Japanese ODA Loan

Ex-Ante Evaluation (for Japanese ODA Loan)

1. Name of the Project

Country:	Arab Republic of Egypt
Project:	Electricity Distribution System Improvement Project
Loan Agreement:	February 29, 2016
Loan Amount:	24,762 million yen
Borrower:	Egyptian Electricity Holding Company (EEHC)

2. Background and the Necessity of the Project

(1) Current State and Issues of the Electricity Sector in Egypt

The economy of the Arab Republic of Egypt grew by an average rate of 4.4% over the ten years from FY2004/2005 to FY2013/2014, but, during the same period, the peak load rose at an average rate of 6.0%, higher than that of the economic growth. The installed capacity of power generation increased each year, and in FY2013/2014, it became 32,015MW, about 1.74 times as large as in FY2004/2005. However, considering that the average operating rate of power plants in the same period was 85%, the available capacity of power generation in FY2012/2013, which excludes the capacity of the power plants under periodic inspection, was 26,183MW, lower than the peak load in the fiscal year of 27,000MW, which demonstrates that power supply is still tight. In order to supply electricity in a stable manner and meet brisk electricity demand, it is necessary to continue to increase the installed capacity of power generation in the future. The government is also urged to achieve greater energy efficiency by developing and improving power transmission and distribution facilities responding to growing demand for electric power.

Reduction in the network loss leads to saving of the amount of generated electricity and the fuel consumption required for the generation as well as streamlining of investments in power generation facilities. In FY2012/2013, the rate of transmission network loss and that of distribution network loss in Egypt were 4.1% and 8.9%, respectively. However, as power supply grows in the future, it is feared that these rates will increase substantially (In general, since they increase or decrease in proportion to the square of electric current, the power transmission and distribution network loss rates rise if power supply grows). The power transmission and distribution losses include nontechnical losses caused by factors such as stealing of electricity and failure to collect electricity fees as well as technical ones. It is reported that in all project areas, approximately 50% of power transmission and distribution network losses are nontechnical, and therefore, it is necessary to cope with such losses when developing power distribution facilities.

(2) Development Policies for the Electricity Sector in Egypt and the Priority of the Project

The National Energy Efficiency Action Plan of Electricity Sector (2012-2015), approved at a cabinet meeting in July 2012, aims to achieve greater energy efficiency by reducing power consumption, and the government views this JICA project as part of this plan. According to the electricity sector strategy announced at the Egypt Economic Development Conference in March 2015, the Egyptian government plans to increase the installed capacity of the country's power generation by 54.5GW by 2022. To evacuate electricity generated by the new power plants, it also intends to develop new transmission and distribution networks and upgrade the

existing ones. This project, which aims to achieve greater energy efficiency through upgrading of the existing power distribution facilities and construction of new ones, agrees with Egypt's policies and challenges.

(3) Japan and JICA's Policy and Operations in the Electricity Sector

In its country assistance plan for Egypt (June 2008), the Japanese government viewed "Sustainable economic growth and creation of employment" as a priority assistance area and set as a development goal "Improving the investment and business environments" mainly through support for key infrastructure development projects. Under this development goal, JICA is supporting the Egyptian government in increasing the installed capacity of power generation and energy use efficiency and promoting energy conservation through its cooperation program "Introduction of new and renewable energy and promotion of energy conservation". Up to now, JICA has implemented 16 Yen Loan projects in the electricity sector, and two of its projects---the Gulf of El Zayt Wind Power Plant Project and Energy Control System Upgrading Project in Upper Egypt---are currently under way. The present project, which aims to achieve greater energy efficiency, is in agreement with these policies. At the Fifth Tokyo International Conference on African Development held in 2013, the Japanese government announced that it would support African nations in infrastructure development required to build the foundation for economic growth, and this project, aiming at enhancing the efficiency and reliability of power supply, contributes to these initiatives of the Japanese government.

(4) Other Donors' Activity

The European Investment Bank (EIB), Germany's KfW Group, the French Development Agency (AFD), and the European Commission (EC) assisted Egypt in the project to expand the power transmission networks using a financial mechanism known as the Neighborhood Investment Facility for four years from 2010. The Korea International Cooperation Agency (KOICA) is currently carrying out the second phase of the grant aid project for improvement of electricity distribution system with North Cairo Electricity Distribution Company as its beneficiary.

(5) Necessity of the Project

Mr. Abdel Fattah el-Sisi, who took office as President in June 2014, has embarked on initiatives to make finances sound, including reduction in energy subsidies, and this project, aimed at achieving greater energy efficiency, supports these initiatives of his administration indirectly. Its implementation will help reduce the loss rate of power distribution network, and this will in turn help curtail greenhouse gas emissions, contributing to mitigation of climate change. As described above, this project is consistent with Egypt's development policy and goals as well as Japan's and JICA's aid priorities, and for this reason, it is highly necessary and appropriate for JICA to carry out this project.

3. Project Description

(1) Project Objective

The objective of this project is to upgrade the existing electricity distribution system and equipment and install new ones in the areas served by Alexandria, North Cairo, and North

Delta Electricity Distribution Companies, thus reducing distribution network loss and enhancing the efficiency and reliability of the power supply and thereby promoting economic growth and contributing to mitigation of climate change.

