

PD-ABR-040
15A 63448

UNCLASSIFIED

INTERNATIONAL DEVELOPMENT

COOPERATION AGENCY

AGENCY FOR INTERNATIONAL DEVELOPMENT

Washington, D.C. 20523

PROJECT PAPER

EGYPT: Shoubrah El Kheima Thermal Power Plant
Amendment 3

PROJECT NO: 263-0030

JULY 1985

UNCLASSIFIED

UNCLASSIFIED

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

AGENCY FOR INTERNATIONAL DEVELOPMENT

WASHINGTON, D.C. 20523

PROJECT PAPER

PROJECT NO. 263-0030

JULY 1985

EGYPT: SHOUBRAH EL KHEIMA THERMAL POWER PLANT - AMENDMENT 3

UNCLASSIFIED

PROJECT DATA SHEET

TRANSACTION CODE

A = Add
 C = Change
 D = Delete

Amendment Number

3

2. COUNTRY/ENTITY

Egypt

5. PROJECT NUMBER

263-0030

4. BUREAU/OFFICE

NE

03

6. PROJECT TITLE (maximum 40 characters)

Shoubrah El-Kheima Thermal Power Plant

6. PROJECT ASSISTANCE COMPLETION DATE (PACD)

MM DD YY
06 30 89

7. ESTIMATED DATE OF OBLIGATION

(Under "B." below, enter 1, 2, 3, or 4)

A. Initial FY 79

B. Quarter 4

C. Final FY 85

8. COSTS (\$000 OR EQUIVALENT \$) =

A. FUNDING SOURCE	FIRST FY			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total	100,000		100,000	263,000		263,000
(Grant)	(100,000)	()	(100,000)	(263,000)	()	(263,000)
(Loan)	()	()	()	()	()	()
Other						
U.S.						
Host Country		78,100	78,000		155,000	155,000
Other Donor(s)	287,800		287,800	500,700		500,700
TOTALS	387,800	78,100	465,900	763,700	155,000	918,700

9. SCHEDULE OF AID FUNDING (\$000)

A. APPROPRIATION PURPOSE CODE	E. PRIMARY TECH CODE	D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) ESP 240 B 825		208,000		55,000		263,000	
(2)							
(3)							
(4)							
TOTALS		208,000		55,000		263,000	

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 augment the electricity generating capacity of the Egyptian Electricity Authority to meet increasing power and energy requirements of consumers throughout Egypt.

14. SCHEDULED EVALUATIONS

Interim MM YY MM YY Final MM YY
09 86 04 90

15. SOURCE/ORIGIN OF GOODS AND SERVICES

000 94 Local Other (Specify)

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

- To assist in financing the foreign exchange costs of a fourth 315 MW generating unit at the Shoubrah El-Kheima Thermal Power Station.
- USAID/Egypt Controller concurs with the proposed methods of implementation and financing

Homi Jamshed, Acting Controller

17. APPROVED BY

Signature: Frank B. Kuehl
Title: Director, USAID/Cairo

Date Signed

MM DD YY
07 29 85

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

MM DD YY

EGYPT - SHOUBRAH EL KHEIMA THERMAL POWER PLANT
AMENDMENT 3

TABLE OF CONTENTS

	<u>PAGE NO.</u>
SUMMARY AND RECOMMENDATION	7
I. INTRODUCTION	9
II. NEED FOR ADDITIONAL GENERATING CAPACITY	13
A. Introduction	13
B. Consumption and Supply	13
C. Capacity Addition Options	15
D. Alternatives to Adding Generating Capacity	17
III. THE PROJECT	20
A. General	20
B. Purpose	20
C. Cost Estimate	20
D. Project Design	21
E. Section 611(a) Requirements	21
IV. TECHNICAL ANALYSIS	23
A. Site	23
B. Physical Plant	23
C. Transmission	25
D. Operations and Maintenance Staffing and Training	26
E. Fuel Supply	26
V. FINANCIAL ANALYSIS	28
A. General	28
B. Accounting System	28
C. Budget	29
D. Tariffs	29
E. Financial Reporting	30
F. Financial Condition	31
G. Financial Viability	31
H. Project Financial Plan	32
I. Disbursement Period	34

VI.	ECONOMIC ANALYSIS	35
VII.	SOCIAL ANALYSIS	37
VIII.	ENVIRONMENTAL ANALYSIS	38
IX.	MANAGERIAL/ADMINISTRATIVE ANALYSIS	39
	A. Ministry of Electricity and Energy	39
	B. Egyptian Electricity Authority	39
	C. Unified Power System	40
	D. Cairo Zone	40
	E. EEA Project Team	40
	F. USAID	41
X.	PROJECT IMPLEMENTATION	42
	A. Implementation Plan	42
	B. Procurement Waivers	42
	C. Contracting Procedure	51
	D. Implementation Schedule	52
	E. AID Financing Procedures	53
	F. Terminal Dates	53
	G. Control and Monitoring	53
	H. Evaluation	54
	I. Audit	54
XI.	CONDITIONS PRECEDENT AND COVENANTS	55
	A. Conditions Precedent	55
	B. Covenants	55
XII.	RECOMMENDATIONS	56
	A. Funding	56
	B. Procurement Waivers	56
	C. Conditions Precedent to Disbursement	57
	D. Covenants	58

ANNEXES

- A. GRANT APPLICATION
- B. GRANT AUTHORIZATION
- C. SECTION 611(e) CERTIFICATION
- D. STATUTORY CHECKLIST
- E. SUMMARY OF INSTALLED GENERATING CAPACITY, PEAK LOAD, RESERVES
- F. PEAK DEMAND AND ENERGY (ACTUAL AND FORECAST)
- G. EXISTING GENERATING STATIONS
- H. CAPACITY ADDITION SCHEDULE
- I. LOAD-CAPACITY SITUATION
- J. PLANNED (CONTEMPLATED) CAPACITY
- K. COST ESTIMATE
- L. RATE TABLES
- M. ECONOMIC ANALYSIS
- N. ENVIRONMENTAL MONITORING PROGRAM
- O. UNIT 4 ENVIRONMENTAL FEASIBILITY STUDY
- P. UNIT 4 AMENDMENT - ENVIRONMENTAL CLEARANCE
- Q. PLANT SITE MAP
- R. OBI EVALUATION OF COMPETITIVE BIDDING IMPACT
- S. IMPLEMENTATION SCHEDULE
- T. LOGICAL FRAMEWORK

REFERENCES

1. AID Project Paper, "Egypt: Shoubrah El Kheima Thermal Power Plant, Project No. 263-0110", dated May 1979.
2. AID Project Paper, "Shoubrah El Kheima Thermal Power Plant, Amendment, Project No. 263-0030", dated June 1981.
3. AID Project Paper, "Shoubrah El Kheima Thermal Power Plant, Amendment, Project No. 263-0030", dated January 1984.
4. World Bank Staff Appraisal Report, "Egypt, Shoubrah El Kheima Thermal Power Project, Report No. 2446-EGT", dated June 5, 1979.
5. Overseas Bechtel Incorporated Report, "Shoubrah El-Kheima Power Station Unit 4 Feasibility Study Report", dated March 1984.

CONVERSION FACTORS

Power and Energy:

1 Kilowatt (kW)	= 1,000 Watts
1 Megawatt (MW)	= 1,000 Kilowatts
1 Kilowatt hour (kWh)	= 1,000 Watt hours
1 Gigawatt hour (GWh)	= 1,000,000 kWh

Pressure:

1 Atmosphere (atm)	= 14.7 pounds/square inch (psi)
--------------------	---------------------------------

Weight:

1 Kilogram	= 2.2 pounds (lbs)
1 Tonnes	= 1000 Kilograms = 2200 pounds

Area:

1 Hectare	= 2.47 Acres
-----------	--------------

Distance:

1 Meter	= 3.38 Feet
---------	-------------

Frequency:

1 Hertz	= 1 Cycle per Second
---------	----------------------

GLOSSARY OF ABBREVIATIONS

ADB	African Development Bank
AID	Agency for International Development (U.S.A.)
CIDA	Canadian International Development Agency
COFACE	Compagnie Francaise d'Assurance Pour Le Commerce Exterieur (France)
EEA	Egyptian Electricity Authority
EEC	European Economic Community
EGPC	Egyptian General Petroleum Company
EIB	European Investment Bank
GEEC	General Egyptian Electricity Corporation
GI	Government of Italy
GLC	Ground Level Concentration
GOE	Government of Egypt
IBRD	International Bank for Reconstruction and Development (World Bank)
IDA	International Development Association
MEE	Ministry of Electricity and Energy
MSCM	Million Standard Cubic Meters
NAAQS	National Ambient Air Quality Standards
NECC	National Energy Control Center
OBI	Overseas Bechtel, Incorporation
OECE	Overseas Economic Cooperation Fund (Japan)
PPC	Petroleum Pipeline Company
SAS	Standardized Accounting System
S&P	Sanderson & Porter
USEPA	United States Environmental Protection Agency
UPS	Unified Power System

EGYPT: SHOUBRAH EL KHEIMA THERMAL POWER PLANT
AMENDMENT NO. 3

SUMMARY AND RECOMMENDATIONS

1. Grantee: The Government of the Arab Republic of Egypt (GOE). The Grant Application is attached as Annex A.
2. Grant Amount: U.S. \$55 million, increasing Grant No. 263-0030 from \$208 million to \$263 million.
3. Implementing Agency: The Egyptian Electricity Authority (EEA), a separate entity within the Ministry of Electricity and Energy.
4. Terms to the Implementing Agency: A loan to the the Egyptian Electricity Authority on terms satisfactory to AID.
5. Project Amendment Purpose: To augment the electricity generating capacity of EEA to meet increasing power and energy requirements of consumers throughout Egypt.
6. Project Amendment Description: Engineering and construction of the fourth 315 MW power generating unit for the 1260 MW thermal power plant to be located approximately five miles north of Cairo on the east bank of the Nile River, together with necessary transmission linkages and technical assistance.
7. Purpose of Grant Amendment: To amend the project description to include a fourth 315 MW generating unit to complete development of the Shoubrah El Kheima site to its full capability of 1260 MW and to increase AID funding to the project.
8. Total Project Cost: Total Project cost (including interconnection), both foreign exchange and local currency equivalent is \$918.7 million. AID will finance foreign exchange costs up to \$263 million under this authorization.
9. Environmental Considerations: The environmental impact of the plant on air and water quality have been addressed and satisfactory mitigation actions have been included in the project.
10. Source of U.S. Funds: Fiscal Year 85 Economic Support Funds.
11. Statutory Requirements: All statutory criteria have been satisfied; see Annex D.
12. Grant Application: The GOE has requested an additional AID grant for this project to assist in financing the foreign exchange costs of the Project. The application is attached as Annex A.

13. Project Committee Recommendation: Approve the waiver of AID competitive procurement procedures to permit the use of the present equipment suppliers and engineering consultant and authorize an Amendment to Grant 263-0030 to increase the Grant funds from \$208 million to \$263 million, in accordance with the terms and conditions set forth in the draft Grant Authorization Amendment which is appended hereto as Annex B.

14. Project Committee:

USAID/Cairo

Project Chairman: John P. Hunt

Project Committee: Joesph Pastic DK/ID
John Starnes DR/UAD
Kevin O'Donnell LEG
Thomas Johnstone FM/FO
Mona El Shafei DPPE/PO
Khaled Sherif DPPE/PAAD

I. INTRODUCTION

1.01 Studies made by EEA of their power and energy requirements in the mid 1970's, confirmed by their consultant and reviewed independently by the World Bank, forecast an annual load growth of 12 to 15 percent over the next decade, and a serious deficit in power generation capability in the mid-1980's which could act as a brake on economic development.

1.02 On July 19, 1979, AID authorized a grant of \$100 million to the Government of Egypt to assist in financing the foreign exchange costs of engineering and constructing a 600 megawatt (MW) thermal power plant, expandable to 900 MW, to be located on a site at Shoubrah El Kheima in Cairo, Egypt. The agreement was signed on August 29, 1979. A detailed appraisal of the project is included in the Project Paper, "Egypt: Shoubrah El Kheima Thermal Power Plant, Project No. 263-0110, May 1979."

1.03 The World Bank Group (IBRD and IDA) and four other multilateral and bilateral donors are also providing financing for the project. They included the European Economic community (EEC), the European Investment Bank (EIB), the Japanese Overseas Economic Cooperation Fund (OECF) and the African Development Bank (ADB).

1.04 The implementing agency for the project is the Egyptian Electricity Authority (EEA), a separate entity of the Ministry of Electricity and Energy (MEE), responsible for the generation and transmission of electricity to Egypt.

1.05 The AID grant of \$100 million was based upon a project foreign exchange cost estimated at \$387.8 million and local currency cost of \$ 78.1 million. AID's grant was to be used to finance the dollar costs of consultant engineering services for the planning and engineering of all facilities; preparation of bid documents and procurement services related to plant and equipment, materials and related civil works construction services; supervision of installation, erection and civil works construction services; acceptance testing and start-up of the plant; assistance and training during initial commercial operations; and to finance major components of power plant equipment.

1.06 EEA competitively selected the U.S. consulting firm Overseas Bechtel, Inc. (OBI) to provide engineering, procurement, construction management, start-up and training services for two nominally rated 300 MW generating units and engineering design of a

third nominally rated 300 MW generating unit. The contract was signed in December 1979 and after amendment of certain terms and conditions to comply with AID's requirements, the contract was approved by AID and subsequently by the Egyptian Council of State in May 1980. On April 15, 1980 EEA advised the co-financiers of their intent to include in the OBI contract, procurement, construction management, start-up and training services for the third 300 MW generating unit.

1.07 OBI prepared a conceptual design of a 945 MW plant, consisting of three (3) 315 MW units, each of similar design, and a procurement packaging plan for plant equipment and services, with due regard for the different source and origin requirements of the various co-financiers of the project. OBI's Preliminary Design Report was issued in August 1980.

1.08 At a co-financiers' meeting in Cairo in September 1980, OBI presented a proposal which would reduce the schedule for the first unit to 58 months as well as significantly reducing the capital cost of the project with OBI performing critical path detailed design and assuming additional procurement responsibilities for critical items for major equipment which would allow earlier design of the critical civil works.

1.09 OBI estimated the total cost of the 945 MW plant to be approximately \$640 million, not including interest during construction. The OBI Preliminary Design Report and cost estimate, based on the 58-month schedule and OBI's expanded engineering role was accepted by EEA and the co-financiers in September 1980.

1.10 In October 1980, following discussions with EEA, OBI proposed to further reduce the schedule to 51 months. This "fast track" schedule was approved by the co-financiers. EEA authorized OBI to proceed on the "fast track" schedule to complete Unit 1 for commercial operation in January 1985, 51-months from October 1980, the start of the drafting of commercial terms and conditions and technical specifications for the Contract Packages or Purchase Orders. Completion of units 2 and 3 would follow the first unit by nine months and fifteen months, respectively, i.e. Unit 2 in October 1985 and Unit 3 in April 1986.

1.11 EEA and OBI completed negotiations for the expanded OBI services and in June 1981, the GOE requested AID to provide additional Grant funds in the amount of \$90 million to assist in financing the expanded scope of the project. A detailed appraisal of the expanded project was included in the paper "Shoubrah El Kheima Thermal Power Plant, Amendment, Project No. 263-0030, dated June 1981."

1.12 On August 25, 1981 AID authorized an additional \$90 million grant to the GOE and the Grant Agreement was amended on August 29, 1981 to provide the additional foreign exchange financing for the expanded scope of OBI's services and to finance major equipment packages for the expanded 945 MW plant. OBI's Contract with EEA was amended on April 1, 1982 and the amendment was approved by USAID on April 21, 1982.

1.13 A total of 39 Contract Packages and Purchase Orders were awarded for equipment, material and services required for the construction of the plant. Foreign exchange funding for the Contract Packages and Purchase Orders has been provided by six (6) multi-lateral and bi-lateral donor agencies. EEA has provided local currency funding for the contracts and orders requiring local currency.

1.14 The co-financiers met in Cairo in June 1982 to discuss the transmission connection of the plant to the Unified Power System (UPS), to define the procurement packages and to allocate financing subject to approval by each co-financier. Foreign exchange financing for the transmission interconnection was provided by AID, ADB, the Canadian International Development Agency (CIDA) and Compagnie Francaise d'Assurance Pour Le Commerce Exterieur (COFACE). EEA provided local currency funding for the contracts and orders requiring local currency.

1.15 In March 1984, the GOE requested AID to provide additional grant funds in the amount of \$18 million to complete the foreign exchange funding shortfall associated with the contracts funded by AID. A detailed appraisal of the funding shortfall is included in the paper "Shoubrah El Kheima Thermal Power Plant, Amendment 2, Project No. 263-0030, dated January 1984." On April 17, 1984 AID authorized an additional \$18 million grant to the GOE. The Grant Agreement was amended on May 14, 1984 to provide the additional foreign exchange financing to fully fund the three unit Project.

1.16 Recent studies of growth in peak demand and energy consumption indicate a serious deficit in electric power generating capacity exists which, if not corrected, could seriously impede the economic development of Egypt. OBI has studied the feasibility and performed preliminary design for adding a fourth generating unit on the Shoubrah El Kheima plant site duplicating the three existing units and has concluded that a fourth unit is technically and environmentally

feasible. The fourth unit would fully utilize the remaining site and common facilities and would require a minimum of plant service facility expansion. The construction cost and schedule would provide maximum economic benefits when compared to other alternatives.

1.17 OBI has estimated the total cost of Unit 4 to be \$156 million based on a 32-month schedule which is in turn based on extension of all existing contracts and purchase orders thereby assuring duplication of Units 1, 2 and 3. The Foreign Exchange cost is \$135 million. AID's portion of the Unit 4 cost is \$55 million. All local currency needs, currently estimated at LE 15 million will be provided by the GOE.

1.18 On October 29, 1984, the GOE requested AID to provide additional grant funds in the amount of \$60 million to assist in the construction of a fourth 315 MW generating unit at Shoubrah El-Kheima. On March 13, 1985, AID announced its intention to provide up to \$60 million to finance part of the \$156 million cost of the fourth 315 MW generating unit with the balance being funded by other international donors.

1.19 The co-financiers met in Cairo in April 1985 to discuss the feasibility of constructing a fourth unit at Shoubrah El Kheima, to define the procurement packages and allocate financing subject to approval by each co-financier. Since IBRD funding will not be available for Unit 4, those contracts previously financed by the IBRD will be funded by AID, ADB, EIB, OECF and the Government of Italy (GI). The co-financiers also discussed the implementation procedures and recommended utilization of the same consultant, suppliers and contractors as were utilized for Units 1, 2 and 3 except for the shoreline development work which is not on the critical path for operation of the fourth unit.

II. NEED FOR ADDITIONAL GENERATING CAPACITY

A. Introduction

2.01 The Egyptian Unified Power System (UPS) is composed of more than 120 generating units in hydro, steam and gas turbine plants from Aswan to the Mediterranean Sea and the Suez Canal. The development of the installed generating capacity, the maximum demand and installed (nameplate) reserves from 1952 through 1984 are summarized in Annex E. The generating units are interconnected through an extensive high voltage network of transmission lines. Partly because of the high rate of growth in demand and consumption, the power system due to its configuration and low efficiency, as calculated from EEA reports, is characterized by inordinately high energy losses, low voltage and frequent outages caused by equipment failure. In recent years, the inability to add new generating capacity to meet customer demands has resulted in prolonged periods of low voltage (brownouts) and low frequency and, on many days, interruption of service (blackouts). Unless sufficient generating capacity can be installed in the next several years, Egypt's economic development will be threatened.

B. Consumption and Supply

2.02 The annual growth in peak demand and energy consumption over the past five years has averaged 11.2% and 12% respectively. This growth in demand and consumption is the result of population growth, intensive industrial and agricultural development programs, rural electrification and urban electric distribution rehabilitation particularly along the Suez Canal. The most recent forecast of annual demand and consumption, Annex F, indicates a gradual tapering off from the current 13 percent growth to an annual growth of about six percent in the early 1990's based primarily on the results of the intended conservation program.

