Japanese ODA Loan

Ex-Ante Evaluation (for Japanese ODA Loan)

1. Name of the Project

Country: The Republic of Mozambique
Project: Maputo Gas Fired Combined Cycle Power Plant Development Project
Loan Agreement: January 13, 2014
Loan Amount: 17,269 million yen
Borrower: The Government of the Republic of Mozambique

2. Background and Necessity of the Project

(1) Current State and Issues of the Power Sector in Mozambique

In Mozambique, as of 2012, the peak power demand was 706MW, and the annual electricity consumption was 4,251GWh. They annually increased on average by 8.8% and 14.1%, respectively, over the past five years. The power system in Mozambique is divided into two grids, one for the south, and the other for the center and north. As for the southern system including the supply for capital Maputo, the peak power demand was 407MW, and the annual electricity consumption was 2,095GWh that accounted for the majority of the total consumption (excluding a transmission and distribution loss of 17%). The country's recent strong economic performance is expected to boost electricity consumption nationwide, and the demand in the southern system alone is also projected to expand at an annual average rate of approximately 18% over the next five years, reaching a peak power demand of 794MW and an annual electricity consumption of 4,855GWh in 2016. Meanwhile, as of 2012, the peak-hour and annual supply capacity of the southern system, including imported electricity, was 407MW and 2,811GWh, respectively. Most of the electricity generated at the Cahora Bassa Hydroelectric Power Station, the largest power plant in Mozambique with a capacity of 2,075MW, is exported to South Africa, while more than 90% of the electricity supplied to the southern system is imported back from South Africa. The import of electricity, however, is unlikely to increase significantly in the future, and Mozambique is anticipated to face a chronic lack of electricity even if additional power plants are built as planned. It is therefore urgent to expand power generation capacity for the Southern System by using natural gas produced in southern Mozambique.

(2) Development Policies for the Power Sector in Mozambique and the Priority of the Project

The Government of Mozambique places a huge emphasis on infrastructure development in areas with a high potential for economic development and areas with high poverty rates in the Poverty Reduction Action Plan (PRAP) 2011-2014 since it considers that the lack of basic infrastructure, such as electricity, is one of the primary reasons for poverty in rural and suburban areas. For the energy sector, the Strategy for the Energy Sector 2009-2013 sets out policies on energy sector development. The strategy considers the Maputo Metropolitan Area as one of the main power supply destinations, and it includes a plan to

construct combined thermal power plants using natural gas from gas fields in southern Mozambique. This strategy is embodied in the 2013 Annual Plan of the Electricity of Mozambique (Eletricidade de Moçambique; EDM), which gives high priority to this Project to develop a 100MW-class gas-fired combined cycle power plant in Maputo in order to enhance the power supply capacity in the metropolitan area. This Project is also to be given high priority in the Electricity Master Plan, which is in the process of updating.

(3) Japan and JICA's Policy and Operations in the Power Sector/Maputo Corridor Region

The Government of Japan has identified "regional economic revitalization including corridor development" as one of the priority areas in its Country Assistance Policy for the Republic of Mozambique (revised in March 2013). Under this priority area, the Maputo Corridor Development and Rehabilitation Program is being implemented with a focus on economic and social infrastructure development, including transportation and electricity. Moreover, JICA's Country Analysis Paper for Mozambique emphasizes the importance of not only the "development and rehabilitation of the Maputo Corridor" but also "cooperation in the resources and energy sector." Not only is this Project in line with these policies, but also it is consistent with one of the pillars of the Fifth Tokyo International Conference for African Development (TICAD V) to contribute to "robust and sustainable economy."

(4) Other Donors' Activity

Norway assisted the Government of Mozambique in formulating the Electricity Master Plan 2005-2019 (which is now in the process of updating with the assistance of France). Norway also implemented several other projects including electrification projects. Meanwhile, the World Bank has carried out projects such as improving access to electricity. Thus, multiple donors have provided support for the energy sector in Mozambique. None of them, however, has supported the development of power generation capacity; therefore, there will be no overlap.

(5) Necessity of the Project

This Project can contribute to increasing the supply of electricity to the Maputo Metropolitan Area. Moreover, this Project is in line with the development policies of the Government of Mozambique as well as the assistance policies of the Government of Japan and JICA. Therefore, it is highly necessary and relevant for JICA to support this Project.

3. Project Description

(1) Project Objective

The objective of the Project is to stabilize and improve power supply in Southern Mozambique, by constructing a new gas fired power plant in the area, thereby contributing to economic development and poverty reduction in the region.

(2) Project Site/Target Area: Maputo City, Maputo Province

(3) Project Components

Construction of a new gas-fired combined cycle power plant (100MW-class) in Maputo city, Mozambique.

1) Civil works and equipment to be procured
   (i) Construction of a 100MW-class gas-fired combined cycle power plant and its associated facilities (gas and steam turbines, exhaust gas heat recovery boilers, etc.) (International competitive bidding)
   (ii) Long-term Service Agreement (LTSA) for hot parts and supply of other spare parts (International competitive bidding)
2) Consulting services (detailed design, bidding assistance, construction supervision, etc.) (short-listing method)

(4) Loan Amount

18,395 million yen (of which, for loan amount: 17,269 million yen)

(5) Project Implementation Schedule

January 2014 to March 2025 (135 months in total) Project completion is defined as when the facility operation is commenced.

