

Ex-Ante Evaluation (for Japanese ODA Loan)

1. Name of the Project

Country: Lao People's Democratic Republic
Project: Nam Ngum 1 Hydropower Station Expansion Project
Loan Agreement: June 21, 2013
Loan Amount: 5,545 million Yen
Borrower: The Government of Lao PDR

2. Background and Necessity of the Project**(1) Current State and Issues of the Electricity Sector in Lao**

Lao PDR is proactively developing power sources using its ample potential hydropower. Most electricity facilities in the country are owned by independent power producers (IPPs) that produce electricity chiefly for export to Thailand. The ratio of annual power generation by IPP and that of power for export are both 80%. On the other hand, domestic demand for electricity has been growing due to the recent high economic growth, power consumption having more than tripled over the decade. The consumption in the central region including the capital sphere accounts for half of the nationwide power consumption and is expected to increase further in future. The amount of power import has been increasing; the balance of the supply system of Electricité du Laos (EDL) has shown an excess of imports since 2007. Furthermore, the vast majority of the power supply sources in Laos is hydropower, so there is a large fluctuation in output between the dry and rainy seasons, and the gap between power supply and demand is particularly large in the dry season during peak hours. Measures to make up for the power shortage include the development of power sources by EDL itself and IPPs, and imports from the neighboring countries, but these measures must be combined in a well-balanced manner in light of economic efficiency of each measure, stable energy supply and other factors. Import has been considerably increasing due to the rapid increase in demand that is faster than the pace of development of power sources, and a priority in the central region where the capital is located is thus the development of power sources of its own, focusing on stable energy supply.

The Nam Ngum 1 Hydropower Station, completed in 1971, is under the supervision of a Lao governmental organization (EDL / EDL-Generation Public Company (EDL-Gen)). It has a huge reservoir of 7 billion m³ and stable volume of water inflow throughout the year thanks to development of power sources upstream. It is located approximately 65km in the north of Vientiane, so is potentially able to supply power through the load following operation to meet the peak power demand in the capital. Thus, imminent tasks are to promote more efficient use and development of potentials of the hydropower station.

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

The Seventh Five-year National Socio-Economic Development Plan (NSED) (2011-2015) emphasizes to increase the domestic supply and exports of electricity to promote economic growth with particular focus on hydropower stations. This project aims to increase generation capacity by adding an extra power generation unit at the Nam Ngum 1 Hydropower Station that supplies electricity to the capital sphere and export surplus electricity, and thus considered to contribute to the development policy in the electricity sector set forth in the NSED.

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

Through grant aid and Japanese ODA loans, Japan has provided construction support for the Nam Ngum 1 Hydropower Station starting in the 1960s, and has further provided support for rehabilitating the first and second turbines since the turn of the century. (The Project for Rehabilitation of the Nam Ngum 1 Hydropower Station, a grant aid cooperation project. Exchange of Notes (E/N) signed in 2002). In addition, the Country Assistance Policy for Lao PDR formulated by the Ministry of Foreign Affairs of Japan in April 2012 views assistance to the electricity sector as one of the priority areas "development of economic and social infrastructure", and this project is counted as a part of "Outcome 3: development of electricity facilities" of "Power Development Program" in Lao PDR. Meanwhile, Japan's assistance to the electricity sector in Lao

PDR in recent years includes the “Southern Region Power System Development Project” (ODA Loan. L/A signed in 2012), “Project for Improvement of Power Sector Management” (Technical Cooperation. 2010-2013) and “Power Policy Advisor” (Individual Experts. 2006-2012).

(4) Other Donors’ Activity

The World Bank (WB) and the Asian Development Bank (ADB) have been supporting the electricity sector of Lao PDR concerning building of power generation and transmission facilities, and electrification in rural areas. The WB also conducts surveys to review electricity tariff and gives recommendations to the EDL, which constantly revises the tariff according to the recommendations.

Major donors including JICA cooperate with one another through exchanging information.

(5) Necessity of the Project

The project conforms to the issues and development policy of the government of Lao PDR, and the assistance policy of the Japanese government and JICA. The project is highly necessary and relevant, and JICA should support implementation of the Project.

3. Project Description

(1) Project Objective(s)

This project will aim to increase generation capacity to meet the peak power demand of the capital region by adding an extra power generation unit at the Nam Ngum 1 Hydropower Station, thereby contributing to expansion of stable, sustainable and efficient power supply in Lao PDR.

(2) Project Site/Target Area

The Nam Ngum 1 Hydropower Station on Nam Ngum water system in Vientiane Province

(3) Project Components

1) Expansion work of a power generation unit (400MW x 1 unit)

- (i) Civil Work
- (ii) Hydro Mechanical Works
- (iii) Electro/Mechanical Equipment

2) Consulting Services (construction supervision, monitoring of environmental and social considerations, etc.)

(4) Estimated Project Cost (Loan Amount)

5,987 million Yen (Loan Amount: 5,545 million Yen)

(5) Schedule (Cooperation term)

May 2013 - January 2019 (69 months). The project will be completed when the facilities start operation.

