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The World Bank

Report No: ICR2300

IMPLEMENTATION COMPLETION AND RESULTS REPORT
(IBRD-73590)

ON A

LOAN

IN THE AMOUNT OF
US$259.6 MILLION

TO THE

ARAB REPUBLIC OF EGYPT

FOR A

EL TEBBIN POWER PROJECT

November 21, 2012

Sustainable Development Department
Middle East and North Africa Region

CURRENCY EQUIVALENTS
(Exchange Rate Effective September 5, 2012)

Currency Unit
LE – Egyptian Pounds 1.00 = US$ 0.164
US$ 1.00 = LE – Egyptian Pounds 6.09

FISCAL YEAR
July 1 – June 30

ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
CCGT	Combined Cycle Gas Turbine
CEPC	Cairo Electricity Production Company
CTF	Clean Technology Fund
DSCR	Debt Service Coverage Ratio
EEHC	Egyptian Electricity Holding Company
EEUCPRA/ERA	Egyptian Electric Utility and Consumer Protection Authority/ Electricity Regulatory Agency
EIB	European Investment Bank
ERR	Economic Rate of Return
EPC	Engineering, Procurement and Construction
ESMAP	Energy Sector Management Assistance Program
FMU	Financial Management Unit
FY	Fiscal Year
GASCO	Natural Gas Transmission Company
GEF	Global Environment Facility
GWh	Gigawatt hour
GOE	Government of Egypt
HFO	Heavy Fuel Oil
IPP	Independent Power Producer
ISN	Interim Strategy Note
kWh	Kilowatt hour
LRMC	Long Run Marginal Cost
MMBTU	Million British Thermal Units
MW	Megawatt
NBE	National Bank of Egypt
NIB	National Investment Bank
O&M	Operations and Maintenance
OPEC	Organization of the Petroleum Exporting Countries
PGESCO	Power Generation Engineering and Services Company
PMU	Project Management Unit
PPP	Public Private Partnership
PPA	Power Purchase Agreement
Pt	Piasters (LE 0.01)
TA	Technical Assistance
TOU	Time of Use
USAID	United States Agency for International Development
US¢	US cents

Vice President:	Inger Andersen
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Egypt, Arab Republic Of
EL TEBBIN POWER PROJECT

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A. Basic Information			
Country:	Egypt, Arab Republic of	Project Name:	EG-El Tebbin Power
Project ID:	P091945	L/C/TF Number(s):	IBRD-73590
ICR Date:	11/21/2012	ICR Type:	Core ICR
Lending Instrument:	SIL	Borrower:	GOVERNMENT OF EGYPT
Original Total Commitment:	USD 259.60M	Disbursed Amount:	USD 259.60M
Revised Amount:	USD 259.60M		
Environmental Category: A			
Implementing Agencies: Egyptian Electricity Holding Company			
Cofinanciers and Other External Partners:			

B. Key Dates				
Process	**Date**	**Process**	**Original Date**	**Revised / Actual Date(s)**
Concept Review:	09/30/2004	Effectiveness:	08/23/2006	08/23/2006
Appraisal:	10/14/2005	Restructuring(s):		12/10/2009 04/20/2011 10/23/2011
Approval:	02/16/2006	Mid-term Review:		06/30/2009
		Closing:	04/30/2011	04/30/2012

C. Ratings Summary	
C.1 Performance Rating by ICR	
Outcomes:	Moderately Satisfactory
Risk to Development Outcome:	Substantial
Bank Performance:	Moderately Satisfactory
Borrower Performance:	Moderately Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)			
Bank	**Ratings**	**Borrower**	**Ratings**
Quality at Entry:	Moderately Satisfactory	Government:	Moderately Satisfactory
Quality of Supervision:	Satisfactory	Implementing Agency/Agencies:	Satisfactory
Overall Bank Performance:	Moderately Satisfactory	**Overall Borrower Performance:**	Moderately Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators			
Implementation Performance	**Indicators**	**QAG Assessments (if any)**	**Rating**
Potential Problem Project at any time (Yes/No):	No	Quality at Entry (QEA):	None
Problem Project at any time (Yes/No):	No	Quality of Supervision (QSA):	None
DO rating before Closing/Inactive status:	Satisfactory		

D. Sector and Theme Codes		
	Original	**Actual**
Sector Code (as % of total Bank financing)		
Power	100	100
Theme Code (as % of total Bank financing)		
Infrastructure services for private sector development	100	100

E. Bank Staff		
Positions	**At ICR**	**At Approval**
Vice President:	Inger Andersen	Christiaan J. Poortman
Country Director:	Hartwig Schafer	Emmanuel Mbi
Sector Manager:	Patricia Veevers-Carter	Jonathan D. Walters
Project Team Leader:	Mohab Awad Mokhtar Hallouda	Anna M. Bjerde
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F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document)
The project development objectives are to: (i) assist the GOE in enhancing the provision of energy supply in a sustainable manner, through investment in new generation capacity, and (ii) help the GOE strengthen sector performance by engaging in policy dialogue and supporting measures aimed at improving financial performance, the functions of the regulator and energy efficiency. Input would also be provided to the development of the legal framework for the sector.

Revised Project Development Objectives (as approved by original approving authority)

(a) PDO Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Increase in total generating capacity (MW)			
Value quantitative or Qualitative)	18,117 MW	26,679		27,049 MW
Date achieved	09/15/2005	03/31/2010		06/30/2011
Comments (incl. % achievement)				
Indicator 2 :	Debt service coverage ratio.			
Value quantitative or Qualitative)	1.4	1.4		1.1
Date achieved	09/15/2005	06/08/2011		06/30/2011
Comments (incl. % achievement)				
Indicator 3 :	EEHC current ratio.			
Value quantitative or Qualitative)	0.5	>=1		0.5
Date achieved	10/20/2011	06/09/2011		06/30/2011
Comments (incl. % achievement)				

(b) Intermediate Outcome Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	El-Tebbin power plant is operational with net capacity of 700 MW			
Value (quantitative or Qualitative)	0	700 MW		700 MW*
Date achieved	09/15/2005	03/31/2010		06/30/2011
Comments (incl. % achievement)	*A fire incident occurred on October 26, 2012. The power plant is currently out of operation, pending investigation and repair activities.			
Indicator 2 :	Enhanced contribution by the regulator to design and apply pricing			

Value (quantitative or Qualitative)	0			Time of use electricity tariffs for industrial users implemented.
Date achieved	09/15/2005			06/30/2011
Comments (incl. % achievement)				
Indicator 3 :	Energy efficiency - better ability to manage peak load			
Value (quantitative or Qualitative)	0			Load management program is designed based on patterns and use by industrial and large commercial users and feasibility of interruptability scheme is assessed.
Date achieved	09/15/2005			03/23/2012
Comments (incl. % achievement)				

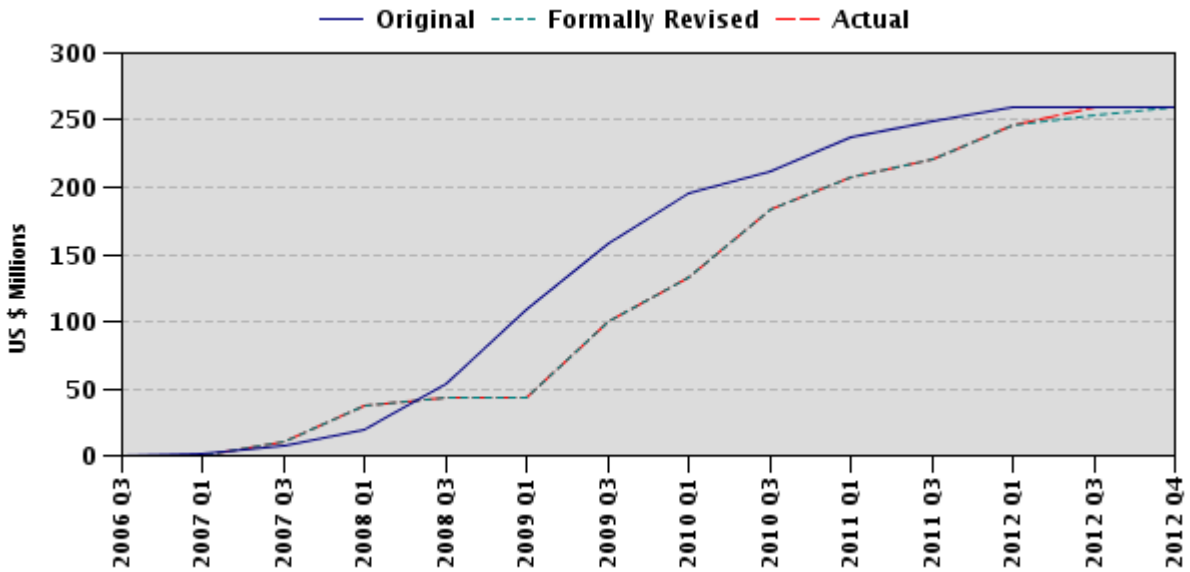
G. Ratings of Project Performance in ISRs

No.	Date ISR Archived	DO	IP	Actual Disbursements (USD millions)
1	03/16/2006	Satisfactory	Satisfactory	0.00
2	09/21/2006	Satisfactory	Satisfactory	0.00
3	12/06/2006	Satisfactory	Satisfactory	0.00
4	05/18/2007	Satisfactory	Satisfactory	9.85
5	11/27/2007	Highly Satisfactory	Highly Satisfactory	42.93
6	05/21/2008	Highly Satisfactory	Highly Satisfactory	42.93
7	11/23/2008	Highly Satisfactory	Highly Satisfactory	42.93
8	06/23/2009	Highly Satisfactory	Highly Satisfactory	113.17
9	12/23/2009	Satisfactory	Satisfactory	166.35
10	06/24/2010	Satisfactory	Satisfactory	188.54
11	01/04/2011	Satisfactory	Satisfactory	217.98
12	06/26/2011	Satisfactory	Satisfactory	232.84
13	11/06/2011	Satisfactory	Satisfactory	248.37

H. Restructuring (if any)

Restructuring Date(s)	Board Approved PDO Change	ISR Ratings at Restructuring		Amount Disbursed at Restructuring in USD millions	Reason for Restructuring & Key Changes Made
		DO	IP		
12/10/2009	N	HS	HS	166.35	The Project was restructured to (i) revise project financing plan to accommodate project cost increase; (ii) reduce the number of procurement packages in the procurement plan that are financed by the IBRD loan; and (iii) change the allocation of the IBRD loan between disbursement categories to bring them in line with the procurement packages.
04/20/2011		S	S	220.22	Closing Date Extension from April 30, 2011 to October 30, 2011.
10/23/2011		S	S	246.05	Closing date extension from October 30, 2011 to April 30, 2011.

I. Disbursement Profile



1. Project Context, Development Objectives and Design

1.1 Context at Appraisal

Country Issues

1. The political system in Egypt was characterized by stability and continuity at the time the Project was prepared and in 2004 about 98 percent of the country's population had access to electricity.

2. At the time of appraisal in November 2005, Egypt was one year into undergoing comprehensive economic reforms which were aimed at reducing a rising fiscal deficit, stimulating growth and reducing poverty. The fiscal deficit rose from 3.9 percent in FY00 to 9.6 percent in FY05. The reforms were centered on finance, investment, trade and industry. Also included in the reform agenda was the expansion of public-private partnerships (PPPs), and undertaking public sector reforms aimed at enhancing the provision of public goods and services, including physical and social infrastructure. The power sector became a key area of focus in enhancing physical infrastructure in Egypt.

3. The EL Tebbin Power Project was designed with the objective of assisting the Government of Egypt in reaching its goal of providing the country with energy supply at least cost and in a sustainable manner, through investment in new generation capacity and support for improved performance.

4. The Bank had limited involvement in the Egyptian power sector since the cancellation of the Kureimat Power Loan in 1992. This meant the Bank had played no role in policy or institutional reform in this important sector for quite some time. It was envisaged that this Project could be the first in a longer-term program of assistance, where follow-up projects would focus increasingly on improving the reliability of electricity services to the consumers as well as the performance of the energy sector, including supporting policy issues at a pace with which the government was comfortable.

Sector Issues

5. Egypt's rapidly expanding economy was based on the availability of reliable and reasonably priced electric power and there was a need to keep up with this growing demand by substantially increasing the generation capacity. Installed capacity of electric power was 20,452 MW in 2005/2006, of which 85 percent comprised thermal power (10 percent of which is provided by the private sector through three Independent Power Producers, IPPs). The remaining capacity was attributed to hydropower (15 percent) and wind (1 percent). Peak load reached 17,300 MW and close to 90 percent of the thermal power production was based on natural gas.

6. The increase in demand for electricity in Egypt averaged 7 percent during 1997/98-2002/03 and was expected to remain in the 6-7 percent range over the next 10 years. To meet the expected demand, the Egyptian Electricity Holding Company (EEHC), responsible for generation, transmission and distribution of electricity in Egypt,

developed a least cost generation expansion plan. This plan had two phases: a fast track phase (2002-2007), during which 4,500 MW of combined cycle gas turbines will be implemented, and a medium-term phase (2008-2012), during which 8,375 MW of steam and Combined Cycle Turbines will be implemented. The EL Tebbin Power Project was intended to contribute to the medium-term phase by improving generation capacity and improving long-term sustainability in the energy sector.

