Department of Energy Policy and Planning
Ministry of Energy and Mines
Lao People's Democratic Republic

Project for the Improvement of the Governance Mechanism for Sustainable Power Development Planning

Final Report

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Japan International Cooperation Agency

Chubu Electric Power Co., Inc.
Electric Power Development Co., Ltd.

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Figures and Tables

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Abbreviations and Acronyms

ADB	:	Asian Development Bank
AIMS	:	the ASEAN Interconnection Master Plan Study
ASEAN	:	Association of Southeast Asian Nations
AusAID	:	Australian Agency for International Development
BOL	:	Bank of the Lao PDR
CA	:	Concession Agreement
CDEP	:	Coordinating Committee for the Development of Electric Power
CDM	:	Clean Development Mechanism
CSG	:	China Southern Power Grid Co., Ltd.
DEB	:	Department of Energy Business
DEE	:	Division of Environmental Engineering, DEPP
DEM	:	Department of Energy Management
DEPD	:	Department of Energy Promotion and Development
DEPP	:	Department of Energy Policy and Planning
DESIA	:	Department of Environmental and Social Impact Assessment
DOE	:	Department of Electricity
DSM	:	Demand Side Management
EBIT	:	Earnings Before Interest and Taxes
ECI	:	Electrical Construction and Installation, State Enterprise
EDC	:	Electricité du Cambodge
EDL	:	Electricité du Laos
EDL-Gen	:	EDL Generation Public Company
EDL-PDP	:	Power Development Plan of EDL
EGAT	:	Electricity Generating Authority of Thailand
EIA	:	Environmental Impact Assessment
ESIA	:	Environmental and Social Impact Assessment
ESMMP	:	Environmental and Social Monitoring and Management Plan
GDP	:	Gross Domestic Product
GMS	:	Greater Mekong Sub-region
GNI	:	Gross National Income
GOL	:	the Government of the Lao People's Democratic Republic
HAPUA	:	Head of ASEAN Power Utilities/Authorities
IDA	:	International Development Agency
IEE	:	Initial Environmental Examination
IEEJ	:	the Institute of Energy Economics, Japan
IFS	:	International Financial Statistics (of the IMF)
IMF	:	International Monetary Fund
IPO	:	Initial Public Offering
IPP	:	Independent Power Producer
IPSM	:	Project for Improvement of Power Sector Management (JICA)
IREP	:	Institute of Renewable Energy Promotion

JBIC : Japan Bank for International Cooperation
JEPIC : Japan Electric Power Information Center, Inc.
JICA : Japan International Cooperation Agency
LDC : Least Developed Country
LEnS : Lao Environment and Social Project
LHSE : Lao Holding State Enterprise
LSX : Lao Stock Exchange
MDGs : Millennium Development Goals
MEA : Metropolitan Electricity Authority of Thailand
MEM : Ministry of Energy and Mines
MIC : Ministry of Industry and Commerce
MIH : Ministry of Industry and Handicraft
ML : Mega Litre (million litre)
MNRE : Ministry of Natural Resources and Environment
MOF : Ministry of Finance
MOU : Memorandum of Understanding
MPI : Ministry of Planning and Investment
MRC : Mekong River Commission
MW : Megawatt
NARPD : Northern Area Rural Power Distribution Project (ADB)
NERI : National Economic Research Institute
NGPES : National Growth and Poverty Eradication Strategy
NLMA : National Land Management Authority
NN3 : Nam Ngum 3
NN3PC : Nam Ngum 3 Power Company
NORAD : Norwegian Agency for Development Cooperation
NPC : National Power Corporation (of the Philippines)
NSEDP : National Socio-Economic Development Plan
NPDP : National Power Development Plan
NPEP : National Poverty Eradication Programme
NPSH : National Policy on Environmental and Social Sustainability of Hydropower Sector
NUOL : National University of Lao PDR
ODA : Official Development Assistance
PDA : Project Development Agreement
PDEM : Provincial Department of Energy and Mines
PDP : Power Development Plan
PEA : Provincial Electricity Authority of Thailand
PPDD : Power Plant Development Department
PPP : Public and Private Partnership
PRSP : Poverty Reduction Strategy Paper
PSIF : Private Sector Investment Finance (JICA)
RE : Renewable Energy
REP : Rural Electrification Project (World Bank)

