

Country Name	Project on Power System Master Plan
Lao People's Democratic Republic	

I. Project Outline

Background	In the past, the electric power strategy of Lao focused on hydropower development and power grid extension for the electrification of the country as well as the export for an increase in fiscal revenue, by utilizing abundant hydropower resources and interconnecting in ASEAN Power Grid. Regarding the power grid extension, although connecting the national power system was planned to be completed in 2017, the domestic power energy sales were expected to rise by 4 times and the Laos government was under pressure to address to the rapid increase in power demand. Therefore, Electricity of Laos (EDL:Electricite Du Laos) was required to formulate the power system master plan in order to develop power generation for domestics and upgrade the power network system for the stable supply to support the industrialization and modernization of Laos.								
Objectives of the Project	The project aims at i) preparation of a power system development plan for 2030, ii) development of a roadmap and iii) preparation of rules for power system operation including a grid code, thereby contributing to securing domestic power supply and enhancing regional power exchange with neighbouring countries in a sustainable, reliable and efficient manner for realizing steady economic and social development in Laos. 1. Expected Goals through the proposed plan¹: To secure domestic power supply and enhance regional power exchange in a sustainable, reliable and efficient manner for realizing steady economic and social development in Lao P.D.R.								
Activities of the Project	1. Project Site: The whole country of Laos 2. Main Activities: i) Data collection on power sectors, including organization, power supply/demand, and generation projects, ii) Review of power demand forecast of Laos and neighboring countries, iii) Review of long-term power generation and long-term power system development plan, iv) Preparation of a draft "National Power Development Plan up to 2030", v) Formulation of "Grid Code of Laos", vi) Holding technical seminars/workshops, and so on. 3. Inputs (to carry out the above activities) <table><tr><td>Japanese Side</td><td>Lao Side</td></tr><tr><td>1) Mission members: 16 persons</td><td>1) Staff Allocated: 20 persons</td></tr><tr><td></td><td>2) Facility and space: Office space for Japanese experts</td></tr></table>			Japanese Side	Lao Side	1) Mission members: 16 persons	1) Staff Allocated: 20 persons		2) Facility and space: Office space for Japanese experts
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1) Mission members: 16 persons	1) Staff Allocated: 20 persons								
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Project Period	(ex-ante) August 2017-January 2019 (18 months) (actual) August 2017 – March 2020 (32 months)	Project Cost (Japanese side only)	(ex-ante) 196 million yen, (actual) 251 million yen						
Implementing Agency	Ministry of Energy and Mines (MEM) Electricity of Laos (EDL)								
Cooperation Agency in Japan	- Tokyo Electric Power Company Holdings, Incorporated - TEPCO Power Grid, Incorporated - Nippon Koei Co., Ltd - TOKYO ELECTRIC POWER SERVICES CO., LTD.								

II. Result of the Evaluation

<Special Perspectives to be considered at the time of ex-post evaluation>

- There were no descriptions of the utilization Status of the Proposed Plan, and the indicators were not set in the Record of Discussion (R/D). Hence, the project was confirmed by using the implementation status of the contents proposed in the Master Plan (MP) and the utilization status of power interchange and interconnection with neighboring countries.
- Since there was no set of indicators of expected goals through the proposed plan in the R/D, the project was verified by indicators related to domestic power supply and power trade.

1 Relevance/Coherence

[Relevance]

<Consistency with the Development Policy of Laos at the Time of Ex-Ante Evaluation >

The project was consistent with the development policies of Laos at the time of ex-ante evaluation such as “Vision 2030”, which aims to increase the household electrification rate to 98%. In addition, the “Ten-year Socio-Economic Development Strategy (2016-2025)” and “The 8th National Socio-Economic Development Plan (2016-2020)” mentioned the promotion of electrification in Laos and were also approved by the 10th National Congress of the Lao People's Revolutionary Party. Aside from these, EDL was required to further develop transmission and substation facilities in accordance with the” Power Development Plan (PDP) (2015-2025). “ This plan is to be renewed every five years until 2025.