7. Another issue faced by the sector at appraisal was the under-pricing of electricity which was a contributor to the relatively high growth in consumption, with consequently heavy capital expenditure demands which caused the negative impact on the financial position of the sector. Prices for electricity were changed for the first time since 1992 in October 2004 (from an average of 12.8 Pt/kWh to 14.06 Pt/kWh–2.4 US¢/kWh).[1] Prices had declined substantially in real terms over that period and, with the depreciation of the Egyptian pound, in foreign currency terms as well. During this time, the operating costs of existing plant and the capital costs of new plant had increased, resulting in a widening gap between the sector's revenues and costs. Electricity became subsidized overall (i.e., prices do not fully cover costs) and there were also substantial, poorly targeted cross-subsidies.

8. The sector went through a number of first stage reforms including (i) the unbundling of the sector under a state-owned holding company model where the generation, transmission and distribution retailing segments were functionally separated within the EEHC; (ii) the establishment of a sector regulator in 2000, the Egyptian Electric Utilities and Consumer Protection Authority (EEUCPRA or ERA), and the establishment of an internal power pool in 2002 to replace the previous dispatch processes. However, the benefits of these reforms were yet to be materialized and there was much improvement still needed in the area of legal and regulatory framework. In the late 1990's the government introduced private sector participation in the sector through the three Independent Power Producer (IPPs). The view then was that the sector should increasingly be financed by the private sector. However, with the devaluation of the Egyptian pound, the cost of the power purchased – which was fixed in US dollars— started to exceed the average retail price for electricity thus bring losses to the sector.

Rationale for Bank Involvement

9. The rationale for Bank involvement was twofold: (i) there was a need for investment in power generation by the public sector; and (ii) there was momentum and political support for continuing the reforms started in the late 1990s. The Project was identified as a high risk operation for the Bank. It was envisaged that the Bank would have little leverage in encouraging further power sector reform through the Project due to its small size relative to Egypt power sector investment program. However, it was also

[1] The 2004 increase was 8%, with a further 5% increase p.a. for the next 5 years.

envisaged that the Bank can have significant input to the sector reform process, even if the Project does not include a substantial technical assistance component[2].

10. Private participation was being sought by GOE to reduce the fiscal burden of power sector investments caused by the tariff policy which was in place then and the associated social safety net issues. The cost for the IPPs ranged from US$612/kW to US$495/kW (thus yielding the lowest IPP electricity prices in the world), the devaluation in 2003 nearly doubled the cost of power under the Power Purchase Agreements (PPAs) to the EEHC and exceeded both the retail price and EEHC's estimates of the costs from its own new plant. GOE was reluctant to enter into new IPPs under the framework of the late 1990s, i.e., with PPAs in US Dollars and where the EEHC is obligated to purchase the power. Consequently, GOE opted for public sector financing of the power sector generation requirements, including for the EL Tebbin Plant. The GOE subsequently reinitiated the private participation program. This started first with the Suez Gulf wind power project in 2009 and then with a conventional power project at Dairut site in 2010.

11. Since the cancellation of the Kureimat Power Loan in 1992 (IBRD Loan Number 34410), the Bank had limited involvement in the Egyptian power sector, mainly providing support for the development of Egypt's renewable energy resources through the Global Environment Facility (GEF). Funding for recent power plants and the fast track capacity program had come from sources such as European Investment Bank (EIB), African Development Bank (AfDB) and Arab Funds, while technical assistance was largely funded by the United States Agency for International Development (USAID).

12. World Bank involvement in the funding of the EL Tebbin Plant therefore allowed for contribution to the development of sector policy in key areas, such as the legal and regulatory frameworks, future gas and electricity pricing and planning, renewable energy development (wind and solar) and further implementation of already undertaken reforms.

1.2 Original Project Development Objectives (PDO) and Key Indicators (as approved)

13. The project development objectives are to: (i) assist the GOE in enhancing the provision of energy supply in a sustainable manner, through investment in new generation capacity, and (ii) help the GOE strengthen sector performance by engaging in policy dialogue and supporting measures aimed at improving financial performance, the functions of the regulator and energy efficiency. Input would also be provided to the development of the legal framework for the sector.

[2] Bank deliberations during Energy & Mining Sector Board Country Review and Regional Operations Committee meetings related to the Project.

Table 1: Key Outcome Indicators by Component	
Component	**Key Results Indicators**
1. Investment in new generation capacity	EL Tebbin Power Plant is completed and operational with a net capacity of 700 MW
2. Technical assistance to improve long-term sustainability of the sector:	
Financial performance improvement	Improved ability to generate accurate financial reports for decision-making Improved current ratio and Debt Service Coverage Ratio (DSCR) at EEHC
Regulatory support	Enhanced contribution by the regulator to design and apply pricing
Energy Efficiency	Ability to manage peak load better

1.3 Revised PDO and Key Indicators

14. The PDO was not revised as it remained relevant throughout the project implementation.

1.4 Main Beneficiaries

15. Power Component: The main beneficiaries of the power component are the people of Egypt who would receive more sustained energy supply through the increase in total generating capacity.

16. Technical Assistance Component: The main beneficiaries of this component are the Ministry of Electricity and Energy and its subsidiaries such as EEHC, EEUCPRA and CEPC.

1.5 Original Components (as approved)

Component 1: EL Tebbin Power Plant

17. The Project was to finance a 700 MW power plant comprising of two units of 350 MW steam turbines and boilers using natural gas as a main fuel and residual oil (mazout) as emergency back-up fuel. The total project cost was estimated at about US$449.6 million, of which the Bank had been requested to finance US$259.6 million. The remaining project cost was to be financed by EEHC/CEPC corporate financial resources.

18. This component included the following: (i) demolition of existing plant and site preparation works; (ii) two units of 350 MW steam turbine-generators; (iii) two units of steam generators (boilers); (iv) electrical equipment including transformers and

switchyard; (v) auxiliary mechanical equipment including pumps and drives, heat exchangers and de-aerators, and critical and non-critical piping and valves; (vi) a water and wastewater treatment plant; (vii) the implementation of the Environmental Management Plan (EMP), including environmental monitoring equipment; (viii) distributed control systems and instrumentation, (ix) engineering and project management services including design, procurement and construction supervision as well as commissioning, testing and start-up of the Project; (x) civil works, yard tanks and medium and low voltage switchgear; (xi) insurance; and (xii) transmission lines to interconnect to the national power grid.

Component 2: Technical Assistance Component

19. The Technical Assistance (TA) component was designed to address key issues facing the sector, such as the need for better financial performance, strengthening the pricing structure and energy efficiency. The assistance mainly comprised of studies and implementation support as necessary and was estimated at about US$2.45 million. The Energy Sector Management Assistance Program (ESMAP), a multi-donor grant facility managed by the World Bank, was to finance US$0.65 million. The sub-components consisted of the following:

(i) Financial Performance Improvement (US$1.7 million):

20. The Government took steps to improve the financial performance of the sector with the 2004 tariff increase and the approval for a 5 percent annual increase for the next five years. To ensure better monitoring and reporting of the financial position of the sector and to allow for the use of financial information as a decision-making tool for management, an automated financial management system was to be implemented at the EEHC. This component was to be financed by EEHC and not financed as part of this Project.

(ii) Support to strengthen the Design and Application of Time-of-Use (TOU) Tariff Structure (US$0.35 million):

21. The Ministry of Electricity and Energy was interested in reviewing pricing signals to reduce energy consumption. An effective pricing mechanism is the time-of-use tariff aimed at reducing the demand at peak periods and thus relieving the pressure of maintaining investment to meet peak demand. This component was to be financed by a grant from ESMAP.

(iii) Energy Efficiency (US$0.40 million)

22. During project preparation, a workshop was held where experts from different countries shared their experiences on energy efficiency measures aimed at reducing consumption of electricity. Based on discussions during the workshop and an assessment of the achievements already made in Egypt in this area, three TA activities were agreed to:

- Design of a load management program, based on an assessment of data collected on consumption patterns of industrial and large commercial customers (US$0.2 million; financed by a grant from ESMAP).
- Upgrade of Long Run Marginal Cost (LRMC) software (US$0.1 million; to be financed by EEHC).
- Feasibility assessment of an "Interruptability" Scheme (US$0.1 million; financed by a grant from ESMAP)

1.6 Revised Components

There was no change to the Project components

1.7 Other Significant Changes

23. In December, 2009, the Project was restructured to (i) revise project financing plan to accommodate project cost increase; (ii) reduce the number of procurement packages in the procurement plan that are financed by the IBRD loan; and (iii) change the allocation of the IBRD loan between disbursement categories to bring them in line with the procurement packages.

> The closing date for the Project was extended twice in response to requests from GOE to complete the remaining activities under the contracts financed by the World Bank. The first extension, approved on April 20, 2011 was to extend the closing date from April 30, 2011 to October 30, 2011 and the second approved on October 23, 2011 was to extend the closing date from October 30, 2011 to April 30, 2012.

24. **A fire incident occurred on October 26, 2012 disrupting EL Tebbin Power Plant operation. T**he power plant is currently out of operation while an investigation is being carried out. This is elaborated in paragraph 33. This ICR and ratings do not take this incident into account, pending the investigation.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry

25. ***Project preparation.*** A qualified team with the required skills was in charge of project preparation. Safeguards issues, including consultations, were adequately addressed and supported by the fact that the power plant was being built on an existing old power plant site. The overall project risk for procurement was identified to be high, and was mitigated through trainings of counterparts and prior review of all Bank-financed packages. As for financial management, a special financial management unit was created and assisted by a consulting firm with experience in Bank projects. In terms of project viability, the project net economic benefits were found to be viable with an economic rate of return of about 20 percent.

26. The Project had indicated the need for further reforms in the power sector, but proposed that the reforms and the pace of reform were government owned. In addition, the placement of conditions or rigid covenants was considered inappropriate.

27. ***Ambitious PDO for the TA component.*** The PDO had emphasized: (i) provision of energy supply in a sustainable manner through investment in new generation capacity; (ii) strengthen sector performance aimed at improving financial performance; (iii) improving/enhancing role of the regulator; and (iv) improving energy efficiency. The first PDO emphasis (sustainable energy supply) was compatible with the EL Tebbin Power Plant component. However, the other PDO emphases and outcome indicators were ambitious relatively to the modest TA component activities. For instance: (i) EEHC financial performance could not be improved through upgrading financial management system alone; and (ii) the role of the regulator could not be substantially enhanced just from their participation in the TA component of this Project. In other words, the project component that intends to improve the functions of the regulator was not substantial enough as intended by the PDO.

2.2 Implementation

Power plant component:

28. **The implementation of the EL Tebbin Power Plant component by EEHC/CEPC supported by the engineering consulting firm PGESCO was carried out effectively.** The support of the Ministry of Electricity and Energy and EEHC in responding to human and financial resources needed and the continuous high level follow up has brought the EL Tebbin Power Plant to a satisfactory conclusion. The EL Tebbin Power Plant was fully operational at its full 700 MW capacity since early 2011 as was envisaged. However, a fire incident occurred in October 2012 and the power plant is currently out of operation. This is elaborated in paragraph 33.

29. **Power plant component cost increase was identified during procurement stage; the increased costs were financed by incremental loans from local bank, OPEC Fund, and CEPC.** Procurement of the first Bank-financed contract (for turbine generators and condensers) had resulted in bid prices increase by about 75 percent over estimated cost. The main reasons for the power plant cost increase during construction phase were identified to be: (i) a general increase in global steel price; (ii) a general increase in power equipment price due to strong demand from Asia; and (iii) a depreciation of the US dollar against the euro where Bank-financed contracts were largely denominated. Subsequently by October 2006 the project cost estimates for the power plant component were raised to about $640 million, compared to $450 million at Board approval in January 2006 or a 42 percent increase. The actual power plant component cost eventually reached $705 million by February 2012 after full disbursement, or $663 million excluding custom duties, sales taxes and miscellaneous fees. This cost increase was satisfactorily covered by incremental loans from a state-owned bank, the OPEC Fund for International Development, and by CEPC. The amount of World Bank loan was unchanged; however, the number of Bank-financed procurement packages was reduced from twelve to four. The final cost of El-Tebbin compares equally

with plants built at the same period such as Cairo West (700 MW) $729 million, and slightly later construction of Ain Sokhna (1300 MW super critical) $ 1,700 million to be commissioned in 2014.

30. In January 2011, Egypt experienced a wave of popular protests that led to the toppling of the previous government on February 11, 2011. An interim government was tasked with organizing free and fair elections for a new parliament and president, which took place from December 2011 to June 2012. The revolution had an effect on electricity projects causing some delay to some projects and disturbances to others. However, the EL Tebbin Power Plant was successfully completed with minor delay.

31. **Job creation:** During EL Tebbin Power Plant project preparation and construction phase about 1,300 jobs[3] were directly created including technical, non-technical and consulting jobs. Over 99 percent of jobs created were local hires. During the operating phase, the power plant is staffed with about 450 full-time employees, including operation staff working in three rotating shifts daily.

