AGENCY FOR INTERNATIONAL DEVELOPMENT

Washington, D. C. 20523

PROJECT PAPER

Egypt: Power Sector Support
(386-0507)

September 18, 1989

UNCLASSIFIED

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

AGENCY FOR INTERNATIONAL DEVELOPMENT

CAIRO, EGYPT

PROJECT PAPER

PROJECT NO. 263-0215

SEPTEMBER 1989

EGYPT: POWER SECTOR SUPPORT

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number

DOCUMENT CODE: 3

COUNTRY/ENTITY: EGYPT

3. PROJECT NUMBER: 263-0215

4. BUREAU/OFFICE: ASIA/NEAR EAST — 03

5. PROJECT TITLE (maximum 40 characters): POWER SECTOR SUPPORT

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 12 DD 31 YY 93

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)
A. Initial FY 89 B. Quarter 4 C. Final FY 91

8. COSTS ($000 OR EQUIVALENT $1 = LE 2.60)

A. FUNDING SOURCE	FIRST FY B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total	$136,000		$136,000	$336,000		$336,000
(Grant)	($136,000)	( )	($136,000)	($336,000)	( )	($336,000)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country		$ 24,731	$ 24,731		$ 24,731	$ 24,731
Other Donor(s)						
TOTALS	$136,000	$ 24,731	$160,731	$336,000	$ 24,731	$360,731

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) ESF	740B	825		0		$136,000		$336,000	
(2)									
(3)									
(4)									
TOTALS				0		$136,000		$336,000	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)

11. SECONDARY PURPOSE CODE

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)
A. Code
B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

To support past and promote continued GOE progress in reducing electricity subsidies and in making other energy sector policy changes by providing capital infrastructure incentives to the GOE.

14. SCHEDULED EVALUATIONS
Interim MM 10 YY 90 MM 10 YY 91 Final MM 07 YY 93

15. SOURCE/ORIGIN OF GOODS AND SERVICES
[XX] 000 [ ] 941 [ ] Local [ ] Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP amendment.)

USAID/EGYPT Controller concurs with the proposed methods of implementation and financing.

Phillip R. Amos
AD/FM

17. APPROVED BY
Signature: Marshall Brown
Title: Marshall D. Brown, Director
Date Signed: MM 09 DD 18 YY 89

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION
MM DD YY

UNITED STATES AGENCY for INTERNATIONAL DEVELOPMENT

CAIRO, EGYPT

ACTION MEMORANDUM TO THE DIRECTOR

DATE: September 14, 1989

FROM: CD/PDS/PS, Frank Miller

SUBJECT: Approval of the Power Sector Support PP

THRU: AD/PDS, Vivikka Molldrem

Problem: Your signature is required to approve the PP for the Power Sector Support Project No. 263-215 for $136 million.

Discussion: The subject PP has been reviewed by the Project and the Executive Committees and the revisions noted in the decision memorandum have been made. The following changes have been highlighted in the PP itself where appropriate:

1. Language has been added to the Project Description (p.21) and the Executive Summary (p.iii) to show that the total LOP funding for this Project is planned at $336 million.

2. The Project Background and Rationale section of the PP has been revised to provide for more flexibility in determining requirements and conditionality for future funding in the electric power sector (pp.14-15, paragraphs 1.38-1.40). The Project Description (p. 21) also outlines how this Project is policy based.

3. Language has been added to the Monitoring and Evaluation section stipulating that a baseline for evaluating electricity rate increases will be formulated, and a system for monitoring rate increases in-house will be set up by November of 1989 (p.47).

4. $3 million will be provided to fund studies and a personal services contractor (electrical engineer) over the life of the Project (p. 23g and p.28)

5. The financial rate of return has been revised and is shown on p.53 of the Project Paper and p.12 of Annex H.

Recommendation: That you sign the PP facesheet, the Project Authorization, the 611(E) certification, and the Gray Amendment certification.

Clearances

DR/UAD, JHunt _____

AD/DR, Paul Thorn _____

ANNEXES

A. PID APPROVAL MESSAGE
B. LOG FRAME MATRIX
C. STATUTORY CHECK LIST
D. REQUEST FOR ASSISTANCE
E. SECTION 611 (E) CERTIFICATION
F. GRAY AMENDMENT CERTIFICATION
G. TECHNICAL ANALYSIS
H. FINANCIAL ANALYSIS
I. ECONOMIC ANALYSIS
J. SOCIAL SOUNDNESS ANALYSIS
K. MANAGERIAL/ADMINISTRATIVE ANALYSIS
L. ENVIRONMENTAL ANALYSIS
M. COST ESTIMATE

UNITED STATES GOVERNMENT

memorandum

DATE: August 29, 1989

REPLY TO ATTN OF: OD/PDS/PS, Frank Miller

SUBJECT: Power Sector Support Project Paper (263-0215)
Issues for Executive Committee Review

TO: Members of the Executive Committee (See Distribution)

The following issues were raised for the Executive Committee review of the subject PP. The Executive Committee Review is scheduled for Wednesday, August 30 at 9:30 A.M. in the 9th floor conference room.

1. The PID Approval Cable states that "Since this Project is justified as a reform project, there needs to be a life-of-project scenario or formula linking anticipated real price increases to future demand levels and thus release of funds for needed additional generation facilities." (Annex A, p.3) This paper does not attempt to formulate a strategy for the future other than holding out the possibility of funding in response to rate increases which "average ten percentage points above the rate of inflation since the previous electricity price increases." (Annex B) Other policy based projects in the agriculture and water/wastewater sectors have defined policy reform scenarios over the life of the project. Can we be more specific about benchmarks and expectations in this Project?

2. Though we mention "examining and monitoring past and current Mission and Embassy electricity bills and examination of an appropriate cross-section of Distribution Company billing records" there is no specific plan for monitoring and analyzing data. Do we have a reliable baseline to work from when evaluating electricity rate increases? How will the cost of service study mesh with in-house verification measures? Do we have records of data over time which can provide us with the means to verify the latest price increase?

3. Is it appropriate to use 0102 funds for the studies cited in the Project Paper, or would it be better to fund them from the Project?

4. The AID/W Pid Approval Cable expresses concern with the proposal to waive competition for consulting services as well as the sweeping use of waivers. Are all of the waivers in the Project Paper adequately justified?

OPTIONAL FORM NO. 10
REV. 1-80
GSA FPMR 41 CFR 101-11.6
5010-114

6

The following elements of the Project Paper should be clarified:

1. Whether or not a proprietary procurement waiver is appropriate for procurement of turnkey contractors.

2. The covenant on payment of salary incentives and supplements on p.72 of the Project Paper will be changed to unequivocally preclude payment of salary incentives and supplements.

Distribution:

A/DIR, Charles Weden
AD/AGR, Edwin Stains
AD/DR, Paul Thorn
AD/FM, Phillip Amos
AD/HRDC, William Gelabert
AD/LEG, Kevin O'Donnell
AD/MGT, Harold Daveler
AD/PDS, Vivikka Molldrem
AD/TI, Gregory Huger
OD/PDS/E, Paul O'Farrell
OD/PDS/P, Christopher Crowley

UNITED STATES GOVERNMENT

memorandum

DATE: August 30, 1989

REPLY TO ATTN OF: CD/PDS/PS, Frank Miller

SUBJECT: Power Sector Support Project, No. 263-0215
Decision Memorandum -- Executive Review of Project Paper

TO: Members of the Executive Committee (See Distribution)

The Executive Committee met on August 30 to review the subject Project Paper (PP). The PP was approved and the following decisions were made:

1. Language will be added to the Project Description and the Executive Summary to show that the total LOP funding for this Project is planned at $336 million. (The Project Authorization will be revised as, or if, appropriate.) Subsequent funding above the present $136 million will be linked to acceptable future tariff increases and other policy reforms.

2. Some language will be added to the Project Paper to provide for more flexibility in determining requirements and conditionality for future funding in the electric power sector. The Project Description will also more clearly outline how this Project is policy based.

3. A more specific data analysis and monitoring plan will be worked out by the energy economist in conjunction with the evaluation officer as stipulated in the Project Paper. A baseline for evaluating electricity rate increases will be formulated, and a system for monitoring rate increases in-house will be set up by November of 1989.

4. $3 million will be provided to fund studies and a personal services contractor (electrical engineer) over the life of the Project. The PP and Project Authorization will be revised to show an initial total of $136 million and AID/W will be requested to process a Technical Notification.

5. At the time the PID Approval Cable was written, there was some concern about waivers, particularly the waiver on competitive selection of consulting services. Since that time, the justification of the waiver on consultant services has been strengthened as a result of the consultant having been on site during this time period. The Mission believes that all waivers stipulated in the Project Paper are adequately justified.

OPTIONAL FORM NO. 10
(REV. 1-80)
GSA FPMR (41 CFR) 101-11.6
5010-114

6. PDS/E will revise the Financial Analysis and indicate the financial rate of return accordingly (p.64 of the PP and p.11 of Annex H).

Clearance:

AD/DR, PThorn ____in draft____

AD/PDS, VMolldrem ____in draft____

Distribution:

A/DIR, Charles Weden
AD/AGR, Edwin Stains
AD/DR, Paul Thorn
AD/FM, Phillip Amos
AD/HRDC, William Gelabert
AD/LEG, Kevin O'Donnell
AD/MGT, Harold Daveler
AD/TI, Gregory Huger
CD/PDS/E, Paul O'Farrell
CD/PDS/P, Christopher Crowley

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EGYPT - POWER SECTOR SUPPORT

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GLOSSARY OF ABBREVIATIONS

ADB	African Development Bank
AID	Agency for International Development
B&W	Babcock & Wilcox
CDSS	Country Development Strategy Statement
CIP	Commodity Import Program
D L/COMM	Direct Letter of Commitment
DR/UAD	Development Resources Directorate Office of Urban Administration and Development
EDA	Egyptian Distribution Authority
EEA	Egyptian Electricity Authority
EGPC	Egyptian General Petroleum Corporation
EIB	European Investment Bank
FM	Financial Management Directorate, USAID/Cairo
GCII	Gilbert/Commonwealth International, Inc.
GE	General Electric
GOE	Government of Egypt
GTCC	Gas Turbine Combined Cycle Associates
IBRD	International Bank for Reconstruction and Development (World Bank)
IMF	International Monetary Fund
ISO	International Standards Organization rating based on ambient air temperature of 15°C (59°F), at sea level pressure of 1 atmosphere (14.7 psia)
Km	Kilometer
kV	Kilovolt

kWhr	Kilowatt-hour
L/C	Letter of Credit
LE	Egyptian Pound
MEE	Ministry of Electricity and Energy
MIC	Ministry of International Cooperation
MVA	Mega volt amperes
MW	Megawatt
MWhr	Megawatt-hour
NECC	National Energy Control Center
OBI	Overseas Bechtel, Inc.
PACD	Project Assistance Completion Date
PDS/P	Program Development and Support Directorate, Office of Programs, USAID/Cairo
PID	Project Identification Document
PSC	Personal Services Contract
TDD	Terminal Disbursement Date
UNDP	United Nations Development Program
USAID	Agency for International Development - Cairo Mission
UPS	Unified Power System
8(A)	Minority and other socially and economically disadvantaged business.

REFERENCES:

Feasibility Study, "Cairo South Extension - 165 MW Module Combined Cycle" (Draft) prepared by EEA.

Working Papers, studies, reports and proposals for Cairo West Rehabilitation and Modernization prepared by EEA.

Staff Appraisal Report, Arab Republic of Egypt, Fourth Power Project, May 30, 1989, prepared by the World Bank.

General Electric Study, "Modification and Relocation of two (2) General Electric Gas Turbine Generators" dated June 1989..

PROJECT AUTHORIZATION

Name of Country: Arab Republic of Egypt **Name of Project: Power Sector Support**
Project Number: 263-0215

1. Pursuant to Part II, Chapter 4, Section 532 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Power Sector Support Project for the Arab Republic of Egypt (the "Cooperating Country"). The Project involves planned obligations of not to exceed $136 million in grant funds, to help in financing the foreign exchange costs, and limited local currency costs, of the Project. The estimated life of the Project is four years and three months from the date of initial obligation.

2. The Project will support the Cooperating Country's movement towards economic pricing of electricity through provision of additional power generation and the rehabilitation and refurbishment of existing generation needed to assure a reliable power system. More specifically, the Project will fund the following components: equipment and installation services for a 150 MW combined cycle unit at Cairo South; the modernization of the four 87.5 MW generating units at Cairo West; equipment and supervision services for the refurbishment of three gas turbines and their move to Hurgada extension of the National Energy Control Center microwave communication system from Cairo to the Suez Canal area; procurement of commodities; and the services of engineering consultants for the above generating capacity installation, modernization or refurbishment and the microwave system extension.

3. The Project Agreement may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority. The Project Agreement shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

4. Source and Origin of Commodities, Nationality of Services

   Goods and services, except for ocean shipping, financed by A.I.D. under the Project shall have their source and origin

in the Cooperating Country or in the United States, except as A.I.D. may otherwise agree in writing.

Ocean shipping financed by A.I.D. under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States.

5. Requirements Precedent to Disbursement:

The Project Agreement shall contain the following Requirements Precedent:

a. Requirements Precedent to Disbursement:

(1.) Prior to any disbursement or to the issuance of any commitment documents under the Grant, the Cooperating Country shall, except as the Parties may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D.:

(a) A statement of the names and titles with specimen signatures of the persons authorized to represent the Cooperating Country for Project purposes for the: Cairo South combined cycle unit; Cairo West Modernization; gas turbine refurbishment and installation of Hurgada; microwave system extension to the Suez Canal area; and for procurement of commodities.

(b) A contract or contracts for engineering and construction supervision services for infrastructure covered by the Project, which services shall include inter alia the preparation of an Environmental Assessment covering the Cairo South combined cycle unit.

(c) A commitment by the Cooperating Country to finance from Project funds a study to identify the sources and magnitude of individual distribution company system losses, nationwide, and to recommend, with cost estimates, corrective measures which, if implemented, would reduce system losses.

(d) A commitment by the Cooperating Country to finance from Project funds an electricity pricing strategy study, which study could be the basis for future rate design.

(e) A commitment by the Cooperating Country to finance from Project funds other technical assistance services as required throughout the life of the Project.

(f) Evidence that the proceeds of the Grant, except for funds used to finance consultant services and technical assistance, have been loaned to EEA on terms and conditions approved by the appropriate authorities of the Cooperating Country.

(g) Evidence that the local currency financing for the Project has been budgeted by the Grantee and will be available for timely expenditure by EEA; and

(h) Evidence that accounting records for local currency and in-kind contributions to the Project will be maintained by EEA.

(2.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment to disburse under the Grant for the purpose of financing the installation of a combined cycle unit at Cairo South, the Cooperating Country shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) An executed construction contract, which will appropriately reflect inter alia the outcome of the Environmental Assessment prepared by the Project's engineer/construction supervisor, for the design, supply and installation of equipment, testing, start-up and training for the combined cycle unit at Cairo South.

(b) A statement from the National Investment Bank or similar financial institution evidencing that the funds necessary for the local currency costs of the Cairo South combined cycle unit construction contract have been deposited in EEA's account and are available for disbursement in an amount based on a cost estimate approved by EEA.

(c) **Evidence that EEA will provide a transmission substation, coordinated with the completion of the Cairo South Combined Cycle Unit, of sufficient capacity to distribute the unit's energy output to the EEA system.**

(d) Evidence that the Egyptian General Petroleum Company (EGPC) will deliver sufficient natural gas to the Cairo South combined cycle unit to permit EEA to operate that unit, under normal conditions, on natural gas without curtailing gas supplies to other EEA facilities.

(3.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment to disburse under the Grant for the purpose of financing the modernization of the Cairo West thermal power station, the Cooperating Country shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) A contract for consultant engineering services that includes an analysis of plant performance and an environmental analysis of emissions for a range of fuel mixes (Natural Gas and Mazout).

(b) A statement from the National Investment Bank or similar financial institution evidencing that the funds necessary or the local currency costs of the Cairo West modernization contracts has been deposited in EEA's account and are available for disbursement in an amount based on a cost estimate approved by EEA.

(c) Evidence that the Egyptian General Petroleum Company (EGPC) will deliver sufficient natural gas to the existing Cairo West thermal power station to permit EEA to operate, the four units simultaneously under normal conditions, on natural gas without curtailing gas supplies to other EEA facilities.

(4.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment under the Grant for the purpose of financing the refurbishment of gas turbines at El Fayoum Cairo North and Abu El Matamir and, later, installation of those gas turbines

at Hurgada, the Cooperating Country shall furnish to A.I.D., except as A.I.D. may otherwise agree in writing, in form and substance satisfactory to A.I.D.:

(a) A statement from the National Investment Bank or similar financial institution evidencing that the funds necessary for the local currency costs of the relevant contract has been deposited in EEA's account and are available for disbursement.

(b) Evidence that EEA will provide a distribution substation, coordinated with the completion of the Hurgada gas turbine plant, of sufficient capacity to distribute the plant's generation to the distribution system serving the Hurgada area.

(c) Evidence that EEA owns or otherwise has legal jurisdiction over the site at Hurgada upon which the gas turbines will be installed and all rights of way necessary for the gas turbine facilities and transmission/distribution connection to the power system.

(d) Evidence that EGPC will deliver sufficient gas to the Hurgada plant to permit EEA to operate that plant, under normal conditions, on gas without curtailing gas supplies to other EEA facilities.

(5.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment under the Grant for the purpose of financing the extension of the microwave communication system from Cairo to the Suez Canal area, the Cooperating Country shall furnish to A.I.D., except as A.I.D. may otherwise agree in writing in form and substance satisfactory to A.I.D.:

(a) A contract for consultant engineering services.

(6.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment under the Grant for the purpose of procuring the project financed commodities, the Cooperating Country shall furnish to A.I.D., except as A.I.D. may otherwise agree in writing, in form and substance satisfactory to A.I.D.:

(a) Specifications for the commodities to be procured.

(7.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment under the Grant for the purpose of financing consultant services for the design review and preparation of equipment specifications for the 1200 MW El Kureimat Thermal Power Station, the Cooperating Country shall furnish to A.I.D., except as A.I.D. may otherwise agree in writing, in form and substance satisfactory to A.I.D.:

(a) Evidence of firm commitments by international and foreign lending institutions for provision of 100 percent of all foreign exchange funds required for the thermal power station, aside from these funds to be provided by A.I.D.

(b) Evidence that the local currency financing for the thermal power station has been budgeted by the Grantee and will be available for timely expenditure by EEA.

(c) Evidence that EGPC will provide the necessary transmission facilities and deliver sufficient gas to the thermal power station to permit EEA to operate the station, under normal conditions, on gas without curtailing gas supplies to other EEA facilities.

(d) Evidence that EEA owns or will otherwise have legal jurisdiction of the plant site and necessary electric and fuel transmission rights of way.

(e) Evidence that the GOE is implementing an energy pricing adjustment program that will result in fuel and electricity pricing at their economic value prior to the operation of the first unit at the thermal power station.

(f) Evidence that the thermal power station will be designed, built and operated to conform to U.S. EPA, World Bank and Egyptian air and water quality regulations.

6. **Covenants:**

The Cooperating Country shall covenant substantially as follows:

a. **Exemption from Decennial Liability Law:**

Contractors, architects, consultants and subcontractors, regardless of nationality, working on the Project shall be exempt from the application of Egyptian Civil Code with respect to decennial liability. The exemption will not relieve such contractors, architects, consultants or subcontractors of their respective contractual obligations which relate to their duty.

b. Payment of Salary Incentives and Supplements:

Grant proceeds or funds derived from the Special Account arising under the Commodity Import Program will not be used to pay Project related salary supplements.

c. Local Currency and In Kind Contributions:

The Cooperating Country, through EEA, will provide A.I.D., on a quarterly basis, with copies of its accounting records on local currency and in-kind contribution provided for the Project.

d. Plant Operations and Maintenance Training:

The Cooperating Country shall covenant that EEA will select additional operational and maintenance staff, and will commence a comprehensive training program, sufficiently in advance of the start-up of all gas turbines and steam turbines to be installed or rehabilitated under the Project, so that operation and maintenance personnel will be on-site, trained and fully qualified to operate and maintain the gas turbine and steam turbine units when placed in service.

e. Plant Fuel Supply:

The Cooperating Country will promote the operation by EEA of the Cairo South combined cycle unit, the Cairo

West steam turbine units and the Hurgada gas turbine, financed by this Grant, under normal operating conditions, on gas.

f. Consultation on Electricity Tariffs:

The Cooperating Country shall covenant that EEA will periodically consult with A.I.D. on electricity tariffs and their impact on the financial viability of EEA.

g. Social Insurance and Taxes on Expatriates:

The Cooperating Country shall covenant that any social insurance assessments and any taxes on expatriates arising under Grant financed work will be paid directly or reimbursed by the Cooperating Country from its own resources.

7. Procurement Waivers:

A. For the purpose of implementation of the Project, a waiver of competition is hereby approved to permit the noncompetitive procurement by EEA of:

(1) Gas Turbine Combined Cycle Associates (a joint venture comprised of Overseas Bechtel, Inc. and Gilbert/Commonwealth International, Inc.) for Technical (Consultant) services for the Cairo South Combined Cycle Unit;

(2) Westinghouse Electric Company for the rehabilitation of the Cairo West turbine generators and associated controls;

(3) Babcock & Wilcox for the rehabilitation of the Cairo West boilers and associated controls and addition of natural gas firing to the boilers and;

(4) General Electric Company for the renovation of three gas turbines and subsequent installation at Hurgada.

B. For the purposes of implementation of the Project, EEA is authorized to procure competitively a General Electric gas turbine equivalent to the three General

Electric gas turbines presently installed and operating at Cairo South and a General Electric steam turbine generator properly sized for the combined cycle unit.

Marshall D. Brown
Director

Sept 18, 1989
Date

NonCompetitive Review Board:

OD/MGT/CS:RWomack: RW
SLA:KO'Donnell: KOD
OD/PS:FMiller:

Clearances:

OD/UAD:MGould: MSG
OD/PDS/PS:FMiller:
AD/DR:PThorn: PT
AD/LEG:KO'Donnell: KOD
AD/PDS:VMolldrem:
AD/FM:PAmos:

EGYPT - POWER SECTOR SUPPORT
EXECUTIVE SUMMARY

I. INTRODUCTION

Electric power in Egypt is heavily subsidized. The subsidy is primarily implicit and results from the GOE's:

1) underpricing of fuels used to generate electricity;
2) undervaluation of foreign exchange and negative real interest rates which subsidize the cost of capital for electricity production; and,
3) a small subsidy included in the Egyptian budget to the Egyptian Electricity Authority to cover its operating losses.

In the Egyptian fiscal year 1987/88 the total subsidy, including uncompensated losses in the distribution system, amounted to approximately LE 6.7 billion.

The average price of electricity to the consumer is 4 piasters per kilowatt hour (kWhr). The economic cost (based on the long run marginal cost) of generation and high voltage transmission is estimated at 17.1 piasters per kWhr. The economic cost of final distribution through the medium and low voltage network is estimated to add four piasters per kWhr to the cost. Thus, the average current price is approximately 19 percent of the economic value of electricity.

The subsidy to consumers is not evenly distributed. The lowest rates go to the first 100 kWhr per month of residential consumption, the first 100 kWhr/month of commercial consumption and the total consumption of large public sector companies who operate on high and very high voltages at rates which are below 2.8 piasters per kWhr . The highest rates, 14 piasters per kWhr and up, are charged to large residential and commercial consumers. In addition, private sector joint venture companies organized under Law 43 (foreign investment law) pay a 4 piasters per kWhr premium above the rate charged to a similar domestic company. Finally, there is no rate differential for on/off peak load for any category of consumer.

The low price of electricity is one of the key economic distortions affecting the pattern of resource allocation in Egypt. The level and structure of electricity rates have encouraged consumption and investment in energy intensive

processes. From 1974 to 1984, consumption of electricity grew at a compound annual rate of 13 percent. Similar growth in peak load demand due to the absence of peak load pricing resulted in a relatively constant relationship between total energy consumption and peak load.

During the past several years, the government has grown more aware of the importance of correcting the price structure of electricity and reducing the distorting subsidies. In 1985, the government raised rates by an average of 37 percent. Since the start of the GOE/IMF discussions in 1986, rates have been raised twice, 29% in April 1987 and 30% in March 1989. The 1987 increase raised the rates for industry and large residential and commercial consumers by 40% or more. The 1989 increase raised industrial rates by another 66%, although several very highly subsidized factories were exempted. Overall, these price increases have raised the average price of electricity from 15 percent of the economic price to 19 percent. Since 1985, the annual growth in total consumption has declined to 4.54 percent in 1988. The growth in peak load has similarly declined, but at a slightly higher rate. Finally, the annual load factor has improved, in part, as a result of an EEA program to shift part of the demand of certain large public industries from peak hours to off-peak hours.

The program to continue to reduce the electricity subsidy is a central topic in the macroeconomic policy reform agenda now under discussion with the International Monetary Fund (IMF), the World Bank (IBRD) and USAID. In the case of the IBRD and USAID, the allocation of significant new resources for power generation depend upon progress in reducing the subsidy. Furthermore, the African Development Bank has conditioned its 1988 power loan on progress in developing a new rate structure. Thus, this Project fits within a larger effort involving the IMF and the IBRD to help the government stabilize and restructure Egypt's economy. The Project specifically supports the government's reform program by providing the framework for policy discussions and technical studies related to electricity price corrections and improved system efficiency.

Policy discussions leading to further reductions in the subsidy are anticipated for at least the next five years. These discussions will be conducted primarily in the context of future IMF standbys, IBRD structural adjustment and energy sector loans and USAID's Power Sector Support Project.

The IBRD is expected to take the lead role in negotiating the rate of price adjustment with the government. While expectations are that subsequent price increases will be in the range of 10 to 20 percent, real increases and specific evaluation of price changes will be made should additional resources be considered for this Project. This evaluation will consider the actual price adjustment in the context of the larger macro-economic reform.

The net effect of the macroeconomic reform, including the correction in the price of electricity, on the consumption of electricity is expected to be a slowdown in the rate of growth of demand for electricity. However, even with the elimination of uneconomic uses, the growth of demand for electricity will require additional generation capacity and distribution facilities over the period of the Project. Consequently, USAID support for the electricity price reform is being programmed to the electricity sector rather than for general balance of payments support. Project resources will assist the development of the electricity sector through capital assistance to expand and preserve generation capacity, commodity assistance for needed spare parts and equipment and training for improved operations and maintenance of the facilities and equipment provided under the Project.

II. PROJECT DESCRIPTION

The goal of the Project is to promote rational investment and consumption decisions throughout the economy and to reduce the national budget deficit. The purpose of the Project is to support past and 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 total LOP funding ($336 million) will be approved in phases contingent on satisfactory policy reform in the electric energy sector. The initial phase of $136 million constitutes a discrete Project. Additional future funding will be added by amending the Project.

The Implementing Agency of the GOE for the Project will be the Egyptian Electricity Authority (EEA). EEA has successfully implemented similar projects. The Power Systems Group within the Urban Administration and Development Office (UAD) of the Mission will monitor project implementation. The Power Systems Group has extensive experience monitoring projects in the electric power sector and with the addition of one technical staff member, the group will be able to effectively manage project implementation.

The Project consists of the installation of a 150 MW combined-cycle generating unit; modernization of a 350 MW thermal power station; refurbishment of three 24 MW gas turbine generators and their subsequent installation at a new site; expansion of the microwave communication system serving the National Energy Control Center; and the procurement of replacement parts, spare parts and work equipment essential for the reliable and economic operation of the Egyptian power system.

A 150 MW combined-cycle generating unit consisting of a nominally rated 110 MW gas turbine generator and a 50 MW steam turbine generator will be installed at the existing Cairo South Thermal Power Station. A single contractor will be responsible for the design, manufacture, supply, shipment, installation, testing, training and start-up of the unit. The gas turbine will be fueled, under normal operating conditions, by natural gas. The gas turbine high temperature exhaust gases will be utilized to convert water to steam, in a non-fired boiler, which will drive the steam turbine generator. Cooling water for the steam turbine will be drawn from the Nile River and, after condenser service, will be returned to the river. The electrical output of the combined-cycle unit will be delivered to the EEA network through the 220 kV gas insulated substation existing at Cairo South.

The 350 MW Cairo West Power station, consisting of four 87.5 MW turbine generators and boilers, will be modernized. Portions of the three steam turbine generators, installed in the mid 1960's, will be rebuilt to achieve greater efficiency and reliability. Portions of the superheaters, reheaters and attemperators will be replaced so that boilers can operate at rated pressure and steam output. The present oil burners will be replaced with burners designed for dual fuel operation (oil and natural gas). Boiler controls will be replaced with a modern burner management system and control instrumentation. The original equipment suppliers will provide the replacement equipment and materials and will supervise and be responsible for the replacement work being performed by EEA personnel. The plant will normally operate on natural gas.

Gas turbine-generators at El Fayoum, Abu El Matamir and Cairo North, each rated 24 MW, will be renovated and made operational. New control systems will replace the existing deteriorated controls. Once the units are returned to operational condition, they will be moved to a site near Hurgada where they will be installed and placed in operation.

The units will normally operate on gas. The original equipment supplier will provide the replacement parts and materials; will supervise and be responsible for the gas turbine refurbishment being performed by EEA personnel; and after testing, will supervise the installation, start-up and initial operation at Hurgada.

The microwave communication system that collects and transmits operating data to the National Energy Control Center (NECC) will be expanded to collect operating data from six EEA stations between Cairo and the Suez Canal. When completed, this communication system expansion will facilitate collection and transmission of additional operating data which, when integrated with the operational data referenced immediately above, will enhance the reliability and efficiency of the power system's operation. A turnkey contractor will be responsible for the design, manufacturer supply, shipment, installation, testing, training and start-up of the system's expansion.

Commodities in the form of replacement parts and spare parts for gas turbine and diesel-driven generating units will be procured. The Project will also finance the procurement of laboratory test and metering instruments, transducers and specialized work equipment and tools essential for the maintenance of the 500 kV and 220 kV transmission lines and substations.

Technical assistance in the form of project monitoring services (AID personal services contractor) and electricity pricing strategy and distribution system loss reduction studies will be financed. The results of these studies will provide guidance to the Ministry of Electricity and Energy on future electricity pricing decisions and how most effectively to reduce energy losses on the distribution networks.

In addition, it is possible that, based on later mutual agreement, the Project budget will be adjusted (without increase to AID's contribution of $136 million) in order to provide funding for design work and writing of specifications for a thermal power station to be constructed at El Kureimat. EEA and USAID intend, in considering this possibility, to review the likelihood of financing for the El Kureimat facility being available from other donors.

Throughout the Project, EEA will utilize the services of several consulting engineers, acceptable to A.I.D., to assist

in the preparation of equipment specifications, procurements, contract negotiations, contract administration, factory inspections and supervision of installation, rehabilitation and refurbishment of equipment.

Project Outputs:

The ultimate objective of the Project is significant increases in the selling price of electric energy based on a program of annual price increases sufficient to eliminate the electricity sector subsidy by the late 1990's. The outputs of the Project are:

Construction of 1-150 MW combined-cycle unit.
Rehabilitation of four steam turbine generating units.
Renovation of three gas turbine-generators and installation at a new site.
Expansion of the microwave communications systems serving NECC.
Provision of spare and replacement parts and work equipment.

The fact that this Project is being implemented after a substantial electricity price increase in March 1989 demonstrates the supportive nature of AID's economic assistance in sectoral policy formation and implementation. At the forefront of the policy dialogue and electric energy strategy is the narrowing of the gap between the existing highly subsidized electric energy costs and the real (economic) costs of generating, transmitting and distributing electric energy. The electricity pricing strategy study to be undertaken by EEA will recommend rate strategies and will include an evaluation of time-of-day pricing which, if implemented, should have a major impact on peak demand.

Electricity price increases in subsequent years will be evaluated to determine if the price increase conforms to the longer range plan to eliminate subsidies by the late 1990's by the gap between current prices and the economic price eliminating of electricity. Additional funds may be provided through an amendment to the Project Authorization for activities that constitute a "least-cost" addition of generating capacity or otherwise improve the efficiency of the power system.

III. COST ESTIMATES AND FINANCIAL PLAN

The Project cost is estimated to be $136 million and LE 64.3 million. This estimate is based on estimates of each Project component by EEA which have been reviewed by the Project Office in USAID. The Project cost estimate is summarized in the following table.

SUMMARY OF COST ESTIMATES
(U.S. $ and LE Million)

	USAID ($)		GOE (LE)
Technical Assistance	$ 9.0	LE	4.0
Equipment and Installation	$ 99.8	LE	57.9
Commodities	$ 13.3	LE	2.4
Audit, Evaluation	$ 0.3	LE	-
Contingency	$ 13.6	LE	-
TOTALS	$136.0	LE	64.3

Disbursement of Project funds over the project implementation period are presented on the following table. The disbursement schedule is based on the Project being authorized in FY 89 with all construction being completed in FY 93.

DISBURSEMENT SCHEDULE - AID FUNDING
(U.S.$ - MILLIONS)

FISCAL YEAR	U.S. DOLLARS
FY 90	$ 19
FY 91	$ 35
FY 92	$ 54
FY 93	$ 28
TOTAL	$136

The Project is based on sound engineering analysis performed by the EEA assisted by various consulting firms and original equipment suppliers. The Project Office and Project Committee have reviewed the plans and find them to be reasonably firm within the meaning of the statutory requirement. It is concluded that the requirements of Section 611 (a) of the Foreign Assistance Act of 1961 as amended have been satisfied.

Training of EEA's operations and maintenance staff for each plant will be included in each equipment supply contract. For equipment financed by AID, the training will include intensive classroom and hands-on training in the manufactures plant(s) in the United States followed by additional on-site training during the final check-out and start-up of the equipment. EEA will assign experienced operations and maintenance staff to form a solid nucleus for each plant and will introduce employees with less experience who, with training, will become qualified to operate and maintain the equipment.

The Project Assistance Completion Date will be December 31, 1993, four years and three months from the September 1989 Project Authorization. By this date, all equipment and services financed from the Project will have been delivered to the Project site and placed in operation.

The USAID Project Office (UAD) will monitor the Project on a daily basis, attend the Project meetings, visit the Project sites and review reports and correspondence to assure that Project implementation conforms to AID regulations, the Grant Agreement, Host Country contracts and contract schedule.

The Project will be evaluated during its implementation and upon completion to determine the progress in attaining the Project objectives and outputs and to identify generic implementation problems. The evaluation will be managed by the Mission's Program Development and Support Directorate. The Evaluation Team will be composed of personnel from the Mission's Economic Group, Program Planning Office and the Project Office. The evaluation will be funded from the Project. Based on the findings, the Evaluation Team will present recommendations which, if implemented, would improve implementation of similar projects in the future.

The Project has been determined to be technically appropriate and cost effective. The sociocultural impact of the Project

will be positive. The Project is financially viable and has an acceptable rate of return when judged on economic prices. The gas turbine component of the Project will not degrade the environment surrounding the Cairo South and Hurgada gas turbine sites. The conversion of the oil burning boilers to burn natural gas will enhance the environment adjacent to the Cairo West thermal power station. Before financing of the equipment contracts for the steam cycle addition at Cairo South a scoping session will be conducted and an Environmental Assessment developed focusing on the impact of the condenser cooling thermal discharge on the aquatic species native or migrating through the water source.

The Project is warranted since Egypt needs to expand its energy sources for continued industrial, commercial and residential expansion. However, any additional investments in power generation should be accompanied by electricity pricing reforms with the objective of eliminating the extremely high level of implicit subsidies in the electricity sector so that the consumption of electricity is based on economic prices.

IV. PROJECT NEGOTIATION STATUS

All Project activities and implementation arrangements have been thoroughly discussed with the EEA. The EEA agrees to all conditions and covenants cited in the Project Paper. Discussions with the Distribution Authority about the required energy loss reduction study are ongoing. The Ministry of Electricity has requested this Project and USAID's Director has concurred. The Ministry of International Cooperation is in the process of formally requesting the Project.

V. RECOMMENDATIONS:

A. That the Mission Director authorize a Grant of $136 million.

B. That the Mission Director approve:

(1) the proprietary procurement of a General Electric gas turbine-generator and steam turbine-generator for installation at Cairo South.

(2) **waivers of AID competitive procurement procedures to permit EEA to negotiate contracts with:**

- **Gas Turbine Combined-Cycle Associates for consultant services for the Cairo South Combined-cycle unit;**

- **Westinghouse Electric Company for the rehabilitation of the Cairo West turbine-generators and controls;**

- **Babcock and Wilcox for the rehabilitation of the Cairo West boilers and controls and conversion of the boilers to dual fuel firing;**

- **General Electric for the renovation of three gas turbines and subsequent installation at Hurgada.**

VI. LIST OF CONTRIBUTORS

PROJECT COMMITTEE

Co-chairs	John P. Hunt	DR/UAD
	Alison Barkley	PDS/PS
	Charles Crane	FM/FA
	Kevin O'Donnell	LEG
	Paul O'Farrell	PDS/E
	Todd Amani	PDS/P
	Lottie Erikson	PDS/P

GOE Officials

Chairman EEA	M. El Said Issa
Deputy Chairman, Technical Studies	Mostafa Swidan
President, Cairo Zone	Eng. Hazem Tanbouli

I. BACKGROUND AND RATIONALE

A. Impact of Energy Sector Pricing:

1.01 The energy sector in Egypt is one of the most important sectors that underpin the Egyptian economy. Egypt is fortunate to be a relatively rich country in indigenous energy resources which include petroleum, natural gas, hydraulic, wind and solar resources. Egypt has substantially developed its hydro resources but other renewable resources (wind and solar) are not yet developed to any significant degree. Demand for energy in all forms has been growing at a rate exceeding the proven reserves. Development of significant additional petroleum reserves is doubtful. Exploitation of natural gas reserves has only recently begun. The harnessing of wind to produce electric energy is just beginning and offers a substantial energy resource for the future. Egypt is constructing a hydraulic power station at Esna and is planning additional power stations at Nag Hammadi and Assiut which, when completed, will have effectively utilized the hydro potential of the Nile. Egypt offers vast opportunities for the conversion of wind and solar energy to usable forms. Low oil prices limit the economic competitiveness of wind turbine, photovoltaic and solar thermal collectors. As oil prices increase and/or technology develops and equipment costs become more competitive with other forms of energy supply, wind and solar will become greater sources of energy in Egypt. Egypt's coal reserves, located in the Sinai peninsula, offer limited long term energy potential.

1.02 The growth in the demand for energy in all forms has been spurred by the economic development of Egypt and the low, subsidized price of energy. For example, Mazout (No.6 Oil) and natural gas are priced to the Egyptian electric utility at 47% percent of world prices and the electric energy produced, while priced at nearly 100 percent of its production cost, is priced at 19 percent of its economic cost due to the heavily subsidized cost of fuel and capital. These extremely low prices translate into very high implicit subsidies. The combined implicit subsidy of the energy sector has been estimated at about LE 11 billion in FY 89/90. This implied subsidy, when compared with the projected LE 16.7 billion deficit of the Egyptian budget in FY 89/90, illustrates the effect which the Government of Egypt's (GOE) energy sector subsidy has on the national economy. Phasing out of implicit energy subsidies in Egypt would go a long way toward balancing the national budget.

1.03 **The implicit subsidies, leading to unrealistically low prices, have other consequences. First, low prices convey false signals to users about the value of energy resources, leading to overconsumption, waste, inefficiency and lack of incentives to conserve. Second, domestic overconsumption of cheaply priced energy resources deprives Egypt of scarce foreign exchange which could be earned by exporting energy products. Finally, subsidized prices deprive Egypt of an important source of budgetary revenues. The electric power sub sector is the most heavily subsidized element of the Egyptian energy sector as a whole.**

B. Electric Power Sector:

1.04 Electric power was first introduced into Egypt in 1882 and, up to 1964, utility systems were operated by a large number of Government, municipal and private organizations. In 1964 the Ministry of Electricity and Energy (MEE) was formed and the electric power sector is now entirely state owned and controlled through the Ministry. Policy is made by the Minister, in line with the Government's overall plans for the country. The finances of the sector form part of the national budget, and the annual and long range plans of the sector must be approved by the Minister of Planning, the Cabinet and the President.