<Consistency with the Development Needs of Laos at the Time of Ex-Ante Evaluation >

¹ The degree of achievement of expected goals is not to be assessed in principle at the time of ex-post evaluation, since it is defined as the medium-to-long-term goals which will be attained as a result of crystallizing the proposed plan (“output” of the project).

The project was consistent with the development needs of Laos for a stable power supply to meet domestic power demand and expanding electricity exports to neighboring countries at the time of ex-ante evaluation.

<Appropriateness of Project Design/Approach>

The project design/approach was appropriate. No problem attributed to the project design/approach was confirmed.

<Evaluation Result>

In light of the above, the relevance of the project is ③².

[Coherence]

<Consistency with Japan’s ODA Policy at the Time of Ex-Ante Evaluation>

The project was consistent with the Japan’s ODA policy to Laos at the time of ex-ante evaluation. “Country Assistance Policy for Lao People’s Democratic Republic (2012) ” is to address “Expansion of safe and stable power supply”, as one of the priority areas in “Economic and Social Infrastructure”.

<Collaboration/Coordination with JICA’s other interventions>

Although the collaboration/coordination between the project and “Data Collection Survey on Power Sector in Vietnam” of JICA was planned during the project period and was implemented, any effects were not confirmed at the time of ex-post evaluation.

<Cooperation with other institutions/ Coordination with international framework>

Any cooperation/coordination with other institutes was not clearly planned at the time of ex-ante evaluation.

<Evaluation Result>

In light of the above, the coherence of the project is ②.

[Evaluation Result of Relevance/Coherence]

In the light above, the relevance/coherence of the project is ③.

2 Effectiveness/Impact

<Status of Achievement for the Objectives at the Time of Project Completion>

The objectives of the project were partially achieved by the project completion. Prioritized and planned projects in the roadmap have been in delaying implementation and most of them have been under feasibility studies. A part of the grid operation rules’ formulation was made as suggested. For instance, EDL and the Electricity Generating Authority of Thailand (EGAT) had a Grid to Grid Operation Agreement on November 14, 2019 and started making its draft of the grid operation rules. Currently, the rules have been applied to grid codes between Thailand and Laos to facilitate the power trade.

< Utilization Status of the Proposed Plan at the Time of Ex-post Evaluation>

The proposed plan has been mostly utilized by the time of ex-post evaluation. Some high-priority export and development projects have been implemented. Specifically, the Nam-Ngum 3 hydropower plant is under construction and more than 80% complete. The 500 kV interconnected transmission line (M. Nan - Tha Wan Pha) was obviously listed in the development plan and is expected to be implemented. The development plans of the Mekong Luang Prabang hydropower plant and the Mekong Pakbeng and Sanakham hydropower are in being approved and authorized for the sale and purchase electricity and have been progressing smoothly towards the conclusion of contracts. In addition, the development plans of the 230 kV Thailand-Laos domestic grid and the 230 kV Laos-Myanmar domestic grid have been considered as the priority ones (Indicator 1). Regarding the implementation of the action plan of a road map, the transmission lines proposed in the master plan were not built, yet EDL is continuing to consider building new transmission lines with financial support from the government of China (Indicator 2). With regard to capacity development for the expansion of the interconnected system, EDL conducts capacity development for grid operation by receiving support from various donors. For example, capacity development of practical aspects of grid operation and power supply command has been conducted to EDL by EGAT and JICA Besides this, the World bank (WB) has a plan to conduct capacity development in the "Power Distribution Improvement Project in Lao PDR"(Indicator 3). In terms of the grid codes in Laos, although they were not properly operated at the project completion, JICA has supported MEM and EDL to revise grid codes through the Technical Cooperation Project “Power Quality Improvement through Upgrading Grid Code and Strengthening Its Enforcement System (2021- 2025)”. This indicates good prospects for appropriate operation and utilization of Grid codes in Laos (Indicator 4).

