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FOR INFORMATION

MEMORANDUM

TO : THE BOARD OF DIRECTORS

FROM : Vincent O. NMEHELLE
Secretary General

SUBJECT : EGYPT – AIN SOKHNA 1300 MW SUPERCRITICAL THERMAL POWER PLANT PROJECT

PROJECT COMPLETION REPORT*

Please find attached the above-mentioned Report.

Attach.

Cc: The President

***Questions relating to this document may be addressed to:**

Mr. M. EL AZIZI	Director General	RDGN	Extension 1414
Ms. L. MOKADEM	Country Manager	COEG	Extension 6730
Mr. A. MOUSSA	Power Engineer	COMA/RDGN.1	Extension 7335
Mr. K. EL ASKARI	Principal Energy Officer	COEG/RDGN.1	Extension 6735
Ms. F. GABA	Principal Energy Economist	PESD.1	Extension 4269

AFRICAN DEVELOPMENT BANK



EGYPT

AIN SOKHNA 1300 MW SUPERCRITICAL THERMAL POWER PLANT PROJECT

PROJECT COMPLETION REPORT (PCR)

RDGN DEPARTMENT

June 2017

PROJECT COMPLETION REPORT FOR PUBLIC SECTOR OPERATIONS (PCR)



AFRICAN
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I BASIC DATA

A Report data

Report date	Date of report:	27/11/2016	
	Mission date (<i>if field mission</i>)	From: 15/5/2016	To: 27/5/2016

B Responsible Bank staff

Positions	At approval	At completion
Regional Director	Mr. A. Zejly	Mr. Jacob Kolster
Country Manager	Mr. S. Khushiram	Ms. Leila Mokadem
Sector Director	Mr. G. Mbeshherubusa	Mr. Alex Rugamba
Sector Manager	Mr. A.T. Diallo	Mr. Engedasew Negash
Task Manager	Mr. E. B. Nzabanita	Mr. Khaled El-Askari
Alternate Task Manager	--	Ms. Fatimata Gaba
PCR Team Leader		Mr. Khaled El-Askari
PCR Team Members		Ms. Fatimata Gaba Mr. Arkins Kabungo Mr. Ayman Algindy

C Project data

Project name: Ain Sokhna 1300 MW Supercritical Thermal Power Plant		
Project code: P-EG-FAA-014	Instrument number(s): ADB loan 2000130003680	
Project type: Public Investment	Sector: Energy/Power	
Country: Egypt	Environmental categorization (1-3): 1	
Processing milestones – Bank approved financing only (add/delete rows depending on the number of financing sources)	Key Events (Bank approved financing only)	Disbursement and closing dates (Bank approved financing only)
Financing source/ instrument1: ADB loan 2000130003680	Financing source/ instrument1:	Financing source/ instrument1:
Date approved: 22/12/2008	Cancelled amounts: USD 60 million	Original disbursement deadline: 30/06/2015
Date signed: 15/03/2009	Supplementary financing: None	Original closing date: 30/06/2015
Date of entry into force: 19/08/2009	Restructuring (<i>specify date & amount involved</i>): N/A	Revised (<i>if applicable</i>) disbursement deadline: 30/06/2017
Date effective for 1st disbursement: 16/11/2009	Extensions (<i>specify dates</i>): 30/06/2017	Revised (<i>if applicable</i>) closing date: 30/06/2017

Date of actual 1st disbursement: 16/12/2009				
Financing source/instrument (add/delete rows depending on the number of financing sources):	Disbursed amount (amount, USD million):	Percentage disbursed (%):	Undisbursed amount (USD million):	Percentage undisbursed (%):
Financing source/instrument 1: ADB loan	374.2	96%	15.8	4%
Financing source/instrument 2: World Bank	414.0	98.5%	6.5	1.5%
Financing source/instrument 3: Arab Fund	157.7	86.9%	23.8	13.1%
Financing source/instrument 4: Kuwaiti Fund	76.3	77.1%	22.7	22.9%
Financing source/instrument 5: EDEPC (GoE)	253.8	93.8%	16.7	6.2%
TOTAL:	1,276.1	93.7%	85.4	8.4%
Financing source/instrument (add/delete rows depending on the number of financing sources):	Committed amount (USD million):	Percentage committed (%):	Uncommitted amount (USD million):	Percentage uncommitted (%):
Financing source/instrument 1: ADB loan	390.0	100%	0.0	0%
Financing source/instrument 2: World Bank	420.5	100%	0.0	0%
Financing source/instrument 3: Arab Fund	181.5	100%	0.0	0%
Financing source/instrument 4: Kuwaiti Fund	99.0	100%	0.0	0%
Financing source/instrument 5: EDEPC (GoE)	270.5	100%	0.0	0%
TOTAL	1,361.5	100%	0.0	0%
Co-financiers and other external partners: The project is parallel-financed by the World Bank (WB), Arab Fund (AFESD) and Kuwait Fund (KFAED); in addition to counterpart funding from EDEPC.				
Executing and implementing agency (ies): Egyptian Electricity Holding Company (EEHC)/East Delta Electricity Production Company (EDEPC)				

D Management review and comments

Report reviewed by	Name	Date reviewed	Comments
Country Manager	Ms. Leila Mokadem		
Sector Manager	Mr. Jacob Kolster		
Regional Director (as chair of Country Team)	Mr. Engedasew Negash		
Sector Director	Mr. Alex Rugamba		