1.05 The electric power sector is a well run sector with aggressive and imaginative leadership and very competent technical talent housed in the Ministry of Electricity and Energy (MEE). Effective planning and foresight on the part of the Ministry have led to the timely construction of generation and transmission facilities to meet Egypt's demand for electric power which has been growing at nearly ten percent per year over the past ten years.

1.06 The MEE is comprised of nine administrative authorities. Among these authorities, the Egyptian Electric Authority (EEA) is responsible for the planning and construction of thermal power stations and the bulk high voltage transmission system, operations and maintenance of generating and transmission facilities, sales to customers served from the transmission system and sales to the Distribution Companies.

1.07 EEA is a highly centralized organization with aggressive, imaginative and technically sound management. However, archaic administrative systems often impede decision making and as a result slow progress in the development and improvement of the operation of the power system. There is

limited delegation of authority and minimal coordination between the technical and financial units. EEA is modernizing its planning and decision making processes and introducing procedures to integrate the financial units into the overall management process of the utility. EEA's operating facilities are modern and the operations and maintenance staffs are knowledgeable and able to operate and maintain the equipment after appropriate training.

1.08 To aid in the decision making process, EEA has initiated a major effort, under the guidance of a U.S. consulting firm financed by the United Nations Development Program (UNDP), to develop a management information system supported by a data base. The management information system when completed in 1991 will provide EEA management with a comprehensive computerized energy planning, financial and economic assessment capability using the most current software programs available in the industry. EEA is currently utilizing the Wien Automated System Planning (WASP) III software and the Electric Generation Expansion Analysis Systems (EGEAS) software for capacity expansion planning which includes load flow, statistical analysis and decision analysis models. EEA utilizes an Automated Financial Forecast model, tailored to their specific needs, for long-range forecasts of earnings, cash requirements and financing. They are procuring a Power System Simulation program for analysis of system performance under a wide range of operating conditions. EEA is utilizing Transmission Line Optimization programs for transmission planning and design.

1.09 EEA, acting through five operating zones (Cairo, Alexandria, Delta, Canal and Upper Egypt), is responsible for the operation of all generating capacity, primary transmission, sales to major industries served at transmission voltages and bulk sales to Distribution Companies at 11 KV. The Electricity Distribution Authority (EDA) is responsible for electricity distribution and customer services throughout Egypt, acting through seven distribution regions: Cairo, Alexandria, Delta, Canal, Beheira, North Upper Egypt and South Upper Egypt.

C. Unified Power System:

1.10 Electric power was introduced into Egypt in 1882 when small diesel engine driven generators were first installed in Cairo, Alexandria, Port Said and Ismailia with low voltage networks distributing direct current to supply energy for households and street lighting loads. With the construction of the 40 MW Shoubrah El Kheima power station in 1932 (at the site presently occupied by the 1260 MW Shoubrah El Kheima Thermal

Power Station), 33 kV networks were developed to distribute the energy short distances and by 1952 more than 52 communities were served by these constrained networks. Since 1952, the electricity network in Egypt has developed into a complex interconnected system, commonly referred to as the Unified Power System (UPS), serving all the major load centers in Egypt.

1.11 Generating facilities consist of 59 steam turbine generating units with a total nameplate capacity of 4990 MW, 62 gas turbine generating units with a total nameplate capacity of 1,561 MW and 25 hydraulic turbine generating units with a total nameplate capacity of 2,713 MW. While the total nameplate capacity of the system is 9,264 MW, EEA is normally only able to dependably produce 7,400 MW due to de ratings caused by ambient air conditions, water levels of the Nile River, equipment age and maintenance. The recent drought in the Nile catchment of East Africa demonstrated that even the hydraulic generating capacity at the High Dam is vulnerable to reduction in output if the hydraulic head (the difference in water level between the High Dam lake and lower reservoir) is reduced appreciably from the normal (design) head.

1.12 The average age of the steam turbine capacity is 10 years with more than 300 MW of capacity in excess of 30 years of age and 1,200 MW of capacity in excess of 20 years of age. The average age of the gas turbine units is eight years. The average age of the hydroelectric turbine units is 20 years.

1.13 The peak demand for electric energy, which occurs annually in December, was 6,221 MW in December 1988. The total energy generated to meet customer requirements in 1988 was 38,569 million kWhr of which, 8,412 million kWhr (22%) was supplied from hydro units and the balance of 30,157 million kWhr (78%) was supplied from gas and steam turbine units. The fuel mix for the steam and gas turbine units was 51 percent Mazout (No. 6 Oil), 48 percent natural gas and 1 percent Solar (No. 2 Oil).

1.14 The increase in both peak demand and energy consumption has fluctuated from 12 to 20 percent during the period 1974-84 and has tapered off to a more reasonable annual growth of between 7 and 9 percent in recent years. However, electric energy generation has not kept pace with the steady increase of customer demand. Generating units out of service for maintenance or forced out of service by breakdowns frequently result in insufficient capacity available to meet customer demands. As a result, customers are subjected to frequent interruptions or low voltage and abnormal frequency.

1.15 The transmission system consists of a network of 1,576 Km of 500 kV, 3,826 Km of 220 kV, and in excess of 3,000 Km of 132 kV overhead lines and approximately 4,000 Km of 66 kV overhead lines and underground cables. At the end of 1987 the substation capacities associated with the 500 kV, 220 kV and 132 kV networks were 3,280 MVA, 8,970 MVA and 2,240 MVA respectively. The 500 kV and 220 kV networks are relatively new, having been built in the mid 1960's and expanded in an orderly and well planned fashion. The 132 kV and 66 kV and lower voltage distribution networks are old and in many instances outdated. The 11 kV distribution lines belong to the distribution companies and in 1986 had attained a total substation capacity of 13,260 MVA against a total route length of 7,438 Km. Areas outside the reach of the UPS are supplied from gas turbine and diesel driven generators with a total installed capacity of less than 200 MW. Private generation exists but is negligible, accounting for less than 1% of the total.

D. Condition of the Existing System:

Hydro Plants

1.16 On July 1, 1989, EEA was operating 25 hydro turbine units in three stations on the UPS with a total installed capacity of 2,713 MW. The capacity available for operation varies between 1,900 MW and 2,200 MW. While the High Dam can produce 2100 MW with all 12 units in operation, the runner replacement program (financed by AID) limits output to ten units having a combined output of 1,750 MW. The output of Aswan I, rated 345 MW, is limited to 270 MW due to the imposed hydraulic head of the High Dam. The hydraulic stations are well maintained and have not experienced frequent forced outages.

Gas Turbine Plants

1.17 On July 1, 1989, EEA was operating 54 gas turbine units in 18 stations on the UPS with a total installed capacity of 1,561 MW. The capacity available for operation varies between 850 MW and 1,050 MW due mainly to ambient air conditions and equipment failures. Seven units have been out of service for more than one year due to equipment failures and refurbishment. During capacity shortages the gas turbines are operated as base load units, 24 hours a day, seven days a week. System conditions permitting, periodic maintenance has been accomplished in accordance with manufacturers' maintenance schedules and the units are generally operating satisfactorily.

Steam Plants

1.18 On July 1, 1989 EEA was operating 57 steam turbine generating units in 14 stations with a total capacity of 4,890 MW. The capacity actually available for operation varies between 3,500 MW and 4,400 MW. The largest units in the system are rated 315 MW (the first having been commissioned in 1985 at the Shoubrah El Kheima Thermal Power Station). Some of the units are more than 35 years old, but have not been retired due to the lack of adequate reserve capacity and difficulties in financing new facilities. With the exception of the newer 150 MW and 300 MW size units, preventive maintenance scheduling has been erratic and often limited to cases where maintenance could be carried out without a complete shutdown for lengthy periods. With maintenance often postponed the available capacity is often reduced due to equipment break down. Steam plants are normally base loaded.

Combined Cycle Plants

1.19 Since July 1989 EEA has operated two combined cycle units at the Talkha station with a rated capacity of 380 MW. The combined cycle installation consists of eight 24 MW gas turbines installed in 1979-1980 and two 50 MW steam turbine generators installed in 1989. The plant utilizes the waste heat from the gas turbine exhaust to produce steam which drives the steam turbines. The "combined" units are expected to be the most efficient in the UPS.

Transmission System

1.20 The 500 kV bulk power transmission lines connecting the High Dam power station complex at Aswan with the load centers to the north including Cairo was built as two separate single circuit structures sharing the same right of way for a distance of 788 Km. In the past, the dusty environment along the route contributed heavily to insulator flashover and line tripping. As a corrective measure the length of the disc insulator string and hence creepage distance was increased and vibration dampers installed. Additionally, live line insulator washing is carried out on a regular basis. These and other strict preventive maintenance practices have increased the lines' reliability. The protective relaying on these circuits and the circuit breakers at the High Dam Hydroelectric Power Station are being replaced with modern equipment (financed by AID under the High Dam Rehabilitation/Modernization Project) which will further improve the performance of the transmission lines and enhance their reliability.

1.21 The 220 kV and 132 kV systems are also maintained to very high standards. However, with large capacity additions in generation, many of the circuit breakers in the substations are no longer adequate and will require replacement to assure continued reliable operation of the system. Until the circuit breakers are replaced, the system will be segmented for operation resulting in decreased transmission reliability and impaired system stability. A permanent solution is expected to lie in a coordinated program of replacing all circuit breakers and related protection devices and initiating proper design standards for any new equipment in the system.

System Operation:

1.22 A modern National Energy Control Center (financed by AID), commissioned in April 1983, is located adjacent to the Cairo West Thermal Power Station in Imbaba. The Center utilizes state of the art system control, dispatching and data acquisition technology to monitor and control the operation of the UPS. The system has an on-line capability to estimate data, determine power flow, optimize system losses, provide contingency analyses, schedule hydro and thermal capacity on a short term basis and provide a short term load forecast.

E. Import of Electrical Energy:

1.23 The UPS is not connected with power systems in neighboring countries. The Governments of Egypt and Jordan have completed a feasibility study to connect their electric power systems and financing for additional studies and equipment procurements is being provided by the Arab Fund. This initial tie at 500 kV is expected to lead to the interconnection of other Arab countries including Syria, Iraq, Saudi Arabia, and Kuwait and eventual ties with the European networks through Turkey.

1.24 The country's long term plans include the possibility of importing low cost hydroelectric power from elsewhere in Africa and recently the principal focus has been on resources in Zaire. Zaire has an undeveloped hydro potential well in excess of 30 Gigawatts (30,000 MW) with the potential annual production of more than 240 billion kWhr which could be produced without a large dam. This power output is more than twice Egypt's estimated peak demand in the year 2000. Preliminary talks have been held between the officials of the two countries and an interconnection study of the two networks is planned. Bulk transport of power in amounts proposed has been successfully achieved elsewhere by use of high voltage direct current transmission in the voltage range of 750-1000 kV.

F. AID Involvement In the Electric Power Sector:

1.25 The history of AID involvement in the electric power sector dates back to 1963 when AID financed the construction of three units at the Cairo West thermal power station (AID Loan 263-H-020) and more recently beginning in 1974 with the financing of a fourth generating unit at Cairo West and studies to rehabilitate the war ravaged distribution systems along the Suez Canal. Table I-2 summarizes AID involvement in the electric power sector since the restoration of the AID program in Egypt beginning in 1975. AID assistance in the sector exceeds $1.1 billion. The bulk of this assistance (63%) went for new generation facilities, with lesser amounts (13%) for rehabilitation and modernization of generating facilities, (20%) for rehabilitation of distribution system and (4%) for modernization of the National Energy Control Center (NECC). The baseload generation financed with AID assistance amounts to about 28 percent of all installed capacity and far exceeds the normal operating capacity of the High Dam.

1.26 Although the bulk of AID assistance has been used to finance expansion of infrastructure, AID has emphasized rehabilitation of facilities, economic pricing of energy and training in the course of its assistance. Pricing policy changes achieved have been modest because of the GOE's reliance on subsidies which do little to control or encourage economic oriented decisions on energy utilization.

TABLE I-1
USAID/EGYPT ELECTRIC POWER SECTOR
FINANCIAL ASSISTANCE
($000)

TITLE	TOTAL AUTHORIZATION	OBLIGATIONS 1975 THRU AUGUST 1989	GENERATING CAPACITY IN OPERATION
Electric Power Distribution	$ 30,000	$ 29,834	--
Helwan-Talkha Gas Turbine	$ 69,000	$ 67,307	312 MW
Abu Sultan Thermal Power Plant	$250,000	$250,000	600 MW
National Energy Control Center	$ 43,500	$ 43,500	--
Shoubrah Thermal Power Plant	$263,000	$263,000	1260 MW
Urban Electric Distribution	$ 97,200	$ 97,200	--
Aswan High Dam Rehabilitation& Modernization	$140,000	$140,000	--
Talkha Combined Cycle	$ 65,000	$ 65,000	100 MW
Alexandria Network Modernization	$ 50,000	$ 15,500	
TOTAL PROJECT OBLIGATIONS TO DATE		$971,341	2272 MW
TOTAL COMMODITY OBLIGATIONS TO DATE		$153,734	719 MW
TOTAL TRADE FACILITY FINANCING TO DATE		$ 5,920	
	TOTAL	$1,130,995	2576 MW

G. Electric Sector Problems and Policy Issues:

1.27 The most crucial problem in the sector is the pricing of electric energy. In 1989/1990, the implicit subsidy is forecast to be LE 6.7 billion as a result of a rate structure which sets the average price of electricity at 19 percent of its economic cost (based on Long Run Marginal Cost Methodology). In addition, there is a small explicit subsidy to EEA equal to LE 4 million. The low rates encourage overconsumption and in some cases inappropriate (uneconomic) uses of electricity. Stimulated by the subsidy, demand growth compels the government to undertake major capital investments in generation, transmission and distribution.

1.28 In addition to the overall level of subsidy, the structure of the rate schedule (Table I-2) provides particularly large subsidies to large industries and the first 100 kWhr per month of residential and commercial consumers. In the case of residential consumption, the subsidy to the small consumers may be viewed as part of a social safety net and an effort to improve the quality of life for low income households. However, the rate structure for industry and commercial enterprises is designed to discriminate by size of firm and type of user rather than to charge prices warranted on economic grounds.

1.29 In particular because of differences in the size of public sector firms compared to private sector firms (the latter are generally much smaller than the former), the structure of electricity rates results in a greater subsidy being provided to public sector firms than private sector firms. Also an explicit differential of 4 piasters per kWhr is added to the rates applied to private sector firms organized under Law 43 (the international joint venture investment law). The structure and level of prices charged to industries is particularly distorting because it biases investment on the side of larger and more energy intensive enterprises than would be the case if investors faced economic prices for energy and other inputs. Energy intensive investment, particularly in the public sector, remains a drain on the economy's resources (and the budget) for years into the future because of the government's unwillingness to face the social and political consequences of closing uneconomic energy intensive factories.

1.30 The government's provision of a larger subsidy to the price of electricity coupled with its desire to maximize budget revenues has resulted in a substantial problem for the EEA. While revenues retained by EEA are generally sufficient to cover the local currency costs of operations and maintenance,

the government has not been willing to permit EEA adequate access to foreign exchange to import spare parts and equipment. The foreign exchange austerity imposed on EEA is particularly important when maintenance must be deferred due to a lack of operable reserve generating capacity.

TABLE I - 2

Electricity Tariffs
(Millieme/kwh)

I EEA	1987/88	April 1989	Percent Increase
1 Very High Voltage			
Kima	12.20	12.20	0.0
Aluminum	10.80	19.99	85.1
Sonned	13.10	22.24	66.0
Assuit Cement 1	23.33	23.33	0.0
Assuit Cement 2	23.33	23.33	0.0
Ferrosilicon	12.20	20.25	66.0
Iron & Steel	26.60	29.79	12.0
1 Weighted Average	14.11	19.68	33.5
2 High Voltage			
Industry	17.10	28.39	66.0
Cement	29.65	29.65	0.0
Abiris Spining	24.50	26.46	8.0
Mirates	24.50	26.46	8.0
Agriculture	17.10	28.39	66.0
Government	17.10	28.39	66.0
2 Weighted Average	20.04	28.46	42.0
3 Medium Voltage			
Suez Cement	42.00	47.04	12.0
Agriculture	32.30	53.62	66.0
Assuit Pipe Lines	33.00	54.78	66.0
3 Weighted Average	37.25	50.50	35.6
EEA AVERAGE	16.31	22.83	40.0

II DC/B	1987/88	April 1989	Percent Increase
Medium Voltage			
Moving Power	33.14	55.01	66.0
Moving Power	55.00	55.00	0.0
Cement	45.00	50.40	12.0
Weighted Average	39.55	54.58	38.0
Residential			
100 kwh	18.00	19.01	5.6
101-200 kwh	30.00	32.01	6.7
201-350 kwh	38.00	41.99	10.5
351-500 kwh	46.00	50.00	8.7
501-650 kwh	60.00	66.00	10.0
651-800 kwh	70.00	80.01	14.3
801-1000 kwh	80.00	90.00	12.5
1001-2000 kwh	100.00	112.00	12.0
2001-4000 kwh	120.00	129.96	8.3
>4000 kwh	140.00	140.00	0.0
Weighted Average	25.41	27.24	7.2
Commercial			
100 kwh	21.00	28.01	33.4
101-200 kwh	36.00	47.02	30.6
201-350 kwh	64.00	80.00	25.0
351-500 kwh	88.00	99.97	13.6
501-1000 kwh	100.00	120.00	20.0
1001-2000 kwh	120.00	140.04	16.7
2001-4000 kwh	140.00	150.08	7.2
>4000 kwh	160.00	170.08	6.3
Weighted Average	58.98	70.22	19.1
Government	64.00	100.03	56.3
Public Lighting	64.00	100.03	56.3
Housing Companies	22.60	29.83	32.0
Weighted Average	53.70	82.56	53.76
DC/B AVERAGE	35.92	45.31	28.90
WEIGHTED AVERAGE (EEA+DC/B)	30.77	40.14	30.45

Source: EEA and IBRD

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H. Electricity Pricing (Tariffs):

1.31 EEA is responsible for electricity rate design and implementation of these rate structures upon approval by the President. EEA's recommendations are reviewed by an Inter Ministerial committee of the Cabinet and, following their endorsement by the Prime Minister, are submitted to the Presidency. In the past, EEA has utilized French consultants for conceptual rate design. EEA's technical studies staff for rate design is well trained and knowledgeable.

1.32 Following the 1982 tariff study financed by the IBRD and performed by the French consultant Sofrelec ("Societe Francaise D'Etudes et De Realisation d'Equipment Electrique", a subsidiary of Electricite de France), EEA began a program of gradually increasing electricity rates for the various categories of consumers aimed at reaching the marginal cost of supplying electricity by the mid 1990's. Electricity price increases during the first several years were only token efforts, averaging less than 10 percent per year while consumer prices were increasing at nearly double the rate of electricity prices. As a result, the electricity pricing increases had little or no impact on demand or consumption.

1.33 Since energy pricing drives consumption decisions and the need to expand generating capacity, energy pricing reforms provide the means to bring about conservation that can lead to deferral of generating capacity installation. Price reform has become the criterion for international donors' future funding of new capacity. Meaningful rate increases did not begin until 1986 when electricity rates were increased by an average of 35 percent.

1.34 Because of the very low base for electricity rates and their structure, these recent large rate increases have not yet sufficiently altered the electricity pricing levels to convey to consumers the cost of resources (both in economic and financial terms) used to supply electricity. AID's efforts are being directed towards improving both the rate structure and the level of electricity pricing.

1.35 The GOE's efforts, at the insistence of financing institutions including AID, the World Bank (IBRD) and the African Development Bank (ADB) have been directed towards improving both the structure and level of electricity rates. The Government has initiated several steps in this direction. These include: (i) the GOE's stated objective of raising fuel prices and electricity prices to realistic economic levels by the late 1990's; (ii) 35%, 29% and 30% increases in electricity

rates implemented in 1986, 1987 and 1989 respectively; (iii) improving the rate structure; and (iv) design and implementation of load management measures.

1.36 Eliminating subsidies will result in electricity rates which reflect the marginal cost of electricity supply. Realistic energy pricing is a desirable economic objective because it will correct distortions in the economy, promote energy conservation and, finally, will generate revenue and mobilize resources more effectively. Using the international price for fuel oil, the marginal cost of electricity is estimated to be approximately 21 piasters per kWhr. The current average price of electricity of 4 piasters per kWhr (after the 1989 increase) is 19% of the economic cost of electricity.

1.37 EEA recognizes the need for electricity pricing based on the marginal cost of service according to user classification. EEA has approved a scope of services for an electricity pricing strategy study to be financed by the Project. This study will develop and design rate structures which reflect as closely as possible the true economic (marginal) cost to the nation of providing electricity to different customer segments. This marginal cost structure will establish the fundamental economic frame of reference for formulating pricing strategies that will promote efficient resource utilization by discouraging waste and resource misallocation; that will encourage economically optimal levels of conservation and demand/management; and that will direct the usage of electricity to their most valued and productive end uses. A Requirement Precedent to Disbursement of FY 89 funds would require the agreement by the GOE to finance this electricity pricing strategy study.

1.38 This Project addresses the electricity pricing issue by providing funding for critical initiatives in the sector in response to the GOE's implementation of significant tariff increases. AID will consider providing additional financing through future amendments to this Power Sector Support Project following the GOE's implementation of electricity price increases satisfactory to the needs of the macroeconomic reform. In this regard, the lead donor for negotiating energy price reforms will likely remain the IBRD. It is AID's strategy under this Project to closely coordinate our policy objectives in energy with those of the IBRD.

I. Project Rationale

1.39 The Project supports the government's program to reform the structure of electricity rates and reduce the level

of the subsidy. This Project fits within a larger effort involving the International Monetary Fund (IMF) and the World Bank (IBRD) to stabilize and restructure Egypt's economy. Correcting the price of electricity is an essential element of this macroeconomic adjustment. In terms of structural adjustment, the reform of electricity prices will provide consumers with a more appropriate relative price of electricity vis-a-vis other production inputs. In terms of stabilization, correct prices will reduce uneconomic consumption and raise needed budget revenues.

1.40 The net effect of the macroeconomic reform including the correction in the price of electricity and its effect on the consumption of electricity is expected to be a slow down in the rate of growth of demand for electricity in the near term (next five years) followed by an increase thereafter as the reform stimulates new but more economic uses. Consequently, USAID support for electricity price reform is being programmed to the electricity sector rather than for general balance of payments support. Even with the elimination of uneconomic uses, the growth of demand for electricity will require additional generation capacity and distribution facilities.

J. Conformity with Recipient Strategy and Programs

1.41 In addition to the GOE's price reform commitment within the framework of the structural adjustment, the electricity sector is an important element of the government's Five Year Plan. The present Five Year Plan (1987/88 - 1991/92) calls for a LE 4.2 billion investment in the sector, which is 10 percent of the total planned national investment. The GOE considers development of the electric power sector to be a critical element of their long term strategy for national modernization. The GOE's major objectives for the sector are: (1) expand electric generating facilities on a least cost basis in order to meet anticipated demand; (2) maximize the hydroelectric generation potential of the Nile; (3) expand existing gas turbine plants through the addition of steam cycles (combined cycle operation); (4) maximize the use of available natural gas as a primary fuel; (5) reduce system losses; (6) improve the reliability and efficiency of the electric power system; (7) develop solar and wind generation capacity; and (8) implement programs to reduce the rate of growth of electricity consumption.

1.42 EEA is currently rehabilitating a number of gas and steam turbine generating units with a combined rating of 400 MW and hopes to recover more than 200 MW upon completion of this rehabilitation. More than 1200 MW of EEA's generating capacity is in excess of 20 years old and could benefit from a comprehensive rehabilitation program.

1.43 Technical and commercial energy losses in the national power system (transmission and distribution) are estimated to be in excess of 16% of the energy transmitted. Of these, some 8% occur on the EEA networks and losses in excess of 8% occur on Distribution Companies' systems. These losses are about double the losses on comparable power systems in the U.S. On some Distribution Company systems, distribution losses have exceeded 20% of the energy purchased from EEA. EEA has initiated a reactive power compensation project aimed at reducing these losses by installing capacitor banks on the 11kV busses in 66/11 kV substations. The Urban Electric Distribution Project (Project 263-0033) and the Alexandria Electric Network Modernization Project (Project 263-0194) are funding the installation of capacitors distributed on the 11kV distribution circuits in Alexandria.

1.44 While rehabilitation of the distribution systems in Cairo, Alexandria, Shibin El Kom, Beni Suef and along the Suez Canal have been effective in lowering distribution system losses, major energy savings are possible in other areas. A Requirement Precedent to Disbursement of Project funds would require the agreement of the GOE to undertake a study, using Project funds to identify the sources and magnitude of individual distribution system losses in Distribution Company systems and The Canal, Delta and Northern and Southern Upper Egypt, and to recommend specific corrective measures including cost estimates.

1.45 EEA is pursuing energy conservation programs on both the supply and demand sides of the sector directed at all segments of the Egyptian economy. On the supply side, EEA is planning to add steam cycles to many gas turbine installations to achieve the operating efficiencies of combined cycle operation. EEA is proceeding with the installation of hydroturbine generators at Esna and plans to make similar installations at Nag Hammadi and Assiut to maximize their hydro energy.

1.46 On the demand side, EEA's program of energy conservation involves the identification of unnecessary uses of electric energy, introduction of measures to improve the efficiency of energy utilization, and management of customer demand. EEA's studies of the cement industry have identified processes that could be rescheduled to off peak periods without affecting production output and EEA's recommendations are being implemented.

1.47 This Project supports EEA's program of initiating pricing reforms based on a rational pricing strategy,

identifying system improvements that would reduce energy losses and achieving efficiency improvements on the supply side. The outputs of the Project will directly contribute to increasing efficiency of supply. They are: a 150 MW combined cycle unit; modernization of a 350 MW oil fired generating plant and conversion of its boilers to burn natural gas; refurbishment and relocation of three gas turbines to a site off the EEA network; extension of a microwave communication network from Cairo to the Suez Canal area; and the supply of commodities and spare parts essential for the assured reliable operation of the national power system.

K. Relationship to CDSS:

1.48 USAID's 1989 CDSS, dated January 19, 1987, identified energy as a key factor affecting Egypt's productivity and noted that a reliable power source is clearly a critical element in the growth of modern industry and agriculture. Just as important, Egypt's energy pricing policies have burdened the economy with overconsumption and waste of this essential input to development which has led to uneconomic industrial investments and a growing fiscal deficit.

1.49 The CDSS identified a number of problems inherent in the existing power system which could prevent the system from providing the reliable power needed for expanded productive activity. It pointed out that potential shortages over the next few years would result in poor system reliability, inability to meet peak demand, scheduled and unscheduled blackouts, reduced productivity and unproductive investments in standby generation.

1.50 The CDSS concluded that, since rational energy pricing is the first step in stimulating energy conservation which could resolve many of the above problems, USAID's strategy in the sector would emphasize the need for price increases in concert with other donors and that USAID would focus on a "least cost" energy strategy emphasizing rehabilitation, conservation, training and planning. Given the critical importance of pricing to remove distortions, USAID would not provide any further funding for physical improvements in the sector (rehabilitation or new generation) in the absence of significant price increases.

1.51 Over the past two and a half years the GOE has undertaken reforms but at a slower pace than the CDSS had contemplated and as a result many opportunities for needed assistance were lost. The 1989 CDSS Update dated July 4, 1989 provides much needed flexibility in the rational and effective

programming of funds when policy progress is slow. To the extent possible, USAID will use both program and project assistance to support policy progress and will use policy based sector projects to support sectoral policy reforms when it makes sense to do so. At the project level, policy emphasis will focus on issues of institutional development, cost recovery, operations and maintenance, environmental concerns, participant involvement in decision making and providing choices in the delivery of goods and services.

L. Other Donors:

1.52 The IBRD considers energy price reforms to be crucial for meaningful economic reform and is ready to provide a major infusion of funds to the electric power sector under an effective reform scenario. The IBRD has provided three loans to the power sector for generating capacity additions at Shoubrah El Kheima and Aswan II and for a Rural Electrification Program. As a result of the March 1989 electricity price increase, the IBRD is expected to finance a fourth project involving combined cycle additions to existing gas turbines at Mahmoudia and Dammanhour and transmission system additions associated with the Damietta combined cycle plant.

1.53 The African Development Bank (ADB) likewise has taken an active role in the electric power sector. The ADB has financed nine projects in the power sector in the last 15 years. Five projects involved the extension of electrical networks along the Suez Canal and in rural areas of Egypt and the remaining four projects involved generating capacity additions. The ADB shares the pricing concerns of AID and the IBRD and linked financing of their most recent project, two 300 MW generating units at Cairo West, to a substantial electricity price increase before mid 1989.

1 54 The European Investment Bank (EIB) has taken an active role in the electric power sector. The EIB has financed portions of the Shoubrah El Kheima plant and is expected to finance equipment for the steam cycle additions at Damietta. EIB financing in the sector is contingent on substantial electricity price increases.

1.55 Other donors have provided "soft" loans which have been used for the purchase of cables, switchgear and other accessories for the modernization of electrical networks in Egypt.

M. AID/W Review of PID:

1.56 The Project Identification Document (PID) was reviewed by ANEPAC on March 17, 1988. The Power Sector Support Project then proposed was based on electricity pricing reforms which would trigger financing for generating capacity additions and refurbishment of several gas turbines.

1.57 The PID was approved (Annex A) with the recommendation that the Project also consider broader issues which include:

a. A comprehensive approach to institutional and managerial reforms that would improve the overall performance of the utility (EEA) by modernizing investment planning, financial, technical and information management systems;

b. Establishment of a "sister" relationship with a corresponding electric utility in the United States that would provide support capability in expansion planning, tariff structuring and load management research; and

c. Development of reform targets which would trigger subsequent funding based on the linkage of anticipated real price increases to future demand levels.

1.58 EEA has instituted organizational and managerial reforms in investment planning, financial, technical and information management system as described in this section and in the Financial and Managerial/Administrative Analysis Annexes (Annexes H and K).

1.59 The benefits of a "sister" relationship with an electric utility in the United States could include support capability in expansion planning, electricity price structuring, load management, etc. and deserves careful review. Such a relationship must consider EEA's broader development needs and how EEA, as a government owned and controlled organization, could benefit from such a relationship with an investor owned utility. Considering EEA's utilization of a broad range of utility consultants in all aspects at their operation, the suggested relationship with a U.S. utility may do little to enhance EEA's operations and management. EEA, however, is always interested in exploring opportunities to improve their overall operational and managerial capabilities and the concept will be reviewed in depth.

1.60 The reform target is the economic pricing of electricity by the late 1990's. Progress in meeting this reform target sufficient to warrant additional funding has been discussed in this Section.

1.61 A joint review of the restructured project by AID/W and USAID during Program Week in April 1989 concluded that, since the reform concept of the Project remained unchanged, a revision to the PID was not required.

II - PROJECT DESCRIPTION

A. Goal and Purpose:

2.01 The goal of the Project is to promote rational investment and consumption decisions throughout the economy and to reduce the national budget deficit.

2.02 The purpose of the Project is to support past and 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.

B. Project Focus:

2.03 The focus of this Project is support of the program undertaken by the GOE to add generating capacity and to rehabilitate existing generating facilities, to more fully utilize natural gas as the fuel for generating electricity, and to secure replacement parts and spare parts to maintain existing generating facilities. The Project will fund technical assistance and engineering services, equipment and construction. It is a direct response to the 30% increase in electricity tariffs which the GOE implemented in March of 1989. Possible future expansion of the Project will be driven by GOE policy changes and improvements in the way the sector is managed. The MEE and EEA are seeking reforms in the sector, particularly a rational energy pricing structure, and AID will support these organizations in achieving their sector policy goals.

C. Project Components:

2.04 The total LOP funding ($336 million) will be approved in phases contingent on satisfactory policy reform in the electric energy sector. The initial phase of $136 million constitues a discrete Project. The Project is designed to be financed in a single year and the components of the Project will not be dependent on subsequent financing. The Project, by its very nature as a Sector Support Project, can be expanded to include additional components which could build on the activities outlined here. Decisions on subsequent year funding will be based on policy reforms in the Sector. Additional future funding will be added by amending the Project.

2.05 This Project is part of the means to achieve the larger purpose of significant increases in the selling price of electric energy. Based on a program of annual price increases, the electricity sector subsidy could be eliminated by the late 1990's. The Project, as a response to a substantial price

increase in March 1989, demonstrates AID's commitment to economic assistance in sectoral policy formation and implementation. AID's willingness to support policy change of this nature is expected to contribute to future moves toward economic pricing of electrical energy. At the forefront of the policy dialogue and electric energy strategy is the narrowing of the gap between the existing highly subsidized electric energy costs and the real (economic) costs of generating, transmitting and distributing electric energy. The electricity pricing strategy study, to be undertaken by EEA, will recommend rate strategies and will include an evaluation of time of day pricing which, if implemented, should have a major impact on peak demand.

2.06 AID will finance goods and services with their source and origin in the United States. The GOE will finance the local currency costs for the various components of the project. GOE in-kind contributions will include staff, office space and equipment, buildings and land.

2.07 EEA will be the implementing agency for the Project.

2.08 Project funds will finance the foreign exchange cost of:

a. equipment and installation of a combined cycle unit at Cairo South which will include a gas turbine, a steam turbine, a heat recovery steam generator and auxiliaries including a water treatment system. AID will finance consultant services associated with the plant design and installation. When the combined cycle unit is operational in 1993, the plant capacity will be increased by an estimated 150 MW.

b. equipment, installation supervision and technical assistance for the modernization of the 350 MW Cairo West Thermal Power Station boilers and turbine generators and modification of the boilers to burn natural gas as well as mazout oil. A computerized burner management system will be installed, portions of the boiler will be replaced, portions of the steam turbines will be replaced and portions of the electrical instrumentation and controls associated with the turbine generators will be upgraded or replaced. When the plant rehabilitation is complete in 1993, the plant output will be increased from the present 300 MW to 350 MW, the plant fuel consumption rate will be improved from the present 275 grams per kWhr to 260 grams per kWhr and the plant availability

will be improved so that the plant capacity factor will increase from the present 68 percent to 80 percent. AID will also finance consultant services associated with this modernization.

c. replacement parts, modern control systems and installation supervision necessary to refurbish several gas turbine generating units that have been in operation for nearly 10 years. Once the units are repaired, they will be relocated to a site along the Red Sea adjacent to Hurgada to strengthen the isolated network serving the Hurgada-Safaga coastal region. When the installation is complete, the gas turbines should individually produce 20 MW with a fuel consumption rate of 360 grams per kWhr. AID will also finance consultant services to oversee the installation of the gas turbine units.

d. expansion of EEA's microwave communication system from Cairo to the Suez area. This expansion will include towers, antenna and radio equipment necessary for the transmission of data from six stations to the NECC. AID will also finance a limited scope of consultant services to support EEA during the contractor selection and the equipment manufacturing phase of procurement of the microwave system.

e. procurement of replacement parts, spare parts, control instruments, test and laboratory instruments, specialized mobile work equipment and work tools used in system wide applications.

f. training of EEA staff who will operate and maintain the equipment once installed. The training requirements will be determined by the contractors selected in collaboration with EEA and the appropriate consultant.

g. technical assistance in the form of project monitoring services (AID personal service contractor) and electricity pricing strategy and distribution system loss reduction studies and subsequent follow-up studies as required.

2.09 EEA is seeking donor financing for equipment and services for a 1200 MW natural gas/oil fired thermal power station to be constructed on a site near El Kureimat on the east bank of the Nile River, 95 kilometers south of Cairo. The feasibility study was financed by AID. EEA plans to convene a

meeting of potential financiers in September 1989. If sufficient financing is pledged, EEA will request that sufficient funds for the initial design and preparation of specifications (presently estimated not to exceed $10 million) be transferred from the funds for Cairo South to the unfunded El Kureimat component.

D. Project Outputs:

2.10 The ultimate objective of the Project is significant increases in the selling price of electric energy based on a program of annual price increases sufficient to eliminate the electricity sector subsidy by the late 1990's. The outputs of the Project are:

- Construction of 1-150 MW combined cycle unit.
- Rehabilitation of four steam turbine generating units.
- Rehabilitation of three gas turbines and installation at new site.
- Extension of the NECC microwave communications system.
- Provision of spare and replacement parts and work equipment.
- Completion of electricity pricing strategy and loss reduction studies.

2.11 The fact that this Project is being implemented after a substantial price increase in March 1989 demonstrates the supportive nature of AID's economic assistance in sectoral policy formation and implementation. At the forefront of the policy dialogue and electric energy strategy is the narrowing of the gap between the existing highly subsidized electric energy costs and the real (economic) costs of generating, transmitting and distributing electric energy. The electricity pricing strategy study, to be undertaken by EEA, will recommend rate strategies and will include an evaluation of time of day pricing which, if implemented, should have a major impact on peak demand.

2.12 Electricity price increases in subsequent years will be evaluated to determine if the price increase conforms to the longer range plan to eliminate subsidies by the late 1990's and is reducing the gap between current prices and the economic price. Additional funds may be provided through an amendment to the Project Authorization for activities that constitute a "least cost" addition of generating capacity or otherwise improve the efficiency of the power system. Expanded Project activities could include:

a. consultant services and major items of equipment for a thermal power station.

b. consultant services, technical services and hardware to upgrade the computer hardware and software systems of the National Energy Control Center to more powerful systems.

c. consultant services, equipment and materials to reduce energy losses on the distribution systems.

d. consultant services, equipment, construction and installation services for additional hydraulic generation at sites along the Nile River.

B. Section 611 (a) Requirements:

3.03 The estimated costs of the goods and services to accomplish the Project purpose have been based on a sound engineering approach to achieving project outputs. The plans for accomplishing the Project purpose are consistent with good utility practices. The cost estimate for Cairo South was developed by EEA based on recent cost data from several similar projects. The cost estimates for the Cairo West rehabilitation and gas turbine refurbishment are based on current firm price proposals from the original equipment suppliers following extensive investigations and negotiations. The cost estimates for the microwave extension and commodities are based on equipment costs from similar procurements. The cost estimates for the technical assistance are Mission estimates based on the scope of services for the studies and monitoring services. The cost estimates have been reviewed by the Project office and are judged to be reasonable. Therefore, it is the conclusion of the Project Committee that the requirements of Section 611 (a) of the Foreign Assistance Act of 1961, as amended, have been satisfied.