<Status of Achievement for Expected Goals through the Proposed Plan at the Time of Ex-post Evaluation>

The expected goals through the proposed plan have been mostly achieved at the time of ex-post evaluation. To mitigate transformer overloads in substations, additional work recommended in the Master Plan was well considered in a timely manner and some of them was implemented as planned. Also, additional work also planned for other power substations that are scheduled to be carried out in the future, in line with the master plan (Indicator1). In addition, since the master plan was formulated, the number of accidents has remained stable, despite the fact that the power grid in Laos has been expanding. The causes of accidents were mainly due to natural disasters, and those caused by human error were limited (Indicaoter2).

<Other Impacts at the Time of Ex-post Evaluation>

No negative impact has been confirmed as of ex-post evaluation.

<Evaluation Result>

In light of the above, the effectiveness/impact of the project is ③.

Status of Achievement of Utilization Status of the Proposed Plan and Expected Goals through the Proposed Plan			
Aim	Indicators	Results	Source
(Utilization Status of the Proposed Plan)	Indicator 1 High-priority export and development projects are implemented.	Status of Utilization: Mostly utilized (Ex-post Evaluation) - Some high-priority export and development projects have been implemented. The export plan of Nam-Ngum 3 hydropower plant is under construction and more than 80% complete. - The development plans of the Mekong Luang Prabang hydropower plant and the Mekong Pakbeng and Sanakham hydropower are in being approved and authorized for the sale and purchase electricity	Questionnaire to MEM and EDL

² ④ : very high, ③ : high, ② : moderately low, ① : low

		and have been progressing smoothly towards the conclusion of contracts. - In addition, the development plans of the 230 kV Thailand-Laos domestic grid and the 230 kV Laos-Myanmar domestic grid have been considered as the priority ones. - The 500 kV interconnected transmission line (M. Nan - Tha Wan Pha) was obviously listed in the development plan and it expected to be implemented.	
	Indicator 2 The action plan of a road map is implemented to strengthen “System to System” between Thai and Laos.	Status of Utilization: Partially utilized (Ex-post Evaluation) The transmission lines proposed in the master plan were not built, yet EDL is continuing to consider building new transmission lines with financial support from the government of China.	Questionnaire to MEM and EDL
	Indicator 3 Strategies and studies are carried out to expand the interconnected system.	Status of Utilization: Mostly utilized (Ex-post Evaluation) - EDL conducts capacity development for grid operation by receiving support from various donors. - Capacity development of practical aspects of grid operation and supply command has been conducted to EDL by EGAT and JICA. - WB has a plan to conduct capacity development in the “Power Distribution Improvement Project in Lao PDR”.	Questionnaire to MEM and EDL
	Indicator 4 Grid codes in Laos are operated/used appropriately.	Status of Utilization: Mostly utilized (Ex-post Evaluation) Although the grid codes in Laos were not operated properly at the project completion, JICA has supported MEM and EDL to revise grid codes through the Technical Cooperation Project “Power Quality Improvement through Upgrading Grid Code and Strengthening Its Enforcement System (February 2021 – June 2025)”. This indicates good prospects for appropriate operation and utilization of Grid codes in Laos.	Questionnaire to MEM and EDL
(Expected Goals through the proposed plan) To secure domestic power supply and enhance regional power exchange in a sustainable, reliable and efficient manner for realizing steady economic and social development	Indicator 1 Reduction in the number of power stations where transformers are overloaded.	Status of Achievement: Mostly achieved as planned (Ex-post Evaluation) - To mitigate transformer overloads in substations, additional work recommended in the Master Plan was well considered in a timely manner and some of them was implemented as planned. - Additional work on other power substations has been planned to be carried out in line with the master plan.	Questionnaire to MEM and EDL
	Indicator 2 The number of power failures in the transmission system.	Status of Achievement: Mostly achieved as planned (Ex-post Evaluation) Since the master plan was formulated, the number of accidents has remained stable, despite the fact that the power grid in Laos has been expanding. The causes of accidents were mainly due to natural disasters, and those caused by human error were limited.	Questionnaire to MEM and EDL

3 Efficiency

The project cost exceeded the plan (the ratio against the plan:128% and the project period considerably exceeded the plan (the ratio against the plan:177%). However, due to necessary and additional tasks such as grasping the overall picture of the Greater Mekong Subregion wide-area interchange regime and organizing its issues. Therefore, the outputs were produced more than planned.