II Project performance assessment

A Relevance

1. Relevance of project development objective

Rating*	Narrative assessment (max 250 words)
4	<p>Egypt has made very good progress in terms of providing access to modern electricity services to almost the entire population through the national grid which covers all main populated areas of the country. Demand for electricity has been growing steadily at an average rate of 6% – 7% per year during the last decade. The demand is primarily driven by population and economic growths, and increased urbanization. The dominant electricity consumer sectors are industry, public utilities and services, the commercial and residential sectors. Accordingly, electricity is one of the main sources of secondary energy in Egypt and access to reliable and affordable electricity services is critical to achieving the country's economic and social development goals as articulated in the GoE 6th National Development Plan 2007-2012. This translated into the need for systematic expansion of the power infrastructure, by adding on average about 1500 MW of new generation capacity each year. Against this background, the Ain El-Sokhna Power Plant Project was conceived as part of the preparation of EEHC's 2002 - 2007 Power Generation Expansion Plan. The Plan aimed at adding about 7000 MW of new thermal generation capacity to the national grid between FY 2007/08 and 2013/14 to meet the expected growth in the demand during that period. By the time the preparations of the Ain El-Sokhna project started, power projects with a total capacity of 4,400 MW were already under construction as per the Expansion Plan.</p> <p>Accordingly, the Ain El-Sokhna Power Project was highly relevant to the development needs of the country in line with the priorities of the 6th National Development Plan (2007-2012) as well as the Bank's CSP for Egypt (2007-2011) that sought to support promoting the private sector as one of its two main strategic pillars through focus on infrastructure development including power. In fact, the Project was key in helping Egypt overcome the acute power shortage that was experienced in 2014, which would have continued in 2015 if the project had not started commercial operation, along with other measures taken by the government to close the supply gap.</p>

* For all ratings in the PCR use the following scale: 4 (Highly satisfactory), 3 (Satisfactory), 2 (Unsatisfactory), 1 (Highly unsatisfactory)

2. Relevance of project design

Rating*	Narrative assessment (max 250 words)
3	<p>The Ain El-Sokhna project was designed as a stand-alone green field project due to its size and complexity. The selection of the technology was based on a holistic planning approach that was followed during the development of the Power Generation Expansion Plan. The target was to maintain a balance between the two key thermal generation technologies; namely the steam cycle and the gas turbines. Among the factors that favoured the use of the steam-cycle technology for Ain El-Sokhna project was its location by the sea where the environmental conditions could potentially have adverse impacts on the gas turbines due to excessive humidity and dust from the hilly/desert areas surrounding the project site. Nonetheless, the Ain El-Sokhna project was the first project in Egypt to be based on the more advanced super-critical boiler technology in order to attain higher efficiency that results in lower fuel consumption and emissions. Ain El-Sokhna was selected for the project location since it has an industrial zone that is growing and a flourishing tourism industry and related developments; both of which are driving the demand for electricity in the area. It is always desirable to try to locate power plants as close to demand areas (load centers) as possible in order to reduce the cost of and power losses due to long transmission. Access to the site is very good given that it is just next door to the Ain El-Sokhna sea port so bringing heavy equipment to the site was convenient. The site is also close to the national transmission grid and natural gas network. Further, it is relatively close to other larger cities such as Cairo and Suez where demand for power is high. The financing plan of the project was based on parallel finance from four development institutions, including the Bank, in addition to counterpart funding from EDEPC. The project was broken down into several contracts – instead of EPC – to match the parallel co-finance arrangements in order to avoid the possible conflict among the procurement rules of the financiers in case of joint co-financing. Consequently, the project included a component for project management that essential for ensuring strong coordination among the contractors and financiers, etc.</p>

3. Lessons learned related to relevance

Key issues <i>(max 5, add rows as needed)</i>	Lessons learned	Target audience
1. Faster adoption of new technologies in Africa with proper training and capacity building before hand	Africa should not lag behind in the adoption of modern proven technologies in order to quickly benefit from advancement in technology. The super-critical power generation technology has been well established worldwide more than half a century ago. However, the Ain El-Sokhna project is the first to use this technology in Africa, partly because of the small installed capacities in many parts of the Continent, but also due to the typical fear of new technologies by many utilities. The experience from Ain El-Sokhna project has so far been very positive, with the operator reporting that technical staff became familiar with the new technology rather quickly and in fact find it easier and more flexible to operate than older technologies. This has to do with a strong training program that was organised to EDEPC O&M staff by the various contractors as part of their scope of work under the project. In fact, one recommendation from the operator is to even start the theoretical part of such trainings before project implementation in order to provide the necessary technological foundation for those who will be involved in the project. On the other hand, the overall positive experience from Ain El-Sokhna project was among the key factors that helped EEHC take a decision to change two of the recent power generation projects that are currently under implementation (Assiut and Cairo West) to the super-critical technology after being initially designed as sub-critical, in addition to the South Helwan project that was designed as super-critical from the beginning. All these projects will almost be a replica of Ain El-Sokhna.	Project Developers/Financing Institutions

B Effectiveness

1. Progress towards the project's development objective (project purpose)

Comments
<p><i>Provide a brief description of the Project (components) and the context in which it was designed and implemented. State the project development objective (usually the project purpose as set out in the RLF) and assess progress. Unanticipated outcomes should also be accounted for, as well as specific reference of gender equality in the project . The consistency of the assumptions that link the different levels of the results chain in the RLF should also be considered. Indicative max length: 400 words.</i></p>
<p>The main objective of the Project is to enhance socio-economic development in Egypt by providing infrastructure for increasing the generation capacity in the country in order to help meet the expected increase in the demand. The project involves the construction of a green-field thermal power plant consisting of 2x650 MW steam-cycle power generation units using the advanced super-critical boiler technology with higher efficiency, lower fuel consumption and emissions. The project is located in Ain El-Sokhna, 52 km south of the city of Suez and 112 km east of Cairo. The power plant is connected to the national grid; hence benefits the entire population of Egypt.</p>
<p>The project comprises the following main components and sub-components: (A) Civil Works; (B) Goods (Supply and Installation of Equipment): (B.1) Steam Generators & Auxiliaries, (B.2) Steam Turbine Generators & Condensers, (B.3) 500 kV Switchyard, (B.4) Power Transformers, (B.5) Pumps and Drives, (B.6) Feed Water Heaters, (B.7) Water & Wastewater Treatment/Desalination Plant, (B.8) Critical Piping and Valves, (B.9) Distributed Control Systems, (B.10) Electrical Equipment/Instrument & Control Installation, (B.11) Mechanical Equipment/Pipe Installation, and (B.12) Switchgear; (C) Environmental Monitoring; (D) Project Management/Engineering Services; and (E) Wrap-up Insurance. Main fuel for the project is natural gas, with heavy fuel oil (HFO) as backup. In addition, light fuel oil (LFO) is used for plant start-up. The power plant is connected to the national grid through 500 kV facilities, including a switchyard on site and 15 km overhead transmission line. The transmission line was implemented by the Egyptian Electricity Transmission Company (EETC) as a separate project, but was very well coordinated with the implementation of the power plant to ensure that it was ready on time.</p>

