PD-ABS-088

PROJECT ASSISTANCE COMPLETION REPORT

HURGHADA GAS TURBINE REFURBISHMENT

USAID GRANT 263-0215.03

PROJECT ASSISTANCE COMPLETION REPORT

HURGHADA GAS TURBINE REFURBISHMENT

GRANT No 263-0215 03

This Project Assistance Completion Report (PACR) has been prepared in accordance with the requirements of USAID Handbook 3, Appendix 14A, and Mission Order 201 dated May 10 1998, Item 51

1 PROJECT PURPOSE AND DESCRIPTION

The Hurghada Gas Turbine Refurbishment Project is a component of AID's Power Sector Support Project-I (PSSP-I) The PSSP-I consists of eight separate infrastructure projects designed to support the Government of Egypt (GOE) in its movement towards economic pricing of electricity through the provision of additional generation and the refurbishment of existing generation needed to ensure a reliable power system The goal is to promote continued GOE progress in reducing electricity sector subsidies and in making other energy sector policy changes by providing capital infrastructure incentives to the GOE

The purpose of this component of the project was to finance the relocation of three gas turbines from existing power plants to a new site near Hurghada AID financing would also cover the installation, refurbishing and repair, and re-commissioning at Hurghada

The new plant is located on the Red Sea coast between Magawish and the city of Hurghada AID funded several aspects of this project with the remainder of the costs being borne by the Egyptian Electricity Authority (EEA)

In 1988 the EEA commenced planning to augment the existing electrical supply facility at Hurghada This consisted of four 5MW gas turbine generators The plant was no longer able to meet demand in the area and, due to its age and maintenance requirements, was experiencing availability problems Hotel owners in the area had resorted to the installation of their own diesel generators to ensure

adequate and uninterrupted power supplies The cost of fuel for these generators was being subsidized by the GOE The subsidy was due to be phased out in 1995, at which time the cost of the energy produced would exceed the cost of purchasing it from EEA

The four existing 5MW turbines were installed between 1982 and 1987 to meet the growth in electricity demand in an area that was undergoing development as a major tourist destination These units were derated to nearly 80% of their nameplate rating due to high ambient air temperatures in the peak load summer months

In order to meet the rapid growth in demand EEA proposed to move three 24MW gas turbine generators that were no longer required at their existing locations, and put them back into service in Hurghada AID agreed to provide funds under the PSSP-I for the following

- A technical services contract between K&M Engineering and Consulting Corporation and AID to assist EEA (Canal Zone), the Owner and Project Manager, with the Engineering and Project Management of the Hurghada project

- A Host Country Contract between EEA and General Electric Technical Service Co (GETSCO) to provide technical services, spare parts and equipment, and training for the refurbishment, re-commissioning, and operation of the three turbines

The GETSCO contract included a CIF fixed price for parts and materials, and a unit price for technical support AID authorized EEA to negotiate a contract with GE who was the original manufacturer and installer of the three units to be refurbished

GETSCO were contracted to provide technical support to the EEA workforce who would perform the actual relocation and refurbishment of the turbines The GETSCO technical scope of work was limited to providing support to EEA in the disassembly of the three units at their original locations, installation at Hurghada, and the modification, overhaul, and commissioning at the new plant

Based on visual inspections of the turbines, and their experience with the maintenance and spare part replacements

normally required for units of this type and age, GETSCO produced a list of all necessary replacement parts, materials and equipment to bring the turbines back into commercial operation Purchase and shipping of these parts was included in the GETSCO contract

EEA were responsible for funding and managing the following work

- Dismantling the turbines and transporting them from their existing locations at El Fayoum, Cairo, and Abu El Matamir to the new site at Hurghada

- Construction of all Civil, Mechanical, and Electrical installations needed to support the turbines operation in their new location

EEA utilized the services of one of its own companies, Hydelico, to perform the civil works, site development, and relocation works under a direct contract with EEA

K&M Consultants provided technical services to EEA for

- The review of drawings, designs, and technical specifications
- Project coordination among the various parties involved in the project
- Witness and review of tests and inspections
- Technical surveillance, and progress and expenditure reviews

