Ex-Ante Evaluation (for Japanese ODA Loan)

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1. Basic information

Country: The Republic of Uzbekistan
Project Name: Navoi Thermal Power Plant Modernization Project (Phase 2)
Loan Agreement Signing Date: December 19, 2019

2. Background and Necessity of the Project

(1) Current State and Issues of the Electric Power Sector in Uzbekistan and Purposes of this Project

The population of the Republic of Uzbekistan (hereinafter "Uzbekistan") is approximately 32.39 million and GNI per person is 2,020 US dollars according to the World Bank (2018). Since Uzbekistan produces abundant natural gas and coal, thermal power generation is the main power source in the country, accounting for approximately 80% of the total power, followed by hydro-power generation that takes approximately 20%. Natural gas power generation, in particular, accounts for 75% of the total power supply in Uzbekistan as the main power. The electric power demand in Uzbekistan has been increasing in line with the stable economic growth (the real GDP growth rate from 2004 to 2017 remains 5% or higher (IMF)). The maximum electric power demand in 2018 was 10,420 MW while the supply capacity remains approximately 9,611 MW. The electric power demand is expected to steadily increase also in the future due to economic growth and other reasons and the maximum electric power demand is expected to be 17,000 MW in 2027 (Joint Stock Company Thermal Power Plants, 2019).

In addition, the operation of most of ten natural gas thermal power plants in the country, which generate approximately 90% of the total thermal power generation capacity, started in the former Soviet Union era and thereby they are aging. Therefore, the gross power efficiency is in a low level at approximately 30% and increase in the fuel consumption has been causing a major environmental impact. The International Energy Agency reported that the greenhouse gas emissions in Uzbekistan were in the highest level in the world due to its use of the aging and in-efficient power plants. Uzbekistan's CO_2 emissions per one dollar of GNI comes in sixth in the world (International Energy Agency, 2016). Therefore, the Uzbek government needs to introduce renewable energy, promote energy saving measures, and improve the power generation efficiency of natural gas thermal power plants, which are the base load power in Uzbekistan.

Navoi, a province in the central part of Uzbekistan, produces a large quantity of mineral resources that support the Uzbekistani economy and the province has a metallurgical industrial complex to process such resources. The Presidential decree issued in January 2018 (PP-3465) announced that the government would improve and increase facilities in the industrial complex along with other measures and that means more power is demanded. However, the supply capacity of the Navoi Thermal Power

Plant as of 2018 was approximately 1,150 MW while Navoi expects electric power demand of approximately 2,200 MW in 2027 (among that, approximately 600 MW is the increase due to facility improvement at the industrial complex). Therefore, developing new power is an urgent task for the government.

The Uzbek government determined to work to improve the access to power through modernizing existing power plants and constructing new ones as a priority task in the "Five-Area Development Strategy for 2017-2021" formulated in 2017. The Development Strategy also aims at reducing the consumption of natural gas and other fuels by improving the power generation efficiency. According to the Energy Sector Master Plan that the Uzbek government is currently formulating and for which ADB is assisting the formulation, the government is planning to develop combined cycle gas turbine (CCGT) power facilities with 9,110 MW at total seven thermal power plants including the Navoi Thermal Power Plant from 2020 to 2030. The Master Plan also states that the operation of total 6,410 MW of aging thermal power facilities (gas and coal) will be stopped and replaced with efficient CCGTs in the same period.

This project aims at increasing the power supply and improving the power generation efficiency in Uzbekistan, aligns with the Uzbek government's development policies and the Government of Japan and JICA's cooperation policies and analysis, and contributes to SDGs goal 7 (Affordable and clean energy) and 9 (Industry, innovation and infrastructure). Therefore, supporting this project is considerably meaningful.

(2) The Government of Japan's and JICA's Policy for the Electric Power Sector Electric Power Sector and Position of this Project

The Government of Japan's Development Cooperation Policy for Uzbekistan (March 2017) defines the rehabilitation and development of economic infrastructure (for transportation and energy) as a priority area and JICA country analysis paper for Uzbekistan (December 2014) also highlights development of economic infrastructure especially for transportation and power sector as a priority area, which is consistent with the objective of the Project.