(6) Project Implementation Structure

1) Borrower: The Government of the Republic of Mozambique
2) Executing Agency: Eletricidade de Moçambique (EDM)
3) Operation and Maintenance System: EDM

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

1) Environmental and Social Consideration

① Category: B

② Reason for Categorization: This Project is not assumed to have a significant negative impact on the environment because it does not fall under the category of large-scale projects in the thermal power sector as specified in the "JICA guidelines for environmental and social considerations" (issued in April 2010) Moreover, the Project does not have sensitive characteristics nor is located in sensitive areas as defined in the guidelines.

③ Environmental Permit: The Environmental Impact Assessment (EIA) report was approved by the Ministry of Coordination of Environment Affairs in September 2013.

④ Anti-Pollution Measures: During construction, environmentally conscious measures are to be taken, such as the use of silencers and the management of waste. After the start of operations, the quality of air and water will be managed to meet the emission and other environmental standards of Mozambique by installing a continuous emission monitoring system and monitoring the discharge of water on a regular basis.

⑤ Natural Environment: Since the Project is not located in or around sensitive areas such as national parks, its adverse impact on the natural environment is assumed to be minimal.

⑥ Social Environment: This Project will not require the acquisition of additional land or the relocation of residents because it will be implemented within the land owned by the EDM.

⑦ Other / Monitoring: The environmental department of the EDM will monitor the quality of air and water, the level of noise, and other necessary matters.

2) Promotion of Poverty Reduction: none

3) Promotion of Social Development (e.g. Gender Perspective, Measure for Infectious Diseases Including HIV/AIDS, Participatory Development, Consideration for the Handicapped, etc.): The implementing organization will ensure that the contractor will be contractually obliged to take HIV/AIDS prevention measures for construction workers.

(8) Collaboration with Other Donors: none

(9) Other Important Issues: This Project can contribute to the alleviation of climate change.

4. Targeted Outcomes

(1) Quantitative effect

(1) Operation and Effect Indicator

Indicator		Baseline (Actual Value in 2014)	Target (2021〔2 years after project completion〕)
Maximum output (MW)		N.A	100.0
Plant availability factor (%)		N.A	83.0
Plant load factor (%)		N.A	90.0
Gross generating efficiency (%)		N.A	47.0
Auxiliary power ratio (%)		N.A	3.0
Outage hours by reasons (hour/year)	Human error	N.A	0
	Mechanical failures	N.A	684
	Planned outage	N.A	192
Net electric energy production (GWh/year)		N.A	705.3
CO2 emissions reduction volume (Note) (tCO_2)		N.A	40,774

Note: This is calculated by the preparatory study team based on the assumption that the electricity would be supplied from the gas-fired power station planned to be constructed in Ressano Garcia near the border with South Africa in order to bridge the gap between supply and demand if this Project were not implemented.

2) Internal Rate of Return

Based on the conditions indicated below, the economic internal rate of return (EIRR) of the Project is 18.7% and the financial internal rate of return (FIRR) of the Project is 7.4%.

【EIRR】

Cost: Project cost (tax excluded), operation and maintenance cost

Benefit: Income from sale of electricity (including power distribution and customer-related costs and interests. Electricity sales price: 0.119USD/kWh)

Project Life: 25 years

【FIRR】

Cost: Project cost, operation and maintenance cost

Benefit: Income from generating electricity (excluding power distribution and customer-related costs and interests. Electricity sales price: 0.095USD/kWh)

Project Life: 25 years

(2) Qualitative effect:

Stable supply of electricity, improvements in the quality of life, and promotion of economic growth in southern Mozambique

5. External Factors and Risk Control

(1) The political stability and public safety will be maintained in Mozambique and neighboring countries.

(2) There will be no major natural disasters or events that can delay the construction.

(3) Natural gas will be supplied to this Project as planned.

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

(1) Findings of Similar Projects

The ex-post evaluation results of similar projects completed in the past, such as the Rades Thermal Power Station Project in Tunisia, indicate that competent maintenance staff and well-designed training are essential to the success and sustainability of this type of projects.

(2) Lessons Learned to the Project

In this Project, support will be provided to develop and establish a maintenance system as follows. During the construction period, the implementing organization will be encouraged to recruit and retain necessary staff, and the contractor will provide training on how to operate the plant while consultants will support the procurement process and supervise the construction process. After the completion of the construction, the contractor will train staff of the implementing organization on how to maintain the facilities and equipment in accordance with the LTSA, and consultants will supervise the training process and transfer know-how on the management of the power station as a whole to the implementing organization. Moreover, it is designed to retain the trained staff after the completion of the construction, and necessary measures will be taken to ensure this happens.

7. Plan for Future Evaluation

(1) Indicators for Future Evaluation

1) Maximum output (MW)
2) Plant availability factor (%)
3) Plant load factor (%)
4) Gross generating efficiency (%)
5) Auxiliary power ratio (%)
6) Outage hours by reasons (hour/year)
7) Net electric energy production (GWh/year)
8) O2 emissions reduction volume (tCO2)
9) Internal Rate of Return (%)

(2) Timing of Next Evaluation : 2 years after project completion