C. Project Financial Plan:

3.04 The source and application of funds required for the Project are summarized in Table III-3:

TABLE III-3
SUMMARY FINANCIAL PLAN

FUNDING SOURCE	U.S.DOLLARS (MILLIONS)	EGYPTIAN POUNDS-MILLIONS CASH	IN-KIND
AID Grant	$136.0		
GOE Contribution		LE 42.7	21.6
	$136.0	LE 42.7	LE 21.6
FUNDING APPLICATION			
Technical Services			
Consultant Services	$ 6	LE 4	-
El Kureimat Design Services	-	-	-
Electricity Pricing Strategy Study	$ 0.5	-	-
Loss Reduction Study	$ 1.0	-	-
Personal Services Contract Support	$ 1.0	-	-
System Studies (Other)	0.5	-	-
Sub-Total	$ 9.0	LE 4	-
Equipment and Installation Services			
Cairo South Combined Cycle	$ 68	LE 30.7	LE 12.0
Cairo West Modernization	$ 23.6	LE 4.0	LE 1.3
Hurgada Relocation	$ 7.3	LE 1.3	LE 8.1
Microwave Expansion	$ 0.9	LE 0.3	LE .2
Sub-Total	$ 99.8	LE 36.3	LE 21.6
Commodities			
Spare Parts, Instruments, Test Equipment	$13.3	LE 2.4	-
Sub-Total	$13.3	LE 2.4	-
Audit, Monitoring and Evaluation	$ 0.3		
Contingency-Price	$ 6.0		
(Inflation) Physical	$ 7.6	-	
	$ 13.9	LE 0	LE 0
T O T A L	$136.0	LE 42.7	LE 21.6

D. Funding Responsibilities:

3.05 AID grant funds will finance the consultant(s)' foreign exchange costs and the cost of equipment and installation services for the combined cycle unit at Cairo South, the modernization of the generating units at Cairo West, equipment and supervision services for the rehabilitation of three gas turbines and their move to Hurgada and procurement of commodities. Payment will be made by USAID through Direct Letters of Commitment (D L/Comm).

3.06 The Grant Agreement will contain a Requirement Precedent to Disbursement requiring that the Cooperating Country provide evidence that the proceeds of the Grant's funding for consultant services have been passed to EEA as a grant and the balance of the Grant for equipment, materials and installation service have been passed to EEA as a loan on terms and conditions approved by the appropriate authorities of the Cooperating Country.

3.07 The Grant Agreement will provide that the Cooperating Country will provide any additional foreign exchange required by the project.

3.08 The GOE will finance all local currency costs associated with the Project including land acquisition, storage areas, electric transmission system modifications to their network to connect the gas turbines and combined cycle plants to the Unified Power System, and extension of gas transmission pipelines to the Cairo South, Cairo West and Hurgada sites. The GOE will issue appropriate local currency letters of credit (L/C) to contractors supplying equipment and materials.

3.09 The Grant Agreement will contain a Requirement Precedent to Disbursement requiring that the Cooperating Country provide evidence that the local currency financing for the Project has been budgeted by the Cooperating Country and will be available for timely expenditure by EEA.

E. Disbursement Projections:

3.10 Disbursement of the $136 million in AID funds over the project implementation period is outlined in Table III - 4 below. The disbursement schedule is based on the Project being authorized in FY-89 with all construction or equipment installation to be completed in FY 93.

TABLE III-4
DISBURSEMENT SCHEDULE - AID FUNDING
(U.S.$ - MILLIONS)

FISCAL YEAR	US DOLLARS
FY 90	$ 19
FY 91	$ 35
FY 92	$ 54
FY 93	$ 28
TOTAL	$136

3.11 The Grant Agreement will contain a Requirement Precedent to Disbursement requiring that EEA establish and maintain accounting records of local currency and in-kind contributions for each component of the Project.

3.12 The Grant Agreement will also contain a Covenant that EEA will provide to USAID, in a timely fashion, quarterly copies of the accounting information on local currency and in-kind contributions for each component of the Project.

F. Assessment of EEA Contracting and Voucher Examination Capabilities:

3.13 USAID's Financial Management (FM) Directorate, in conjunction with previous A.I.D. Grants, has assessed EEA's contracting and voucher examination capabilities. Their assessments have found that throughout the implementation of previous projects EEA has performed well in: (1) the review of project designs, bid solicitation and contract documents; (2) approval and award of contracts; and (3) overall management of contractor performance. The strengths of EEA's contracting and voucher examination system are good segregation of duties, good documentation of decisions and a thorough system of approvals. These same strengths, however, have sometimes contributed to slowness and delays in contracting actions. Based on FM's review and USAID's extensive prior experience with EEA's contracting capabilities, it is our opinion that EEA's contracting capabilities and voucher examination procedures are satisfactory. It is our opinion that EEA is well equipped to undertake the additional activities proposed by this Project.

3.14 In accordance with the requirements of the Sixteen Payment Verification Policy Statements, Table III-5 illustrates the methods of implementation and financing of AID funds for the Power Sector Support Project.

G. Audit Coverage:

3.15 Funds provided by this project will be used to finance one or more AID Direct contracts and five or more lump sum, fixed price Host Country contracts with U.S. firms. These contracts are summarized in Table III-6.

TABLE III-5
ASSESSMENT OF THE POWER SECTOR SUPPORT PROJECT
METHODS OF IMPLEMENTATION AND FINANCING

ACTIVITY	METHOD OF IMPLEMENTATION	TYPE OF CONTRACT	METHOD OF FINANCING	COST ESTIMATE $ MILLION	IMPLEMENTING AGENCY
1. Consultant Services	AID Direct/ Host Country	Cost + Fixed Fee	Direct L/Com	12	EEA
2. Cairo South Combined Cycle	Host Country	Lump Sum	Direct L/Com	72	EEA
3. Cairo West Modernization	Host Country	Lump Sum	Direct L/Com	25	EEA
4. Hurgada Relocation	Host Country	Lump Sum	Direct L/Com	8	EEA
5. Microwave Expansion	Host Country	Lump Sum	Direct L/Com	1	EEA
6. Commodities	AID Direct	Lump Sum	Direct Payment	17.7	AID
7. Monitoring/ Evaluation	AID Direct/ PSC	Fixed Price	Direct Payment	0.2	AID
8. Audit	AID Direct	Fixed Price	Direct Payment	0.1	AID

The only method of financing requiring justification is the use of the Direct Letter of Commitment. The use of the Direct Letter of Commitment is justified because the GOE does not have the foreign exchange to pay and wait for reimbursement.

3.16 At least five contracts will be lump sum fixed price (FP) contracts. For any AID financed negotiated contract (NC), the contract is subject to audit of costs. The Project will also utilize consultant engineering services financed through a Host Country contract (HC) which is also subject to audit of costs. All contracts, however, are subject to audit for compliance with other AID regulations and funds are allocated for this purpose. The Project budget includes $100,000 to cover the estimated auditing costs of these contracts. Audit funds budgeted by activity are summarized in Table III-6.

TABLE III-6
UTILIZATION OF AUDIT FUNDS

ACTIVITY	NUMBER OF CONTRACTS	TYPE OF CONTRACT	ESTIMATED CONTRACT AMOUNT ($000)	AUDIT FUNDS BUDGETED
Technical Services	1 to 7	NC-HC/AID CR	$ 12,000	$ 10,000
Cairo South Combined Cycle	1	HC-FP	$ 72,000	$ 30,000
Cairo West Modernization	1	HC-NC-FP	$ 25,000	$ 30,000
Hurgada Relocation	1	HC-NC-FP	$ 8,000	$ 15,000
Microwave Expansion	1	HC-FP	$ 1,000	$ 15,000
Commodities	Numerous	AID-FP	$ 17,700	-

IV. PROJECT IMPLEMENTATION PLAN

A. Implementing Agency:

4.01 The EEA will have primary responsibility for the overall management of the Project and for providing direction to the consulting engineer(s) and contractors. The Grant Agreement will contain a Requirement Precedent to Disbursement requiring a statement of the names of the persons authorized to represent the Cooperating Country for each component of the Project together with a specimen signature of each person.

B. Project Procurement Plan - General:

4.02 The procedures and guidelines contained in AID Handbook 11, Country Contracting, shall apply to the procurement of goods and services for the Project with source/origin of goods and services limited to AID Geographic Code 000 (the US).

4.03 In the past, application of certain host country laws have had an adverse impact on contractors financed by AID. Therefore, covenants will be included in the Grant Agreement exempting AID financed Project contractors from the application of the "Decennial Liability Law" and "Social Insurance and Taxes on Expatriates."

4.04 Use of U.S. minority owned, small and/or economically and socially disadvantaged subcontractors will be utilized to the maximum extent practicable in the procurement process. A set aside for Section 8(A) small business enterprises is included in the procurement plan. All notices and advertisements placed in the U.S. soliciting expressions of interest from or announcing opportunities for U.S. consulting engineering firms or organizations to submit bids or qualifications for components of this project will state that the primary contractor will make every reasonable effort to identify and make the maximum practicable use of Gray Amendment entities.

4.05 USAID has had considerable prior experience with EEA's contracting capabilities on projects of similar scope and has found them to be effective and satisfactory even if at times they appear cumbersome and time consuming. EEA competitively selected and awarded 10 individual supply and construction contracts for the AID financed portion and 29 other contracts for other donor financed portions of the Shoubrah El Kheima thermal power station, and six contracts for the non AID

financed combined cycle installation at Damietta and negotiated a turnkey contract for the installation of the three gas turbines at Cairo South. EEA will utilize turnkey contracting for the combined cycle installation at Cairo South and the microwave system expansion and equipment supply contracts (with installation supervision services) for the Cairo West and gas turbine refurbishment and relocation. EEA will utilize Host Country contracts. USAID will review all contracts to assure compliance with AID regulations and to verify the reasonableness of the contract cost.

4.06 Technical services will be provided through a Host Country contract for the services at Cairo South and through AID Direct contracts for 8(A) firms that will provide services for the Cairo West, microwave system expansion and gas turbine refurbishment and relocation.

4.07 Several procurement waivers are contemplated. The justification for these waivers is more fully discussed in subsequent paragraphs.

4.08 A covenant will be included in the Grant Agreement which will provide that a vehicle procurement plan, if vehicles are to be procured, will be prepared by EEA in accordance with relevant USAID requirements prior to the procurement of any Project financed vehicles.

C. Project Procurement Plan - Technical Services

4.09 The Gas Turbine Combined Cycle Associates, (GTCC) a joint venture of Overseas Bechtel, Inc. (OBI) and Gilbert/Commonwealth International, Inc. (GCII) is under contract to EEA to provide contract administration, engineering support and construction supervision services for the installation of the three gas turbine generators at the existing Cairo South thermal power station. OBI had previously prepared the gas turbine and Heat Recovery Steam Generator specifications for this installation. GCII has been the construction supervisor for the installation of the three gas turbines and for all AID project financed gas turbines installed in Egypt. Gilbert was EEA's engineer and provided construction supervision for the Talkha combined cycle addition (AID Project 263-0196). EEA has requested AID approval to negotiate a contract with GTCC for consultant services for the Cairo South combined cycle unit. Retention of GTCC would provide EEA with the benefit of OBI's and GCII's combined expertise in the details of this addition and utilize specifications previously developed for the gas and steam turbine generators and heat recovery steam generators.

4.10 If EEA were to follow AID normal competitive procedures for the selection of the consultant, GTCC would likely be selected since technical expertise (based partly on experience), not cost, is the major basis for selecting a technical services contractor.

4.11 A.I.D. Handbook 11, Chapter 1, paragraph 2.4.2 a.3 authorizes a sole source waiver for technical services when:

> "One firm can be demonstrated to have the unique capability by reason of special experience or facilities, or specialized personnel who are recognized as predominant experts in the particular field to perform the services required for the project."

4.12 GTCC special capabilities, through their present involvement at the Cairo South site and in similar projects for EEA, are clear. The delay inherent in competitive procedures with GTCC almost certain to be chosen anyway at the end of such a process would be inconsistent with the GOE's desire to quickly disburse the funds. Therefore, pursuant to this provision, the Project Committee recommends the noncompetitive selection of Gas Turbine Combined Cycle Associates to provide technical services for the combined cycle unit to be installed at Cairo South. The Mission's NonCompetitive Review Board has been consulted (as required by Delegation of Authority (DOA) 653) and concurs that the noncompetitive selection choice of Gas Turbine Combined Cycle Associates is justified.

4.13 An 8(A) firm with demonstrated experience in power plant performance analysis, operations, maintenance and life extension and AID Host Country contracting regulations will be utilized to review the operating performance of the Cairo West plant. The firm will identify boiler, turbine generator and instrumentation conditions which affect the efficiency and reliability of the plant and modifications to the boiler required to adapt the boiler to gas firing as well as mazout. The 8(A) firm will then assist EEA in contracting for these plant modifications and improvements. The 8(A) firm will act as EEA's consultant and will provide engineering, contract administration and construction monitoring services.

4.14 An 8(A) firm familiar with AID Host Country contracting regulations and gas turbines will assist EEA in contracting for the refurbishment of three gas turbines and their installation at a site adjacent to Hurgada. Supervision of EEA's work force and responsibility for gas turbine refurbishment and installation at the Hurgada site will also be

provided by the gas turbine replacement parts contractor. The 8(A) firm will act as EEA's consultant and will provide engineering, contract administration and installation monitoring services.

4.15 An 8(A) firm familiar with AID Host Country contracting regulations and microwave communications systems will assist EEA in preparing specifications, evaluating bids and awarding a contract for the turnkey installation of a microwave communications system between Cairo and the Suez Canal area. The 8(A) firm will act as EEA's engineer and will provide factory inspection services in the U.S.

4.16 An electrical engineer with extensive electric utility and project management experience, working under a Personal Services Contract, will assist the Mission's Power System Group in maintaining implementation of the Project.

4.17 Engineering firms will be competitively selected to perform studies that define electricity pricing strategies and identify energy loss reduction programs in selected Distribution Company systems.

4.18 USAID's Office of Commodity Management and Trade will provide procurement services for the procurement of those commodities being financed by the Project.

4.19 If EEA elects to proceed with the initial engineering and preparation of specifications for the 1200 MW El Kureimat Thermal Power Station, the consultant engineer will be selected in accordance with A.I.D. Handbook 11, Chapter 1 regulations. The selected consultant, working under an AID Host Country contract, would initially provide engineering services in the design of the plant and preparation of technical specifications for the various equipment and services packages. The same consultant would also be eligible for subsequent project management, procurement, construction management, start-up and training services.

D. Project Procurement Plan - Construction Services and Commodities

Cairo South Combined Cycle Unit

4.20 EEA, using their own foreign exchange, contracted with General Electric (GE) in 1988 for the installation of three GE Model No. PG 9161 gas turbine generators at the Cairo South plant as the initial step to repower the existing steam turbine

driven generators. GE also installed a gas insulated 220 kV substation to receive the output of the plant and deliver it to the UPS.

4.21 The proposed combined cycle unit to be financed by this Project will consist of a gas turbine generator, a heat recovery steam generator, a steam turbine generator, water treatment facilities and associated auxiliary equipment and controls. A Requirement Precedent to Disbursement will require evidence that a transmission substation will be available upon completion of the unit of sufficient capacity to receive and distribute the unit's energy to the system. Of the various contracting arrangements available, i.e. turnkey or multiple equipment and construction services packages, EEA prefers a turnkey contract which places the burden of responsibility with the turnkey contractor and relieves EEA from monitoring a number of contracts simultaneously. EEA has utilized turnkey contracts on most of their generation expansion projects. Turnkey contracts require that the contractor be totally responsible for the plant design and that the EEA technical consultant review and verify that the design and subsequent installation complies with contract specifications and relevant industry standards.

4.22 EEA has requested a waiver of AID's competitive procurement procedures and approval of a proprietary procurement so they can obtain a GE gas turbine generator of the same model as the three gas turbines installed at Cairo South and a General Electric steam turbine generator.

4.23 The installation of a fourth gas turbine generator incorporating a different design, having different operating characteristics, requiring different maintenance procedures and maintenance tools and requiring a completely different spare parts inventory is not in the best interest of Egypt.

4.24 The steam turbine generator to be installed in conjunction with the gas turbine would be designed to deliver 55 MW at full gas turbine output. Since the UPS is operated at 50 Hertz, the steam turbine generator must be designed to operate at this frequency. Only one U.S. firm, General Electric, manufactures steam turbine generators designed for 50 Hertz operation that comply with AID's source and origin regulations.

4.25 AID Handbook 11, Chapter 3, Section 2.2.5 b states that Proprietary procurement may be justified for reasons such as:

"(1) Substantial benefits, such as economies in maintenance of spare parts inventories, ... or greater familiarity by operating personnel, can be achieved through standardizing on a particular brand;

(2) Compatibility with equipment on hand is required; or

(3) Special design or operational characteristics are required."

In the case of Cairo South, all of these criteria are met and proprietary procurement is justified. As required under Delegation of Authority (DOA) 653, the Mission's NonCompetitive Review Board has been consulted and concurs.

4.26 Based on the above rationale and standards set forth in AID Handbook 11, Chapter 3, the Project Committee recommends approval of a proprietary procurement of a General Electric gas turbine generator and steam turbine generator based on AID competitive procurement procedures for the Cairo South combined cycle unit.

Cairo West Modernization:

4.27 The proposed boiler rehabilitation will involve extensive boiler tube replacement involving the water walls and superheater sections. Conversion of the boiler from Mazout to dual fuel firing requires additional reconfiguration of the combustion zone of the boilers. The turbine generator rehabilitation will involve major reworking of portions of the steam turbines. EEA has discussed with Westinghouse Electric company (Westinghouse), the turnkey contractor and turbine generator supplier for the Cairo West plant, and Babcock & Wilcox (B & W), the boiler supplier for the plant, programs to rehabilitate the plant and add natural gas firing of the boiler. Both B & W and Westinghouse have provided EEA with proposals to rehabilitate the boilers, turbine generators, instrumentation and controls and to add natural gas firing for the boilers.

4.28 The turbine generators and their associated controls were designed, manufactured and installed by Westinghouse. The designs are proprietary and held exclusively by Westinghouse. Similarly, the boilers and their associated controls were designed, manufactured and installed by B & W. The designs and materials for the boilers are proprietary and held exclusively by B & W. Through the years, both Westinghouse and B & W have monitored the plant performance and B & W did provide, on a noncompetitive basis, equipment and installation services for

boiler repairs in 1982-83. Both Westinghouse and B & W will provide technical assistance to EEA's work force for the rehabilitation of equipment, installation of the burner management system, start-up, testing and training.

Hurgada Relocation:

4.29 EEA and GE have discussed the refurbishment of the gas turbines presently installed at El Fayoum, Cairo North and Abu Matamir. The gas turbine generators and their associated controls were manufactured by GE. The major components of the gas turbines to be refurbished involve the compressor, combustion chambers, hot gas path and turbine blading, all incorporating proprietary designs and materials owned by GE. In addition, GE will furnish current design voltage regulators, excitation controls and integrated turbine generator control systems, again incorporating proprietary designs. GE will supervise, direct and be responsible for EEA's work force carrying out the refurbishment, move, installation, start-up, testing and training.

Waiver of Competitive Procurement Procedures

4.30 EEA has requested a waiver of AID's competitive procurement procedures and approval to negotiate contracts with: (1) Westinghouse Electric Company for the rehabilitation of the Cairo West turbine generators and associated controls; (2) Babcock and Wilcox for the rehabilitation of the Cairo West boilers and to add natural gas firing for the boilers; and (3) General Electric for the rehabilitation of three gas turbines and their relocation and installation at a site near Hurgada.

4.31 Handbook 11, Chapter 3, Section 2.2.5 states that:

> "Proprietary procurement may be justified for reasons such as:
>
> (2) Compatibility with equipment on hand is required; or
>
> (3) special design or operational characteristics are required."

In the case of equipment and services discussed in Sections 4.20 through 4.25 above, some or all of these criteria are met and proprietary procurement is justified. As required under DOA 653, the Mission's NonCompetitive Review Board has been consulted and concurs.

Handbook 11, Chapter 3, Section 2.2.5c states:

> **"If proprietary procurement is justified, the requirement may serve as the basis for authorizing... negotiation with a single source in accordance with Section 2.2.6."**

Section 2.2.6a states:

> "Competition in the procurement of commodities may be waived and negotiation with a single source authorized:
>
> (2) When proprietary procurement is justified and the necessary equipment, materials or spare parts are available from only one source taking into account any special requirements such as the need for in country service capability."

The needed equipment and parts are custom made and available, with confidence, only from the original manufacturer. The Mission's Noncompetitive Review Board has been consulted and concurs.

4.32 Based upon the above rationale and standards set forth in AID Handbook 11, Chapter 3, the Project Committee recommends approval of a waiver of AID procurement rules and authorization for EEA to negotiate contracts with Westinghouse for the rehabilitation of the turbine generators and associated controls at Cairo West; Babcock & Wilcox for the rehabilitation of the boilers and associated controls and addition of natural gas firing for the Cairo West; and General Electric for the refurbishment and installation of three gas turbines at Hurgada.

Microwave Expansion:

4.33 The procurement of the microwave communication system, utilizing a Host Country turnkey contract, will be competitively awarded based on A.I.D. Handbook 11, Chapter 2 and 3 regulations. The turnkey contractor will perform a site survey to determine tower locations, and will design, supply, install, test and start-up the communication system, train EEA personnel, provide spare parts and warrant the system for two years.

Commodities:

4.34 The procurement of commodities to be financed by this project will be in accordance with normal commodity procurement procedures. Since a portion of the commodities includes either replace parts or spare parts, several procurement waivers are anticipated.

E. **Implementation Schedule:**

4.35 By September 1, 1989, the Project Authorization is expected to be approved.

4.36 By September 30, 1989, the Project Grant Agreement should be executed by representatives of the Governments of the United States and the Arab Republic of Egypt.

4.37 By late December 1989 all Initial Requirements Precedent to Disbursement of Project Funds contained in the Grant Agreement should be satisfied and grant funds could be available for Project commitments.

4.38 By December 31, 1989 the consultant services contract for the Cairo South Combined Cycle unit should be signed.

4.39 By December 31, 1989 an 8(A) contract will be signed for the analysis of the Cairo West plant and for contract negotiation assistance for EEA.

4.40 By December 31, 1989, an 8(A) contract will be signed for consultant services to assist EEA in negotiating a contract with GE for the gas turbine refurbishment and relocation to Hurgada.

4.41 By February 28, 1990, an 8(A) contract will be signed for consultant services to assist EEA in the extension of the microwave communication system from Cairo to the Suez Canal area.

4.42 By March 31, 1990 the 8(A) contractor will complete the analysis of the Cairo West Plant.

4.43 By May 31, 1990 the contract for the gas turbine refurbishment and relocation to Hurgada should be signed.

4.44 By June 30, 1990 the specifications and bid documents for the Cairo South combined cycle unit will be complete and the procurement will be advertised in the Commerce Business Daily.

4.45 By July 31, 1990 the specifications and bid documents for the turnkey installation of the microwave communication system will be advertised in the Commerce Business Daily.

4.46 By August 30, 1990 the contract for the Cairo West rehabilitation will be signed.

4.47 By September 30, 1990 technical study contracts for the electricity pricing strategy study and distribution loss reduction study will be signed.

4.48 By March 31, 1991 the turnkey contract for the Cairo South combined cycle unit will be signed.

4.49 By April 30, 1991 the turnkey contract for the microwave communication system will be signed.

4.50 By September 30, 1991 the El Fayoum, Cairo North and Abu El Matamir gas turbine generators will have been refurbished and relocated at a site near Hurgada and will be operational.

4.51 By September 30, 1991 the electricity pricing strategy study will be complete.

4.52 By September 30, 1992 the distribution loss reduction study will be complete.

4.53 By April 30, 1993 the microwave communication system between Cairo and the Suez Canal area will be operational.

4.54 By May 31, 1993 the rehabilitation of the Cairo West turbine generators and boilers will be completed and the four boilers will be fired on gas.

4.55 By September 30, 1993 the Cairo South Combined Cycle unit will be installed and in operation.

4.56 Project completed on December 31, 1993.

4.57 Terminal Date for Disbursements September 30, 1994.

F. Training:

4.58 Formal training programs will be conducted by the equipment supply contractors as part of each Project component. Foreign exchange costs will be financed from Project funds and local costs, including overseas air transportation, will be provided by the EEA. The contractors will be responsible for conducting the formal training programs at the contractor's and/or subcontractor's plants and on-site in Egypt.

4.59 A Covenant will be included in the Grant Agreement which will provide that EEA select additional operation and

maintenance staff as required for each plant, and will commence comprehensive training programs sufficiently in advance of the startup of all Hurgada gas turbines, the Cairo South combined cycle unit and the rehabilitated Cairo West turbine generators and boilers, so that operations and maintenance personnel will be on-site, trained and fully qualified to operate and maintain the generating units when they are placed in service.

G. AID Financing Procedures:

4.60 All Host Country procurements of services and equipment financed by this Grant will be financed by Direct Letters of Commitment (D L/Comm). Upon receipt of an executed contract acceptable to AID and a request from EEA to issue a Letter of Commitment, AID will issue a Direct L/Comm to the contractor. EEA will issue appropriate Letters of Credit (L/C).

H. Terminal Dates:

Requirements Precedent:

4.61 The terminal date for meeting the Requirements Precedent to Disbursements for the initial funds provided by this agreement will be 90 days from the signing of the Grant Agreement.

Project Assistance Completion Date:

4.62 The Project Assistance Completion Date (PACD) is December 31, 1993.

Terminal Disbursement Date:

4.63 The Terminal Disbursement Date (TDD) will be September 30, 1994, nine months after completion of all services, to allow for final payments.

V. MONITORING AND EVALUATION PLAN

A. General:

5.01 The information collected and analyzed in this monitoring and evaluation plan will be used by EEA, PDS/E and USAID Project and Mission management.

B. Institutional Locus:

5.02 The Economics group in USAID monitors policy developments in the electricity and energy sectors as part of their ongoing responsibilities. Information on the impacts of electricity tariff reforms on the macro-economy will be gathered via special studies designed by USAID staff economists and/or via external project evaluations. Data necessary to inform decisions regarding obligation and release of subsequent funds under the Power Sector Support Project will be collected, analyzed, and presented to Mission management and to the Project Committee by USAID staff economists. Monitoring responsibilities related to the construction and rehabilitation of electricity generating infrastructure will be carried out by the Power System Group within the Office of Urban Administration and Development of the Development Resources Directorate. In addition to participating in reviews of contractors' progress and preparation of contractor workplans (described below), Power System Group representatives will conduct periodic site visits to confirm progress indicated in monthly contractor reports (described below).

C. Goal, Project and Output Questions, Indicators and Data Collection Methodologies:

Project Goal:

5.03 The goal of this Project is to promote rational investment and consumption decisions throughout the economy and to reduce the national budget deficit.

Goal Level Evaluation Questions:

5.04 To what extent have increased electricity prices affected economy wide investment, trade, and consumption decisions? Identify factors which have limited the impact of pricing reforms (like the inability of EEA to collect increased revenues). Identify any factors limiting impact which might be addressed by USAID in future activities.

To what extent has the energy sector's contribution to the national budget deficit been reduced by energy pricing revisions?

5.05 Indicators (to be determined in conjunction with PDS/E energy economist):

- o Decreased rate of growth in electricity consumption overall and for selected consumer categories.
- o Increased electric energy conservation (e.g., increased output per unit of energy consumed) in small scale industrial and informal sectors.
- o Reduction in electric power sector's implicit and explicit subsidies.

5.06 Data Collection Methodology

Data collection methodology for goal level indicators will be determined by PDS/E staff.

5.07 Project Purpose

The purpose of this Project is to support past and 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.

5.08 Purpose Level Questions

Has continued progress on electric tariff and fuel price increases been sufficient to permit USAID to obligate and release future tranches of funds under the Power Sector Support project?

5.09 Indicators (to be determined in conjunction with PDS/E staff economist)

o Future electricity rate increases are implemented and are of sufficient magnitude to obtain additional financing from other donors like the IRBD.

o Future electricity rate structures are based on the economic cost of serving various customer classes.

o Future electricity rate increases average ten percentage points above the rate of inflation since the previous electricity price increases.

5.10 Data Collection Methodology

Data collection methodology f· purpose level indicators will be determined by PDS/E staff ..onomists. A requirement precedent to disbursement of FY 89 funds is agreement by the GOE to finance an electricity pricing strategy study using Project funds. Analysis of data in support of decisions to obligate and release future funds will be conducted by PDS/E prior to future decisions to obligate funds. A baseline for evaluating electricity rate increases will be formulated and a system for monitoring rate increases in-house will be set up by November of 1989.

5.11 Project Outputs

Project outputs necessary to achieve objectives include construction of 1-150 MW combined cycle unit, rehabilitation of four steam turbine generating units, rehabilitation of three gas turbines and their installation at a new site, extension of a microwave communications system and provision of spare and replacement parts and work equipment.

5.12 Indicators

- o 150-MW combined cycle unit in service by September 30, 1993.
- o Cairo West plant output increased to 350 MW; plant heat rate improved to 260 grms/kWhr, and plant load factor improved to 80 percent by May 31, 1993.
- o Additional 72 MW's of gas turbine generating capacity in service by September 30, 1991.
- o 6 additional stations providing data to NECC by April 30, 1993.

5.13 Output Level Questions

The key output level questions are: (1) Is construction of the 150 MW combined cycle plant proceeding as planned? (2) Is rehabilitation of the four steam turbine generating plants proceeding as planned? (3) Is rehabilitation of the three gas turbines proceeding as planned? (4) Is extension of the microwave communication system proceeding as planned? (5) Is provision of spare and replacement parts proceeding as planned?

If the answer to any of these questions is no, then what factors are constraining timely or appropriate construction/rehabilitation? How can these constraints be overcome?

5.14 **Data Collection Methodology**

Procedures will be developed by the UAD Power System Group for collecting information on output level indicators.

D. Feedback/Monitoring:

5.15 Project consultants selected to implement the components of the project will have the primary responsibility for monitoring all activities and approving invoices submitted by the supply and construction contractors. They will also assist EEA in monitoring contractors' performance and providing general support to EEA. The consultants will implement monitoring systems with the following features:

Monthly and Quarterly Reports
Annual Work Plans
Joint Annual Reviews of Progress

5.16 USAID has had considerabl experience implementing projects similar to the proposed Project. The primary responsibility for USAID monitoring of the individual components of the Project will be carried out by the Power System Group within the Office of Urban Administration and Development of the Development Resources Directorate (DR/UAD). The group is experienced and, with the addition of a Project funded Personal Services Contractor (PSC) with extensive project development and capital development experience in the electric power industry, will adequately carry out this responsibility.

5.17 In addition to participating in monthly and annual reviews of progress and annual workplans, USAID will conduct periodic site visits to confirm progress indicated in monthly and or quarterly reports.

E. Monthly and Quarterly (if desired) Progress Reports:

5.18 The purpose of the reports will be to communicate implementation progress and problems to the implementing agency and to USAID project management. These reports will discuss planned versus actual procurement and construction/ installation accomplishments of tasks and sub tasks and costs; will identify existing or expected problems/constraints which have or could result in delays or slippage; will propose and rank solutions to these problems; and if appropriate will present revised timetables for accomplishment of tasks.

5.19 These reports will be brief, concise and action oriented. They should avoid unnecessary detail. They should be written to be read by a busy project manager.

5.20 These reports will include a prioritized list of issues which require action by either EEA or USAID project management. Issues will be presented in table format with entries for the following: assigned priority; brief description of issue; date identified; assistance needed; by when; and current status. Issues will be repeated in the table until they are resolved.

5.21 Monthly progress review meetings will be held at each site. Those meetings will be attended by USAID, EEA and the appropriate engineering consultant and contractor(s). Problems will be identified as they occur and will be resolved either on-site or submitted for discussion and resolution at the monthly site meetings. The consultant's monthly (or quarterly) progress report will be the basis for the monthly (quarterly) progress review.

F. Joint Annual Review of Progress:

5.22 The purpose of the joint annual reviews will be to assess the past year's progress and to develop a strategy for attaining next year's benchmarks. This strategy will be embodied in the annual workplan, discussed below. The contractors, EEA counterparts, the AID Project Officer and selected USAID project committee members will participate in the joint annual review. Participants will assess progress on selected indicators to determine whether implementation is progressing satisfactorily and achieving the expected impact on the beneficiaries. They will propose corrections or solutions to implementation problems which are identified.

G. Annual Workplan:

5.23 The annual workplan for each component of the Project will be developed together by the consultants, USAID Project management, and EEA counterparts, using conceptual guidance contained in the PP and incorporating necessary changes suggested by review of implementation experience to date. The annual workplan is intended to answer the questions "What exactly will we achieve this year?" and "How will we achieve it?" The annual workplan will detail:

(1) the coming year's impact on the end of Project status, output benchmarks and a plan for data collection; and

(2) a strategy for attaining these benchmarks (task(s), sequencing, responsible party(ies), target dates, deliverables), possible impediments/constraints to success, ways of preventing these impediments from materializing, and alternative courses of action to pursue if they do materialize.

H. External Evaluations:

5.24 USAID in collaboration with EEA will conduct formal reviews of the Project in October 1990 and October 1992. The formal review will determine the status of compliance with covenants, implementation progress and plan future actions. USAID may seek external assistance for conducting this review and funds have been budgeted for this purpose.

5.25 A final Project evaluation is scheduled for July 1993. The purpose of this evaluation will be to assess progress in providing Project outputs and their contribution to the GOE's long term energy sector goals in order to determine how effective the provision of funding for critical initiatives has been in promoting progress on electricity pricing issues, and to determine the impact of electricity pricing reforms on economy wide investment and consumption decisions.

I. Budget:

5.26 Roughly $200,000 or .15 percent of the $136,000,000 designated for this project has been set aside for special studies, external evaluations and other data collection, monitoring and evaluation activities.

VI. SUMMARIES OF ANALYSES

A. Technical Analysis:

6.01 The gas turbine and combined cycle technology which is the basis of the Project has been utilized successfully for many years in the electric utility industry around the world. Gas turbines of increasing capacity have been in service for more than 30 years and EEA has successfully operated gas turbines for more than 20 years. The gas turbine heats compressed air to a high temperature (1700 F) which, after expanding through a turbine to drive a generator to produce electricity, is exhausted at high temperature (900 F) to the atmosphere. In a Combined Cycle plant, the high temperature exhaust gases from the gas turbine are utilized to produce steam in a "boiler" which is subsequently passed through a steam turbine to produce approximately 50 percent additional electric energy without the need for additional fuel. The Combined Cycle plant offers the advantages of fuel efficiency, flexibility of operation and phased and shortened construction time. EEA has completed construction of a Combined Cycle plant at Talkha based on a steam cycle addition to the existing gas turbines and is building a second combined plant at the Damietta plant site. EEA plans to add steam cycles to existing gas turbines at Mahmoudia and Dammanhour. The Cairo South combined cycle addition will build upon EEA's acquired knowledge and experience. EEA's trained and experienced operations and maintenance staff will receive specific training on each plant addition.

6.02 The site for the combined cycle unit at Cairo South is owned by EEA. The site for the gas turbines at Hurgada has been granted to EEA by the appropriate GOE government authority. A Requirement Precedent to Disbursement will require evidence that EEA has legal justification over the Hurgada site and rights of way of the pipelines and distribution lines. The sites are located adjacent to major highways and waterways to facilitate delivery of major equipment to the site during construction. Sufficient cooling water for condenser cooling of the Cairo South steam cycle is available.

6.03 The boilers and turbine generators at Cairo West have been in operation for more than 20 years. During this period, the plant has maintained a high level of efficiency and reliability. The rehabilitation of the boilers and turbine generators will extend their useful life and enhance their efficiency. The modifications to the boiler to provide for natural gas firing and the modern burner management system will

further enhance the overall performance of the plant. EEA's trained and experienced operations and maintenance staff at Cairo West will receive specific training on the equipment being added and on the enhanced operational characteristics of the plant.

6.04 All generating units being installed, renovated or rehabilitated will be fueled by natural gas through gas pipelines connected to a reliable and expanding gas reserve. Solar oil (kerosene) will be used as a standby fuel for the gas turbines and mazout (No. 6 Oil) will be the standby fuel for the rehabilitation of boilers at Cairo West. The Grant Agreement will contain Requirements Precedent to Disbursement requiring evidence that the Egyptian General Petroleum Company (EGPC) will deliver sufficient natural gas to Cairo South, Cairo West and either natural or associated gas to the Hurgada site to permit EEA to operate the respective plants on natural gas under normal conditions without curtailing the natural gas supply to plants presently burning natural gas.

6.05 The energy generated by these plants will be delivered to the EEA system through extensions of the existing transmission networks. The Grant Agreement will contain Requirements Precedent to Disbursement requiring evidence that EEA will provide the necessary substations at Cairo South and Hurgada to distribute the respective plant's generation to the EEA system.

B. Financial Analysis:

6.06 EEA's annual financial plans are included in the MEE's documentation of planned capital expenditures and operation expenses. The financial plans are contained in the GOE's annual budget which is approved by the Cabinet and the President. At the end of each fiscal year, EEA prepares financial statements of their operation in accordance with the GOE's accounting principles. USAID's Financial Management Directorate (FM) has reviewed and analyzed EEA's financial statements. The financial analysis indicates that EEA maintains a minimal level of working capital which may limit their ability to meet its local currency obligations. EEA revenues are constrained by a tariff structure imposed by the GOE. The major component of operating expenses are fuel costs and depreciation, which are regulated by the GOE. Any income in excess of operating expenses or financial loss by EEA reverts to the GOE budget. Due to the special nature of EEA as the primary source of electric energy for Egypt, the vital importance of electric power to the Egyptian economy and the welfare of the Egyptian people, in spite of EEA's financial difficulties, EEA's

operation will continue with any needed financial assistance coming from the GOE.

6.07 EEA's project implementation, as documented in financial reports and equipment utilization; has been audited and found to be satisfactory. The Grant Agreement will contain a Requirement Precedent to Disbursement requiring that EEA establish and maintain accounting records of local currency and in-kind contributions to the Project and a Covenant will stipulate that EEA provide USAID copies of these accounting records on a quarterly basis.

6.08 Total Project related funding is the equivalent of $160.7 million dollars. AID will provide $136 million in Grant funds, EEA will provide the equivalent of $24.7 million.

6.09 The financial internal rates of return for the Project components are:

Component	Financial IRR (%)
Cairo South	N/A
Cairo West	1.04
Hurgada Relocation	1.39
Microwave Expansion	- 14.07
Commodities	- 10.20

6.10 Based on the results of the least cost screening analysis, the gas fired combined cycle installation at Cairo South is the least cost addition for meeting the identified power needs. Renovation and rehabilitation of generating capacity is cost effective in prolonging the useful life of these capital investments.

C. Economic Analysis:

6.11 This Project supports important sector pricing policy reforms which are an essential element of macro-economic structural adjustment. The economic analysis has shown that the Mission's best estimate of least growth (under a maximum price reform scenario) implies that peak demand of existing capacity will be surpassed unless new power is brought on line before or by mid 1993.

6.12 Increased power generation is justified. But any additional investments in power generation need to be accompanied by tariff reforms in order for the economy to realize the potential economic benefits of the investments.

D. Social Soundness Analysis:

6.13 This Project will enhance the functioning of the Egyptian electricity network and will benefit all Egyptians due to the resultant increased efficiency and productivity of enterprises and individuals dependent on electricity. The impact of this discrete Project will be an increased electricity supply to energy consumers.

6.14 The construction of the generating plants will result in permanent employment of operations and maintenance and administrative personnel. The rehabilitation of existing plants will preserve employment of the existing plant staff. The plants will be staffed by experienced personnel who will receive specialized training related to the equipment in each plant.

6.15 The benefits of this Project will apply equally to men and women. The longer term goal of sectoral change which is affected by this Project will have a much more far ranging impact on the Egyptian population with less predictable spread effects. Though beyond the scope of this particular Project, the following should be taken into consideration in the continuing policy dialogue on reduction and eventual elimination of subsidies to the electric power sector in Egypt:

- Special care must be taken to ensure that increased revenues lead to increased quality of service. The success of any long term electricity pricing is dependent upon the customers' willingness to pay based on the quality of service received.

- The structure of electricity rates must be carefully formulated to ensure that benefits of a more efficient electricity network are equitably distributed. Special attention should be paid to low income consumers and women. The beneficiary study to be conducted under the Alexandria Electrical Network Modernization Project may provide some clues as to who benefits from subsidized electric service and who may suffer from increased tariffs.

- Any study of changes in the electric power sector should address the feasibility issue. Who can pay more? What spread effects will result from higher electricity prices? Can the electricity rate structure be adjusted in a way to alleviate possible negative effects of a rate increase?