ROA	:	Return on Asset
ROE	:	Return on Equity
SC	:	Static Condenser
SEA	:	Strategic Environmental Assessment
SEZ	:	Special Economic Zone
ShR	:	Shunt Reactor
SLACO	:	Sino-Lao Aluminum Corporation Limited
SPP	:	Small Power Producer
SPRE	:	Southern Provincial Rural Electrification (Project)
TA	:	Technical Assistance
TNB	:	Tenaga Nasional Berhad (of Malaysia)
TOE	:	Tonne of Oil Equivalent
UN	:	the United Nations
UNFCCC	:	United Nations Framework Convention on Climate Change
UXO	:	Unexploded Ordinance
VPRE	:	Vientiane Plain Rural Electrification (Project)
WB	:	the World Bank
WREA	:	Water Resource and Environment Administration

Executive Summary

1. Introduction

JICA, in close consultation with the Lao partner institutions as well as major stakeholders such as donor organizations, drafted its first "Power Sector Cooperation Program" in January 2012. The goal of JICA Power Sector Cooperation Program is set as "Secure domestic power supply in sustainable, reliable and efficient manner enough for realizing steady economic and social development", and four expected outcomes in the four sub-categories, viz., "Policy & Planning", "Regulatory Framework", "Infrastructure", and "Implementing Capacity", are determined.

This project, titled "the Project for the Improvement of the Governance Mechanism for Sustainable Power Development Planning" (hereinafter referred to as "the Study"), covers the three areas of the above outcomes except "Regulatory Framework". In addition, the Study was expected to bring future cooperation projects in shape in accord with the program. In this context, the Study can be a foundation of realizing the Cooperation Program of JICA, and therefore, JICA decided to implement the Study upon request from the Government of Laos. The Study is regarded as a preparatory work for full-fledged implementation Cooperation Program of JICA in the coming years. The goal of the Study is to propose the specific measures for improvement of the governance mechanism of the power sector as implied in the project title, and the following six outputs were expected:

i) Present situation analysis
ii) Improvement of PDP
iii) Proposal for power facility development mechanism
iv) Proposal for institutional management and human resources development
v) Proposal of potential yen-loan projects
vi) Capacity development

Present situation analysis made it clear that the most critical issue on the existing PDP was lacking power sector policies, and that the declaration of clear policies would be indispensable for strengthening the power sector governance. Thus the Study Team proposed that the preparation of a comprehensive power development plan (NPDP: national power development plan) be set as the focal point of the Study. Preliminary policy analyses and technical improvement of the current PDPs were conducted in the Study. Institutional management, human resource development, and capacity development were also focused in the preparation of NPDP, and future cooperation for the formulation of NPDP was proposed. As a result, major achievements of the Study were summarized in the following four items.

i) Present situation analysis
ii) Formulation of NPDP
iii) Proposal of appropriate mechanism for power facility development
iv) Proposal of future cooperation project including yen-loan project

The Study was implemented from June 2012 to May 2013, and the Study Team, comprising 12 Japanese experts with 10 areas of expertise, conducted activities in Laos.

Though recommendations were made through this one year study, completing the original task will take several more years in a true sense as the ultimate aim of JICA‘s cooperation is not only equip the partner institutions with proposals and reports but develop their capacities to carry them out on their own.

2. Present situation analysis

(1) Policy and institutional issues

There are a number of issues to be the barriers and bottlenecks for the better power sector governance. The Government of Laos (GOL) sets two vital national priorities for the power sector: i) affordable power supply to Lao society and industry with competitiveness; and ii) earnings of foreign currency from electricity export. However, domestic power supply is currently not sufficient (power import has been more than export since 2009). The current PDP is being developed by EDL as its domestic business plan and there has been no comprehensive PDP developed by the GOL with consideration of power trade with future transmission networks, efficient utilization of river water with socio-environmental issues, financial constrains, etc. despite the stipulation of the Electricity Law.

(2) Organization

The former Department of Electricity (DOE) was divided in three organizations such as DEPP, DEM and IREP in May 2012. DEPP, DEM, IREP and DEB as the department to monitor and negotiate with IPP developers and EDL as the organization to prepare domestic PDP, work for the power sector under MEM from planning to operation of power facilities including IPP management. It was observed, though DEPP should be in charge of compilation of the NPDP and coordinate stakeholders for its implementation, they are still struggling to meet the requirements as they were short of staff with expertise. According to the further analysis through the interviews to DEPP and EDL staff, management capabilities to IPP developers, coordination of related ministries and departments, review of mandates to realistic operation, etc. were observed as key issued to organizational reinforcement.

(3) EDL's PDP

The current PDP developed by EDL was reviewed in terms of demand forecast, generation planning and transmission planning. Regarding the demand forecast, a huge gap between forecasted and actual demand was observed because the current bottom-up (summing up) approach cannot reflect econometric phenomena correctly. Generation planning, demand-supply balance and power system planning have been conducted for on the annual peak power and energy, and the necessity of monthly analysis was proposed to take into account the gap between rainy and dry season.