2.03 While the total installed generating capacity (based on nameplate ratings) of the UPS is nearly 7000 MW, only 72 percent is available to meet customer requirements due to capacity limitation and derating of the generating units and their auxiliaries. Annex G lists the existing generating plants by zone, type of generation and show both nameplate capacity and available capacity. The hydro capacity is being further derated as a result of the unprecedented drought in

East Africa which has reduced the water in storage, and water level, in the High Dam Lake. Planned and unplanned outages, historically averaging 30 percent of the available capacity, further reduce generating capacity.

2.04 Generating capacity currently under construction and to be completed prior to 1989 will not significantly improve the inadequate generating facilities. The GOE has had limited success in attracting financial assistance for new base load generating capacity of the magnitude required to meet the anticipated requirements beyond 1986. The most recent generating units committed to construction included Abu Sultan Unit 4 financed by AID, a steam turbine unit for Ataka Unit 3 and gas turbine units at Dammanhour and Wadi Hoff financed through suppliers credits. The GOE's ability to finance substantial additional base load generating capacity, in a timely fashion absent donor assistance, is doubtful.

2.05 A reliable power system is able to provide sufficient generating capacity to meet customer demands and provide for planned maintenance of generating units and the unplanned coincidental outages of several major generating units. Based on EEA's historical data, an average of 15 percent of available capacity is out of service at any given time for scheduled maintenance and an additional 15 percent of available capacity is out of service for non-scheduled reasons. An absolute minimum reserve capacity, equal to 30 percent of the estimated peak demand will assure a minimally reliable generation supply.

2.06 The lack of generating reserves is already evident. On 139 days in 1984, EEA was compelled to shed customer loads varying between 400 to 700 MW. On several occasions up to 1500 MW was shed. EEA attempts to limit system frequency deterioration to 49.6 Hertz (normal 50.0 Hertz). Prolonged operation at frequencies of this level or below could damage the modern generating units and customer owned equipment. In 1984 and for the foreseeable future, EEA when experiencing supply shortages will allow system frequency to deteriorate to 49.6 Hertz (120 MW reduction) and will then shed residential customer load in rural areas. The shedding is rotated among areas to minimize the duration of outage to any customer. For shortages exceeding 400 MW industrial shedding becomes inevitable. EEA is also pursuing cutbacks in street lighting and partial interruptions in service to the Kima Fertilizer Plant in Aswan and the Aluminum Plant in Nag Hammadi. In addition the GOE has initiated a campaign to encourage customer energy conservation.

2.07 The EEA's planned additional capacity, presently under construction, is not sufficient to assure a reliable power supply since there will only be 17 percent reserve available in 1985, nine percent available reserve in 1986, two percent available reserve in 1987 and with no reserve and insufficient capacity to meet customer demands predicted for 1988 and beyond. The Capacity Addition Program is summarized in Annex H. The capacity reserves based on the load forecast and existing and new generation scheduled to come into service indicate that a shortage of capacity will exist for the foreseeable future with no reserve capacity, a serious situation if Egypt's economic growth is to continue. An analysis of the Load-Capacity Situation is summarized in Annex I.

C. Capacity Addition Options

2.08 The need for additional capacity, to be in service by mid 1988, is critical and EEA is considering a number of activities for adding capacity to meet their generating requirements (Annex J) and thereby improve the reliability of the Unified Power System. Considering the peaking capacity available at the High Dam, base load capacity additions are essential.

2.09 EEA has in the past and may in the future resort to the installation of Gas Turbines to eliminate imminent capacity deficiencies accepting their high operating costs for the advantage of short installation time. Gas Turbines have inherent high operating costs and are intended for use as "peaking" generation. EEA is presently operating Gas Turbines as "base load" generation until sufficient base load steam turbine generators can be placed in service. If gas turbines are to be operated as base load units, it is often advantageous to add heat recovery boilers which produce steam from the turbine exhaust gases and pass the steam through steam turbine generators to generate additional power and energy. AID has financed a study to determine the technical, economic and financial feasibility to convert the AID-financed Talkha Gas Turbine Plant to such a Combined Cycle Plant gaining an additional 90 MW of generating capacity. The earliest the Combined Cycle Plant could deliver energy to the Unified Power System would be 1989. Simple cycle gas turbines should only be a capacity alternative where no other capacity alternative is available and the installation should provide for future modification for combined cycle operation.

2.10 Consideration is being given to the rehabilitation of generating capacity which, due to the condition of the physical plant, is unable to operate at design capacity and efficiency and at normal industry levels of availability. EEA has taken action to

rehabilitate specific equipment at Cairo West, El Tebbin, Cairo South, Cairo North and Siouf Power Stations. These efforts at rehabilitation, while achieving some improvement in unit capacity have not resulted in substantial overall improvement in the availability of the units to supply energy. Any long-term improvement in capacity and availability must be viewed in the much broader context of plant and operator upgrading based upon a comprehensive analysis of each plant. EEA has requested AID financing of technical assistance for rehabilitating Cairo West, Cairo South, Suez, Dammanhour, Kafr El Dawar and Talkha thermal power plants. This assistance would be to identify economically sound programs from which detailed specifications and implementation schedules for each plant upgrading would be developed. Any improvement realized, at best, could only be considered as a medium term partial solution since many of these units are small and as EEA's system grows should be retired.

2.11 Rehabilitation of hydroturbines at the Aswan Hydroelectric Power Station and installation of Low Head Hydro Generating Units on the Nile would improve efficiency and increase the energy supply. Upon completion of the High Dam, the hydraulic head at the Aswan Hydroelectric Power Station was reduced by approximately 30 percent reducing the plant power output by 145 MW, 42 percent of the original plant rating. Replacement of the Kaplan runners with runners designed for the existing head would recover nearly 50 percent of the lost output. If a decision was made to proceed with the replacement of these runners, the first runner could be delivered to the station within three years and replacement completed within six years. While studies have identified approximately 500 MW of Hydro capacity potential at existing or contemplated barrages along the Nile, only projects that would provide some 300 MW of hydro capacity are currently being contemplated. However, studies of the barrage structures and engineering of the power house installation, followed by construction, would require 4 to 7 years and are, therefore, not a viable alternative to contribute to reducing the existing capacity deficiency. However, in the long run, the additions would save substantial amount of Egypt's gas and oil resources.

2.12 The most viable long term solution to alleviate the capacity deficiency involve the installation of base load steam turbine generation either at new sites or at existing power stations. The decision to develop a new site would require the selection of an architect/engineer to perform the feasibility studies associated with site selection, unit sizing, fuel selection and transmission facilities, selection of a consultant to provide

engineering and construction monitoring services, specification preparation and negotiation of equipment and construction contracts. This initial phase would require 3 years. Site development, construction and start-up of the first unit would require an additional 4 years.

- a. EEA initiated a limited feasibility study (Canadian financed) in January 1985 for a 600 MW Combined Cycle plant on the Mediterranean Sea. The 400 MW gas turbines would be in service in 1989 with the combined cycle addition to be complete in 1990. The study also provides for the future addition of a 600 MW conventional thermal plant. The study should be completed in mid 1985.
- b. EEA initiated a feasibility study (Japanese financed) in January 1983 for a 1,200 MW power station at Ayn Musa in the Sinai. The study was completed in January 1984. Financing for this plant has not been secured.
- c. EEA initiated a feasibility study (AID financed) in March 1985 for a 1,200 MW power station in the Delta. The study should be completed by late 1985.

However, due to the engineering and construction time requirements, the plants resulting from the Japanese and AID studies would not be delivering initial generation to the UPS before 1992 at the earliest.

2.13 The above considerations are not viable alternatives to meeting the power and energy shortage beyond 1987 since time requirements will not result in capacity being added to the UPS to meet the 1988 shortage.

D. Alternatives to Adding Generating Capacity

2.14 As indicated in Section 2.02 conservation practices resulting from a combination of increased tariffs to consumers and improved efficiency if accomplished could forestall the need to shed substantial blocks of customer load but would not be a viable long term solution to the development of a reliable power system. However, the savings to the Government of Egypt could be enormous. Implementation of such practices continues to be the central focus of our policy dialogue with the GOE.

2.15 Due to subsidies, rates for electrical energy in Egypt are among the lowest in the world. This encourages wastage and reduces the incentive of users, particularly large industrial users, to

modernize their processes and improve the efficiency of their operation. EEA is attempting to encourage customer conservation through tariff adjustments which indirectly encourages customers to consciously adjust their consumption habits to reduce their electric bill. Past tariff increases in low, medium and high voltage customer classifications, while important and positive steps to more realistic pricing, have not been of sufficient magnitude by themselves to encourage customer conservation. Proposed tariff increases to be implemented in mid 1985 are expected to encourage some consumer conservation but rates will still be far below the unsubsidized level. Nevertheless, at this early stage in tariff increases, the long-term effect of tariffs on customer consumption cannot be reliably predicted because tariff adjustments take considerable time to work through the system to influence consumer behavior even if tariffs are raised to optimum levels.

2.16 A program to improve the efficiency (power factor) of the Unified Power System through the planned installation of capacitors on the distribution system would improve voltage levels, reduce losses and release substantial generating and system capacity presently utilized to supply losses. Preliminary estimates of EEA's capacitor requirements to improve the system efficiency from 75 percent to 95 percent would indicate a need to install some 4,000 MVAR's of capacitors which would possibly release some 400 MW to 500 MW of existing generation. If EEA were to embark on a capacitor installation program, the initial benefits would appear with the first installation in the second year of the project and the full benefits of the program would be realized upon completion of the project in the fourth year. USAID has discussed a capacitor installation project with EEA and would recommend a study to quantify benefits to be derived from installation of capacitors on the distribution system.

2.17 The installation of a steam turbine generator at an existing plant site is the quickest way to add base load capacity to the UPS particularly if mobilized contractors or contractors familiar with the existing plant are utilized for its design, supply and construction. EEA has been reviewing for the past year a feasibility study to add a fourth unit at Shoubrah El Kheima Thermal Power Plant duplicating Units 1, 2 and 3 which could be in service in 1988 and a technical proposal for supplier financing of a 300 MW generating unit to be installed at the Dammanhour Power Plant with an option for financing two additional units, one at Ataka and the other at Assuit. Only at Shoubrah El Kheima are there contractors partially mobilized and available contractors familiar with the existing plant under construction. On the Dammanhour project,

contractors have not been selected. It is not reasonable to expect that this unit could be on line before 1989, one year following Shoubrah El Kheima Unit 4..

2.18 The addition of a fourth generating unit at Shoubrah El Kheima Thermal Power Plant, duplicating Units 1, 2 and 3 which are nearing completion, has been chosen by EEA as the highest priority for adding capacity to their system.

III. THE PROJECT

A. General

3.01 The project is basically as described in the original Project Paper of May 1979, and the Amended Project Papers of September 1981 and January 1984. The proposed Amendment increases the size and capacity of the project and provides for engineering, procurement of equipment and construction of a fourth 315 MW generating unit increasing the total capacity of the plant to 1260 MW. The fourth Unit will consist of a nominally rated 315 megawatt reheat turbine-generator with associated boiler, condensing and feedwater heating systems, plus ancillary mechanical and electrical auxiliary supporting systems, all duplicating the equipment and systems provided for Units 1, 2 and 3.

3.02 The additional AID Grant assistance will finance:

- a. The foreign exchange costs for engineering, procurement, construction management, start-up and training services for the fourth 315 MW generating unit.
- b. The foreign exchange costs for design, supply and erection of major equipment packages for the turbine-generator, boiler feed pumps, condenser and heaters, panels and controls, water treatment facilities and reinforcing steel for the fourth 315 MW generating unit.

B. Purpose

3.03 The purpose of the project remains to augment the electricity generating capacity of EEA to meet increasing power and energy requirements of consumers throughout Egypt.

Cost Estimate

3.04 A cost estimate for the Unit 4 addition was prepared in March 1984 by EEA's Project Consultant, OBI. The estimate was based on Unit 4 duplicating Units 1, 2 and 3 with equipment materials and services being provided by Units 1, 2 and 3 suppliers and contractors. EEA obtained assurance from all major equipment and services suppliers in 1984 and again in early 1985 of their willingness to provide equipment, material and services for Unit 4 at Unit 3 price levels or unit rates of 1982. The project cost estimate is based on a 32-month schedule commencing with OBI's

authorization to proceed until initial operation of the generating unit. Table III-1 presents a summary of project costs. A detailed cost estimate for Unit 4 is shown in Annex K.

TABLE III-1
SUMMARY OF COST ESTIMATES
(Expressed in Equivalent U.S. \$ - MILLIONS)

	<u>UNITS 1,2 AND 3</u>		<u>UNIT 4</u>		<u>TOTAL</u>
	<u>FOREIGN</u>	<u>LOCAL</u>	<u>FOREIGN</u>	<u>LOCAL</u>	
Equipment, Materials, Supplies, Construction Services	426.8	91.8	118.8	17.8	655.2
Technical Assistance	78.1	13.5	10.2	3.3	105.1
Contingency	<u>12.7</u>	<u>2.0</u>	<u>6</u>	<u>-</u>	<u>20.7</u>
Power Plant Subtotal	517.6	107.3	135.0	21.1	781.0
Equipment, Materials, Supplies, Construction Services	98.3	23.9	5.0	0.6	127.8
Contingency	<u>7.8</u>	<u>2.1</u>	<u>-</u>	<u>-</u>	<u>9.9</u>
Interconnection Subtotal	<u>106.1</u>	<u>26.0</u>	<u>5.0</u>	<u>0.6</u>	<u>137.7</u>
Project Totals	623.7	132.3	140.0	21.7	918.7

D. Project Design

3.05 A logical framework showing the Project design is included as Annex T. The only changes in the logical framework are the Project Inputs and Outputs.

E. Section 611(a) Requirements

3.06 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. The project is an extension of the original project which was based upon sound engineering analysis initially performed by Sanderson & Porter, Inc., and

reviewed and confirmed by Overseas Bechtel, Inc., the Consulting Engineer for the project. The Mission has reviewed the proposals for engineering and other plans and finds them to be acceptable and has reviewed the estimated costs and finds them to be reasonably firm within the meaning of the statutory requirements.

IV. TECHNICAL ANALYSIS

A. Site

4.01 The Shoubrah El-Kheima Thermal Power Plant is located in the Governate of Kalubia on the east bank of the Nile River. The site, shown in Annex Q, is some 10 kilometers (6 miles) north of the main business district of Cairo. The site occupies a total area of approximately 8.4 hectares (21 acres). The power block, triangular in shape and occupying an area of 6 hectares (15 acres), extends some 375 meters along the Nile River east of the Corniche with the southern boundary extending eastward from the Nile some 334 meters to the General Factories Road which forms the northeast boundary. Fuel storage occupies 1.4 hectares (3.5 acres) along the northeast side of General Factories Road. The water intake structure complex and Administrative Building will occupy 1.0 hectare (2.5 acres) between the Corniche and the Nile River.

4.02 The shoreline along the Nile River will be extended to the north from the existing water intake structure to provide space to accommodate the administration building with parking space as well as the circulating water intake structure for Unit 4. The shoreline extension will be a precast platform deck on precast pretensioned hollow core concrete piles.

4.03 A pedestrian overpass for personnel access to and from the plant over the Corniche Road extension will be provided. The overpass will be of precast, pretensioned construction and will be provided with concrete stairs and handrails.

4.04 The existing boundary wall fence including gates and guard posts will be extended to encompass the changed plant layout which includes Unit 4. In the area of the Unit 4 stack, the fence will encroach on the General Factories Road. The road has been closed since the beginning of construction and EEA is taking action to permanently close the road between the plant and the fuel storage tanks. A Condition Precedent to Disbursement will require evidence that EEA has legal jurisdiction over all rights-of-way necessary for the plant facilities and transmission connection to the UPS.

B. Physical Plant

4.05 The physical plant is basically the same as described in the original and amended Project Papers of May 1979, June 1981 and January 1984 except that the scope now provides for construction of a 1260 MW plant rather than a 945 MW plant.

4.06 The Unit 4 turbine-generator and steam-generator together with their accessories, condenser, pumps, feedwater heaters, etc. will be physically located in an extension, to the north, of the existing Unit 3 open turbine deck and open boiler structure. A new control room will be provided similar to that provided for Units 1, 2 and 3. Space will be provided to relocate Unit 3 controls to this new control room at a future date, if desired.

4.07 All turbine-generators, including Unit 4, will be outdoor design, double-flow, tandem-compound units with a guaranteed rating of 315,000 kW at 170 atm (2500 psi.) and 538 °C/538 °C (1000 °F/1000 °F). The generator will be rated at 437,500 kVA, 50 Hz, 20,000 volts at 0.8 power factor, 0.58 short-circuit ratio with hydrogen cooling at 4.0 atm (60 psi).

4.08 All steam generators will be outdoor design, drum-type, natural gas or mazout (No. 6) oil fired, pressurized furnace units consisting of an economizer, primary and secondary superheaters, and reheater. The units will have a guaranteed steam output of 297.8 kg/sec (655 pounds/sec) at 184.5 atm (2712 psi) and 540.6 °C (1005 °F) with feedwater at 252 °C (486 °F). Reheat will be to 540.6 °C (1005 °F).

4.09 All condensers will be single pass, single pressure type, with divided water box. Nile River water will be used as cooling water. The cooling water will be taken from the Nile River by vertical pumps in a new circulating water intake structure. The new intake structure and pump house for Unit 4, a reinforced concrete structure on piles similar to the intake structure for Units 1, 2 and 3, will be constructed north of the present intake. A new traveling screen and screenwash system will be supplied. Prefabricated concrete pipe will be used for the circulating water supply and discharge lines.

4.10 The chlorination system is adequate and will require only the addition of a chlorine line to the new circulating water pump house to provide treatment from the existing equipment.

4.11 The additional switchgear needed to operate Unit 4 will be housed in the switchyard building which will be extended one extra bay toward the north.

4.12 Unit 4 will share common facilities with the other three units, i.e., wastewater, boiler makeup water, sewage and sewage treatment facilities which will not require additions.

4.13 Provisions for cross-connecting Unit 4 closed cooling water and auxiliary steam systems with the common portions (e.g., air compressors, fuel oil heating) of the existing systems will be included.

4.14 The existing Gas Turbine will be connected to supply startup power in the event power is lost to the plant. The existing auxiliary boilers, which supply steam to steam driven auxiliaries during start-up, will be tied into the Unit 4 auxiliary steam system. Compressed air for Unit 4 will be provided by extending the existing service and instrument air headers and adding a new compressor and air dryer.

4.15 Unit 4 fire protection will be provided by enlarging the underground fire loop and supplying the new unit identical to the existing units. Fire protection internal to the Unit 4 power block will be a duplicate of the existing protection. Expansion of the existing foam system for protection of the Unit 4 fuel oil day tank will be necessary.

4.16 The domestic water system will be extended to supply Unit 4 as well as the relocated administration building. Upgrading of the domestic water system is not required.

4.17 The service gas systems have sufficient capacity to support the expansion with the slight possibility of additional nitrogen storage being required.

4.18 All underground utilities, such as storm sewers, sanitary sewers, potable water, fire protection, and gas and electrical ductbanks will be extended to handle the additional demands created by the addition of Unit 4.

4.19 Minimal additional spare parts will be required since the spare parts for Units 1, 2 and 3 will be available to meet the needs of Unit 4.

C. Transmission

4.20 Transmission system additions required to deliver the output of Unit 4 to the UPS will comprise one additional 220kV underground circuit from the Shoubrah El-Kheima plant to Bassous Substation and associated circuit breakers, protective relaying, controls and station service systems.

D. Operations and Maintenance Staffing and Training

4.21 To operate and maintain Unit 4, the plant staff will be increased by 34 operations and maintenance personnel. The operating staff will be increased by 20, from 111 to 131 employees to operate the unit on four shifts. The plant maintenance staff will be increased by 14, from 77 to 91 employees. The administrative staff will not be increased.

4.22 Since Unit 4 will be a duplicate of Units 1, 2 and 3, operators from these units will be available and will have gained experience on the other units prior to start-up of Unit 4. EEA will be required to commence training of the additional staff one year prior to the start-up of Unit 4. The additional operating staff will be trained using classroom instruction, simulator instruction and on-the-job study instruction and hands-on experience. A Covenant will be included in the Grant Agreement to assure that training of additional operators and maintenance staff will be initiated to assure trained and qualified operators to operate Unit 4 without effecting Units 1, 2 and 3.

