Japanese ODA Loan

# Ex-Ante Evaluation (for Japanese ODA Loan)

## 1. Name of the Project

Country: The Republic of Uzbekistan
Project: Tashkent Thermal Power Cogeneration Plant Construction Project
Loan Agreement: October 25, 2015
Loan Amount: 12,000 million yen
Borrower: The Government of the Republic of Uzbekistan

## 2. Background and Necessity of the Project

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

In the Republic of Uzbekistan (hereinafter referred to as Uzbekistan) peak power demand reached 8,400 MW in 2014, although the currently available peak generation capacity of facilities within the country is only around 7,800 MW. Its total rated power generation capacity is 13,409 MW, however obsolete facilities cannot provide sufficient power as demanded. As well, thermal power plants (out of which 90% uses natural gas as fuel) generate approximately 90% of all power, and their low average thermal efficiency (around 30%) causes a major environmental impact. In addition, in large cities like Tashkent City, it is indispensable that based on its urban city plans, to provide heated water and central heating to local residents and industries such as textile factories. Therefore, stabilizing generation of power and heated water and improving energy efficiency is one of the highest priorities in Uzbekistan.

The government of Uzbekistan has shown its high appreciation to made-in-Japan facilities and products in the power sector, which were procured by its own budget, and it has repeatedly expressed strong desire to establish a long-term relationship for financial and technical cooperation in this sphere. To cope with such desire, on November 11, 2014, the government of Japan has decided to conclude a comprehensive Exchange of Notes with the government of Uzbekistan namely “the Electric Power Sector Project Loan (SPL), which consists of three different individual projects in the power sector (total: 86.839 billion Japanese yen). This project is one of the above three projects under the SPL framework.

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

Welfare Improvement Strategy (2008-2010) and Welfare Improvement Strategy II (2012-2015)—the highest national development plans of Uzbekistan—specifically indicate its plan to strengthen efficiency and reliability of power supply by upgrading power generation capacity through

introducing combined cycle power generation facilities and thermal and power cogeneration facilities. The mid-term plan for energy efficiency between 2015 and 2019 also put its priorities on promotion of thermal and power cogeneration system, as well as introduction of energy saving technology, rehabilitation of existing facilities and construction of facilities with the latest technology.

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

Japan's Country Assistance Policy for Uzbekistan (April 2012), defines the renovation and development of economic infrastructure (for transportation and energy) as one of the priority areas, and JICA country Analytical Paper (established in July 2012 and updated in December 2014) also highlights development of economic infrastructure especially for the transportation and power sectors as prioritized areas. The objective of the Project is consistent with those policy documents. In the past, Japan has provided Japanese ODA loan to five projects (Loan Agreements Amount: 162 billion Japanese yen). On top of the financial assistance, JICA implements technical assistance for human resources development in this sphere.

(4) Other Donors' Activities

The World Bank and the Asian Development Bank are assisting in such areas as the introduction of the smart meters, development of transmission lines and extension of generation facilities. Moreover, the World Bank is conducting a feasibility study on rehabilitation of heated water production facilities in local cities with implementing relevant pilot projects.

(5) Necessity of the Project

As the Project is in response to Uzbekistan's development issues for stable supply of power and heated water and is in line with its development policies as well as Japan's assistance policy, it is highly relevant for JICA to support the Project.

## 3. Project Description

(1) Project Objectives

The objective of the Project is to enhance efficient and sustainable supply of heat and energy in Tashkent, by constructing a thermal and power cogeneration facility in the city, thereby contributing to the country's sustainable economic growth.

(2) Project Site/Target Area

Tashkent City

(3) Project Components

1) Construction of Gas Turbine Cogeneration Plant (four units of 30 MW) and

auxiliaries

2) Installation of Transmission Lines (approximately 3km) and Rehabilitation of Substation (Not covered by the Japanese ODA Loan)
3) Consulting Services (design, bidding assistance, construction supervision)

(4) Estimated Project Cost (Loan Amount)

37,403 million yen (Loan amount: 12,000 million yen)

(5) Schedule

From October 2015 to August 2021 (total: 71 months). The Project completion is defined as the commencement of the service of the facilities (August 2020).