(2) Project Site/Target Areas

Areas served by Alexandria, North Cairo, and North Delta Electricity Distribution Companies (Governorates of Alexandria, Cairo, Dakhalia, and Damietta)

(3) Project Components

1) Installation of electricity distribution system and equipment for Alexandria, North Cairo, and North Delta Electricity Distribution Companies and upgrading of the existing system and equipment
2) Consulting services (basic design, assistance in bidding, construction supervision, and training for installation of smart meters by the power distribution companies and monitoring of the installation)

(4) Estimated Project Cost (Loan Amount)

32,322 million Yen (Loan Amount: 24,762 million Yen)

(5) Schedule

From March 2016 to February 2023 (84 months); the project is scheduled to be completed when the power distribution companies finish installation of smart meters

(6) Project Implementation Structure

1) Borrower: Egyptian Electricity Holding Company (EEHC)
2) Guarantor: Government of the Arab Republic of Egypt
3) Executing Agency:
   Egyptian Electricity Holding Company (EEHC)
   Alexandria Electricity Distribution Company (AEDC)
   North Cairo Electricity Distribution Company (NCEDC)
   North Delta Electricity Distribution Company (NDEDC)
4) Operation and Maintenance System
   Alexandria, North Cairo, and North Delta Electricity Distribution Companies will operate and maintain the distribution network facilities and equipment installed in the respective companies.

(7) Environmental and Social Consideration/Poverty Reduction/Social Development

1) Environmental and Social Consideration
   (1) Category: C
   (2) Reason for Categorization: According to the Japan International Cooperation Agency's Guidelines for Environmental and Social Considerations, published in April 2010, it is expected that this project has minimal or little adverse impact on the environment and society.
2) Promotion of Poverty Reduction: None

3) Promotion of Social Development: None

(8) Collaboration with Other Donors: None

(9) Other Important Issues

1) This project, aimed at reducing the distribution loss rate, will contribute to reducing greenhouse gas (GHG) emissions. As the global warming mitigation effect, the estimated amount of GHG gas emissions reduced by the project is approximately 142,773 tons/year-CO2.
2) This project will contribute to reduction in nontechnical loss by installing the automatic meter readers and smart meters, which enable the power distribution companies to grasp the amount of electricity stolen and take measures against stealing of electricity.

4. Targeted Outcomes

(1) Quantitative Effects

1) Performance Indicators (Operation and Effect Indicator)

Indicator	Power distribution companies (Service areas)	Baseline (Actual Value in 2012)	Target (2025)	
			If the project were not implemented	Target
System Average Interruption Duration Index (Minutes/ customer)	Alexandria (West Alex)	22 minutes	22 minutes	4.5 minutes
	North Cairo (El Helmeya)	95 minutes	95 minutes	19.6 minutes
	North Delta (North Dakhalia)	159 minutes	159 minutes	32.7 minutes
Peak Load (MW)	Alexandria (West Alex)	530 MW	953 MW	904 MW
	North Cairo (El Helmeya)	1,030 MW	2,218 MW	2,195 MW
	North Delta (North Dakhalia)	520 MW	1,000 MW	982 MW
Distribution loss rate (%)	Alexandria (West Alex)	12.6%	17.4%	12.3%
	North Cairo (El Helmeya)	10.8%	16.8%	15.7%
	North Delta (North Dakhalia)	11.1%	14.1%	12.3%

(2) Qualitative Effects

- Promotion of energy conservation
- Promotion of economic development
- Mitigation of climate change through reduction in the distribution loss rate

(3) Internal Rate of Return

Calculated on the basis of the assumptions listed below, the economic internal rate of return (EIRR) for this project is 13.13%, and the financial internal rate of return (FIRR) 9.77%.

[EIRR]
Cost: Project cost (excluding taxes) and operation and maintenance costs
Benefit: Reduction in the fuel required for thermal power plants and in the cost of outage
Project Life: 20 years

[FIRR]
Cost: Project cost (excluding taxes) and operation and maintenance costs
Benefit: Growth in electricity sales and reduction in construction cost of power stations
Project Life: 20 years

5. External Factors and Risk Control

None

6. Lessons Learned from Past Projects

The lesson learned mainly from the results of ex-post evaluation of the Distribution System Reliability Improvement Project in Thailand is that it is important to enhance the abilities of the personnel to handle the distribution system improved through the project.

Based on the lesson described above, this project plans to provide training through consulting services and contractors to enhance the abilities of the personnel to handle the power supply system to be introduced by the project. In the areas covered by the project, nontechnical loss such as stealing of electricity, that accounts for about 50% of the total network loss, is a challenge to tackle in the project. The project will introduce automatic meter readers to make possible detection of power stealing. JICA plans to enhance the abilities of the personnel of the power distribution companies to take comprehensive measures to reduce power transmission and distribution network losses, including nontechnical ones, mainly through the Knowledge Co-Creation Programs (Group and Region Focus) organized by JICA in the field of power distribution.

7. Plan for Future Evaluation

(1) Indicators to be Used

System Average Interruption Duration Index (Minutes/customer), Peak load (MW), Distribution loss rate (%), and internal rate of return

(2) Timing

Two years after the completion of the project