2. Outcome reporting

Outcome indicators (as per RLF; add more rows as needed)	Baseline value (Year) (A)	Most recent value (B)	End target (C) (expected value at project completion)	Progress towards target (% realized) [(B-A)/(C-A)]	Narrative assessment (indicative max length: 50 words per outcome)	Core Sector Indicator (Yes/No)
Outcome 1: Increased installed electricity generation capacity of EEHC	20,452 MW (2005)	32,000 MW (2015)	21,752 MW (2014)	>100%	The project started commercial operation in 2015, reflecting almost one year delay, but all expected outcomes have been achieved. It is to be noted that the outcome targets set at appraisal were not ideal since they wanted to measure the impact of the project alone using sector wide indicators that are impacted by other interventions in the sector. This explains the large discrepancy between the most recent values of the indicators (2015) versus the end targets at appraisal (2014).	Yes
Outcome 2: Increased number of consumers with grid connection	21.5 million consumers (2005)	31.5 million consumers (2015)	22.6 million consumers (2014)	>100%		Yes
Rating* (see IPR methodology)	Narrative assessment					
3	The targeted outcomes from the project have been achieved, albeit with one year delay behind the completion date expected at appraisal. In fact, the project was key in helping Egypt overcome the acute power shortage that was experienced in 2014, which would have continued in 2015 if the project had not started operation, along with other measures taken by the government to close the supply gap.					

3. Output reporting

Output indicators (as specified in the RLF; add more rows as needed)	Most recent value (A)	End target (B) (expected value at project completion)	Progress towards target (% realized) (A/B)	Narrative assessment (indicative max length: 50 words per output)	Core Sector Indicator (Yes/No)
Civil works	1	1	100%	All outputs have been fully achieved. The power plant has successfully passed all commissioning tests and has been running under commercial operation without major problems.	
Supply and installation of equipment	1	1	100%		
Environmental Monitoring	1	1	100%		
Wrap up Insurance and Project Management	1	1	100%		
Rating* (see IPR methodology)	Narrative assessment				
3	All outputs from the project have been fully produced, but project implementation suffered from about one year delay due to reasons mostly of force-majeure nature.				

4. Development Objective (DO) rating

DO rating (derived from updated IPR)*	Narrative assessment (indicative max length: 250 words)
3	The project managed to achieve its full developmental objectives by expanding the power generation infrastructure in the country to the benefit of the various consumer sectors. The project was instrumental in helping Egypt overcome the severe power shortage that was experienced during the summer of 2014.

5. Beneficiaries (add rows as needed)

Actual (A)	Planned (B)	Progress towards target (% realized) (A/B)	% of women	Category (eg. farmers, students)
99%	99%	100%	50%	Population with grid access: The project injects its generated electricity into the national grid to the benefit of the various consumer sectors. With electrification reaching nearly 99% in Egypt, the national grid is serving almost the entire population, out of which 50% are women, and therefore any additional generation contributes directly to satisfying the demands of those people. The main electricity consumer sectors in Egypt are the industrial, residential, commercial, and public utilities and services.
3,000	1,500 – 3,000	100%	< 1%	Job Creation: The project created some 3,000 direct jobs over its construction phase and up to 250 permanent jobs. More than 90% of the construction jobs and 100% of the permanent jobs went to Egyptians varying between engineers, technicians, administration and other support staff to also casual labourers, etc. In addition, on-the-job training has been provided as part of the scope of work for many contracts under the project, which helps build the skills of the employed persons, especially the young who lack the practical experience. In addition to those direct jobs, the project helped create indirect jobs through the spill over effect (e.g. catering and transportation services for the workforce, local accommodation for the expatriates, etc.). It is estimated that between 40% - 50% of the total project cost was spent in the local economy helping boost local industries and services (steel/metal works, low and medium voltage equipment, and other goods such as pipes, cables, etc.).

6. Gender equality

Assessment on the performance of gender equality in the operation (indicative max length: 250 words)
In accordance with the Egyptian Labour Law, EDEPC is committed to equal opportunity practices. Nonetheless, due to the nature and location of the project, the percentage of direct jobs that benefitted women was negligible. The project is nonetheless expected to contribute positively to women's welfare through the provision of reliable and affordable electricity to the various consumer sectors. The improved living conditions for the households are expected to have positive impacts on women in particular who tend to assume the larger responsibilities in running their homes. They will also benefit from the improved health facilities as a result of improved electricity services. Women could also seize the reliable electricity services to pursue income generating activities that will help

empower them and support their families. Industrial development will also benefit women, especially those industries that rely more on women such as the textile, food processing, etc.

