though newsletters printed on the reverse of customer bills, through several radio talk events, and through one unfortunately poorly-attended public meeting.[62]

Signs of Customer Abuse are Already Beginning to Appear

NRECA and YECO are justifiably proud of their relatively low rate of energy losses; this is currently estimated as only 2.5% of energy for total (i.e., technical plus any commercial) losses (Ref Interview 5). This low ratio indicates that there is little, if any, "commercial loss" – for example, with illegal direct connections to the system, or bypassing of meters.

However, during the visit to Yei, the team noted (indeed, NRECA staff pointed out) several instances where a properly connected customer had provided a further sub-connection, typically to one or more neighbours. These appeared in both residential and (several) commercial connections; in at least one instance, home-made poles had been constructed to carry wires across streets.

This sort of activity causes several problems, including fostering low quality and possibly unsafe electrical connections, and depriving NRECA / YECO of legitimate connection fees and monthly fixed charges of providing service. We were surprised to learn that NRECA / YECO is apparently not at this time pursuing an aggressive policy to curb this practice, even though it was NRECA staff who described the practice as "not unusual and becoming more common". We note that with the fairly recent addition of the hospital / street lighting surcharges, there will be an increased incentive (particularly among smaller users) to use this practice.[63]

[58] Ref 12, Interview 5
[59] Ref 5, 6, 14
[60] Reference 13, p 17
[61] Reference 13, p 17
[62] Reference Interviews 5 – 13
[63] Ref: Conversations with NRECA staff during Yei visit; see also photographs taken during Yei visit.

3.5 Principal Findings Relevant to EQ5: Replicability

3.5.1 The Feasibility Studies generally indicate that YECO can be replicated from a technical point of view, though questions remain whether the logistical experience of YECO has been fully reflected.

The Feasibility Studies were completed before YECO results were known. From a purely technical point of view their conclusions can, by implication, by an endorsement of the notion of YECO Replicability, but we would caution that the Yei utility is a very small scale project in comparison to the ambitious timetable and penetration rates set forth in the Feasibility Studies. In retrospect, the YECO project is not supportive of the timetables and penetration rates set forth in the Studies. Also, the technical obstacles experienced by Yei – delays in procurement due to transport and non-availability of equipment in local markets -will be exacerbated by the logistical challenges posed as more and larger projects are attempted. The construction of YECO is not directly scalable technically to larger projects or multiple projects which together are larger than YECO.

3.5.2 Other considerations, including those related USG Goals and Costs / Economic Sustainability and Alternative Options will be additional factor for consideration in answering the question of whether YECO should be replicated in any specific location.

We do not discuss these points here, but we note that in our Conclusions related to the Evaluation Questions, these additional factors will play a role.

3.6 Principal Findings Relevant to EQ6: Alternative Options

3.6.1 NRECA's Feasibility Studies do not appear to evaluate a broad range of alternatives. They further rely on strong assumptions regarding the availability of capital and operating grants, and probably do not fully incorporate all the lessons learned from the YECO pilot.

NRECA's feasibility studies were oriented toward evaluating only diesel based generation projects, rather than evaluating a range of choices, including smaller scale micro nets or stand-alone generation.[64] Generation options considered included only diesel options. The approach taken in financial analysis of the feasibility studies appears to assume that a full direct grant covering all capital expenditures of the system would be provided, and tariffs would be structured to allow only a small level (less than standard amortisation) of system replacement costs. . Other analytical assumptions, such as system consumption figures and connection rates appeared to be generally overly optimistic in light of the Yei experience. The reports then typically conclude that with a calculated level of fuel subsidy (e.g., for Malakai, 66% with diesel priced at $ 1 / liter), the operations could be financially sustainable.

We note also that it appears likely that the Feasibility Studies do not reflect the full extent of learning from the Yei project in terms of commercial and operational factors – including for example materials

[64] In comments on the draft version of this report, both the USAID CTO and NRECA pointed out that GOSS had apparently requested consideration of only "YECO-like" diesel-fueled options in the feasibility studies. The Feasibility Studies therefore would appear to be responsive to GOSS's requests, but the Evaluation Team observes that it would appear that there has been no further, broader look at alternative options. We note that the Scope of Work for this Evaluation Report has specifically asked whether options in addition to diesel (e.g., solar, etc) were considered.

costs, uptake of customers, etc. At least part of this is naturally due to the timing of the studies, which were begun (and finished) well prior to the full assimilation of learning from the Yei pilot project.[65]

We note also that the lack of consideration of other alternatives – for both generation options (e.g., solar / battery, or small scale hydro, if available) and distribution organisation – makes the studies rather limited. The fact that the authors assume full capital grants for all capital expenditures in addition to fuel subsidies would certainly make the evaluations of other options more interesting. In any case, the conclusion of the Feasibility Studies – that a distribution system can be financially viable – needs to be read with the understanding that such conclusion depends on the provision of substantial subsidies, and also that alternatives to a Yei-like rural distribution system powered by diesel have not been tested.