The expected results form this project were an increase in the EEA generating capacity in the Hurghada area to a level that would permit hotel operators to retire their privately operated diesel generators In addition, EEA was expected to increase electricity prices charged to consumers and reduce its tariff subsidy as a result of the completion of this and other capital infrastructure projects within the Power Sector Support Project-I

2 SUMMARY OF CONTRIBUTIONS (HOST COUNTRY AND AID)

The PSSP-I was obligated in September 1989 at which time the cost of the Hurghada Gas Turbine Refurbishment Project was estimated as shown in Table 1 In addition to the cash sums shown, the budget cost included a GOE in kind contribution of LE12M

ESTIMATED TOTAL COST $7 93M LE1 3M

PLANNED SOURCES OF FUNDING		
	PLANNED	ACTUAL
AID $	7,930,000	14,727,658
GOE LE	1,300,000	1,300,000[1]

TABLE 1

The initial budget for this project, as set forth in the PSSP-I Project Paper is shown in Table 2

INITIAL PROJECT BUDGET (from PSSP-I Project Paper)		
	FOREIGN ($ M)	LOCAL (LE M)
CONSULTANT SERVICES (K&M)	0 6	
EQUIPMENT/INSTALLATION	7 3	1 3
AUDIT	0 03	
Total	**7 93**	**1 3**

TABLE 2

The original contract was amended five times Four amendments covered the purchase of additional parts that were found to be required after the turbines were dismantled, and additional training

[1] Records for LE expenditures on the GETSCO contract are not available Discussions with personnel familiar with this project indicate that all the budgeted LE funds were expended during the life of the project

A second contract was negotiated with GETSCO, initially for one additional gas turbine, and then amended to include the fifth unit The final project budget, as detailed in the PSSP-I Grant Agreement, Amendment 7, Revision 3, is presented in Table 3 Funds were transferred to the Hurghada Gas Turbine Refurbishment Project from the Commodities component of the PSSP-I to cover the cost of the second contract

The actual utilization of funds throughout the project (including additional funds committed during the life of the project) is shown in Table 4

FINAL PROJECT BUDGET		
	FOREIGN ($ M)	LOCAL (LE M)
CONSULTANT SERVICES (K&M)	1 28	
EQUIPMENT/INSTALLATION	13 75	1 3
AUDIT	0 03	
Total	**15 05**	**1 3**

TABLE 3

Actual Utilization of Funds		
	FOREIGN $	LOCAL LE
CONSULTANT SERVICES (K&M)	1,240,535	
EQUIPMENT/INSTALLATION	13,487,123	1,300,000
AUDIT	0	
Total	**14,727,658**	**1,300,000**

TABLE 4

3 PROJECT HISTORY AND BACKGROUND

Contract 1

By 1988 the EEA had determined the need for additional generating capacity in the Hurghada area The demand, fueled by the development of the area as a tourist resort, far exceeded the limited capacity in place at this time The fuel subsidy provided by the GOE to the hotels was going to end in 1995, and reliable power supplies had to be provided by the EEA before then

The project called for the relocation of three existing gas turbine generators from EEA plants in El Fayoum, Cairo, and Abu El Matamir, to a new plant outside the city of Hurghada There they would be refurbished and repaired prior to being placed in service

The three units were nominally rated at 24MW but, given the ambient summer air temperatures in Hurghada, the expected output was estimate to be 17MW each

The PSSP-I Project Paper was authorized in September 1989 $7 93M was obligated for the Hurghada Gas Turbine Refurbishment Project under grant agreement 263 0215 The PSSP-I Project Paper included a procurement waiver permitting EEA to proceed with the non-competitive procurement of services from GE for the renovation of three gas turbines and subsequent installation at Hurghada This was justified because the turbines to be renovated were manufactured and installed at their original locations by GE The Hurghada Gas Turbine Refurbishment Project would require the purchase and installation of proprietary parts and equipment only available from GE