4.23 OBI's Operations Advisors from Shoubrah El Kheima Units 1, 2 and 3 will be available for a period of 18 months after Unit 1 is placed in commercial operation and these services can be extended to advise EEA in the operation of Unit 4.

4.24 The start-up staff will be required for the duration of the start-up period of unit 4.

E. Fuel Supply

4.25 Unit 4 will be designed to burn natural gas as the preferred fuel. Mazout (No. 6 fuel oil) may be used to make up for shortages of natural gas with Solar (No. 2 oil) available as the ignition and warm-up fuel.

4.26 When operating at full-load capacity Unit 4 will consume 2.1 million standard cubic meters (MSCM) of natural gas per day from the Abu Maadi gas field in the Delta. The total natural gas required for full-load operation of all four units, including the gas turbine, will be 9 MSCM per day. An additional gas pressure reducing station will be required at Shoubrah El-Kheima. While the pipeline is designed to transport 10 MSCM per day, the PPC gas terminal capacity is limited to 7.2 MSCM per day.

4.27 EEA has obtained a written commitment from EGPC for a supply of 9 MSCM per day of natural gas beginning in 1989. This represents 100 percent of the requirements for four unit operation including the gas turbine. A Condition Precedent to Disbursement will require evidence that EGPC will deliver sufficient gas to the plant to permit EEA to operate the plant after 1986, under normal plant operating conditions, with no less than two units on gas at any time, and to operate after 1988, under normal plant operating conditions, with all four units on gas.

4.28 Alternatively, at full-load capacity Unit 4 will consume approximately 1,950 metric tons (tonnes) of oil per day. With all four units operating, the plant will consume 7,800 tonnes of mazout per day. The existing 16-inch pipeline has a maximum capacity of approximately 12,000 tonnes per day. Therefore, the pipeline supplying the station has ample capacity for four units, but additional pumps may be required at the Moustorod Pumping Station.

4.29 The current usable mazout storage capacity is approximately 47,000 tonnes in the two mazout storage tanks and 2,000 tonnes in each of the three day tanks. Total storage is approximately 53,000 tonnes. When Unit 4 is added, total storage will be reduced from a 9-day supply to a 7-day supply. Additional storage is maintained by PPC at the Moustorod Pumping Station. The pumping station has a flow range of 1,500 to 12,000 tonnes per day. At maximum flow these pumps can fill the onsite storage tanks in approximately four days.

4.30 A second fuel oil additive storage tank will be added to maintain the existing 13-day storage capacity for four units and one additive metering pump and two ignitor fuel oil pumps will be added for Unit 4. A new Unit 4 day tank will be added. The feed to Unit 4 from the main fuel oil storage system will be provided. The transfer pumps need no upgrading. Any future on-site storage will be integrated with the existing storage to provide a common system supplying all four units.

V. FINANCIAL ANALYSIS

A. General

5.01 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

5.02 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.

C. Budget

5.03 EEA's budget is prepared annually on a cash basis. The budget process begins in December of each year (mid-fiscal year). Revenues from electricity sales are forecast principally by the customer's account staffs of the five operating zones. EEA's National energy Control Center staff make independent forecasts of customer usage and the two forecasts are reconciled for budget purposes. Expenses are forecast by each Zone's operating organizations, based on anticipated production and investments in their respective Zones.

5.04 With the formation of Distribution Companies and the creation of the Egyptian Distribution Authority in 1984, EEA's budget no longer includes expenses or receipts for the Distribution Companies. Energy is sold to each Distribution Company at wholesale rates. Energy losses, the differences between energy generated and energy sold, as reported by EEA does not include distribution system losses.

5.05 The capital development (investment) section of the budget is prepared through coordination of plans of EEA's technical departments with the national 5-Year Plan as controlled by the Ministry of Planning.

5.06 The GOE's approval and inclusion of an EEA project in the 5-Year Plan represents the GOE's approval and agreement to commit funds over the 5-year period without prescribing specific amounts for each year of the plan.

5.07 The combined budgets for operation and investment are assembled in a preliminary projection and reviewed at Ministerial level in March. After the Ministry of Finance has determined the impact of the combined budget on the national economy and made obtained any necessary adjustments, the Budget for the coming Fiscal Year is then presented to the People's Assembly. After budget reviews by committees for two months, with possible changes, it is finally approved by the People's Assembly, about the end of the Fiscal Year. The approved budget is allocated between the Zones and administrative divisions and these allocations become the EEA budget for the Fiscal Year.

D. Tariffs

5.08 Electricity tariffs based on a 1970 study by Electricite de France remained unchanged from 1975 until January 1980 when changes were introduced for residential and small commercial customers. These increases were further adjusted in March 1980. In April 1982 following tariffs studies by Soferlec (Paris, France), tariffs were increased 5 to 20 percent, depending on the level of consumption, for High Voltage, Irrigation and Drainage customers and Medium and Low Voltage customers in the tariff classifications of Housing Company, Government and Public Utility, Private Sector, Lighting and Residential and Small Commercial except for those Residential and Small Commercial customers in the lowest consumption level. In November 1982 tariffs were increased by 60 percent for Kima Fertilizer and 50 percent Nag Hammadi aluminum. In April 1983, tariffs were again increased 5 to 20 percent, depending on level of consumption, for High Voltage, Irrigation and Drainage customers and Medium and Low Voltage customers in the tariff classifications of Housing Company, Government and Public Utility, Private Sector, Lighting and Residential and Small Commercial except for those Residential and Small Commercial customers in the lowest consumption level. In July 1983 the tariffs for several Very High Voltage, High Voltage and Medium and Low Voltage consumers, whose tariffs had not been increased since 1975, were raised by 15 percent. Between January and March 1984, tariffs to all customers, except those residential and small commercial consumers at the lowest consumption level were again increased 10 to 20 percent.

5.09 On March 12, 1985 the GOE Committee on Higher Policies and the Prime Minister approved tariff increases to all customer classes, regardless of consumption level, ranging from 10 to 60 percent to be implemented by the Ministry of Electricity and Energy between May and July 1985 with an additional increase of 15 to 50 percent to all customer classes to be implemented between April and July 1986. These proposed increases, if fully implemented, represent a modest but significant first step in a long term program to bring electricity tariffs to the unsubsidized price of electric energy. Implementation of these proposed increases has not been verified.

5.10 The existing and proposed selling prices of electricity are tabulated in Annex 1. The trend in average electricity prices is summarized in Table V-1.

TABLE V-1
TREND IN AVERAGE ELECTRICITY PRICES
(milliemes per kilowatt-hour - m/kwhr)

<u>Year</u>	<u>(m/kwhr)</u>	<u>Price Index</u> (1975 = 100%)
1975	8.94	100
1980	10.80	121
80/81	10.52	118
81/82	11.14	125
82/83	12.37	138
83/84	14.66	164
84/85	16.36*	183
85/86	22.35**	250
86/87	28.22**	316

Excludes wholesale price to distribution company.

*Forecast

**Proposed

E. Financial Reporting

5.11 Financial and accounting reports for each Zone and Administration Division of EEA are prepared monthly on a cash basis as compared with the fiscal year budget. The fiscal year budget is not subdivided into quarterly or monthly periods for meaningful comparative purposes. The Financial Statements are essentially a listing of cash flow transactions that have occurred during the year, although EEA does own assets, has incurred liabilities and has a stated capital. These reports present the past months and year to date performance.

5.12 The Financial Statements are prepared monthly in the format of the Budget and of the SAS accounting system. Zones report through their Presidents to the Chairman of EEA. The Headquarters staff of EEA prepares consolidated reports for the Chairman and a further consolidated quarterly report is prepared for the Minister of Electricity and Energy.

F. Financial Condition

5.13 EEA's operating revenues increased 34 percent in FY 83/84 and 24 percent in FY 82/83. Kilowatt hours sold increased 14 percent in FY 83/84 compared with an increase of 13 percent in FY 82/83. The major factor in the increases was the continued growth in sales of electric energy to all customer classes and at higher rates.

5.14 Revenues from sales to distribution companies rose by 33 percent in FY 83/84 on a 14 percent increase in Kwhr sales, and were up 32 percent in FY 82/83 on a 17 percent increase in Kwhr sales. The increases in revenues are primarily attributed to increased sales volume and higher rates that went into effect during the periods.

5.15 Revenues from sales to Very High Voltage, High Voltage and Medium Voltage customers served by EEA rose by 49 percent in FY 83/84 on a 14 percent increase in Kwhr sales, and were up 27 percent in FY 82/83 on a 4 percent increase in Kwhr sales. The increases in revenues are the result of increased sales at higher rates that went into effect during the periods.

5.16 Fuel expense increased 21 percent in FY 83/84 and 17 percent in FY 82/83. The FY 83/84 increase reflects a 3.4 billion Kwhr increase in thermal generation in FY 83/84 and a 3.2 billion Kwhr increase in thermal generation in FY 82/83. During these periods, EEA costs for Mazout (No. 6 Oil) was LE 7.5 per ton; Solar (No. 2 Oil) LE 40 per ton; and Natural Gas LE 6.6 per million cubic feet.

5.17 Net income for FY 83/84 of LE 4.6 million represents an increase of 22 percent. The net income for FY 82/83 of 3.8 million represents an 89 percent increase. These increases are mainly the result of the previously mentioned increases in operating revenue accompanied by smaller increases in operating expenses.

G. Financial Viability:

5.18 The present structure of electricity tariffs which result in the average price of electricity of 16 milliemes per kwhr and fuel prices for Mazout of L.E. 15 per ton is extremely low due to subsidization. The project, however, will provide a positive financial rate of return, based on these subsidized prices of, approximately eight percent. This rate of return analysis, Annex M, Table 3, Case A, is based on actual and planned capital expenditures and operation and maintenance expenses in constant 1985 prices, fuel

costs at the subsidized cost of Mazout of L.E. 15 per ton and the average price of electricity at 16 millimes per kwhr. It should be noted that current tariffs understate substantially the economic benefit value of electric power in Egypt. Future rate increases will of course increase the rate of return to EEA. Since EEA must make the necessary investments to meet future power demands and since it obtains financial support from the GOE, sufficient funds will be available to operate and maintain Unit 4.

H. Project Financial Plan

5.19 The sources of project financing previously secured for Units 1, 2 and 3 and for the construction of Unit 4 and associated transmission interconnection are summarized in Tables V-2 and V-3.

TABLE V-2

SOURCES OF PROJECT FINANCING FOR UNITS 1, 2, 3 AND 4
(Expressed in Equivalent U.S. \$ - MILLIONS)

	<u>UNITS 1, 2 AND 3</u>		<u>UNIT 4</u>		<u>TOTAL</u>
	<u>FOREIGN</u>	<u>LOCAL</u>	<u>FOREIGN</u>	<u>LOCAL</u>	
Estimated Cost	517.6	107.3	135.0	21.1	781.0
Funds Provided					
AID	200.7		55.0		255.7
IBRD	227.0				227.0
GI			9.0		9.0
EEC	25.2				25.2
EIB	29.1		22.0		51.1
OECEP	27.4		6.4		33.8
ADB	11.0		45.0		56.0
EEA		114.6	0.7	21.1	136.4
Total	520.4	114.6	138.1	21.1	794.2

TABLE V-3

SOURCES OF PROJECT FINANCING FOR TRANSMISSION CONSTRUCTION
(Expressed in Equivalent U.S. \$ - MILLIONS)

	<u>UNITS 1, 2 AND 3</u>		<u>UNIT 4</u>		<u>TOTAL</u>
	<u>FOREIGN</u>	<u>LOCAL</u>	<u>FOREIGN</u>	<u>LOCAL</u>	
Estimated Cost	106.1	26.0	5.0	0.6	137.7
Funds Provided					
AID	7.3				7.3
ADB	19.3				19.3
CIDA/EDC	41.0		5.0		46.0
COFACE	30.0				30.0
EEA	<u>16.9</u>	<u>26.0</u>	---	<u>0.6</u>	<u>43.5</u>
Total	114.5	26.0	5.0	0.6	146.1

5.20 AID has previously authorized \$208 million for the construction of Units 1, 2 and 3 and has committed \$197.2 million for consultant services and four major equipment contracts. Funds unobligated and available for contingencies total \$10.8 million.

5.21 The proposed \$55 million AID grant together with the uncommitted \$10.8 million from the 1984 grant, will be used to finance additional consultant services, amendments to six major equipment and material supply contracts (including spare parts) and contingencies required to complete the project.

5.22 The AID Financial Plan is summarized in Table V-4.

TABLE V-4

ALLOCATION OF A.I.D. FUNDS
(U.S. \$ - MILLIONS)

	<u>PREVIOUSLY ALLOCATED</u>	<u>TO BE OBLIGATED BY THIS AMENDMENT</u>	<u>TOTAL</u>
Consultant Services	76.4	10.2	86.6
Turbine Generator	79.7	26.8	106.5
Condensers and Heaters	16.3	5.6	21.9
Pumps	13.9	5.4	19.3
Panels and Controls	10.9	3.5	14.4
Water Treatment	----	2.5	2.5
Reinforcing Steel	----	1.0	1.0
Contract Audits	0.1	---	0.1
Contingency (Physical)	7.1	---	7.1
Contingency (Cost)	3.6	---	3.6
Total	<u>208.0</u>	<u>55.0</u>	<u>263.0</u>

5.23 The Grant Amendment will contain a Condition Precedent to Disbursement requiring that the funds, made available by AID to the GOE, will be loaned to EEA on terms and conditions satisfactory to AID. Recent Loan Agreements, approved by AID, have provided for repayment in 15 years with 25 semi-annual payments with the first payment of principal due two and one-half years after the first disbursement by AID with interest at the rate of eight percent per annum on the outstanding balance.

5.24 The Grant Amendment will contain a Condition Precedent to Disbursement requiring evidence of firm commitments for not less than 100 percent of the estimated foreign exchange required for Unit 4, aside from those funds provided by the AID grant, before AID funds will be released for equipment and material contracts.

5.25 A Condition Precedent to Disbursement will require that EEA provide evidence that all local currency financing for the construction of Unit 4 has been budgeted and will be available for expenditure.

I. Disbursement Period

5.26 Disbursement of the additional \$55 million in AID funds for consultant services, equipment and materials for Unit 4 will extend over 36 months from EEA's Notice to Proceed to commercial operation of Unit 4. The estimated disbursements over the implementation period are summarized below:

TABLE V-5

<u>DISBURSEMENT SCHEDULE</u>	
<u>(U.S. \$ - MILLIONS)</u>	
<u>Year-Quarter</u>	<u>Disbursement</u>
1986 - 1st	\$0.8
2nd	4.7
3rd	2.1
4th	2.0
	<u>\$9.6</u>
1987 - 1st	\$2.6
2nd	17.3
3rd	17.3
4th	3.2
	<u>\$40.4</u>
1988 - 1st	\$3.1
2nd	1.0
3rd	0.9
	<u>\$5.0</u>
Total	\$55.0

VI. ECONOMIC ANALYSIS

6.01 This amendment will add a fourth identical 315 MW generating unit to the three units already in operation or under construction at the Shoubrah El-Kheima site. The original project was undertaken on the basis of a 1978 study which demonstrated the need for the additional capacity. The Projects financial and economic feasibility and was the basis for a 1979 AID Project Paper appraisal and a 1979 World Bank appraisal which found Shoubrah El-Kheima to be the least cost alternative for meeting the projected power and energy requirements of Egypt at existing rate structures.

6.02 A 1984 feasibility study for the fourth unit at Shoubrah El-Kheima by Overseas Bechtel Incorporated (OBI) reports a serious projected peak demand power deficit in Egypt after 1986. The study bases its predictions on load forecasts by EEA, the World Bank and the International Atomic Energy Agency. Because Shoubrah El-Kheima Unit 4 is an extension of an existing project, it would enjoy important shadow cost advantages over gas turbines or other alternative projects for meeting incremental needs for power beyond 1987.

6.03 Given the projected need for the additional output of Shoubrah El-Kheima unit 4 and the desire and expectation that Egypt's economy will continue to expand at a moderate rate in the future, prompt completion of Shoubrah unit 4 will have particular value in enhancing reliability of the EEA grid beyond 1987. A reliable supply of electric power has strong direct economic benefits to industrial, agricultural, commercial and household activities. Since no system exists for priority load-shedding of low-value industrial customers (e.g., Kima fertilizer and Naga Hamadi aluminum companies), an excess of system demand leads to rolling blackouts and low voltage conditions throughout the power system that are highly disruptive and costly for high-value industrial and residential customers. Thus the addition is considered to be justified in terms of meeting Egypt's power and energy requirements.

6.04 Table 1 shows actual and estimated capital costs of the project in both current and constant 1985 prices. Annex M in tables 2 and 3 all values are shown in constant 1985 prices and are translated into Egyptian pounds. Costs are adjusted to reflect opportunity costs, with fuel valued at the estimated price for incremental exports of fuel oil. Thus the average tariff would have to increase to 91.5 millimes per kwhr to achieve a zero percent return. This implies that the current average tariff is only about 18 percent of what would be needed to cover the long-run marginal economic costs of supplying electrical power in Egypt.

6.05 Under existing conditions, though, the economic analysis undertaken proves that this project will provide a negative rate of return of approximately twelve percent. This rate of return analysis, Annex M, Table 3, Case B, is based on actual and planned capital expenditures and operation and maintenance expenses in constant 1985 prices, fuel costs at its world price of L.E. 230.4 per ton and the average price of electricity at 91 millimes per kwhr. This determination and the negative financial return derived indicate that USAID should continue its dialogue with the GOE on energy pricing and electricity tariff reforms. A covenant will be included in the Amendment to the Grant requiring EEA to covenant to periodically consult with AID on electricity tariffs and their impact on the financial viability of EEA.

VII. SOCIAL ANALYSIS

7.01 The May, 1979 Project Paper contains a detailed social analysis, the validity of which is not diminished by the addition of a fourth unit to the plant.

7.02 That analysis discussed employment opportunities and effects during construction of the plant. The construction of the fourth unit would provide employment for approximately 2000 skilled, semi-skilled and unskilled laborers primarily from private sector companies for two years and would continue to strengthen the local area economy as goods and services are traded for the continuing incomes.

7.03 The analysis commented on the employment effect of the plant when it is in operation and the permanent employment generated. The addition of a fourth unit would increase the work force by 34 employees for operation and maintenance of the plant.

7.04 The social analysis noted that the most significant effect of the project would be the long-term impact of adequate electricity on the Egyptian economy as a whole.

VIII. ENVIRONMENTAL ANALYSIS

- 8.01 In 1978, an Environmental Assessment of the Shoubrah El Kheima Thermal Power Plant was prepared by Sanderson and Porter, the feasibility study consultant. The major concern relative to plant operations on the environment dealt with air quality and the burning of mazout to fuel the plant. Additional studies of the effect on the environment were performed by the project engineer, Overseas Bechtel, Inc. for the design of the plant to assure compliance with environmental regulations of the IBRD and AID.
- 8.02 An environmental monitoring system at the plant site and three mobile monitoring stations adjacent to the site have been in operation since November 1984 collecting background air quality data. The monitoring stations monitor sulfur dioxide (SO₂), oxides of nitrogen (NO-NO₂-NO_x) and Ozone (O₃) and Particulates. Initial data from the monitoring stations indicate that the impact is less than forecast and the future impact with four units should not adversely effect the area around the plant. The status of the plant monitoring program is described in more detail in Annex N.
- 8.03 OBI has performed studies using the U.S. EPA Single Source atmospheric dispersion model to predict ground level concentrations for each applicable pollutant based on operation of four generating units with various combinations of oil and natural gas. The studies clearly show that even with a combination of three units burning oil and one unit burning gas the effect on the environment will be less than the limits established by environmental regulations. Gas sufficient to generate 500 MW is presently available for the plant. EEA has obtained a written commitment from EGPC to supply sufficient gas to operate all four units commencing in 1989.
- 8.04 Nevertheless, to assure compliance with clean air standards and maximize the use of natural gas, a Covenant will be included in the Amendment to the Grant requiring EEA to covenant to operate after 1986, under normal plant operating conditions, no less than two units on gas at any time, and to operate after 1988, under normal plant operating conditions, with all four units on gas.
- 8.05 The addition of a fourth generating Unit will not adversely impact the water quality discharges from the plant.
- 8.06 The Air and Water Quality Studies relating to the addition of Unit 4 are more fully described in Annex O.
- 8.07 The Environmental Coordinator has found the proposed Unit 4 addition to be in compliance with the requirements of 22 CFR 216, "AID Environmental Procedures", Annex P.