(4) Others

Environmental and social consideration is a key issue to plan and implement the power projects minimizing the risk for the nature and public. In the master plan (NPDP) stage, SEA should be carried out to find out some risks and alternatives from the early stage of the projects. Among other assistance programs from donor agencies, the World Bank TAs for CA management to DEB, hydropower planning

to DEPP and tariff study for EDL, are closely related to this study.

The table below summarizes the major issues and necessities found in the Study.

Table: Issues and necessities

Category	Issues and necessities
Policy	Concrete power policies in the MEM to reflect current and future power supply-demand situation
Institute	Comprehensive national PDP (NPDP) considering power trade with transmission network, efficient utilization of water, financial constrains, etc.
Organization	Better coordination among the related organizations (ministries and departments) for the development of the NPDP
	Better coordination among the departments under MEM for the better power development mechanism (IPP management)
Environmental consideration	Introduction of the SEA in earlier (NPDP) stage ESIA coordination during implementation stages of the projects
Technical skills	Better technical skills for power demand and detailed (monthly) power system analysis and power planning
Collaboration with other donors	Collaboration with WB TA programs (CA management, hydropower planning and tariff study)

3. Formulation of NPDP

From the review of the current PDP, the following two major improvement points are observed:

1) To secure the comprehensiveness in the PDP. In other words, not only the mere facility development plan but also the policies for power development should be included such as the policies regarding how to deal with large industrial demand, in how power generation should be demarcated (domestic or export) or in what way the future power system, etc.
2) Technical improvement by providing the methodologies including the reliability of demand forecasting, the ranking in generation planning and the accuracy of system analysis.

The first point is essential and the proposal for improvement was detailed as the formulation of the NPDP, and the second point, originally requested from the Lao side, was conducted as a technical preparation of NPDP in this Study.

(1) Formulation of NPDP

As preparatory works for NPDP formulation, the Study Team proposed i) Structure, ii) Policies to be described, iii) Approaches including organizational arrangement and capacity development, and iv) Contents, and discussed them among the stakeholders including DEPP.

(2) Improvement of existing power development plan

As a preparation of the formulation of NPDP, technology transfers on demand forecast and system analysis was conducted through workshops and OJTs, and the improved methodologies were compiled in a manual ("Manuals for developing the PDP"). The Study Team proposed the following two major improvement points for the revision of PDP.

i) Demand forecast

One of the largest problems in the current PDP is inaccuracy of demand forecasting, and econometric model, which has already been applied for energy demand forecast, was introduced replacing the current bottom-up approach in this study in order to make demand forecast more reliable.

ii) System analysis

The EDL has so far conducted power system planning on the basis of annual balance. That is to say, annual total energy generation, and the balance between maximum power supply and peak load, have been the focal points of planning. However, the power flow situation in Laos changes a lot seasonally depending on the output of its dominant hydropower generation, so that monthly-based system planning is recommended in order to optimize power system development and operation.

4. Proposal of appropriate mechanism for power facility development by IPPs

(1) Internal linkage among MEM to strengthen governance

It is clarified that there are five stages for the IPP development. In the planning stage (mid-long term), the NPDP will be prepared as a reference document to consider the future IPP development by the DEPP, as the secretariat using information of DEB, IREP and EDL. Before MOU to CA stage, the DEB is a gate for the developers to negotiate and monitor the projects implemented by IPP developers. The DEM conducts examination and inspection to check the conformity to the Lao Electric Power Technical Standards (LEPTS).

(2) IPP management mechanism

The Study Team clarified challenges in the IPP development procedures, and proposed the solutions in each development stage aforementioned. In addition, the alternatives of the development procedures were proposed from the viewpoint of efficiency, transparency, and accountability. The proposal for improvement of IPP management mechanism was compiled in the "Power Development Mechanism Guidance".

5. Recommendations

As a conclusion of the Study, the Study Team proposed future cooperation projects in the form of "technical cooperation", "ODA Loan" and "Private Sector Investment Finance".

(1) Technical cooperation for preparation of NPDP

The preparation of NPDP will be the most critical issue for not only DEPP but also whole the power sector in the context of power sector governance. In this Study, preparatory work for the formulation of NPDP has been conducted, but the actual formulation will require further external support. JICA is basically positive to extend the technical support in this regard, and the Study Team proposed a technical cooperation project of JICA. The main objective of the project is not only the formulation of NPDP itself, but also the capacity development for the formulation of NPDP, considering the sustainability of planning, revising and updating the NPDP. It will thereby take at least four years.