3.7 Principal Findings Relevant to EQ7: Project Value

3.7.1 There were many project beneficiaries

The definition of beneficiaries extends beyond the simple number of connected customers in Yei to include a broader population. In Yei, the quantity of beneficiaries is comprised of two subtotals: beneficiaries of street-lighting and beneficiaries from discrete metered services. The later is totaled up from estimates made for each service, at the time of installation. Currently it is estimated that there are more than 9,000 individual beneficiaries of electric power in Yei[66].

In addition to this estimate, in cases where public services have improved through electrification, the users of those services would presumably also indirectly benefit. To the extent to which electrification has assisted in "jump starting" commercial activity, there would also possibly be further indirect beneficiaries due possibly to increases in employment or also increased consumer surplus derived from increased commerce.

3.7.2 Other considerations, including those related USG Goals and Costs / Economic Sustainability and Alternative Options will be additional factors for consideration in answering the question of "Project Value"

We do not discuss these points here, but we note that in our Conclusions related to the Evaluation Questions, these additional factors will play a role.

3.8 Principal Findings Relevant to EQ8: Lessons Learned

Several of the "findings" discussed above could also serve as individual "lessons learned" from this work. In the sections below, we note additional lessons / observations which do not fit easily into the Evaluation Question / Findings framework set out above.

[65] Ref Interview 5; email (with response to written questions) from F. Mills 15 May. We note that subsequent to this referenced input, in written comments (see comments transmitted with B. Magaya 5 June 2008 email), NRECA has asserted that material cost estimates (at least) based on Yei experience were incorporated into the Feasibility Studies (a claim which would slightly contradict some of the information previously provided by NRECA staff). Regardless of the actual position relative to material costs, it would be obvious simply from the timing of the studies that all of the Yei experience could not be incorporated into the studies.

[66] From: NRECA "Southern Sudan Rural Electrification Project - Project Completion Report for Yei Electric - Generation/Distribution Component", Annex 9, Page 1

3.8.1 Local Material Quality was not as Good as NRECA's Desired Standard

NRECA found that local materials frequently did not meet their desired quality standards. Their experience obtaining timber poles for power lines in particular appears to have cost a great deal of effort, time and quite possibly money to solve. To summarise this experience:

> After finding a local supplier (TTI) of treated timber poles and entering into a contract in August 2005, persistent problems emerged. NRECA worked with the supplier to improve quality throughout 2006 (including issuing a second purchase contract in March 2006), but finally ended the relationship and found a different local supplier (the treatment plant owned by the Ugandan local utility) sometime after January 2007. During this time, NRECA was apparently forced to actually import timber poles from the United States for some brief period of time.[67]

In addition to the problems with timber poles, NRECA found deficiencies in local insulated wire, street lights and even nuts and bolts.[68]

3.8.2 The "Design & Build While Connecting" approach worked well and facilitated quicker operations / customer uptake than the original plan

The original concept of NRECA's work in Yei apparently was based around a plan to design both the street lighting system and at least the beginnings of the customer distribution network, to then build that initial system, and then to begin to sign up customers and provide service.

In fact, the realized plan had more of a character of building a (perhaps limited) initial street lighting circuit, energizing and operating it, and then building out the beginnings of the distribution network and connecting and serving customers "on the fly" as the network was being built. This quickened pace was at least in part due to the demand for an extremely accelerated pace of initial operation of the street lighting circuit. After the fact, NRECA staff assessed the accelerated approach as a success, citing that among other things it quickened the uptake of service among consumers and also hastened the acceptance of the project as a valuable and "real" service. It was felt that any additional engineering complexities introduction of the "combined" (rather than step-by-step) approach were outweighed by these benefits.[69]

3.8.3 Good coordination between the real-time needs of the on-site work and the funding source is essential

Good coordination between the real-time needs of the on-site work and the home office as well as the funding source is essential to avoid project delays, to avoid incurring unnecessary costs due to delays, and to use labor and management resources efficiently.