IX. MANAGERIAL/ADMINISTRATIVE ANALYSIS

A. Ministry of Electricity and Energy

9.01 Electric power was first introduced into Egypt in 1895. Through 1964, the generation, transmission and distribution of electric energy was the responsibility of a large number of independent governmental and private organizations. In 1964, the Ministry of Electricity was formed in accordance with Law No. 60 of 1963, which consolidated all individual electric generating facilities into a single state-owned and controlled organization. The Ministry of Electricity and Energy has continued to evolve to meet the expanding energy requirements of Egypt. The Ministry of Electricity and Energy directs and coordinates the activities of six Authorities each headed by a Chairman and a Board of Directors. The Ministry of Electricity and Energy is responsible for the establishment of energy policies in support of the GOE's overall plans for Egypt, development of 5, 10 and 20 year forecasts and plans and coordination between the Authorities.

B. Egyptian Electricity Authority

9.02 In 1965, Presidential Decree No. 3726 was issued establishing the General Egyptian Electric Corporation (GEEC) with authority to manage, operate and maintain power stations and networks and to construct facilities for the production, transmission and distribution of electric energy in all parts of Egypt. In 1976, the People's Assembly approved Law 12 which established the Egyptian Electricity Authority (EEA) as the successor to GEEC. The senior policy and decision making unit within EEA is the Board of Directors. The Chairman is appointed by Republican Decree. Members of the Board of Directors are appointed by order of the Prime Minister upon the recommendation of the Minister of Electricity and Energy.

9.03 EEA is the operating authority for the Ministry of Electricity and Energy and is responsible for planning, construction, operation and maintenance of thermal generating facilities; operation and maintenance of hydro generating facilities; and planning, construction, operation and maintenance of bulk power which constitutes the Unified Power System transmission facilities interconnecting the generating plants.

9.04 EEA is divided into four administrative division and five operational zones. The four administrative divisions are: Finance and Administrative Affairs, Operations, Studies and Research and Projects. The five operational zones are: Alexandria, Cairo, Canal, Delta and Upper Egypt.

C. Unified Power System

9.05 The Unified Power System (UPS) is operated as a multi-area system based on historical development of the network, operating experience, system structure and the territory covered by each operating zone. However, since all areas are integrated into a large system, economy and security of the major generation and transmission systems are evaluated on a total system basis.

9.06 The UPS is supervised and controlled by the National Energy Control Center (NECC) located in Imbaba northwest of Cairo. Information necessary for control of the interconnected system is transmitted from generating plants and substations by either microwave or power-line carrier to the NECC where on-line digital computers perform economic dispatch computations and automatic generation control, security assessment, post-disturbance review, and system state estimation; collect, compute, display, alarm and log all data necessary for the real-time supervision and control of the operation of the major generators and the 500 KV and 220 KV transmission systems.

D. Cairo Zone

9.07 The Cairo Electric and Gas Company was established in 1949 following the acquisition of the electrical system from a French company. In 1964 this company was integrated into GEEC as the Cairo Zone. The Cairo Zone is responsible for the operation and maintenance of all generation and transmission facilities in metropolitan Cairo and includes eight power stations with an installed capacity of 1,335 MW, 366 Kms of 220 KV transmission lines and 1,850 MVA of transformer capacity in substations which supply the 66 KV and 33KV subtransmission and 11 KV distribution networks.

E. EEA Project Team

9.08 EEA established a Project Team, reporting directly to the EEA Chairman, with authority to make day-to-day decisions and approvals. The team is composed of a Project Manager, Project Engineer, Procurement Specialist, Financial Manager and Legal Advisor. While many of the team members have been integrated into

the plant staff, the team will continue to manage the construction of Unit 4.

F. USAID

9.09 The Power Systems Group within the Office of Infrastructure Development, Development Resources Division will have monitoring responsibilities for AID. The Group is responsible for implementation of the original project and other projects in the electrical sector. This group has developed an excellent working relationship with all levels of the EEA. The assigned personnel possess extraordinary experience in the design, construction, operation and maintenance of electric power systems and management and administration of electric utilities.

X. PROJECT IMPLEMENTATION AND PROCUREMENT - UNIT 4

A. Implementation Plan

10.01 The project will be implemented by the same group in EEA that is implementing Units 1, 2 and 3. If the waivers requested herein are granted, the same consultant, equipment suppliers and construction contractors will be utilized. As shown by Table X-3 under these conditions the project will require 36 months to complete. If the requested waivers are not granted, the addition of Unit 4 will require approximately 51 months which would seriously affect the availability of power on the schedule outlined in Section II, B, above.

B. Procurement Waivers

10.02 Consulting Engineer. Overseas Bechtel Inc., is under contract to EEA to provide engineering, procurement, construction management, start-up and training services for Shoubrab El Kheima Units 1, 2 and 3. EEA has requested approval to negotiate an amendment to their contract to retain OBI's services for Unit 4. EEA has also requested that Unit 4 be eligible for AID funding from March 1, 1985. Retention of OBI would provide the Unit 4 phase of the project with the benefit of OBI's expertise in the details of this project that have been built up by its work on Units 1, 2 and 3, provide uniformity for all four units and services could continue without interruption which is necessary if additional capacity is to be added to EEA's system by mid 1988.

10.03 Table X-1 compares the time requirements for the competitive selection of the project consultant for Units 1, 2 and 3 (actual) and forecasts the time required, under the best of conditions, for competitive selection, versus OBI contract amendment to reach the stage where equipment procurement actions could be started. Selection of a different consultant would delay implementation of Unit 4 by a minimum of 11 months which would nullify economies to be gained through duplication of the present units and delay the badly needed unit. OBI was initially selected for units 1, 2 and 3 pursuant to A.I.D. Host-Country competition procedures. OBI would likely be selected under A.I.D. Host-Country competitive procedures for unit 4, since technical expertise (based partly on experience), not cost, is the major basis for selecting a technical services contractor.

TABLE X-1.

COMPARISON OF TIME REQUIREMENTS IN DAYS
FOR COMPETITIVE SELECTION OF CONSULTANT

<u>Steps in Procedure</u>	Shoubrah El-Kheima		
	<u>Units 1-2-3 (Actual)</u>	<u>Unit 4 (Competed)</u>	<u>Unit 4 (Extended)</u>
Preparation & Submission of Prequalification Data	27	30	0
Evaluation of Prequalification Data and Short-List Approval	39	30	0
Preparation and Submission of Technical Proposal	106	90	0
Evaluation of Technical Proposal and Contractor Selection	55	45	0
Contract Negotiations and Contract Execution	194	120	60
Engineering Design of Plant for Specifications	<u>202</u>	<u>90</u>	<u>30*</u>
Days	623	405	60
Weeks	89	58	9
Months	20.5	13.3	2.0

*Concurrent with Contract Amendment negotiations.

10.04 A.I.D. Handbook 11, Chapter 1, paragraph 2.4.2(e)
authorizes a sole source waiver for technical services where:

"The Borrower/Grantee desires to utilize a contractor previously engaged in the project for follow-on work and the contractor clearly has special capabilities by virtue of previous experience in the work but...the Contracting Agency did not advise all competing firms that a follow-on contract might result. A waiver on these grounds should be granted only after careful review of all pertinent facts..."

An additional ground for sole-source waiver, under subparagraph (b) of the same paragraph is that:

"Adherence to competitive procedures would result in impairment of the objectives of the United States foreign assistance program or would not be in the best interest of the United States."

OBI's special capabilities, through involvement in the earlier units, are clear. The delay inherent in competitive procedures, with OBI almost certain to be chosen anyway at the end of such process, would be inconsistent with the need, both on developmental, economic and political grounds, that Unit 4 be implemented promptly. Therefore, pursuant to these provisions, the Project Committee recommends the non-competitive selection of Overseas Bechtel Inc. to provide engineering, procurement, construction management, start-up and training services for Shoubrah El Kheima Unit 4 with costs incurred beginning March 1, 1985 to be eligible for funding. The Mission's Non-Competitive Review Board has (as required under ROA 113.8) been consulted and concurs that the non-competitive choice of OBI is justified.

10.05 Equipment and Materials: OBI has evaluated the impact of competitive bidding of each major contract on the overall project schedule, project cost, and operation and maintenance expense. Competitive bidding of all contracts could delay operation of Unit 4 by a minimum of eight to 12 months from the time bids are requested and increases project cost by \$15 to \$20 million. Competitive bidding of the Turbine-generator and/or Steam Generator could delay completion by eight to 12 months and bidding of other selected contracts could delay completion from three to eight months. OBI's evaluation is tabulated in Annex R.

10.06 Steam Turbine Generator Contract: The contract for the steam turbine generator was competitively bid and awarded to Westinghouse International Power Systems Company in 1981. The contract provided for design, supply and delivery to the site of three custom designed steam turbine generators, accessories and spare parts; the furnishing of all construction equipment and supervision for their erection, startup and testing. EEA has requested that AID waive competition and authorize amendment of the present contract to provide for the Unit 4 Turbine Generator. Westinghouse is reported to have agreed to supply Unit 4 at Unit 3 price level, i.e. \$27.6 million. OBI has compared the proposed Unit 4 price with current industry prices for similar turbine generators and has concluded that the Westinghouse price for Unit 4 is

reasonable. Competitive bidding of the turbine-generator would delay completion of the project by eight to 12 months and if a different turbine generator was selected there would be a major impact on engineering design and operator training and could result in additional costs estimated in excess of three million dollars being incurred. The change in design could have a major affect on the design of the balance of plant.

10.07 Condensers, Accessories and Heaters Contract: The contract for the condensers, accessories and heaters was competitively bid and awarded to Southwestern Engineering Company in 1982. The contract provided for the custom design, fabrication, testing and delivery to the site of three surface condensers, twelve low pressure and six high pressure feedwater heaters and three deaerating feedwater heaters and accessories, spare parts and engineering supervision during erection. EEA has requested that AID waive competition and authorize amendment of the present contract to provide for the Unit 4 condensers, accessories and heaters. Southwestern Engineering Company is reported to have agreed to supply duplicate equipment for Unit 4 at the same price level for Unit 3, i.e. \$5.6 million. OBI has compared the proposed Unit 4 price with current industry prices for similar condensers and heaters and has concluded that the Southwestern price for Unit 4 is reasonable. Competitive bidding of the condenser would delay completion of the project by six to eight months and a change in the design would impact the mechanical and piping and electrical and controls construction contracts. If a different condenser and heaters was selected, additional engineering design and spare parts costs estimated in excess of \$600,000 could result. The selection of the condenser and heaters would affect the final design of the turbine generator, boiler, foundations and piping.

10.08 Pumps Contract: The contract for pumps was competitively bid and awarded to Transamerica De Laval in 1981. The contract provided for the custom design, engineering, furnishing, fabricating, testing and delivery of six feed pumps with turbine drives, three feed pumps with electric motor drives and six vertical circulating water pumps, engineering supervision during startup, training and spare parts. EEA has requested that AID waive competition and authorize amendment of the present contract to provide for the Unit 4 pumps. Transamerica De Laval is reported to have agreed to supply duplicate equipment for Unit 4 at escalated Unit 3 prices i.e. \$5.4 million. OBI has compared the proposed Unit 4 price with current industry price for similar pumps and drives and has concluded that the Transamerica De Laval price for Unit 4 if reduced to \$4.2 million would be reasonable. Competitive bidding of

the pumps would delay completion of the project by six to eight months and a change in the design would impact the mechanical and piping and electrical and controls construction contracts. If different pumps were selected, additional engineering design and spare parts costs estimated in excess of \$1.2 million could be incurred. The selection of the pumps would affect the final design of the circulating water system and pump house.

10.09 Panels and Controls Contract: The contract for panels and controls was competitively bid and awarded to Westinghouse Electric Corporation in 1982. The contract provided the custom design, furnishing, fabrication, testing and delivery to the site of panels and controls for the boilers, turbine generators, plant auxiliaries, substation and plant electric distribution and included the plant computer and programmable controllers, engineering supervision during startup and spare parts. EEA has requested that AID waive competition and authorize amendment of the present contract to provide for the Unit 4 panels and controls. Westinghouse is reported to have agreed to supply duplicate equipment for Unit 4 at the same price level for Unit 3, i.e. \$3.5 million. OBI has compared the proposed Unit 4 price with current industry prices for similar equipment and has concluded that the Westinghouse price for Unit 4 is reasonable. Competitive bidding of the panels and controls would delay completion of the project by three to five months. If different panels and control systems were selected, there would be a major impact on operator training and additional engineering design and spare parts costs estimated in excess of one million dollars could be incurred. The selection of panels and controls not duplicating those existing would effect the final design of the plant.

10.10 Water Treatment Contract: The contract for the water treatment plant was competitively bid in conformance with IBRD regulations and awarded to Infilco Degremont, Inc., (a U.S. firm and equipment of U.S. source/origin) in 1982. The contract provided for the design, furnishing of materials, fabrication of parts, manufacture, assembly, testing and delivery to the site of water treatment systems, spare parts and engineering supervision during startup. EEA has requested that AID waive competition and authorize amendment of the present contract to provide for the Unit 4 water treatment equipment. Infilco Degremont is reported to have agreed to supply duplicate equipment for Unit 4 at the same price level for Unit 3, i.e. \$2.4 million. OBI has compared the proposed Unit 4 prices with current industry prices for similar equipment and has concluded that the Infilco Degremont price for Unit 4 is reasonable. Competitive bidding of the water treatment system could

delay completion of the project by six to eight months. If a different water treatment system was selected, additional engineering design and spare parts and training costs, estimated in excess of one million dollars could be incurred. The selection of water treatment systems not duplicating the existing systems would effect the final design of the plant.

10.11 Reinforcing Steel Contract: The contract for reinforcing steel was competitively bid in conformance with IBRD regulations and awarded to Owen Steel Company, Inc., (a U.S. firm and material of U.S. source/origin) in 1981. The contract provided for the engineering, furnishing, fabrication, testing and delivery to the site of reinforced steel and welded wire fabric. EEA has requested that AID waive competition and authorize amendment of the present contract to provide for the Unit 4 reinforcing steel. Owen Steel is reported to have agreed to supply the materials for Unit 4 at the same unit prices provided for Unit 3 a total cost of \$1.0 million. OBI has compared Owen Steel unit prices for the reinforcing steel and weld wire fabric with current industry prices and has concluded that the Owen Steel prices for Unit 4 are reasonable. Competitive bidding of the reinforcing steel would delay the start of civil construction by eight to 12 months.

10.12 It is possible to install a fourth unit of different design and manufacture. However, it must be recognized that there are definite construction, operation, maintenance and cost advantages for duplication of a generating unit in a plant already containing three duplicate generating units. The justification for Unit 4 equipment to be a duplicate of Units 1, 2 and 3 are summarized below:

a. Construction:

Space requirements may be different if the fourth unit is of another manufacturer.

- 1) The turbine deck may need to be widened to accommodate Unit 4. Space between the building and the switchyard might become inadequate.
- 2) If the condenser height is higher, it will have to be placed in a pit to keep the operating deck elevation the same on Unit 4 as on Units 1, 2 and 3.
- 3) Space between the boiler building and the stack may be inadequate.

- 4) The turbine generator gantry crane may be unable to span the fourth unit machine, therefore a new crane would be required.

b. Engineering Reasons:

If the equipment for the fourth unit is of different design all engineering drawings would have to be reviewed once again since this would be a completely different unit in design. This would present additional costs both for the manufacturer and engineer since it would require a complete review similar to that done for Units 1, 2 and 3. Additionally field engineering costs of the engineer could be reduced, since they would be dealing with the same contractor as on Units 1, 2 and 3.

c. Operations:

If the Unit 4 control room panels would duplicate the panels for Units 1, 2 and 3, the control room operators could obtain training and operational familiarity with the first 3 units. If the fourth unit were different, the operators would have to go through an additional training program to operate Unit 4 because of the difference in instrument and switch location and possible dissimilarities in operation. This is particularly important during an emergency situation when an operator would have to spend some time, in his own mind, to determine the correct course of action based on which unit was involved, rather than on an "automatic" reaction based on the knowledge that all equipment in the plant gives the same indications and requires the same corrective action to a given emergency. The opportunity for serious error exists.

d. Spare Parts:

If the equipment for Unit 4 came from a different manufacturer, it very likely would differ in many if not in all respects from Units 1, 2 and 3. The first three units might, in fact, have little in common with Unit 4. Therefore, there would be a greater need for warehousing and knowledge of the locations for different spares. Along with stocking, inventory and location problems there would be maintenance problems. Maintenance groups would require different training since the equipment would be materially different.

10.13 Table X-2 compare the time requirements for the major procurements for Units 1, 2 and 3 (actual) and forecasts of time requirements for competitive procurement versus contract/purchase order extension. Competitive procurement of major equipment would require 9 to 10 months versus an estimated one to three months if contracts were amended.

TABLE X-2
COMPARISON OF TIME REQUIREMENT IN MONTHS FOR PROCUREMENTS

<u>CONTRACT/PURCHASE ORDER</u>	<u>UNITS 1, 2 & 3</u> <u>(ACTUAL)</u>	<u>UNIT 4</u> <u>(COMPETED)</u>	<u>UNIT 4</u> <u>(AMENDED)</u>
Turbine Generator	11	9	1
Condenser	10	9	1
Panels and Controls	13	9	2
Pumps	9		1
Steam Generator	13	9	1
Water Treatment	20	9	2
Civil Works	20	10	2
Mechanical and Piping	12	10	3
Electrical and Instrumentation	12	10	2
Switchgear	16	9	2
Transformers	16	9	2
Switchyard	15	9	2

10.14 Table X-3 compares the time requirements for the construction of Unit 4 based upon duplication of all critical equipment achieved through extension of the present contracts. The 20 month savings is directly attributable to time savings in site development, engineering design and procurement. By duplicating the equipment at the site based on the design of the first three Units, the addition of a fourth Unit could be accomplished at a substantially lower cost and implementation schedule shortened by up to 20 months, 5 months saved since demolition of existing plant is not required and 15 months saved through prior engineering design and contract extension rather than competition.

TABLE X-3

COMPARISON OF TIME REQUIREMENTS IN MONTHS FOR CONSTRUCTION
SHOUBRAH EL-KHEIMA UNIT 4
(NEW UNIT VERSUS DUPLICATION)

<u>ITEM OF WORK</u>	<u>MILESTONES (in months) FROM NOTICE TO PROCEED</u>		
	<u>UNIT 1</u>	<u>UNIT 4</u>	<u>SAVINGS BY DUPLICATION</u>
Start Piling	11	4	7
Start Major Concrete	15	6	9
Start Boiler Steel	19	9	10
Erection Boiler Drum	23	13	10
Set Turbine Generator	33	16	17
Commence Start Up	39	22	17
Energize Plant Systems	43	24	19
Boil Out and Steam Blows	47	28	19
Initial Synchronization Unit	49	32	17
Complete all Work for Unit (Commercial Operation)	51*	36	15

* Estimate based on status of current construction.

10.15 A decision to competitively procure the equipment would delay construction of Unit 4 by a minimum of 15 months with no assurance of cost savings for procurement since negotiated prices are expected to be the same as those obtained as a result of competitive bidding in 1981 and 1982. Selection of equipment different from Units 1, 2 and 3 would further increase the overall cost of Unit 4 since engineering to integrate the equipment into an operating configuration would have to be repeated and substantially greater quantities of spare parts would be required to support a unique unit.

10.16 AID Handbook 11, Chapter 3, Section 2.2.5b 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 cases of equipment and materials identified and discussed in Sections 10.05 through 10.11 above, some or all of these criteria are met and proprietary procurement is justified. As required under ROA 113.8, the Mission's Non-Competitive 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:

(1) When the Contracting Agency can demonstrate the existence of an emergency situation in which the requirement for competition would result in unacceptable project delays;

(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."