6.16 Because this Project is part of an effort to support policy reform in the electric power sector, its design includes the possibility of add-ons through Project amendments in the future in response to further sectoral improvements. When implementing policy reforms in the sector, the social soundness and desirability of the reforms should be carefully considered.

E. Managerial/Administrative Analysis:

6.17 The Project will be implemented by the Egyptian Electricity Authority, which is responsible for the planning and construction of all thermal power stations. The plants will be located within the Cairo and Canal operational zones. Both zones are composed of major generating facilities connected to a transmission grid which is interconnected to adjacent operating zones. The entire system is operated as a unified power system.

6.18 EEA will establish individual project teams to manage the respective plant construction work. These teams, reporting to the appropriate Zone President, will have the authority to make day-to-day decisions and approvals. Upon completion of each plant, the Project team will be integrated into the plant staff or will be assigned to responsible positions in EEA's Project organization.

6.19 The Power System Group within DR/UAD will have monitoring responsibilities for USAID. This group has extensive experience in monitoring similar projects and has developed a solid working relationship with the Implementing Agency.

F. Environmental Analysis:

6.20 The Egyptian Electricity Authority has installed and is operating 62 gas turbines ranging in size from 17 to 100 MW. For gas turbines installed over the past 10 years, each installation was the subject of an environmental assessment by EEA and respective donors concerning the effect of the operation of the gas turbines on the air and water quality and the biotic and community environment. These assessments concluded that gas turbine operation has no adverse effect on the existing air or water quality or on the biotic and community environment and, therefore, the gas turbine installations at Cairo South and Hurgada are environmentally sound.

6.21 Addition of steam cycle facilities to the gas turbine at Cairo South to produce a Combined Cycle plant will have an impact on the water quality. Water will be circulated through

the condenser for steam cooling and returned to the Nile River at an elevated temperature which is dependent upon the design of the circulating water system and the size of the condenser. Investigations of the Cairo South sites will be required to determine the effect of the thermal plume resulting from the circulating water discharge on the aquatic life in the area.

6.22 The modification of the Cairo West boilers to burn natural gas and the addition of a modern integrated computer system to manage combustion will reduce the release of sulfur dioxide and oxides of nitrogen, ozone and particulates to levels below limits established by the U.S. Environmental Protection Agency (EPA), the World Bank and the GOE. The technical consultant for the Cairo West component will perform studies using the U.S. EPA Single Source Atmospheric dispersion model or comparable model to predict ground level concentrations for each applicable pollutant based on operation of the four generating units with various combinations of natural gas and oil from which EEA can establish environmentally sound operating practices.

6.23 An Initial Environmental Examination (IEE) indicates that the Project will not have a significant effect on the environment. Special assessment and studies will identify any concerns that, if unattended, could adversely impact the environment so that correct action can be taken in advance of contract execution. The IEE Determination Sheet with appropriate clearances and approvals is attached as Annex L.

6.24 The Grant Agreement will contain Requirements Precedent to Disbursement requiring the preparation of an Environmental Assessment for the Cairo South Combined Cycle unit and that the outcome of the Assessment will be incorporated in the turnkey contract for the plant addition. Funding for the Combined Cycle unit turnkey construction contract will be released after the Draft Environmental Assessment, including necessary mitigations that should be included in the Project, has been reviewed and the Environment Assessment has been approved by the ANE/PD Environmental Coordinator.

VII. REQUIREMENTS PRECEDENT, COVENANTS AND WAIVERS

A. Requirements Precedent to Disbursement:

7.01 The Project Agreement shall contain the following Requirements Precedent:

a. Requirements Precedent to Disbursement:

(1.) Prior to any disbursement or to the issuance of any commitment documents under the Grant, the Cooperating Country shall, except as the Parties may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D.:

(a) A statement of the names and titles with specimen signatures of the persons authorized to represent the Cooperating Country for Project purposes for the: Cairo South combined cycle unit; Cairo West Modernization; gas turbine refurbishment and installation of Hurgada; microwave system extension to the Suez Canal area; and for procurement of commodities.

(b) A contract or contracts for engineering and construction supervision services for infrastructure covered by the Project, which services shall include inter alia the preparation of an Environmental Assessment covering the Cairo South combined cycle unit.

(c) A commitment by the Cooperating Country to finance from Project funds a study to identify the sources and magnitude of individual distribution company system losses, nationwide, and to recommend, with cost estimates, corrective measures which, if implemented, would reduce system losses.

(d) A commitment by the Cooperating Country to finance from Project funds an electricity pricing strategy study, which study could be the basis for future rate design.

(e) A commitment by the Cooperating Country to finance from Project funds other technical assistance services as required throughout the life of the Project.

(f) Evidence that the proceeds of the Grant, except for funds used to finance consultant services and technical assistance, have been loaned to EEA on terms and conditions approved by the appropriate authorities of the Cooperating Country.

(g) Evidence that the local currency financing for the Project has been budgeted by the Grantee and will be available for timely expenditure by EEA; and

(h) Evidence that accounting records for local currency and in-kind contributions to the Project will be maintained by EEA.

(2.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment to disburse under the Grant for the purpose of financing the installation of a combined cycle unit at Cairo South, the Cooperating Country shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) An executed construction contract, which will appropriately reflect inter alia the outcome of the Environmental Assessment prepared by the Project's engineer/construction supervisor, for the design, supply and installation of equipment, testing, start-up and training for the combined cycle unit at Cairo South.

(b) A statement from the National Investment Bank or similar financial institution evidencing that the funds necessary for the local currency costs of the Cairo South combined cycle unit construction contract have been deposited in EEA's account and are available for disbursement in an amount based on a cost estimate approved by EEA.

(c) Evidence that EEA will provide a transmission substation, coordinated with the completion of the Cairo South Combined Cycle Unit, of sufficient capacity to distribute the unit's energy output to the EEA system.

(d) **Evidence that the Egyptian General Petroleum Company (EGPC) will deliver sufficient natural gas to the Cairo South combined cycle unit to permit EEA to operate that unit, under normal conditions, on natural gas without curtailing gas supplies to other EEA facilities.**

(3.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment to disburse under the Grant for the purpose of financing the modernization of the Cairo West thermal power station, the Cooperating Country shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) A contract for consultant engineering services that includes an analysis of plant performance and an environmental analysis of emissions for a range of fuel mixes (Natural Gas and Mazout).

(b) A statement from the National Investment Bank or similar financial institution evidencing that the funds necessary or the local currency costs of the Cairo West modernization contracts has been deposited in EEA's account and are available for disbursement in an amount based on a cost estimate approved by EEA.

(c) Evidence that the Egyptian General Petroleum Company (EGPC) will deliver sufficient natural gas to the existing Cairo West thermal power station to permit EEA to operate, the four units simultaneously under normal conditions, on natural gas without curtailing gas supplies to other EEA facilities.

(4.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment under the Grant for the purpose of financing the refurbishment of gas turbines at El Fayoum Cairo North and Abu El Matamir and, later, installation of those gas turbines at Hurgada, the Cooperating Country shall furnish to A.I.D., except as A.I.D. may otherwise agree in writing, in form and substance satisfactory to A.I.D.

(a) A statement from the National Investment Bank or similar financial institution evidencing that the funds necessary for the local currency costs of the relevant contract has been deposited in EEA's account and are available for disbursement.

(b) Evidence that EEA will provide a distribution substation, coordinated with the completion of the Hurgada gas turbine plant, of sufficient capacity to distribute the plant's generation to the distribution system serving the Hurgada area.

(c) Evidence that EEA owns or otherwise has legal jurisdiction over the site at Hurgada upon which the gas turbines will be installed and all rights of way necessary for the gas turbine facilities and transmission/distribution connection to the power system.

(d) Evidence that EGPC will deliver sufficient gas to the Hurgada plant to permit EEA to operate that plant, under normal conditions, on gas without curtailing gas supplies to other EEA facilities.

(5.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment under the Grant for the purpose of financing the extension of the microwave communication system from Cairo to the Suez Canal area, the Cooperating Country shall furnish to A.I.D., except as A.I.D. may otherwise agree in writing in form and substance satisfactory to A.I.D.:

(a) A contract for consultant engineering services.

(6.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment under the Grant for the purpose of procuring the project financed commodities, the Cooperating Country shall furnish to A.I.D., except as A.I.D. may otherwise agree in writing, in form and substance satisfactory to A.I.D.:

(a) Specifications for the commodities to be procured.

(7.) Prior to any disbursement or to the issuance of any disbursement authorization or commitment under the Grant for the purpose of financing consultant services for the design review and preparation of equipment

specifications for the 1200 MW El Kureimat Thermal Power Station, the Cooperating Country shall furnish to A.I.D., except as A.I.D. may otherwise agree in writing, in form and substance satisfactory to A.I.D.

(a) Evidence of firm commitments by international and foreign lending institutions for provision of 100 percent of all foreign exchange funds required for the thermal power station, aside from these funds to be provided by A.I.D.;

(b) Evidence that the local currency financing for the thermal power station has been budgeted by the Grantee and will be available for timely expenditure by EEA;

(c) Evidence that EGPC will provide the necessary transmission facilities and deliver sufficient gas to the thermal power station to permit EEA to operate the station, under normal conditions, on gas without curtailing gas supplies to other EEA facilities;

(d) Evidence that EEA owns or will otherwise have legal jurisdiction of the plant site and necessary electric and fuel transmission rights of way;

(e) Evidence that the GOE is implementing an energy pricing adjustment program that will result in fuel and electricity pricing at their economic value prior to the operation of the first unit at the thermal power station;

(f) Evidence that the thermal power station will be designed, built and operated to conform to U.S. EPA, World Bank and Egyptian air and water quality regulations;

(B) Covenants:

7.02 The Cooperating Country shall covenant substantially as follows:

a. Exemption from Decennial Liability Law:

Contractors, architects, consultants and subcontractors, regardless of nationality, working on

the Project shall be exempt from the application of Egyptian Civil Code with respect to decennial liability. The exemption will not relieve such contractors, architects, consultants or subcontractors of their respective contractual obligations which relate to their duty.

b. Payment of Salary Incentives and Supplements:

Grant proceeds or funds derived from the Special Account arising under the Commodity Import Program will not be used to pay Project related salary supplements.

c. Local Currency and In Kind Contributions:

The Cooperating Country, through EEA, will provide A.I.D., on a quarterly basis, with copies of its accounting records on local currency and in-kind contribution provided for the Project.

d. Plant Operations and Maintenance Training:

The Cooperating Country shall covenant that EEA will select additional operational and maintenance staff, and will commence a comprehensive training program, sufficiently in advance of the start-up of all gas turbines and steam turbines to be installed or rehabilitated under the Project, so that operations and maintenance personnel will be on-site, trained and fully qualified to operate and maintain the gas turbine and steam turbine units when placed in service.

e. Plant Fuel Supply:

The Cooperating Country will promote the operation by EEA of the Cairo South combined cycle unit, the Cairo West steam turbine units and the Hurgada gas turbine, financed by this Grant, under normal operating conditions, on gas.

f. Consultation on Electricity Tariffs:

The Cooperating Country shall covenant that EEA will periodically consult with A.I.D. on electricity tariffs and their impact on the financial viability of EEA.

g. Social Insurance and Taxes on Expatriates:

The Cooperating Country shall covenant that any social insurance assessments and any taxes on expatriates arising under Grant financed work will be paid directly or reimbursed by the Cooperating Country from its own resources.

(C) Procurement Waivers:

A. For the purpose of implementation of the Project, a waiver of competition is hereby approved to permit the noncompetitive procurement by EEA of:

(1) Gas Turbine Combined Cycle Associates (a joint venture comprised of Overseas Bechtel, Inc. and Gilbert/Commonwealth International, Inc.) for Technical (Consultant) services for the Cairo South Combined Cycle Unit;

(2) Westinghouse Electric Company for the rehabilitation of the Cairo West turbine generators and associated controls;

(3) Babcock & Wilcox for the rehabilitation of the Cairo West boilers and associated controls and addition of natural gas firing to the boilers and;

(4) General Electric Company for the renovation of three gas turbines and subsequent installation at Hurgada.

B. For the purposes of implementation of the Project, EEA is authorized to procure competitively a General Electric gas turbine equivalent to the three General Electric gas turbines presently installed and operating at Cairo South and a General Electric steam turbine generator properly sized for the combined-cycle unit.

ACTION AID 3 INFO DCM ECON /5

ANNEX A
Page 1 of 3

LIIC: 036 029
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DR PDS

ACTION TO PDS DR
ACTION TAKEN DATE 4/25/27
BAR INITIALS

AIDAC

E.O. 12356: N/A
TAGS: N/A
SUBJECT: EGYPT - POWER SECTOR SUPPORT PROJECT (263-0215)
PID REVIEW

1. PRC MET MARCH 17, 1988 TO REVIEW SUBJECT PID. BECAUSE OF NEAR UNANIMITY OF OPINION OF THOSE ATTENDING DECISION WAS MADE APRIL 4, 1988 BY ACTING AA/ANE TO APPROVE PID, SUBJECT TO GUIDANCE PROVIDED BELOW, WITHOUT HOLDING FORMAL ANPAC REVIEW (COPY ACTION MEMORANDUM TO AA/ANE DATED APRIL 1, 1988 PREVIOUSLY FOUCHED TO JOHN HUNT, DR/UAD). MISSION IS AUTHORIZED TO COMPLETE PROJECT PAPER AND TO APPROVE PROJECT IN FIELD FOR FY 88 OBLIGATION. PLEASE PROVIDE RELEVANT CN DATA WHEN AVAILABLE.

2. PRC WAS GENERALLY ENTHUSIASTIC ABOUT THE PROJECT AS AN OPPORTUNITY TO LINK CRITICALLY-NEEDED TECHNICAL AND CAPITAL ASSISTANCE WITH GOE ACTION TO SUPPORT SIGNIFICANTLY INCREASED ELECTRICITY TARIFFS AND TO ENGAGE IN A LONG-TERM POLICY DIALOGUE OVER CONTINUED MEASURES TO ELIMINATE ENERGY SUBSIDIES BY 1994.

3. PRC MEMBERS HAD QUESTIONED HOW THE PID RECONCILED WITH MISSION'S FALL, 1986 CDSS, AND WHETHER IT WAS

CONSISTENT WITH AID/W REPORTING CABLE PROVIDING GUIDANCE ON THE SUBJECT. HOWEVER, THEY ACCEPTED MISSION REPRESENTATIVES' ASSURANCE THAT WITH THE POWER SECTOR SUPPORT PROJECT, THE MISSION IS ASSUMING A MUCH MORE ACTIVE ROLE IN THE ENERGY SECTOR POLICY DIALOGUE. RATHER THAN SIMPLY WITHHOLDING FUNDING IN THE SECTOR UNTIL PRICING REFORMS HAVE BEEN MADE, IT NOW PLANS TO BEGIN UNDERLINE ENCOURAGE END UNDERLINE SUCH REFORMS, BY OFFERING THE PROSPECT OF SIZEABLE PROGRAM LEVELS, IN SUPPORT OF SPECIFIC, AGREED-UPON POLICY REFORMS. FURTHER, THERE WAS CONSENSUS THAT THE CDSS REPORTING CABLE PERMITTED INVESTMENT IN NEW GENERATION FACILITIES IF SUBSTANTIAL REFORM IN TARIFF RATES WAS FORTHCOMING. THEREFORE, ANE CONCURS WITH THE MISSION THAT THE PROJECT'S ESSENTIAL FOCUS IS ON ACHIEVEMENT OF ESSENTIAL TARIFF REFORM AND, PROVIDED THE GOE IMPLEMENTS THE SPECIFIED REFORMS IN A TIMELY MANNER, THE INVESTMENT IN

NEW GENERATION CAPACITY DOES NOT VIOLATE THE SENSE OF THE COSS OF AID/W POLICY GUIDANCE. THE PROJECT PAPER WILL, HOWEVER, NEED TO INCLUDE A STRONG ECONOMIC ANALYSIS, WITHIN THE BOUNDARIES OF A REFORM AGENDA, DEMONSTRATING THAT THE ADDITIONAL GENERATING CAPACITY INVESTMENTS ARE ECONOMIC AND CONSISTENT WITH LEAST COST DEVELOPMENT ALTERNATIVES. THE ECONOMIC ANALYSIS SECTION SHOULD CONTAIN AN ILLUSTRATIVE CALCULATION OF FUTURE GROWTH IN DEMAND BY ASSUMING, FOR EXAMPLE, THAT THE AVERAGE PRICE RISE IN YEAR ONE WILL BE 35-40 PERCENT, IN YEAR TWO A SIMILAR INCREASE, AND IN YEAR THREE A SPECIFIC INCREASE. THEN, WITH THE ASSUMPTIONS ON DEMAND ELASTICITIES, THERE WILL BE THE DERIVED INCREASES IN ELECTRICITY DEMAND, AND SUBSEQUENTLY THE RESULTANT NEED FOR REPLACEMENT AND/OR ADDITIONAL FACILITIES. AN OVERALL INVESTMENT PLAN COULD THEN BE SUGGESTED AND BE PART OF THE ONGOING DIALOGUE WITH EEA.

4. THE FPC EXPRESSED CONCERN AT THE PROPOSED PROJECT DID NOT INCLUDE A COMPREHENSIVE APPROACH TO INSTITUTIONAL AND MANAGEMENT REFORM IN THE POWER SECTOR THAT SOUGHT TO IMPROVE THE OVERALL PERFORMANCE OF EEA AND RELATED SYSTEMS. THE PERCEIVED EMPHASIS WAS ON A NARROW APPROACH PROVIDING PLANT-SPECIFIC ENGINEERING CONSULTING SERVICES AND EQUIPMENT. WHILE ENDORSING THE NEED FOR COMPREHENSIVE TARIFF AND LOSS REDUCTION STUDIES AS CPS, THE COMMITTEE EXPRESSED ITS VIEW THAT THE DEVELOPMENT, IN COOPERATION WITH THE WORLD BANK AND OTHER DONORS, OF AN OVERALL APPROACH TO MODERNIZATION OF THE INVESTMENT PLANNING, FINANCIAL, TECHNICAL AND INFORMATION MANAGEMENTS SYSTEMS OF EEA WAS AN ESSENTIAL COMPLEMENT TO A PRICING REFORM APPROACH. THEREFORE, THE

MISSION SHOULD BEGIN NOW TO DEVELOP THE ANALYTICAL BASIS FOR A BROADER POWER SECTOR REFORM PROGRAM. IT MIGHT ALSO EXPLORE THE SETTING UP OF A SISTER UTILITY RELATIONSHIP BETWEEN EEA AND A MAJOR U.S. UTILITY, E.G., TVA OR AMERICAN ELECTRIC POWER. THE DEVELOPMENT OF A U.S. SUPPORT CAPABILITY IN SYSTEM EXPANSION PLANNING, TARIFF STRUCTURING AND LOAD MANAGEMENT RESEARCH WOULD BE CRITICAL ELEMENTS OF SUCH A PROGRAM. WHILE AUTHORIZATION OF THE PROJECT PAPER WILL NOT REQUIRE ADDITIONAL ACTIONS IN THIS AREA TO BE PART OF THIS PARTICULAR PROJECT, THE PROJECT PAPER SHOULD ADDRESS THESE OVERALL EEA MANAGEMENT AND PERFORMANCE ISSUES RELATED TO THE RAPID GROWTH OF THE ELECTRICITY SYSTEM IN EGYPT, THE WORSENING LOADSHEDDING PROBLEM, AND INDICATE HOW EITHER THIS PROJECT OR OTHER MISSION OR DONOR PROJECTS WILL DEAL WITH VARIOUS ASPECTS OF THESE ISSUES.

5. ANE RECOGNIZES THAT ACHIEVEMENT OF A NOMINAL 35 TO 40 PERCENT RATE INCREASE BY MID-1988 WOULD BE A

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SIGNIFICANT POLICY REFORM ACHIEVEMENT GIVEN THE CURRENT ECONOMIC AND POLITICAL CLIMATE, WARRANTING A FIRST TRANCHE OF AID ASSISTANCE TO THE EGYPTIAN POWER SECTOR. IT RECOGNIZES THAT THE ENERGY INCREASE SHOULD BE SUFFICIENT TO ENSURE WORLD BANK INVOLVEMENT IN THE SECTOR. HOWEVER, THE PID IS SILENT ON REFORM TARGETS TO TRIGGER ADDITIONAL INPUTS THE FOLLOWING TWO YEARS. SINCE THIS PROJECT IS JUSTIFIED AS A REFORM PROJECT, THERE NEEDS TO BE A LIFE-OF-PROJECT SCENARIO OR FORMULA LINKING ANTICIPATED REAL PRICE INCREASES TO FUTURE DEMAND LEVELS AND THUS RELEASE OF FUNDS FOR NEEDED ADDITIONAL GENERATION FACILITIES.

6. SEVERAL MEMBERS OF THE PRC EXPRESSED CONCERN WITH THE PID'S PROPOSAL TO WAIVE COMPETITION FOR CONSULTING SERVICES, POINTING OUT THAT WE WOULD BE COMMITTING TO A SINGLE FIRM FOR SIX YEARS OF NON-COMPETITIVE SERVICES, THAT LESS SWEEPING USE OF WAIVER AUTHORITY COULD SHORTEN THE PROCESS WITHOUT ELIMINATING THE COMPETITIVE ELEMENT, AND THAT THE ADMINISTRATOR HAS BEEN QUESTIONING STRONGLY THE AGENCY'S USE OF COMPETITIVE WAIVERS. FOLLOWING A COMPETITIVE WAIVER PROCEDURE WOULD ALMOST CERTAINLY ELICIT PROTESTS FROM THE U.S. ENGINEERING COMMUNITY DESPITE OBI'S STRONG COMPETITIVE POSITION VIS-A-VIS ITS COMPETITORS IN EGYPT. IT WAS SUGGESTED THAT THERE MIGHT BE OTHER ALTERNATIVES TO SOLE SOURCE PROCUREMENT, WHICH COULD STILL MEET THE MISSION'S CONTRACTING OBJECTIVES, SUCH AS EXPLORING A NON-ADVERTISING APPROACH OR FRAGMENTING THE PROCUREMENT. THEREFORE, THE MISSION SHOULD FULLY EXPLORE ALL ALTERNATIVES FOR COMPETITIVE

SELECTION OF CONSULTING SERVICES RATHER THAN RELY ON A COMPETITIVE WAIVER, INCLUDING THE USE OF AN ACCELERATED NON-ADVERTISING APPROACH (SHORT LIST FROM AID FORMS 254 AND 255, EVALUATE AND NEGOTIATE) AND/OR THE POSSIBILITY OF SPLITTING THE PROCUREMENT INTO A SHORT TERM (ONE YEAR) NON-COMPETITIVE CONTRACT WITH THE LONGER TERM EFFORT SELECTED ON A COMPETITIVE BASIS.

7. THE PRC ALSO RAISED PROCEDURAL QUESTIONS FOR PROCUREMENT OF GAS TURBINES IN VIEW OF PROBLEMS BEING ENCOUNTERED BY THE PAKISTAN MISSION IN PROCURING SIMILAR EQUIPMENT FROM GE ON A SOLE SOURCE BASIS. ANE AGREED THAT MISSION SHOULD CONSIDER ALTERNATIVES WHICH COULD INTRODUCE COMPETITION, I.E., DESIGNING FOR DIFFERENT SIZED TURBINES TO ALLOW OTHER MANUFACTURERS TO COMPETE, BEARING IN MIND A.I.D.'S SOURCE AND ORIGIN REQUIREMENTS. WHITEHEAD
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PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 89 to FY 94
Total U. S. Funding $133
Date Prepared: [illegible]

Project Title & Number: Power Sector Support (Project 263-0215)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: (A-1) To promote rational investment and consumption decisions throughout the economy and to reduce the national budget deficit.	Measures of Goal Achievement: (A-2) Decrease rate of growth in electricity consumption overall and for selected consumer categories. Increase electric energy conservation in all classes of users except large industrial. Reduce contribution to the national budget deficit made by electric power sector's implicit subsidy.	(A-3) . EEA Data . PDS/E calculations	Assumptions for achieving goal targets: (A-4) Fuel price increases passed on to consumers Electricity price increases are sufficient to decrease inefficient and wasteful uses.
Project Purpose: (B-1) To support past and 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	Conditions that will indicate purpose has been achieved: End-of-Project status. (B-2) Electricity price increases approved in March 1989 are implemented./Future electricity price increases are sufficient to obtain additional financing from other donors (IBRD, ADB, EIB)./Future electricity price structures are based on economic cost to serve various customer classes. Future electricity rate increases average ten percentage points above the rate of inflation since the previous electricity price increases.	(B-3) . Examining and monitoring past and current Mission and Embassy electricity bills and examination of an appropriate cross-section of Distribution Company billing records.	Assumptions for achieving purpose: (B-4) March 1989 electricity price increases are in effect and are consistently applied. EEA proceeds with electricity pricing strategy study and future price increases are based on the results of the study. Infrastructure incentives provided as planned and lead to continued reforms. GOE approves pricing structure
Project Outputs: (C-1) Construct 1-150 MW combined-cycle unit. Rehabilitate four steam turbine generating units. Rehabilitate three gas turbine and install at new site. Extend microwave communications system. Provide spare and replacement parts and work equipment.	Magnitude of Outputs: (C-2) Combined-cycle unit in service by September 30, 1992. Cairo West plant output increased from 300 MW to 350 MW; plant fuel consumption rate rate improved from 275 gms/kwhr. to 260 gms/kwhr; plant capacity factor improved from 67% to 80% by May 31, 199[illegible] Additional 72 MW gas turbine generating capacity in service by September 30, 1991. Six additional stations being monitored by the National Energy Control Center of the expanded microwave system.	(C-3) EEA Monthly Operating Reports EEA Annual Report of Electric Statistics	Assumptions for achieving outputs: (C-4) Sufficient local currency to cover installation costs. Equipment is rehabilitatable. Sufficient gas supply to fuel combined-cycle unit, four steam turbine-generating unit boilers and three gas turbines. Microwave frequencies are available and approved by GOE.
Project Inputs: (D-1) Consultant services. Turnkey contracts for combined-cycle unit and microwave extension. Equipment supply and installation supervision contracts for steam turbine generating units and gas turbine units rehabilitation. Commodity procurement contracts.	Implementation Target (Type and Quantity) (D-2) $ 9 million $71 million $33 million $20 million	(D-3) Monthly contractor reports.	Assumptions for providing inputs: (D-4) EEA and USAID will negotiate contracts with US firms. EEA will satisfy Requirements Precedent to Disbursement.

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Listed below are satutory criteria applicable to projects. This section is divided into two parts. Part A includes criteria applicable to all projects. Part B applies to projects funded from specific sources only: B(1) applies to all projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT

1. FY 1989 Appropriations Act Sec. 523; FAA Sec. 634A. If money is sought to be obligated for an activity not previously justified to Congress, or for an amount in excess of an amount previously justified to Congress, has Congress been properly notified?	Normal Congressional Notification procedures will be satisfied prior to obligation of funds.
2. FAA Sec. 611(a)(1). Prior to obligation in excess of $500,000, will there be (a) engineering, financial or other plans necessary to carry out the assistance, and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	Yes.
3. FAA Sec. 611(a)(2). If legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	No such action is required.

4. <u>FAA Sec. 611(b); FY 1989 Appropriations Act Sec. 501</u>. If project is for water or water-related land resource construction, have benefits and costs been computed to the extent practicable in accordance with the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See A.I.D. Handbook 3 for guidelines.)	Not such a project.
5. <u>FAA Sec. 611(e)</u>. If project is capital assistance (e.g., construction), and total U.S. assistance for it will exceed $1 million, has the Mission Director certified and the Regional Assistant Administrator taken into consideration the country's capability to maintain and utilize the project effectively?	Yes.
6. <u>FAA Sec. 209</u>. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	Not such a project.
7. <u>FAA Sec. 601(a)</u>. Information and conclusions on whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d)	Since this is a public sector project, it will have no significant impact in these areas.

discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	
8. FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	Both services and equipment contracts will be competitively let in the U.S.
9. FAA Secs. 612(b), 636(h). Describe steps taken to assure that, to the maximum extent possible, country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	Egypt will contribute substantially to the local currency costs of the project. U.S.-owned Egyptian currency is not available specifically for this project.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No.
11. FY 1989 Appropriations Act Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes	N/A.

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operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?

12. FY 1989 Appropriations Act Sec. 549. Will the assistance (except for programs in Caribbean Basin Initiative countries under U.S. Tariff Schedule "Section 807," which allows reduced tariffs on articles assembled abroad from U.S.-made components) be used directly to procure feasibility studies, prefeasibility studies, or project profiles of potential investment in, or to assist the establishment of facilities specifically designed for, the manufacture for export to the United States or to third country markets in direct competition with U.S. exports, of textiles, apparel, footwear, handbags, flat goods (such as wallets or coin purses worn on the person), work gloves or leather wearing apparel?

No.

13. FAA Sec. 119(g)(4)-(6) & (10). Will the assistance (a) support training and education efforts which improve the capacity of recipient to prevent loss of biological diversity; (b) support efforts to

"No" to all questions.

identify and survey ecosystems in recipient countries worthy of protection; or (c) by any direct or indirect means significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas?

14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (either dollars or local currency generated therefrom)? N/A.

15. FY 1989 Appropriations Act. If assistance is to be made to a United States PVO (other than a cooperative development organization), does it obtain at least 20 percent of its total annual funding for international activities from sources other than the United States Government? N/A.

16. FY 1989 Appropriations Act Sec. 538. If assistance is being made available to a PVO, has that organization provided upon timely request any document, file, or record necessary to the auditing requirements of A.I.D., and is the PVO registered with A.I.D.? N/A.

17. FY 1989 Appropriations Act Sec. 514. If funds are being obligated under an appropriation account to which they were not appropriated, has prior N/A.

approval of the Appropriations Committees of Congress been obtained?

18. State Authorization Sec. 139 (as interpreted by conference report). Has confirmation of the date of signing of the project agreement, including the amount involved, been cabled to State L/T and A.I.D. LEG within 60 days of the agreement's entry into force with respect to the United States, and has the full text of the same agreement been pouched to those same offices? (See Handbook 3, Appendix 6G for agreements covered by this provision).

Case-Zablocki Act reporting procedures will be followed with respect to this project.

B. FUNDING CRITERIA FOR PROJECT

1. Economic Support Fund Project Criteria

a. FAA Sec. 531(a). Will this assistance promote economic and political stability? To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of Part I of the FAA?

Yes; to both questions.

b. FAA Sec. 531(e). Will this assistance be used for military or paramilitary purposes?

No.

c. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?

N/A.

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5C(3) - STANDARD ITEM CHECKLIST

Listed below are the statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction and (C) Other Restrictions.

A. PROCUREMENT

1. FAA Sec. 602(a). Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?	Yes.
2. FAA Sec. 604(a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him?	Yes.
3. FAA Sec. 604(d). If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company?	Egypt does not so discriminate.
4. FAA Sec. 604(e); ISDCA of 1980 Sec. 705(a). If non-U.S. procurement of agricultural commodity or product thereof is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where	N/A.

commodity financed could not reasonably be procured in U.S.)

5. FAA Sec. 604(g). Will construction or engineering services be procured from firms of advanced developing countries which are otherwise eligible under Code 941 and which have attained a competitive capability in international markets in one of these areas? (Exception for those countries which receive direct economic assistance under the FAA and permit United States firms to compete for construction or engineering services financed from assistance programs of these countries.)

Egypt and the U.S. will be the only eligible sources under the project.

6. FAA Sec. 603. Is the shipping excluded from compliance with the requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 percent of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent such vessels are available at fair and reasonable rates?

50/50 shipping rules will apply to this project.

7. FAA Sec. 621(a). If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the

"Yes" to the first question. As to the second, U.S. private firms are expected to b the sole provider of services.

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fullest extent practicable? Will the facilities and resources of other Federal agencies be utilized, when they are particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?

8. International Air Transportation Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available? — Yes.

9. FY 1989 Appropriations Act Sec. 504. If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States? — Yes.

10. FY 1989 Appropriations Act Sec. 524. If assistance is for a consulting service through a procurement contract pursuant to 5 U.S.C. 3109, are contract expenditures a matter of public record and available for public inspection (unless otherwise provided by law or Executive order)? — Yes.

B. CONSTRUCTION

1. FAA Sec. 601(d). If capital (e.g., construction) project, will U.S. engineering and professional services be used? — Yes.

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2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? — Yes.

3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million (except for productive enterprises in Egypt that were described in the CP), or does assistance have the express approval of Congress? — N/A.

C. OTHER RESTRICTIONS

1. FAA Sec. 122(b). If development loan repayable in dollars, is interest rate at least 2 percent per annum during a grace period which is not to exceed ten years, and at least 3 percent per annum thereafter? — N/A.

2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? — N/A.

3. FAA Sec. 620(h). Do arrangements exist to ensure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? — Yes.

4. **Will arrangements preclude use of financing:**

a. FAA Sec. 104(f); FY 1989 Appropriations Act Secs. 525, 536. (1) To pay for performance of abortions as a method of family planning or to motivate or coerce persons to practice abortions; (2) to pay for performance of involuntary sterilization as method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization; (3) to pay for any biomedical research which relates, in whole or part, to methods or the performance of abortions or involuntary sterilizations as a means of family planning; or (4) to lobby for abortion? — Yes.

b. FAA Sec. 483. To make reimbursements, in the form of cash payments, to persons whose illicit drug crops are eradicated? — Yes.

c. FAA Sec. 620(g). To compensate owners for expropriated or nationalized property, except to compensate foreign nationals in accordance with a land reform program certified by the President? — Yes.

d. FAA Sec. 660. To provide training, advice, or any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? — Yes.

e. FAA Sec. 662. For CIA activities? — Yes.

f. FAA Sec. 636(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained?	Yes.
g. FY 1989 Appropriations Act Sec. 503. To pay pensions, annuities, retirement pay, or adjusted service compensation for military personnel?	Yes.
h. FY 1989 Appropriations Act Sec. 505. To pay U.N. assessments, arrearages or dues?	Yes.
i. FY 1989 Appropriations Act Sec. 506. To carry out provisions of FAA Section 209(d) (transfer of FAA funds to multilateral organizations for lending)?	Yes.
j. FY 1989 Appropriations Act Sec. 510. To finance the export of nuclear equipment, fuel, or technology?	Yes.
k. FY 1989 Appropriations Act Sec. 511. For the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?	Yes.
l. FY 1989 Appropriations Act Sec. 516; State Authorization Section 109. To be used for publicity or propaganda purposes designed to support or defeat legislation pending before Congress to influence in any way the outcome of a political election in the United States, or for any publicity or propaganda purposes not authorized by Congress?	Yes.

5. <u>FY 1989 Appropriations Act Sec. 584</u>. Will any A.I.D. contract and solicitation, and subcontract entered into under such contract, include a clause requiring that U.S. marine insurance companies have a fair opportunity to bid for marine insurance when such insurance is necessary or appropriate?	Yes.

ARAB REPUBLIC OF EGYPT
MINISTRY OF INTERNATIONAL COOPERATION
DEPARTMENT FOR ECONOMIC COOPERATION
WITH U. S. A

Sept,21,1989

Mr. Marshall D. Brown
Director
USAID/Cairo

Dear Mr. Brown:

This is to request A.I.D. funding in the amount of $136 million for the Power Sector Support project (263-0215). The Government of Egypt (GOE) contribution to this project will not be less than 64.3 million Egyptian Pounds.

This project consists of the installation of a 150 MW combined-cycle generating unit; modernization of a 350 MW thermal power station; refurbishment of three 24 MW gas turbine generators and their subsequent installation at a new site; expansion of the existing micro-wave communication system serving the National Energy Control Center; and the procurement of replacement parts, spare parts and work equipment essential for the reliable and economic operation of the Egyptian power system.

Sincerely yours,

Ahmad Abdel Salam

Ahmad Abdel Salam Zaki
Administrator

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RESERVED

REQUEST FOR ASSISTANCE FROM MIC

CERTIFICATION PURSUANT TO
SECTION 611 (e) OF THE
FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

As Director and Principal Officer of the Agency for International Development in Egypt, having taken into account, among other things, the maintenance and utilization of projects in Egypt previously financed or assisted by the United States, I do hereby certify that in my judgment Egypt has both the financial capability and human resources capability to effectively maintain and utilize the capital assistance to be provided for: the installation of 150 MW combined cycle unit at the Cairo South thermal power station; the modernization of the Cairo West thermal power station (including modifications to permit burning of natural gas); the refurbishment of two gas turbines and their installation near Hurgada, the expansion of EEA's microwave system from Cairo to the Suez Canal area and purchase of commodities.

This judgment is based upon general considerations summarized in Section IV - E (Managerial/Administrative Analysis) and in Annex K of the Project Paper to which this certification is attached.

Marshall D. Brown
Director

Sept 16, 1989
Date

POWER SECTOR SUPPORT PROJECT
PROJECT 263-0215

CERTIFICATION PURSUANT TO
GRAY AMENDMENT

As Director and Principal Officer of the Agency for International Development in Egypt, I certify that full consideration has been given to the potential involvement of small and/or economically and socially disadvantaged enterprises, historically black colleges and universities and minority controlled private and voluntary organizations covered by the Gray Amendment.

The attached Project Paper discusses the efforts that will be undertaken in connection with the procurement plan to maximize the participation of minority owned and small and disadvantaged organizations. At the time of each procurement action, every effort will be made to encourage the participation of these organizations and draw upon their knowledge and expertise.

Marshall D. Brown
Director

Sept 14 1989
Date

TECHNICAL ANALYSIS

A. GENERAL:

The technical justification for the proposed project is based upon the availability of sites of sufficient area adjacent to either highway, railroad or canals since large, heavy equipment deliveries are involved and consideration of all technical aspects associated with the design, construction, rehabilitation, modernization and operation of the proposed facilities including the availability and transportation of either natural gas or other petroleum fuel to fuel the plants and the necessary transmission lines to deliver the electrical energy to the Unified Power System.

B. SITES:

Cairo South:

The Cairo South gas turbine plant site is located in the Cairo Governorate on the east bank of the Nile River 11 Km (7 miles) south of Maadi and 3 Km (2 miles) north of Helwan. The site of the proposed combined-cycle unit is on the south side of the existing Cairo South steam power plant on the site of the former 220 KV substation which is being cleared of above grade obstructions. The 0.0149 Km^2 (3.7 acres) site is 120 meters (393 feet) wide and 280 meters (919 feet) deep and lies some 4 meters (13 feet) above mean river level. The existing generating facilities consist of 4.60 MW steam turbine generating units served by a bank of 8 boilers connected by a common steam header. The plant was built in the late 1950's. Three gas turbine generating units have just been placed in service in the first phase of a plant repowering and will be the source of heat to convert water to steam to drive the steam turbine generators so that the deteriorated boilers can be retired. The gas turbines are rated 148 MVA and designed to produce 118 MW at 11.5 KV when operated at a 0.8 power factor. The proposed 150 MVA combined cycle unit arrangement on the site is based on an ultimate expansion to four combined cycle units. There is sufficient water in the Nile River, passing the site, for condenser cooling.

Cairo West:

The Cairo West Thermal Power Station is located in the Governorate of Giza on the west bank of the Nile River. The plant is some 15 kilometers (9 miles) northwest of the main business district of Cairo. The plant occupies a total area of approximately 16 hectares (40 acres). The plant consists of 4-87.5 MW steam turbine generators and

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steam generators together with all necessary accessories, condensers, pumps, water treatment facilities and fuel storage tanks.

The steam generators (boilers) are outdoor design, drum type, mazout (No. 6) oil fired, pressurized furnace units consisting of primary and secondary superheaters, reheaters, economizer and evaporator. The units have a guaranteed steam output of 81.8 kg/sec (650,000 pounds per hour) at 102 atm (1725 psi) and 543'C (1010'F) with feedwater at 237'C (457'F). Reheat is to 543'C (1010'F).