32. **Sustainable energy supply:** During the first year of full operation (January–December 2011) the power plant generated 4,640 million kWh of electricity, representing about three percent of generated electricity in Egypt. The plant used 1.04 billion cubic meters of natural gas as primary fuel and 29,000 tons of heavy fuel oil No. 6 as secondary fuel. The average plant heat rate was 8,005 Btu per kWh generated, compared to 8,400 Btu per kWh average for all EEHC power plants. The plant is thus one of the most efficient steam power plants in Egypt. In terms of generation cost, the average cost of generation in 2011 was about LE 0.18 per kWh sent-out to the grid, which was below the average *end-user* tariff of LE 0.20 per kWh in FY2011[4]. The plant had fired Heavy Fuel Oil (HFO) for about three percent of operating time during this period, slightly exceeding the planned two percent limit. A larger quantity of HFO was used in August 2011 due to gas supply constraint in Egypt, which was subsequently resolved. The latest ambient air quality and stack emissions data indicate compliance with Egyptian and World Bank applicable standard for NOx and SO_2. However, above-limit ambient air quality data for TSP and PM10 were occasionally recorded; this was substantially due to events of sand storm and surrounding industrial activities, and not a result of plant stack emissions.

33. **A fire incident occurred on October 26, 2012 disrupting EL Tebbin Power Plant operation.** The Unit 1 steam turbine and generator had tripped and caught fire on October 26, 2012, forcing operation stoppage for both Unit 1 and Unit 2 steam turbine and generator. The Unit 1 was partially damaged and will need to be replaced/repaired. A full investigation is being carried out by EEHC, CEPC and the manufacturer Alstom to identify the cause of the incident following the dismantling of Unit 1. The Unit 2 will be undergoing inspections for a possible return to operation by the end of January 2013.

[3] Corresponds to about 70,000 man-months of manpower over four and a half years.

[4] EL-Tebbin's 2011 average cost of generation was based on: (i) the prevailing average natural gas price of about US$ 1 per MMBtu; (ii) 8,005 Btu per kWh generation heat rate; (iii) 20-year depreciation of $ 705 million capitalized cost of the power plant; and (iv) 7 percent average cost of debt.

Subject to the outcome of these investigation and inspections, the cost of the damage is expected to be covered by the manufacturer warranty and insurance proceeds. EEHC reported no worker injuries due to the fire. A site visit by the World Bank to review the incident is being planned for December 2012.

TA component:

34. (i) The intended self-finance TA on financial performance improvement, which envisaged EEHC's hiring of a consultant to assist in the design and implementation of a comprehensive automated corporate financial management system did not take place. EEHC had continued to use its existing automated financial reporting system in preparing its financial statements, which is accessible by a small unit of staff within the financial department but not all relevant departments such as auditing, accounting, costing, the electricity hospital, etc.

35. (ii) The TA on the design and application of time of use tariffs and energy efficiency[5] was funded by ESMAP and executed by the Bank. The Bank had hired a consultant for this task in April 2007 and the consultancy was concluded in December 2008, following one contract extension from September 2007. By January 2010 a time-of- use tariff structure became effective for energy-intensive industrial customers[6]. The software models for LRMC and demand response (load management and interruptible scheme) were concluded at the end of the consultancy. In parallel, the regulatory agency prepared interruptible power contracts to be considered for implementation; these contracts are becoming more significant as electricity shedding was implemented in 2012.

36. ***Midterm review:*** The Project Midterm Report (MTR) dated February 2009 was prepared by CEPC. The MTR indicated good progress of the power plant component with the overall project implementation completion rate of 60.7 percent, and good progress on environmental, social and project financial management aspects. Specifically, of the four Bank-financed contracts, their completion rates were 96.9 percent (circulating water pumps and drives), 96.1 percent (switch yard), 84.9 percent (steam turbine generator and condenser), and 48.4 percent (steam generator, boiler). The MTR did not specifically provide an update on the TA component because CEPC was not the counterpart in that component. However such information was available in the World Bank mission Aide Memoires.

37. ***Project restructuring:*** Three restructurings were approved in August 2009, April 2011 and October 2011, respectively. The *first restructuring* was to revise project financing plan and reduce IBRD-funded procurement packages—from twelve to four—to accommodate for project cost increase. During this restructuring, the IBRD Loan allocation was also changed between disbursement categories to bring them in line with

[5] The energy efficiency subcomponent focused on a design of a load management program, an upgrade of long run marginal cost analysis, and a feasibility assessment of an interruptible power supply scheme.

[6] The first group of energy-intensive industrial customers to come under time of use tariff structure includes iron, cement, fertilizer, aluminum, copper and petrochemical industries.

the procurement packages. The *second and third restructurings* were to extend the project closing date from the original date of April 30, 2011 by a total of twelve months, which followed project construction completion and commissioning in August and September 2010. About 85 percent of the World Bank loan was disbursed by the time of the second restructuring, April 30, 2011 ($220.20 million out of $259.60 million commitment). The continuing political events in Egypt during 2011 had caused additional implementation delay, including the supply of spare parts for steam turbine generators financed by the Bank. Moreover, additional time was required to finalize closing out activities of the four Bank-financed contracts.

Factors that contributed to successful implementation:

38. Project Management Unit and Engineering, Procurement, Construction (EPC) consultant -- There were three subgroups within the PMU overseeing power plant implementation, environment and social, and financial management aspects. This PMU structure proved to be effective and enabled satisfactory project monitoring and evaluation. The EPC consultant, PGESCO, was an integral part in the day-to-day implementation of the power plant component. PGESCO is an Egyptian engineering consulting firm[7] that had provided multiple EPC consultancy services for EEHC group of companies prior to the EL Tebbin Project. Effectively, PGESCO is a public-private partnership in power engineering consultancy with a focus on Egypt and Middle-East and North Africa. PGESCO personnel worked closely with CEPC, EEHC and contractors in the day-to-day project implementation. In addition to delivering its services, the interactions between PGESCO and CEPC/EEHC staff provided on-the-job learning opportunities for the concerned parties.

39. Additional financing from local bank, OPEC Fund and CEPC/EEHC – The incremental project cost of about $255 million over the estimated cost at appraisal was financed by loans from the state-owned National Bank of Egypt (NBE), the OPEC Fund and from CEPC/EEHC resources. The additional financing was critical for a successful project implementation. The final project financing structure was 37 percent World Bank loan, 14 percent NBE loan, 4 percent OPEC Fund loan, and 45 percent CEPC/EEHC corporate contribution.

40. Experienced and reliable suppliers and contractors for power plant – There were all together 18 procurement contracts for the power plant component. The contractors for these contracts—both local and foreign entities—were experienced in their fields and contributed substantially to a successful implementation. Specific to the four Bank-financed contracts, the contractors were Siemens (switch yard), Ansaldo (steam generator, boiler), Alstom (turbine generator and condenser), and Termomeccanica Pompe – TM.P. (circulating water pumps and drives).

7 PGESCO is owned by the Government of Egypt (40 percent), the American engineering company Bechtel (40 percent) and the Commercial International Bank of Egypt (20 percent). Source: PGESCO.

41. Client's ownership of TA activities – EEHC had nominated senior officials of the Economical Studies Department, the Load Forecast Department, and the Generation Planning Department as the focal point for the ESMAP-funded TA on time of use tariffs and energy efficiency. The focal point had facilitated the work of the consultant and provided input and feedback on the written reports and computer models developed under the consultancy. This has helped ensure that the final reports and computer models can be used by local stakeholders in the future. The electricity sector regulator had provided inputs for the TA; however, the authorities to approve electricity tariffs still remained with the government not with the regulator. The time of use tariffs and energy efficiency study had eventually led to a proposal for time of use tariffs for energy-intensive industrial customers that became effective in January 2010.

42. ESMAP funding support for TA component – ESMAP provided about $0.25 million budget to fund the Bank-executed TA component on time-of-use tariffs and energy efficiency under the Project. Separately, ESMAP supported the TA on estimating economic cost of Egypt natural gas (completed in 2007) and another TA on energy pricing strategy (completed in 2009). These ESMAP supports were crucial in aiding energy sector policy dialogue with the authorities.

Challenges during implementation:

43. Currency mismatch between Bank loan and Bank-financed expenditures: The four Bank-financed contracts for the power plant component were largely denominated in the euro. However, the chosen IBRD loan was denominated in US dollar. During construction phase, the euro had generally appreciated against the US dollar, resulting in a financing gap that was met by other financing sources.

44. Delay in Bank-executed TA: The delay in the TA component was attributable to multiple factors such as: (i) limited face-to-face interaction between the consultant and EEHC; (ii) lack of local team member on the consulting team; (iii) reliance on electronic communication; (iv) extra time taken for data gathering and data preparation; (v) computer modeling errors; and (vi) consultants and EEHC personnel's other engagements during the study. EEHC personnel have indicated that by the end of the consultancy the computer model for demand response (load management and interruptible scheme) was satisfactory. However, the computer model for LRMC is not always user friendly and occasionally generates questionable results.

45. Lack of funds for self-financed client-executed TA: EEHC has not upgraded its financial management system as envisaged during project appraisal due in part to lack of funds. EEHC generally does not use debt financing for TA activities. Nevertheless, EEHC had provided the Bank its corporate financial reports based on its existing financial management system on a timely manner during the course of the Project for supervision purpose.

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

M&E design:

46. The overall M&E design was satisfactory and covered all project components. The responsibility for data collection was clearly identified. However, the results/outcome indicators of the TA component were not always compatible with the PDO to improving sector financial performance and enhancing the role of the regulator.

47. M&E design for the power plant component had focused on Egypt's total electric generating capacity and EL Tebbin Power Plant generating capacity. However, the outcome indicators did not include EL Tebbin electricity generation efficiency that would further support the fact that EL Tebbin Power Plant is one of the most efficient steam power plants in Egypt, thus contributing to meeting PDO in a sustainable manner.

48. M&E design for the TA component on regulatory support and energy efficiency had envisaged reviewing the electricity regulator's operations reports and EEHC operations reports to monitor progress, output and outcome resulting from these TAs.

49. The other TA component on financial performance improvement would track EEHC's financial indicators based on EEHC financial reports. There was no issue with M&E design for this TA component.

50. ***M&E implementation****:* M&E implementation largely followed its original design and was satisfactory for the power plant component. However, monitoring of parts of the TA component did not adequately measure the intended outcome. A summary of the implementation of various M&E tools is as follows:

Power plant component:

51. Monitoring of construction progress and related procurement activities was carried out by the PMU and PGESCO as intended. The Project Progress Reports provided a good summary of construction, procurement, project cost status, and manpower information of the EL Tebbin Power Plant. These reports were satisfactory and timely, totaling 58 reports with the final report completed in February 2012.

52. Monitoring of environmental and social aspects was also carried out by the PMU through the Environmental Progress Reports, incorporating the project ESIA. These reports were largely satisfactory and timely, totaling 27 reports by March 2012; however, the next reports could benefit from showing additional operating phase data and explanation of deviation from baseline values or applicable guideline limits.

53. Monitoring of financial management aspects was also carried out by the PMU through the quarterly Financial Monitoring Reports—inclusive of independent auditor's opinion. These reports provided detailed project cost status and source/use of fund information by each procurement package, including a comparison of planned versus actual expenditures. These reports were satisfactory and timely, with the final report expected to be delivered by December 31, 2012.

TA component and other M&E implementation:

54. EEHC Annual Reports provided information on Egypt's power generation capacity, efficiency as well as information on electricity demand and sales. These reports

were satisfactory and generally available less than six months after the end of a fiscal year.

55. EEHC corporate consolidated financial statements include income statements, balance sheets and cash flow statements. These statements are audited by the state Central Audit Organization and generally available less than six months after the end of a fiscal year. However, the Bank team has observed occasional restatements to the financial statements, resulting in changes to EEHC financial indicators.

56. The electricity regulator's operations reports and TA component committee reports were not produced as envisaged at project appraisal. In lieu of these reports, the regulator's website provides an update of its activities and published studies and reports. The Bank Aide Memoires provide progress on the studies under the TA component. However, the expected monitoring of stronger role for the regulator and reduced energy consumption as a result of the TA was not reflected by the Bank through the periodic ISR documents.

2.4 Safeguard and Fiduciary Compliance

Environmental and social safeguards:

57. Mechanism of Environmental and Social Impacts Assessment and Management

The proposed project falls under the World Bank environmental Category A classification according to OP4.01 on Environmental Assessment. A full-fledged Environmental and Social Impact Assessment (ESIA) report was developed by an independent third party consulting firm prior to appraisal, including two sets of public consultation meetings. The mitigation measures and institutional and monitoring plans were detailed in the Environmental Management Plan (EMP) which form part of the EIA report. The Bank task team included environmental and social team members from day one of project preparation, all the way to project completion. Furthermore, an environmental manager was assigned to the PMU to oversee safeguards implementation. All Bank supervision missions for this project included an environmental and a social team member to oversee safeguards implementation, and a specific section on safeguards was included in every mission Aide Memoire, to report on environment, health, safety, and social aspects. Safeguards aspects were also rated in every ISR.