(6) Project Implementation Structure

1) Borrower: The Government of the Republic of Uzbekistan
2) Executing Agency: Joint Stock Company "Uzbekenergo"(Tashkent Thermal Power Cogeneration Power Plant under Uzbekenergo will be responsible for operation and maintenance after commencement of the service)
3) Operation and Maintenance System: In terms of operation and management, Uzbekenergo expanded its operating cash flow and has remained in surplus by introduction of modern highly efficient power generation facilities and by increasing revenues from its customers through raising tariffs. As for operation and maintenance, in spite of Uzbekenergo's limited experience in operation and maintenance on thermal power cogeneration systems, the company is engaged in building capacity of technical staff members through various relevant trainings. JICA is now implementing technical assistance to increase the capacity of the company itself.

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

1) Environmental and Social Considerations
   (i) Category: B
   (ii) Reason for Categorization: The Project is not located in a sensitive area, nor has sensitive characteristics, nor falls into sensitive sectors under the JICA Guidelines for Environmental and Social Considerations (April, 2010), and its potential adverse impacts on the environment are not likely to be significant.
   (iii) Environmental Permit: The Project's Environmental Impact Assessment report was approved in November 2013 by the State Nature Protection Committee of the Republic of Uzbekistan (Goskompriroda).
   (iv) Anti-Pollution Measures: to fulfill the relevant rules in Uzbekistan, during the Project's construction phase, measures such as idling construction machineries, using low-noise and low-vibration

devices, reducing construction hours in the morning and the evening, using tentative storage for waste water, and using oil-water separator will be taken against the air pollution, water discharge, and noise. After commencement of the services, there will be introduction of low-NOx burner, discharge of water after cooling down at the primary treatment plant, and installment of low-noise and low-vibration device and structure.

(v) Natural Environment: The area in which the Project will be carried out is not in sufficient proximity to national parks or similar land to have adverse effects on such resources. Any negative impact on the natural environment is expected to be minimal.

(vi) Social Environment: As the land will be transferred from the municipality government of Tashkent City to the executing agency, the Project will not involve any land acquisition or involuntary resettlement.

(vii) Other / Monitoring: During the project implementation, contractors will monitor air and water quality, noises and others. After the commencement of the service, the executing agency will conduct monitoring on exhausted gas, water, noises and others.

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 Person with Disability etc.): None

(8) Collaboration with Other Donors: None

(9) Other Important Issues:

The Project is aimed at efficient use of energy by installing a cogeneration facility with gas turbines and heat recovery boilers, and it can contribute to reduction of greenhouse gas emission.

New Energy and Industrial Technology Development Organization of Japan has implemented a fuel reduction model project to install a cogeneration facility for generating power and heated water simultaneously by a highly efficient gas turbine since 2008 in Uzbekistan. The result of the model project indicated the reduction of fuel usage by 21%, compared with production of the same amount of power and heated water in conventional facilities (the saved amount of natural gas is approximately 2,005,000$m^3$). Based on such result and others, the Project was formulated to achieve the similar objectives.

## 4. Targeted Outcomes

(1) Quantitative Effects

1) Performance Indicators (Operation and Effect Indicator)

| | | Baseline (2015) | Target (2022) two years after the project completion |
|---|---|---|---|
| Operational Indicators | | | |
| Rated Net Power Output (MW) | | - | 120 MW |
| Maximum Heat Output per unit hour (Gcal/h) | | - | 160 Gcal/h |
| Plant Load Factor (Power) (%) | | | 79.5 % |
| Plant Load Factor (Heat) (%) | | | 90.5 % |
| Auxiliary Power Ratio (%) | | - | 9.6 % |
| Availability Factor (%) | | - | 95.6 % |
| Outage Hours per cause (hours/year) | Human Error | - | 0 hours/year |
| | Machine Trouble | - | 0 hours/year |
| | Planning Outage | - | 384 hours/year |
| Effect Indicators | | | |
| Annual Net Power Output (GWh/y) | | - | 856 GWh/year |
| Annual Net Heat Output (Gcal/y) | | - | 1,267,882 Gcal/year |
| Annual Net Fuel Consumption ($m^3$) / Annual Net Power Output MWh) | | - | 240 $m^3$/MWh |
| Annual Net Fuel Consumption ($m^3$) / Annual Net Heat Output (Gcal) | | - | 320 $m^3$/Gcal |
| Annual Reduction of $CO_2$ (ton) | | - | 308,312 ton |

(2) Qualitative Effects: promotion of economic development in the capital region and national level

(3) Internal Rate of Return: based on the conditions indicated below, the economic internal rate of return (EIRR) of the project is 12.1%. The financial internal rate of return (FIRR) of the Project is 5.9%.