The steam turbines are indoor design tandem compound 3000 rpm condensing machines with a single reheat and single double flow pressure section. The turbines have a guaranteed rating of 87,500 KW at 102 atm (1500 psi) and 538'C/538'C (1000'F/1000'F) with a condenser pressure of 63.5 mm (2.5 in.) HgA. The condenser is a two pass, twin bank type with a divided water box.

The generators are hydrogen cooled and can produce 105,000 kva at 2 atm. (30 psi) hydrogen pressure, with a guaranteed ouput of 87,500 kW at 13.8 KV when operated at 50 Hz (3000 rpm) 0.85 power factor, 0.58 short-circuit ratio.

The intake for the circulating water is located on the south side of the site, with the discharge located on the north. The discharge consists of a concrete conduct paralleling the shore line with the discharge north of the fourth turbine generating unit. A new demineralizer building is located to the west of the circulating water pump house and south of the plant.

Day tanks for fuel storage are located behind the steam generators on the shore line. Bulk fuel oil storage facilities are provided on the south side of the site, utilizing 14 storage tanks. Fuel oil is delivered to the site by pipeline and barge. A natural gas pipeline has been extended across the Nile south of the plant and an extension of the pipeline is planned to serve the site.

The first three units in the plant were placed in service in 1966. The fourth unit was completed in 1979. The performance of the plant has been consistently high and is only bettered by generating units entering service since 1983.

Hurgada:

The proposed Hurgada gas turbine plant site is located in the Red Sea Governor on the Red Sea coast between Magawish and the village of Hurgada. The 0.8 Km^2 (200 acres) site is 1000 meters (3280 feet) long and 800 meters (2600 feet

wide) and lies on a belt of desert about 5 meters (16 feet) above sea level. The site is bounded on three sides by the desert, and on the fourth side by the Red Sea. A paved highway passes the site. The site is owned by the Red Sea Governor and has been granted to EEA for the project. The site is located adjacent to the Red Sea and could accommodate a future Heat Recovery Steam Generator which would supply steam to a contemplated desalination plant.

C. TECHNICAL ASPECTS - COMBINED-CYCLE PLANT:

General:

The use of gas turbines as the prime movers for electric energy generation based on firing either natural gas or distillate oil (solar) is well established. EEA has in operation 65 gas turbines which have been in operation an average of 8 years with the first units having been in operation 23 years. These gas turbines are characterized by their quick starting, suitability for either base load or cyclic operation, low installation cost, short installation time and high fuel consumption per unit at energy and moderate operation and maintenance cost.

In recent years, gas turbines have been combined with steam cycle units, utilizing the heat in the gas turbine exhaust gases as the heat source in a heat recovery steam generator (an unfired boiler) to produce steam to drive the steam turbine, to produce additional energy. These combined-cycle units achieve generating efficiencies equaling or exceeding the efficiencies of the most modern base load steam cycle plants. The combined cycle unit offers all the advantages of the gas turbine plant along with the efficiency of large base load steam plants. The complexities of operating two technologies in one power plant has not been a serious problem in the utility industry and the use of computer control systems for the control of the combined cycle plant operation is an industry standard.

EEA began operation of the first combined cycle plant in Egypt in April 1989 and the Talkha combined cycle plant, consisting of two combined cycle units (each unit composed of 4 gas turbine generators and 1 steam turbine generator) entered commercial operation in June 1989. EEA is constructing a 1000 MW combined cycle plant at Damietta (financed by the ADB, EIB, Arab Fund and the GOE). EEA plans to add steam cycles to gas turbine installations at Mahmoudia and Dammanhour (financed by a IBRD loan).

EEA has effectively operated both gas turbine and steam turbine generating units. The integration of the two types of units into a hybrid generating unit was accomplished and has been placed into operation without incident.

Cairo South Combined - Cycle Unit

The proposed combined cycle unit will consist of one combined cycle module nominally rated at 165 MW (110 MW gas turbine unit plus 55 M.W. steam turbine unit). The primary fuel will be natural gas although the gas turbine will also be capable of burning distillate gas oil (solar). The module concept is based on the unit system in which the combined cycle unit comprises one gas turbine, one heat recovery unit steam generator and one steam turbine-generator and all auxiliary equipment. The unit system will be a self contained unit not dependant on other generating units in the station except for certain common services such as fuel receiving, handling and storage and the cooling water system. The gas-turbine generator will be enclosed with acoustic covers and will be provided with a ventilation system, housed in a completely enclosed turbine hall equipped with over head travelling bridge cranes.

The steam-turbine generator will be of the indoor type and located in the same turbine hall. The main control room and electrical relay rooms will be located in an auxiliary bay parallel to the turbine hall. The generator main transformer and the module auxiliary transformer will be located outside the auxiliary bay. A new 220 kV indoor substation with sulfur-hexa floride insulated switchgear will connect the genrated energy to the system.

The combined cycle module will be specified and designed according to the criteria outlined below:

Size and Capacity

The modular configuration of one gas turbine with its own exhaust heat recovery steam generator feeding a single steam turbine is a standard combined cycle arrangement for a number of manufactures. It offers considerable flexibility for load management as the steam turbine may be operated at load levels to maintain an optimum load factor. The basis for comparison of gas turbine ratings have been established by the International standards organization which has reforenced all gas turbine ratings to their performance at sea level with an air abient temperature of 15' C. The unit will be installed at an elevation near sea level but will be operated for considerable periods of the year at ambient of temperatures of 35 to 40' C so the site rating will approximately 85 percent at the ISO rating. The site ratings of currently available gas turbine vary between 81 MW up to 115 MW.

Therefore, the conceptual design unit with a rating at 150 MW will require a gas turbine with an ISO rating at 112 MW and an overall rating at 146 MVA if the desired output is to delivered at an operating power factor of 80 percent. However few over 100 MW have been used as the conceptual.

Availability and Operations:

The combined cycle module will be specified to have at least 90% availability to provide a reliable power supply for the Cairo region. The module will be designed for maximum operation and flexibility and will have minimum start-up time from cold and hot stand by conditions. The module will be designed for a maximum loading/unloading rate capability and will include a turbine bypass system to permit rapid start-up of the steam turbine and improve its flexibility. The critical auxiliary equipment will have a biult in redundancy to ensure continued full load operations should an auxiliary component be out of service.

The gas turbine will be self contained and have the capability of operating in simple cycle mode by using the bypass stack controlled from either the gas turbine or central control room.

In recognition of the comparatively high maintenance requirements of the gas turbine, the unit design and layout will facilitate maintenance by providing adequate protection, laydown areas and access aisles, hoistways, monorails and lifting beams for removal of heavy equipment and components. The components of the gas turbine are designed for a long life. In particular, the turbine blading usually has a design life of approximately 100,000 hours (10-11 years) burning a clean fuel such as natural gas. Factors which adversely affect the life of gas turbine components are:

-Operation at power output above base load (i.e. peak fired hours) increase creep and corrosion effects.
-Contaminated fuel increases corrosion effects.
-Start and stop cycles increase thermal shock damage (turbine trips significantly increase thermal shock damage).

Fuel

The gas turbine unit will be designed to burn natural gas as the primary fuel. It will also be capable of burning distillate gas oil (solar), as available from Egyptian refineries, as a back-up fuel. Gas oil washing facilities and vanadium inhibiting systems will be required to limit contaminents such as sodium, potassium and vandium to levels recommended by the gas turbine manufactures.

Unloading facilities for the distillate fuel will be designed to handle sufficient fuel to maintain the module at full load operation. Sufficient fuel oil storage for 21 days operation at full load will be included and unloading facilities will be sized to receive on days supply during one shift day.

Cooling System

Water for steam turbine condenser cooling will be brought to the steam unit from the Nile River by conduit from a new separate pumphouse and intake and will discharged via the existing discharge channel.

Description of the module

The combined cycle module will be located at the north end of former 220 kV outdoor substation. The module has been arranged to make the best use of the space available, to minimize the possibility of drawing hot exhaust gases from the existing stacks into the air intake of the gas turbine.

Foundations:

The actual foundation design will be based on a geotechnical investigation to be carried out in the location of all major structures.

Power House

The power house consists of a turbine hall and auxiliary bay and independent waste heat steam generator support structures.

The turbine hall will house the gas turbine, the steam turbine generators and auxiliary equipment such as the lubricating oil systems; boiler feed pumps and air intakes etc. The gas turbine set will be arranged longitudinally in the turbine hall. The area of the turbine hall will be accessible by the over head travelling cranes and laydowen or loading days will be provided at the ground floor level which will be accessible by road.

Access ways will be provided from these bays wherever possible to facilitate the use of mobile equipment for maintenance purposes. Space for turbine and generator rotor withdrawal and laydown will be provided at the operating floor level. The steam generator support structures will be provided with access for operation and maintenance at all levels by means of stairs, platforms and walkways .

Circulating water structures

The pumphouse will consist of an intake structure, pumphouse building and chlorination area.

The pumphouse will supply cooling water to the 55 MW steam turbine condenser and will be constructed on the bank of the Nile.

The intake structure will be of reinforced concrete and will house the trash racks, screens and pumps. The intake structure will be designed to ensure that the required volume of circulating water and other service water requirements can be drawn from the Nile at all river levels. The depth of the pump chambers will be chosen to suit the pump requirements.

Isolating gates will be provided to isolate portions of the intake structure and pump bays and allow these to be dewatered for equipment maintenance and inspection. The pumphouse building will be sized to contain all the pumping equipment chlorination plant and switchgear. The building will have a structural steel frame and will be clad in preformed metal sheeting.

Overhead traveling cranes will be provided over the intake structure and within the pumphouse building over the pumps. These cranes will be sized to suit the maximum installation or maintenance lift required.

The supply conduits will extend from the circulating pump discharge piping to the inlet piping at the condensers. The discharge conduits will extend from the outlet piping at the condenser to the discharge structure of the existing steam units.

Gas Turbine Generator and Auxiliaries

The Gas Turbine Generator and Auxiliaries consist of the gas turbine inlet filtration and silencing system. The gas turbine with lubricating systems; fuel systems and control systems and the generator and exiter. The gas turbine will be a single shaft heavy frame industrial type with axial compressor and turbine running at 3000 rpm. The first rows of turbine stationary and rotating blading will be cooled by bleed air from the compressor.

The gas turbine will be provided with pulse type, self cleaning inlet filtration system. In order to minimize dust ingestion and or moisture ingestion, the air intake will be located on the auxiliary bay roof. The air quality will be tested prior to detailed specification of the filter. Access to the filter house shall be provided via catwalks; stairways and lockable doors as required for frequent inspection and maintenance.

An inlet silencer will be provided between the filter house and the turbine inlet. All components upstream of the turbine intake will be constructed such that bolts and other such fastenings are avoided in order to prevent ingestion of such components into the gas turbine compressor.

The gas turbine will exhaust to a duct which incorporates a damper to divert the exhaust gases either into the Heat Recovery Steam Generator (HRSG) or up the bypass stack.

A unitized lubricating oil system will be included with the gas turbine generator for the lubricating oil and control oil requirements The main lubricating oil pumps will be provided by air cooled heat exchangers with electric motor driven fans for forced circulation of the cooling air.

The generator will be either hydrogen cooled, water or water air cooled and will include a static type exiter. Cooling air will be prefiltered and silenced. For a unit with a hydrogen cooled generator, a plant hydrogen generating system will be required along with a carbon dioxide purging system.

Noise from the gas turbine will be attenuated by an enclosure over the unit, so that a sound pressure level of 60 dBA at 122 meters is not exceeded when operating at rated load. The noise from auxiliary equipment will not exceed a sound pressure level of 95 db at 1 meter. The noise from the gas turbine silencing enclosure or ducting will not exceed 90 dBA at 1 meter. The gas turbine will have dual fuel systems for gas and distillate oil. Each system will include the required trip and control valves vents, drains, pumps and tanks necessary for operation. Gas will be supplied from a plant header and fuel oil will be delivered from a forwarding pump located at the fuel oil storage area.

The gas turbine unit will have a unit transformer, main transformer and auxiliary switchgear. The gas turbine package is delivered largely prewired and therefore will be field interconnected.

Electronic controls will be provided for turbine generator control. A local control panel will be located near the gas turbine unit with a remote control panel in the central control room.

Heat Recovery Steam Generator and Auxiliaries

The Heat Recovery Steam Generator (HRSG) will be of the dual pressure two drum convection type, suitable for outdoor installation. This arrangement will produce high and low pressure steam simultaneously. Steam temperatures will be controlled by spray attemperators.

High and low steam pressures and temperatures will be selected to suit the particular manufactures steam turbines in order to optimize thermal efficiency.

The gas turbine exhaust gases are ducted to the HRSG from the bypass stack damper. These gases are nominally 500 C° at the base load rating of the gas turbine. At lower gas turbine outputs the exhaust gases decrease in temperature. The exhaust gases will be turned vertically to pass up through the convection sections of the HRSG to the exhaust stack mounted on the top of the HRSG unit.

In the HRSG, the exhaust gases give up heat to the high pressure superheater, high pressure evaporator and high pressure economizer low pressure superheater, low pressure evaporator and low pressure economizer. The design of the HRSG unit will be such that its exhaust gas temperatures are above the dew point of any oxides of sulphur emissions from the combustion of sulphur-bearing liquid fuel. A stack exit temperature will be specified to prevent corrosive solutions condensing in the exhaust.

Access platforms and stairways will be provided to the drum levels on the HRSG's. The HRSG will include a top mounted 45 m (min) above ground level, steel stack, the stack will be provided with access ladders and aircraft warning lights.

Steam Turbine Generator and Auxiliaries

The non-reheat type, tandem compound, 3000 r.p.m. turbine generator will be nominally rated at 55 MW with the low pressure steam turbine exhausting to the condenser at 0.084 bar. Extraction points will supply steam for dearation and feed water heating.

The condenser will be of the double pass type, supported from the turbine foundation and connected to the turbine exhaust neck through a flexible joint. Tube material will be stainless steel. The condenser design back pressure of 0.084 bar is based on a cooling water inlet temperature of 30 C°. The air extraction equipment will consist of 2 100% capacity main steam air ejectors and a quick start "hogging" ejector for rapid evacuation on start up. The ejectors will use live steam from the boiler.

The generator will be 3-phase, 50 hertz machines with either air cooling, hydrogen cooling, or water cooled stators. In the case of hydrogen cooling an associated hydrogen gas supply systems will be included. Excitation will be provided by a solid state static exciter fitted with special stabilizing circuits. For the steam turbine lubricating oil, seal oil and control oil will be cooled by a closed cooling systems which will be supplied with make-up water from the condensate system.

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Due to the high quality of water required for stator cooling, this system will have its own independet cooling circuit. The automatic extraction steam line shut-off will be incorporated to prevent water induction into the main turbine.

Main High Pressure and Low Pressure Steam System

The high pressure steam piping will be of alloy steel construction to provide maximum reliability and minimum maintenance. Hydraulically operated combined stop and emergency valves, located on both the high pressure, and low pressure lines together with bypass valves will provide automatic protection for the turbine. The boiler stop valves and all steam line drain valves will be electrically operated.

Low Pressure Feedwater System

The low pressure feedwater system for the steam unit will comprise two 100% electrically driven condensate extraction pumps, two 100% two-stage steam air ejectors, gland steam condenser, drains cooler, and a dearator with spray distribution. The system will be interconnected with two condensate surge and storage tanks, giving 30 tons storage capacity for the unit.

These tanks will be used to receive and store surplus water from, or transfer make-up condensate to the feedwater system will normally work on a unit basis. The condensate extraction pumps will draw condensate from the condenser hotwell and pump it through the gland steam and air ejector condenser into the dearating heater and storage tank. The water level in the storage tank will be maintained constant and will provide about ten minutes feedwater supply. the feedwater heater system will incorporate provisions for recirculation of condensate through the air ejector, the gland steam condenser and back to the condenser during start-up periods of low load. Operation of the system will be fully automatic, variations in hotwell level controlling make-up and surplus flows.

The deaerator will be heated by steam extracted from the steam turbine. During start-up, feedheating steam is obtained from the low pressure steam system. The feedwater is pumped to the low pressure economizer the heated water enters the low pressure boiler drum. Boiler circulating pumps for HRSG withdraw water from the low pressure drum and circulate it through the low pressure evaporator. When reentering the low pressure drum, saturated steam is moisture separated and passes into the the low pressure superheater before going to the low pressure steam turbine.

High Pressure Feedwater System:

The 2-100% high pressure feedwater pumps for the HRSG will draw water from the low pressure drum and pump it via the high pressure economizer to the high pressure economizer to the high pressure drum. This water is then pumped through the high pressure evaporator by the 2-100% high pressure circulating pumps for the HRSG before re-entering the high pressure drum and passes through the high pressure superheater and then to the high pressure superheater and then to the high pressure turbine.

Feed water flow to the HRSG will be controlled by a conventional three element control system, measuring HRSG drum HRSG boiler feedwater flows and steam flow to control the pumps and regulating valves.

Cooling Water Systems

The cooling medium for the condenser and the heat exchangers of the closed circuit equipment cooling system will be river water. The water will pass through two sets of screening equipment, each set comprising of one raking bar screen. A travelling motorized rake will be provided for the bar screens. Two 50% circulating water pumps will be provided for the steam turbine.

In normal operation two pumps will be in service. An "on line" condenser tube cleaning system such as "Amertap" will be considered at the design stage in order to reduce the condenser fouling losses and maintain a high heat transfer coefficient. The condenser cooling water circuit will operate on the syphon principle in order to minimize circulating water pumping head.

The traveling screens will be operated either in the manual or automatic mode. Normally they will run on an intermittent basis. During running periods the screen wash pumps will be automatically turned on. The system will be designed to operate automatically, once placed in operation. Control and interlock will be provided to eliminate the possibility of destructive water hammer due to the long conduit systems.

All the major and auxiliary equipment throughout the steam turbine section will be cooled by a closed circuit equipment cooling system consisting of two 100% electric motor driven pumps, a head tank fed with make up water from the condensate system and two 100% heat exchangers with river water as the cooling medium.

D. TECHNICAL ASPECTS - CAIRO WEST REHABILITATION:

Boiler Modernization:

The Cairo West station began commercial operation in 1966. During the 1967-1973 middle-east conflict, Egypt's refinery capacity was severely curtailed and EEA was compelled to burn heavy crude oil in its generating plant boilers rather than Mazout, a refinery product similar to No. 6 oil. As a result, the boiler tube walls and portions of the superheaters, reheaters, economizers and air preheaters were subjected to extensive corrosion and tube failure. This corrosion problem was compounded by poor water quality and lack of chemical cleaning of the boilers for nearly 10 years.

Babcock and Wilcox (B&W), the boiler manufacturer has regularly inspected the boilers and has the supplied replacement boil tubes and installation supervision to correct the most serious problems. EEA is presently forced to operate the boilers at pressures far below the design pressure to avoid extensive tube failures and the output of several units is restricted to approximately 60 percent of rating. The availability of the boilers is far below acceptable levels due to outages to repair boiler tubes. The rate of fuel consumption (heat rate) of the boilers has deteriorated to 80 percent of the original design output. The boilers can be returned to reliable operation by replacement of the corroded tubes in the water walls and superheater section. These changes will allow EEA to operate the units at full output and improve the heat rate to 90 percent of design rating.

Conversion to dual fuel firing

The boilers were designed to burn Mazout. No provision was made for firing natural gas. EGPC is constructing a natural gas pipeline which has crossed the Nile just south of the Cairo West plant and EGPC will extend a pipeline into the site to supply natural gas for boiler fuel. The conversion of the boiler to burn either natural gas or Mazout involves no new technology.

B&W will redesign the oil and gas burners for boiler 1, 2, 3 and 4. The burners will incoporate designs to limit the formation and release of nitrous oxides. Since the low nitrous oxides burners will require a larger throat diameter, the burner throat opening will replaced. The boiler will still utilize No. 2 oil for light-off and low output operation, so the No. 2 oil atomizer assemblies and oil lighters will replaced along with the automatic lighter combustion control system.

The forced draft fans and gas recirculation fans and motor drives will be replaced with higher capacity fans which will allow the boiler to operate at a higher capacity.

The combustion instrumentation and controls will be replaced with a modern Burner Management System and combustion controls utilizing micro processors. With the modern burner management system, EEA will have the capability of controlling each of the nine burners in each boiler individually. Existing flow nozzles, spray nozzles, control valves, control drives, automatic shut-off drives and the existing field equipment will be interfaced with the control system.

Pressure Part Replacment

B&W will provide replacement superheat and reheat headers for boilers 1, 2, and 3. Inspection of boiler 4 has formed the headers to be of adequate design and natural.

B&W will redesign the secondary superheaters for boilers 3 and 4, each consisting of 23 sections, from the inlet header tube stub to the outlet header tube stub. The sections will be supplied complete with tube attachments. The secondary superheater design will duplicate those in use on boilers 1 and 2.

B&W will also provide replacement superheat and reheat attemperators for boilers 1, 2, 3 and 4. The superheat attemperators (2 per boiler) will be complete with piping and spray nozzles. The reheat attemperators (1 per boiler) will be complete with piping and spray nozzles.

Turbine-Generator Rehabilitation

Westinghouse recently completed an extensive inspection of Unit 3 and less extensive inspections of Units 1 and 2. The turbine generators have generally performed well and were conservatively designed. Similar units around the world have been modified at minimal expense and have yielded increased power output (EEA is not presently considering a turbine generator uprating).

High Pressure Turbine Rotor Seals:

The inspection found the high pressure (H.P.) turbine rotor seals to be worn and damaged which reduce the unit efficiency by allowing steam to bypass the seal area, thus the steam energy is not transferred to the rotating element. If the condition is allowed to progress, erosion to the rotor steam seal grooves could occur, creating a more difficult condition to correct.

Westinghouse will utilize specialized equipment incorporating a rotating hydraulic drive and "V-blocks" for the rotor seal removal and final machining. Also, seal removal and replacement tools will be supplied for use by the Westinghouse Blading Technicians and Machinist Technicians. The scope of work for the H.P. rotor seal replacement includes:

EEA will set up the H.P. rotor in V-blocks
Westinghouse will machine out the H.P. rotor seals
Westinghouse will install new rotor seals
Westinghouse will machine new rotor seals to final size

High Pressure Turbine Blade Ring Diaphragm:

Inspection of the turbine revealed that the blade diaphragms in the H.P. blade ring had been mislocated in the blade ring grooves by as much as 20 degrees. The caulking segments securing the affected diaphragms will be removed, the diaphragms properly positioned, and the caulking segments replaced. Westinghouse will utilize a special boring bar set-up for machining out the existing diaphragm caulking and Westinghouse caulking tools for installation of new caulking pieces. The scope of work for repositioning the mislocated H.P. blade ring diaphragms includes:

Westinghouse will set up boring bar in bottom half of blade ring
EEA will assemble the H.P. blade ring
Westinghouse will machine out caulking on affected diaphragms
EEA will disassemble the H.P. blade ring
Westinghouse will correctly position affected diaphragms
Westinghouse will install new caulking segments

High Pressure Turbine Blade Ring Shroud Seals:

The inspection of the H.P. turbine components revealed that the rotating and stationary parts have come in contact causing damage to the blading shroud seals. The damaged seals reduce the unit efficiency by allowing steam to bypass the seal area thus preventing the steam energy transfer to the rotating element of the turbine. The scope of work for the replacement of the H.P. blade ring shroud seals is as follows:

Westinghouse will remove blade ring shroud seals
Westinghouse will install new seals in blade ring
Westinghouse will assemble boring bar in blade ring base
Westinghouse will assemble blade ring
Westinghouse will machine seals to final dimensions

Westinghouse will utilize the same boring bar equipment used H.P. blade ring diaphragm recaulking for the seal machining along with specialized seal replacement kits.

Low Pressure Turbine Rotor Water Gland Runners:

The inspection of the unit showed that impact or electrolytic damage had occurred to the low pressure (L.P.) turbine rotor water gland runner. The gland runner will be replaced to restore the water gland assembly to acceptable condition. The removal and replacement of the gland runner can be accomplished in three shifts. The work scope includes:

EEA will set the low pressure rotor in the V-blocks and drive
Westinghouse will machine out existing gland runner caulking from low pressure rotor
Westinghouse will remove the existing gland runner
Westinghouse will install new gland runner
Westinghouse will utilize the same equipment used in the seal replacement activities.

High Pressure Turbine Blade Ring Sealing Strips:

The inspection of the unit and the blade path clearance data indicate that steam erosion of the H.P. turbine blade ring sealing strips has detrimentally affected the stationary blading (blade ring) position such that the blading clearances are not acceptable. If the condition is allowed to progress, risks of the rotating blades coming in contact with the stationary blading during unit operation are very significant. Westinghouse has recommended that the sealing strips be replaced and machined to the proper thickness to provide for acceptable blading clearances.

The removal of the existing strips will require that the assembled blade rings be set up in a vertical boring mill or vertical lathe for machining and preparing the blade ring groove for replacement seals. After new seals are installed in the blade rings, the seals will be machined to the proper thickness. Westinghouse has recommended that EEA contract directly with a local machine shop for the vertical boring mill rental and operation. A Westinghouse machinist will direct or witness the machining activities at the Cairo local shop. The use of the local non-specialty equipment will result in a savings to EEA for this portion of the work.

The scope of work for the removal and replacement of the blade ring to cylinder sealing strips includes:

EEA will assemble H.P. blade ring top and bottom halves
EEA will transport blade rings to local EEA approved machine shop
Westinghouse will set up blade rings in vertical boring mill
Westinghouse will machine out existing seals
Westinghouse will install new seals
Westinghouse will machine new seals to proper thickness
EEA will transport blade rings to Cairo West Station

Turbine Non-destructive Testing:

The most recent inspection of Unit 3 was in 1984. The service hours provided since the last inspection have subjected the the turbine generator to excessive distress as is evident from the present damaged condition. The non-destructive examination of the major components reveal areas of componet distress which are not detectible by visual inspection alone, and identify areas of distress which will affect the future reliability of the turbine generator.

Westinghouse will supply specialized non-destructive examination equipment and materials which will prove for the most advanced examination techniques to be applied on the turbine. The scope of work for the non-destructive exam activities includes:

Wet flourescent Magnetic Particle and Visual Inspection of:
- H.P. & low pressure Rotor Discs, Blading, and Bodies
- H.P. & low pressure Blade Rings and Inner Cylinders
- H.P. Dummy Rings
- H.P. Nozzle Block
- H.P. & low pressure Coupling Bolts
- H.P. & low pressure Bolting, Washers, and Nuts

Magnetic Rubber Mold Inspection of:
- H.P. Turbine Steam Inlet Sleeve Trepan Area

Ultrasonic Inspection of:
- H.P. & low pressure Cylinder and Blade Ring Heated Bolting
- H.P. Nozzle Chamber Welds
- Thrust Bearing Shoes
- Coupling Bolts

Flourescent Penetrant Inspection of:
- Main Oil Pump
- H.P. Outer Cylinder Internal Surfaces and Bolt Hole Areas
- H.P. & low pressure Inner Cylinder and Blade Ring Casings

High Pressure Turbine Blade Ring Seal Strips:

The inspection of the unit showed that a high percentage of the steam path seal strips in the high pressure turbine bladed rings have rubbing or impact damage and seal clearances are excessive. This condition lowers the unit efficiency and could effect reliability if the embrittled seals should breaAkand enter the steam path.

The scope of work for the replacement of the H.P. blade ring seal strips:

Westinghouse will remove existing blade ring seals from four blade rings and Curtis stage ring
Westinghouse will install new seals
Westinghouse will machine seals to proper clearance

Low Pressure Turbine Blade Ring Seal Strips:

The inspection of the unit showed that a high percentage of the low pressure inner cylinder steam path seals have rubbing or impact damage and the seal clearances are excessive. This condition lowers the unit efficiency and could effect reliablity if the embrittled seals should bread off and enter the steam path.

The scope of work for the replacement of the low pressure turbine blade ring seal strips is as follows:

Westinghouse will remove existing low pressure inner cylinder seals
Westinghouse will install new seals
Westinghouse will set up boring bar in low pressure base
EEA will assemble low pressure inner cylinder
Westinghouse will machine seals to proper dimensions.

Generator Testing:

A complete generator testing program will be implemented during the outage to assess the condition of the generator. The recommended testing program will identify areas of insulation damage, stator core lamination short-circuiting, stator and rotor conductor electrical integrity, stator slot wedge tightness, core through-bolt tightness, and rotor retaining ring condition - all which affect unit reliability and operation.

Instrumentation:

The instrumentation of the plant is old, and should be selectively replaced. The instrumentation will be compatible with the balance of plant instrumentation and any special training to service the new instrumentation will be provided.

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E. TECHNICAL ASPECTS - GAS TURBINE REFURBISHMENT:

The gas turbines at Abu El Matamir, Cairo North and El Fayoum are General Electric Model MS 5001 gas turbines with a design output of 24 MW. All three units are controlled by GE's Mark II Speedtronic solid-state electronic control system. The gas turbines, including their control systems, are in various stages of deterioration: Cairo North has been out of service for several years due to turbine component failure; Abu El Matamir has been out of service for more than one year awaiting turbine replacement parts; and El Fayoum is an operating unit that dependably procedures full output.

The Cairo North and Abu El Matamir gas turbines can be returned to operation by replacing the turbines' hot gas path components and portions of the turbine blading and the Abu El Matamir unit's coupling between the turbine and generator. Since the hot gas path components incorporate advanced technology designs that increase the generator output and efficiency and extend the life of the turbine, hot gas path components on the El Fayoum unit would also be replaced. The excitation and MARK II integrated controls systems are obsolete and would be replaced with current production controls.

F. TECHNICAL ASPECTS - MICROWAVE COMMUNICATION EXTENSION:

EEA constructed a microwave communication systems, in conjunction with the National Energy Control Center, to collect and transmit operating performance data on many of EEA generating units and substations. With the growth in the EEA generation and transmission facilities, the microwave system must be expanded to meet the communication requirements of the control center. The communication equipment to be added will provide for two-way data transmission using microwave frequencies. The installation of the microwave system will be similar to other microwave links from NECC to EEA facilities. Since EEA has managed similar microwave expansions, there will be a minimal role for a consultant. The consultant, if required, will prepare a detailed scope of work for the turnkey contractor and a construction cost estimate.

G. FUEL AVAILABILITY AND TRANSPORTATION:

The generating facilities being financed by this project will normally burn natural gas which is readily available in Egypt. EEA normally operates their boilers on dual fuels (80% gas and 20% oil) for combustion reliability. The Cairo South combined cycle unit will normally burn natural gas supplied from gas fields in the Gulf of Suez. Cairo West units will normally burn natural gas supplied by pipeline from the Abu Madi gas field in the Delta. The Hurgada gas turbine plant will normally burn associated gas supplied from oil wells in the Gulf of Suez.

Facilities for the unloading, storage and burning of distillate oil (solar) exist at Cairo South and will be provided at Hurgada.

H. TRANSMISSION:

The electrical energy produced by the Cairo South combined cycle unit will be delivered to the 220 KV network presently connecting Cairo South to the UPS. The electrical energy produced by the Hurgada units will be connected to the existing 11KV distribution network serving Hurgada. The transmission lines to be added will be based on an analysis of the transmission requirements necessary to assure reliable operation for a variety of operating conditions.

I. CONCLUSIONS:

The combined cycle technology is a proven technology which has been widely and successfully used in the electric utility industry for over 30 years. The design of the project builds on this experience and is consistent with the general body of knowledge on gas turbine and combined cycle technologies. Given the many years of EEA operating experience with a variety of gas turbines and other generating plant facilities, USAID believes that the EEA, the GOE implementing agency, will require only minimal additional personnel and training to effectively operate and maintain the new combined cycle plant and the gas turbine being refurbished and subsequently installed on a site adjacent to the Red Sea at Hurgada.

Rehabilitation of the Cairo West turbine generators and boilers and conversion of the boilers to burn natural gas as well as Mazout is based on accepted industry practice. Boiler tube replacement will allow operation at design pressure and will extend the boiler's life and the combustion controls for burner management will maximize the efficient operation of the plant combustion.

The microwave system expansion will utilize communication equipment proven over many years of operation on similar applications, and will represent a small extension to an already extensive existing microwave systems.

Accordingly, the proposed project design is determined to be technically appropriate and cost effective.

FINANCIAL ANALYSIS

A. General:

The Egyptian Electricity Authority (EEA) is an operational organization within the Ministry of Electricity and Energy. EEA is bound by certain government standards, practices and traditions.

B. Accounting System:

The GOE applies a Standardized Accounting System (SAS) to all operations of the government. The SAS is administered by the Central Auditing Organization together with the Ministry of Finance. The SAS is uniform for all government organizations regardless of their function.

The capital development (investment) section of the budget is prepared through coordination of plans of EEA's technical department with the national Five-Year Plan as controlled by the Ministry of Planning. The GOE's approval and inclusion of an EEA project in the Five-Year Plan represents the GOE's agreement to commit funds over the five year period without prescribing specific amounts for each year of the plan.

The operation expense section of the budget is prepared by EEA's operating zones. Each zone forecasts operational and maintenance expenses which are then assembled into a comprehensive operational budget which is then submitted to the Ministry of Finance.

The investment and operational expense budgets are assembled by the Ministry of Finance and after determining the impact of the combined budget on the national economy and after making any necessary adjustments, the budget is submitted to the Cabinet for further review and approval.

The accounting and internal audit functions globally fall under the deputy chairman for finance and economy. This office was set up in 1985 by splitting the functions of finance and administration which used to be under the responsibility of one deputy chairman. This reorganization was undertaken in order to limit the span of control and enable the two deputy chairman (finance and economy; and administration, manpower and training) to effectively supervise the activities falling under their respective functions. The finance and economy department has under its responsibility the budget, general accounting, cost accounting and internal audit functions.

The annual budget is prepared at the Head Office and zonal offices; and the latter submit to Head Office Budget Division their respective budget proposals for review and consolidation. EEA also prepares a rolling budget covering a period of five years based on a five year investment program approval by the cabinet.

The accounting department is responsible for preparing all payment documents that shall be effected after they are duly checked and authorized by the Budget Division. All financial records are separately maintained by Head Office and Zone offices through a system of cost accounting. The Zones are required to submit to Head Office their respective quarterly returns and annual statements which are eventually consolidated to reflect the overall financial performance of EEA.

The audit units at headquarters and zonal offices are continuously engaged in pre-audit and post-audit functions. The internal audit function is being reorganized for effective control of the financial and operational activities of EEA. EEA's external auditor is the Government's Central Audit Organization, which has a competent staff working exclusively for the audit of EEA.

In general, the accounting system of EEA is quite comprehensive. If properly applied and the tasks coordinated, the system could provide useful information for management's decision making. It has been assessed that certain improvements are required to achieve this goal. First, there is a need to provide adequate training to the staff working at the various levels of the accounting functions. Second, there is a need to have a system that could facilitate the dissimilation of information among the various offices, departments and divisions within EEA to avoid duplication of effort and assist i streamlining the duties and responsibilities of each staff. To this end, EEA has already undertaken two major programs. The accountants training program discussed in the Managerial/Administrative Analysis aims at upgrading the quality of the staff as they will be trained to have practical experience in an electricity setup. The Electricity Energy Data Bank also discussed in the Managerial/Administrative Analysis will be a major breakthrough for EEA as it will not only computerize all the technical and financial activities but also setup a centralized information system.

EEA is now in the process of computerizing most of its activities. The personnel and accounting functions have already been computerized. The next step is to computerize loan administration and the activities of the Operating Zones. As part of the Electricity/energy Data Bank program, a consulting firm is in place for implementing a system-wide automated cost reporting system for EEA. The success of the overall system automation program would greatly contribute towards the continuous institutional development effort of EEA.

Billing and Collection:

Until the beginning of 1979 EEA in addition to generation and transmission, had been undertaking the distribution and selling of electricity throughout the country and at the same time handling all the billing and collection functions. Following the creation of the Distribution Companies in January 1979, EEA's customers were limited to large industries, governmental bodies and the seven Distribution Companies. At present the number of EEA's customers stands at 32 which includes the seven Distribution Companies. This limited number of customers has greatly eased the billing functions which are performed manually by EEA whereas the billing of distribution company served customers performed by computer generated bills.

Collection of receivables had in the past been very difficult because the public sector often had liquidity problems causing delays in payments. EEA's accounts receivable from its customers corresponded in 1978 to about six months sales. EEA has strengthened its collection efforts and was able to decrease accounts receivable to less than three months in FY 83/84. Nevertheless, since then, the collection level has deteriorated as reflected by the outstanding receivables shown in the Table below.

Table 1
Egyptian Electricity Authority
Outstanding Receivables

Fiscal Year	Revenues/year LE million	Receivables as % of sales	Receivables as No. of Months Sales
80/81	127	30	3.6
81/82	145	27	3.2
82/83	180	28	3.3
83/84	240	24	2.9
84/85	288	26	3.1
85/86	440	32	3.8
86/87	513	38	4.5
87/88	735	41	4.9

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EEA's and the Distribution Companies' effort to minimize the level of outstanding receivables ahs been hampered by the delay on the part of governmental offices and public sector firms to settle their bills. The breakdown of the outstanding receivables by voltage and customers of EEA is shown in Table 2.

Table 2

ACCOUNTS RECEIVABLES - COLLECTION PERFORMANCE
(Source - IBRD)

	FY84/85	FY85/86	FY86/87	FY87/88	
	(LE million unless stated otherwise)				
Sales Revenues	287.72	440.33	513.28	734.89	
of which:					
Electricity Dist. Companies	238.48	366.89	424.24	606.03	(82%)
Industry	42.07	63.59	78.48	115.19	(16%)
Agriculture	6.45	9.65	10.56	13.67	(2%)
Government	0.26	0.20	-	-	
Accounts Receivables	69.04	131.93	191.47	305.02	
of which due from:					
Electricity Dist. Companies	56.54	100.42	151.61	239.98	(79%)
Industry	8.82	24.21	28.35	44.59	(15%)
Agriculture	3.68	7.3	11.51	20.45	(6%)
Government	0.02	-	-	-	
No. of months sales in Receivables	2.9	3.6	4.5	4.9	
of which in:					
Electricity Dist. Companies	2.8	3.3	4.3	4.8	
Industry	2.5	4.6	4.3	4.7	
Agriculture	6.8	9.1	13.1	17.9	
Government	0.9	-	-	-	

From Table 2, it can be seen that about 21% of the outstanding receivables is attributed to the EEA's direct customers, while 79% is attributable to the customers served by Distribution Companies. Further analysis of the breakdown of outstanding receivables of the Distribution Companies indicates that 70% of the outstanding amount is due from the public sector, 25% from Government and municipalities and only 5% from residential, commercial and private sectors. Thus, 95% of the outstanding

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receivables is attributable to Government and Government protected sectors for which disconnection of electricity supply is difficult to undertake.

Following extended discussions with the Government of arearages adversely affecting EEA, the Government agreed to settle the arrears on an installment payment basis at the rate of LE 50 million per year effective July 1988. A condition of funding for a recent ADB loan requires EEA to implement collection procedures which will reduce the level of outstanding receivables so as not to exceed the equivalent of 2.5 months revenue by 1991 fiscal year.