In January 1990, K&M Engineering and Consulting Corporation were competitively selected to provide Consultant Services to EEA for the Hurghada Gas Turbine Refurbishment Project and two other components of the PSSP-I K&M performed these services under a direct contract with AID

The Host Country Contract between EEA and General Electric Technical Services Company (GETSCO) was approved by AID in May 1990 This included Contract Amendment #1, which incorporated AID's comments and revisions The breakdown of the GETSCO price for this contract and the subsequent Units 4 and 5 is detailed in Appendix A

GETSCO were responsible for providing technical support to the EEA workforce during the dismantling, relocation and refurbishment, and re-commissioning of the turbines Based on inspections and past experience they also identified and procured the parts necessary to bring the turbines back into operation Hydelico, a wholly owned subsidiary of EEA, were contracted directly by EEA to construct the civil, electrical, mechanical works required to house and operate the turbines at their new location Hydelico commenced work in November 1989 based on a Letter of Intent from EEA

One of the Requirements Precedent for this project was for the turbines to be fueled by Natural Gas from a field near Hurghada, soon to be developed by EGPC This development had recently been cancelled after it was determined that it was not viable The nearest alternative was the Ras Shukeir field, 140kM away The $20M pipeline needed to bring gas from this field to Hurghada had not yet been budgeted for, and would not be completed until mid 1993 at the earliest AID issued a waiver to this requirement and agreed that the plant could be run on low sulfur light oil until the gas pipeline was completed Having reached an agreement on this point, AID earmarked $7,635,699 for the project

Due to delays in the negotiation and approval of the GETSCO Host Country Contract, and in issuing the AID Letter of Commitment, a large part of the unit relocation and civil works were completed before GETSCO had signed a contract This had the effect of reducing the material procurement period from five months to almost zero and placed material delivery on the project critical path This also led to the cannibalization of the Cairo North turbine for minor items needed to bring the other two units on line as close as possible to the scheduled date

The El Fayoum unit was delivered to site and installed on its foundation in February 1990 This turbine was intact and had been used as a standby unit in El Fayoum Due to its age (14 yrs) it was recommended that a major overhaul be performed on the Turbine/Generator Control System New controls and cables were installed and the unit re-commissioned It was placed in hot standby mode during June 1990 to support the old Hurghada power station It was decided that the major overhaul items required for the

El Fayoum turbine would be completed once the other two units were on line

GETSCO monitored the relocation of the El Fayoum unit and provided foundation design data for all three units EEA did not utilize their services to monitor the relocation of the other two turbines

The Abu El Matamir unit had been out of commission for over two years and was delivered to Hurghada in February 1990 The general condition of the equipment required a thorough overhaul of the major components The control systems needed to be replaced due to corrosion of the panels and components

The turbine from the Cairo North plant arrived in Hurghada in May 1990 GETSCO carried out further inspection to this unit while it was being dismantled in Hurghada and recommended additional repairs and replacements Contract Amendment No 2 was approved in May 1991 and provided additional funding for repairs to Cairo North The amendment also took into account reductions in the costs of Turbine Rotor Repairs and Engineering Reviews The net cost of this amendment ($212,168 70) was funded from the contingency sum

A third amendment to GETSCO's contract was issued in August 1991 to cover additional parts for Cairo North and Abu El Matamir The amendment added an additional $28,491 to the contract cost and funds were transferred from the contingency sum to cover this Also included in this amendment was a six-month contract extension to cover the procurement of the additional parts, and delays caused by Gulf War disruption of sea transportation to the Gulf and surrounding areas The contract completion date was now extended to May 1992

Further amendments were approved by AID in August 1991 for additional repair parts (No 4), and October 1991 for recommended spares and additional on-site training (No 5) These were funded from the contingency item and by transferring unused funds from the "Services" line item in GETSCO's contract

Amendments to the first contract and their financial implications are detailed in Table 5