7. Unanticipated or additional outcomes (add rows as needed)

Description	Type (eg. gender, climate change, social, other)	Positive or negative	Impact on project (High, Medium, Low)
None			

8. Lessons learned related to effectiveness (add rows as needed)

Key issues (max 5, add rows as needed)	Lessons learned	Target audience
1. Optimal use of the power sector infrastructure based on the merits of the different technologies available is critical for improving the overall performance of the sector and its sustainability	<p>Integrated energy/power sector planning and management is key to ensuring optimum utilisation of the assets and resources.</p> <p>The average load factor for the Ain El-Sokhna Power plant during the first year of commercial operation is 75%, which is slightly below the minimum load (78%) for the super-critical mode as per the design of the boilers. While operating the plant at 75% load, i.e. in dry sub-critical mode, would still achieve high efficiency (reported by EDEPC as 40 – 42%), further efficiency gains could be achieved by increasing the load to move to the full super-critical mode. The plant has also been running on HFO during 90% of the time, because of unavailability of natural gas, which increases the fuel as well as O&M costs; hence results in higher generation costs. Most of these factors are external to the plant owner (EDEPC), but are controlled by other entities within the power/energy sector (e.g. plant loading dictated by the National Control Center and fuel availability by the Ministry of Petroleum). High-level coordination and information sharing among all such entities is therefore paramount for achieving the optimal conditions for asset utilisation and providing full benefits to plant owners and to the consumers.</p>	EEHC / Ministry of Petroleum
2. Project risks need to be carefully assessed and project owners have a critical role to play in risk management plans, including adequate training of PMUs.	<p>Implementation of the Ain El-Sokhna project was impacted by some external events such as the political unrest in Egypt during 2011 - 2013, Tsunami in Japan, floods, etc. Given the force majeure nature of these events and their long durations, they could have resulted in complete suspension of the project. However, EEHC/EDEPC and the Project Engineer exerted effort to minimize disruptions to the work on site to the best of their ability/control, and as a last resort, to ensure that full suspension of the project does not happen. Based on experience from other projects in the region with similar situations, this decision and effort were critical in preventing the Ain El-Sokhna project from possibly experiencing very long implementation delays and high cost escalation had implementation been fully suspended and then resumed again later on due to the force majeure. On the same vein, EDEPC (and the Bank) fully supported one of the contractors that suffered from severe financial difficulties due to economic problems back home. Due to non-project related cash flow problems, the contractor would not have been able to complete their scope of work, and therefore delay the completion of the whole project, if it was not again for the financial and technical support by EDEPC and the Project Engineer the helped the contractor, and the project, overcome this risk. From EDEPC side, they opened letters of credit for the contractor to be able to buy the raw material they needed to carry out their work. The cost of the material was then deducted from the payments made to the contractor when they delivered the. The Bank subsequently agreed to reimburse the costs of the letters of credit to EDEPC since they were issued to the benefit of a Bank-</p>	Project Developers/Finance rs

	financed contract. With these re-arrangements, the contractor was able to perform their work, and the project was saved from possibly very critical delays.	
3. Poorly formulated project results indicators	The key project outcome indicators selected by the Bank during appraisal were not properly formulated. The indicators tried to measure the impact of the project alone using sector wide indicators that are impacted by many other interventions in the sector and therefore cannot ideally be used to measure project-specific results alone. For example, indicator on increased installed electricity generation capacity tried to measure the impact of the project alone at the time of its completion, whereas it should have been formulated to measure the impact of the project as well as other similar parallel investments that collectively impact the value of the indicator at project completion.	Bank

C Efficiency

1. Timeliness

Planned project duration – years (A) (as per PAR)	Actual implementation time – years (B) (from effectiveness for 1st disb.)	Ratio of planned and actual implementation time (A/B)	Rating *
5.5	6.75	80%	3
Narrative assessment (indicative max length: 250 words)			
<p>The first milestone of project implementation was achieved by awarding the contract for the engineering consultant on 1 June 2008. The project schedule was developed such that the reliability runs of the two units would start 63 and 68 months from this award date respectively. However, the reliability runs of the two units actually started after 81 and 82 months respectively. These durations reflect delays of 18 and 14 months for the two units, i.e. project construction and commissioning took between 20% – 30% more time to be completed than planned.</p> <p>This delay is attributed to several factors; including external factors such as the general unrest that prevailed in Egypt following the Jan 2011 revolution, the Tsunami in Japan, and the severe floods in Thailand, where some of the project equipment were being manufactured. Internal project delays were caused by some of the contractors, because of either workforce management issues that were also related to the unrest in the country, or slow work progress by some contractors. In fact, without the very close follow-up on the progress of implementation by EEHC, EDEPC and the Project’s Engineer (PGESCO) and the good cooperation from most of the contractors; the Ain El-Sokhna project could have possibly suffered from much longer delays.</p>			

2. Resource use efficiency

Median % physical implementation of RLF outputs financed by all financiers (A) (see II.B.3)	Commitment rate (%) (B) (See table I.C – Total commitment rate of all financiers)	Ratio of the median percentage physical implementation and commitment rate (A/B)	Rating *
100%	100%	1.0	4
Narrative assessment (indicative max length: 250 words)			
<p>The total project cost at completion is the equivalent of USD 1.44 billion, about 72.6% of the cost estimated at appraisal (about USD 2.0 billion). This sizable reduction in the actual cost, despite of the implementation delay, is due to a group of factors; including a conservative cost estimate at appraisal, combined with very competitive contract prices for most of the components; but especially for the switchyard, environmental monitoring, and switchgear equipment. The generous cost estimate at appraisal is primarily due to the lack of local/regional market reference prices for the super-critical technology with the project being the first one of its kind in the region. The competitive contract prices are due to strong international competition, especially from new market players as well as from local equipment manufacturers and contractors in Egypt. The actual project cost is translated as USD 1110/kW, which is comparable to the market range for this technology.</p>			