(6) Project Implementation Structure

- 1) Borrower: The Government of Lao PDR
- 2) Guarantor: N/A
- 3) Executing Agency: Electricité du Laos (EDL)
- 4) Operation and Maintenance System: EDL Generation Public Company (EDL-Gen)

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

1) Environmental and Social Consideration

- (i) Category: B
- (ii) Reason for Categorization: the project does not fall under the category of large-scale projects in the hydropower, dams and reservoirs sector, and its potential adverse impacts on the environment are not likely to be significant. It does not have sensitive characteristics, nor is it located in a sensitive area.
- (iii) Environmental Permit: the project conducted an Initial Environmental Examination (IEE) according to the relevant laws in Lao PDR and has obtained an Environmental Compliance Certificate (ECC).
- (iv) Anti-Pollution Measures: as anti-water pollution measures during construction, water quality tests will be regularly conducted in the lower course of the river, and drainage traps installed to minimize impact on the environment.
- (v) Natural Environment: a conservation area exists upstream and outside the project area, but the

expansion work will not have any impact in the higher course of the river, so adverse impact on the natural environment is assumed to be minimal.

- (vi) Social Environment: this project is construction of an extra power generation unit at the existing hydropower station and requires neither resettlement of residents nor land acquisition. It should be noted, however, that the operation of the station after the project will increase fluctuations of the water level in the lower course in the dry season. Thus, the project plans to take measures such as a gradual increase in output and installation of warning boards.
- (vii) Other / Monitoring: an environmental management committee for the project comprising the governor, Provincial Energy and Mine Department, village mayors and all concerned village authorities, as well as EDL and EDL-Gen, will monitor the states of various measures to alleviate impacts on the environment, water quality and noise.
- 2) Promotion of Poverty Reduction: N/A
- 3) Promotion of Social Development (e.g. Gender Perspective, Measure for Infectious Diseases Including HIV/AIDS, Participatory Development, Consideration for the Persons with Disabilities etc.): the project will conduct HIV/AIDS preventative programs for civil engineering workers who are expected to come from various regions in the country.
- (8) Collaboration with Other Schemes and Donors: the project will exchange opinions from time to time with the WB and ADB in relation to revisions to the electricity tariff. In addition, the "Project for Improvement of Power Sector Management" and "Power Policy Advisor" cited above are enhancing the capacity of the Executing Agency of this project and will produce synergistic effects.
- (9) Other Important Issues: this project calls for piercing of the existing dam body, which will allow for work to proceed without stopping generation at the existing units.

4. Targeted Outcomes

(1) Quantitative Effects

1) Performance Indicators (Operation and Effect Indicator)

Indicator	Baseline (Actual Value in 2012)	Target (2020) [Expected value 2 years after project completion]
Plant Factor (Unit No.6) (%)*	0	68.8
Annual Unplanned Outage Hours (Unit No.6) (hrs)	0	0
Annual Power Generation (Unit No.6) (GWh)*	0	241
Maximum Output (MW)	155	195
Annual Power Generation (GWh)	1,117 (average**)	1,176

* The figure is calculated in proportion to the annual power generation (of the entire station including the additional unit). The target value is subject to revision after the whole units start the load following operation to meet the power demand.

** The figure is an average of the existing five units of the Nam Ngum 1 Hydropower Station.

- 2) Internal Rate of Return: based on the conditions indicated below, the economic internal rate of return (EIRR) of the project is 14.9% and the financial internal rate of return 5.2%.

[EIRR]

Cost: project cost (excluding taxes) and operating and maintenance costs

Benefits: facility cost (kw value) of alternative thermal power (diesel) and the variable cost (kwh value) of alternative thermal power (diesel)

Project life: 50 years

[FIRR]

Cost: project cost and operating and maintenance costs

Benefits: revenues of electricity tariff

Project life: 50 years

- (2) Qualitative Effects: stabilization of domestic power supply, promotion of investment and vitalization of industries

5. External Factors and Risk Control

N/A

6. Results of Evaluations and Lessons Learned from Past Projects

- (1) Results of Evaluation of Similar Past Projects

The ex-post evaluation of the “Sirikit Hydroelectric Project Unit 4 in Thailand” gives a lesson that the implementation of appropriate preventive maintenance and regular inspections is important for the sustainability of the capacity of units to deal with peak demand.

- (2) Lessons for the Project

In line with the lesson above, this project will provide EDL-Gen that is in charge of operation and maintenance of the Nam Ngum 1 Hydropower Station with consulting services to enhance their system to operate and maintain the facilities.

7. Plan for Future Evaluation

- (1) Indicators to be Used

- 1) Plant factor (Unit No.6) (%)
- 2) Annual unplanned outage hours (Unit No.6) (hrs)
- 3) Annual power generation (Unit No.6) (GWh)
- 4) Maximum output (MW)
- 5) Annual power generation (GWh)
- 6) EIRR (%)
- 7) FIRR (%)

- (2) Timing of Next Evaluation

Two years after project completion