Much of the needed equipment is custom-made and available, with confidence, only from the original manufacturer. In all cases, as shown above, delay inherent in a competitive bidding, i.e., for reinforcing steel, would result in significant delay to this politically and developmentally important project. The Mission's Non-Competitive Review Board has been consulted and concurs.

10.17 Based upon the above rationale and the 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 contract amendments for Shoubrah El Kheima Unit 4 with Westinghouse International Power Systems Company for the Turbine-generator; with Southwestern Engineering Company for the Condenser, Accessories and Heaters; with Transamerica DeLaval Incorporated for Pumps; with Westinghouse Electric Corporation for Panels and Controls; with Infilco Degremont, Inc. for Water Treatment facilities; and with Owen Steel Company for Reinforcing Steel. The Project Committee recommends that the fourth unit be duplicate design of Units 1, 2 and 3.

C. Contracting Procedure

10.18 USAID has had extensive prior experience with EEA's contracting capabilities and has found them to be effective and

satisfactory even if at times they appear cumbersome and time consuming. The procedures for negotiation and approval of amendments to previously approved contracts are much much less time consuming and burdensome. The project has and will continue to utilize Host Country contracts with payment through Direct Letters of Commitment.

10.19 EEA will negotiate an amendment to the OBI contract to provide services for Unit 4. AID will review the contract amendment to assure compliance with AID regulations and the reasonableness of the contract cost.

10.20 EEA, assisted by OBI, will negotiate amendments to the Westinghouse contracts for the Turbine-Generator and Panels and Controls; the Southwestern Engineering contract for the Condenser; the Transamerica Delaval contract for Pumps; the Infilco Degremont contract for Water Treatment equipment and the Owen Steel contract for Reinforcing Steel. These amendments will be extensions of the existing contracts. AID will review the contract amendments (or new contracts) to assure compliance with AID regulations and the reasonableness of the contract cost.

D. Implementation Schedule

10.21 The implementation schedule for the construction of Unit 4 is set forth in Annex S. Principal or milestone dates of this schedule are summarized in Table X-4.

TABLE X-4

Implementation Schedule*

<u>Item of Work</u>	<u>Milestone Date</u>
Start Work	January 1986
Start Excavation at site	April 1986
Complete Boiler Foundation Design	June 1986
Start Boiler Erection	June 1986
Complete Turbine Pedestal Installation	March 1987
Comerse Operator	July 1987
Start Turbine Erection	March 1987
Start Checkout of all plant systems	December 1987
Initial Synchronization	August 1988
Complete All Work (Commercial Operation)	December 1988

* This schedule is based upon AID authorization to fund Shoubrah El Kheima Unit 4 prior to July 1985, with the Amendment to the Grant Agreement ratified and Conditions Precedent to Initial Disbursement satisfied prior to January 1986.

E. AID Financing Procedures

10.22 All procurements of services and materials financed by this Grant will be financed by Direct Letters of Commitment (L/Comms). Upon receipt an executed contract or purchase order, acceptable to AID, and a request from EEA to issue a Letter of Commitment, AID will amend or issue Direct L/Comms to the supplier. EEA will amend or issue appropriate Letters of Credit.

F. Terminal Dates

10.23 Conditions Precedent. The terminal date for meeting the Conditions Precedent to the Disbursement from the additional funds provided from this amendment will be 180 days from the signing of the amendment. This is the estimated time that will be required for the financing from all other financiers to be in place. Design will have been started utilizing funds from previous obligations to fund OBI's contract amendment.

10.24 Project Assistance Completion Date. The project assistance completion date will be June 30, 1989, six months following the projected date of commercial operation of the fourth 315 MW Unit at Shoubrah El Kheima Thermal Power Station. However, should the need arise to extend this PACD, Unit 4 will be considered a new project and the Mission Director will retain the authority to extend the PACD within his Delegation of Authority (ROA 113.8).

10.25 Terminal Disbursement Date. The terminal disbursement date will be March 31, 1990, nine months after completion of all services for Unit 4 to allow for final payments.

G. Control and Monitoring

10.26 Throughout the life of the project, the U.S. consultant will monitor the project, bringing all the routine problems, together with recommended solutions, to the attention of EEA and USAID in the form of the monthly progress report. The contractor will submit monthly and quarterly progress reports stating progress conformance with the implementation schedule, Annex M. In addition, monthly implementation review sessions will be held between the U.S. consultant, EEA and USAID staff to closely monitor project implementation. More serious problems, those requiring immediate action, will be monitored by members of the USAID/Cairo Project Committee through frequent and timely periodic visits to the project site, meetings with EEA principals and site personnel. AID's internal financing reports will be monitored to ensure that

disbursements are occurring in accordance with the implementation schedule. Regular semi-annual reviews of progress will be conducted by the USAID Mission's top management staff. Such reviews will be followed, when required, by meetings with EEA senior management staff.

H. Evaluation

10.27 There is an evaluation of Electricity Sub-Sector projects scheduled for the fourth quarter of Fiscal Year 1986. This project will be evaluated at that time including the progress being made on Unit 4.

I. Audit

10.30 Funds in the amount of \$100,000 have been provided for an external audit of cost reimbursable Host Country contracts. This audit will be conducted in 1989.

XI. CONDITIONS PRECEDENT AND COVENANTS

A. Conditions Precedent

11.01 The Conditions Precedent contained in the Grant Agreement and Amendment 1 and 2 have been satisfied.

B. Covenants

11.02 The Grant Agreement and subsequent Amendment Nos. 1 and 2 also set forth covenants to be met throughout the life of the Project. The covenants and the status of compliance are summarized below:

<u>COVENANT</u>	<u>STATUS</u>
a. Project Evaluation	Evaluation Scheduled in 4th Quarter FY-86.
b. Project Consultation	USAID attends regular monthly project progress meetings and meetings of the co-financers. EEA discusses with USAID contractor performance.
c. Project Management and Staffing	Project Team and Plant Staff assigned and trained.
d. Financial Management Planning and Reporting	Financial reports and forecasts provided annually.
e. Strengthen Accounting Procedures	Recommendations of IBRD consultant being implemented.
f. Studies and Implementation of Electricity Tariff and Fuel Pricing	Studies completed and Electricity tariffs have been increased annually with additional increases expected. Fuel price increases expected in mid-1985.
g. Exemption from Decennial Liability Law	Project exempt by Decree.
h. Transmission Facilities	Facilities planned and being constructed with funds from donors and GOE.

11.03 The GOE is also complying with similar covenants contained in the Loan and Grant Agreements for the Ismailia (Abu Sultan) Thermal Power Plant; Urban Electric Distribution and Aswan High Dam Rehabilitation/Modernization Projects.

XII. RECOMMENDATIONS

A. Funding

12.01 We recommend that AID's grant to the GOE be increased from \$208 million to \$263 million, an increase of \$55 million.

12.02 We further recommend that the Government of Egypt lend the funds to the Egyptian Electricity Authority at an annual interest rate satisfactory to AID with the principal to be repaid on terms satisfactory to A.I.D.

12.03 Procurement of all goods and services financed by AID will have their source, origin and nationality in the United States.

B. Procurement Waivers

12.04 We recommend the non-competitive selection of Overseas Bechtel, Incorporated to provide engineering procurement, construction management, start-up and training services associated with construction and installation of Unit 4 and that EEA be authorized to negotiate a contract with Overseas Bechtel, Incorporated.

12.05 We recommend the non-competitive selection of Westinghouse Electric Corporation as the contractor to design, supply and erect the Unit 4 315 MW Steam Turbine Generator and accessories and that EEA be authorized to negotiate a contract with Westinghouse Electric Corporation.

12.06 We recommend the non-competitive selection of Westinghouse Electric Corporation as the contractor to design, fabricate, test and deliver the Unit 4 Panels and Controls and that EEA be authorized to negotiate a contract with Westinghouse Electric Corporation.

12.07 We recommend the non-competitive selection of Southwestern Engineering Company as the contractor to design, fabricate, test and deliver the Unit 4 Condenser, Accessories, and Heaters and that EEA be authorized to negotiate a contract with Southwestern Engineering Company.

12.08 We recommend the non-competitive selection of Transamerica DeLaval Incorporated as the contractor to design, fabricate, test and deliver the Unit 4 Pumps and that EEA be authorized to negotiate a contract with Transamerica DeLaval Incorporated.

12.09 We recommend the non-competitive selection of Infilco Degremont Incorporated as the contractor to design, fabricate, test and deliver the Unit 4 Water Treatment facilities and that EEA be authorized to negotiate a contract with Infilco Degremont Incorporated.

12.10 We recommend the non-competitive selection of Owen Steel Company as the contractor to supply Reinforcing Steel for Unit 4 and that EEA be authorized to negotiate a contract with Owen Steel Company.

C. Condition Precedent to Disbursement

12.11 We recommend the following Conditions Precedent be incorporated in the Grant Agreement Amendment:

Prior to any disbursement or to the issuance of any Direct Letter of Commitment from the additional Grant funds available under this amendment the GOE 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. Evidence of firm commitments for not less than 100 percent of all foreign exchange funds required for the project, aside from those funds provided by the AID Grant.
- b. Evidence that local currency financing for the Project has been budgeted by the Grantee and will be available for expenditure by EEA on the Project pursuant to a cost estimate made by the consulting engineer and approved by EEA.
- c. Evidence that the Grant proceeds will be loaned to the Egyptian Electricity Authority on terms satisfactory to AID.
- d. Evidence that EGPC will deliver sufficient gas to the plant to permit EEA to operate the plant after 1986, under normal plant operating conditions, with no less than two units on gas at any time, and to operate after 1988, under normal plant operating conditions, with all four units on gas.
- e. Evidence that EEA has legal jurisdiction over all rights of way necessary for the plant facilities and transmission connection to the UPS.

12.12 We recommend that the terminal date for meeting the Conditions Precedent to disbursement from the additional funds provided from this amendment be 180 days from the signing of the grant agreement amendment.

D. Covenants:

12.13 We recommend the following covenants be incorporated in the Grant Agreement Amendment:

- a. Plant Operations and Maintenance Training: The Cooperating Country shall covenant that EEA will select additional operation and maintenance staff and commence a comprehensive training program, a minimum of one year prior to startup of Unit 4, so that operation and maintenance personnel will be on-site, trained and fully qualified to operate and maintain the added plant when it is placed in service.
- b. Plant Fuel Supply: The Cooperating Country shall covenant that EEA will operate the plant after 1986, under normal conditions, no less than two units on gas at any time, and to operate after 1988, under normal conditions, with all four units on gas.
- c. Consultation on Electricity Tariffs: The Cooperating Country shall covenant that EEA will periodically consult with AID on electricity tariffs and their impact on the financial viability of EEA.
- d. Monthly Operation and Management Reports: The Cooperating Country shall covenant that EEA will provide to USAID within 20 days of the following month the following reports:
 1. The Dispatching Center Report of Statistics of Operations including but not limited to capacity additions, capacity outages and deratings, energy supply, hydro and thermal plant and unit performance, power transfers, fuel utilization, daily demands, outages and interruptions, maintenance, staffing.
 2. The EEA Management Information Report containing but not limited to performance indicators on system and plant performance, installed and spinning reserves, losses, financial performance and status of construction programs.



MINISTRY OF Planning AND
INTERNATIONAL COOPERATION

C20
no 141 11

MAR 20, 1985

Mr. Frank Kimball
U.S.A.I.D. Director
Cairo, Egypt.

DPPE
DD

212

ACTION TO	<i>DP</i>	<i>DIR</i>
ACTION TAKEN		DATE <i>4/9</i>
NAME	<i>X</i>	INITIALS <i>AE</i>

Dear Mr. Frank:

We have received a request from EEA to finance a portion of the foreign exchange costs of Shoubrah Power plant (Unit 4) from U.S. Economic Assistance to Egypt during FY 1985.

As you know the first unit of Shoubrah El Kheima Power Plant has been started generating power since January 1984, the rest of the plant is progressing satisfactorily and the second and third units are expected to be put in operation during 1985, ahead of schedule, EEA is intended to add a fourth unit at Shoubrah to meet critical power needs during 1987 and 1988.

Kindly be informed that MPIC supports EEA's request due to the importance of the said project.

Best regards.

Sincerely yours,

Ahmad' Abdel Salam.

Ahmad Abdel Salam Zaki
Administrator.

Rec'd cil
4/11/85
AE

MINISTRY OF ELECTRICITY & ENERGY
OFFICE OF THE MINISTER

Page 2 of 2

776, 1
27/10/1984

Cairo, October, 29th, 1984

M. Peter McPherson,
Administrator
Agency for International Development,
Washington D.C. 20523

Dear Mr. McPherson,

I was pleased to see you during your recent visit to Egypt and to discuss Egypt's electric power programs. Your continued interest in the development of our electric power system is most appreciated. Our discussions of the need for USAID participation in the financing (estimated at US \$ 60 million) for the fourth unit at Shoubra El-Kheima was most helpful.

I believe that our recent actions of which you are aware, are indicative of the forthcoming improvements that we wish to achieve.

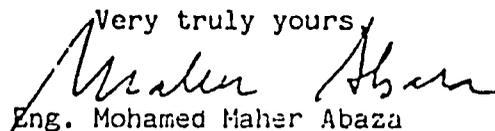
In view of the necessity of keeping supplier'/contractor' prices for the fourth unit at the level of Shoubra El-Kheima units 1, 2 and 3, and as the schedules for construction of these units dictate that changes to accommodate Unit 4 be made not later than January 1985, a decision is needed urgently.

We would like to proceed expeditiously to call a meeting of the Co-Financiers so that the financing/procurement process can begin.

I would greatly appreciate your support for such a Co-Financiers meeting and a response to our financing request.

With best personal regards,

CC. Mr. Michael Stone,
USAID / CAIRO

Very truly yours,

Eng. Mohamed Maher Abaza
Minister of Electricity & Energy

THIRD AMENDMENT
TO
PROJECT AUTHORIZATION

Name of Country: Arab Republic
of Egypt

Name of Project: Shoubrab El Kheima
Thermal Power Plant

Number of Project: 263-0030

Pursuant to Sections 531 and 532 of the Foreign Assistance Act of 1961, as amended, the Shoubran El Kheima Thermal Power Plant Project for the Arab Republic of Egypt was authorized on July 19, 1979, and that authorization was amended on August 25, 1981 and April 17, 1984. That authorization, as amended, is hereby further amended as follows:

1. The first two unnumbered paragraphs of the original project authorization and the first numbered paragraph of the first and second amendments to that project authorization are hereby deleted and the following is substituted therefor:

"1. Pursuant to Sections 531 and 532 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Shoubran El Kheima Power Plant Project (the "Project") for the Arab Republic of Egypt ("the Cooperating Country") involving planned obligations of not to exceed Two Hundred Sixty-three Million Dollars (\$263,000,000) in grant funds over a ten-year period from the date of initial authorization in 1979, subject to the availability of funds in accordance with the AID OYB/allotment process, to help in financing foreign exchange costs for the Project. The planned life of the Project, with the exception of the Unit 4 component, from the date of initial obligation is six (6) years and ten (10) months. The planned life of the Unit 4 component is three (3) years and six (6) months from the date of execution of the Project Agreement Amendment funding that component.

"2. The Project consists of engineering and construction of a 1260 MW plant in Shoubrab El Kheima, Egypt (hereinafter referred to as the Project). When completed, the plant will include four steam generating units, each capable of producing 315 megawatts (net) under normal operating conditions, together with the necessary auxiliary equipment. The funds authorized herein will be made available to the Egyptian Electricity Authority (EEA) to carry out the project."

61-

2. The Project Agreement Amendment, which 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, 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.

3. Conditions and Covenants

a. Source and Origin of Commodities, Nationality of Services

Commodities financed by A.I.D. with funds added by this third amendment shall have their source and origin in the United States except as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services shall have the United States as their place of nationality, except as A.I.D. may otherwise agree in writing. Ocean shipping, except as A.I.D. may otherwise agree in writing, may be financed only on flag vessels of the United States.

b. Condition Precedent to Disbursement

Prior to any disbursement or to the issuance of any Direct Letter of Commitment from the additional Grant funds available under this amendment the GOE 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.:

- 1) Evidence of firm commitments for not less than 100 percent of all foreign exchange funds required for the project, aside from those funds provided by the AID Grant.
- 2) Evidence that local currency financing for the Project has been budgeted by the Grantee and will be available for expenditure by EEA on the Project pursuant to a cost estimate made by the consulting engineer and approved by EEA.
- 3) Evidence that the Grant proceeds will be loaned to the Egyptian Electricity Authority on terms satisfactory to AID.
- 4) Evidence that EEA will deliver sufficient gas to the plant to permit EEA to operate the plant after 1986, under normal plant operating conditions, with no less than two units on gas at any time, and to operate after 1988, under normal plant operating conditions, with all four units on gas.
- 5) Evidence that EEA has legal jurisdiction over all rights of way necessary for the plant facilities and transmission connection to the UPS.

c. Covenants:

- 1) Plant Operations and Maintenance Training: The Cooperating Country shall covenant that EEA will select additional operation and maintenance staff and commence a comprehensive training program, a minimum of one year prior to startup of Unit 4, so that operation and maintenance personnel will be on-site, trained and fully qualified to operate and maintain the added plant when it is placed in service.
- 2) Plant Fuel Supply: The Cooperating Country shall covenant that EEA will operate the plant after 1986, under normal plant operating conditions, with no less than two units on gas at any time, and to operate after 1988, under normal plant operating conditions, with all four units on gas.
- 3) Consultation on Electricity Tariffs: The Cooperating Country shall covenant that EEA will periodically consult with AID on electricity tariffs and their impact on the financial viability of EEA.

4. Waivers

For purposes of implementation of the Project's Unit 4 component, waivers of competition are hereby issued to permit A.I.D. funded non-competitive procurement by EEA of the following:

a. Continuation of consulting engineering services by Overseas Bechtel, Incorporated over the life of the Unit 4 component; and

b. Supply of equipment, material and related services from Westinghouse International Power Systems Company; Southwestern Engineering Corporation; Transamerica DeLaval, Incorporated; Westinghouse Electric Corporation; Infelco Degremont, Incorporated; and Owen Steel Company, all as necessary to permit timely supply and installation of Unit 4 equipment identical (or substantially identical) to that furnished and installed under the Project's Unit 1, 2 and 3 components.

- 62

5. Extension of Terminal Dates

The Project Assistance Completion Date (PACD) is extended to June 30, 1989, or such other date as A.I.D. may agree to in writing, and the date for receipt of requests for disbursement under the Project to March 30, 1990, or such other date as A.I.D. may agree to in writing. However, should the need arise to extend the PACD, Unit 4 will be considered a new project and the Mission Director will retain the authority to extend the PACD within his Delegation of Authority.

Frank B. Kimball
Frank B. Kimball
Director, USAID/Cairo
July 29 1985
Date

Non-Competitive Review Board:

IS/CS:ABjoriykk: [Signature] Date 6-25-85
SLA:KO'Donnell: [Signature] Date 6-15-85
IS/EMI:WJGill: [Signature] Date 2/28/85

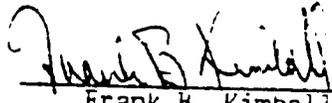
LEG:KO'Donnell/ID:JHunt:nd 5/85 (ID 2173D)
Clear:OL/ID:TA Pearson: [Signature] Date 7/2/85
AD/EM:McManon: [Signature] Date 6/23/85
AD/DPPE:GLaudato: [Signature] Date 7/2/85
AD/DR:GRvanRaalte: [Signature] Date 7/15/85
DD:AMHardly: _____ Date _____
AD/IS:DPressley: [Signature] Date 2 July 85

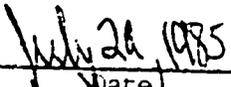
ANNEX C

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, 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 150 Mw Shoubra El Kheima Thermal Power Plant in Cairo, Egypt.

This judgment is based upon general considerations discussed in Section II of the Project Paper to which this certification is attached.



Frank B. Kimball
Director


Date

5C(2) PROJECT CHECKLIST

Listed below are statutory 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 with Development Assistance loans, and
B.3. applies to projects funded from ESF.

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

A. GENERAL CRITERIA FOR PROJECT

1. FY 1985 Continuing Resolution Sec. 525; FAA Sec. 634A; Sec. 653(b).

(a) Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that amount)?

a. Congressional notification will be submitted.

b. The intended obligation is within the level of funds appropriated for Egypt for FY 85.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of \$100,000, 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?