58. Progress During Project Implementation

This was the first project by the Ministry of Electricity and Energy with the World Bank after a long absence. Therefore, there was a certain learning process at the early phases of implementation. This is evidenced by the unsatisfactory rating of the first supervision mission. This was primarily due to the delay in implementing the requirements of the ESMP, and the risky practices by the local sub-contractors during the decommission activities of the existing power plant. The issue was raised to the attention of the senior officials in the GOE, and a plan of corrective actions was agreed upon. The safeguards aspects were later markedly improved, leading to satisfactory rating in all subsequent missions. Another interesting feature is that the EMP was amended during project implementation, upon the request of the PMU and upon the review and approval of the

Task Team, in order to respond to requests/clarifications on some of the monitoring sites and frequency.

59. Project Positive Impact and Sustainability

The success of the project to achieving its safeguards targets had a positive impact on the sector and beyond. In the sector, the capacity built through the project, and through numerous training to EEHC on safeguards aspects greatly facilitated the preparation of all subsequent projects in the electricity sector. Furthermore, the project's quarterly environmental reporting format and content was also considered favorably by the Bank, and was used as an example for other PMUs to follow in Egypt. The sustainability of the achieved success would be ensured by the existing institutional structure whereby the manager of environmental matters is employed full time by the EL Tebbin Power Plant, and he reports to the Environment Manager in CEPC. Furthermore, environmental issues and any deviation from environmental standards are reviewed in the monthly meeting of the Board of EEHC.

60. Lessons Learned

The main elements of success in managing the safeguards in this project can be attributed to the following factors: (a) EEHC Senior Management support for the implementation of the EMP, (b) Training and capacity building provided by the Bank team on a frequent basis to the counterpart on safeguards matters, (c) ensuring that an environmental and social safeguards team members are part of the Bank task team throughout project implementation.

Procurement performance was rated satisfactory in the last ISR (October 2011).

Power plant component:

61. The GOE had requested to use the procedure of one stage-2 envelope system sequential opening instead of simultaneous opening of the technical and financial envelopes for several packages of supply and installation of equipment and procurement of goods financed under the project. The Bank had agreed to the requested procedure after reaching an agreement on the underlying principles, safeguards, and training requirement for PMU, EEHC and CEPC.

62. One-stage bidding was chosen instead of two-stage bidding because in the power sector in Egypt, procurement of plant Design, Supply & Installation (DSI) is based on very detailed technical requirements which are to be expected of a Design Supply & Installation process of this nature as opposed to functional requirements. The process results in a single responsibility contract that includes Designing, fabricating, furnishing, delivery to Site, storing, installing, training, testing, start-up, commissioning, placing into successful operation and maintaining until Operational Acceptance Certificate (OAC) of the various packages. The two envelope procedure was accepted provided the borrower followed certain special provisions that ensure the integrity of the process and proper addressing of complaints. The results were highly satisfactory. There was good competition, reasonable prices and no complaints from bidders. Coordinating multiple contracts was a risk to be dealt with under a very complex operation as the building of a multimillion dollar power plant is. The above risk was mitigated by ensuring that the

borrower had a strong engineering consultant to carry out the procurement as well as contract management, which proved to be a critical factor in ensuring a successful implementation. The main packages financed by the World Bank were the switchyard, the steam generator and the turbine generator and condenser.

63. By April 2008, following loan effectiveness in August 2006, four Bank-financed procurement contracts and 14 other contracts/purchase orders were signed.

TA component:

64. The Bank had executed one consultancy contract for the ESMAP-funded TA on time-of-use tariffs and energy efficiency in April 2007. Following one contract extension the consultancy was concluded in December 2008. There were no contractual issues with the contract.

Financial Management (FM) was rated satisfactory in the last ISR (October 2011).

65. The project's financial management (FM) arrangements were consistently found to be satisfactory. The establishment and maintenance of the FM arrangements were assigned to a PMU within CEPC. The constant satisfactory FM arrangements is attributed primarily to the fact that i) CEPC employed new graduates and well trained staff who are familiar with the English language and possess adequate computer skills; ii) clear segregation of duties within the PMU on financial management was always adhered to as per the established Financial Policies and Procedures Manual; and iii) recording and reporting was executed through sound automated accounting management information system (Oracle) which is capable of generating the quarterly IFRs and annual financial statements required under the loan umbrella.

66. CEPC adopted primarily the direct disbursement method throughout the entire life of the project. This method was convenient given the nature of the project disbursements which were bulky and transferred to large contractors/suppliers.

67. Within the project life all of the audit reports were timely received, reviewed and found acceptable by the Bank. All of the audit reports were unqualified. The final audit report is expected to be delivered before December 31, 2012.

2.5 Post-completion Operation/Next Phase

68. ***Continuing high electricity demand growth:*** Peak electricity demand had increased from 17,300 MW in 2005/2006 (project appraisal) to 23,470 MW in 2010/2011, a compounded annual increase of 6.3 percent per year -- in line with estimates at project appraisal. During this same period, installed capacity had increased from 20,452 MW (17,486 MW thermal) to 27,049 MW (23,562 MW thermal), annual increase of 5.8 percent per year. (The installed capacity is in line with the Project outcome indicator, which envisaged 26,679 MW by 2010.) At the same time, electricity energy sales had increased from 92.8 billion kWh to 126.9 billion kWh, annual increase of 6.5 percent. Nevertheless, according to preliminary information, Egypt’s available power generation

capacity has lagged behind actual 2012 peak demand of about 27,000 MW by about 2,500 MW.

69. ***Transition to post-completion operation:*** The EL Tebbin Power Plant is now under the full oversight of CEPC; the plant is staffed with about 450 full-time employees. By 2011 CEPC's installed capacity reached 5,920 MW, including 700 MW of EL Tebbin installed capacity. The power plant was subject to a warranty inspection in early 2012—with each of the two units out of operation for about two months alternately and was back in operation before the summer season. However, due to the fire incident in October 2012, the power plant currently is not operational.

70. According to actual operating procedures, the power plant has been operating at a minimum load of 210 MW and a maximum load of 730 MW at actual operating conditions. The capacity factor achieved in 2011 was 76 percent. The plant was therefore a base-load plant, but ranked below CCGT power plants. In addition, plant availability averaged 96 percent in 2011.

71. During the full year 2011, EL Tebbin generated 4,640 million kWh of electricity. Natural gas was the primary generation fuel (1.04 billion cubic meters) and fuel oil was the secondary fuel (29 thousand tons). Therefore, natural gas accounted for 97 percent of fuel used in terms of heating value. EL Tebbin's thermal efficiency averaged 43 to 45 percent with actual generation heat rate of about 8,005 Btu per kWh, compared to EEHC's overall average of about 8,400 Btu per kWh in fiscal 2010. These figure places EL Tebbin as one of the top performing power plants in its category in Egypt.

72. According to CEPC, major maintenance of the plant will be performed once every eight years at today's estimated cost of US$ 1.7 million. Other maintenance is performed on an on-going basis by EL Tebbin and CEPC staff. Monitoring of emissions and air quality would continue using the existing equipment.

73. ***Continuing activities on energy/power sector reform:*** During the EL Tebbin Project implementation phase, the Bank had engaged with the authorities on a number of sector reform activities that included, *inter alia*, energy pricing, energy sector investment and financing, and the promotion of renewable energy and energy efficiency. Notable completed activities include a TA on the economic value of Egypt natural gas; a TA on energy products pricing; the MENA concentrated solar power CTF Investment Plan; and a TA on the impact of the 2008 financial crisis on Egypt power sector.

74. A number of operations have followed the EL Tebbin Project and provided opportunities for further energy/power sector reform dialogue. The following TA activities are on-going: a TA on power sector governance and power generation investment; a TA on the development of Egypt wind IPP program and the integration of wind power; a TA on energy efficiency strategy (two phases); a TA on private sector participation in Egypt power sector; and a TA on the potential of carbon capture and storage application in Egypt.

75. ***Follow-up gas-based conventional power generation lending operations:*** Two power generation projects were approved by the World Bank following EL Tebbin. These were the $600 million loan for the 1,300 MW Ain Sokhna Power Project in January 2009 and the $600 million loan for the 1,500 MW Giza North Power Project in June 2010. Subsequently, an additional financing for 750 MW extension of Giza North Power Project of $240 million was approved in February 2012, including a component for a new natural gas pipeline with the gas company GASCO. By FY2011, the share of combined-cycle power generation installed capacity had reached 34 percent, an increase from 19 percent in FY2006 at Project appraisal.

76. ***Grant and lending operations in renewable power***: The Bank administered a $48.9 million GEF grant for the Kureimat Integrated Solar Combined Cycle Power Project, approved in December 2007. This was followed by a combined $70 million IBRD loan and $150 million CTF loan for a new electric transmission infrastructure under the Egypt Wind Power Development Project, approved in June 2010. By FY2011, the share of renewable power generation installed capacity had remained at about 13 percent (mostly hydro power). However, installed wind power generation had tripled from 183 MW in FY2006 to 546 MW in FY2011.

77. ***Lending operation in the natural gas sector:*** In January 2008 the Bank approved a loan of $75 million for the Natural Gas Connections Project, which seeks to switch households from economically costly Liquefied Petroleum Gas (LPG) to domestic natural gas. By FY2010, 2.9 million residential properties are connected to the domestic gas supply network.

78. In summary, the Egypt energy program is active and includes on-going and pipeline projects. The active Egypt energy program was substantially initiated by the EL Tebbin Project. Egypt is going through socioeconomic and political changes, and the Bank is responding under the guidance of the Interim Strategy Note (ISN), which was approved by the Bank Board of Executive Directors on June 28, 2012. The challenges in the energy sector are significant; however, the on-going activities provide invaluable opportunities for sector reform dialogue during the transition period.

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

79. The project objectives, design and implementation remains relevant to current country priorities and Bank assistance strategy. The power plant component has helped enhance energy supply while the technical assistance component has allowed the Bank to re-engage in power sector policy dialogue, including efficiency improvement, private sector investment and renewable power. These supports the three pillars of the ISN for the Arab Republic of Egypt for the period July 2012–Dec 2013: (i) improving economic management through control of the fiscal deficit and initiating reforms to enhance transparency in Government operations; (ii) creating opportunities for short-term productive job-creation, particularly for women, and initiating steps to improve the environment for longer-term private sector job creation; and (iii) fostering approaches

that will broaden access to and greater participation in the delivery of economic and social services for disadvantaged groups, particularly for women and in lagging regions of the country.

3.2 Achievement of Project Development Objectives

80. The progress towards achievement of the PDO is rated as *Moderately Satisfactory* as evidenced by the achievement of the key outcome indicators. Prior to the October 2012 fire incident, the EL Tebbin Power Plant was fully operational and generated 700 MW of electricity as was envisaged. The plant provides employment for about 450 staff. The PDO that focused on sustainability, strengthening sector performance, and enhancing the role of the electricity regulator however was ambitious *under the context and timeframe of the Project*. While the PAD reasonably indicates that the Project could be the first in a longer-term program where follow-up projects would focus increasingly on sector policy issues, there were certain mismatches between the PDO and what can actually be achieved under the Project and its modest TA component. Therefore, this rating reflects the ambitiousness of the PDO.

81. The following assessment of outcomes emphasizes the direct outcomes of the Project given its small scale relative to Egypt's power system and the Project timeframe. First, sustainable energy supply, as stated in the PDO, is assessed from the perspective of the EL Tebbin Power Plant. Second—strengthened sector performance, enhanced role of the regulator, improved energy efficiency—is assessed based on the direct impacts of technical assistance under the Project.

Table 2: Achievement of PDO

(i) Assist the GOE in reaching its goal of providing the country with energy supply in a sustainable manner, through investment in new generation capacity

(ii) Strengthen sector performance by engaging in policy dialogue and supporting measures aimed at improving financial performance, role of the regulator and energy efficiency.

Outcome Indicators	Target	Achieved value at completion
Increase in total generating capacity	26,679 MW country-wide by 2010 700 MW EL Tebbin Power Plant	27,049 MW by June 2011 700 MW EL Tebbin Power Plant
Improved financial performance of EEHC	Debt service coverage ratio > 1.4 Current ratio > 1 Improved ability to generate accurate financial reports for decision-making	DSCR 1.1 (FY2011) Current ratio 0.5 (FY2011) New financial management system not implemented. EEHC consolidated financial reports were timely generated but occasionally were restated.

Enhanced role of the regulator in electricity price design and setting	Enhanced contribution by the regulator to design and apply pricing.	• The regulator provided inputs to facilitate the TA on time of use tariff. • The regulator had prepared on an annual basis since 2006 the cost of electricity supply studies, which have been submitted to the Ministry of Electricity and Energy and EEHC as inputs for electricity price design and setting. But the regulator does not have the capability of determining pricing yet. • The preparation of a draft of a new Electricity Law which strengthens the regulator's role in tariff setting. The law is under parliament review.
Reduced energy consumption in particularly energy intensive customer segments as a result of the implementation of demand side management measures	Better ability to manage peak load	• A time-of-use tariff structure for energy intensive industrial customers[8] became effective in January 2010 and was adjusted for better results effective in January 2012. • A 25-40% increase in electricity tariff to intensive and middle size industry • Natural gas prices to energy-intensive customers have been raised, approaching $4 per MMBtu compared to below $1 at project approval. • Deployment of 9 million

[8] The first group of energy intensive industrial customers to come under time of use tariff structure includes iron, cement, fertilizer, aluminum, copper and petrochemical industries. Industrial customers accounted for about 33 percent of total electricity consumption, of which highly energy-intensive industrial customers accounted for about a half.