3. Cost benefit analysis

Economic Rate of Return (at appraisal) (A)	Updated Economic Rate of Return (at completion) (B)	Ratio of the Economic Rate of Return at completion and at appraisal (B/A)	Rating*
EIRR (base case) 13%, ENPV EGP 6,648 million, ENPV USD 1,237 million	EIRR (base case) 36%, ENPV EGP 27,101 million, ENPV USD 3,011 million	2.77	4
Narrative assessment (indicative max length: 250 words)			
<p>The Ain El-Sokhna project was appraised in December 2008 with anticipated completion date in 2014. The project was found economically viable with the base case assumptions. In 2008, the EIRR was estimated at 13% and the ENPV was EGP 6,648 million (USD 1,237 million). Although the project appraisal report documents the main assumptions and parameters used in assessing the project's economic viability, the PCR team could not locate the detailed financial model that was used in the analysis. The team had therefore to reconstruct the model and used the assumptions and results at appraisal to verify the reconstructed model to ensure consistency. The model was then used to analyse the project at completion, taking into consideration the current macro-economic, financial and commercial and O&M information and the Long Run Marginal Cost (LRMC), given the anticipated demand growth. Accordingly, the project at completion is highly economically viable with the EIRR at 36% and the ENPV at EGP 27,101 million (USD 3,011 million). The two key factors that have significantly and positively affected the economic benefits of the project are (i) a higher economic tariff which is a resultant of the LRMC; and (ii) a significantly reduced investment cost in USD despite of the construction delays.</p>			

4. Implementation Progress (IP)

IP Rating (derived from updated IPR) *	Narrative comments (commenting specifically on those IP items that were rated Unsatisfactory or Highly Unsatisfactory, as per last IPR). (indicative max length: 500 words)
3.6	The overall implementation rating is an average of 3.6, which is equivalent to Highly Satisfactory. All project covenants have been complied with. Procurement under the project went rather smoothly. Funds from the various project co-financers were available in a timely manner, and no delays in disbursement were encountered. Financial management of the project was found acceptable by the Bank. Some loan savings amounting to USD 60 million were cancelled to be possibly used for other energy projects.

5. Lessons learned related to efficiency

Key issues (max 5, add rows as needed)	Lessons learned	Target audience
1. Procurement is a critical activity in infrastructure projects so it needs to be properly thought through and implemented.	The Ain El-Sokhna project was procured in 18 packages (contracts), which had the advantage of providing EDEPC and the Engineer greater control over the project's technical design and implementation schedule, but also caused challenges in terms of contract management and coordination among the contractors, which subsequently affected the implementation schedule. There is a need to carefully design the procurement strategy and packaging to facilitate project coordination and smoothen implementation.	Project Developers/Finance rs
2. Proper archiving of project documents and other data used for project appraisal.	The Bank's PCR team could not easily locate the detailed financial analysis model that was used at appraisal. The team therefore had to reconstruct the model from scratch and use appraisal data to verify the results of the reconstructed model to ensure consistency. It would have been far more efficient if the model used at appraisal was located by the PCR team. Proper archiving of such project data is therefore critical for the business of the Bank.	Bank

D Sustainability

1. Financial sustainability

Rating *	Narrative assessment (indicative max length: 250 words)
3	The project was found financially viable at appraisal in 2008. The FIRR was estimated at 7% and the FNPV was EGP 6,324.99 million (USD 1,177 million). At completion, the PCR mission assessed the financial viability of the project taking into consideration the current macro-economic, financial and commercial and O&M information and the new tariff levels. The team used the financial model at appraisal for the 2016 financial sustainability assessment. The FIRR at completion is 11% with a FNPV of EGP 14,034 million (USD 1,559 million). Although the plant has not been operating as per original load factor due to fuel unavailability, the project is still financially sound with a FIRR at completion greater than the one at appraisal. Going forward, to improve the plant FIRR, there is a need for management to understand the required and prerequisite actions to be taken for the plant to operate in the optimal conditions. The two major factors that have significantly and positively affected the financial sustainability are the new level of tariff, which is 112% higher than the tariff in 2008, and (ii) the significantly reduced investment cost in USD despite the construction delays.

2. Institutional sustainability and strengthening of capacities

Rating *	Narrative assessment (indicative max length: 250 words)
3	Given that the Ain El-Sokhna Power Project introduces a new technology (super critical boilers) in the power sector in Egypt, capacity building of EDEPC staff was paramount during the implementation of the project. All contracts included as part of the scope of work training of EDEPC staff on the operation and maintenance of the equipment/facilities covered by those contracts. The trainings were mostly conducted on the project site, but also included sessions in the contractor's manufacturing/training facilities as necessary. In addition, the project includes a simulator that helps operation staff receive the necessary on-the-job training within the confines of the much safer simulator environment before actually resuming their duties on the power plant itself. These provisions collectively aimed at ensuring that proper capacity building was provided to EDEPC staff to guarantee successful completion of the project and subsequently operation of the power plant. As a result, EDEPC staff reported that contrary to their initial anticipation, they were able to quickly comprehend the new technology and as such they were able to run the plant smoothly without major problems. Moreover, based on the success of Ain El-Sokhna, EEHC decided to implement more projects employing the same advanced technology, and used Ain El-Sokhna project for experience sharing and as a training platform for the staff of those new projects as well.

3. Ownership and sustainability of partnerships

Rating *	Narrative assessment (indicative max length: 250 words)
4	Large and complex infrastructure projects such as Ain El-Sokhna Power Plant inevitably comprise a relatively large number of stakeholders that are engaged during their implementation, albeit with varying degrees. The ultimate responsibility for the implementation of the project rested with EEHC/EDEPC, but with extensive support from the Project Engineer (PGESCO) for both project management and supervision. These parties had to work in close tandem to ensure full coordination among not only the large number of contractors involved, but also other stakeholders such as the project financiers, local government authorities and other government central/local agencies. One particular case worth highlighting here is the issue of a contractor that for reasons external to the project went bankrupt and was therefore unable to continue fulfilling its role in the project. The straightforward action from EEHC/EDEPC in such a case would have been to terminate the contract with that particular contractor and award the remaining work to another one. However, after due consultation with all relevant stakeholders, including the Bank, the decision was taken to try to support the contractor as much as possible to enable them to complete their job in order to avoid the delay that would have happened if the remaining work were to be awarded to another contractor. This action nonetheless was accompanied with strong technical and financial measures to mitigate the associated potential risks. Finally, it worked reasonably well for the project and the contractor was able to complete its job. The Bank also played a very good role in this case by accepting to reimburse EDEPC for eligible expenditures under this contract, which significantly helped the cash flow of the company and hence of the overall project.