As for the past Japanese ODA loan projects in the Electric Power Sector, there were six projects approved (total 174.094 billion yen). For the Electric Power Sector, based on high expectation to establish long-term partnership with Japan from the financial and technical aspects, the Japanese government concluded comprehensive E/N (November 2014) targeting three individual projects (86.839 billion yen) as the Electric Power Sector Electric Power Loan. JICA signed all the loan agreements by October 2015. In addition, Uzbekistan is short of engineers who manage and operate high-efficiency CCGT power facilities, so the following two Japanese ODA loan projects for improving operation, maintenance, and management skills were started in January 2015: The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center and the Technical Cooperation for Strengthening of Combined Cycle Gas Turbine (CCGT)

Training Center. The Uzbek government also requested the Japanese government to provide support for Navoi unit 4 and conducting F/S is under consideration.

(3) Other Donors' Activity

The World Bank (WB) and Asian Development Bank (ADB) have been assisting Uzbekistan in introducing smart meters, developing power transmission lines (mainly 220-kV class), and increasing power plants. In addition, WB and ADB have been working on social and economic reform, such as privatizing national enterprises including the Electric Power Sector through Policy Based Lending.

3. Project Description

(1) Project Objectives

The objective of the Project is to strengthen the power supply capacity and reduce the fuel consumption by modernizing the Navoi Thermal Power Plant by constructing the highly efficient Combined Cycle Power Plant (CCPP), thereby contributing to stabilizing the reliability and increasing efficiency of power in the country.

(2) Project Site/Target Area: Navoi Province

(3) Project Details

A natural gas combined cycle co-generation power facility (unit 3) with the power output of 600 MW and heat supply of 200 Gcal/hour will be constructed at the Navoi Thermal Power Plant. The plant is located six kilometers northwest from the center of Navoi City, Navoi Province, which is in the southern part of Uzbekistan. In addition, spare parts for maintaining and managing unit 3 will be supplied and technical instruction will be provided by Japan.

1) CCGT power facility (unit 3) (600 MW × 1), heat supply system, balance of plant, 220-kV power transmission lines, and 220/500-kV transforming facility
2) Spare parts supply and provision of technical instruction
3) Consulting services (basic design, tender assistance, and construction supervision)

(4) Total Project Cost: 159,241 million yen (loan amount: 128,246 million yen)

(5) Project Period: November 2019 to April 2031 (total 138 months). The Project completion is defined as the commencement of the service of unit 3 (April 2025).

(6) Project Implementation Structure

1) Borrower: The Government of Republic of Uzbekistan
2) Executing Agency: Joint Stock Company Thermal Power Plants
3) Implementing Agency: Joint Stock Company Navoi Thermal Power Plant

(7) Collaboration with Other Projects and Organizations and Division of Roles

1) The Government of Japan's Activities

The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center and the Technical Cooperation for Strengthening of Combined Cycle Gas Turbine (CCGT) Training Center

2) Activities by Other Donors: None

(8) Environmental and Social Consideration / Cross Cutting Issues / Gender Classification

1) Environmental and Social Consideration

(i) Category: A

(ii) Reason for Categorization

The Project falls under the thermal power generation sector under the "JICA guidelines for environmental and social considerations" (issued in April 2010).

(iii) Environmental Permit

The Project's environmental impact assessment report regarding the power plant was approved in May 2019 and that regarding the power transmission lines and substation was approved in July 2019 by the State Committee of the Republic of Uzbekistan for Nature Protection.

(iv) Anti-Pollution Measures

Regarding anti-pollution measures, Uzbek and international emissions standards are expected to be followed through maintenance of vehicles and heavy machinery, water sprinkling, and other measures during the construction and adoption of high stacks and cutting-edge power generation technologies at the plant in service. With regard to wastewater, wastewater to be discharged to rivers will be purified, by way of neutralization of general wastewater, separation of air content and other treatment before discharge to minimize the negative environmental impact. Waste products will be properly disposed of based on the rules and regulations of Uzbekistan and necessary instruction on how to dispose of them according to the Waste Product Management Plan will be provided to workers. Waste products are expected to be properly handled by waste disposal companies in accordance with Uzbek law. Regarding noise, the use of heavy machinery is controlled at night during the construction, low-noise and low-vibration equipment will be used for the plant in service, and other measures (e.g., periodic maintenance) will be taken and thereby the impact is expected to be minimal.

(v) Natural Environment

The Project site is not located in an area such as national parks or their peripheral areas where there would be adverse effects caused by the Project. Therefore, any negative impact on the natural environment is expected to be minimal.