		CFL to households in 2009–2010. On-going replacement of street lamps with more efficient lamps in major cities. • Gradual electricity tariff increases for larger consumers, covering households, commercial and industrial sectors. • The regulator prepared drafts for four types of Interruptible Power Supply Contracts with large consumers which were used by EEHC to manage peak demand during summer 2010.

3.3 Efficiency

82. The economic analysis for the EL Tebbin Power Plant has been re-evaluated with the new evaluation variables available at the ICR stage. These variables include: i) increased cost required to commission a 700 MW single cycle steam turbine plant, estimated at appraisal to be US$ 403 million, vis-à-vis an actual economic value of US$ 608 million; and ii) increased input costs due to the higher economic cost of natural gas from US$ 2 to US$ 3 per MMBtu. Despite the substantially revised assumptions, the project yields an economic rate of return (ERR) of about 18.4 percent, well above the hurdle value.

3.4 Justification of Overall Outcome Rating

Rating: Moderately Satisfactory

83. The overall outcome is rated *moderately satisfactory* for the following main reasons: (i) the power plant component was highly successfully implemented and provides Egypt with a well-designed, efficient, and sustainable power plant for the selected technology[9]; (ii) energy policy dialogue reengaged in the sector and actions aimed at improving sector financial performance, role of the regulator and energy efficiency have been taking place; (iii) the sector technical performance such as power generation efficiency and transmission/distribution losses –though not captured as

[9] The rating does not take into account the October 2012 fire incident, pending the on-going investigation.

outcome indicators—has improved and helps with power supply sustainability and improve financial performance through cost savings.

84. The overall outcome rating is aligned with the PDO and the implementation progress ratings included in the latest ISR (October 2011). While the power plant component was highly satisfactory prior to the October 2012 fire incident, the TA component that targeted improving long-term sustainability of the electricity sector has had limited outcome impact. This is evidenced in EEHC's difficult financial situation—significantly resulting from below-cost electricity tariffs and large investment (see Annex 3). In addition, the authorities to making key decisions for sector sustainability continue to lie outside the regulatory body. But the regulator's role in advising the authorities on electricity cost of supply is an increasingly credible role that could lead to enhancing sector sustainability.

3.5 Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development

85. ***Sustainable performance of state-owned power utility:***

(a) The technical performance of EEHC continues to improve as indicated by key technical indicators. In generation, the thermal efficiency had increased from 38.6 percent in 2005/06 to 42.1 percent in 2010/11. In transmission and distribution, the combined T&D losses had remained unchanged at about 11 percent in the same period.

(b) The consolidated financial performance of EEHC has been undermined by below cost electricity tariffs, rising operating costs, large investment program and high debt load. During the course of the project, the level of government financial subsidies to EEHC has increased, especially subsidies for fuel and capital investments. Measures to reduce EEHC indebtedness contemplated at appraisal did not proceed, including debt restructuring and expedited settlement of obligations. The two financial monitoring indicators (current ratio and debt service coverage ratio) remain below the envisaged levels at appraisal[10], confirming a difficult financial situation of EEHC (see Annex 3).

86. ***Regulatory support and energy efficiency:*** The time-of-use electricity tariff for energy-intensive industrial customers became effective in January 2010. According to EEHC, the initial TOU tariffs did not adequately encourage customers to change their consumption pattern from peak hours to non-peak hours. A revised intensive industry tariff and TOU tariff schedule became effective in January 2012, and is expected to better shift customers' electricity demand toward a better managed profile through further refinement.

[10] Key financial performance indicators envisaged at appraisal to be achieved by project Closing Date were a current ratio higher than or equal to 1 and a debt service coverage ratio higher than or equal to 1.4. These ratios in FY2011 were: current ratio 0.5 and debt service coverage ratio 1.1.

(b) Institutional Change/Strengthening

87. ***Power sector regulator:*** The electricity regulator was established in 1997. The regulator advises the government on electricity tariff matters—among other considerations—although it has currently no authority in approving or mandating electricity tariffs for end-users. The regulator is led by a full-time managing director, who in turn reports to a board of directors chaired by the Minister of Electricity and Energy. In recent years the regulator has placed emphasis on customers' protection and electricity service performance review. It had started publishing annual cost of electricity services reports since 2006 for the benefits of the authorities and EEHC, thus providing decision makers with an analytical tool for electricity tariffs setting purposes. The regulator also has a key role in supporting private investments in the sector by proposing mechanisms and market reforms to encourage private investments. By 2011, the regulator's personnel had reached 80 staff with an annual operating budget of about $ 3 million, compared with 40 staff and $0.7 million budget in FY2004. The sources of its operating budget are largely licensing fees from electricity companies and investments. Donations and grants received are typically in the form of services received, not budgetary supports.

88. The Project had limited direct impact on the institutional change and strengthening of the power sector regulator. However, the Project has led to on-going dialogue, technical assistance and cooperation, notably in the area of electricity market structure and energy subsidies. In addition, the role of the regulator will be further strengthened and more significant once the new Electricity Law is approved.

89. ***Energy efficiency entity:*** An Energy Efficiency Unit was established in 2009 and reports to the prime minister's office. This is seen as a first step to coordinate activities related to energy efficiency in Egypt. A follow-up ESMAP-funded TA is being carried out by the Bank and focuses on enabling institutional, regulatory, policy and financing in energy efficiency in Egypt.

3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

Not applicable.

4. Assessment of Risk to Development Outcome

90. The risk to development outcome is rated *Substantial*.

Table 3: Risks to Development Outcome	
Development Outcome	**Risk**
Increase in total generating capacity to 26,679 MW by 2010	• Power sector financial constraints may delay generation capacity expansion program by both the public and private sectors. • Deteriorated country economic situation and investment

	climate may significantly deter or delay public or private sector investment in the power sector, therefore impacting supply quality. • Natural gas supply unavailability or disruption is a risk factor. Heavy fuel oil is economically more expensive and could result in more emissions. New steam power plants such as EL Tebbin may use less natural gas than planned during gas shortage. • Political and public unrest causing generation, transmission and distribution project delays
Improved financial performance of EEHC	• EEHC financial situation does not improve, and it continues to operate as a parastatal electric utility that relies greatly on explicit and implicit state budgetary supports. • Difficulties in raising electricity tariffs to commensurate for the rising operating costs and a large investment program puts further pressure on EEHC financial performance.
Enhanced role of the regulator in electricity price design and setting	• The regulator continues to have limited influence on electricity pricing directives, which require a governmental decision. • Proposals by the regulator on electricity pricing are not approved by the authorities or not supported by electricity users.
Reduced energy consumption in particularly energy intensive customer segments as a result of the implementation of demand side management measures	• The initial time of use electricity tariff structure for energy intensive customers became effective in January 2010 and has not led to a significant reduction in peak power demand because the difference between peak and non-peak tariffs was too small. However, a revised tariff schedule became effective in January 2012 and is expected to better shift demand to non-peak hours. • Increasing tariffs without parallel incentives for power generators to reduce production cost may not yield optimum outcomes. • Increasing tariffs for energy intensive customers might result in increase in manufacturing costs and negatively affect the competitiveness of industries.

5. Assessment of Bank and Borrower Performance

5.1 Bank Performance

(a) Bank Performance in Ensuring Quality at Entry

Rating: Moderately Satisfactory

91. The Bank performance in the identification, preparation, and appraisal of the project is rated *moderately satisfactory*. The Bank identified, facilitated the preparation of, and appraised the operation. The Project was consistent with the Government's

development priorities. The Bank was mindful of the challenges facing Egypt's power sector, the need for reforms and the then prevailing momentum supporting reforms, and the importance of reengaging the authorities on sector policy issues to facilitate further reforms. On the other hand the project PDO with respect to strengthening sector performance aimed at improving financial performance, the functions of the regulator and energy efficiency was ambitious relatively to the project timeframe and its small scale. The PDO could have been more consistent with project components.

(b) Quality of Supervision
(including of fiduciary and safeguards policies)

Rating: Satisfactory
92. The Bank performance during supervision is rated *satisfactory*. The Bank satisfactorily addressed the Project cost overrun for the power plant in cooperation with the counterparts, which allowed the Project to move forward with no change to Project design in a timely manner. The Bank also facilitated Closing Date extensions to facilitate implementation disruptions following political protests in Egypt during 2011. This rating is below highly satisfactory because the Bank did not address EEHC's inaction in upgrading its financial management system, and not monitoring the outcome of TA to enhance contribution by the electricity regulator to design and apply electricity pricing and TA on energy efficiency.

(c) Justification of Rating for Overall Bank Performance

Rating: Moderately Satisfactory
93. In view of the Bank performance at entry (moderately satisfactory) and during supervision (satisfactory), the Implementation Completion Report (ICR) rates the overall performance of the Bank as *moderately satisfactory*.

5.2 Borrower Performance
(a) Government Performance

Rating: Moderately Satisfactory
94. The government performance rating is rated as *moderately satisfactory*. During the initial years of project implementation, the government had carried out further reform of the power sector through broad-based tariff increases until FY2009 and gradually raising the cost of power generation fuel toward their economic cost. However, the reform efforts were placed on hold since 2009. This rating reflects the pause in governmental support in creating a policy environment that supports sector sustainability during the course of the Project, especially in electricity pricing reforms, subsidies reform and EEHC balance sheet restructuring.

(b) Implementing Agency or Agencies Performance

Rating: Satisfactory
95. The implementing agency performance is rated as *satisfactory*. This rating reflects the outstanding implementation of the EL Tebbin Power Plant, and the fact that

implementation of an automated financial management system for EEHC and subsidiaries aimed at providing the authorities with timely and accurate financial information for decision-making was not carried out.

(c) Justification of Rating for Overall Borrower Performance

Rating: Moderately Satisfactory

96. In view of the Government's and implementation agencies' performance, the ICR rates the overall performance of the Borrower as *moderately satisfactory*.

6. Lessons Learned

97. ***Alignment of PDO and project design.*** While the PDO for the project are relevant and important, the project and its components could be insufficient for the PDO to be achieved under the project timeframe and scale. The experience of this project helps confirm the need for a more-focused, realizable and time-bound PDO.

98. ***Supportive management strong PMU and a fine consultant are essential to project success.*** EL Tebbin had strong support from EEHC/CEPC management, a good PMU and a well qualified project consultant responsible for designing the project and procurement packages and integrating the activities in full harmony with the PMU and the World Bank. The project also contributed to capacity building in implementation procurement, FM and environment and social and reflected positively on EEHC future projects.

99. ***Reform efforts can be abruptly put on hold.*** With the onset of the global economic downturn in 2008, the Egyptian authorities had discontinued the much needed electricity tariff adjustments and subsidies reform. While the Bank-funded construction of the EL Tebbin Power Plant was continuing, electricity pricing reform and corporate balance sheet restructuring was put on hold and rendered financial improvement of EEHC less attainable.

100. ***The need for parallel tracks for project implementation and close dialogue on sector reforms.*** The project design had emphasized the need for further reforms in the power sector, but proposed that the reforms and the pace of reform were government owned. In addition, the placement of conditions or rigid covenants was considered inappropriate. With the benefit of hind sight, such strategic project design indeed had helped restore confidence between the government and the Bank, and facilitated other policy dialogue. The experience of this Project has shown that it would not be practical to halt power project implementation when difficult power sector reforms were placed on hold. There were clear benefits of having parallel tracks for project implementation and close dialogue on resuming sector reforms. This approach has led to successful project implementation and meaningful consultation with the authorities on sector reforms.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

(a) Borrower/implementing agencies

101. See Annex 7.

(b) Cofinanciers

102. Not applicable.

(c) Other partners and stakeholders

103. Not applicable.

Annex 1. Project Costs and Financing

(a) Project Cost by Component (in USD Million equivalent)

Original Components	Appraisal Estimate (USD millions)	Revised Estimate (USD millions)	Actual (USD millions)	Percentage of Appraisal
Power Plant	365.0	351.3	662.9	
Environmental Management Plan	2.2	2.2		
Interconnection Cost		13.7		
Total Baseline Cost	367.2	367.2	662.9	180%
Physical Contingencies	36.7	36.7	0.0	n/a
Price Contingencies	45.7	45.7	0.0	n/a
Customs, taxes, fees		42.7	42.1	n/a
Total Project Costs	449.6	492.3	705.0	157%
Front-end fee PPF	0.0	0.0	0.0	n/a
Front-end-fee (1%)		2.6		
Total Financing Required	449.6	494.9	705.0	157%

(b) Financing

Source of Funds	Type of Cofinancing	Appraisal Estimate (USD millions)	Revised Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Borrower		190.00	348.00	317.18	167%
International Bank for Reconstruction and Development		259.60	259.60	259.60	100%
OPEC FUND		n/a	40.00	27.55	n/a
National Bank of Egypt (NBE)		n/a	133.78	100.66	n/a

n/a = not applicable

Annex 2. Outputs by Component

Component 1: Investment in new generation capacity
Output: Completion of EL Tebbin Power Plant with a net capacity of 700 MW.