4. Environmental and social sustainability

Rating *	Narrative assessment (indicative max length: 250 words)
3	The project submitted routinely environmental and social monitoring reports that described the monitoring activities and the results of monitoring. In total 29 of those reports were submitted to the Bank. The parameters monitored were based on the ESMP including air quality; water quality; noise; flora and fauna; land use, landscape and visual impacts; soil and hydrology; traffic and transport; solid waste management; archaeology; occupational health and safety; and the socio-economic environment. Two air quality monitoring stations were permanently installed at selected locations in the project site and covered some of the necessary monitoring parameters. Other environmental monitoring activities were out-sourced to specialized service providers. The results were compiled in the E&S monitoring reports. Furthermore, the project was subject to an independent environmental audit that was carried out for the Bank on a sample of 10 projects selected from various sectors across the Continent. The result of all these monitoring/follow-up activities indicated that the project was in general complying with the requirements of the ESMP without significant environmental damage. Nonetheless, the Bank and other project financiers from time to time made some suggestions for improvement that were reasonably addressed by EDEPC. The project was not the subject of any complaint related to environmental or social issues, although, as it is the case with many large projects, demand for employment by the local people was an issue that in some cases slightly disrupted work on site as people gathered around the site demanding work. EDEPC did its best to try to address those demands to the extent possible. Finally, there was no resettlement due to the project and therefore no need for compensation since the project land was not in use prior to the project and was formally allocated to EDEPC for the purpose of the project.

5. Lessons learned related to sustainability

Key issues (max 5, add rows as needed)	Lessons learned	Target audience
1. Early inclusion of all project stakeholders is key to its smooth implementation	Knowledge of the Bank's procurement and disbursement rules and procedures by all stakeholders involved in project implementation (owner/executing agency, project implementation team, engineering consultant, etc.) is paramount for smooth implementation. This calls for wider inclusion of all such stakeholders in for example project launching missions, but also for the Bank, through the field offices for example, to continuously provide training workshops and hands-on clinics to the various stakeholders whenever needed during project implementation. It is also suggested that the introduction of new Bank procedures takes into consideration some transitioning period that is necessary for providing training to the staff of affected project.	Project Developers/Finance rs

III Performance of stakeholders

1. Bank performance

Rating *	Narrative assessment by the Borrower on the Bank's performance, as well as any other aspects of the project (both quantitative and qualitative). See guidance note on issues to cover. (indicative max length: 250 words)
3	Although the Ain El-Sokhna project is co-financed by several financing institutions, including the Bank, each institution carried out its appraisal of the project separately which put some burden on EDEPC/EEHC on having to deal with almost the same requests for information repeatedly. It would have been more effective if project appraisal would have been carried out jointly by the co-financers as feasible for more effective coordination. Nonetheless, overall the Bank has shown good support throughout the project starting from the appraisal phase when the Bank favourably agreed to increase its proposed loan in order to help the project achieve financial close. Subsequently throughout implementation, the Bank generally responded to project requests and needs in a timely manner. In particular, the Bank support in the case of the contractor that faced financial difficulty during implementation was very effective and positive. It certainly helped the project move forward without significant delay. In addition, the Bank responded favourably to the request of the project to use some of the potential loan savings for financing some additional small works under the project that aim at improving the reliability of the operation of the power plant. Procurement under the project went rather smooth and the Bank provided good advice and support on the use of Advance Procurement Action in order to help start procurement of the main project components that usually have long lead time ahead of loan approval in order to meet the target schedule of the project.

<p>Comments to be inserted by the Bank on its own performance (both quantitative and qualitative). See guidance note on issues to cover. (indicative max length: 250 words)</p> <p>The Bank was proactive during the implementation of the project by carefully investigating issues faced during implementation and providing support to EDEPC/EEHC on how to address them. The project was field-supervised by the Bank at least twice a year by a multi-disciplinary team as needed. In addition to those supervision missions, the Bank's presence on the ground through EGFO played an important role in keeping continuous follow-up and monitoring of project activities and providing first-hand support and response to project needs in a timely manner. In addition, the project was subject to a special independent audit on its environmental and social aspects. The findings and recommendations of the audit were useful in helping the project achieve better compliance with its ESMP.</p>	
<p>Key issues (related to Bank performance, max 5, add rows as needed)</p>	<p>Lessons learned</p>
<p>1. Stronger coordination among project co-financers</p>	<p>Although the Bank and World Bank maintained a very close coordination concerning the project, coordination with the other co-financers was rather weak, particularly because they did not have permanent presence on the ground and only supervised the project through short missions from their headquarters. Nonetheless, there was still room for stronger coordination between the Bank and World Bank through for example conducting project appraisal and supervision missions jointly.</p>
<p>2. Continuous training to be provided by the Bank to PMUs on Bank rules and procedures.</p>	<p>PMU staff greatly benefit from routine training by the Bank on its rules and procedures related to procurement, financial management, disbursement and environmental and social management. In the case of Ain El-Sokhna project, the PMU could have benefited from more training on Bank environmental and social policies and requirements in particular. The presence of staff covering those areas of expertise in the Bank's field offices can critically facilitate the delivery of such trainings to PMUs. Otherwise, the trainings can be programmed with project supervisions for efficiency.</p>

