

## Ex-ante Evaluation

### **1. Name of the Project**

Country: The Arab Republic of Egypt

Project: Kuraymat Integrated Solar Combined Cycle Power Plant Project

Loan Agreement: January 19, 2006;

Total Project Cost: 21,383 million yen (Loan Amount: 10,665 million yen)

Borrower: New and Renewable Energy Authority

### **2. Necessity and Relevance of JBIC's Assistance**

Power demand in Egypt has been growing rapidly, at about 7% annually in recent years. The gap between supply and demand is very tight, with average spare supply limited to about 1.5%. Power demand in Egypt is expected to continue growing at a similar pace. Under such circumstances, it is an urgent task to achieve stable power supply through planned development of power generation facilities commensurate with Egypt's power demand. Also, the Government of Egypt has decided to place a emphasis on reducing the environmental damage caused by power generation and utilizing new and renewable energy resources in the future development plan of power generation. The government has a policy of generating 880MW of power; which is about 3% of the total amount of installed capacity in the country, from new and renewable energy resources by 2011. On the other hand, JBIC places "a foundation for sustained growth" as one of the prioritized areas in its Guidelines for Overseas Economic Cooperation Operations, proclaiming a policy for providing support to promote sustained growth through achieving development of economic and social infrastructure(including electric power sector) which is indispensable for private sector activity. Also, JBIC has a policy of actively supporting the introduction of new and renewable energy as part of its effort in promoting its priority area; "commitment on global issues and peace building." Thus, JBIC's assistance for this project is highly necessary and relevant.

### **3. Project Objectives**

The Project aims to produce electricity to supply to electricity network, by the construction of 150MW integrated solar combined cycle power plant which is alternative to thermal power plants, thereby contributing to mitigation of climate change through the reduction of greenhouse gas emission.

### **4. Project Description**

#### (1) Location

Kuraymat district, about 100km south of Cairo

#### (2) Project Outline

Construction of integrated 150MW solar combined cycle power plant. (80MW Gas turbine, 70MW Steam turbine [40MW by gas turbine heat recovery and 30MW by solar heat exchanger]). The Global Environment Facility (GEF) will support the solar heat portion. JBIC will support the power generation portion (main equipment: gas turbine power generation facility, steam turbine power generation facility, heat recovery boiler including solar heat exchanger).

#### (3) Total Project Cost/Loan Amount

21,383 million yen (Yen Loan amount: 10,665 million yen)

(4) Schedule

September 2005-June 2011 (70 months)

(5) Implementation Structure

- (a) Borrower: New and Renewable Energy Authority
- (b) Guarantor: The Government of the Arab Republic of Egypt
- (c) Executing Agency: Same as borrower
- (d) Operation and Maintenance System: Same as borrower

(6) Environmental and Social Consideration

(a) Environmental Effects/ Land Acquisition and Resident Relocation

(i) Category: B

(ii) Reason for Categorization

This project does not fall under the category of sectors or attributes prone to producing effects and areas which are easily affected as listed in the JBIC Guidelines for Confirmation of Environmental and Social Considerations (established April 2002). For this reason, and because it has been judged that undesirable effects on the environment will not be significant, this project falls into Category B.

(iii) Environmental Permit

Environmental Impact Assessment report has been approved by the Egyptian Environmental Affairs Agency in November 2004.

(iv) Anti-Pollution Measures

Since this project uses natural gas and is expected to meet Egypt emission and environmental standards, it is not recognized to have significant adverse impact on environment. Also, as cooling water will be appropriately treated, no significant adverse impact on surrounding rivers is foreseen.

(v) Natural Environment

The new facility will be constructed adjacent to an existing power plant in the desert area. As it is neither a national park nor a nationally declared protectorate, no significant impact on the natural environment is foreseen. Also, there are no protected areas or habitats for valuable species requiring protection as stipulated under Egyptian domestic laws, international treaties around the project site.

(vi) Social Environment:

The government of the Arab Republic of Egypt has already acquired a land for the planned site. There will be no resettlement of residents.

(vii) Other/Monitoring

The executing agency will monitor aspects such as the status of air and water quality during construction and operation

(b) Promotion of Poverty Reduction

None in particular.

(c) Promotion of Social Development (e.g. Gender Perspective):

Women comprise about 40% of high-level engineers in the New and Renewable Energy Authority. Given this high ratio, many women engineers are expected to have opportunities to participate in the project.

(7) Other Important Issues

- (a) This project constructs a new type of power generation system. It shifts heat energy received

from solar collector equipment to the gas combined cycle as supplemental energy to the steam turbine to reduce its environmental impact. Thus, impact as a pilot project is expected.

(b) Co-funding aid project with GEF (grant aid).

## 5. Outcome Target

### (1) Evaluation Indicators (Operation and Effect Indicator)

Indicator	Baseline (2004)	Target (2011) (2 years after project completion [note])
Maximum output (MW)	—	150 MW
Plant load factor (%)	—	70%
Plant availability factor (%)	—	91%
Gross generating efficiency (%)	—	50%
Outage hours due to human errors (hours/year)	—	0 hours/year
Outage hours due to machine trouble (hours/year)	—	0 hours/year
Net electricity energy production (GWh/year)	—	873 GWh/year
CO <sub>2</sub> emissions reduction volume (tons CO <sub>2</sub> /year)	—	180,000 tons CO <sub>2</sub> /year

(Note) The operations will begin in 2009, however consultant work on operation and maintenance will be completed in 2011.

### (2) Internal Rates of Return

Financial Internal Rate of Return (FIRR): 3.4 %

(a) Cost: Project cost, maintenance cost

(b) Benefit: Electricity sales revenue, etc.

(c) Project Life: 25 years

Economic Internal Rate of Return (EIRR): 19.1 %

(a) Cost: Project cost (excluding taxes), maintenance cost

(b) Benefit: Increased electricity supply, CO<sub>2</sub> reduction, export value of fuel saved from domestic use

(c) Project Life: 25 years

## 6. External Risk Factors

(1) Unusual weather causing drastic reduction in sunlight volume

(2) Force majeure, such as terrorism or conflict

## 7. Lessons Learned from Findings of Similar Projects Undertaken in the Past

The lesson obtained from ex-post evaluations of previous power generation projects is that appropriate operation and maintenance after completion is essential to ensure sustainability of project effect. The New and Renewable Energy Authority, responsible for the operations and maintenance for this project, has been implementing operation and maintenance of power generating plants using new and renewable energy, and has experienced wind power generation project, however has not experienced an integrated solar combined cycle power plant project before. Hence, the Egyptian Electricity Holding Company (EEHC), which has experience managing the operation and maintenance of a gas combined cycle power plant, will be transferring technology through such means as personnel support and dispatches.

## **8. Plans for Future Evaluation**

### (1) Indicators for Future Evaluation

- (a) Maximum output (MW)
- (b) Plant load factor (%)
- (c) Plant availability factor (%)
- (d) Gross generating efficiency (%)
- (e) Outage hours due to human errors (hours/year)
- (f) Outage Hours due to machine trouble(hours/year)
- (g) Net electricity energy production (GWh/year)
- (h) CO<sub>2</sub> emissions reduction volume (tons CO<sub>2</sub>/year)
- (i) Financial Internal Rate of Return (FIRR) (%)
- (j) Economic Internal Rate of Return (EIRR) (%)

### (2) Timing of Next Evaluation

After project completion