1. The plant comprises of two units of 350 MW steam turbines and boilers using natural gas as a main fuel and residual oil (mazout) as emergency back-up fuel. The outstanding implementation of the power plant provides Egypt with a well-designed, efficient, and sustainable power plant for the selected technology. This output meets the objective of Component 1.

Component 2: Technical assistance to improve long-term sustainability of the sector
Output: (i) strengthened sector performance, (ii) enhanced role of the regulator, (iii) improve energy efficiency. The study on the development of a load management program and design of time of use tariffs was completed.

2. While energy policy dialogue and actions aimed at improving sector financial performance, role of the regulator and energy efficiency have been taking place, this component has had limited outcome impact primarily because of EEHC's difficult financial situation—significantly resulting from below-cost electricity tariffs and large investment. In addition, although the authority of making key decisions for sector sustainability continues to lie outside the regulatory body, the regulator's role in advising the authorities on electricity cost of supply is an increasingly credible role that could lead to enhancing sector sustainability.

Annex 3. Economic and Financial Analysis

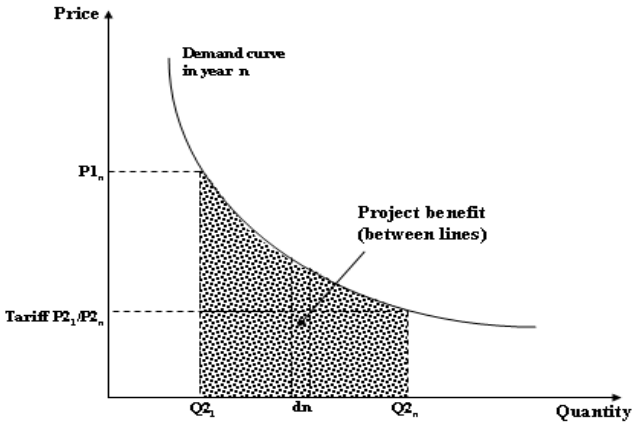
A. Economic Analysis of EL Tebbin Power Plant

1. This Annex presents the economic analysis for the EL Tebbin Project. The project comprises a 700 MW single cycle steam turbine plant which has been fully commissioned in January 2011. The EL Tebbin Plant is part of the least cost expansion plan of EEHC which was assessed at the PAD stage using the Electricity Generation Expansion Analysis System (EGEAS).

2. The economic analysis for the EL Tebbin Power Plant has been re-evaluated with the new evaluation variables available at the ICR stage. These variables include: i) increased cost required to commission a 700 MW single cycle steam turbine plant, estimated at appraisal to be US$ 403 million, vis-à-vis an actual economic value of US$ 608 million; and ii) increased input costs due to the higher economic cost of natural gas from US$ 2 to US$ 3 per MMBtu. Despite the substantially revised assumptions, the project yields an economic rate of return (ERR) of about 18.4 percent, well above the hurdle value (see Base Scenario of Table 1).

3. **Project economic benefits.** The economic benefits for the project are derived in terms of the willingness to pay (WTP) by Egyptian electricity consumers for the forecast increase in electricity consumption from the time that the ELTebbin project starts to generate electricity. This value is illustrated in Figure 1 by the area under the power system price-demand curve for a given amount of consumption at a particular electricity tariff.[11]

Figure 1: Project Economic Benefit is based on Value of Electricity Consumption



[11] For each year of the project's economic life, the value of electricity consumed from the El Tebbin Plant is computed from the value of the total increase in electricity consumption in that year from the time that the El Tebbi plant is fully commissioned multiplied by the ratio of the energy consumed from this plant to the total increase in electricity consumption.

4. By using the average value of the benefit from consuming electricity, this approach recognizes that the electricity that reaches consumers is a mixture of electricity that is supplied from a large number of generating sources whose outputs are dispatched as an integrated system. This means that a specific generation source of supply cannot be allocated to a particular portion of the demand curve and hence cannot be directly linked to a particular segment of WTP for electricity).

5. The observable values for evaluating the economic benefit are the projected increase in total consumption of energy based on the power demand forecast, the amount of this energy that is provided from the project, and the average regulated retail tariff. The base case for the economic evaluation uses the average tariff for the year 2009/2010, which is equivalent to about US$0.035/kWh. Additional information about power demand, however, is needed to calculate the area under the price-demand curve. For this purpose, a demand function was selected with a semi-log relationship between demand and price[12] with a price elasticity of demand equal to -0.2 for the level of demand at the prevailing electricity tariff. This value for the elasticity is based on a regression analysis of the 25-year record from FY1986 to FY2011 of EEHC's average tariff yield[13] and electricity sales and Egyptian GDP (as a proxy for growth in consumer income). Table 1 shows the computed values for the project economic benefits.

6. **Project economic returns.** Based on the approach and assumptions described above, Table 3 shows the computation of the economic return to the El Tebbin Project in the base case. Table 2 summarizes the detailed assumptions used for this computation. The project NPV is estimated to be US$ 1288 million, and the economic rate of return to the project is 18.4 percent, which substantially exceeds the criteria for a positive economic return.

7. Table 1 shows the results of sensitivity analysis of the project economic return under alternative scenarios to the base case scenario. The project economic return falls to 15.5% under 20% lower demand growth (case C), to 17.1% under 20% higher construction cost for the Helwan South plant (case D), and to 16% under 20% higher cost of natural gas used in the plant (case E) than the values used for these variables in the base evaluation case. The project economic return falls to 13.3% in a scenario that combines all three of the changes in cases C, D and E (case F). These returns are well above the hurdle rate of return.

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[12] A semi-log form for a demand curve such as is used for this project economic evaluation (see Table 2 for details) is chosen because it provides a sensible compromise between two critical properties. One is its curvilinear shape that differs sufficiently from a purely linear relationship to provide a credible model of the variation in consumers' willingness to pay for electricity consumption with changes in the price of electricity within consumers' overall budget constraints; the other is that this form is not overly sensitive to the selected value of price demand of elasticity – a key parameter whose value has to be imputed from little available empirical information about consumers' consumption response to price changes and is therefore subject to substantial uncertainty.

[13] EEHC's average tariff yield in EGP per kWh billed is computed from the ratio (Total Sales Value of Electricity in EGP million divided by Total Sales Quantity of Electricity in GWh).

8. The project economic return is sensitive to the value of the price elasticity of Egyptian demand for electricity. A value of –0.2 is used for the elasticity in the base case scenario and in sensitivity cases C, D, E and F. If a lower elasticity of –0.15 were the case, the project economic return would increase substantially, with the EIRR rising to 25% (case A). Likewise, if a higher elasticity of –0.25 were the case, the project economic return would decrease substantially to 14.2% (case B), which is still well above the hurdle rate of return

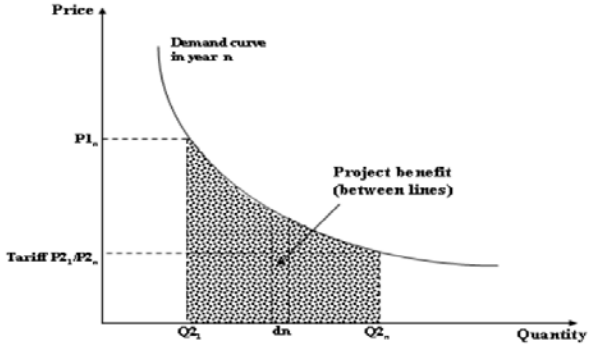
Table 1: Sensitivity of the Economic Return to the Helwan South Project

Eval. Case	Opportunity Cost Capital	Average Retail Tariff	Demand Elasticity	Demand Growth	Construct. Cost Incr.	Nat.Gas Cost	NPV @10%	EIRR
	(%)	(US$/kWh con.)		(%/year)	(%)	($/MMBtu)	(US$million)	(%)
Base	**10.0%**	**$0.035**	**-0.2**	**5.14%**	**0%**	**3.13**	**1,288**	**18.4%**
A	10.0%	$0.035	-0.15	5.14%	0%	3.13	3,832	25.0%
B	10.0%	$0.035	-0.25	5.14%	0%	3.13	488	14.2%
C	10.0%	$0.035	-0.2	4.12%	0%	3.13	718	15.5%
D	10.0%	$0.035	-0.2	5.14%	20%	3.13	1,191	17.1%
E	10.0%	$0.035	-0.2	5.14%	0%	3.76	1,062	16.0%
F	10.0%	$0.035	-0.2	4.12%	20%	3.76	483	13.3%

Source: World Bank staff

9. The analysis does not take into account the positive externalities on health and job creation and does not include the benefits to consumers from reliable electricity, with the alternative being smaller and inefficient and potentially more polluting diesel generators. Health effects are expected to be positive as the new plant's emissions would be significantly lower per unit of energy produced, since the plant use natural gas as primary fuel and heavy fuel No 6 as secondary fuel. In terms of job creation, during EL Tebbin Power Plant project preparation and construction phase about 1,300 jobs were directly created including technical, non-technical and consulting jobs. Over 99 percent of jobs created were local hires. During the operating phase, the power plant is staff with about 450 full-time employees, including operation staff working in three rotating shifts daily.

Table 2: Values for the variables used in the economic evaluation of the El Tebbin Project – Base Case



Demand function $Q_n = a_n + b_n * \log P_n$ in year n of El Tebbin project operation

where subscript or superscript n denotes year n of El Tebbin project operation

a_n is a con: $(1 - \varepsilon_n * \log P2_n) * Q2_n$ b_n is a con: $Q2_n * \varepsilon_n$

$P2_n$ = Average marginal tariff faced by electricity consumers -assumed unchanged in real terms from year 1 onwards to the end of the project evaluation period (30 years)

$Q2_n$ = System consumption of electricity at price $P2_n$

ε_n = price elasticity of demand on the Egyptian power system at point ($P2_n$, $Q2_n$)

dn = System consumption supplied from the Helwan S. project

$P2_1$ = Regulated average retail tariff in year 1 of Helwan S. project operation

$Q2_1$ = System consumption at price $P2_1$ in year 1 of Helwan S. project operation

$P1_n$ = consumers' marginal willingness to pay for quantity $Q2_1$ [$P1_n = \exp((Q_n - a_n)/b_n)$]

$Q2_n$ = $Q2_1 * (1 + r)^{n}$ where r is the forecast annual rate of growth of system demand

The project economic benefit in year n (X_n):

Xn = $B_n * MIN[d_n, Q2_n - Q2_1]/(Q2_n - Q2_1)$
= portion of total economic benefit B_n attibutable to the project

B_n = $b_n * [\exp((Q2_n - a_n)/b_n) - \exp((Q2_1 - a_n)/b_n)]$
= total economic benefit from increase in consumption in year n over year 1

Values for the evaluation variables:

System consumption in base year for power demand forecast (FY06/07)	103857	GWh cons.
System consumption in first year of project operation (FY10/11) ($Q2_1$)	126934	GWh cons.
System demand grows to first year of project operation (FY10/11) at r	0.0514425	/year
Regulated average retail tariff (**P2n**)	0.035	/kWh cons.
Price elasticity ε for total system power demand	-0.2	
Opportunity cost of capital to Egypt (OCC)	0.1	
System demand met from 700MW El Tebbin plant (**dn**)	4292.4	GWh cons.
except for year 1	2146.2	GWh cons.
except for year 2	4292.4	GWh cons.
Project operating life (**n**)	30	years
Project construction cost for steam units	705	million

Cost of natural gas consumed by steam units at Helwan S.	3.13	/MMBtu
Heat rate of gas-fired steam units for power generation	8005	BTU/kWh/gen.
Cost of natural gas to produce 1 GWh by steam unit	25055.65	
Cost of natural gas to produce 1 kWh by steam unit	0.0250557	
Plant non-fuel fixed O&M cost	3	kW/year
Plant non-fuel variable O&M cost	0.4	MWh
Incremental transmission cost of energy sales from El Tebbin	0.006	/kWh gen.
Incremental distribution cost of energy sales from El Tebbin	0.01	/kWh cons.
Consumers' marginal willingness to pay for quantity $Q2_1$: $P1_1$ =	0.0447001	/kWh cons.
Values of demand function constants in year 1: a_1 = 43978.802	b_1 = -26692.76173	