In an interview with Mr. Myk Manon, he related his view that more timely action on procurement requests would reduce delays. The example he gave was that he had requested gensets in June 2006 and they were only procured in June 2007 and arrived on site in March 2008. He explained the delay as resulting from "a different point of view between the home office and the field". Additionally he explained that there was a six month "debate" between NRECA and USAID over additional funds, which had the effect of slowing the project down.[70]

[67] Ref 12 pp 2 –4
[68] Ref 12 p 5; see also Ref 2 p 3
[69] Ref 1, pp 2-3; Interview 5
[70] Ref Interview 5

4. EVALUATION QUESTIONS – CONCLUSIONS

In this section, we provide summaries of our views in the form of Conclusions for each of the Evaluation Questions. We have based these conclusions on the Findings in the above Section. In some cases, the above Findings have provided input to more than one Evaluation Question.

4.1.1 **EQ1: US Objectives**: Does the project support overall USAID / USG Sudan goals? In particular,

Does it help legitimise the Government of South Sudan?
Does it provide a "peace dividend" (e.g., improved security due to street lighting)

The project in Yei brought significant dividends to Yei in terms of improved security and other public benefits. It also materially contributed to helping "jump start" Yei's economy.

GOSS has benefited from being seen as (at least) a significant partner or a leader in bringing these accomplishments to Yei. Also, GOSS has made use of the project's policy initiatives to assist it in executing its role in sector policy leadership.

4.1.2 **Defined Project Objectives:** Did the project itself achieve its stated objectives? Was the process used by the Implementation Partner (NRECA) adequate in terms of planning and responsiveness to meet these objectives, particularly in the face of changing facts on the ground?

We note that the objectives for NRECA broadly can be categorised into three areas[71]:

1. Electrification in Yei: This includes two separately-identified objectives: the introduction and provision of street lighting as a security measure in Yei, and the provision of reliable and affordable electricity to facilitate commercial business operations and development in Yei
2. Feasibility studies for electrification of other Southern Sudanese towns
3. Technical support and capacity building for Juba electric utility and GOSS electrification programme

The project accomplished:

(1) Street Lighting in Yei

(2) Electrification in Yei, though few customers than the original target (700) were connected

(3) Feasibility Studies

(4) Technical Assistance to the Juba Utility, and, eventually, to GOSS

The technical accomplishment of these tasks – particularly the efforts in Yei – was achieved under extremely difficult circumstances. NRECA's technical achievements are to be admired and their proven ability to adapt their timetable and efforts to changing circumstances was a valuable contribution to the project.

[71] See, e.g., the Scope of Work for this Evaluation, p. 3; also Ref 1, 11

4.1.3 **Gender Issues:** What was the project's gender impact? To what extent did the project address the differing needs of men and women? How is NRECA defining and addressing gender equity?

NRECA did not have a written gender strategy, but was sensitive to women issues from the start of its work: It tracked gender involvement and made extra recruitment efforts.

In the commercial sector, it serves a representative cross-section of female-owned enterprises. Direct employment of females is somewhat low, though this is not terribly surprising.

4.1.4 **Cost and Economic Sustainability:** Were the cost levels of the project high or low? Is the cost of power affordable for consumers? Does the tariff reflect full costs and will it lead to a financially sustainable utility?

The costs of the Yei project were higher than expected.

Current tariffs (which already reflect a substantial capital subsidy) are not long-run sustainable for YECO, and current operating results cause some concern for near term financial stability as well.

4.1.5 **Replicability:** Is the approach taken in Yei suitable for replication or expansion?

The project is probably replicable from a technical point of view, though the "lessons learned" from logistical problems in Yei should be considered closely. Whether and where it might be replicated will depend on a more thorough examination of consumer uptake, costs and commercial viability, subsidy policy, and alternative options.

4.1.6 **Alternative Options:** Do the feasibility studies (or other documents etc) suggest that alternative options such as solar / hydro etc might be better options in special circumstances?

The Feasibility Studies do not generally consider options apart from diesel-generation and YECO-like central distribution systems. They make strong (and untested) assumptions regarding the availability and implementation of capital and operating subsidies. Given when they were prepared, they also do not fully include the learning experience from Yei on costs and consumer uptake.