	Project Cost (Japanese side only, yen)	Project Period (months)
Plan (ex-ante)	196 million yen	18 months
Actual	251 million yen	32 months
Ratio (%)	128 %	178 %

In the light above, the efficiency of the project is ②.

4 Sustainability

<Policy Aspect>

Based on this M/P, the “Power Development Strategy (2021-2025)” and “National Power Development Strategy (NPDS) (2021-2030)” was formulated and clearly state the necessity of power transmission line network and development to meet domestic power demand and export to neighboring countries.

< Institutional/Organizational Aspect>

The Department of Energy Policy and Planning (DEPP) under MEM continues to be responsible for the M/P implementation with the appropriate division of roles (energy policy development, NPDP review, power system planning, and generation planning) within the organization. The number of department staff in charge of M/P in both organizations is sufficient and those staff will be continuously allocated to the same position, yet no additional personnel are expected.

In 2020, EDL and China Southern Power Grid State Enterprise Company (CSG) jointly established EDL Power Transmission Company Limited (EDL-T) to carry out grid interconnection projects between Laos and neighboring countries. In addition, EDL-T is responsible for investing in, constructing and operating 230 kV-and 500 kV power grids.

MEM coordinates with stakeholder such as MEM, EDL, and EDL-GENERATION PUBLIC COMPANY, to annually update and amend the project plans to be consistent with the actual current status of power development. Furthermore, the coordination mechanism is likely to be maintained in the future.

<Technical Aspect>

The member of DEPP has been working to improve their skills and knowledge through on-the-job training such as drafting and revising NPDP in order to implement the development plan. In particular, the technical staff sometimes participate in training courses provided by the U.S. Agency for International Development (USAID), New Zealand, EGAT, and JICA. In addition, DEPP offers its member institution-funded study abroad programs to obtain Ph.D. and master's degrees and they return knowledge to the institution. EDL has been trained by EGAT of Thailand on grid systems and operation planning to improve and maintain technical knowledge every year.

<Financial Aspect>

EDL's financial situation is not favorable, making it difficult to secure and allocate the necessary budget for the implementation of the master plan. While the development of priority hydropower projects on the Mekong mainstream remains an attractive investment destination for foreign investors, EDL has an unstable financial base, resulting in a low credit rating, which makes fundraising a challenge. On the other hand, EDL-T has provided financial support for the 230kV and 500kV transmission networks. In addition, the Memorandum of Understanding on power trade is to be signed with Thailand in the near future, which will be one of the stable sources of revenue.

<Environmental and Social Aspect>

No issue on environmental and social aspects has been observed, and it has not been necessary to take any countermeasures.

<Evaluation Result>

In light of the above, slight problems have been observed in terms of the financial aspects of the implementing agency. Therefore, the sustainability of the project effects is ③.

5 Summary of the Evaluation

The project prepared the Power System Master Plan. After the project completion, the proposed plan has been mostly utilized to implement high-priority export and development projects, and the action plan of roadmap, expand interconnected cooperation and operate grid codes in Laos. The project cost/period exceeded the plan due to additional tasks.

Considering all of the above points, this project is evaluated to be highly satisfactory.

III. Recommendations & Lessons Learned

Recommendations for Implementing Agency:

- The current government's policy and power system plan include domestic and regional power demand-supply data, which is uncertain. MEM needs to review NPDS periodically, and then EDL should check the modifications to grasp the appropriate power supply-demand. Based on these approaches, EDL will be able to make reasonable budget requests to the Lao government, which leads to the M/P implementation.

Lessons Learned for JICA:

- When planning projects that involve many stakeholders and countries within a master plan, JICA should make proposals based on appropriate schedules and timelines, taking into account the time required for the implementing agency to coordinate with other relevant agencies and countries.



230 kv power transmission line from Hinherb Substation to Naxaythong substation.



230/115 Kv Power Substation at HinHerb district