Source: World Bank staff

Table 3: Economic Return to the El Tebbin Project – Base Case

FY	Year	Annual Electricity Generated	Annual Electricity Consumption	Total Economic Benefit	Develop.& Construct. Cost	Cost of Fuel consumed	Non-fuel O&M Cost	Annual T&D O&M Cost	Total Economic cost	Net Econ. Benefit
		(GWh)	(GWh)	(US$million)	(US$million)	(US$million)	(US$million)	(US$million)	(US$million)	(US$million)
2010/11	-6								0.0	0.0
2011/12	-5				58.858451				58.9	-58.9
2012/13	-4				169.55838				169.6	-169.6
2013/14	-2				282.58059				282.6	-282.6
2014/15	-1				120.89908				120.9	-120.9
2015/16	1	2,467	2,146	85.1	70.467694	61.8	4.9	36.3	173.4	-88.3
2016/17	2	4,934	4,292	192.5	2.6358071	123.6	7.8	72.5	206.6	-14.1
2017/18	3	4,934	4,292	217.4		123.6	7.8	72.5	204.0	13.4
2018/19	4	4,934	4,292	244.9		123.6	7.8	72.5	204.0	40.9
2019/20	5	4,934	4,292	275.2		123.6	7.8	72.5	204.0	71.2
2020/21	6	4,934	4,292	308.4		123.6	7.8	72.5	204.0	104.4
2021/22	7	4,934	4,292	344.5		123.6	7.8	72.5	204.0	140.6
2022/23	8	4,934	4,292	383.7		123.6	7.8	72.5	204.0	179.8
2023/24	9	4,934	4,292	426.0		123.6	7.8	72.5	204.0	222.0
2024/25	10	4,934	4,292	471.3		123.6	7.8	72.5	204.0	267.3
2025/26	11	4,934	4,292	519.7		123.6	7.8	72.5	204.0	315.7
2026/27	12	4,934	4,292	571.1		123.6	7.8	72.5	204.0	367.1
2027/28	13	4,934	4,292	625.4		123.6	7.8	72.5	204.0	421.4
2028/29	14	4,934	4,292	682.6		123.6	7.8	72.5	204.0	478.7
2029/30	15	4,934	4,292	742.6		123.6	7.8	72.5	204.0	538.6
2030/31	16	4,934	4,292	805.1		123.6	7.8	72.5	204.0	601.2
2031/32	17	4,934	4,292	870.2		123.6	7.8	72.5	204.0	666.2
2032/33	18	4,934	4,292	937.5		123.6	7.8	72.5	204.0	733.5
2033/34	19	4,934	4,292	1,006.9		123.6	7.8	72.5	204.0	802.9
2034/35	20	4,934	4,292	1,078.2		123.6	7.8	72.5	204.0	874.3
2035/36	21	4,934	4,292	1,151.3		123.6	7.8	72.5	204.0	947.3
2036/37	22	4,934	4,292	1,225.8		123.6	7.8	72.5	204.0	1,021.8
2037/38	23	4,934	4,292	1,301.6		123.6	7.8	72.5	204.0	1,097.6
2038/39	24	4,934	4,292	1,378.4		123.6	7.8	72.5	204.0	1,174.5
2039/40	25	4,934	4,292	1,456.1		123.6	7.8	72.5	204.0	1,252.2
2040/41	26	4,934	4,292	1,534.5		123.6	7.8	72.5	204.0	1,330.5
2041/42	27	4,934	4,292	1,613.2		123.6	7.8	72.5	204.0	1,409.3
2042/43	28	4,934	4,292	1,692.2		123.6	7.8	72.5	204.0	1,488.2
2043/44	29	4,934	4,292	1,771.2		123.6	7.8	72.5	204.0	1,567.2
2044/45	30	4,934	4,292	1,850.1		123.6	7.8	72.5	204.0	1,646.1
								NPV @	**10.0%**	**1,288**
									EIRR	**18.4%**
					Levelised economic cost @			**10.0%**	**$0.043**	**/kWh consumed**

Source: World Bank staff

B. Financial Analysis of Past and Current Performance of EEHC (Consolidated Basis)

10. This financial analysis evaluates the overall financial situation of EEHC group of companies, covering the whole spectrum of electricity generation, transmission and distribution businesses.

11. The main findings of the financial assessment are:

(a) **EEHC remains in a precarious financial situation with a high level of outstanding liabilities relative to capital (9.9 times), a large planned investment program (larger than existing fixed assets), and limited relief from electricity tariffs to commensurate rising operating costs.** The authorities and EEHC are aware of the situation and have been working to restructure EEHC capital structure. A Supreme Energy Council Decree was issued in May 2011, authorizing in-principle the Ministry of Finance, the Ministry of Electricity and EEHC to restructure the loan from the National Investment Bank of Egypt (NIB) and to settle accumulated financial obligations between EEHC and governmental agencies. The NIB is EEHC's largest creditor with outstanding loans of LE22 billion by end FY2011. EEHC envisages its debt obligations to NIB to reduce by as much as one half of the current amount following the restructuring. Also in FY2011, EEHC owed over LE40 billion to governmental agencies; on the other hand governmental agencies owed EEHC about LE12 billion.

(b) **Increases in materials and services cost had outpaced revenue growth partly due to a shift toward Combined-Cycle Gas Turbine technology.** About 4,400 MW of CCGT were added to the generation mix over FY2005–FY2010[14]. Over this same period revenue grew on average 15 percent per year while materials and services cost grew by 27 percent – the only cost item growing faster than revenue. Other main cost items – fuels, salaries & wages, financing, depreciation charges – did not outpace revenue growth. EEHC has had to outsource certain operation and maintenance work for CCGT, contributing to such cost increases. As a result, materials and services cost reached a substantial 15 percent of revenue in FY2010 and FY2011.

(c) **Declining profitability in recent years.** EEHC's revenues stem from the sale of electricity generated by its subsidiaries, and purchased from IPPs and New and Renewable Energy Agency (NREA). Based on audited accounts of the past seven fiscal years (FY2005–FY2011), the company has been profitable mainly due to rising average selling tariff. The regular annual increases in

[14] Between FY2005–FY2010 CCGT capacity increased from 2,699–7,137 MW; gas turbines capacity increased from 1,537–2,841 MW; steam turbines capacity remained around 11,500-11,600 MW; and hydro power capacity remained around 2,800 MW.

electricity tariffs[15] resumed in 2004 until 2009, after a 12-year period in which the retail price of electricity had remained unchanged. Tariff increases were again discontinued in 2009, although the shift in demand toward higher tariff blocks caused average selling tariff to grow by 4 percent in FY2010 and FY2011. EEHC achieved earnings before interest expenses, taxes, depreciation and amortization (EBITDA) margin of 33 percent and a net profit margin of 2 percent in FY2011.

(d) **Constrained by cash shortfall** Operating cash flow has been positive and rising, although this is substantially a result of prolonged repayment of current liabilities, including past due obligations owed to the Ministry of Finance, other governmental entities and local banks (i.e. accumulation of arrears). In FY2011, net operating cash flow reached LE 7.6 billion, but this included about LE 6 billion from prolonged repayment net of receivables settlement during the year. Investment for the year totaled LE 14.7 billion (a step increase from 10.7 billion in FY2010), thus requiring an incremental debt financing of about LE 5.7 billion. In FY2011, the estimated cash-basis tariff shortfall was about LE 0.05 per kWh of sold electricity (compared to the average selling tariff of LE 0.20 per kWh – a shortfall of about 23 percent).

(e) **Large accumulated receivables and payables.** Outstanding receivables are large – LE 18 billion – which includes clients' account of LE 8.8 billion averaging almost 167 days of revenue in the past five fiscal years. Detailed information shows that outstanding receivables from households and other private sector clients totaled about LE 3.4 billion, with the remaining amount made up largely of government and public sector entities. On the other hand, outstanding payables are even larger at LE 54 billion, including about LE 41 billion of the past due obligations.

12. Roadmap towards financial sustainability

(a) **Tariff increases.** Gradual tariff increases toward a commercially viable tariff structure should be resumed, with adequate provisions for the adverse social impact. Although past tariffs had resulted in financial profits for EEHC, they had not generated adequate cash for investment and debt services. As a result, EEHC had to incur more debt and delay payment of some financial obligations to make up for the cash shortfall. The latest tariff increases in January 2012 for very-high and high voltage industrial users cover only about 15 percent of overall electric energy sales.

(b) **Debt restructuring, recapitalization and streamlining working capital of EEHC.** The contemplated NIB debt restructuring would substantially reduce interest burden by about LE 1 billion per year, which is about a quarter of total

[15] The average selling tariff increases 7.3 percent over the fiscal years 2003/04 to 2008/09.

interest expenses in FY2011. The prospective accounting gain on debt restructuring could reduce EEHC's leverage from 9.9 times to as low as 4 times, and enable EEHC to fully service other debt obligations. In addition, removal of EEHC's legacy account receivables and account payables would permit EEHC to focus on improving working capital management. Collectively, these measures would allow EEHC to attain a better financial discipline and financial indicators, which would improve access to local and international capital markets.

(c) **Grace period from new loans and longer tenor foreign currency loans.** EEHC is already benefiting from grace period on principal repayment of new loans. The grace period will reduce debt servicing obligation in the next five years. In addition, foreign currency loans typically have longer maturity than local currency loans. This helps reduce the size of each year's loan repayment and spread out the impact on cash flow from foreign exchange rate movement.

(d) **Outsourcing of capital expenditures.** EEHC can significantly reduce its own financing requirement by outsourcing some of the planned investment to other entities, such as to the private sector, although this has become more challenging in recent months due to the political and economic situation in the country.

(e) **Cost control.** By FY2011 fuel cost became the largest cost component (19 percent of revenue). Fuel cost savings may be possible from more efficient fuel use, particularly in newer power plants coming online. During the period of electricity tariff freeze, the moratorium on fuel price increases would help EEHC control this main cost item. Furthermore, cost of materials and services (15 percent of revenue) has increased on average 22 percent per annum in the last five years and may have room for improvement. Third, cost of salaries and wages may now be contained after a major adjustment in 2011.

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Summary of EEHC Financial Results and Indicators

	Unit	FY2006/07	FY2007/08	FY2008/09	FY2009/10	FY2010/11
		actual	actual	actual	actual	actual
GWh sold	GWh	98,812	107,226	112,617	120,180	126,957
Average tariff	EGP / kWh	0.162	0.174	0.187	0.194	0.201
Natural gas used in EEHC plants	BCM	18.2	19.1	19.9	21.5	22.8
HFO used in EEHC plants	Ton million	4.3	4.6	5.2	5.6	5.2
Diesel used in EEHC plants	Ton million	0.1	0.1	0.1	0.2	0.1
Average gas/heavy fuel prices	US$/MMBtu	0.7	0.8	0.9	0.9	0.9
INCOME STATEMENT SUMMARY						
Electricity sales	EGP million	15,968	18,687	21,024	23,336	25,581
Total revenue	"	17,285	20,357	23,003	25,830	28,550
Fuel expenses	"	(3,630)	(4,287)	(4,939)	(5,524)	(5,498)
Purchased electricity expenses	"	(1,902)	(1,897)	(1,996)	(2,227)	(2,255)
EBITDA	"	5,961	7,224	8,081	8,582	9,000
Financing expenses	"	(2,868)	(3,166)	(4,000)	(3,925)	(4,225)
Depreciation	"	(2,301)	(2,477)	(2,665)	(3,043)	(3,743)
Net income	"	768	874	1,742	2,165	465
CASH FLOW STATEMENT SUMMARY						
Changes in working capital	"	(4,074)	7,064	2,529	5,748	5,991
Operating cash flow, net	"	3,666	6,701	7,249	8,339	7,565
Investing cash flow, net	"	(3,362)	(6,993)	(10,976)	(10,691)	(14,694)
Financing cash flow, net	"	223	1,961	4,325	2,135	5,702
Change in cash	"	527	1,669	599	(217)	(1,426)
Cash ending balance	"	2,513	4,182	4,781	4,564	3,138
BALANCE SHEET SUMMARY						
Total assets, of which	"	82,902	96,638	109,182	119,781	136,971
Cash	"	*2,513*	*4,182*	*4,781*	*4,564*	*3,138*
Receivables	"	*14,442*	*17,225*	*18,793*	*18,079*	*18,678*
Fixed assets, net	"	*62,101*	*70,094*	*80,202*	*90,604*	*108,105*
Total liabilities, of which	"	73,696	86,807	97,498	107,818	124,382
Long-term debt, gross	"	*46,406*	*49,029*	*54,324*	*58,806*	*68,065*
Current portion of long-term debt, estir	"	*n/a*	*2,922*	*2,635*	*4,091*	*6,552*
*Past due liabilities**	"	*19,908*	*28,244*	*32,654*	*36,918*	*41,497*
Total equity	"	9,206	9,831	11,684	11,963	12,588
Financial ratios						
EBITDA margin	%	34%	35%	35%	33%	32%
Net margin	%	4%	4%	8%	8%	2%
Return on equity	%	8%	9%	15%	18%	4%
DSCR - EBITDA**	times	1.4	0.7	1.2	1.3	1.1
DSCR - net operating cash flow***	times	1.6	1.0	1.6	1.9	1.4
EBITDA interest coverage ratio	times	2.1	2.3	2.0	2.2	2.1
Self-financing ratio	%	34%	52%	66%	53%	24%
Current ratio	times	0.6	0.6	0.6	0.5	0.5
Cash on hand (# day of revenue)	days	53	75	76	64	40
Receivables day (# day of revenue)	days	305	309	298	255	239
Payables day (# day of external costs)	days	270	301	286	274	325
Liabilities-to-equity ratio	times	8.0	8.8	8.3	9.0	9.9
Long-term debt-to-equity ratio	times	5.0	5.0	4.6	4.9	5.4
Long-term debt / net operating cash flow	times	12.7	7.3	7.5	7.1	9.0
Net debt**** / EBITDA	times	10.8	10.2	10.3	10.8	12.0
Annual % change - GWh sold	%	6.4%	8.5%	5.0%	6.7%	5.6%
Annual % change - average tariff	%	6.6%	7.8%	7.1%	4.0%	3.8%

* Past due liabilities are largely obligations to the Ministry of Finance.
These obligations are gradually being setoff against the cost of electricity supplied to governmental users.