The necessary planning and cost estimate have been completed.

3. FAA Sec. 611(a)(2). If further 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 further legislative action is required.
4. FAA Sec. 611(b); FY 1985 Continuing Resolution Sec. 501. If for water or water-related land resource construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973, or the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See AID Handbook 3 for new guidelines.)
- N/A
5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?
- The Mission Director has so certified, see Annex C.
6. FAA Sec. 209. 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.
- The project is not susceptible to execution as part of a regional project. It is being jointly funded by the IBRD, EEC, EIB, OECF, and ADB.

7. FAA Sec. 601(a). Information and conclusions whether projects will encourage efforts of the country to:
(a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) 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).

9. FAA Sec. 612(b), 636(h); FY 1985 Continuing Resolution Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the 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.

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?

The grant amendment will together with the original grant, increase the flow of international trade and improve technical efficiency of industry, agriculture and commerce, and foster private initiative and competition. It will not have any apparent effect on encouraging cooperative credit unions and savings and loan associations, nor monopolistic practices, nor free labor unions.

All funds expended will be for goods and services from private U.S. concerns.

The Original Project Grant Agreement so provided and the GOE has certified that all local currency funds required will be provided by GOE.

11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?
Yes, competition is waived in accordance with AID regulations.
12. FY 1985 Continuing Resolution Sec. 522. 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 operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?
N/A
13. FAA 118(c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16. Does the project or program taken into consideration the problem of the destruction of tropical forests?
c. Yes
d. N/A
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 (dollars or local currency generated therefrom)?
N/A

15. FY 1985 Continuing Resolution Sec. 536. Is disbursement of the assistance conditioned solely on the basis of the policies of any multilateral institution?

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

- a. FAA Sec. 102(b), 111, 113, 281(a). Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote

- the participation of women in the national economies of developing countries and the improvement of women's status, (e) utilize and encourage regional cooperation by developing countries?
- b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used? N/A
- c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)? N/A
- d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed country)? N/A
- e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project for more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country N/A

"relatively least developed"? (M.O. 1232.1 defined a capital project as "the construction, expansion, equipping or alteration of a physical facility or facilities financed by AID dollar assistance of not less than \$100,000, including related advisory, managerial and training services, and not undertaken as part of a project of a predominantly technical assistance character."

- f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?

N/A

- g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.

N/A

2. Development Assistance Project
Criteria (Loans Only)

- a. FAA Sec. 122(b).
Information an conclusion on
capacity of the country to
repay the loan, at a
reasonable rate of interest. N/A
- b. FAA Sec. 620(d). If
assistance is for any
productive enterprise which
will compete with U.S.
enterprises, is there an
agreement by the recipient
country to prevent export to
the U.S. of more than 20% of
the enterprise's annual
production during the life
of the loan? N/A

3. Economic Support Fund Project
Criteria

- a. FAA Sec. 531(a). Will this
assistance promote economic
and political stability? To
the extent possible, does it
reflect the policy
directions of FAA Section
102? Will enhance ability of GOE to sustain
economic growth and recovery which
will have positive political results.
To the extent rural areas will be
served, policy direction of Section 102
will be reflected.
- b. FAA Sec. 531(c). Will
assistance under this
chapter be used for
military, or paramilitary
activities? No
- c. FAA Sec. 534. Will ESF
funds be used to finance the
construction of, or the
operation or maintenance of,
or the supplying of fuel
for, a nuclear facility? If
so, has the President
certified that such use of
funds is indispensable to
nonproliferation objectives? No
N/A

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?

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. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?
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??
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?

Sole source waivers approved by AID Mission Director for procurement of Engineering services, turbine generator, condenser, pumps and panels and controls to assure duplication of equipment to presently installed and in operation at the plant.

Yes .

Egypt does not so discriminate.

4. FAA Sec. 604(e); ISDCA of 1980 Sec. 705(a). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.)
- There will be no such procurement.
5. FAA Sec. 604(g). Will construction or engineering services be procured from firms of countries which are direct aid recipients and which are otherwise eligible under Code 941, but which have attained a competitive capability in international markets in one of these areas? Do these countries permit United States firms to compete for construction or engineering services financed from assistance programs of these countries?
- No
6. FAA Sec. 603. Is the shipping excluded from compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum 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?
- No

7. FAA Sec. 621. If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? Yes
If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs? N/A
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 1985 Continuing Resolution 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? No direct USG contract is contemplated.

B. Construction

1. FAA Sec. 601(d). If capital (e.g., construction) project, will U.S. engineering and professional services be used? Yes
- FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? N/A Contracts are for engineering services and equipment supply.

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)?

Yes, but FAA Section 620(k) provides exception for Egypt.

C. Other Restrictions

1. FAA Sec. 122(b). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?
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?
3. FAA Sec. 620(h). Do arrangements exist to insure 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?
4. Will arrangements preclude use of financing:
- a. FAA Sec. 104(f); FY 1985 Continuing Resolution Sec. 527. (1) To pay for performance of abortions as a method of family planning or to motivate or coerce persons to practice

N/A

N/A

Yes

1. Yes

10

- 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; (4) to lobby for abortion? 2. Yes
3. Yes
4. Yes
- b. FAA Sec. 620(g). To compensate owners for expropriated nationalized property? Yes
- c. FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? Yes
- d. FAA Sec. 662. For CIA activities? Yes
- e. 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
- f. FY 1985 Continuing Resolution, Sec. 503. To pay pensions, annuities, retirement pay, or adjusted service compensation for military personnel? Yes

- g. FY 1985 Continuing Resolution, Sec. 505. Yes
To pay U.N. assessments, arrearages or dues?
- h. FY 1985 Continuing Resolution, Sec. 506. Yes
To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multilateral organizations for lending)?
- i. FY 1985 Continuing Resolution, Sec. 510. Yes
To finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields?
- j. FY 1985 Continuing Resolution, Sec. 511. Yes
Will assistance be provided 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?
- k. FY 1985 Continuing Resolution, Sec. 516. Yes
To be used for publicity or propaganda purposes within U.S. not authorized by Congress?

EGYPTIAN ELECTRICITY AUTHORITY
SUMMARY OF INSTALLED GENERATING CAPACITY - MW, PEAK LOAD - MW
AND RESERVE CAPACITY - MW AND PERCENT

YEAR	THERMAL	GAS TURBINE	HYDRO	TOTAL	PEAK LOAD-MW	INSTALLED RESERVES	
						MW	%
1952	154	-	-	154	125	29	23
1953	205	-	-	205	137	68	50
1954	251	-	-	251	160	91	57
1955	321	-	-	331	186	148	86
1956	331	-	-	331	186	145	78
1957	466	-	-	466	210	256	122
1958	511	-	-	511	250	261	104
1959	511	-	-	511	282	229	81
1960	541	-	256	797	372	425	114
1961	593	-	345	938	522	416	80
1962	593	-	345	938	548	390	71
1963	593	-	345	938	590	348	59
1964	593	-	345	938	659	279	42
1965	672	-	345	1017	750	267	36
1966	1034	28	381	1443	824	619	75
1967	1179	28	1221	2428	872	1556	175
1968	1322	28	1730	3080	930	2150	231
1969	1382	28	2333	3743	987	2756	279
1970	1302	28	2445	3775	1100	2675	243
1971	1302	28	2445	3775	1160	2615	225
1972	1302	28	2445	3775	1176	2599	221
1973	1302	28	2445	3775	1248	2527	202
1974	1302	28	2445	3775	1433	2342	163
1975	1302	28	2445	3775	1733	2042	118
1976	1299	45	2445	3789	1909	1880	98
1977	1324	91	2445	3860	2284	1576	69
1978	1346	114	2445	3905	2564	1341	52
1979	1430	354	2445	4229	2829	1400	49
1980	1650	611	2445	4706	3239	1467	45
1981	1674	795	2445	4914	3553	1361	38
1982	1674	1011	2445	5130	3900	1230	32
1983	2274	1289	2445	6108	4376	1732	40
1984	3165	1389	2445	6999	4950	2049	41

Source: EEA Annual Reports

EGYPTIAN ELECTRICITY AUTHORITY

PEAK LOAD AND ENERGY GENERATED ACTUAL 1970-1984

<u>YEAR</u>	<u>PEAK LOAD-MW</u>	<u>ENERGY - GWH</u>	<u>LOAD FACTOR - %</u>
1970	1,100	6,915	72
1971	1,160	7,323	72
1972	1,176	7,384	71
1973	1,248	7,435	68
1974	1,433	8,519	68
1975	1,733	9,800	65
1976	1,909	11,645	69
1977	2,284	13,517	68
1978	2,564	15,013	67
1979	2,829	16,359	66
1980	3,239	18,429	65
1981	3,553	20,747	67
1982	3,900	23,353	68
1983	4,376	25,879	67
1984	4,950	29,049	67

PEAK DEMAND AND ENERGY GENERATED FORECAST 1985-2000

<u>YEAR</u>	<u>PEAK LOAD - MW</u>	<u>ANNUAL GROWTH RATE (%)</u>	<u>GENERATED ENERGY (GWh)</u>	<u>ANNUAL GROWTH RATE (%)</u>	<u>LOAD FACTOR</u>
1985	5455	10.2	31,275	7.7	65
1986	6100	11.8	34,095	9.0	64
1987	6730	10.4	36,850	8.1	63
1988	7340	9.0	40,200	9.1	62
1989	8000	9.0	43,850	9.1	63
1990	8720	9.0	47,800	9.0	63
1991	9375	7.5	51,350	7.4	63
1992	10,000	6.7	55,120	7.3	63
1993	10,650	6.5	59,160	7.3	63
1994	11,340	6.5	63,480	7.3	64
1995	12,080	6.5	68,100	7.3	64
1996	12,750	5.5	71,990	5.7	64
1997	13,500	5.9	76,100	5.7	64
1998	14,280	5.8	80,450	5.7	64
1999	15,100	5.7	85,000	5.7	64
2000	16,100	6.0	90,000	5.8	64

Source: EEA - May 1985

82

EGYPTIAN ELECTRICITY AUTHORITY
EXISTING GENERATING STATIONS
(December 31, 1984)

Plant	Type	Units		Capacity (MW)	
		No.	MW	Design	Available*
<u>Upper Egypt Zone</u>					
High Dam	Hydro	12	175	2100	1823(1)
Aswan Dam	Hydro	7	46		
	Hydro	2	11.5	345	267(2)
Assiut	Thermal	3	30	90	85
El Fayoum	Gas Turbine	1	20	20	16
				<u>2555</u>	<u>2191</u>
<u>Cairo Zone</u>					
Cairo North	Thermal	2	10)		
	Thermal	1	20)		
	Thermal	2	30)	100	74
Cairo North	Gas Turbine	1	23	23	15
Cairo South	Thermal	4	60)		
	Thermal	2	7.5)	255	199
Cairo East	Gas Turbine	2	23	46	41
Cairo West	Thermal	4	87.5	350	309
El Tebbin	Thermal	3	15	45	42
El Tebbin	Gas Turbine	2	23	46	41
Helwan	Gas Turbine	5	24	120	105
Heliopolis	Gas Turbine	3	12.5	38	15
Shoubrah El Kheima	Thermal	1	31.5	315	100
				<u>1335</u>	<u>941</u>
<u>Delta Zone</u>					
Talkha	Thermal	3	12.5)		
	Thermal	3	30)	128	120
Talkha	Gas Turbine	8	24	192	176
Damanhour	Thermal	2	15)		
	Thermal	3	65)	225	115
Kafr El Dawar	Thermal	3	110	330	181
Mahmoudia	Gas Turbine	4	50)		
	Gas Turbine	8	24)	392	319
				<u>1267</u>	<u>911</u>
<u>Alexandria Zone</u>					
Abu Qir	Thermal	4	150	600	296
Abu Qir	Gas Turbine	1	20	20	15
Abu Matamir	Gas Turbine	1	20	20	14
El Max	Gas Turbine	2	14	28	22
Karmouz	Thermal		16	64	5
Karmouz	Gas Turbine	2	12.5	25	0
Siouf	Thermal	2	26.5		
	Thermal	2	30)	113	34
Siouf	Gas Turbine	1	26)		
	Gas Turbine	6	33)	225	140
				<u>1095</u>	<u>526</u>

Plant	Type	Units		Capacity (MW)	
		No.	MW	Design	Available ^a
<u>Canal Zone</u>					
Abu Sultan	Thermal	3	150	450	300
Ismailia	Gas Turbine	1	20	20	19
Port Said	Gas Turbine	3	20	60	35
Shabab	Gas Turbine	3	33	100	80
Suez	Thermal	4	25	100	33
Suez	Gas Turbine	1	17	17	2
				<u>747</u>	<u>469</u>
<u>SUMMARY</u>					
			Hydro	2445	2090
			Thermal	3165	1893
			Gas Turbine	<u>1389</u>	<u>1055</u>
				<u>6999</u>	<u>5038</u>

Source: EEA Annual Reports

- (1) Based on ten (10) units available for operation with two units normally scheduled out of service for maintenance.
 - (2) Capacity limited by available net head.
- * Capacity Available from Gas Turbines based on Winter temperatures

84

EGYPTIAN ELECTRICITY AUTHORITY
CAPACITY ADDITION SCHEDULE

<u>UNIT</u> <u>IN-SERVICE</u>	<u>CAPACITY</u>	<u>COMMERCIAL</u>
<u>1985</u>		
Ataka Unit 1	150 MW	1st Quarter
Shoubra El Kheima Unit 2	315 MW	2nd Quarter
Dammanhour CT	100 MW	3rd Quarter
Ataka Unit 2	150 MW	3rd Quarter
Aswan II Unit 1	67.5 MW	3rd Quarter
Wadi Hoff CT	100 MW	4th Quarter
Shoubra El Kheima Unit 3	315 MW	4th Quarter
	<u>1197.5 MW</u>	
<u>1986</u>		
Kafr El Dawar Unit 4	110 MW	1st Quarter
Aswan II Unit 2	67.5 MW	1st Quarter
Aswan II Unit 3	67.5 MW	3rd Quarter
	<u>245.0 MW</u>	
<u>1987</u>		
Aswan II Unit 4	67.5 MW	1st Quarter
Abu Sultan Unit 4	150 MW	1st Quarter
	<u>217.5 MW</u>	
<u>1988</u>		
Ataka Unit 3	300 MW	4th Quarter
	<u>300</u>	
Total under Construction	<u>1960.0 MW</u>	

EGYPTIAN ELECTRICITY AUTHORITY
CAPACITY - LOAD AND RESERVE FORECAST 1985 - 1990

<u>YEAR</u>	<u>INSTALLED CAPACITY-MW</u>	<u>AVAILABLE CAPACITY-MW</u>	<u>LOAD MW</u>	<u>AVAILABLE RESERVE</u>		<u>CAP. REQ. 30% RESERVE MW</u>
				<u>MW</u>	<u>%</u>	
1985	8196	6385	5445	940	17	694
1986	8441	6630	6100	530	9	1300
1987	8659	6848	6730	118	2	1900
1988	8959	7148	7340	0	0	2394
1989	8959	7148	8000	0	0	3252
1990	8959	7148	8720	0	0	4188

EGYPTIAN ELECTRICITY AUTHORITY
PLANNED (CONTEMPLATED) CAPACITY

Shoubra El-Kheima Unit 4	315MW	1988
Damietta - Combustion Turbines	400 MW	1989
Talkha Comined Cycle Add-on	90 MW	1989
Damanhour - Thermal	300 MW	1989
Suez - Thermal	100 MW	1989
Damietta - Comined Cycle Add-on	200 MW	1989
Ataka Unit 4 Thermal	300 MW	1990
Assiut - Thermal	300 MW	1990
Delta - Thermal	600 MW	1991
Sinai - Thermal	600 MW	1992
Delta - Thermal	600 MW	1993
Mediterranean - Thermal	600 MW	1993
Red Sea - Thermal	<u>600 MW</u>	1994
Total Planned Capacity	5005 MW	

COST ESTIMATE SUMMARY

UNIT 4

<u>PURCHASE ORDER/CONTRACT PACKAGE</u>	<u>IN MILLION EQUIVALENT U.S. DOLLARS</u>		
	<u>FOREIGN CURRENCY</u>	<u>LOCAL CURRENCY</u>	<u>TOTAL*</u>
PO-1 Rebar	1.0	0.1	1.1
PO-2 Condensers	5.6	0.2	5.8
PO-3 Pumps	5.4	-	5.4
PO-5 Water Treatment	2.4	-	2.4
PO-7 Critical Piping	3.5	-	3.5
PO-8 Transformers	2.2	0.1	2.3
PO-9 Switchgear	1.3	-	1.3
PO-10 Panels and Controls	3.5	-	3.5
Subtotal (A)	<u>24.9</u>	<u>0.4</u>	<u>25.3</u>
GC-2 Project Insurance	0.7	-	0.7
CP-3.3 General Services	-	0.7	0.7
CP-4.1 Turbine Generator	26.8	0.8	27.6
CP-5.1 Steam Generator	29.0	1.8	30.8
CP-6.1 Civil Works	10.1	8.4	18.5
CP-6.2 Shoreline	5.1	1.7	6.8
CP-7.1 Electrical and Controls	4.6	0.6	5.2
CP-8.1 Mechanical and Piping	13.8	2.9	16.7
CP-9.1 Switchyard	3.6	0.4	4.0
CP-11.1 Tanks	0.2	0.1	0.3
Subtotal (B)	<u>93.9</u>	<u>17.4</u>	<u>111.3</u>
Subtotal (A + B)	118.8	17.8	136.6
Engineering and Construction Management Services	10.2	3.3	13.5
Provisional Sum	<u>6.0</u>		<u>6.0</u>
TOTAL UNIT 4 COST	135.0	21.1	156.1

TRANSMISSION COST

CP-20.1	Underground Transmission Cable	4.1	0.6	4.7
---------	--------------------------------	-----	-----	-----

*Total dollars expressed using conversion rate of \$1 = 0.7 LE, and \$1 = 250 JY.

98

Existing and Proposed Selling Prices.