FINANCIAL ANALYSIS:

Past and Present Financial Performance:

The financial performance of EEA is reflected in the financial statements presented in Table H-1. The Income Statement of EEA's is summarized in Table 3:

Table 3
Income Statement
(Million LE)

	FY 80/81	FY 81/82	FY 82/83	FY 83/84	FY 84/85	FY 85/86	FY 86/87
Operating Revenue	128	145	180	241	288	440	513
Operating Expenses	113	144	171	208	272	380	467
Operating Income	15	1	9	33	16	60	46
Interest	18	6	11	15	42	70	114
Net Operating Income	(3)	(5)	(2)	18	(26)	(10)	(68)
Net Non Operating Income/Loss	(1)	7	6	(13)	36	18	81
Net Income	(4)	2	4	5	10	8	13

EEA's operating income has been positive for the last 8 fiscal years (1980/81 to 1987/88); but the trend has been sporadic in response to the timing of tariff increases. The net operating income (after interest), however, has been negative for the period under review (except for FY83/84 and FY87/88) due mainly to rising interest charges on loans. Since 1984/85 fiscal year interest charges have increased significantly each year as the Egyptian Pound has been devalued. Nevertheless, EEA's net income including other non operating income, has been improving gradually over the period under review.

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The financial structure as reflected in the Balance Sheet is summarized in Table 4. The financial structure has been characterize by poor liquidity and high debt/equity ratio.

Table 4
Balance Sheet
(Million LE)

	FY 80/81	FY 81/82	FY 82/83	FY 83/84	FY 84/85	FY 85/86	FY 86/87	FY 87/88
Net Fixed Assets*	449	525	587	883	365	2119	2452	4888
Current Assets**	169	183	236	275	328	568	764	891
Capital & Reserves	189	228	835	862	895	963	1105	1126
Long Term Liabilities	865	980	718	954	1617	2255	2532	4769
Current Liabilities	266	294	269	329	371	593	723	1704
Current Ratio	0.64	0.62	0.88	0.84	0.88	0.96	1.06	0.52
Debt/Equity Ratio	4.58	4.30	0.86	1.11	1.81	2.34	2.29	4.24
Rate of Return on Average Net Fixed Assets in service	3.3	-	1.6	4.5	1.4	3.5	2.0	5.0

* Excludes Work in Progress.
**Excludes investments and long term receivables.

The liquidity position of EEA has been unsatisfactory over the years although the trend has shown gradual improvement. Analysis of the current liability situation indicates that about 45% of total current liabilities are payments to be made to the Ministry of Finance which is lagging due to the delay in settlement of electricity bills by Governmental offices and public sector institutions. It is the responsibility of the Government to ensure timely payment of electricity bills in order to avoid unnecessary cross indebtedness.

EEA's debt/equity ratio had been very poor in 1981 and 1982, improved in 1983 but has again deteriorated since 1984. The improvement in 1983 was the result of the transfer of all outstanding local loans (LE 530 million) of the Ministry of Finance to EEA's equity. The deteriorating trend since 1984 appear to be due to the change in the foreign exchange rate used to convert foreign loans. Until 1984, the exchange rate used by the Central Bank of Egypt was 1 US$ to 0.84 LE. Since 1984, the official rate for the purpose of accounting foreign exchange loans, has become 1 US$ = 1.35 LE. Recently, this rate was raised to 1 US$ = 2.25 LE.

Table 5
Sources and Applications of Funds
(million LE)

	FY 80/81	FY 81/82	FY 82/83	FY 83/84	FY 84/85	FY 85/86	FY 86/87	FY 87/88
Sources								
Internal Cash generation	40	32	42	69	118	194	277	302
Reserve*	43	37	82	21	22	58	129	6
Overdraft	3	7	1	(7)	(24)	3	(6	4)
Borrowings	224	210	322	306	731	842	506	2584
TOTAL SOURCES	310	286	447	389	847	1097	906	2896
Applications								
Work in Progress	252	186	300	607	745	804	498	3159
Debt Service	69	80	85	76	109	226	280	312
Net Change in Working Capital**	(11)	20	62	(294)	(7)	67	128	(575)
TOTAL APPLICATIONS	310	286	447	389	847	1097	906	2896

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* Includes provisions.
** Includes long term receivables and investment.

EEA's internally generated funds have been short of EEA's debt service requirements. Moreover, EEA has continued to depend on internal and external borrowings for its capital investment. With the past and prevailing electricity rates, EEA has not been able to earn a positive rate of return on its revalued net fixed assets in service.

In conclusion, EEA's overall financial performance, although assessed to be unsatisfactory has shown a gradual improvement over the years. The unsatisfactory performance is almost entirely the result of an electricity rate structure which bears no relationship to the economic price of electricity or to the cost of service to the various classifications of customers and the impact of long delayed major electricity and fuel price increases.

FINANCIAL PROJECTIONS:

The future financial projections of EEA is expected to improve as a result of increased generation and sales of energy as well as the restructuring of the electricity pricing schedule and annual pricing changes need to reach the economic price by the mid 1990's. The IBRD has prepared detailed financial projections for EEA which are presented in Tables H-2.

These projections are based on average electricity tariff increases of 30% in FY89/90 and FY 90/91 and average fuel price increases of 25% in both years. In FY91/92 - 94/95 all fuel prices are assumed to increase in equal annual percentages needed to reach economic cost in FY94/95. Thereafter, they are assumed to increase at the rate of inflation. In the same period the average electricity tariff is assumed to increase at rates required to generate self-financing levels of 20% in FY92, 30% in FY93 and 35% in FY94 and each year thereafter.

Although the tariff increases assumed to take place in FY90-FY91 would not immediately transform EEA into a financially sound utility, they represent a continuation since 1985/86 of the Government's efforts to move the power subsector to a better system of management and to pricing policies which would increasingly provide correct signals for sound investment decisions and would in due course require customers to pay the full cost of goods and services provided to them. Moreover, the magnitude of the increases is broadly the same as those which have been implemented in 1985/86, 1986/87, and in 1988/89, and therefore the probability that they will be implemented is high.

The Government also recognizes that the transition from low prices (energy prices, and an overvalued exchange rate) to economic levels would cause the power subsector short-term financial difficulties and is considering different alternatives for providing support to EEA including possibilities of increasing its equity through debt/equity conversion or new capital injections.

C. Project Audits Completed:

The Office of the Inspector General for Audit, RIG/A/Cairo, has performed two functional audits of AID financed Project in the electric power sector as part of larger audits of a number of projects. The objectives of the audits were to:

a. evaluate the Missions procedures in monitoring the GOE's local currency and in kind contributions and assess the adequacy of controls for the accounting of local currency and in kind contributions.

b. determine how effectively project financed machinery and equipment are being utilized.

These audits revealed that while EEA had established detailed accounting records for project expenditures involving AID funds as well as local currency, there was no monitoring system to insure that the GOE's local currency and in kind contributions were being made. The audits showed that equipment and machinery financed by AID was being used effectively.

The Grant Agreement will contain a Requirement Precedent to Disbursement requiring that EEA establish and maintain accounting records of local currency and in kind contributions to the Project. The Grant Agreement will also contain a Covenant that EEA will provide to USAID, quarterly, copies of the accounting records on local currency and in kind contributions.

D. Sources of Project Funding:

The sources of Project financing for the Projects four components are summarized in Table 10.

Table 10
Source of Project Funding
($ or LE in Millions)

	AID	GOE
Foreign Exchange	$136	-
Local Currency		LE 54

The U.S. dollar cost of the project will be provided to the GOE as a Grant with the proceeds of Grant to finance consultant services passed to EEA as a Grant with the remainder for equipment, construction and installation services and commodities passed to EEA as a Loan. The Grant Agreement will contain a Requirement Precedent to Disbursement requiring that the funds made available by AID to the GOE will be loaned to the EEA.

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The Grant Agreement will contain a Requirement Precedent to Disbursement requiring evidence that local currency financing for the project has been budgeted by the GOE and will be available for expenditure by EEA on the project.

E. Utilization of Project Funds:

The proposed 133 million AID grant will be used to finance technical assistance and engineering advisory services, installation of 150 MW combined cycle unit, rehabilitation of a 4 unit steam plant, refurbishment of three gas turbines, expansion of a communication system and procurement of commodities.

The utilization of AID funds for the four components of the project is summarized in Table 11.

Table 11
Utilization of Project Funds

Technical Assistance	$ 3
Consultant Services	$ 6
Cairo South Combined Cycle	$ 68
Cairo West Rehabilitation	$ 24
Hurgada Gas Turbine Installation	$ 7
Microwave Extension	$ 1
Commodities	$ 13
Contingency	$ 14
TOTAL	$136

F. Disbursement Period:

Disbursement of $133 million in AID funds for engineering advisory services, combined cycle procurement, rehabilitation and installation and subsequent combined cycle addition will extend over five years from the GOE's satisfaction of the Requirements Precedent until the completion of the combined cycle plant at Al Nuberiya, Cairo South and Damietta. The estimated disbursements over the implementation period are summarized in Table 13 below.

Table 12
Disbursement Schedule

FY90	$ 19
FY91	$ 35
FY92	$ 54
FY93	$ 28
	$136

14/0

G. Financial Viability:

The Power Sector Support project is assumed to add 150 MW to Egypt's generating capacity which will result in an energy output of approximately 1,051,000 MWhr per annum. and will recover nearly 666,000 MWhr per annum in capacity presently unavailable due to equipment condition. In addition, 72 MW in gas turbine capacity will be refurbished and installed off the EEA system to support load growth. The communication system extension and supply of commoditites will result in fuel savings by displacement of less efficient capacity with high efficiency generating units.

Capital Cost:

The Capital Cost are based on EEA cost estimates for similar types of plants installed in Egypt. These costs have been compared to the installed cost for similar plants adjusted to reflect any special factors.

Operation and Maintenance Costs:

The O&M Cost is divided into fixed costs based on installed cost (labor costs) and variable costs for lubricants, chemicals and replacement parts which vary with energy output.

Fuel Costs:

The fuel cost is based on firing of 80 percent Natural Gas and 20 percent Mazout (Cairo West) and 95 percent natural gas and 5 percent Solar (Cairo South and Hurgada).

Energy Generated:

Energy generated is based on operation of the units at an annual Capacity Factor of 80 percent.

System Losses:

The EEA system losses are estimated at 8 percent.

Revenue:

The Revenue from net system sales is based on the prevailing average electric energy price of 25.8 millimes per KWhr.

Financial Rate of Return:

The financial IRR's for the components of the Project are summarized below:

Component	Financial IRR
Cairo South	N/A
Cairo West	1.0
Hurgada	1.4
Microwave Extension	14.1
Commodities	10.2

H. Conclusion:

The Egyptian Electricity Authority is financially capable of implementing this project. Performance on previous projects has shown that equipment and materials financed by AID have been used effectively. EEA does maintain detailed accounting records of project expenditures and monitoring systems to track local currency and in kind contributions will be implemented.

Funding for the components of the Project are based on sound engineering estimates prepared by the Implementing Agency. Adequate funds are available in the Grant to achieve the Project purpose of financing consultant services, equipment and installation of the necessary generation.

The financial rate of return for the microwave extension and commodity components of the project are negative due to the low price of electric energy. The components of the project that involve rehabilitation of generating capacity provide positive IRR's even at the low price of energy.

Based on the financial plan, disbursement schedule, and associated operation expenses and sales, the project is financially feasible.

EGYPTIAN ELECTRICITY AUTHORITY

REVENUE AND EXPENSES

(In thousands L.E.)	30/6/83	30/6/84	30/6/85	30/6/86	30/6/87	30/6/88
11. Operating Revenue						
11/1. Sales of Electricity	179,968	240,708	287,715	440,330	513,278	734,892
11/2. Sales of Gas	-	-	-	-	-	-
11/3. Other Operating Revenue	167	137	371	182	212	379
TOTAL OPERATING REVENUE	180,135	240,845	288,086	440,512	513,490	735,271
12. Operating Expenses						
12/1. Fuel	67,327	81,442	89,106	123,481	147,453	256,092
12/2. Purchases for Sales (Electricity)	-	-	-	-		661
12/3. Purchases for Sales (Other)	-	-	-	-		-
12/4. Salaries & Wages (Operation Only)	25,347	29,664	38,796	43,768	48,318	58,056
12/5. Materials & Services Inputs	22,218	25,052	31,231	37,247	00,591	62,113
12/6. Other Operating Expenses (Admin.)	20,833	23,677	41,985	49,581	58,176	42,720
12/7. Depreciation	35,517	48,058	71,154	126,281	152,751	133,130
TOTAL OPERATING EXPENSES	171,242	207,893	272,272	380,358	467,289	552,772
13. Income from Operations	8,893	32,952	15,814	60,154	46,201	182,499
Gross Interest	23,284	29,507	68,347	114,855	168,742	247,078
Interest During Construction	12,156	14,090	26,811	45,457	54,542	76,015
Net Interest Expenses	11,128	15,417	41,536	70,398	114,200	171,063
14. Net Operating Income	(2,235)[1]	17,535	(25,722)[1]	(10,244)[1]	(67,999)[1]	11,436
Non-Operating Revenue	17,034	9,225	58,399	54,360	103,062	51,048
Less Non-Operating Expenses	11,032	22,038	22,669	36,078	22,011	49,[illegible]32
15. Net Non-Operating Income (Loss)	6,002	(12,813)[1]	35,730	18,282	81,051	1,986
16. NET INCOME (LOSS)	3,767	4,722	10,008	8,038	13,052	13,422

Source: EEA Financial Reports.

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BALANCE - SHEET

Source: EEA Financial Reports.

(in thousands L.E.)	30/6/83	30/6/84	30/6/85	30/6/86	30/6/87	30/6/88
A. A S S E T S						
1. Fixed Assets						
Gross Fixed Assets in Service	839,893	1,184,169	1,731,062	2,600,620	3,081,788	5,634,220
Less Accumulated Depreciation	252,994	300,912	366,428	481,149	629,791	746,599
1/1. Net Fixed Assets in Service	586,899	883,257	1,364,634	2,119,475	2,452,197	4,887,621
1/2. Work in Progress	942,889	905,183	1,103,647	1,037,833	1,054,688	1,660,998
TOTAL NET FIXED ASSETS	1,529,788	1,788,440	2,468,281	3,157,308	3,506,885	6,548,619
2. Investments	53,474	53,474	53,474	53,474	53,474	56,474
3. Long - Term Receivables (Loans)	37,659	54,242	36,583	39,145	36,146	105,745
4. Current Assets						
4/1. Cash	23,451	34,578	58,218	156,823	165,865	139,345
4/2. Inventories	116,334	118,744	132,412	158,032	197,029	242,143
4/3. Clients	41,297	53,306	67,037	131,926	191,472	305,029
4/4. Other Accounts Receivable	54,423	68,844	68,063	121,024	210,111	204,421
TOTAL Current Assets	235,505	275,472	327,730	567,805	764,477	890,929
TOTAL ASSETS	1,856,426	2,171,628	2,886,068	3,817,732	4,360,982	7,601,767
B. L I A B I L I T I E S						
Capital	651,031	651,032	651,032	650,977	650,977	650,977
Reserves	177,316	202,841	212,867	271,557	401,696	409,721
Other Provisions	3,030	3,231	3,654	4,400	4,047	3,276
Year's Result	-	-	10,000	8,038	13,052	13,422
Carried Surplus	3,767	4,605	17,609	27,618	35,653	48,708
1. TOTAL Capital & Reserves	835,144	861,709	895,170	962,590	1,105,427	1,126,124
2. Overdraft	33,968	27,277	3,045	6,371	586	4,473
3. Long-Term Liabilities						
3/1. Foreign Long-Term Debt	446,750	533,808	1,010,589	1,368,420	1,428,414	3,277,434
3/2. Local Long-Term Debt	271,527	419,816	606,576	886,482	1,103,585	1,489,430
TOTAL Long-Term Debt	718,277	953,624	1,617,165	2,254,902	2,531,999	4,766,864
4. Current Liabilities						
4/1. Foreign Current Portion	53,786	61,850	61,850	88,385	145,649	329,300
4/2. Local Current Portion	57	60	60	22,049	28,909	52,100
4/3. Suppliers	20,041	17,876	13,329	20,296	18,093	23,562
4/4. Ministry of Finance	114,006	151,621	183,365	280,556	337,884	570,127
4/5. Other Accounts Payable	52,863	69,558	82,901	133,241	147,775	604,311
4/6. Deferred Liabilities	1,523	3,406	4,047	25,400	22,795	79,743
4/7. Deposits	17,763	13,357	24,123	22,950	20,753	25,162
5/8. Provision for Taxes	6,798	6,779	1,013	1	1	1
TOTAL Current Liabilities	267,037	327,015	370,688	593,869	722,970	1,704,306
TOTAL LIABILITIES	1,854,426	2,171,628	2,886,068	3,817,732	4,360,982	7,601,767

EGYPTIAN ELECTRICITY AUTHORITY

SOURCES AND APPLICATION OF FUNDS

(in thousands L.E.)	30/6/83	30/6/84	30/6/85	30/6/86	30/6/87	30/6/88
A. SOURCES OF FUNDS						
1. INTERNAL CASH GENERATION						
1/1. Gross Income	14,875	20,022	51,544	78,436	127,252	184,485
1/2. Depreciation	35,189	47,919	65,516	114,721	148,643	116,809
1/3. Reserve for Higher Prices of Assets	553	759	885	999	1,162	1,051
TOTAL Internal Cash Generation	50,628	68,700	117,945	194,156	277,057	302,344
2. EXTERNAL SOURCES						
2/1. Reserves	81,776	20,999	22,145	57,691	128,976	6,974
2/2. Overdraft	1,361	(6,688)	(24,234)	3,326	(5,785)	3,887
Borrowings						
Foreign Loans	138,375	154,390	253,725	536,726	238,572	2,165,346
Local Loans	183,392	151,177	476,781	304,813	267,619	420,386
2/3. TOTAL Borrowings	321,767	305,567	730,506	841,539	506,211	2,583,732
2/4. Provisions	(8,457)	201	423	(266)	(353)	(254)
2/5. Capital	529,474	-	-	(55)	-	
TOTAL Resources Of Funds	976,949	388,779	846,785	1,096,391	906,106	2,896,183
B. APPLICATIONS OF FUNDS						
1. Work in Progress (incl. IDC)	279,568	304,570	745,357	803,749	498,218	3,158,542
2. Debt Service						
2/1. Foreign Amortization	43,114	59,247	66,965	152,360	121,334	120,675
2/2. Local Amortization	30,272	2,905	-	2,927	44,556	19,441
2/3. Interest (Net)	11,128	15,417	41,536	70,378	114,200	171,063
TOTAL Net Debt Service	84,514	77,569	108,501	225,685	280,090	312,179
3. Increase in Long Debt	9,090	16,583	(17,659)	2,562	(2,999)	69,577
4. Investment	(4,000)	-	-	-	-	3,200
5. Net Change in Working Capital	58,280	(11,943)	10,586	64,375	130,797	(647,124)
TOTAL Applications of Funds	447,452	388,779	846,785	1,096,391	906,106	2,896,186

Source: EEA Financial Reports.

ECONOMIC ANALYSIS

A. Past Trends in Electricity Consumption:

Total electrical energy produced by the Egyptian Electrical Authority (EEA) increased at a rate of 19.5% per annum during the period 1960 through 1965 and continued to rise by 8.3% p.a. through the periods 1965-1970, and fell to a rate of 5.4% p.a. (see attached chart), during the 1970-1974 period.

During the 1974-1989 period, the growth of electricity consumption accelerated to a rate of 7.9%. This increase can be attributed to:

(i) the high rates of economic expansion that occurred during this period, (real GDP increased by approximately by 8.9% p.a. fueled by worker's remittances, oil exports, the Suez canal revenues, and increasing levels of foreign assistance);

(ii) the relatively low and constantly falling real level of electricity tariffs, which are now among the lowest in the world (electricity tariffs declined in real terms by 31% between 1970 and 1988);

(iii) the further expansion of electrical distribution networks throughout the country (virtually all towns in which more than 1,000 Egyptians reside have a public electricity supply);

(iv) the completion of the Naga Hamadi aluminum refinery smelter in 1975 and the later expansion of this facility in 1980 (Naga Hamadi now accounts for 9.8 percent of aggregate electricity consumption in Egypt).

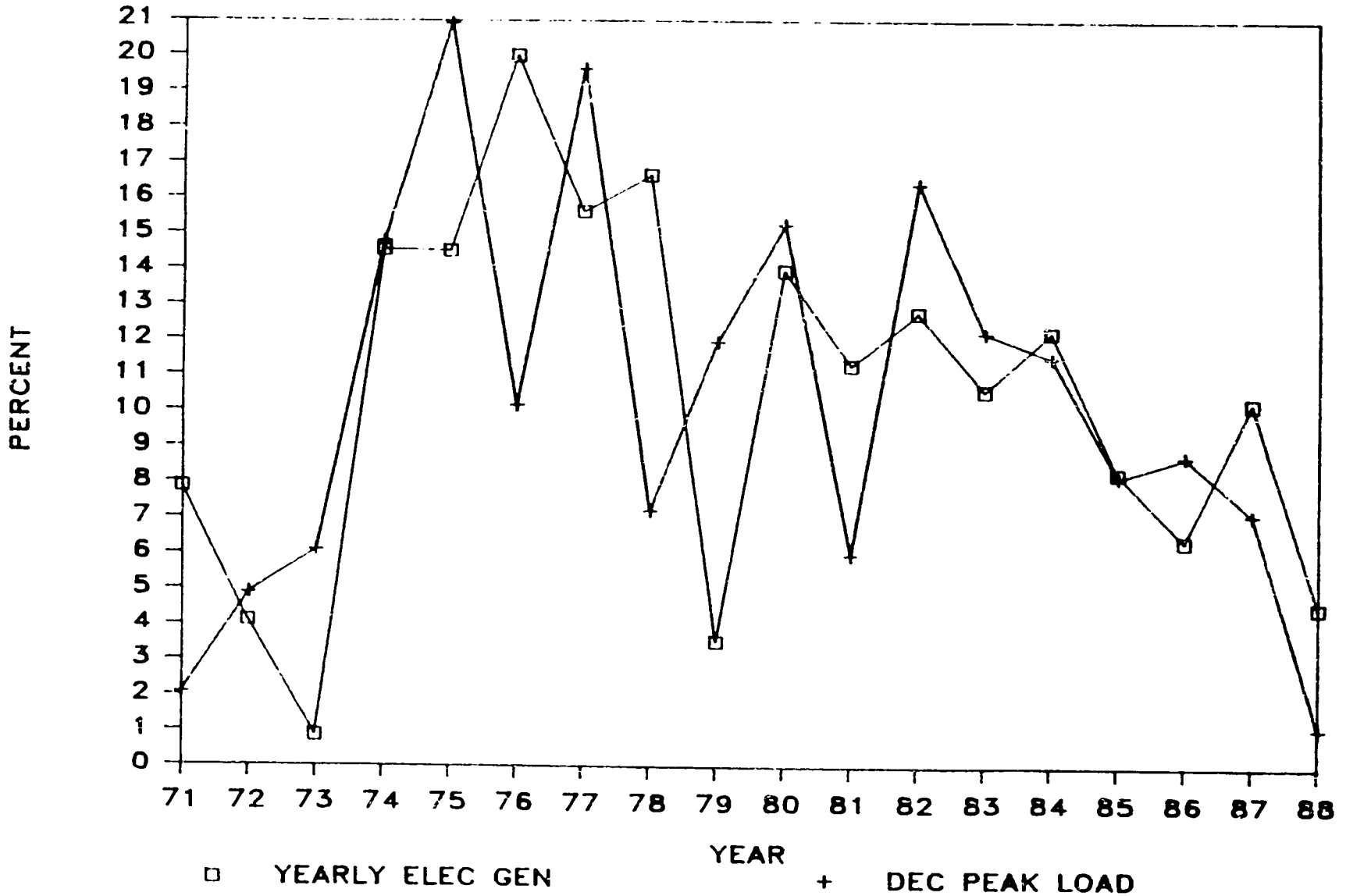
However, GOE policy could reduce the future growth of consumption by:

(1) minimizing the development of electricity intensive heavy industries and pursuing policies to limit waste at the Kima Fertilizer and Naga Hamadi plants;

(2) revising electricity prices towards the level of long run marginal cost (LRMC) and, hence, inducing conservation measures--especially in industry;

(3) introducing load management principles to shift consumers' peak demand to system off-peak periods.

ELECTRICITY GROWTH RATES



The Power Sector Support project supports these policy objectives. The project supports economic growth based on economic structural reforms in energy pricing being implemented by the Government of Egypt. The economic value of the project as well as the existence of continuing need for additional generating capacity and rehabilitation of existing capacity is examined in this analysis.

B. Projected Electricity Consumption

The growth in electricity consumption is particularly sensitive to the rate of economic growth. Since the level of capacity utilization of electricity is already high in Egypt, any growth in consumption, including the connection of new consumers to the network, will require new generating capacity. However, as mentioned earlier, three areas of Government policy could affect future consumption: (a) restructuring of electricity intensive industries; (b) electricity price increases that revise tariffs towards the level of long run marginal cost (LRMC); (c) the introduction of load management to shift consumers' peak demand to system off-peak periods. The potential effect of these three policy changes against the background of a reference case that assumes the continuation of existing policies has been evaluated and is described below. It should be noted that the projections described below are scenarios to indicate the impact of certain policies. These are not intended to substitute for demand forecasts, which would require extensive data collection and more rigorous analysis.

The reference case assumes a continuation of present policies such that the elasticities could remain constant over the forecast period.1/ Economic growth projections calculated by USAID on which the reference case electricity consumption forecast is based are shown in Table 1 (EEA uses more optimistic growth projections). The forecasting errors of GDP projections increase as one looks further into the future and long run electricity demand forecasts based on such GDP projections are subject to error. However, the key electricity demand forecasts are for the years when new capacity is required that necessitates investment decisions today. The reference case scenario is shown in Table 2. Growth rates for electricity sales are projected to slow to 7.2% p.a. during the period 1986/87 - 1991/92 and then grow at 5.8% p.a. for the remainder of the century.

1/ This forecast was based upon an elasticity of electricity consumption with respect to output of 1.48 estimated on the basis of 1974-1986 IBRD data for industry other than Kima Fertilizer and Nag Hammadi Alumminum.

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Table 1
Economic Growth Projections
(% p.a.)

Year	Total GDP	Industrial GDP	Agricultural GDP	Consumption
1986/87	6.0	7.5	2.8	5.5
1987/88-1991/92	4.9	8.2	2.5	5.9
1992/93-1996/97	3.7	4.7	2.5	3.6
1997/98-2001	4.0	5.0	2.5	3.2
2002/03-2011/12	4.6	5.8	2.5	3.2

Source: World Bank, " Current Economic Situation and Growth Projects".

Peak demand will likely increase at lower rates than consumption, 6.4% p.a. during 1986/87 - 1991/92 and 5.1% p.a. during the period 1991/92 to 2001/02. Six sensitivity studies based on alternative policy assumptions were examined and these are discussed on the following pages.

Table 2
Reference Case Demand Scenario
(GWH)

	Electricity Sold				Gross	Peak
Year	Industry	Agriculture	Others	Total	Generation	Demand
1980/81	9,186	777	5,628	15,591	19,866	3,179
1981/82	9,593	836	6,737	17,166	21,896	3,694
1982/83	10,679	852	7,341	18,872	24,041	3,981
1983/84	12,229	870	8,062	21,161	26,786	4,564
1984/85	13,126	889	8,884	22,899	28,986	5,091
1985/86	14,112	910	4,760	24,782	30,978	5,525
1986/87	15,185	930	10,644	26,579	33,449	6,061
----------USAID Projected----------						
1991/92	21,106	1,033	15,824	37,963	46,296	8,258
1996/97	27,767	1,149	21,120	50,036	60,284	10,587
2001/02	37,827	1,277	27,335	66,439	78,164	13,519
2011/12	81,053	1,580	45,841	128,474	149,388	25,453

Source: Mission Estimates.

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Case A assumes that the Kima fertilizer plant, with a peak demand of 219 MW, would be converted to natural gas during the period ending in 1991/92. Alternatively, the Kima plant could be considered to have been closed down and a new fertilizer plant established in the gas field. In either case, some requirement for electricity would remain. The mission assumes it to be 10% of the present consumption. The consequence of phasing out the electrolytic process at Kima would be to reduce the maximum demand for electricity by about 200 MW so that the maximum demand for electricity would grow by 5.9% p.a. during the 5-year period 1989/90 - 1990/95 instead of 6.4% p.a.

Case B also assumes that the Kima demand would be reduced by 90% but, in addition, assumes that production would cease at the Nag Hamadi aluminum smelter. Egypt no longer has surplus hydro energy. Electricity will be generated at the margin in oil or gas or imported coal-fired plants for the foreseeable future. Aluminum smelting is therefore uneconomic, especially considering the locational disadvantage of the plant in terms of local transport costs for imported alumina and exports of the aluminum ingot produced. Ceasing production at the aluminum smelter would lower the maximum demand for electricity by about 411 MW, which together with the 180 MW saved at Kima would lead to an overall reduction of 591 MW or 7.4% of the 1991/92 Reference Case demand.

Case C and Case D examine the sensitivity of electricity prices increasing by a factor of 4 in real terms over a 10-year period. Both Cases C and D are compatible with the reforms outlined by the IBRD. This project paper asks for a 10% real increase in electricity traiffs after year 1 of the project while IBRD seeks a 20% real increase. Electricity tariffs in Egypt are on average about 29% of LRMC calculated at international prices. Correcting this distortion would appear to involve more than a threefold increase in real prices. Establishing the appropriate price eslaticity and dynamic response of demand to a threefold price increase is particularly difficult. Historic electiricty consumption trends in Egypt are a consequence of real prices falling from an already low level and would not provide a reliable guide to the reliable guide to the response to large price increases. In the absence of econometric studies on the response of demand to very large real price increases, we have calculated electricity demand assuming price elasticities of -0.1 (Case C) and -0.3 (Case D) which are at the mid to lower range of typical electricity price elasticities estimated elsewhere. With a low price elasticity of -0.1 (Case C), demand in 1996/97 would be 13% below the Refernce case (see table 3). During the period 1987/88 to 1996/97, maximum demand would grow at an average annual rate of 6.3%, compared to 7.5% in the Reference Case. The accumulated saving over the period would be about 1,370 MW, equivalent to the capacity of a large power station. With the higher elasticity of -0.3 (Case D), demand in 1996/97

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would be 34% below the Reference Case and the average rate of growth in maximum demand up to then would be 4.3% p.a. The accumulated saving would be about 3,600 MW, or about three large power stations. A rough estimate of the investment saved at 1988 prices would amount to US$4.5 billion in Case D.

Case E considers the combined effect of reducing the consumption of the Kima fertilizer plant by 90% and a fourfold real tariff increase with the lower -0.1 price elasticity. This would result in a maximum demand of 6,873 MW in 1991/92, about 17% below the 8,258 MW of the Reference Case. Maximum demand would increase at an average rate of 4.5% p.a. during the period 1989/90 to 1995/96, compared to 5.7% p.a. in the Reference Case.

Case F considers load management, along with the 90% reduction in the Kima load and tariff increases with the lower -0.1 price elasticity. It is assumed here that load management would enable 5% of the peak demand to be transferred to off-peak times, with no change in the total GWhr generated or sold. In this case 1991/92 maximum demand would be about 360 MW less than in Case E, or 1385 MW below the Reference Case. Load management measures are assumed to be implemented first between 1989 and 1991/92. The resulting growth in maximum demand during this period would fall to 3.4% p.a., compared to 4.5% p.a. in Case E and 6.4% p.a. in the Reference Case.

If the Government were to implement policies to restrain the growth of electricity demand, the sensitivity studies above would indicate that the reduction in maximum demand could be considerable, e.g., 17% or 1385 MW below the Reference Case by 1995/96 for Case F.

Table 3
Electricity Demand Scenarios

Energy Sold (MW)	1991/92	1996/97	2001/02
Reference Case	37,963	50,063	66,439
A. Kima - 90% lower	36,523	48,596	64,999
B. Kima - 90% Aluminium closed	33,523	45,596	61,999
C. Tariff increases, e=-0.1	34,167	43,558	57,839
D. Tariff increases, e=-0.3	31,509	33,011	43,833
E. Combine Effect Kima - 90% price e= 0.1	32,871	42,305	56,585
Energy Generated (MW)			
System losses (%)	18	17	15
Reference case	46,296	60,284	78,164
A. Kima - 90%	44,540	58,549	72,469
B. Kima - 90%	40,882	54,935	72,940
C. Tariff increases, e= -0.1	41,667	52,480	68,046
D. Tariff increases, e= -0.3	38,426	39,772	51,568
E. Combined effect A+C	40,087	50,970	66,571
Peak Demand (MW)			
Reference case	8,258	10,587	13,519
A. Kima - 90%	8,061	10,390	13,322
B. Kima - 90%	7,650	9,979	12,911
C. Tariff increases, e= -0.1	7,432	9,217	11,769
D. Tariff increases, e =-0.3	6,854	6,985	8,919
E. Combined effect A+C	7,235	9,020	11,572
F. Combined A+C and load management	6,873	8,569	10,993
EEA forecast	9,933	14,055	19,712

Source: Mission estimates.

Note: 1 GWh = 1 million kWhr.

The EEA currently has 8,400 MW of usable generating capacity assuming approxiamtely 1,750 MW at the High Dam. With non-USAID resources, the EEA will complete an additional 1,500 MW by mid 1994. This project provides an additional 150 MW by mid 1993. Thus, EEA's available capacity will be 9,900 MW if no existing capacity is retired. Since the EEA system is self-contained, a portion of this capacity will be out of service at any given time for routine maintenance and for repairs following breakdown. Studies of the Egyptian Power System indicate the need for a minimum of 25 percent reserve capacity if sufficient capacity is to be available to meet these maintenance and breakdown requirements if black-outs are to be avoided. With useable capacity of 10,050 MW in mid 1993, EEA should be able to reliably serve a peak demand of 8040 MW.

The reliable generating capacity of EEA in 1993 will be more than the capacity required under growth/price reform senarios C through F examined above. In the two cases (Case A and B) involving load reductions at Kima there will be a shortfall in reliable capacity. This shortfall will be met, undoubtly, by delaying maintenance and temperory shedding of peak load. With more agressive policy reform which may more severely effect demand, reliable capacity in 1991/1992 will essentialy equal demand. This outcome is desirable since reliability should be assured when consumers are required to pay higher prices.

C. Pricing:

The price of electricity is one of the fundamental determinants of efficient economic growth in Egypt. Its importance in resource allocation is equalled only by the price of other fundamental production needs such as foreign exchange (the exchange rate), capital (the interest rate), labor (the wage rate) and government services (the budget). The price of electricity in Egypt has been generally, but differentially, held well below its economic cost to produce and distribute. This condition has resulted in serious misallocations of both investment and consumption resources, waste of electricity, severe losses of revenue to the budget and excessive demand for investment in new generating capacity.

The current average price of electricity is 4.0 pt per /kWhr. This average price masks a diverse range of rates charged by EEA and the distribution companies (see table, following). The Government rate structure is set by decree. The rates vary by category of consumer (industry, residential, commercial, government, etc.); by voltage supplied; by quantity used; and in industry, by use of the electricity within the plant (motive power, lights). The rates, however, do not vary with regard to peak versus non-peak demand.

Certain large public sector consumers such as the aluminum smelter at Nag Hammadi and the Kima Fertilizer Plant are charged as little as 2 pt on average per /kWhr respectively. At the other end of the spectrum, private companies with foreign partners organized under Law 43 can be charged as much as 18 to 20 pt per /kWhr.

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Among industrial and agriculural consumers, the lowest rates are given to the very high voltage plants such as Nag Hammadi and Kima. There are six firms in this group with a combined consumption of 18.3% of total electricity sold by the EEA in 1987/88. The average approximately 2.0 pt 2.0 pt per KWhr.

Slightly higher, at an average rate of approximately 3.7 pt per /kWhr, are the firms consuming at high voltages. The official rate for this category is 3.71 pt per KWH but some firms, notably cements plants, are charged at a higher rate. However, the combined consumption of these firms was only 7.5% of total electricity sold by EEA in 1987/88.

At medium and low voltages, rate differences are distinguished between those who contract for more than 500 /kW and those who contract for less. Firms which contract for a supply greater than 500 KW for motive power pay an annual fee of LE 17.40 per KW. In addition, they are charged per /kWhr on a declining scale starting at 3.7 pt per KWH for the first 1000 hours of the contracted /kW.

The combined consumption of medium and low voltage industrial and agricultural consumers was 35.5% of total sales by EEA in 1988/89. The average rate was 4.0 pt per /kWhr.

Most of the public sector industries are in the voltage categories of; very high voltage; high voltage and medium to low voltage but contracting for more than 500 /kW. The private sector, however, is predominately in the medium to low voltage category which contracts for less than 500 /kW or is organized under Law 43 which pays a rate adjustment premium to eliminate a portion of the subsidy. Consequently, there are examples of significant rate disparity between public and private sector firms, especially those producing similar goods, because of the differences in the scale of operation or by virtue of the law under which the private firm was organized.

Residential charges are based on a schedule of marginal rates. For the first 100 /kWhr per month the rate is 1.8 pt per KWH. For the next 100 /kWhr the rate rises to 4.0 pt per /kWhr. For the next 150 /kWhr the rate becomes 4.8 pt per /Kwhr. The highest rate, for amounts over 4000 /kWhr per month, is 14.0 pt per /kWhr. Data for 1987/88 show residential consumption to be 28.3% of total /kWhr sales with 64% billed in the less than 100 /kWhr per month category and 92% billed in the less than 350 /kWhr per month. The very low rates at this level of consumption are meant to be a subsidy to the low income earners. However, all consumers benefit from the subsidy at each increment of consumption.

Rates for commercial enterprises (stores and offices) are similarly structured. The first 100 /kWhr per month is billed at 4.1 pt per /kWhr and rises to 16 pt for consumption exceeding 4000 /kWhr per month. The 1987/88 data show commercial consumers to be only 4% of total /kWhr sales with 43.8% below 100 KWH per month and 68% below 350 /kWhr per month.

The combination of the commercial rate schedule and Law 43 status gives rise to the often heard complaint that the private sector pays 18 pt to 20 pt per /kWhr. This happens because Law 43 commercial firms, such as banks, typically consume above 2000 /kWhr per month. The 4 pt per /kWhr adjustment because of their "international" status makes the highest two marginal rates 18 pt and 20 pt for these firms. The final rate categories are government and street lights. Both are charged 6.4 pt per /kWhr as a flat rate.

D. The Subsidy

The level and structure of prices provides a significant subsidy. The size of the total subsidy is the difference between the revenues now earned at the average price of 4 pt per /kWhr and the revenues which would be earned if the economic price were charged. The normal approach to determining the economic cost is to calculate the long run marginal cost (LRMC).* The LRMC is the current economic cost per /kWhr associated with a significant replacement of obsolete capacity or the installation of new capacity. On the assumption that Egypt's proven reserves of natural gas are limited, the LRMC was calculated on the basis of the imported coal fired Kurimat generating plant. At current economic prices the LRMC is approximately 21.0 pt per /kWhr.

The subsidy is LE 6.2 billion and the current average rate is 19% of the economic cost. Using the IBRD's rate increase formula, the subsidy can be eliminated in 1996 assuming no change in the real value of the LRMC. Using the rate increase suggested by this project, the LRMC will be reached in the year 2000.

Currently, the EEA argues that its "economic cost" should be defined as its financial costs (4 pt per /kWhr) adjusted by the amount of electricity lost in the system (16%) and adjusted by using the world price for oil and the free market exchange rate for imported plant and equipment.

On this EEA basis, the economic cost of the electricity sold in 1987/88 is LE 2.48 billion, the subsidy is LE 1.5 billion and the current average rate is 38% of the cost as determined by this approach.

A real price of 7.9 pt per kWhr as suggested by EEA in 1988 could be reached by 1993 if the rate increases suggested by the IBRD are implemented. These increases are a nominal 35% increase in 1988 (a real increase of 10% assuming an inflation of 25%) followed by annual increases of 20% in real terms. In 1992 the real prevailing rate would be 6.84 pt per kWhr and would require only a 15.5% upward adjustment in 1993 assuming there is no change in the target unsubsidized cost.