Amendment	US$		LE
	Contract Sum	Contingency	
Original Contract & Amendment #1	7,635,699 00	400,00 00	1,300,000
#2—Parts for Cairo North	7,847,867 70	187,831 30	1,300,000
#3—Parts for Cairo North & Abu El Matamir	7,876,358 70	159,340 30	1,300,000
#4—Additional Repair Parts	7,943,860 41	91,838 59	1,300,000
#5—Parts, Spares & Training	8,035,699 00	0 00	1,300,000

Total disbursements under original contract $7,741,596 54
Funds remaining for future allocation $294,202 46

TABLE 5

After each of the Gas Turbine units was completely repaired and refurbished a 200-hour continuous operation run was conducted to demonstrate its reliability The completion dates for each of these tests were

Abu El Matamir	8/28/91
Cairo North	10/27/91
El Fayoum	1/23/92

The contract expired on September 5, 1992 after all the spare parts were delivered

Contract 2

In 1993 AID received a request from EEA to fund a similar relocation and refurbishment project for a fourth gas turbine to be transferred from Helwan to Hurghada AID gave their approval in principal in June 1993 dependent on EEA submitting a technical and financial analysis to justify the project

After completion of the re-commissioning of the three original gas turbine units relocated under this project, the peak demand at Hurghada approached 22MW Demand was projected to exceed 46MW by mid 1996, due to new development and the migrating of existing hotels from private diesel generators to the public electricity supply

system This level of demand would require the continuous operation of all three units, with no spare capacity to cover breakdowns or maintenance

EEA provided AID with their technical and financial justification of the project, and in June 1994 AID authorized EEA to enter into non-competitive negotiations with GETSCO for the relocation and refurbishing of the Helwan gas turbine unit The draft contract was approved by AID in January 1995 The AID-funded portion of the project was $2,956,207, which was re-allocated from the Commodities item of the overall Power Sector Support Project

Hydelico had commenced their site works in December 1994 and proceeded with the turbine move in March 1995 Work progressed on the fourth unit without major incident and the 200-hour reliability test run was completed successfully on October 18, 1995

Before work had been completed on this turbine, estimates of the 1996 peak demand were again revised upwards to a figure of 60MW The total installed capacity to meet this projected summer peak demand would be 63MW once the fourth unit was brought on-line This left minimal reserve capacity and no units available for standby service

EEA identified another gas turbine unit at Helwan that was compatible with the four already moved to Hurghada and requested AID funding to put it into service at the new Hurghada power station AID approved a Waiver of Competition to permit EEA to negotiate once more with GETSCO for the relocation and refurbishment of this fifth unit

Amendment No 1 to the GETSCO contract for turbine #4 was approved by AID in December 1995, and $3M in additional funding was made available for the fifth turbine

Amendment No 1 also authorized the expenditure of the $150,000 Unit 4 Contingency on the following items

- $64,157 84 for additional spare parts for Unit 4
- $73,794 00 for the Automated Maintenance Program computer hardware
- $12,048 16 added to the contingency for Unit 5

Hydelico had started site work in October 1995 and the turbine was moved from Helwan at the end of February 1996 Following repair and re-commissioning, the unit passed its 200-hour reliability run in October 1996

GETSCO Contract 2 financing is shown in Table 6

Amendment	US$		LE
	Contract Sum	Prov Sum	
Contract 2	2,806,207 00	150,000 00	0
#1—Unit 5 and Additional Parts & Computers	5,809,838 84	146,368 16	0

Total disbursements under Contract 2 $5,745,526 46

TABLE 6

4 PROJECT ACHIEVEMENTS

The Hurghada Gas Turbine Refurbishment Project added an additional 85MW of generating capacity to the EEA generation system (allowing for reduced capacity due to high ambient summer temperatures) Initially, this power was available only to the Hurghada area to meet the steadily increasing demand from new developments Hurghada has been connected to the Unified Power System (UPS) since 1998, and now draws its power requirements from the national power grid