	Average Existing Price Milim/K.W.H.	1985/1986		1986/1987	
		Increase Percent %	Average Proposed Price, m/K.W.H.	Increase Percent %	Average Proposed Price, m/K.W.H.
1) Very High Voltage:-					
Kima Co.	6.354	37	8.7	29	11.2
Aluminum Co.	5.607	37	7.7	29	9.9
Somid Co.	7.0	37	9.6	29	12.4
Assiout Cement	23.332	-	23.332	-	23.332
2) High Voltage:-					
Industry	8.921	37	12.2	29	15.7
Cement	29.736	-	29.736	-	29.736
Agricultur	8.551	37	11.7	29	15.1
Government	7.757	37	10.6	29	13.7
Housing Companies	13.068	37	17.9	29	23.1
3) Medium and low Voltage:					
- Moving Power, Privat and Public Sec. with more than 500 K.W., Annual Fixed Installment (L.E./K.W.)					
	8.160	52	12.4	33	16.4
- Consumption rate (6 Categories) from 14.669-6.683					
		52	22.3-10.2	32	29.4-13.5
- Less than 500 K.W. (3 Categories) from 29.544-23.010					
		37	40.5-31.5	29	52.2-40.7
4) Residential Uses:					
Category 1) Monthly till 100 K.W.H.	16.288	10.5	18	15	21
" 2) 101 - 200 K.W.H.	22.627	28	29	28	37
" 3) 201 - 250 K.W.H.	27.307	35	36	35	41
" 4) 251 - 500 K.W.H.	31.104	43	44	40	62
" 5) Any Excess	31.104	58	49	50	74
5) Commercial:					
Category 1) Monthly till 100 K.W.H.	17.43	15	20	15	23
" 2) 101 - 200 K.W.H.	26.62	30	35	30	40
" 3) 201 - 250 K.W.H.	34.93	35	47	35	63
" 4) 251 - 500 K.W.H.	43.2	45	63	40	88
" 5) Any Excess	43.2	60	70	45	100
6) Government:					
Category 1) Monthly 80 K.W.H.	21.780	37	30	29	39
" 2) Succeeding 70 K.W.H.	29.040	37	40	29	51
" 3) Any Excess	36.300	37	50	29	64
7) Public light and Traffic	21.780	37	30	29	38

■ The price has been raised to four times for the cement Companies on 7/10/1984

SHOUSRA EL MEIMA THERMAL POWER PROJECT

TABLE 1. CAPITAL COSTS (000) AND PRICE ADJUSTMENT FACTORS

FOURTH UNIT 315000 KW (CURRENT PRICES)										UNITS I II AND III 945000 KW (CURRENT PRICES)																							
YEAR	POWER STATION/1/		TRANSMISSION/1/		DISTRIBUTION/2/TOTAL CAPITAL				YEAR	POWER STATION/1/		TRANSMISSION/1/		DISTRIBUTION/3/		TOTAL																	
	LE	US\$	LE	US\$	LE	US\$	LE	US\$		LE	US\$	LE	US\$	LE	US\$	LE	US\$																
1979							0	0	1979							0	0																
1980							0	0	1980	0	3606	0	0			0	3606																
1981							0	0	1981	2993	17847	0	0			2993	17847																
1982							0	0	1982	11689	44623	0	0			11689	44623																
1983							0	0	1983	17680	176793	1170	6000			18850	182793																
1984							0	0	1984	18311	148992	3265	19959			21576	168951																
1985							0	0	1985	17200	101700	11800	70500			29000	172200																
1986	7140	33300	0	0			7140	33300	1986	9300	27300	2130	9600			11430	36900																
1987	5600	87300	300	3500			5900	90800	1987	0	0	0	0			0	0																
1988	2000	14400	120	600			2120	15000	1988	0	0	0	0			0	0																
1989							0	0	1989							0	0																
TOTAL	14740	135000	420	4100	0	0	15160	139100	TOTAL	77173	520861	18365	106059	0	0	95538	626920																
PRICE INDICES										FOURTH UNIT								UNITS I II AND III								UNITS I II III AND IV							
EGPTCP1 US\$/D/4/										TOTAL CAPITAL								(1985 PRICES)/5/															
0.15																																	
YEAR PER/YEAR										LE US\$								LE US\$								LE US\$							
-----										-----								-----								-----							
1979	43.23	70.46								0	0			0	0	0	0																
1980	49.72	76.93								0	0			0	4687	0	4687																
1981	57.17	84.35								0	0			5235	21158	5235	21158																
1982	65.75	89.44								0	0			17778	49892	17778	49892																
1983	75.61	92.84								0	0			24930	196890	24930	196890																
1984	86.95	96.33								0	0			24813	175388	24813	175388																
1985	100.00	100								0	0			29001	172200	29001	172200																
1986	115.00	105.00		1.55			15	22.5		6209	31714			9939	35143	16148	66857																
1987	132.25	110.25								4461	82358			0	0	4461	82358																
1988	152.08	115.76								1394	12958			0	0	1394	12958																
1989	174.50	121.55								0	0			0	0	0	0																

NOTES: /1/ ACTUALS, 1980-1984; ESTIMATES 1985-1989. DATA PROVIDED BY PROJECT CONSULTANTS, OFFSEAS ECHTEL INTERNATIONAL
 /2/ DISTRIBUTION CAPITAL COSTS ASSUMED TO BE 1/3 OF THAT FOR SHOUSRA I, II AND III, ADJUSTED FOR INFLATION
 /3/ DISTRIBUTION CAPITAL ESTIMATES COSTS FROM WORLD BANK 1979 FEASIBILITY STUDY
 /4/ 1976 to 1985, ECONOMIC REPORT OF THE PRESIDENT, FEBRUARY 1985. FOR 1986 ON INFLATION IS ASSUMED TO BE 2%.
 /5/ ADJUSTMENT FACTORS ARE INDICES REPORTED IN THIS TABLE. (IT IS ASSUMED THAT DATA WAS ORIGINALLY GIVEN IN CURRENT PRICES.)

SHOUBRA EL KHEIMA THERMAL POWER PROJECT

TABLE 2 CAPITAL COSTS (000) AND PRICE ADJUSTMENT FACTORS

FOURTH UNIT 315000 KW (CURRENT PRICES)										UNITS I II AND III 945000 KW (CURRENT PRICES)									
POWER STATION/1/		TRANSMISSION/1/		DISTRIBUTION/2/TOTAL CAPITAL						POWER STATION/1/		TRANSMISSION/1/		DISTRIBUTION/3/		TOTAL			
YEAR	LE	US\$	LE	US\$	LE	US\$	LE	US\$	YEAR	LE	US\$	LE	US\$	LE	US\$	LE	US\$		
1979							0	0	1979							0	0		
1980							0	0	1980	0	3606	0	0	0	0	0	3606		
1981							0	0	1981	2993	17847	0	0	2993	17847				
1982							0	0	1982	11689	44623	0	0	11689	44623				
1983							0	0	1983	17690	176793	1170	6000	18850	182793				
1984							0	0	1984	18511	148992	3265	19959	21576	168951				
1985							0	0	1985	17200	101700	11800	70500	29000	172200				
1986	7140	33300	0	0			7140	33300	1986	9300	27300	2130	9600	11430	36900				
1987	5800	87300	300	3500			5900	90800	1987	0	0	0	0	0	0				
1988	2000	14400	120	600			2120	15000	1988	0	0	0	0	0	0				
1989							0	0	1989							0	0		
TOTAL	14740	135000	420	4100	0	0	15160	139100	TOTAL	77173	520861	18365	106059	0	0	95536	626920		
PRICE INDICES		EXCHANGE RATE		MAZOUT PRICES				FOURTH UNIT		UNITS I II AND III		UNITS I II III AND IV							
YEAR PER/YEAR	ESPICI	US\$/D/4/	RATE	(LE/TON)	(US\$/TON)	LE	US\$	LE	US\$	LE	US\$								
	0.15		(LE/US\$)																
1979	43.23	70.46																	
1980	49.72	76.93																	
1981	57.17	84.35																	
1982	65.75	89.44																	
1983	75.61	92.84																	
1984	86.95	96.33																	
1985	100.00	100	1.55	230.4	180														
1986	115.00	105.00				6209	31714	9939	35143	16148	66857								
1987	132.25	110.25				4461	82358	0	0	4461	82358								
1988	152.00	115.76				1394	12958	0	0	1394	12958								
1989	174.90	121.55				0	0	0	0	0	0								

NOTES: /1/ ACTUALS, 1980-1984; ESTIMATES 1985-1989. DATA PROVIDED BY PROJECT CONSULTANTS, OVERSEAS ECHTEL INTERNATIONAL
 /2/ DISTRIBUTION CAPITAL COSTS ASSUMED TO BE 1/3 OF THAT FOR SHOUBRA I, II AND III, ADJUSTED FOR INFLATION
 /3/ DISTRIBUTION CAPITAL ESTIMATES COSTS FROM WORLD BANK, 1979 FEASIBILITY STUDY
 /4/ 1976 to 1985, ECONOMIC REPORT OF THE PRESIDENT, FEBRUARY 1985. FOR 1985 ON INFLATION IS ASSUMED TO BE 5%
 /5/ ADJUSTMENT FACTORS ARE INDICES REPORTED IN THIS TABLE. IT IS ASSUMED THAT DATA WAS ORIGINALLY GIVEN IN CURRENT PRICES.

91

SHOUBRA EL KHEIMA THERMAL POWER PROJECT

TABLE 3. ECONOMIC BENEFITS (000) AND IRRs OF EXPANDING EEA GRID PR 1260000 KILOWATTS (1985 PRICES)

YEAR	RELATIONSHIP BETWEEN TARIFFS (PIASTERS/KWH) AND IRRs		MONTHS IN OPERATION	LOAD FACTOR	POWER LOSSES	ELECTRICITY SALES (Kwh)	BENEFITS UNDER ALTERNATIVE TARIFF ASSUMPTIONS (000 LE)		NET BENEFITS UNDER ALTERNATIVE TARIFF ASSUMPTIONS (000 LE)	
	CASE A	CASE B					A	B	A	B
	(Financial)	(Economic)								
1979			0	0.8	0.1	0	0	0	0	0
1980			0	0.8	0.1	0	0	0	-6000	-6000
1981			0	0.8	0.1	0	0	0	-32317	-32317
1982			0	0.8	0.1	0	0	0	-81639	-81639
1983			0	0.8	0.1	0	0	0	-276949	-276949
1984			0	0.8	0.1	0	0	0	-249309	-249309
1985	TARIFFS: 6.4	7.9	4.5	0.8	0.1	2.9E+07	125432	228892	-233135	-189674
1986			9	0.8	0.1	5.8E+09	370863	457784	-69162	17759
1987	IRRs: 0.0000	-0.12093	9	0.8	0.1	5.8E+09	370863	457784	-77317	9604
1988	0.0831		10.5	0.8	0.1	6.8E+09	432674	534082	19143	120551
1989			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
1990	-1.40025		12	0.8	0.1	7.7E+09	494484	610379	41681	157576
1991	-1.40025		12	0.8	0.1	7.7E+09	494484	610379	41681	157576
1992			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
1993	-1.40025		12	0.8	0.1	7.7E+09	494484	610379	41681	157576
1994	-1.40025		12	0.8	0.1	7.7E+09	494484	610379	41681	157576
1995			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
1996			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
1997			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
1998			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
1999			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2000			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2001			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2002			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2003			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2004			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2005			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2006			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2007			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2008			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2009			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2010			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2011			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2012			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2013			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2014			12	0.8	0.1	7.7E+09	494484	610379	41681	157576
2015			7.5	0.8	0.1	4.5E+09	309053	391487	64038	136472
2016			3	0.8	0.1	1.9E+09	123621	152595	9118	38092
2017			3	0.8	0.1	1.5E+09	123621	152595	9118	38092
2018			1.5	0.8	0.1	5.7E+08	61811	76297	5608	20095

an

SHOUBRA EL-KHEIMA
POWER STATION
ENVIRONMENTAL MONITORING PROGRAM

STATUS REPORT
APRIL, 1985

I. INTRODUCTION

An Environmental Monitoring System, consisting of three air quality monitoring stations and one meteorological station, was installed on and near the Shoubrah El-Kheima site in August, 1984. This was based on an air quality modeling study performed by OBI in December, 1980 to determine the locations of the monitoring sites which best represent the local background air quality levels. The purpose of the system is to measure the existing pollutant concentrations and diffusion conditions near the site. These measurements will be used in assessing the local air quality impacts. The total air quality impact includes the maximum projected contributions from the Shoubrah Station and the measured background concentrations at the plant site or its vicinity. The monitoring will be conducted for at least one year to measure the month-to-month variability of meteorological conditions of the site and any seasonal variations of background pollutant concentration levels. Currently OBI is assisting EEA in reviewing all the data collected and in generating monitoring data reports. At the end of the first year data collection period, OBI has proposed to perform an air quality impact study to determine the maximum impact resulting from operation of the Shoubrah Station. OBI will also conduct a technology transfer program to train EEA designated personnel to perform data reduction and air quality modeling.

II. POLLUTANTS MONITORED

Since October, 1984, pollutants monitored are, total suspended particulates (TSP), sulfur dioxide (SO₂), nitrogen dioxide (NO₂) and ozone (O₃). These pollutants, excluding ozone, are emitted from the power station stacks. The hydrocarbons emitted from stacks contribute to chemical reaction producing ozone.

94

III. ONSITE METEOROLOGICAL DATA

To obtain adequate meteorological data for air quality impact assessment, these data should have similar atmospheric dispersion characteristics as the location of the source and its vicinity. Since October, 1984 the meteorological data collected at Shoubrah El-Kheima site are wind speed and wind direction at the 4m, 10m and 25m level, dew point temperature, ambient temperature at 10m, sigma theta (a measure of atmospheric stability) at 10 and 25 meters and acoustic sounding measurements.

IV. MONITORING PROGRAM LEVEL OF EFFECTS

Currently OBI is engaged with the following tasks regarding the monitoring program:

- o Develop and implement computer programs for data checking, data substitution and generation of the required average air quality data.
- o Develop and implement computer programs which generate monthly, seasonal and annual joint frequency tables of meteorological data.
- o Periodic review of environmental monitoring system operation and maintenance.

V. MONITORING PROGRAM CONTINUING EFFORTS

The current and proposed level of efforts through November, 1985 for the monitoring program include the following tasks:

- o Perform meteorological and air quality data review.
- o Determine the semi-annual background pollutant concentrations.

- o Process and reduce the collected meteorological data into a suitable format for use in the dispersion modeling.
- o Develop a site specific air quality model.
- o Periodically generate air quality and meteorological reports.
- o Perform air quality impact analysis.
- o Train two EEA designated personnel on data reduction and dispersion modeling. Training location will be determined by both EEA and OBI.

VI. DATA REPORTING

The following table represents a portion of the averaged pollutant concentration data measured since the monitoring program was started (October 1984 - April 1985).

<u>POLLUTANTS</u>	<u>DAILY AVERAGE</u>		<u>DAILY MAXIMUM</u>	
	ppb	ug/m ³	ppb	ug/m ³
S02	27.1	70.9	72.0	189
TSP	-	366	-	845
NO2	14.9	28.0	52.0	97.8
O3	17.1	33.5	34.0	66.7

96

Available statistical data for TSP for the periods of Sept. 1984 to April 1985 is shown in the following table for different seasons:

STATISTICAL DATA SUMMARY FOR SHUDRAH EL-KHEIMA
TOTAL SUSPENDED PARTICULATES
24 HOUR AVERAGE VALUES IN $\mu\text{g}/\text{m}^3$ BY SEASON

Fall September - December 1984

<u>Site</u>	<u>No. of Samples</u>	<u>Maximum</u>	<u>2nd Max.</u>	<u>Minimum</u>	<u>Arithmetic Mean</u>	<u>Standard Deviation</u>	<u>Geometric Mean</u>	<u>Standard Deviation</u>
BAHTEEM-1	26	828	755	141	326.7	176	291.9	179.5
CORNICHE-2D	32	802 ²	615	123	340.7	150.8	312.2	153.5
CORNICHE-2C	21	1277 ²	716	179	463.8	234.2	420.5	238.3
WARRAK-3	24	484	454	79.15	261	116.7	233.3	120.1

Winter January - March 1985

BAHTEEM-1	11	678	490	193	327.1	152.7	301.1	155.1
CORNICHE-2D	17	845	607	180	420.2	172.5	387.9	175.7
CORNICHE-2C	7	982	533	319	479.2	233.4	444.3	236.6
WARRAK-3	4	628	220	89	283.5	236.6	221.8	247.1

Spring April 1985

BAHTEEM-1	5	639	406	228	385	157.1	362	159.1
CORNICHE-2D	6	321	476	162	348.3	132.2	325.3	134.6
CORNICHE-2C	6	487	375	197	329	103.3	315.3	104.4
WARRAK-3	2	285	232	232	258.5	37.4	257.1	37.5

- NOTE:
1. Corniche Site has two Co-located samplers. These work on the same day and are used to determine precision of samples, for the data shown above there is approximately 17% difference between Corniche 2D and 2C samplers.
 2. Sand storm occurred on this date.

SHOUBRAH EL-KHEIMA POWER STATION
UNIT 4
ENVIRONMENTAL FEASIBILITY STUDY
APRIL 1985

OVERSEAS BECHTEL INCORPORATED
Gaithersburg, Maryland
Job 16464

aa

V. ENVIRONMENTAL CONSIDERATIONS

A. AIR QUALITY IMPACT

Calculations prepared for Shoubrah Units 1, 2, and 3 indicated that the maximum calculated 24-hour SO₂ ground level concentration (GLC) resulting from operation of three units at the Shoubrah El-Kheima site (burning oil with 5 percent sulfur content) is 466.6 µg/m³. This maximum concentration occurs once at a location 1.5 km SSW of the plant. This is based on 5 years of Cairo Airport meteorological data. The second highest calculated value of 327.7 µg/m³ occurred once at a location 0.4 km southwest of the plant. These calculated values are for certain isolated points and, therefore, are not values representing a whole site area. In the United States, a violation is constituted if the National Ambient Air Quality Standards (NAAQS) is exceeded more than once. Therefore, the air quality impact assessment is based on the highest-second highest value. (This means that the GLC would be exceeded once only, which is not a violation under U.S. practice.)

Since the World Bank and the United States Environmental Protection Agency (U.S. EPA) SO₂ standards for 24-hour averaging period are 500 µg/m³, and 365 µg/m³, respectively, the operation of Shoubrah El-Kheima plant when all three units are on oil firing will not cause a violation of the aforementioned standards. However, the Egyptian standard for 24-hour SO₂ concentration is 200 µg/m³. Currently the Egyptian standard is under review by the appropriate Egyptian National Environmental committees.

In the case of clean-burning natural gas, stack emissions of concern are primarily oxides of nitrogen. Both particulates and SO₂ emissions from natural gas burning are very small as compared to the emissions from burning mazout. NO_x emissions from the proposed plant, when burning natural gas in two units, will result in NO_x ground level concentrations well below the 24-hour Egyptian standard of 200 µg/m³ and the annual World Bank and U.S. EPA standards of 100 µg/m³. The commitment to burn natural gas for a minimum of one unit from a total of four units at Shoubrah El-Kheima site will not have an adverse effect on the environment and will meet the United States Environmental Protection Agency and World Bank ambient air quality standards for SO₂, particulates, and NO_x emissions.

An analysis was performed to evaluate the combined air quality impacts resulting from operation of a proposed additional unit together with the currently planned three units at the plant site. The methodology, assumptions, and input data employed and results of the analysis are summarized in this section.

I. STATION CONFIGURATION

Three combinations of oil- and gas-fired units continuously operating over a 24-hour period were considered in the air quality analysis. They are listed as follows:

Combination 1: 2 oil-fired units and 2 natural gas-fired units

Combination 2: 2-2/3 oil-fired units and 1-1/3 natural gas-fired units

Combination 3: 3 oil-fired units and 1 natural gas-fired unit

2. EMISSIONS

The stack effluent emissions and stack parameters used in this analysis are given in Tables V-1, V-2 and V-3, respectively. Stack parameters for Shoubrah Unit 4 are assumed to be the same as the other three units.

3. DISPERSION MODEL

The U.S. EPA Single Source (CRSTER) atmospheric dispersion model was used to predict ground level concentrations for each applicable pollutant (SO₂, particulates, NO_x). The CRSTER model has been modified to include building downwash evaluation. This modified CRSTER model was also used in the Shoubrah Units 1, 2, and 3 air quality study.

Hourly meteorological surface observations from 1971 to 1975 for the Cairo Airport and concurrent upper air data for Helwan, Egypt, provided the necessary meteorological data base for the execution of the air quality model.

4. RESULTS

The CRSTER predicted ground level concentrations of SO₂, particulates, and NO_x from operation of the combinations of oil and natural gas units described in Section I are summarized in Tables V-4, V-5, and V-6. The World Bank and U.S. EPA ambient air quality standards are also included on those tables.

These tables clearly show that combination 3, analyzing the ambient air effects when three of the four Shoubrah units are on mazout and the fourth unit is burning natural gas, has the greatest air quality impact. The maximum resultant SO₂ ground level concentration from this combination is essentially the same as when only three oil units are in operation, as the SO₂ emissions when firing natural gas are negligible. The addition of the natural gas unit slightly elevates the particulate ground level concentration. The natural gas unit's additional emissions of NO_x boost the pollutant ground level concentrations by 30 percent over the currently planned three units at the plant site. Though the additional natural gas unit increases the ground level concentrations of two of the three applicable pollutants, the unit in combined operation with the other three oil units produces pollutant ground concentrations below the World Bank and U.S. EPA air quality standards. Consequently, the addition of a fourth 300 MW unit at the Shoubrah El-Kheima Station will not have an adverse effect on the environment and it is environmentally feasible, provided natural gas is burned in at least one unit.

B. WATER QUALITY IMPACT

1. COOLANT WATER

The primary use of water at Shoubrah is for condenser cooling. Shoubrah is designed with a once-through condenser system, wherein water is pumped from the Nile River through a condenser to condense turbine exhaust steam. The circulating water is returned to the river through a discharge tunnel at about 10 C higher temperature. Addition of the fourth unit will increase the amount of flow but will have no effect on temperature rise, since the condenser will be similar in design to that previously used, maintaining a maximum of 5 C outside the mixing zone in the river with a temperature rise of 10 C across condenser. Previous thermal plume studies indicated adequate dispersion of the thermal effects out from the shoreline and downstream. With the addition of a fourth unit discharging through diffusers, the plume should move further into the river and could have a higher vertical mixing, thus reducing the overall thermal effect.