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*The LRMC as calculated for Egypt is strictly speaking not the long run marginal cost of adding an additional kWhr. Rather, it is the average cost per kWhr of a substantial addition to capacity.

The EEA's adjusted financial costs and the LRMC approaches define the boundaries of the debate over the total subsidy. Regardless of which one is accepted at this time, the current price is significantly low and the adjustment will be lengthy. Since most consumers are not near the economic cost regardless of which cost is assumed to be correct, the largest increases will need to be made for those consumers now receiving the lowest rates -- i.e. large public sector companies.

In terms of the two approaches, EEA's adjusted financial costs has the immediate advantage of exposing to GOE policy makers one key element of the subsidy -- i.e. the under pricing of oil. However, the methodology omits a number of other, less visible subsidies such as interest rates. Most importantly it does not show electricity's true economic cost to society. The LRMC, however, captures this true economic cost by showing the value of production foregone in order to produce an increment of electricity. Since the LRMC is based on economic prices, an increase in the LRMC over that which prevailed in the past indicates that society must give up relatively more of all other consumption in order to consume an extra unit of electricity. Similarly, if the LRMC is less than in the past, the economic or scarcity value of electricity to society has declined.

For rational consumer choice, the increases or decreases in the LRMC should be reflected in the final price paid by consumers for electricity. The financial gains or losses to society because of changes in the LRMC should be reflected in the government's budget. Since financial costs may, to a large extent, reflect historic prices, transfers can be made to the budget when the earnings of EEA, based on the current LRMC exceed EEA's financial cost. Similarly, subsidies can be given from the budget to EEA when its earnings from LRMC pricing are less than its financial costs.

Various scenarios have been developed for adjusting current prices to economic prices. In terms of promoting economic growth along the path of Egypt's comparative advantage in production, the key adjustment issue is the pace by which rates for industry and agriculture can be increased. While the large subsidy to households encourages excessive consumption in this category, the subsidy to industrial and agricultural consumers results in distorted investment decisions on the choice of technology and the relative use of capital. These distorted investment and production decisions result in suboptimal use of resources for periods well into the future or they write off significant investment resources made financially nonviable if the electricity rate were raised to its economic cost.

While not a specific condition for the obligation of the first tranche of this project, USAID has been urging the government in an intense policy dialogue to focus its rate increases on industry -- particularly public sector industries receiving the lowest rates.

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Financial and Economic Analysis of the Project's Components

The Power Sector Support project will finance a new power plant (Cairo South) and rehabilitate two other existing ones (Cairo West and Hurgada). The electricity generated will be sold by EEA to either the distribution companies or to industries. EEA's selling price is P.T. 2.58/kWhr compared to P.T. 4/kWhr charged by the distribution companies. The P.T. 2.58/kWhr will be used for financial analysis purposes while a P.T. 17/kWhr (LRMC of generation and high voltage distribution) will be used for the economic analysis of the project. The LRMC is based on the Africa Development Bank's 1987 calculation for Cairo West adjusted for inflation. The P.T. 17/kWhr is P.T. 4/kWhr less than the economic cost at the final point of sale by the distribution companies (i.e. P.T. 21/kWhr).

On calculating both the economic and financial rates of return, we assumed on annual U.S. inflation rate (of the dollar) of four percent throughout the life of the project. The Egyptian pound was assumed to depreciate by 20% annually for the first three years, 15% for the fourth year and 10% for the fifth year. Years six to eleven, the LE depreciation was assumed to be 5% per year, and zero percent from year twelve till the end of the project. All Egyptian pound values were converted to dollars at commercial bank rate for the financial analysis and at an estimated free market exchange rate for the economic analysis.

In the distribution process, EEA loses about 8% of the electricity generated. That is, the quantity sold is 8% less than that generated.

The fuel value used to generate electricity was measured in mazout equivalent of natural gas and solar. Mazout is converted (using a 1.23 conversion factor from mazout to natural gas, and a 1.04 from mazout to solar) to its equivalent of natural gas and solar. On calculating the financial IRR, the local prices of natural gas (LE 35/ton), mazout (LE 35/ton) and solar (LE 84/ton) were considered. The economic IRR, was measured using world prices of fuel (LE 74/ton of mazout and natural gas, and LE 155.5 per ton of solar).

Cairo South:

Cairo south is a new power station which requires a new piece of land. Because the land belongs to EEA, no extra money would be paid. Yet, the land is worth LE 90 million. Thus, the value of land was only considered in measuring the economic IRR (i.e. the opportunity cost of land).

On the benefits side, the stream of benefits started to flow as of year four and until the end of the project's life (year 25). The project is expected to produce sales of 972 MKWhr annually except for the first year of generation (year 4 of the project) in which sales are expected to amount to 620 MKWhr. At P.T. 17/kWhr, the economic cost of electricity, the IRR was calculated to be a positive 8.03%. Thus, this investment appears relatively expensive compared to the other components of the project most likely due to the imputed value of the land.

The financial IRR based on P.T. 2.58/kWhr could not be obtained due to the constant negative stream of net benefits. For the financial IRR to reach "zero" percent, EEA should charge P.T. 8/kWhr approximately.

Cairo West:

Cairo West is an upgrade of the prevailing system, that is, no extra land is required and there are sunk capital costs. The project will start operation in year four and has a fifteen year duration.

Cairo West financial IRR was calculated to be a positive 1.04% at the prevailing price of P.T. 2.58/kWhr. The positive financial IRR, although quite low, is remarkable given the price distortions in the sector. It reflects the very high economies associated with an investment in upgrading and rehabilitaiton. Using the LRMC, a more realistic exchange rate, world prices for fuel, and an adjusted inflation rate, a positive economic rate of return of 42.07% results.

Hurgada:

In the case of Hurgada, the site is a result of a title transferred from Fayoum and Abou El Madamir to Hurgada. The difference in the value of land between the two sites is minimal. Therefore, no land cost is considered. Full costs of equipment are paid by year two and benefits start to flow in the same year. The project life is fifteen years.

EEA sells electricity to the Hurgada distribution companies at P.T. 3.03/kWhr, 18% above the price it charges other distribution companies in Egypt. This improves the financial IRR from -4.19% to -1.39% (had the P.T. 2.58/kWhr price been used). The economic IRR is calculated to be 47.6%.

Microwave:

The main cost of the microwave system is that of the equipment and installation, while its major benefit is the saved fuel (natural gas and mazout). The microwave system would depreciate over a twelve year period. The financial analysis of the microwave system showed a negative IRR (-14.07%0) due to the high capital costs and low fuel prices. On the other hand, the economic IRR is calculated to be 1.25% based on EEA's estimated of fuel saved.

Spare Parts:

The total costs of the component are limited to the value the spare parts, while the benefit is energy saving. The purchase and installation of spare parts yields a negative financial IRR (-10.2%). The economic IRR shows a positive 6.74%.

Conclusion:

The following table summarizes the financial and economic IRRs of the five components of the project:

Component	Economic IRR (%)
Cairo South	8.03
Cairo West	42.07
Hurgada	47.60
Microwave	1.25
Spare Parts	6.74

According to the above table, the most viable components of the Power Sector Support Project are Cairo West and Hurgada. Both, the Microwave and the Spare Parts purchase and installation could be regarded as inefficient investments on the basis of the assumed fuel savings. Cairo South is slightly below the minimum acceptable IRR (10%) due to the high inputed value of land. If we assume that the value of land declines by 50% as a result of its presence abutting the land which now has a large power plant in operation, the economic IRR would equal to 10.5% which makes the project economically viable.

E. Cairo South Combined Cycle Least Cost Alternative:

To verify that the Cairo South componant is the least cost alternative to meeting the specified capacity requirements, other viable capacity additions have been screened (Table 4). These alternatives included simple cycle gas turbines nad a gas fired steam plant.

In this analysis:

The capital costs for the Cairo South combined-cycle unit are based on updated construction cost forecasts for a combined cycle plant similar to the plant being constructed at Damietta.

The capital costs for the installation of 150 MW of gas turbines is based on the results of recent competitive bidding and EEA negotiations for similar units.

The capital cost estimates for the construction of a 150 MW steam unit consisting of 1-150 MW unit.

The heat rates are based on actual operating experience of similar plants.

This analysis confirms that the combined-cycle unit has the lowest present worth of costs over the life of the various alternatives.

TABLE 4

150 MW CAPACITY ADDITION
LEAST COST ANALYSIS - ASSUMPTIONS

ITEM	UNITS	CAIRO SOUTH	STEAM TURBINE UNIT	GAS TURBINE UNITS
Plant Output	MW	150	150	150
Plant Heat Rate (Gross)	Gm Mazout Equiv./ kWhr.	212	225	320
Annual Capacity Factor	%	80	80	80
Annual Net Generation	Gwh	1050	1050	1050
Capital Cost	88 US$ Mill.	76	102	46
Operation & Maintenance	88 US$ Mill.	4.8	4.7	9.4
Annual Fuel Cost	88 US$ Mill.	25	26.4	39.9
Economic Life	Years	35	35	25

LEAST COST ANALYSIS COMPARISON
10% DISCOUNT RATE

Capital Cost (1)	76	102	46
Interest During Construction (at 10%)	8	10	5
(1) Total	84	112	51
(2) Capital Recovery Factory (CRF)	0.104	0.104	0.11
(3) Annual Capital Costs	8.7	11.6	5.6
(4) Annual Operation & Maintenance Costs (2)	4.8	4.7	0.9
(5) Annual Fuel Costs (3)	25	26.4	39.9
(6) Total Annual Costs (3) + (4) + (5)	38.5	42.7	46.4
(7) Present Worth of Costs [(6) / CRF]	370.2	410.6	421.8

(1) Capital Cost:
- Combined-cycle (100 MW CT + 50 MW ST) = $506/KW
- Gas Turbine 150 MW (3 X 50 MW) = $308/KW
- Steam Turbine 150 MW (1 x 150 MW) = $700/KW

(2) O & M Costs:
- Combined Cycle $ 4.6/MWhr
- Gas Turbine $ 0.9/MWhr
- Steam Turbine $ 4.5/MWhr

(3) Fuel Cost:
- Mazout @$ 16/Barrel, 7.1 Barrel/Ton = $113.6/Ton
- 0.9842 tonnes/ton = $112/tonne

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[illegible]

[illegible]
[illegible]

[illegible]
[illegible] INSTALLATION COSTS

SOLAR [illegible]: [illegible] PRICE: LE [illegible]/TON
[illegible] PRICE: $ 155 [illegible]/TON

NATURAL GAS: [illegible] PRICE: LE 75/TON
[illegible] PRICE: $ [illegible]/TON

EXCHANGE RATE: CALCULATED USING THE BELOW MENTIONED INFLATION RATES

COST OF LAND: [illegible] SOUTH: [illegible] SQ.M. x LE [illegible]/SQ.M. = LE [illegible] MILLION
LAND IS OWNED BY EEA.
[illegible] WEST: NO NEW LAND IS INVOLVED
[illegible] : THE SITE IS TRANSFERRED FROM FAYOUM AND ABOU [illegible] TO HURGADA.
PRICE OF LAND IN THE NEW SITE IS APPROXIMATELY EQUAL TO THAT OF THAT OF THE OLD SITE.
THEREFORE, ADDITIONAL COST EQUALS [illegible]. YET, THE COST OF THE LAND WOULD HAVE COST LE [illegible].

BENEFITS: ARE EITHER SAVINGS OF FUEL AS A RESULT OF A MORE EFFICIENT SYSTEM,
OR EXTRA ELECTRICITY GENERATED. PRICE PER KWH USED IN THIS ANALYSIS ARE:
[illegible]/KWH - PRESENT PRICE (FOR FINANCIAL ANALYSIS PURPOSES).
[illegible]/KWH - THE LRMC, A MORE ACURATE PRICE THAT SHOULD BE USED FOR ECONOMIC ANALYSIS PURPOSES.

	1	[illegible]	[illegible]	4	5	6	[illegible]	[illegible]	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
EGYPT'S INFLATION RELATED TO THE $	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EX. RATE USED FOR ECON. ANALYSIS (LE/$)	[illegible]	[illegible]	[illegible]	4.97	5.46	5.74	[illegible]	[illegible]	6.64	6.97	[illegible]	7.32	[illegible]	[illegible]	[illegible]	7.32	[illegible]	7.32	[illegible]	7.32	7.32	[illegible]	[illegible]	[illegible]	[illegible]
EX. RATE USED FOR FIN. ANALYSIS (LE/$)	[illegible]	[illegible]	[illegible]	4.494	5.112	5.74	[illegible]	[illegible]	6.64	6.97	[illegible]	[illegible]	[illegible]	7.72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

N.B.: [illegible] FIGURES ARE IN [illegible] OF LE

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CONVERSION FACTORS:

1 TON OF N. GAS = 1.[illegible] TONS OF MAZOUT EQUIVALENT
1 TON OF SOLAR = 1.[illegible] TONS OF MAZOUT EQUIVALENT

WEST SOUTH — 95% NATURAL GAS, 5% SOLAR

THE MAZOUT EQUIVALENT OF NATURAL GAS AND SOLAR IS USED.
THE FOLLOWING TABLE SHOWS THE CONVERSION FROM MAZOUT TO NATURAL GAS AND SOLAR

	1000 $ $75/TON MAZOUT EQUIVALENT	QUANTITY 1000 TONS	MAZOUT EQUIVALENT QUANTITY 1000 TONS 95% N.G.	5% SOL.	THEREFORE, Q IN 1000 TONS N. GAS	SOLAR	$/TON 1000 N. GAS	SOLAR	$/TON 1000 N. GAS	SOLAR
YR.1	4976	142	134.9	7.1	109.674	6.82692	1879	573	8116	1462
YR.2	7191	222.6	211.47	11.13	171.926	10.7019	6017	899	12723	1664

	WORLD PR.	LOCAL PR.
SOLAR	155.5	84
MAZOUT	74	75
NATURAL GAS	74	75

YR.1
YR.2

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Finance - Analysis

COSTS

Capital costs:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Equipment:																									
Local	[illegible]	[illegible]	[illegible]	[illegible]																					
Equivalent $ Cost	[illegible]	[illegible]	[illegible]	2,899																					
$ Costs	5,000	10,000	[illegible]	[illegible]																					
Total	5,000	14,[illegible]	36,371	24,899																					
Consultants	1,000	2,000	1,000	1,000																					
O & M:																									
Fixed	0	0	0	1,400	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
Variable	0	0	0	2,800	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200
TOTAL O&M	0	0	0	4,200	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900
Fuel: (Natural resource)																									
Natural gas	0	0	0	5,879	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017	6,017
Solar resources	0	0	0	537	899	899	899	899	899	899	899	899	899	899	899	899	899	899	899	899	899	899	899	899	899
	0	0	0	6,412	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916	6,916
O&M $ equivalent				984	1,753	1,[illegible]	1,149	1,097	1,042	992	945	945	945	945	945	945	945	945	945	945	945	945	945	945	945
TOTAL COSTS	6,000	15,[illegible]	37,371	14,511	1,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816	12,816
US INFLATION	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
T. Proj. Costs (constant $)	6,000	15,411	34,552	14,680	14,956	14,574	14,129	9,735	9,365	9,000	8,658	8,325	8,005	7,697	7,401	7,116	6,841	6,579	6,326	6,083	5,849	5,624	5,408	5,200	5,000

BENEFITS:

Quantity sold (thousand kWh)				620,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000
Sales @ .0258/kwh:				15,996	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078	25,078
O&M in $ equivalent				7,567	4,906	4,769	4,166	3,962	3,777	3,598	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426
TOTAL BENEFITS (constant $)				3,567	4,906	4,369	4,166	3,962	3,777	3,598	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426	3,426
NET BENEFITS	(6,000)	(15,411)	(34,552)	(27,113)	(16,050)	(16,165)	(5,963)	(5,773)	(5,588)	(5,402)	(5,232)	(4,899)	(4,579)	(4,271)	(3,975)	(3,690)	(3,417)	(3,153)	(2,900)	(2,657)	(2,423)	(2,198)	(1,982)	(1,774)	(1,574)

THEREFORE,
IRR: 14.05% where price FT 12/kWh
IRR: 7.79% where price FT 11/kWh

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IRR= 2.00% where price= PT 9/kWH
IRR= 0.07% where price= PT 9/kWH
& IRR= "N/A" where price= PT 2.58/kWH

ERR (28,754) ERR
| |

Costs (US$)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Land (LE):	90,000																								
Equivalent ($)	36,000																								
Equipment:																									
LE costs		17,000	17,000	1,000																					
Equivalent $ Costs		7,611	7,609	2,617																					
$ Costs	5,000	10,000	7,000	2,000																					
Consultants	1,000	2,000	1,000	1,000																					
O & M:																									
Fixed	0	0	0	1,400	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
Variable	0	0	0	2,800	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200
Total O&M	0	0	0	4,200	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900
Fuel (S. & World Prices):																									
Natural Gas	0	0	0	8,116	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723	12,723
Solar Heat Oil	0	0	0	1,062	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664	1,664
Total Fuel	0	0	0	9,176	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387	14,387
TOTAL COSTS	36,000	15,611	17,009	18,990	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287	20,287
US INFLATION	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
T. Proj. Costs (constant $)	36,000	15,011	14,217	14,666	17,141	16,474	16,[illegible]	15,416	14,824	14,253	13,705	13,178	12,671	12,184	11,715	11,262	10,831	10,415	10,014	9,629	9,259	8,903	8,560	8,231	7,914
BENEFITS:																									
Quantity sold (MWH)				620,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000	972,000
Sales (LE .17/kwh):				105,400	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240	165,240
OR in $ equivalent				21,216	30,237	28,797	27,426	26,120	24,876	23,692	22,567	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574
TOTAL BENEFITS (constant $)	0	0	0	21,216	30,237	28,797	27,426	26,120	24,876	23,692	22,567	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574	22,574
NET BENEFITS	-36,000	-15,011	-14,217	-17,450	13,096	12,323	11,[illegible]	10,704	10,052	9,438	8,858	9,396	9,903	10,390	10,859	11,309	11,742	12,159	12,560	12,945	13,315	13,671	14,014	14,343	14,659

THEREFORE,
At the full price of land (LE 90,000, IRR = 0.[illegible]

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[illegible]

[illegible] 1993

[illegible] MISHEIRI, FBS/E

EEA : FEES: 92
FIXED [illegible] % OF INSTALLATION COSTS

MAZUT FUEL OIL: DOMESTIC PRICE: LE 35/TON
WORLD PRICE: $ 74/TON

NATURAL GAS: DOMESTIC PRICE: LE 35/TON
WORLD PRICE: $ 74/TON

EXCHANGE RATE: CALCULATED USING THE BELOW MENTIONED INFLATION RATES

COST OF LAND: IN CAIRO SOUTH: 150,000 sq.m. x LE 600/sq.m.= LE 90 MILLION
LAND IS OWNED BY EEA.
IN CAIRO WEST : NO NEW LAND IS INVOLVED
HURGADA : THE SITE IS TRANSFERRED FROM FAYOUM AND ABOU RADAMIS TO HURGADA.
PRICE OF LAND IN THE NEW SITE IS APPROXIMATELY EQUAL TO THAT OF THAT OF THE OLD SITE.
THEREFORE, ADDITIONAL COST EQUALS "0". YET, THE COST OF THE LAND WOULD HAVE COST LE 80,000.

BENEFITS: ARE EITHER SAVINGS OF FUEL AS A RESULT OF A MORE EFFICIENT SYSTEM,
OR EXTRA ELECTRICITY GENERATED. PRICE PER KWH USED IN THIS ANALYSIS ARE:
PT 2.58/KWH -- PRESENT PRICE (FOR FINANCIAL ANALYSIS PURPOSES)
PT 17/KWH -- THE IRRC, A MORE ACURATE PRICE THAT SHOULD BE USED FOR ECONOMIC ANALYSIS PURPOSES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
EGYPT'S INFLATION RELATED TO THE $	0.20	0.20	0.20	0.15	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00
EX. RATE USED FOR ECON. ANALYSIS (LE/$)	3.00	3.60	4.32	4.97	5.46	5.74	6.02	6.33	6.64	6.97	7.32	7.32	7.32	7.32	7.32	7.32
EX. RATE USED FOR FIN. ANALYSIS (LE/$)	2.6	3.228	3.856	4.484	5.112	5.74	6.02	6.33	6.64	6.97	7.32	7.32	7.32	7.32	7.32	7.32

N.B.: ALL FIGURES ARE IN MILLIONS OF LE

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CONVERSION FACTORS:

1 TON OF N. GAS = 1.27 TONS OF MAZOUT FUEL EQUIV.

WEST BUT NATURAL GAS, NOT MAZOUT

SAVED FUEL

	TONS $ & $% TON MAZOUT EQUIVALENT	QUANTITY TONS TONS	MAZOUT EQUIVALENT QUANTITY TONS TONS		TURNOVER $ TON TONS N. GAS MAZOUT		$ TON TONS N. GAS MAZOUT		$ TON TONS N. GAS MAZOUT	
[illegible]	256[illegible]	7[illegible]	[illegible]	15	49	15	165[illegible]	512	752[illegible]	1083
[illegible]	51[illegible]	146	11	29	35	29	[illegible]	1924	7[illegible]	2166

	WORLD PR.	LOCAL PR.
SOLAR	156	84
MAZOUT	74	35
NATURAL GAS	74	35

Finnish IR 666,525:

Capital Costs:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Equipment:															
IE Costs			500	500											
Equivalent $ Costs			130	112											
$ Costs		4,000	15,000	3,000											
O & M N/A															
Fuel E. & Total Fixed:															
Natural Gas				1,665	3,331	3,331	3,331	3,331	3,331	3,331	3,331	3,331	3,331	3,331	3,331
Residual fuel oil				512	1,024	1,024	1,024	1,024	1,024	1,024	1,024	1,024	1,024	1,024	1,024
				2,177	4,356	4,355	4,355	4,355	4,355	4,355	4,355	4,355	4,355	4,355	4,355
$ Equivalent				486	852	759	723	688	656	625	595	595	595	595	595
TOTAL COSTS	0	4,000	18,130	2,597	852	759	723	688	656	625	595	595	595	595	595
US INFLATION	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
T. Fuel Costs (constant $)	0	3,846	16,762	2,158	728	624	572	527	479	439	402	386	372	357	344

BENEFITS:

Quantity sold (1000 MWH)				333,000	666,000	666,000	666,000	666,000	666,000	666,000	666,000	666,000	666,000	666,000	666,000
Sales (IE .0258/kwh):				8,591	17,183	17,183	17,183	17,183	17,183	17,183	17,183	17,183	17,183	17,183	17,183
OM in $ equivalent				1,916	3,361	2,994	2,854	2,715	2,588	2,465	2,347	2,347	2,347	2,347	2,347
TOTAL BENEFITS	0	0	0	1,916	3,361	2,994	2,854	2,715	2,588	2,465	2,347	2,347	2,347	2,347	2,347
NET BENEFITS (constant $)	0	(3,846)	(16,762)	(1,282)	2,633	2,370	2,283	2,192	2,109	2,026	1,945	1,961	1,976	1,990	2,004

THEREFORE,

IRR: [illegible]

[illegible] = [illegible]

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[illegible]

Capital Costs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Equipment:															
[illegible] costs	"	"	500	500											
Equivalent $ Cost	"	"	116	191											
$ costs	"	4,000	18,000	7,000											
O & M: N/A															
Fuel, $, & World Prices:															
Natural Gas	"	"	0	7,528	7,047	7,047	7,047	7,047	7,047	7,047	7,047	7,047	7,047	7,047	7,047
Residual fuel oil	"	"	"	1,097	2,166	2,166	2,166	2,166	2,166	2,166	2,166	2,166	2,166	2,166	2,166
Total Fuel	"	"	0	4,607	9,209	9,209	9,209	9,209	9,209	9,209	9,209	9,209	9,209	9,209	9,209
TOTAL COSTS	"	4,000	18,116	7,704	9,209	9,209	9,209	9,209	9,209	9,209	9,209	9,209	9,209	9,209	9,209
US INFLATION	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
T. Fuel costs constant $	"	7,846	16,749	5,846	7,872	7,569	7,278	6,998	6,729	6,470	6,221	5,982	5,752	5,531	5,318

BENEFITS:

Quantity sold (000 MWH)				666,000	666,000	666,000	666,000	666,000	666,000	666,000	666,000	666,000	666,000	666,000	666,000
Sales (LF .17/kwh):				56,610	113,220	113,220	113,220	113,220	113,220	113,220	113,220	113,220	113,220	113,220	113,220
OM in $ equivalent				11,799	20,718	19,771	18,792	17,897	17,045	16,233	15,460	15,467	15,467	15,467	15,467
TOTAL BENEFITS (constant $	"	"	"	11,799	20,719	19,771	18,792	17,897	17,045	16,233	15,460	15,467	15,467	15,467	15,467
NET BENEFITS	"	(7,846)	(16,749)	4,547	12,846	12,162	11,514	10,899	10,316	9,767	9,239	9,485	9,715	9,937	10,149

THEREFORE,
IRR = 42.072

[illegible]

[illegible]

[illegible]

FEA LOSSES: 8%
FIXED O&M: [illegible] OF INSTALLATION COST

SOLAR [illegible] OIL: DOMESTIC PRICE: LE [illegible]/TON
WORLD PRICE: $ [illegible]/TON

NATURAL GAS: DOMESTIC PRICE: LE 15/TON
WORLD PRICE: $ [illegible]/TON

EXCHANGE RATE: CALCULATED USING THE BELOW MENTIONED INFLATION RATES

COST OF LAND: IN CAIRO SOUTH: 15,000 sq.m. x LE 600/sq.m. = LE 9m million
LAND IS OWNED BY FEA.
IN CAIRO WEST: NO NEW LAND IS INVOLVED
HURGADA: THE SITE IS TRANSFERRED FROM FAYOUM AND ABOU RADAMIS TO HURGADA
PRICE OF LAND IN THE NEW SITE IS APPROXIMATELY EQUAL TO THAT OF THAT OF THE OLD SITE.
THEREFORE, ADDITIONAL COST EQUALS ZERO. YET, THE COST OF THE LAND WOULD HAVE COST LE 80,000.

BENEFITS: ARE EITHER SAVINGS OF FUEL AS A RESULT OF A MORE EFFICIENT SYSTEM,
OR EXTRA ELECTRICITY GENERATED. PRICE PER KWH USED IN THIS ANALYSIS ARE:
PT 3.033/KWH -- PRESENT PRICE (FOR FINANCIAL ANALYSIS PURPOSES)
PT 17.6KWH -- THE LRMC, A MORE ACCURATE PRICE THAT SHOULD BE USED FOR ECONOMIC ANALYSIS PURPOSES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
EGYPT'S INFLATION RELATED TO THE $	[illegible]	[illegible]	[illegible]	0.15	[illegible]	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EI. RATE USED FOR ECON ANALYSIS (LE/$)	[illegible]	[illegible]	[illegible]	4.37	5.46	5.74	[illegible]	[illegible]	6.44	6.77	[illegible]	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32
EI. RATE USED FOR FIN ANALYSIS (LE/$)	2.6	1.228	2.856	4.484	5.112	5.74	[illegible]	6.37	6.64	6.97	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32

0

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[illegible]

TON OF N. GAS [illegible] TONS OF MAZOUT EQUIVALENT
TON OF SOLAR [illegible] TONS OF MAZOUT EQUIVALENT

[illegible] 95% NATURAL GAS, 5% SOLAR

THE MAZOUT EQUIVALENT OF NATURAL GAS IS SOLAR IS USED.
THE FOLLOWING TABLE SHOWS THE CONVERSIONS FROM MAZOUT TO NATURAL GAS AND SOLAR

YEAR	1000 $ P $35/TON MAZOUT EQUIVALENT	QUANTITY 1000 TONS	MAZOUT EQUIVALENT QUANTITY 1000 TONS 95% N.G. 5% SOL		THEREFORE, Q. IN 1000 TONS N. GAS	SOLAR	$/TON (1000) N. GAS	SOLAR	$/TON (1000) N. GAS	SOLAR
1	441	17	17	1	16	1	741	51	720	94
2	1927	55	52	1	47	1	1.488	222	1.147	412
3	2466	59	56	1	46	1	1.596	238	1.374	441
4	2205	67	64	1	49	1	1.703	254	1.601	471
5	2771	67	63	1	51	1	1.800	269	1.806	498
6	2582	74	70	4	53	4	1.995	298	1.218	552
7	2696	77	73	4	59	4	2.082	311	1.403	576
8	2819	80	76	4	62	4	2.170	324	1.599	600
9	2923	84	79	4	65	4	2.258	337	1.773	624
10	3037	87	82	4	67	4	2.346	356	1.959	649
11	3189	91	87	5	70	4	2.462	368	5.206	681
12	3339	95	91	5	74	5	2.579	385	5.453	713
13	3515	100	95	5	78	5	2.715	406	5.740	751
14	3692	105	100	5	81	5	2.852	426	6.029	789
15	3868	111	105	6	85	5	2.987	446	6.316	826

	WORLD PR.	LOCAL PR.
SOLAR	155.5	84
MAZOUT	74	35
NATURAL GAS	74	35

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WORKS

FINANCIAL ANALYSIS:

COSTS

Capital Costs:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Equipment:															
LE Costs	947	1,777													
Equivalent $ Cost	[illegible]	[illegible]													
$ Costs	[illegible]	[illegible]													
O & M															
Fixed	0	35	126	126	126	126	126	126	126	126	126	126	126	126	126
Variable	0	21	92	98	105	111	123	129	134	139	145	152	159	167	175
Total O&M	0	56	218	224	231	237	249	254	260	265	271	279	285	293	301
Fuel - L. P. Local Prices:															
Natural Gas		741	1,488	1,596	1,707	1,900	1,995	2,082	2,176	2,258	2,346	2,462	2,575	2,715	2,852
Solar Gas Oil		51	223	238	254	269	299	311	324	337	350	368	385	406	426
	0	791	1,711	1,834	1,957	2,069	[illegible]	2,393	2,495	2,595	2,696	2,830	2,960	3,120	3,278
O& M equivalent	0	121	444	449	381	361	381	378	376	372	368	387	405	426	448
TOTAL COSTS	6,333	2,714	662	677	614	598	630	632	626	637	639	665	690	719	749
US INFLATION	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
L. Proj. Costs (constant $)	6,333	2,610	612	563	525	491	498	480	464	448	432	432	431	432	432

BENEFITS:

Quantity sold (000 MWH)		75000	151000	164000	175000	185000	205000	214000	225000	232000	241000	257000	265000	279000	293000
Sales (E [illegible] cents)		1060.50	4635.96	4969.20	5302.50	5605.50	6211.50	6484.20	6756.90	7029.60	7302.36	7665.90	8029.50	8453.70	8877.90
O& M $ equivalent		328.52	1202.26	1108.21	1033.27	976.57	1031.81	1024.36	1017.61	1008.55	997.58	1047.25	1096.97	1154.98	1212.83
TOTAL BENEFITS (constant $	0	729	1,202	1,168	1,077	977	1,022	1,024	1,018	1,009	998	1,047	1,097	1,155	1,213
NET BENEFITS	(6,333)	(1,881)	591	545	512	485	514	544	557	561	566	616	666	727	786

THEREFORE,

IRR: 1.192

2775.02878 -0.01389154B

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COST:

Complete Costs:	[illegible]			4	[illegible]	[illegible]	[illegible]	6	[illegible]	10	11	[illegible]	13	14
Equipment:														
[illegible] costs	[illegible]	[illegible]												
Fo[illegible]eplant $ Cost	299	481												
$ costs	[illegible]	[illegible]												
O & M														
Fixed	"	75	126	126	126	126	126	126	126	126	126	126	126	126
Variable	"	21	92	98	105	111	127	128	134	139	145	152	159	167	175
Total O&M	"	96	218	224	231	[illegible]	249	254	260	265	271	275	285	293	301
Fuel [illegible] (Local Currency):														
Natural Gas		12[illegible]	1,147	1,374	3,681	3,806	4,2[illegible]	4,407	4,589	4,777	4,959	5,2[illegible]6	5,457	5,74[illegible]	6,029
Solar gas oil		96	412	441	471	498	552	576	6[illegible]	624	649	681	717	751	789
	"	814	1,559	1,815	4,07[illegible]	4,304	4,77[illegible]	4,975	5,189	5,399	5,422	5,640	5,919	6,24[illegible]	6,529
O&M $ equivalent	"	226	824	768	745	75[illegible]	79[illegible]	787	781	774	740	771	809	84[illegible]	89[illegible]
TOTAL COSTS	6,289	2,764	1,042	99[illegible]	976	987	1,041	1,041	1,041	1,079	1,011	1,049	1,094	1,14[illegible]	1,193
US INFLATION	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
T. Proj. Costs (constant $)	6,289	2,657	96[illegible]	882	814	811	822	791	761	73[illegible]	683	681	683	685	689

BENEFITS:

Quantity sold (000 MWH)		15000	157000	16800[illegible]	17500[illegible]	185000	205000	214000	223000	232000	241000	253000	265000	279000	293000
Sales (LE .17/kwh)		5950	26[illegible]	2780[illegible]	2975[illegible]	3145[illegible]	3485[illegible]	3638[illegible]	3791[illegible]	3940[illegible]	4097[illegible]	4301[illegible]	4505[illegible]	4763[illegible]	4981[illegible]
OF in $ equivalent		1657	6021	5612	5444	5481	5784	5751	5707	5655	5594	5876	6154	640[illegible]	6805
TOTAL BENEFITS (constant $)	"	1657	6021	5612	5444	5481	5784	5751	57[illegible]7	5655	5594	5876	6154	640[illegible]	6805
NET BENEFITS	(6,289)	(1,005)	5,[illegible]58	4,730	4,610	4,67[illegible]	4,962	4,960	4,946	4,925	4,911	5,19[illegible]	5,471	5,795	6,116

INDEFORGE.

IRR: 47.162

178

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

	[illegible]	[illegible]	[illegible]	4	5	[illegible]	[illegible]	[illegible]	[illegible]	10	11	12	13
EFFECT = INFLATION													
RELATIVE TO THE B	[illegible]	[illegible]	0.20	0.15	0.10	[illegible]	[illegible]	[illegible]	[illegible]	0.05	0.05	0.00	0.00
EL. RATE USED FOR EFFA													
ANALYSIS (EFFA)	[illegible]	[illegible]	[illegible]	4.97	5.46	5.74	[illegible]	[illegible]	[illegible]	6.97	[illegible]	[illegible]	7.32
EL. RATE USED FOR EFFA													
ANALYSIS (EFFA)	[illegible]	5.228	5.856	4.484	5.112	5.74	6.62	6.23	6.84	6.97	7.32	7.32	7.32

N.B.: ALL FIGURES ARE IN 1000'S DOLLARS

[illegible]

[illegible] TONS OF N. GAS [illegible] TONS OF MAZOUT EQUIVALENT
[illegible] TONS OF SOLAR [illegible] TONS OF MAZOUT EQUIVALENT

[illegible] WAVE: SO2 NATURAL GAS, SO2 MAZOUT

THE MAZOUT EQUIVALENT OF NATURAL GAS AND SOLAR IS USED.
THE FOLLOWING TABLE SHOWS THE CONVERSIONS FROM MAZOUT TO NATURAL GAS AND SOLAR.

YEAR	QUANTITY [illegible] TONS	MAZOUT EQUIVALENT QUANTITY - [illegible] TONS		THERE-FORE, U IN [illegible] TONS		LE/TON - [illegible]		$/TON - [illegible]	
		SO2 N.G.	SO2 MAZ.	N. GAS	MAZOUT	N. GAS	MAZOUT	N. GAS	MAZOUT
1									
2									
3	14.5	7.25	7.25	5.89	7.25	[illegible]	253.75	476	537
4	14.2	7.10	7.10	5.77	7.10	[illegible]	248.50	427	525
5	12.1	6.05	6.05	4.92	6.05	172.15	211.75	364	448
6	11.1	5.55	5.55	4.51	5.55	157.91	194.25	334	411
7	10.0	5.00	5.00	4.07	5.00	142.28	175.00	301	370
8	8.7	4.35	4.35	3.54	4.35	123.78	152.25	262	322
9	7.2	3.60	3.60	2.93	3.60	102.44	126.00	217	266
10	5.6	2.80	2.80	2.28	2.80	79.67	98.00	168	207
11	3.8	1.90	1.90	1.54	1.90	54.07	66.50	114	141
12	2.0	1.00	1.00	0.81	1.00	28.46	35.00	60	74

	WORLD PR.	LOCAL PR.
SOLAR	155.5	84
MAZOUT	74	35
NATURAL GAS	74	35

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MIFSH WEM:

FINANCIAL ANALYSIS:

COSTS:

Capital Costs:	1	2	3	4	5	6	7	8	9	10	11	12
$ Costs		1,000										
US INFLATION	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
T. Fnc. Costs (constant $)	0	962	0	0	0	0	0	0	0	0	0	0

BENEFITS:

Fuel (LE. @ Local Prices):

Natural gas	0	206	202	172	158	142	124	102	80	54	28	0
Mazout (gas oil)	0	254	249	212	194	175	152	126	98	67	35	0
	0	460	451	384	352	317	276	228	178	121	63	0
OR $ equivalent	0	183	117	86	69	55	46	36	27	17	9	0
NET BENEFITS	0	(819)	117	86	69	55	46	36	27	17	9	0

THEREFORE,

IRR: -14.072

-0.00000492 -0.140742124
-0.14074212 -0.140742124

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ECONOMIC ANALYSIS:

COSTS:

Capital costs:	1	2		4	5	6	7	8	9	10	11	12
Land (E)	[illegible]											
$ equivalent	47											
$ Costs	0	1,000										
TOTAL COSTS	47	1000										
US INFLATION	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
T. Proj. Costs (constant $)	47	961.54	0	0	0	0	0	0	0	0	0	0

BENEFITS:

Fuel (LE. & Local Prices):

Natural Gas	0	0	436	427	364	314	301	262	217	168	114	60
Mazout (gas oil)	0	0	577	525	448	411	370	322	266	207	141	74
	0		977	952	812	745	671	584	483	376	255	134
OR $ equivalent	0	0	225	192	149	130	111	92	73	54	35	18
NET BENEFITS	47	(962)	225	192	149	130	111	92	73	54	35	18

THEREFORE,
IRR: 1.25%

182

FIT: [illegible]
DO: [illegible]
SUB: [illegible] BENEFIT ANALYSIS OF THE POWER SECTOR [illegible]

BY: [illegible] MISHRIKI, FDS/E
DATE: AUGUST 21, 1990

EXCHANGE RATE: CALCULATED USING THE BELOW MENTIONED INFLATION RATES.

BENEFITS: ALL SAVINGS OF FUEL AS A RESULT OF A MORE EFFICIENT SYSTEM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
EGYPT'S INFLATION RELATIVE TO THE $	[illegible]	[illegible]	0.20	0.15	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EI. RATE USED FOR ECON ANALYSIS (LE/$)	[illegible]	2.60	4.32	4.77	5.46	5.74	6.02	6.33	6.64	6.97	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32
EI. RATE USED FOR FIN ANALYSIS (LE/$)	2.6	3.228	3.856	4.484	5.112	5.74	6.02	6.33	6.64	6.97	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32

N.B.: ALL FIGURES ARE IN 1000 $ OR LE

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CONVERSION FACTORS:

1 TON OF N. GAS 1.[illegible] TONS OF MAZOUT EQUIVELANT
1 TON OF SOLAR : 1.[illegible] TONS OF MAZOUT EQUIVELANT

SPARE PARTS: 50% NATURAL GAS, 50% MAZOUT

THE MAZOUT EQUIVELANT OF NATURAL GAS AND SOLAR IS USED.
THE FOLLOWING TABLE SHOWS THE CONVERSIONS FROM MAZOUT TO NATURAL GAS AND SOLAR.