[EIRR]

Cost: project costs (excluding taxes), operation and maintenance costs (fuel cost and other)

Benefits: increased power supply, reduced natural gas usage, and reduced

$CO_2$ emissions

Project life: 30 years

[FIRR]

Cost: project costs, operation and maintenance costs (fuel cost and other)

Benefits: revenue from sales of electricity and heated water, and reduced $CO_2$ emissions

Project life: 30 years

## 5. External Factors and Risk Control

(1) Possible Risk[s]

In terms of fuel supply, a main trunk gas pipe is laid 1.6 km away from the Project site. The feasibility study for the Project pointed out a possible insufficiency in gas amount and its pressure necessary for the turbine to be properly operated particularly in winter, a season with higher gas demand. Currently, no problem in gas procurement route is observed. Yet, it is noteworthy that without appropriate amount and pressure of gas, it is impossible for the turbine to be operated for generating electricity and producing heated water.

(2) Risk Control

The Project will take several measures to minimize the above mentioned risk. Firstly, Uztransgaz, a state company engaged in transmission and distribution of natural gas in Uzbekistan, will separately construct an external gas pipe that connects between the main trunk gas pipe and the Project site to provide sufficient amount and pressure of gas (not a part of the Project). Although the construction of the external gas pipe is not a part of the Project, JICA will work closely with the executing agency that will coordinate with the relevant ministries and agencies including Uztransgaz during the project implementation phase in order for the construction of the external pipe to be completed before the completion of the Project. If necessary, JICA will request the executing agency to take various necessary actions to achieve the goal. Secondly, in case low gas pressure is observed in spite of installing the external gas pipe between the main trunk gas pipe and the Project site, an additional gas compressor will be installed and it will be used only for emergency case where gas pressure is not adequate (a part of the Project scope). Thirdly, it is confirmed that a letter was issued by Uzbeneftigas, a state company engaged in producing and supplying natural gas, and Uztransgaz, addressed to Uzbekenergo dated July 6, 2015. The letter ensures sufficient amount and pressure of gas necessary for the project operation during the project life and an external gas pipe between the main trunk gas pipe and the Project site will be constructed.

## 6. Lessons Learned from Past Projects

(1) Results of Ex-Post Evaluation on Similar Projects

The outcome of ex-post evaluation on Sylhet Combined Cycle Power Plant Construction Project in Bangladesh reveals that capacity building on operation and maintenance through implementation and operation of the project cannot be enough. The report suggests a necessity to take various strategic approaches on capacity building through continuous cooperation such as technical assistance modality. According to the report, the appraisal mission confirmed a necessity of enhancing technical capacity of the executing agency, and therefore technical assistance component was added within the consulting services of the above project to develop technical skills of the executing agency. However, the evaluation report concludes that an approach with the above on-the-job-training only was not able to sufficiently achieve expected level of technical capacity.

(2) Lessons for the Project

Uzbekenergo, the executing agency of the Project, is in process of gaining technical knowledge and skills on power generation system with gas turbines such as combined cycle power generation system and cogeneration power and heat generation system. To support the executing agency's effort on gaining the skills and experiences, there will be an inclusive and comprehensive approach with various modalities of financial and technical assistances. Implementation of financial and technical assistances synergistically is aimed at strengthening capacity on operation and maintenance of the executing agency. For instance, various country-focused trainings for building operation and maintenance capacity are implemented. Also, technical cooperation project for enhancing the above capacity has been conducted since October 2015; it is aimed at making a training plan for operation and maintenance of power plants, developing textbooks and curriculum, expanding technical knowledge of local instructors, and establishing a training system and structure within Uzbekenergo. Conducting the above operations should increase operation and maintenance capacity of the executing agency.

## 7. Plan for Future Evaluation

(1) Indicators to be Used in Future Evaluations

1) Rated Net Power Output (MW)
2) Maximum Heat Output (Gcal/h)
3) Plant Load Factor (Power) (%)
4) Plant Load Factor (Heat) (%)
5) Auxiliary Power Ratio (%)
6) Availability Factor (%)
7) Outage Hours (hours/year) (Human Error)

8) Outage Hours (hours/year) (Machine Trouble)
9) Outage Hours (hours/year) (Planning Outage)
10) Annual Net Power Output (GWh/y)
11) Annual Net Heat Output (Gcal/y)
12) Annual Net Fuel Consumption ($m^3$) / Annual Net Power Output MWh)
13) Annual Net Fuel Consumption ($m^3$) / Annual Net Heat Output (Gcal)
14) Annual Reduction of CO2 (ton)
15) FIRR
16) EIRR

(2) Timing of Next Evaluation

Two years after project completion

End