2. Borrower performance

<p>Rating *</p>	<p>Narrative assessment on the Borrower performance to be inserted by the Bank (both quantitative and qualitative, depending on available information). See guidance note. (indicative max length: 250 words)</p>
<p>3</p>	<p>EDEPC/EEHC showed strong commitment to the project from the onset. The Bank loan was signed in about three months after approval. Loan effectiveness was not as fast however, but it did not delay first disbursement. The availability of counterpart funding was adequate throughout the project and did not result in related delays. Overall, EDEPC/EEHC managed the project very well, despite of the completion delay. In fact, the bulk of project construction took place at difficult times following the 2011 uprisings in Egypt. The diligent follow-up on and management of the project by EDEPC/EEHC and the Project Engineer (PGESCO) played a critical role in achieving smooth implementation of the project. The PMU was very well-staffed with highly qualified personnel covering various expertise as needed for a project of such complexity. The PMU kept all project stakeholders, including the Bank, fully informed of project progress and arising issues. The project also submitted routine month progress reports throughout its implementation. EDEPC/EEHC effectively facilitated Bank supervisions and follow-up on the project. The Bank enjoyed very open and candid discussions with EDEPC/EEHC, and they were in general responsive to Bank recommendations. The response was not as fast though when it came to the recommendations concerning financial management issues, but overall financial management of the project was found satisfactory.</p> <p>Comments to be inserted by the Borrower on its own performance (both quantitative and qualitative). See guidance note on issues to cover. (indicative max length: 250 words)</p> <p>EDEPC is very proud to have the Ain El-Sokhna project successfully completed. EDEPC faced some challenges during the implementation of the project, most of which were external such as the unstable political environment in Egypt following the 2011 revolution; the tsunami in Japan (where the turbine generator was manufactured); the severe floods in Thailand (where some electronic equipment were produced); and even a flooding incident at the project site. EDEPC and PGESCO worked very hard with the concerned contractors to try to overcome those challenges and keep the project moving ahead. The most critical challenge for EDEPC was in fact the occasional demonstrations at the project site by the local people asking for work in the project. EDEPC tried to accommodate as much of those demands as was practically possible and in a transparent manner.</p>

Key issues (related to Borrower performance, max 5, add rows as needed)	Lessons learned
1. Faster response by project PMU to Bank recommendations related to improvement of project financial management and audits.	The presence of a Financial Management specialist in the Bank field office would have enabled much closer follow-up on financial management issues instead of the typical twice-a-year supervision missions which are still not frequent enough to push for swift actions to be taken by the executing agency.

3. Performance of other stakeholders

Rating *	Narrative assessment on the performance of other stakeholders, including co-financiers, contractors and service providers. See guidance note on issues to cover. (indicative max length: 250 words)	
2	The main other stakeholders that affected project performance were the various contractors on the project. Despite of a thorough procurement process that was based on international competition for procuring those contractors, it is inevitable that on such a large and complex project that some of the contractors do not deliver their work up to the quality and time schedule of their contracts. Such issues could potentially impact the entire project if the work of those contractor's is on the project's critical path. EDEPC and PGESCO had to continuously deal with such issues in order to minimize the delay to the overall project schedule due to poor performance of some of the contractors. Notably, the project completion report produced by PGESCO clearly documents the performance of each contractor in the project. This was a strong recommendation of the Bank in earlier projects with the power sector. The documentation of the performance of the contractors will serve as a good reference for procurement in future projects.	
Key issues (related to performance of other stakeholders, max 5, add rows as needed)	Lessons learned (max 5)	Target audience (for lessons learned)
1. Poor performance of some contractors	1. Procurement of the various project contractors should be based on thorough due diligence of their past performance and experience in similar projects. 2. Proper documentation of the performance of the contractors is important to be used as a reference for future procurements.	Project Developers

IV Summary of key lessons learned and recommendations

1. Key lessons learned

Key issues (max 5, add rows as needed)	Key lessons learned	Target audience
1. Faster adoption of new technologies in Africa with proper training and capacity building before hand	Africa should not lag behind in the adoption of modern proven technologies in order to quickly benefit from advancement in technology. For example, the super-critical power generation technology has been well established worldwide more than half a century ago. However, the Ain El-Sokhna project is the first to use this technology in Africa, partly because of the small installed capacities in many parts of the Continent, but also due to the typical fear of new technologies by many utilities. The experience from Ain El-Sokhna project has so far been very positive, with the operator reporting that technical staff became familiar with the new technology rather quickly and in fact find it easier and more flexible to operate than older technologies. This has to do with a strong training program that was organised to EDEPC O&M staff by the various contractors as part of their scope of work under the project. In fact, one recommendation from the operator is to even start the theoretical part of such trainings before project implementation in order to provide the necessary technological foundation for those who will be involved in the project.	Project Developers/Finance rs
2. Project risks should be carefully assessed and project owners have a critical role to play in risk management, including adequate training of PMUs.	Typically, project risks increase with its complexity as in the case of large infrastructure projects. This makes risk assessments and mitigation plans very critical components of proper project preparation studies. Nonetheless, dealing with un-anticipated risks	Project Developers/Finance rs