YEAR	QUANTITY 000 TONS	MAZOUT EQUIVELANT QUANTITY - 000 TONS		THEREFORE, Q. IN 000 TGAS		LE/TON - (000)		$/TON - (000)	
		50% N.G.	50% MAZ.	N. GAS	MAZOUT	N. GAS	MAZOUT	N. GAS	MAZOUT
1									
2									
3	132.0	66	66	54	66	1.878	2.310	3.971	4.884
4	396.0	198	198	161	198	5.634	6.930	11.912	14.652
5	396.0	198	198	161	198	5.634	6.930	11.912	14.652
6	264.0	132	132	107	132	3.756	4.620	7.941	9.768
7	132.0	66	66	54	66	1.878	2.310	3.971	4.884
8	132.0	66	66	54	66	1.878	2.310	3.971	4.884
9	132.0	66	66	54	66	1.878	2.310	3.971	4.884
10	132.0	66	66	54	66	1.878	2.310	3.971	4.884
11	132.0	66	66	54	66	1.878	2.310	3.971	4.884
12	132.0	66	66	54	66	1.878	2.310	3.971	4.884
13	132.0	66	66	54	66	1.878	2.310	3.971	4.884
14	132.0	66	66	54	66	1.878	2.310	3.971	4.884
15	132.0	66	66	54	66	1.878	2.310	3.971	4.884
16	132.0	66	66	54	66	1.878	2.310	3.971	4.884
17	132.0	66	66	54	66	1.878	2.310	3.971	4.884
18	132.0	66	66	54	66	1.878	2.310	3.971	4.884
19	132.0	66	66	54	66	1.878	2.310	3.971	4.884
20	132.0	66	66	54	66	1.878	2.310	3.971	4.884

	WORLD PR.	LOCAL PR
SOLAR	155.5	84
MAZOUT	74	35
NATURAL GAS	74	35

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MIDDLE EAST:

FINANCIAL ANALYSIS:

COSTS:

Capital Costs:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
$ Costs	0	6,000	14,600																
US INFLATION	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
T. Fre. costs (constant $	0	5763.23	12947.79	0	0	0	0	0	0	0	0	0							

BENEFITS:

Fuel [illegible] Local Prices:

Natural Gas	0	1.878	5.634	5.634	3.756	1.878	1.878	1.878	1.878	1.878	1.878	1.878	1.878	1.878	1.878	1.878	1.878	1.878	1.878
Mazout (gas oil)	0	2.310	6.930	6.930	4.620	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310
	0	4.188	12.564	12.564	8.376	4.188	4.188	4.188	4.188	4.188	4.188	4.188	4.188	4.188	4.188	4.188	4.188	4.188	4.188
OR $ equivalent	0	1.297	3.258	2.802	1.639	730	696	662	631	601	572	572							
NET BENEFITS	0	(4.472)	(9.685)	2.802	1.639	730	696	662	631	601	572	572							

THEREFORE,

IRR -10.202

-7679.91191 -0.102007337
-0.04911267 -0.049112676

ECONOMIC ANALYSIS:

COSTS:

Capital Costs:	1	2	3	4	5	6	7	8	9	10	11	12
$ Costs	0	6,000	18,000									
US INFLATION	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
T. Proj. Costs (constant $)	0	5769.23	12,944	0	0	0	0	0	0	0	0	0

BENEFITS:

Fuel (U.E. & Local Prices):

Natural Gas	0	0	3.971	11.912	11.912	7.941	3.971	3.971	3.971	3.971	3.971	3.971
Mazout (gas oil)	0	0	4.884	14.652	14.652	9.768	4.884	4.884	4.884	4.884	4.884	4.884
	0		8.855	26.564	26.564	17.709	8.855	8.855	8.855	8.855	8.855	8.855
OR $ equivalant	0	0	2.050	5.747	4.861	3.086	1.470	1.400	1.333	1.270	1.209	1.210
NET BENEFITS	0	(5.769)	(10.894)	5.747	4.861	3.086	1.470	1.400	1.333	1.270	1.209	1.210

THEREFORE,

IRR: 6.74%

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SOCIAL SOUNDNESS ANALYSIS

A. Socio-cultural Feasibility:

The socio-cultural impacts of this project will be positive due to the economic reforms in the electricity pricing structure which will: encourage proper economic decisions by all customers and thereby bring about a more effective use of Egypt's energy resources; encourage formulation of a rate structure based on the economic cost to serve users based on facility investment thereby minimizing preferential rates for special interest groups; and add very efficient generating capacity and rehabilitate existing capacity that will demonstrate the reliability of the power supply consumers.

The social consequences of high electricity prices are largely determined by the electricity rate for the purpose of this project, an equitable rate structure is defined as a ratestrucutre based on the actual cost of serving various types of customers. Electricity rate increases prior to March 1989 tended to place the burden upon residential and commercial customers with only minor increases to the public sector industrial customers. As a result, many residential and commercial customers had experienced increases in their electricity bills well above the rate of inflation which encouraged the initial signs of social displeasure with the government's reform efforts. The March 1989 rate increase was a significant first step towards correcting the price inequity and will have a positive impact on low income Egyptian energy consumers. The higher cost of electricity is encouraging customer initiated conservation of electricity and other forms of energy which has slowed annual growth in electricity consumption by nearly 50% over the past several years.

The customers' willingness to accept higher prices for their electric service is dependent upon improved quality and reliability of electric service. Most customers would find higher prices for power services unjustified unless there were noticeable improvements in the quality and reliability of electric service. The generating facility additions and improvements will aid in improving the quality and reliability of service.

The generating capacity being installed or rehabilitated will burn natural gas and eliminate the burning of Mazout and the emission of airborne contaminants. The combined cycle plant at Cairo South will meet applicable U.S. noise standards; there should be no significant additional as a result of the plant noise.

B. Spread Effects:

The generating capacity to be added or rehabilitated by this Project will utilize standard technology presently in use at many existing power stations in Egypt. EEA's operations staff have successfully operated gas turbines and steam turbines to generate electric energy for many years. The operations staff to be assigned to each of the added plants will be trained to operate the new equipment, thus building on their present skills. A maintenance staff will be assigned to each plant to service the new equipment. This staff, composed of experienced maintenance personnel and supplemented by other specialists will be trained to service the modern equipment and control systems. Operations and maintenance staff at Cairo West will receive hands on refresher training in a U.S. operating power station and upon their return to Egypt will have enhanced abilities to operate the plant equipment. Since EEA anticipates the construction of additional generating facilities throughout their system in the future, the Project could provide training and development of operations and maintenance personnel for these future facilities.

C. Benefit Incidence:

The construction and rehabilitation of generating facilities to be financed by this project will offer both short-term and long-term employment opportunities which will directly enhance the economy of the area surrounding each plant, but will not require moving people from one area to another except for the small number of technicians who may be assigned to each plant from other areas.

To the extent that this Project contributes to the continuity and efficiency of energy services to customers, it will benefit all persons utilizing electrical energy from Egypt's unified power system.

D. CONCLUSION:

The design of the proposed Project is compatible with the socio-cultural environment in which it is to be introduced. The proposed Project will build on technology previously introduced in Egypt which has been operating successfully for a number of years. Host Country personnel will be trained as part of the Project to operate and maintain the new facilities. The proposed project, when implemented, should result in the direct and indirect benefits being distributed throughout Egypt. The components of the Project do not discriminate against women.

MANAGERIAL/ADMINISTRATIVE ANALYSIS

A. ORGANIZATION:

With the formation of the Ministry of Electricity and Energy (MEE) in 1964 all individual electric generating, transmission and distribution facilities were consolidated into a single state owned and controlled organization. The Egyptian Electricity Authority (EEA) is the operating authority for the MEE responsible for the planning, construction, operation and maintenance of the Egyptian Unified Power Systems (UPS) which consists of the generating units and bulk energy transmission systems.

EEA is organizationally divided into five administrative divisions (planning, construction, operation, finance and manpower development) and five operational zones, two of which will be involved with this Project.

The organization chart of EEA is attached as Figure K-1. At the headquarters level, EEA is headed by a Chairman directly assisted by five deputy chairmen for: finance and economy; manpower and training; operations; projects and studies; and research. Each of these offices is further structured into line and staff organizations. All of the principal officers are members of EEA's board. Geographically EEA's operations are divided into five zones, namely Canal, Upper Egypt, Delta, Alexandria and Cairo.

The top and middle management positions are held by qualified and experienced personnel. Management, with the assistance of consultants, has demonstrated its capability to manage a major utility organization by the smooth implementation of projects and operations.

EEA has launched a major program to improve the management information system which will facilitate management decisions based on accurate and up-to-date information. The program is referred to as the Electricity Energy Data Bank. It is financed by United Nations Development Program (UNDP) and the Government of Egypt; and is being executed by EEA in collaboration with the United Nations. The program implementation started in October 1984 and is being executed in two phases for completion in 1991. The first phase dealt with setting up the computer hardware and training of personnel.

SCHEMATIC ORGANIZATION OF EGYPTIAN ELECTRICITY AUTHORITY

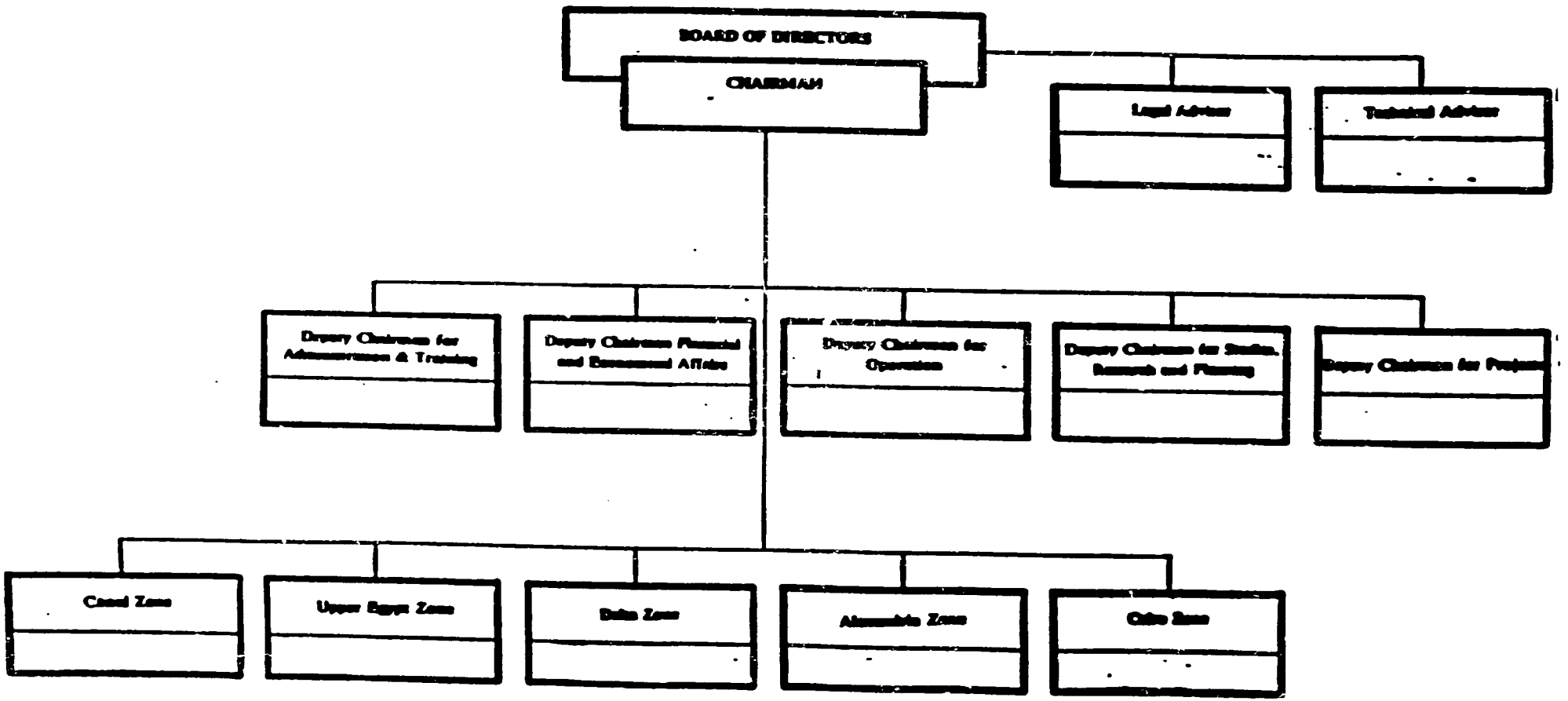

Figure K-1

EEA Organization Chart

The second phase which started in July 1987 is geared to developing all the necessary software programs and setting up the management information system. The program involves computerization of all the technical and financial activities of EEA (including its zones) and the distribution companies; and monitoring and controlling the activities under a single system. The successful completion of this Project would not only be beneficial to EEA but also to all AID and financing institutions like the IBRD and ADB as it would facilitate the gathering and compilation of data.

Staff and Training:

EEA's permanent staff has increased from about 21,000 to 28,000 over the last 10 years an average increase of 3 percent per year. In spite of the rapid expansion of EEA's operations, the growth rate is modest. In addition to the permanent staff, EEA employs temporary staff as the need arises particularly during the implementation of new projects. The existing staff strength is shown below by category of functions.

Table 1
Staff Strength

Category	As at February 1988	Percentage Distribution
Engineers	2,859	10
Chemists and Physicians	286	1
Other Graduates*	1,398	5
Clerks	3,819	14
Technicians	7,861	28
Semi-skilled	10,761	38
Services	1,202	4
TOTAL	28,186	100

---

* Includes Lawyers, Accountants and Administrative personnel.

The staff strength of EEA is characterized by a shortage of qualified and experienced staff for certain functions such as engineers, technicians and accountants and by overstaffing in clerical and semiskilled functions. EEA is minimizing these problems over time by intensifying its training program and provision of bonuses to retain qualitu staff and restricting recruitment of staff for activities which are already overstaffed.

EEA has two training centers (in Cairo North and Cairo South) which provide specialized training in generation and transmission respectively. The Cairo South Center is in the process of being developed as a National Training Center for Transmission. Since 1984 a training center has become operational in Cairo North for training of staff in financial and administrative functions.

Two additional technical training centers (in Alexandria Zone and Canal Zone) are now being developed which will provide training in both generation and transmission. The Alexandria Center (financed by the British Government), is expected to start operation by the end of 1989. The Canal Zone Center will be financed by the IBRD. The feasibility studies for two more training centers in the Lower Egypt and Upper Egypt Zones have already been completed and the financing is being secured from Czechoslovakia and Sweden respectively. These centers will provide training in both generation and transmission. EEA plans to provide training in its centers for not less than 3000 engineers and 5000 technicians through mid 1992 (1987/88-1991/92).

The training center in Cairo North provides four week courses in accounting and administrative functions. There is a plan to train 4000 staff by mid 1992 in basic accounting and management functions. Moreover, EEA, with IBRD financing, implemented a training program with Electricite de France (EDF) for accountants. This program involved training of a total of 30 middle-level accountants.

EEA is aware that there is not sufficient training for the lower level management staff which has hindered delegation of duties and responsibilities. EEA has identified the training requirements in these areas and is developing in-house and external training programs to be undertaken in phases. This move will not only improve the quality of the staff but also facilitate the delegation of duties and responsibilities.

Operating Zones:

The Cairo operational zone (which includes the Cairo South and Cairo West sites) has effectively managed the operations and maintenance of a complex system of generation and transmission facilities serving metropolitan Cairo. These facilities presently include a total installed generating capacity of 2344 MW (1995 MW in steam turbine capacity and 349 MW in gas turbines capacity), 562 Km of 220 kV transmission lines and 2750 MVA of transformer capacity.

The Canal operational zone (which includes the Red Sea coast line and the Hurgada site) has effectively managed the operations and maintenance of a complex system of generation and transmission facilities serving the area along the Suez Canal, Sinai and along the Gulf of Suez and Red Sea coast line. The facilities presently include a total installed generating capacity of 1497 MW (1300 MW in steam turbine capacity and 197 MW in gas turbine capacity), 1390 Km of 220 KV transmission lines and 1305 MVA of transformer capacity.

B. EEA PROJECT MANAGEMENT:

We anticipate that EEA will establish a Project Team for each component of the project reporting directly to the respective Zone President who in turn will report to the EEA Chairman. Each Project Team will have the authority to make day-to-day decisions and approvals. Each Project Team will be composed of a project manager, project engineer and financial specialist. The team members will be either integrated into their respective plant staff's upon completion of their project, or continue to provide their respective Zones and EEA with enhanced project management.

C. OPERATIONS AND MAINTENANCE:

To effectively operate and maintain the combined cycle unit at Cairo South and the gas turbine at Hurgada, EEA will assign appropriate levels of operations and maintenance and administrative employees.

These employees will be selected from EEA's operating plants. Since EEA is currently operating 68 gas turbines in 18 plants and 59 steam turbines in 15 plants, the addition of a single

combined cycle unit should not adversely affect EEA's current operations and EEA should have no problem assigning knowledgeable and qualified personnel to operate these generating units without adversely affecting their operation and maintenance of other plants.

The operations and maintenance staffs at Cairo West will receive refresher training in an operating power plant in the U.S. where they can sharpen their present skills. The operations and maintenance staff for Hurgada will receive extensive training. EEA will be required, through a Covenant, to commence training of the additional staff sufficiently in advance of the equipment installation and checkout so that the EEA staff for each plant will be knowledgeable about the equipment and can participate in the checkout and start-up of each plant. The operations and maintenance staff will be trained in the classroom and on the job.

The turnkey contractors for the Cairo South and microwave system extension and the supply/installation supervision contractors for Cairo West and Hurgada will be required to remain at the sites for the duration of the start-up periods until each plant is accepted by EEA.

D. USAID:

The Power Systems Group within the Office of Urban Administration and Development (DR/UAD) has monitoring responsibilities for other projects in the electric power sector and has developed an excellent working relationship will all levels of EEA personnel. The assigned personnel are experienced in the design, construction, operations and maintenance of electric power systems and the management and administration of electric utilities and, with the addition of an engineer with extensive electric utility experience, should provide sufficient AID monitoring support throughout the life of this Project.

E. CONCLUSIONS:

EEA has many years of extensive and successful experience in the construction, operation and maintenance of both gas turbine and steam turbine power generating facilities. The proposed Project is designed to build on this experience. EEA has demonstrated a capability to effectively manage the implementation of much larger and more complex power plant

construction projects. At the same time, the available DR/UAD staff strengthened by the addition of an additional engineer should be sufficient to provide the necessary AID monitoring support. Accordingly, the Project is judged to be administratively feasible.

ENVIRONMENTAL ANALYSIS

A. General:

The Project will finance the installation of a combined cycle plant at Cairo South, the reibursement of three gas turbines and their subsequent reinstallation at a site near Hurgada, the rehabilitation of a steam turbine generating plant and the expansion of the NECC microwave communication system. The environmental input of these installations concerns the environmental impacts of gas turbines and steam turbine equipment. The Egyptian Electricity Authority has installed and is currently operating 60 gas turbine generators ranging in size from 17 MW to 135 MW and two combined cycle units consisting of 8-24 MW gas turbines and 2-50 MW steam turbines. The environmental impact of these gas turbine installations has been the subject of numerous assessments by EEA and respective financiers including AID, IBRD and ADB. These assessments were concerned with the impact of gas turbine operation on air and water quality, biotic and community environment and the impact of the steam cycle portion of the combined cycle unit on water quality.

B. Gas Turbine Installation - Impact on Air Quality:

Previous studies involved atmospheric dispersion modelling of the emission from the proposed additions. Maximum pollutant ground concentrations from gas turbine installations were calculated using the U.S. EPA Industrial Source Complex (ISC) air quality model. Dispersion meteorological data and background air quality levels were either measured or, if not available, the gas turbine air quality impact assessment was based on contributions from emissions of the gas turbines and air quality screening techniques using worst case scenario meteorology utilizing natural gas firing.

All analyses have found that the maximum calculated sulfur dioxide (SO_2) and total suspended particulate (TSP) ground level concentration are well below the applicable World Bank, U.S. EPA and Egyptian standards. The maximum calculated nitrogen dioxide (NO_2) concentrations have also been found to be consistently below applicable World Bank, U.S. EPA and Egyptian standards. Operation of the gas turbine on solar fuel will increase the SO_2, TSP and NO_2 concentrations but these increased concentrations will not exceed the applicable World Bank, U.S. EPA and Egyptian standards. A Covenant will be included in the Grant requiring EEA to operate the gas turbines being financed by the Grant on natural gas under normal operating conditions.

Therefore, the operation of gas turbines, using either natural gas or solar firing, has been shown to have no adverse effect on the existing air quality of the area.

C. Gas Turbine Installation - Impact on Water Quality:

The primary use of water for gas turbine installations is for makeup to closed loop lube oil cooling, cleanup and domestic purposes. For the Cairo South and Hurgada gas turbine installations, water consumption of less than 2000 liters per day (500 gallons per day) is normal. The water, to be discharged, would be delivered to sewage disposal tanks and percolation systems designed to handle the waste water flow. The operation of the proposed gas turbine installations therefore will have no adverse effect on the surrounding water quality.

D. Gas Turbine Installation - Impact on Biotic Environment:

The Cairo South site is contained with the existing Cairo South thermal Power Station. The Hurgada site is a desert site. Few if any plants or animals exist on either site. Any displaced flora and fauna can repopulate in similar nearby desert areas. Construction and operating activities will also force any animals living on the site to find similar habitats in the adjacent desert.

E. Gas Turbine Installation - Impact on Community Noise:

The sound emissions from gas turbines are generally rated on the basis of sound pressure measurements taken at 400 feet (122 meters) from the gas turbine per NEMA standards. Combustion turbines of the type to be provided for this Project have a combined guaranteed rating of 71dBA at 400 feet. This sound level can be extrapolated into a community, taking into account listener distance from the source and air absorption. For simplicity and conservation, the attenuation effects of air absorption are not generally considered.

The predicted noise level resulting from the proposed Project at the boundary of the nearest residential area is considerably below 40dBA. U.S. EPA has published guidelines on noise pollution which state that in a residential environment, the average sound level below which there is adverse effect on public health and welfare occur is 55dBA. Since the predicted noise contribution from the proposed project is well below established U.S. noise criteria/guidelines, no significant noise related impact to the surrounding residential areas is expected to occur.

F. Steam Cycle Installation - Impact on Coolant Water:

Previous environmental studies of the impact of a combined cycle addition to an existing gas turbine installation indicate that the only significant potential environmental impact is related to the thermal discharge of water used for condenser cooling.

At Cairo South, the steam cycle addition would be designed with a once through condenser system, wherein water is pumped from the Nile River through condensers to condense turbine exhaust steam. The condenser would be of sufficient capacity to return the circulating water to the river through a discharge system with a temperature rise not exceeding 10'C. The cooling water system would be designed to maintain a maximum temperature rise of 5'C outside the mixing zone in the river with a temperature rise of 10'C across the condenser.

Further investigations are required to determine whether the Nile River adjacent to Cairo South is used as a spawning, nursery or feeding ground, or a migration route by important fishes during the year and the affect of the thermal discharge on the aquatic species found in the respective areas.

G. Combined Cycle Installation - Impact on Wastewater Treatment:

Various unit wastewater steams will result from the following:

- Intake screen debris
- Clarifier blowdown
- Filter backwash water
- Demineralizer regeneration
- Power block sumps for dirty, clean, and acid wastes.
- Oil spills
- Compressor and gas turbine wash
- Laboratory and sampling steams
- Sanitary waste
- Fuel oil treatment plant wastewater
- Heat recovery steam generator blowdown
- Desalination plant blowdown

1 Environmental Assessment for Talkha Combined Cycle Plant, AID Project 263-0196; Environmental Assessments for African Development Bank financed Damietta Combined Cycle Plant - Phase One, performed by Montreal Engineering Company and overseas Bechtel, Inc. Environmental Assessment of Dammanhour and Mahmoudia Combined Cycle plants prepared by the Electricity Supply Board of Ireland.

Wastewater treatment facilities consisting of an oil/water generator system, neutralizing tanks, clarifiers, and filters will be designed for the proposed units. All waste steams will be treated to meet U.S. EPA effluent guidelines, prior to discharge to the receiving river. The wastewater flows associated with either station represent a minor fraction compared to the condenser cooling water. Given the innocuous character of the projected facility discharges, the associated incremental impacts will be minor.

H. Cairo West Rehabilitation:

The Project will finance the rehabilitation of the Cairo West Thermal Power Station consisting of 4-87.5 MW steam turbine generators and their unit boilers. Included in the rehabilitation of the boilers will be their conversion to natural gas burning. The boilers presently burn Mazout, a petroleum fuel similar to No. 6 oil. The burning of Mazout at the Cairo West plant, often without proper combustion controls, has had an adverse impact on the surrounding area. Emissions of sulfur dioxide, nitrous oxides and particulates to exceed allowable limits. The conversion of the boilers to natural gas burning, the use of burners to minimize nitrous oxides and installation of a modern burner management system will enhance the plant's performance and reduce the negative environmental impact of the plant on the surrounding area by reducing the sulfur dioxide, nitrous oxides and particulate emissions. There will be no change in the intake, treatment, circulation and discharge of river water for condenser cooling and other plant applications.

I. Environmental Conclusions:

The numerous similar gas turbine installations in Egypt and related studies and conclusions mentioned above indicate that no further information would be gained by additional studies or environmental investigations. The water drawn from the Nile for condenser cooling will be returned at a temperature of less than 10°C. Prior to the completion of the unit specifications for the combined cycle unit, a scoping session will be conducted and a concise Environmental Assessment will be developed which focuses on the impact of the Cairo South combined cycle unit's steam cycle condenser cooling thermal discharge on the aquatic species native or migrating through the area. The format of the Environmental Assessment shall be consistent with the requirements of 22 CFR Part 216, "AID Environmental Procedures".

The engineering services contract scope of work for the Cairo South combined cycle unit will require the investigation

mentioned in Section F above and will require conducting the Scoping Session. Funding for the Cairo South Combined Cycle turnkey contract will be released after the Draft Environmental Assessment, including necessary mitigations that should be included in the Project, has been reviewed and the Environmental Assessment has been approved by the ANE/PD/ENV Environmental Coordinator.

INITIAL ENVIRONMENTAL EXAMINATION

Project Location	: Egypt
Project Title and Number	: Power Sector Support 263-0215
Funding	: AID $133 million grant, GOE LE 60 million
Life of Project	: Four Years
IEE Prepared by	: John P. Hunt USAID Project Officer

Signature _____

Date 8/17/89

Environmental Action Recommended : 1. Scoping Session and follow up Environmental Assessment for the Cairo South Combined Cycle unit (Item C of attached Environmental Analysis)

2. No other environmental concerns arising from this project. Therefore, no further action required.

Mission Environmental Officer's Concurrence : Signature _____
Shankar Gupta
DR/UAD

Date AUG 17 1989

Associate Mission Director's Concurrence : Signature _____
Paul Thorn
AD/DR

Date AUG 17 1989

Decision of Environmental Coordinator, Bureau for Asia and Near East : Approved _____

Disapproved _____

Date _____

ACTION: AID 4 INFO: OCM ECON /6

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CN: 53497
CHRG: AID
DIST: AIDA
ADD: LEG MGT/CS

DIRECTOR DR PDS
ENTER DATE 8/28
BAR _____ INITIALS _____

AIDAC FOR J.HUNT AND S.GUPTA

E.O. 12356: N/A
TAGS:
SUBJECT: INITIAL ENVIRONMENTAL EXAMINATION (IEE) FOR POWER SUPPORT PROJECT (263-0215)

REF: HUNT/KUX FAX 8/17/89

1. ANE/PD ENVIRONMENTAL COORDINATOR, MOLLY KUX WILL CONCUR IN THE IEE FOR THE SUBJECT PROJECT WITH THE FOLLOWING MINOR MODIFICATIONS:

A) THAT USAID/CAIRO WILL INVESTIGATE WHETHER NEW PIPELINES FOR SUPPLYING NATURAL GAS WILL BE CONSTRUCTED AND IF SO, WHETHER PLACEMENT WILL BE PARALLEL TO EXISTING LINES OR NEW ALIGNMENTS ARE BEING PLANNED. IF THE LATTER, THE ENVIRONMENTAL ASSESSMENT PLANNED BY THE MISSION SHOULD BE EXPANDED TO ADDRESS THE IMPACTS OF THE NEW CONSTRUCTION.

B) THE LAST SENTENCE OF THE IEE SHOULD BE REVISED TO READ AS FOLLOWS: 'QUOTE, FUNDING FOR THE CAIRO SOUTH COMBINED CYCLE TURNKEY CONTRACT WILL BE RELEASED AFTER THE DRAFT ENVIRONMENTAL ASSESSMENT (EA), INCLUDING NECESSARY MITIGATIONS THAT SHOULD BE INCLUDED IN THE

PROJECT, HAS BEEN REVIEWED AND THE FINAL EA APPROVED BY THE ANE ENVIRONMENTAL COORDINATOR.

2. MISSION COMMENTS AND/OR AGREEMENT ON THE PROPOSED CHANGES WOULD BE APPRECIATED BY ANE/PD/ENV. EAGLEBURGER
BT
#CC81

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ORIGIN: AID 4 INFO: DCM ECON /6

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CLASS: UNCLASSIFIED
CHRGE: AID 27AUGUST19
APPRV: CD/UAD: MGOULD
DRFTD: DR/UAD: JHUNT
CLEAR: DR/UAD:SGUPTA
DISTR: AIDA
ORGIN: UCR

AIDAC

FOR ANE/FD/ENV M.KUX

E.O. 12356: N/A
SUBJECT: INITIAL ENVIRONMENTAL EXAMINATION (IEE)
- FOR POWER SECTOR SUPPORT PROJECT (263-0215)

REF. STATE 270C81

1. MISSION APPRECIATES QUICK RESPONSE TO SUBJECT IEE. SUGGESTED IEE MODIFICATION 8 WILL BE INCORPORATED INTO IEE.

2. REGARDING THE NATURAL GAS PIPELINE, THE EXISTING GAS PIPELINE SERVING CAIRO SOUTH HAS SUFFICIENT CAPACITY TO SUPPLY THE NATURAL GAS NEEDS OF THE EXISTING FACILITIES AND THE GAS TURBINE INSTALLATION BEING FINANCED BY THE PROJECT.

3. THE LAST SENTENCE OF THE IEE WILL BE REVISED AS REQUESTED. IN ADDITION, REQUIREMENTS PRECEDENT TO DISBURSEMENT OF PROJECT FUNDS FOR THE CAIRO SOUTH PROCUREMENT REQUIRE: (1) THE CAIRO SOUTH CONSULTANT TO PREPARE AN ENVIRONMENTAL ASSESSMENT COVERING THE CAIRO SOUTH INSTALLATION AND (2) THAT THE TURNKEY CONTRACT REFLECT THE OUTCOME OF THE ENVIRONMENTAL ASSESSMENT.
BT
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COST ESTIMATE

CAIRO SOUTH COMBINED - CYCLE UNIT

The foreign exchange cost estimate based on EEA cost estimate in US dollar equivalent contained in Cairo South Feasibility Study dated July 1989 and USAID cost estimates developed from the Talkha actual costs and IBRD, ADB project data and EEA studies

	U.S. DOLLARS (million)	LE (million)
Gas Turbine - generator (110 MW)	$25.3	LE 3.0
Heat Recovery Steam Generator	$ 7	LE 3.9
Steam Turbine - generator w/Aux	$13	LE 2.0
Water Treatment	$ 2	LE 0.6
Switchgear	$ 4.7	LE 0.8
Site Work	$ 1	LE 2.4
Civil Works	$ 7	LE 15
Electric/Mechanical Works	$ 6	LE 2.6
Training	$ 1	LE 0.4
Switchyard	--	--
	$67	LE 30.7

Based on EEA cost estimated - $Eq. 74.5 (excluding 9% contingency and Consultant Services)

Price Comparisons

135 MW Gas Turbine competively bid for Damietta (1986) - 6 units	$ 163.43 + LE 19.2
110 MW Gas Turbine purchase Negotiated (1988) Cairo South - 3 units	$ 78.46 + LE 6.7
Heat Recovery Steam Generators: Completed Bid Damietta (1989) - 6 units at	$ 40.4 + LE 13
55 MW Steam Turbine - Generator /Aux purchase negotiated (1986) Talkha - 2 units (including switchgear)	$ 28.6 + LE 3.8
Mahmoudia Cost Estimate (1986)	$Eq. $19.3

COST ESTIMATE
CAIRO WEST REHABILITATION COST ESTIMATE

The foreign exchange cost estimated based on firm price proposals from Westinghouse Electric Manufacturing Company and Babcock & Wilcox

Turbine Generator - Westinghouse Quotations dated June and July 1989

Material

Unit 3 Inner cylinder bolts	$	169,693
Unit 3 Outer cylinder bolts	$	302,751
Unit 3 Blad Ring 1 and 2 tightening bolts	$	55,998
Unit 3 replacement parts	$	1,102,627

Service for Unit 3 $ 663,714

replace H.P. rotor seal strips
replace H.P. blade ring shroud seal strips
replace blade ring No. 1
replace L.P. rotor water gland seal strip
remove and replace blade diaphragm caulking
remove and replace Monel sealing strips
on all high pressure turbine blade rings
Non-destructive testing of turbine
Generator Testing

Service for Unit 1 $ 665,000

replace H.P. rotor seal strips
replace H.P. blade ring shroud seal strips
replace blade ring No. 1 and No. 2
replace L.P. rotor water gland seal strip
remove and replace blade diaphragm caulking
remove and replace Monel sealing strips
on all high pressure trubine blade rings
Non-destructive testing of turbine
Generator Testing

Service for Unit 2: $ 665,000

replace H.P. rotor seal strips
replace H.P. blade ring shroud seal strips
replace blade ring No. 1 and No. 2
replace L.P. rotor water gland seal strip
remove and replace blade diaphragm caulking
remove and replace Monel sealing strips
on all high pressure trubine blade rings
Non-destructive testing of turbine
Generator Testing

Sub-total $ 3,624,783

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Boiler - Babcock & Wilcox proposal RE - 2274E of April, June, July 1989

Conversion to dual fuel firing

Supply low Nitrous oxide burners and new burner throat panels for Units 1, 2, 3 and 4	$ 1,740,000
Supply Burner Management System and combustion controls for Units 1, 2, 3, and 4	$ 8,180,000
Supply new forced draft fans and motors drives for Units 1, 2, 3 and 4	$ 1,200,000
Supply new gas recirculation fans and motor drives for Units 1, 2, 3 and 4	$ 1,250,000
Supply No. 2 oil atomizers and lighters and an automatic lighter control system	$ 3,310,000
Sub-Total	$15,680,000

Pressure Part Replacement

Supply replacement superheat and reheat attemperators for Unit 1, 2, 3, and 4	$ 475,000
Supply replacement superheat and reheat outlet headers for Unit 1, 2, and 3. (NOTE: Unit 4 headers are of adequate design and material type).	$ 450,000
Supply redesigned secondary superheater for Units 3 and 4	$ 550,000
Provide additional soot blosers, controls and thermal drain systems for Units 1, 2, 3 and 4	$ 850,000
Technical Services (2376 Mondays @#841.75/md) (Include travel, living expenses)	$ 2,000,000
Sub-Total	$ 2,000,000
Total	$23,629,783

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COST ESTIMATE
COMMODTIES

The foreign exchange cost estimate based on firm price quotations from replacement and spare part suppliers, for generating units. EEA price estimates for laboratory and metering equipment and materials.

Spare and Replacement Parts

Spare Parts for Talkha Combined-cycle plant (GE Invoice #001)	$ 989,974
Spare Parts for Cairo Zone Gas Turbines (GE 0314620 B)	$ 5,065,653
Spare Parts for Canal Zone (Sinai) Diesel engine generators	$ 500,000
260 Transducers (Voltage, Watt/Var MW Hr)	$ 120,000
Sub-total	$ 6,675,627

Laboratory and Metering Equipment

Fuel and Oil Testing Instruments	$ 230,000
5 - Carbon Analyzer	$ 100,000
4 - Ion Chromatograph	$ 80,000
1 - Inductively Couple Plasma Spectrometer	$ 80,000
1 - Fourer Transformer Spectrometer	$ 80,000
Sub-total	$ 570,000

Maintenance equipment for overhead Lines and substations

7 - 40 meter Articulated boom Aerial Platforms mounted on trucks for 500 KV and 220 KV transmission line maintenance	$ 1,260,000
11 - 40 meter Aerial Platform insulator washer mounted on trucks for 500 KV and 220 KV transmission line maintenance	$ 1,260,000
29 - Skid mounted hot line washing units mounted on chassis for 500 KV and 220 KV transmission line maintenance	$ 1,044,000

20 - Double cab light duty maintenance trucks	$ 1,050,000
Overhead Line Maintenance Tools (146 wire grips, 32 ratchet hoists, ropes, 50 hand line bags, 86 hydraulic presses, 200 tackle, 30 insulator testers, 35 coffin hoists, 35 dynamometers, 60 Ladders, 680 suspension pulleys, 250 ground clumps	$ 450,000
Safety and detection equipment (8 thermovision units, 50 thermometers, 200 binoculars, 200 pair rubber gloves, 200 pair work gloves, 425 safely straps, 845 safety harnesses and belts	$ 546,000
Sub-total	$ 6,000,000
	$13,245,627

COST ESTIMATE
HURGADA INSTALLATION

Cost Estimate based on firm price proposal from General Electric company - GETSCO Proposal 916G5106 Rev. 4 and 6 dated February and June 1989 for Turbine Reinbursement

El Fayium Unit -	Gas Turbine Rebuild	$ 147,737
	Generator Repair	$ 88,688
	Hot Gas Path Upgrade	$ 335,190
	Sub Total	$ 571,615
Abu Motamir Unit -	Gas Turbine Rebuild	$ 204,589
	Generator repair	$ 88,688
	Hot Gas Path Upgrade	$ 335,190
	Sub Total	$ 628,467
Cairo North Unit -	Gas Turbine Rebuild	$ 348,000
	Generator repair	$ 111,000
	Hot-gas path upgrade	$ 335,190
	Sub Total	$ 794,190
Technical Services (1537 person days @#918.50/day		$1,412,194
SPECDTRONIC Control (3)		$1,168,000
Generator Control Panel (3)		$ 381,000
Excitation Control System (3)		$ 540,000
Fuel Facilities (3)		$ 283,000
Trust Bearing Modification (3)		$ 55,000
Cooling Water Facilities (3)		$ 594,000
Exhaust Modifications (3)		$ 66,000
Control Interconnection (3)		$ 327,000

Foundation Embedments (3)	$ 102,000
Review of EEA design	$ 28,000
Tools	$ 150,000
Training	$ 142,000
Sub Total	$5,248,194
Total	$7,242,466

COST ESTIMATE

MICROWAVE EXTENSION

The foreign exchange cost estimated is based on NECC cost of 1978 escalated at an average of 7% year to 1991

6 Remote Transmitting Units	$235,000
4 - 60 meter towers @36,000/tower	$185,000
14 High gain type antenna @#3,000	$ 42,000
Digital Microwave Recievers,	
Radio Equipment, Transmitters	$460,000
	$922,0008

COST ESTIMATE

CONSULTANT SERVICES

Staffing in Egypt:	Cairo South	225 person months
	Cairo West	60 person months
	Hurgada	12 person months
	Microwave	3 person months

Salaries

300 person months Egypt staff (including overhead)	$3,700,000
100 person months U.S. based staff (including overhead)	$1,000,000
Travel	$ 300,000
Transportation/Storage Cost	$ 250,000
Miscellaneous Job Costs	$ 200,000
Sub-total	$5,450,000
Fee	$ 550,000
Total	$6,000,000

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Housing Expenses in Egypt	LE 450,000
(300 person months X 1500/month	
Subcontractor	LE 2,550,000
Total	LE 3,000,000