** EBITDA divided by previous year current portion of long-term debt and interest expenses for the year.

*** Operating cash flow and interest expenses -- net of changes in working capital,
divided by previous year current portion of long-term debt and interest expenses for the year.

**** Sum of short- and long-term debt/obligations, subtract cash balance

Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Pierre Audinet	Senior Energy Economist	SEGES	Economist
Anna M. Bjerde	Senior Manager	AFTSN	Task Team Leader
Richard James	Consultant	AFTWR	Operations Officer
Badr Kamel	Senior Procurement Specialist	MNAPR	Procurement Specialist
Lizmara Kirchner	Water & Sanitation Specialist	LCSUW	Operations Analyst
Reinaldo Goncalves Mendonca	Consultant	MNSED	Energy Consultant
Sahar Ahmed Nasr	Lead Economist	MNSF1	Economist
Knut Opsal	Sr. Social Scientist	EASER	Social Scientist
Hany Shalaby	Consultant	AFTEN	Energy Consultant
Hisham Ahmed Waly	Sr. Financial Management Specialist	OPCFM	Financial Management Specialist
Supervision/ICR			
Mohamed Yahia Ahmed Said Abd El Karim	Financial Management Specialist	AFTFM	Financial Management Specialist
Layla Mohamed-Kotb Abdel Wahab	Program Assistant	MNC03	Program Assistant
Armando Ribeiro Araujo	Consultant	LCSTR	Procurement Consultant
Rome Chavapricha	Senior Infrastructure Specialist	MNSEG	Financial Analyst
Akram Abd El-Aziz Hussein El-Shorbagi	Sr. Financial Management Specialist	MNAFM	Financial Management Specialist
Wael Ahmed Elshabrawy	Financial Management Analyst	MNAFM	Financial Management Specialist
Sydnella Kpundeh	Program Assistant	MNSSD	Program Assistant
Mohab Awad Mokhtar Hallouda	Senior Energy Specialist	MNSEG	Energy Specialist and Task Team Leader
Ahmedou Hamed	Consultant	MNAPR	Procurement Consultant
Maged Mahmoud Hamed	Senior Environmental Specialist	MNSEN	Environmental Specialist
Knut Opsal	Sr. Social Scientist	EASER	Social Scientist
Masaki Takahashi	Sr. Power Engineer	EASIN	Power Engineer
Husam Beides	Lead Energy Specialist	MNSEG	Energy Specialist
Vladislav Vucetic	Lead Energy Specialist	MNSEG	Energy Specialist
Maria Vagliasindi	Lead Economist	SEGEN	Economist
Luis Prada	Sr. Procurement Specialist	MNAPC	Procurement Specialist

(b) Staff Time and Cost

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	No. of staff weeks	USD Thousands (including travel and consultant costs)
Lending		
FY05	59.49	261.42
FY06	78.95	376.21
FY07	0.30	0.43
Total:	138.74	638.06
Supervision/ICR		
FY06	4.67	34.03
FY07	22.36	125.09
FY08	19.22	70.35
FY09	17.15	114.20
FY10	18.59	72.91
FY11	12.95	45.20
FY12	9.84	36.06
Total:	104.78	497.84

Annex 5. Beneficiary Survey Results

Not applicable.

Annex 6. Stakeholder Workshop Report and Results

Not applicable.

Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR

Client Feedback and comments

Comments on challenges &difficulties faced by CEPC/EEHC in implementing the project

- During the implementation of the project, EEHC/CEPC experience some delay to grant the WB no objection to the tender documents, especially for the steam turbine contract package, as well as, the steam generator contract package (boiler), which constitutes a major delay in the project start date, accordingly, some delay in the project original schedule as follows:-

  a- Delay of two months in the review of STG package by the world bank
  b- one month extension in the procurement cycle due to world bank requirement to add two weeks for bidders as indicated in progress report No.1 –May 2006

Comments on the performance of world bank team

- All WB requirement by the CEPC project dedicated team to apply all the agreed upon during the project appraisal by the WB improved the team performance and facilitate the interface with the WB team during the project implementation. Regular reports are issued and send to all financing agencies, including WB, on a timely manner, reflecting the status of the project implementation and the deviation of the project targets, and the proposed approach to resolve the issues. The project was completed on time and The power plant started the commercial operation on 26/8 & 17/9/2010.
- The Bank team gave strong support to the project, in the early days of the project they supported the bidding and implementation with good guidance and ideas. The cooperation between the Bank team and the project team was V good
- For reports and the team suggests that the bank prepare forms for different types of requested reports to simplify the process and make it more efficient

Feed Water Heaters DCA Problem

- Please refer to progress report No.57 APPENDIX- I Critical Action Report: All unit 1 and 2 Feed Water Heaters Drain Cooler Approach- temperatures are significantly higher than the design values due to internal steam leakage caused by poor quality control during heater fabrication at Walter Tostos shop in Italy. Walter Tostos tried to expand the tubes to minimize or eliminate the steam leakage but failed to resolve the problem satisfactory. He provided two recommendations to resolve the problem.

Lessons that can be learned from El –Tebbin implementation

- It worth to mention that the variation of currency along the execution time of the project, especially the increase of the Euro against the US dollar (currency of WB

loan) causes some additional burden to EEHC/CEPC, accordingly, it is strongly to advice any borrower to hedge against the currency fluctuation for any future arrangement for any similar project

- Loan validity should be till end of warranty period

Suggestions for withdrawal procedures from the loan

- Activating the Token so disbursement can take only 3 days
- To withdraw from loan in block amounts to pay for contracts and use and recharge when the amount is consumed
- To have 20% reserve in the loans to be able to cover currency fluctuations and additional works that exceeds contingences

Comments and feedback on financial matters

Power Plant Component

Due to the fact that the estimated cost of the Project fell short of the actual contracting prices, the US$ 259.6 million financing of the World Bank was confined to cover certain packages under the project leaving some other packages to be financed out of the Owner's own resources.

EEHC has successfully obtained support from the National Bank of Egypt by making available a loan in the amount of US$ 450 million partly used in financing the packages of El-Tebbin power project not covered by the WB contribution, and the remaining part of the loan was used in funding some other projects like Cairo West and Koreimat power plants.

Technical Assistance Component

1) **Financial Management:** There is a small financial unit, established since 2007 without the assistance of any external party, which is responsible for preparing and reporting on the financial statements (balance sheet, income and cash flow statements) together with the related enclosures.

   Aiming to improve the management of the Company's finances, it is anticipated in the coming period that EEHC will consider the possibility of engaging a company specialized in financial mechanization to introduce an automated system accessible by all financial departments to be linked to the system (e.g. auditing, accounting, costing departments and the electricity hospital, etc.).

2) **Personnel Information System**: Two contracts are being executed now for the supply and installation of computer equipment and internal information network (Part I) and the preparation and implementation of an integrated program for personnel affairs, wages, training and data-base utilization licenses (Part II). The first contract was awarded to *Interact Computer Stores* and the second one to *Smart Vision Co.* for an aggregate price of about 200'000 Egyptian pounds for the two contracts.

3) Wages Rescheduling: EEHC is in the process of considering a rescheduling of wages of the employees of EEHC and its affiliated companies. Invitation letters have already been sent to some financial consultants like Hazem Hassan KPMG, Abdel-Aziz Hegazy, and Price Waterhouse to submit their offers for the execution of this assignment.

Annex 8. Comments of Cofinanciers and Other Partners/Stakeholders

Not Received

Annex 9. List of Supporting Documents

Type of Document	Report No.	Date
Project Appraisal Document	Report No: 34779-EG	January 18, 2006
Project Agreement	Loan Number 7359-EGT	March 2, 2006
Final Progress Report		February – March 2011
Project Mid-Term Report		February 2009
Aide Memoire: Appraisal Mission		September 17 – October 14, 2005
Aide Memoire: Supervision mission		April 26 – May 4, 2007
Aide Memoire: Supervision mission		November 5 – 15, 2007
Aide Memoire: Supervision mission		October 29 – November 9, 2006
Aide Memoire: Supervision mission		October 12-24, 2008
Aide Memoire: Supervision mission		April 10-18, 2008
Aide Memoire: Supervision mission		May 16-26, 2006
Financial Monitoring Report, CEPC		June, 2011 February, 2012
ISR 1		March 16, 2006
ISR 2		September 21 2006
ISR 3		December 6, 2006
ISR 4		May 18, 2007
ISR 5		November 27, 2007
ISR 6		May 21, 2008
ISR 7		November 23, 2008
ISR 8		June 23, 2009
ISR 9		December 23, 2009
ISR 10		June 24, 2010
ISR 11		January 4, 2011
ISR 12		June 26, 2011
ISR 13		November 6, 2011

ARAB REPUBLIC OF EGYPT

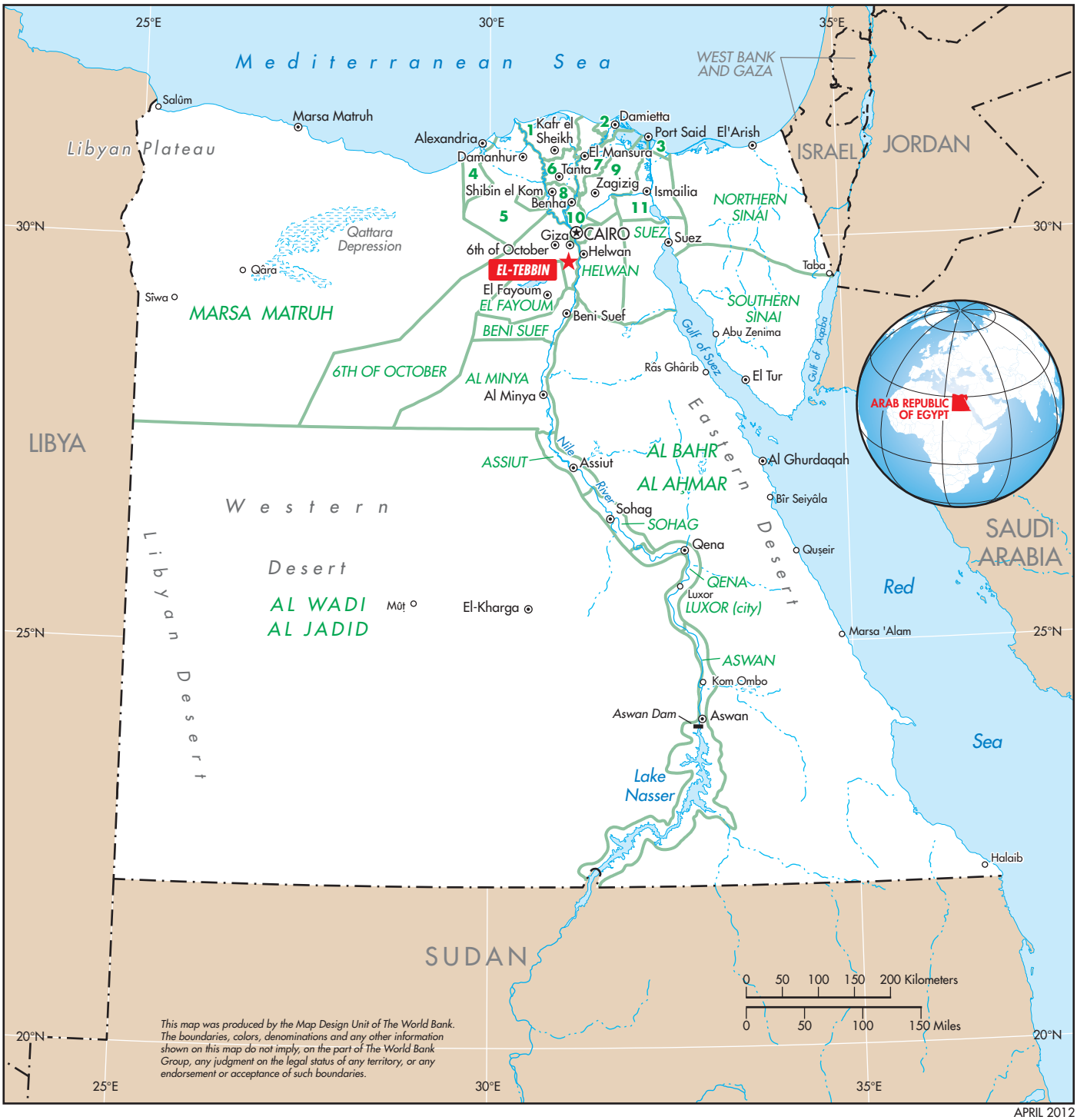
EL-TEBBIN POWER SECTOR PROJECT

★ EL-TEBBIN PROJECT LOCATION

- CITIES AND TOWNS
- GOVERNORATE CAPITALS
- NATIONAL CAPITAL
- RIVERS
- GOVERNORATE BOUNDARIES
- INTERNATIONAL BOUNDARIES

GOVERNORATES IN NILE DELTA:

1 KAFR EL SHEIKH
2 DAMIETTA
3 PORT SAID
4 ALEXANDRIA
5 BEHEIRA
6 GHARBIYA
7 DAGAHLIYA
8 MENOUFIYA
9 SHARGIYAH
10 QALIUBIYA
11 ISMAILIA



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