	(e.g. force majeure) during project implementation is equally important. Traditional solutions (e.g. contract termination) may not necessarily be the most optimum in such circumstances. All efforts need to be exerted by all concerned entities (project executing agency, contractors, engineer, financiers) to find the most optimum solutions. This requires project PMUs to be adequately trained and empowered to be able to handle such risks. The support of the Bank is also critical in such cases as an important stakeholder and development partner in the projects.	
3. Parallel-financing could simplify implementation arrangements in case of few financiers	Large infrastructure projects tend to be co-financed by a relatively large number of financiers, including DFIs and commercial banks. Structuring the financing plans, and therefore procurement arrangements, in such projects based on parallel-financing arrangements (instead of joint-financing) could help simplify implementation. This however requires strong project management and coordination among the co-financiers by project executing agencies and PMUs. The support of a project management engineer/agency may also be critical in such cases.	Project Developers/Financiers
4. Procurement is a critical activity in infrastructure projects so it needs to be properly thought through and implemented.	The Ain El-Sokhna project was procured in 18 packages (contracts), which had the advantage of providing EDEPC and the Engineer greater control over the project's technical design and implementation schedule, but also caused challenges in terms of contract management and coordination among the contractors, which subsequently affected the implementation schedule. There is a need to carefully design the procurement strategy and packaging to facilitate project coordination and smoothen implementation.	Project Developers/Financiers
5. Early inclusion of all project stakeholders is key to its smooth implementation	Knowledge of the Bank's procurement and disbursement rules and procedures by all stakeholders involved in project implementation (owner/executing agency, project implementation team, engineering consultant, etc.) is paramount for smooth implementation. This calls for wider inclusion of all such stakeholders in for example project launching missions, but also for the Bank, through the field offices for example, to continuously provide training workshops and hands-on clinics to the various stakeholders whenever needed during project implementation. It is also suggested that the introduction of new Bank procedures takes into consideration some transitioning period that is necessary for providing training to the staff of affected project.	Project Developers/Financiers

2. Key recommendations (with particular emphasis on ensuring sustainability of project benefits)

Key issue (max 10, add rows as needed)	Key recommendation	Responsible	Deadline
1. Optimal use of the power sector infrastructure based on the merits of the different technologies available is critical for improving the overall performance of the sector and its sustainability	Integrated energy/power sector planning and management is key to ensuring optimum utilisation of the assets and resources. The average load factor for the Ain El-Sokhna Power plant during the first year of commercial operation is 75%, which is slightly below the minimum load (78%) for the super-critical mode as per the design of the boilers. While operating the plant at 75% load, i.e. in dry sub-critical mode, would still achieve high efficiency (reported by EDEPC as 40 – 42%), further efficiency gains could be achieved by increasing the load to move to the full super-critical mode. The plant has also been running on HFO during 90% of the time, because of unavailability of natural gas, which increases the fuel as well as O&M costs; hence results in higher generation costs. Most of these factors are external to the plant owner (EDEPC), but are controlled by other entities within the power/energy sector (e.g. plant loading dictated by the	EEHC / Ministry of Petroleum	As soon as feasible

	National Control Center and fuel availability by the Ministry of Petroleum). High-level coordination and information sharing among all such entities is therefore paramount for achieving the optimal conditions for asset utilisation and providing full benefits to plant owners and to the consumers.		
2. Continuous training to be provided by the Bank to PMUs on Bank rules and procedures.	PMU staff greatly benefit from routine training by the Bank on its rules and procedures related to procurement, financial management, disbursement and environmental and social management. In the case of Ain El-Sokhna project, the PMU could have benefited from more training on Bank environmental and social policies and requirements in particular. The presence of staff covering those areas of expertise in the Bank's field offices can critically facilitate the delivery of such trainings to PMUs. Otherwise, the trainings can be programmed with project supervisions for efficiency.	Bank	N/A
3. Project executing agencies should pay due attention to Bank recommendations, e.g. on financial management issues, and implement them in a timely manner.	The presence of a Financial Management specialist in the Bank field office would have enabled much closer follow-up on financial management issues instead of the typical twice-a-year supervision missions which are still not frequent enough to push for swift actions to be taken by the executing agency.	Executing Agencies/Bank	N/A
4. Poor performance of some contractors	4.1. Procurement of the various project contractors should be based on thorough due diligence of their past performance and experience in similar projects. 4.2. Proper documentation of the performance of the contractors is important to be used as a reference for future procurements.	Project Developers	N/A
5. Better archiving of all project documents by the Bank	All project documents, starting from those used for project appraisal, should be centrally archived by the Bank. Digital archiving should as much as possible mirror the traditional paper archiving for ease of access. It is also recommended to use one central repository for digital document archiving instead of using scattered systems for efficiency.	Bank	As soon as feasible

V Overall PCR rating

Dimensions and criteria	Rating*
DIMENSION A: RELEVANCE	3.5
Relevance of project development objective (II.A.1)	4
Relevance of project design (II.A.2)	3
DIMENSION B: EFFECTIVENESS	3
Development Objective (DO) (II.B.4)	3
DIMENSION C: EFFICIENCY	3.65
Timeliness (II.C.1)	3
Resource use efficiency (II.C.2)	4
Cost-benefit analysis (II.C.3)	4
Implementation Progress (IP) (II.C.4)	3.6
DIMENSION D: SUSTAINABILITY	3.25
Financial sustainability (II.D.1)	3
Institutional sustainability and strengthening of capacities (II.D.2)	3

Ownership and sustainability of partnerships (II.D.3)	4
Environmental and social sustainability (II.D.4)	3
AVERAGE OF THE DIMENSION RATINGS	3.35
OVERALL PROJECT COMPLETION RATING	3

VI Acronyms and abbreviations

Acronym (add rows as needed)	Full name
ADB	African Development Bank
AFESD	Arab Fund for Economic and Social Development
CSP	Country Strategy Paper
DFI	Development financing institution
E&S	Environmental & social
EDEPC	East Delta Electricity Production Company
EEHC	Egyptian Electricity Holding Company
EETC	Egyptian Electricity Transmission Company
ESMP	Environmental and Social Mitigation Plan
GoE	Government of Egypt
HFO	Heavy fuel oil
IPR	Implementation Progress and Results Report
KFAED	Kuwait Fund for Arab and Economic Development
LFO	Light fuel oil
LRMC	Long Run Marginal Cost
MW	Mega Watt
PMU	Project Management Unit
WB	World Bank

Required attachment: Updated Implementation Progress and Results Report (IPR)– the date should be the same as the PCR mission.