2. WASTEWATER AND SANITARY

The various power plant wastewater streams will result from the following:

- o Intake screen debris
- o Clarifier blowdown
- o Filter backwash water
- o Demineralizer regeneration
- o Power plant sumps - dirty, clean, and acid wastes
- o Oil spills
- o Air preheater cleaning
- o Boiler wash
- o Laboratory and sampling streams

Wastewater treatment facilities are already in place, consisting of an oily water separator, neutralizing tanks, clarifiers, and filters. All waste streams are treated to meet effluent guidelines shown below, prior to discharge to the Nile.

The discharges associated with the additional capacity of Unit 4 will consist of minor incremental additions to the existing plant wastewater streams. The associated incremental impacts will be minor, given the innocuous character of the projected facility discharges. This will be the case since the existing treatment systems will accommodate or be upgraded to accommodate the additional quantities of wastewater, if final design calculations so require.

Tables V-7, V-8, V-9 show the various water quality standards and the calculated effluent qualities from Shoubrah, with Units 1, 2, and 3 and the addition of Unit 4.

TABLE V-1

EMISSION FROM OIL AND NATURAL GAS FIRING

EMISSION RATE PER GENERATING UNIT AT FULL LOAD, lb/hr

<u>POLLUTANT</u>	<u>OIL FIRING</u>	<u>NATURAL GAS FIRING</u>
Particulates	1212	30.4
Sulfur Dioxide	18030*	1.8**
Nitrogen Dioxide	2400	2130.0

*For 5 percent sulfur oil

**For 0.001 percent sulfur gas

102

TABLE V-2
TOTAL EMISSIONS, lb/hr

<u>Pollutant</u>	<u>Combination 1</u> <u>2 oil + 2 gas</u>	<u>Combination 2</u> <u>2-2/3 oil & 1-1/3 gas</u>	<u>Combination 3</u> <u>3 oil & 1 gas</u>
Particulates	2,485	3,272	3,666
Sulfur Dioxide	36,064	48,082	54,092
Nitrogen Dioxide	9,060	9,240	9,330

TABLE V-3
STACK PARAMETERS*

Stack Height	121.9 meters (one stack/unit)
Stack Exit Diameter	6.1 meters
Stack Exit Velocity	17.1 meters/second
Stack Gas Exit Temperature	421.9° K

*These parameters remain unchanged for the fractional units in the 2-2/3 oil units and 1-1/3 gas units combination.

104-

TABLE V-4

MAXIMUM AIR QUALITY IMPACT, $\mu\text{g}/\text{m}^3$

(Two oil-fired units and two natural gas-fired units at full load)

<u>POLLUTANT</u>	<u>TYPE AND PERIOD OF AVERAGING</u>	<u>AMBIENT AIR QUALITY CRITERIA</u> WORLD BANK - U.S. EPA		<u>CONTRIBUTION FROM* THE SHOUBRAH EL-KHEIMA STATION</u>
Suspended Particulates	Max annual	100	60	.7
	Max 24-hour	500	150	15.1
Sulfur Dioxide	Max annual	100	80	9.3
	Max 24-hour	500	365	218.5**
Nitrogen Dioxide	Max annual	100	100	2.5

*No background pollutant concentrations are included.

**Maximum impact occurred 0.4 km southwest of the plant.

105-

TABLE V-5

MAXIMUM AIR QUALITY IMPACT, $\mu\text{g}/\text{m}^3$

(Two 2/3 oil-fired units and one 1/3 natural gas-fired units at full load)

<u>POLLUTANT</u>	<u>TYPE AND PERIOD OF AVERAGING</u>	<u>AMBIENT AIR QUALITY CRITERIA WORLD BANK - U.S. EPA</u>		<u>CONTRIBUTION FROM* THE SHOUBRAH EL-KHEIMA STATION</u>
Suspended Particulates	Max annual	100	60	.9
	Max 24-hour	500	150	19.7
Sulfur Dioxide	Max annual	100	80	12.4
	Max 24-hour	500	365	291.3**
Nitrogen Dioxide	Max annual	100	100	2.5

*No background pollutant concentrations are included.

**Maximum impact occurred 0.4 km southwest of the plant.

106'

TABLE V-6

MAXIMUM AIR QUALITY IMPACT, $\mu\text{g}/\text{m}^3$

(Three oil-fired units and one natural gas-fired unit at full load)

<u>POLLUTANT</u>	<u>TYPE AND PERIOD OF AVERAGING</u>	<u>AMBIENT AIR QUALITY CRITERIA</u>		<u>CONTRIBUTION FROM* THE SHOUBRAH EL-KHEIMA STATION</u>
		<u>WORLD BANK - U.S. EPA</u>		
Suspended Particulates	Max annual	100	60	1.0
	Max 24-hour	500	150	22.2
Sulfur Dioxide	Max annual	100	80	14.0
	Max 24-hour	500	365	327.7**
Nitrogen Dioxide	Max annual	100	100	2.6

*No background pollutant concentrations are available.
**Maximum impact occurred 0.4 km southwest of the plant.

107 -

TABLE V-7
COMPARISON OF WATER QUALITY STANDARDS
FOR POWER PLANT EFFLUENTS

<u>EFFLUENT PARAMETER</u>	<u>EGYPT</u>	<u>WORLD BANK</u>	<u>U.S. EPA</u>	
			<u>MONTHLY AVERAGE</u>	<u>DAILY MAXIMUM</u>
TSS, mg/l	30	-	30	100
BOD, mg/l	20	-	-	-
COD, mg/l	15	-	-	-
Copper, mg/l	-	-	1	1
Iron, mg/l	-	-	1	1
Sulfide, mg/l	1	-	-	-
Cyanide, mg/l	0.1	-	-	-
Oil & grease, mg/l	10	-	15	30
pH	6-9	-	6-9	6-9
Temperature, C	35	*	**	**

*3 degree C rise above the receiving water temperature (receiving water temperature >28 C)
5 degree C rise above the receiving water temperature (receiving water temperature ≤28 C)

**Case-by-case determination beyond an agreed upon mixing zone area

108-

TABLE V-8
WASTEWATER EFFLUENT QUALITY
WASTEWATER TREATMENT PLANT EFFLUENT

EFFLUENT PARAMETER	UNITS 1, 2, AND 3		UNITS 1, 2, 3, AND 4	
	AVERAGE	MAXIMUM	AVERAGE	MAXIMUM
Flow, liters/day	1.06x10 ⁶ *	2.85x10 ⁶ **	1.41x10 ⁶ *	3.67x10 ⁶ ***
TSS, mg/l	30	100	30	100
BOD, mg/l	20	20	20	20
COD, mg/l	15	15	15	15
Copper, mg/l	1	1	1	1
Iron, mg/l	1	1	1	1
Sulfide, mg/l	trace	trace	trace	trace
Cyanide, mg/l	trace	trace	trace	trace
Oil & grease, mg/l	15	20	15	20
pH	6 - 9	6 - 9	6 - 9	6 - 9

*Based on an average blowdown of 1.5 percent from each unit

**Based on a maximum simultaneous blowdown of 5.0 percent from three units

***Based on a maximum simultaneous blowdown of 5.0 percent from four units for a limited period of time (The wastewater treatment plant can accommodate this increased flow by using the spare treatment equipment.)

TSS - Total suspended solids
BOD - Biological oxygen demand
COD - Chemical oxygen demand

109

TABLE V-9
WASTEWATER EFFLUENT QUALITY
CIRCULATING COOLING WATER DISCHARGE

<u>EFFLUENT PARAMETER</u>	<u>UNITS 1, 2, AND 3</u>		<u>UNITS 1, 2, 3, AND 4</u>	
	<u>AVERAGE</u>	<u>MAXIMUM</u>	<u>AVERAGE</u>	<u>MAXIMUM</u>
Flow, liters/day	3149x10 ⁶	3149x10 ⁶	4198x10 ⁶	4198x10 ⁶
Condenser Temperature Rise	10 C	10 C	10 C	10 C
River Temperature Rise Beyond the Mixing Zone	-	5 C	-	5 C*

*The proposed discharge will be designed to result in a temperature rise of 5 degrees C or less.

110

MEMORANDUM

Date: March 9, 1985

To: NE/PT/EGYPT, Charles Patalive, Project Officer

From: NE/PD/ENV, Stephen F. Lintner, Environmental Coordinator JFL

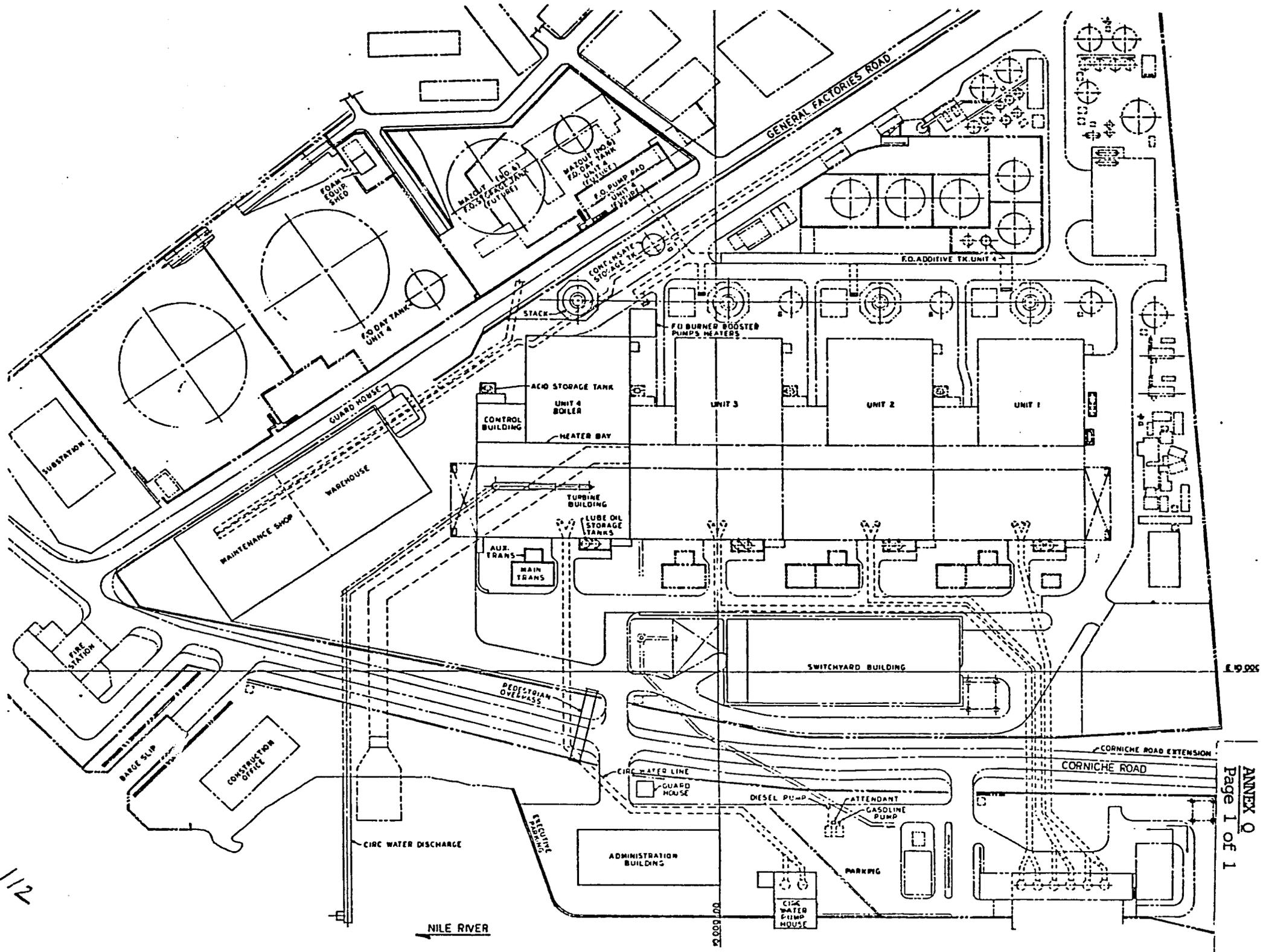
Subject: EGYPT - Shoubra El-Kheima Power Station Project Paper
(263-0030) - Unit 4 Amendment - Environmental Clearance

I have reviewed the Shoubra El-Kheima Power Station - Unit 4 Feasibility Study Report prepared by Overseas Bechtel Incorporated (Job 16464) and find that it provides adequate data to be considered the equivalent of an Amended Environmental Assessment, as required under 22 CFR 216, "A.I.D. Environmental Procedures," for the proposed project paper amendment. This clearance should be noted in the environmental analysis section of the project paper amendment.

It is requested that the issue of fuel selection continue to be an element of the Mission's "Policy Dialogue" with the Government of Egypt. It should be noted that significantly better air quality can be regularly provided at the Shoubra El-Kheima Power Station through the use of cleaner fuels such as natural gas. The larger the percentage of low quality fuels which are burned, especially mazout, the greater the level of effort in plant management which will be required to provide adequate air quality from this facility.

cc: GC/NE, R. Johnson
AID/Cairo, J. Starnes, Mission Environmental Officer
AID/Cairo, J. Hunt, Mission Project Officer
AID/Cairo, K. O'Donnell, Senior Legal Advisor

- 111 -



E. 19.026

1/2

EVALUATION OF COMPETITIVE BIDDING IMPACT
(IN MILLION EQUIVALENT US \$)

P.O./ CONTRACT	FUNDING AGENCY	CONTRACT PRICE	NEGOTIATION TARGET	PROBABLE PRICING DIFFERENTIAL	SCHEDULE IMPACT (Months)	ENG'N IMPACT	OPER'N TRAIN'G IMPACT	SPARE PARTS	CONTIN- GENCY	REMARKS
<u>Shoubrah El-Kheima Plant, Unit 4</u>										
Turb. Genr.	USAID	27.6	27.6	Reasonable	8-12	Major	Major	1.0	2.0	
Boiler	EIB/GI	30.8	29.8	[3]	8-12	Major	Major	1.2	2.0	
Civil (Main)	ADB	18.5	18.0	[3]	5-12	Minor	None	None	1.5	5M - If T/G, S/G are not rebid, and civil is. 12M - If T/G and S/G are rebid too.
Shoreline	ADB	6.8	6.3	[1]	NONE	Minor	None	None	0.5	Recommend rebid due to change in scope
Elect. & Cont'l.	ADB	5.2	5.2	Reasonable	0-8	Medium	Minor	0.2	0.5	OM - If Civil is rebid. 8M - If Condenser, Pumps are rebid
Mech. & Piping	ADB	16.7	16.7		0-8	Medium	Minor	1.0	1.5	OM - If civil is rebid 8M - If Condenser & Pumps are rebid.
Condensers	USAID	5.8	5.8	Reasonable	6-8	Medium	Medium	0.1	0.5	Will impact Mech. & Elect. Packages.
Pumps	USAID	5.4	4.2	[1]	6-8	Medium	Minor	0.7	0.5	Will impact Mech. & Elect. Packages.
Critical Piping	ADB	3.5	3.5	Reasonable	0-6	Minor	Medium	0.4	0.5	OM - If Mech. & Piping is rebid
Transformers	OECF	2.3	2.3	Reasonable	NONE	Medium	Medium	0.1	0.2	
Switchgear	ADB	1.3	1.3	Reasonable	0-6	Medium	Medium	0.1	0.1	OM - If Elect. is rebid
Panel & Controls	USAID	3.5	3.5	Reasonable	3-5	Medium	Major	0.5	0.5	Elect. will be impacted
Switchyard	OECF	4.0	4.0	Reasonable	NONE	Medium	Medium	0.1	0.3	
TOTAL		131.4	128.2	[6]	-	5-10	-	5.4	10.6	
<u>* Interconnection for Unit 4</u>										
220 KV U.G.	CIDA/EDC	5.5	5.5	-	NONE	Minor	None	0.2	0.0	
Transmission & Related Work	COFACE	0.1	0.1	-	NONE	-	-	-	0.0	Proposed using exist. financ
	EEA	2.2	2.2	-	-	-	-	-	-	
	USAID	0.9	0.9	-	-	-	-	-	-	
		8.7	8.7							

* Included on this table after the Co-financiers Meeting

Note: Estimate for consulting services is as presented in the feasibility report.

1/3

**PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK**

Life of Project:
From FY 79 to FY 89
Total U. S. Funding \$ 263 Million
Date Prepared: June 6, 1985

Project Title & Number: Shoubrah El Kheima Thermal Power Plant, Amendment No. 3, Project 263-0030

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Program or Sector Goal: The broader objective to which this project contributes: (A-1)</p> <ol style="list-style-type: none"> To provide power and energy needed for continuing industrial, commercial and residential expansion and economic growth. Improvement of rural and urban living conditions. 	<p>Measures of Goal Achievement: (A-2)</p> <ol style="list-style-type: none"> Increased industrial sector GDP Increased industrial employment 	<p>(A-3)</p> <p>Government of Egypt Statistical Data</p>	<p>Assumptions for achieving goal targets: (A-4)</p> <ol style="list-style-type: none"> The policies and actions of the Egyptian Government concerning fiscal and monetary policy, prices and debt management that will foster continued growth. The GOE will continue to move electricity and fuel pricing toward unsubsidised price levels
<p>Project Purpose: (B-1)</p> <p>To augment the capacity of the Egyptian Electricity Authority to meet increasing energy requirements of consumers throughout Egypt.</p>	<p>Conditions that will indicate purpose has been achieved: End-of-Project status. (B-2)</p> <ol style="list-style-type: none"> The four 315 MW generating units at Shoubrah El Kheima will be fully operational and will be delivering rated output to the UPS for supply to consumers The plant will be staffed by trained operators and maintenance personnel. 	<p>(B-3)</p> <p>Examination and inspection of the completed steam turbine generating plant</p>	<p>Assumptions for achieving purpose: (B-4)</p> <ol style="list-style-type: none"> That required transmission line and substation facilities to connect the additional generation from the plant to the network will be completed in a timely fashion. That natural gas and mazout pipelines will be sufficient to supply the additional fuel required.
<p>Project Outputs: (C-1)</p> <p>Construction of a four unit 1,260 MW steam turbine generating plant at Shoubrah El Kheima.</p>	<p>Magnitude of Outputs: (C-2)</p> <ol style="list-style-type: none"> Unit and Plant Gross and Net Output in MW. Unit and Plant Gross and Net Generation in Kilowatt-hours. Unit and Plant Heat Rate. Unit and Plant Availability. 	<p>(C-3)</p> <ol style="list-style-type: none"> Review and approval of contracts for consultant services, equipment and material. Contractor reports. Consultant Monthly Reports. Review of disbursements made upon shipment of equipment. Inspection and examination of the work. 	<p>Assumptions for achieving outputs: (C-4)</p> <ol style="list-style-type: none"> Donors will provide all foreign exchange required to carry out the project. GOE will provide all local currency required to carry out the project. GOE will continue to comply with project covenants.
<p>Project Inputs: (D-1)</p> <ol style="list-style-type: none"> Contract Amendment for consulting engineer to provide engineering, procurement, construction management, start-up and training services. Contract amendments for equipment and material supply for Turbine-generator, condenser, pumps, panels and controls, water treatment and reinforcing steel. 	<p>Implementation Target (Type and Quantity) (D-2)</p> <p>Commercial Operation of:</p> <p>Unit 1 - May 1985 Unit 2 - October 1985 Unit 3 - April 1986 Unit 4 - December 1988</p>	<p>(D-3)</p> <ol style="list-style-type: none"> Contract review Comparison of cash flow to cash flow plan. Delivery schedules of equipment. Installation schedules of equipment. Construction progress in comparison to construction schedules. 	<p>Assumptions for providing inputs: (D-4)</p> <ol style="list-style-type: none"> Conditions Precedent will be met within 180 days of Grant Agreement signing. Existing equipment will be duplicated Equipment and services will be provided at 1982 price levels.

115