(vi) Social Environment

This project needs to acquire 53.44 ha of land and affects 36 houses (villa residences), two shops, and 24 farmhouses. The land will be acquired according to the Land Acquisition and Resettlement Action Plan formulated in accordance with Uzbek law and JICA guideline. There was no special opposing opinion about the implementation of this project in discussion with residents for this project.

(vii) Other / Monitoring

During the Project's construction phase, the contractors will monitor air quality, water quality,

noise, waste products, and other matters. After the commencement of the service of the facility, work will be conducted by the Navoi Thermal Power Plant to monitor air quality, water quality, noise, waste products, and other matters. The Executing Agency will monitor the acquisition of the land and residents' livelihood after the relocation in cooperation with the consultants on the land acquisition and resident relocation and special committee to be established under the local government.

2) Cross Cutting Issues

This project will contribute to greenhouse gas (GHG) emissions reduction through improving the fuel efficiency. This project's effect for mitigating climate change (rough CO_2 emissions reduction) is expected to be 994,931 t/year.

3) Gender Classification: [Not applicable] ■GI (gender mainstreaming needs survey and analysis project)

[Reasons for classification] Gender mainstreaming needs were surveyed and checked for this project. However, it was determined that no specific work that will contribute to gender equality and female empowerment would be conducted.

(9) Other Important Issues

The relocation and construction of the power transmission lines from switching stations and transforming facility to areas close to end users would be implemented separately by the Uzbek government by its own financing. However, to exert the effects of this ODA project for unit 3, such power transmission lines are essential components to receive and transmit electricity to be generated in the plant of this project, so the relocation and construction need to be carried out in accordance with the JICA guidelines for environmental and social considerations.

4. Targeted Outcomes

(1) Quantitative Effects

1) Outcomes (Operation and Effect Indicators)

Indicators		Baseline (Results as of 2019)	Target (2027) (2 years after project completion)
Maximum power output (generating end) (MW)		0	600
Annual operating time (hours/year)		0	7,500
Plant load factor (%)		0	80
Auxiliary power ratio (%)		0	5
Gross power efficiency (power generation + heat supply) (%)		0	60
Outage hours per	Human errors	0	0

cause (hours/year)	Machine errors	0	6
	Planned outage	0	25
Annual net heat output (Gcal)		0	1,000,000

(2) Qualitative Effects: Stable power supply to local industries and improvement of the energy efficiency

(3) Internal Rate of Return:

Mainly based on the conditions indicated below, the economic internal rate of return (EIRR) of the project is 29.8% and the financial internal rate of return (FIRR) is -5.0%. The reasons are as follows: the increase rate of the unit price of fuel gas used at the Navoi TPP has been over that of the unit price of electricity sold since 2017 and thereby the Navoi TPP's operating profit ratio has been low. Currently, the financial situation has been improved through reformation of the Electric Power Sector (e.g., revision of tariffs), so the profitability will be improved and the project is expected to be feasible from the financial aspect.

[EIRR]

Cost: Project costs (excluding taxes) and operation, maintenance, and management costs

Benefits: Increased power and heat supply, reduced fuel consumption, and reduced CO_2 emissions

Project life: 30 years

[FIRR]

Cost: Project costs and operation, maintenance, and management costs

Benefits: Power and heat sales revenue

Project life: 30 years

5. Preconditions and External Factors

(1) Preconditions: None

(2) External Factors: None

6. Lessons Learned from Past Projects and Application to this Project

The post-project evaluation and other reports of the Sylhet Combined Cycle Power Plant Construction Project in the People's Republic of Bangladesh (evaluated in FY2001) have taught us that only a single project is not sufficient to enhance the operation, maintenance, and management capability of the target country. Therefore, medium- to long-term strategies including technical cooperation is important. For this project in Uzbekistan, considering the outcomes of past Japanese ODA loan projects and projects for enhancing the Electric Power Sector capacity, supply of spare parts and technical guidance by Japan for six years are included in the project scope to enhance the operation, maintenance, and management capability.

7. Evaluation Results

This project aligns with the Uzbek government's development policies and the Government of Japan's and JICA's cooperation policies and analysis. It also contributes to increasing power supply and reducing fuel consumption by adding a high-efficiency gas combined cycle power facility as well as contributes to SDGs goal 7 (Affordable and clean energy) and 9 (Industry, innovation and infrastructure), so it has been evaluated that supporting this project is considerably meaningful.

8. Plan for Future Evaluation

(1) Indicators to be Used in Future Evaluations

The items in (1) to (3) in 4

(2) Next evaluation

Two years after the project completion

End