The six renovated 24MW gas turbines at Hurghada (five financed by AID and one by EEA) are presently used only in standby mode in case of surges in demand or plant outages elsewhere in the system This is because they have not yet been connected to the natural gas system, and are relatively expensive to run (using Solar) compared to other turbines that use natural gas However, EEA has applied for a natural gas connection for this plant To make this economically feasible, they plan to move six more similar turbines to Hurghada and then convert all 12 to Combined Cycle operation The addition of one or more Heat Recover Steam Generators to the system will boost power output by 50% with no additional fuel requirements The resulting power plant will have an operating output of approximately 300MW available to the entire country (and for export) through the UPS

The Hurghada Gas Turbine Refurbishment Project provided the least cost solution to the shortage of EEA electrical generating capacity in the Hurghada area EEA was able to utilize surplus generating equipment from other parts of the country to satisfy growing demand in the rapidly developing tourist area around Hurghada They were able to achieve this for approximately half the cost of constructing a totally new generating plant of the same capacity

EEA's participation, through its in-house construction contractor, and the utilization of its own labor and craft workers for the turbine move and refurbishment, resulted in considerable cost savings over the use of offshore contractors EEA also gained considerable experience in this field, which they will be putting to use during the next phase of expansion at the Hurghada power plant

In addition, EEA personnel received training in the US and on-site in the operation of the upgraded plant

5 POST PACD ACTION

The project is complete and post PACD action is not required All post-project considerations of changes that could be implemented in future projects are discussed in the Lessons Learned section of this report

6 PROJECT STATUS

The project is complete All obligated funds have been disbursed The first unit has been in commercial service since August 1991 and the most recently refurbished plant has been operational since October 1996

7 OUTSTANDING PROBLEMS

There are no outstanding problems with this project All covenants were met, and all outputs achieved There is no recommendation for follow-on action

8 LESSONS LEARNED

In any future project of this type the following points should be taken into account

- The initial in-situ survey of the turbine units should include partial disassembly to ensure that the list of replacement and repair parts accurately reflects the condition of the units The expenditure of additional time at this stage will avoid greater delays later in the project, caused by waiting for the delivery of offshore parts and equipment

- The process of dismantling and transporting the turbines to their new location needs to be more closely monitored and controlled Parts removed from the main unit prior to transportation should be tagged and containerized, and remain in the container until required Some parts were lost in transit and additional costs were incurred in replacing them

- EEA's use of its own Civil Works contractor resulted in considerable cost savings but, if the same model is used again, it should be implemented under a traditional construction contract package (Commercial terms and conditions, schedules, technical specifications, drawings, and quality control and testing requirements) In the absence of these K&M relied on interpretation of local engineering and construction practices to monitor and accept the work performed

- Detailed project scheduling responsibilities were not clearly defined in either the GETSCO or Hydelico contract Without such schedules the control and coordination of the overall project is not possible

9 AUTHORITY

Item 52 of Mission Order 201, dated May 10, 1998, authorizes the SOTL to approve the Project Assistance Completion Report

10 RECOMMENDATION

That the SOTL of the Power and Telecommunications Division approves the Hurghada Gas Turbine Refurbishment Project Assistance Completion Report

Approved _____

Disapproved _____

Date 2/28/00

Information USAID/W/PPC/CDIE

Clearance
EI/PT HIsmail _____ 2/17/2000
SCS/SIS WRiley _____ 2/22/00
FM/FA HElKhodary _____ 2/23/00
Drafted EHardy 2/15/00

APPENDIX A

HURGHADA GAS TURBINE REFURBISHMENT

GRANT No 263-0215 03

GETSCO CONTRACT PRICE BREAKDOWN

	Units 1,2&3	Unit 4	Unit 5
Technical Advisory Services	$1,519,199	$378,856	$406,816
Parts	$1,835,000	$2,257,053	$2,270,614
Conversion, Modification & Upgrade Materials	$3,839,500		
Rotor Repair		$63,250	$63,250
Training	$142,000	$27,048	$45,000
Ocean Freight & Marine Insurance	$300,000	$80,000	$80,000
	$7,635,699	$2,956,207	$2,865,680
Contingency	$400,000	$150,000	$146,368 16
Total	**$8,035,699**	**$2,956,207**	**$3,012,048 16**