4.1.7 **Project Value:** Was the project Value for Money? Were the Technical Assistance portions of the project well received and utilized? Was the electrification of Yei accomplished efficiently in terms of cost and was it the best way to serve consumers?

The Yei portion of the project provided significant "public good" benefits by introducing street lighting and providing service to the hospital. The overall cost of providing services to the (relatively few) consumers however was high. Consideration should be given to evaluating alternative organizational or subsidy arrangements which might achieve the public benefits results more effectively in other towns or rural areas, particularly those with lower population densities.

The other technical assistance parts of the project show mixed results. The GOSS policy work was successful and continues to be actively built upon by GOSS. The assistance to the Juba utility was not immediately taken up. The feasibility studies will be useful from a technical point of view, but probably need a more refined economic / commercial analysis.

4.1.8 **Other Lessons Learned:** Were there key Success and Failure Stories, or examples of Best and Worst Practices?

These have been described in Section 3.

5. RECOMMENDATIONS

These are forward-looking recommendations based on a combination of the Findings and Conclusions made in the above sections, together with the authors' combined experience with utility, infrastructure, and development issues in literally dozens of developing and transition economies.

1. A comprehensive Country-wide Electrification Plan should be developed and realistically costed.

2. As part of the development of this Plan, the Feasibility Studies should be updated incorporating lessons learned from YECO in order to develop a more up-to-date and coherent analysis re-addressing issues such as willingness to pay, quantities of energy demanded at various tariff levels, tariffs, subsidies and utility financial viability.

3. GOSS should decide, together with donors, if, how, and to what extent to fund (e.g., through subsidy or otherwise) the capital and / or operating costs of the programs so identified.[72]

4. GOSS should develop budgetary mechanisms to channel funds to institutions of government (police, hospitals, counties, etc) to pay for services provided them by utilities.

5. Tariffs should be fully cost reflective, i.e. including amortization of capital equipment regardless of the source of funds, and should any reflect subsidies In the interest of transparency and to aid in planning and developing utility services.

6. The issue of YECO long-run financial sustainability should be addressed, either through a well-considered tariff adjustment, a subsidy, or other means.

7. Any future new distribution network should not proceed until there is a well linked WTP analysis which shows the quantity of energy expected to be sold at various prices, linked to a commercial viability study (taking into account subsidies) for the proposed operating entity

8. Alternative, smaller scale options (e.g., micro-nets or stand-alone small scale generation (either diesel or solar / battery) should be considered for areas "remote" from cities. Where cities themselves can only barely (or not at all) support viable "YECO-like" structures, then "remote" is not very far away at all. Alternative organisational options, including those which separate the provision of "public good" services from more commercial services should also be considered.

9. USAID should continue to support YECO, by authorizing a needs assessment. We would expect the areas to be examined would include:

[72] In comments provided on the draft version of this report, the USAID CTO has asserted that "GOSS / MHLPU has affirmed their commitment to include in the next budget subsidy amounts to support Yei and other similar projects funded by USAID". This might be an important factor in improving YECO's financial sustainability. However, at the time of writing of this report, no specific details of any subsidy scheme were available, and of course the Evaluation Questions have focused on the current state of YECO. We also note of course that the implementation of subsidy mechanisms presents complex policy and economic issues which will be need to be addressed if such subsidies become available in the future.

- Training for the Members of the Board in Utility governance
- Training in revenue protection – particularly to prevent customer abusive behaviour toward the system.
- Customer outreach and education – i.e. the customer as Co-op owner
- Programs to empower women as consumers
- Consideration of smaller scale solutions for more remote areas – include in YECO's area – such as mini hydro, micro-nets, solar, etc.
    - There is an immediate need for YECO but the programs should be designed and developed so as to be able to rolled-out.

10. USAID should consider facilitating the use of its microfinance program to assist the uptake of smaller scale options as well as programs targeted at building load for current and future YECO consumers.

11. Any future build-out of larger scale options should preferably be coordinated to overcome some of the procurement problems faced by faced by NRECA through the development of a centralized logistics and procurement office in New Sudan.

12. USAID should consider if it is possible to pool the regional knowledge / experience base in order to better identify an adequate set of local suppliers for materials. If necessary, a survey of existing large-scale and small-scale regional utilities might be undertaken.

13. The legal framework should adequately address the ability of utilities / cooperatives to aggressively pursue customer abuse and theft. YECO should be encouraged to begin to address customer abuse now.

ANNEX 1: INTERVIEW LISTING

Interview 1: Mr Boutros Magaya (check spelling), Mr Lance During, USAID

Interview 2: Eng. Samuel Taban, Director of Power Supply, Ministry of Housing & Public Utilities

Interview 3: Eng. Raymond Pitya, Undersecretary, Ministry of Housing & Public Utilities

Interview 4: Mr. Lewis Gore George, Director General Infrastructure, Central Equatorial State

Interview 5: Mr Myk Manon, NRECA

Interview 6: Mr Ben Alel, YECO General Manager

Interview 7: C&A Photo Printing (YECO Customer)

Interview 8: Gemtel (YECO Customer)

Interview 9: Kolondiro Guest House (YECO Customer)

Interview 10: Red Sea Hotel (YECO Customer)

Interview 11: Small Kiosk (YECO Customer)

Interview 12: Mobil Phone / Battery Charging Kiosk (YECO Customer)

Interview 13: Danish Refugee Council NGO (YECO Customer)

Interview 14: D. Moses, Yei County Executive Director, Yei County Engineer, Eng. S. Taban, Four (of five) YECO interim board members

ANNEX 2: DOCUMENT REFERENCES

Documents referred to in various citations throughout this report include:

"First Quarterly Report, Southern Sudan Electrification Project" July – September 2005; NRECA International Ltd

"Second Quarterly Report, Southern Sudan Electrification Project" October -- December 2005; NRECA International Ltd

"Third Quarterly Report, Southern Sudan Electrification Project" January – March 2006; NRECA International Ltd

"Fourth Quarterly Report, Southern Sudan Electrification Project" April – June 2006; NRECA International Ltd

"Fifth Quarterly Report, Southern Sudan Electrification Project" July – September 2006; NRECA International Ltd

"Sixth Quarterly Report, Southern Sudan Electrification Project" October -- December 2006; NRECA International Ltd

"Seventh Quarterly Report, Southern Sudan Electrification Project" January – March 2007; NRECA International Ltd

"Eighth Quarterly Report, Southern Sudan Electrification Project" April --June 2007; NRECA International Ltd

"Ninth Quarterly Report, Southern Sudan Electrification Project" July – September 2007; NRECA International Ltd

"Tenth Quarterly Report, Southern Sudan Electrification Project" October – December 2007; NRECA International Ltd

"Eleventh Quarterly Report, Southern Sudan Electrification Project" January – March 2008; NRECA International Ltd

"Southern Sudan Electrification Project, Project Completion Report for Yei Electric Generation / Distribution Component" March 28, 2008, NRECA International Ltd

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ANNEX 3: BACKGROUND OF THE AUTHORS

Thomas J. Sherwood: Mr. Sherwood is a financing specialist whose expertise includes leadership roles in structuring Public Private Partnerships, international project finance (electricity, oil and gas), investment banking and international credit markets (euro-bond issues, municipal bond issues, corporate new issues), corporate banking, venture capital (fund raising, security issuance, investment selection, and new venture management), international business formation and promotion, management of technology transfer, and management of energy company operations. Mr. Sherwood has 35 years of professional experience and has spent over 25 years living and working in West, Central and East Africa, S.E. Asia, the Middle East, the Caucasus, and Central and Southern Europe. Mr. Sherwood has an undergraduate degree in Industrial engineering and an MBA in Finance, both from Columbia University.

Kirby Owen has been an advisor to both private-sector and public-sector clients in the areas of energy and infrastructure economics, regulation and competition policy for over twenty-five years. Much of his recent work has been in the area of energy sector restructuring, regulatory reform and privatization within both European Union member states and in developing / transitional economies. He has advised senior level Government officials, business leaders, lending institutions, development agencies and others on a wide variety of issues world-wide.

In developing / transitional economies, Mr. Owen has worked at a senior level in over two dozen countries, ranging from Central and Eastern Europe to Central and Southern Asia to the Far East. He has advised on energy sector policy as well as regulation and social protection in virtually all of these countries. He has also served as arbitrator in privatization disputes. .

Mr. Owen holds a BSc (*summa cum laude*) in Mechanical Engineering (Lehigh University), an MSc in Engineering and Applied Sciences (concentration in Physical Chemistry, Northwestern University) and an MSc in Management (concentrations in Economics and Finance, Sloan School of Management, MIT).