On the other hand, the top management of MEM and DEPP had different views on the formulation of NPDP. Under the limitation of human resources in DEPP, they desired a more shortcut approach and more tangible outputs directly from the consultant on the critical policy issues. The period of coming project should be at the longest one year, and the most critical policy issues for the time being are i) rational electricity tariff of EDL, including the discussions on cross-subsidies in the residential sector, and long-run marginal cost considering not only the generation cost of EDL-Gen but also payment of power import from foreign countries and domestic IPP, and transmission and distribution cost; and ii) realistic and sustainable investment planning of EDL along with the promotion of private sector investment.

In this context, the Study Team proposed two alternatives of technical cooperation for the formulation of NPDP: i) capacity development project, and ii) study-type project.

(2) Transmission line and substation project

As a result of system analysis and site survey of substations, the Study Team proposed potential projects for ODA loan and technical cooperation.

The system analysis showed the overload of transmission lines and transformers, and significant voltage fluctuation. The difference between the current PDP and the system analysis in this Study resulted mainly from the data of generation projects and assumption on the large industrial demand. In accordance with the results of the analysis, the lists of transmission lines and transformers to be enhanced were revised, and eight transmission projects were picked up for potential ODA loan projects. In addition, the strategic environmental assessment (SEA) exercise was implemented for the proposed transmission projects.

In the site survey, the Study Team found the undesirable condition of substation facilities such as switchgears and protection devices, resulted from insufficient maintenance skills. A technical cooperation for training program of maintenance skills was proposed. To replace the deteriorated substation facilities, financial assistance will be also expected.

(3) Private Sector Investment Finance

The Government of Japan made a decision in October 2012 to fully resume JICA's Private Sector Investment Finance (PSIF) corresponding to increasing private investment promotion in the development of infrastructure including electricity due to the budgetary restriction of public sector in quite a few developing countries. Hereafter, JICA will be able to finance development projects in developing countries through PSIF. IPP projects for domestic supply in Laos, although each project needs to be evaluated individually, generally seem in conformity with the fundamental requirement for the provision of the PSIF.

On the other hand, more than 80% of newly developed generation capacity by 2025 relies on the investment by private sector through the IPP development schemes. In order to ensure the power development plan for domestic supply from IPP projects, the investment environment of IPP projects should be more attractive for foreign investors by improving transparency and fairness.

In addition to the improvement of investment environment by the effort of Lao side, the support from the

Government of Japan (GOJ) is expected to encourage the Japanese investors to enter the IPP market by improving the financial condition and the investment environment. Although three Japanese companies shows interest in IPP development in Laos and so far concluded the MOU or PDA, their progresses were not made smoothly as originally planned. To enhance feasibility and encourage sustainable development of power sector, the GOJ‘s financial assistance through PPP (Public-Private Partnership) scheme and the special finance measures by JICA‘s PSIF is expected.

Chapter 1 Introduction

1.1 Background

The Lao People's Democratic Republic, dubbed a ―battery of Indochina", holds an enormous hydropower potential approximately 30 times more than the domestic peak power demand (as of 2010). Power development has been carried out by the state utility, Electricité du Laos (EDL), and independent power producers (IPPs), but nowadays IPPs are taking a major role from the financial and technical constraints of EDL. Around 85% of generation capacity sited in the country are owned and operated by IPPs as of 2010. According to the latest Power Development Plan (PDP) formulated in 2011, around 90% of generation capacity will be developed by IPPs over the next ten years, and the dependence on IPPs is expected to increase more than ever.

Domestic power facilities are to be developed based on the PDP which EDL formulates every few years, so the PDP is expected to include accurate mid and long term domestic power demand forecasts and guidelines to systematically develop power facilities and promote power interchange with neighboring countries including Thailand. The current PDP, however, is considered unreliable in terms of demand forecast, facilities planning etc. since rapid annual demand growth of 20 - 30% makes it difficult for the authorities to estimate accurate power demand, and moreover human resources themselves in EDL and Ministry of Energy and Mines (MEM) are not sufficient. Insufficient coordination and information sharing among relevant ministries and institutions are also worsening the situation. EDL has responsibility only for domestic power balance of supply and demand, while the Department of Energy Business (DEB) under MEM has the jurisdiction over IPP business including both export and domestic supply. As a result, actual progress situation of IPP projects such as studies and construction works have not been properly reflected in the PDP.

DEB and Department of Energy Policy and Planning (DEPP) under MEM, are expected to properly promote and manage the studies and construction works of new IPP projects in cooperation with EDL within the entire power supply and demand planning, but insufficient coordination and information sharing have been observed so far due to the lack of organizational cooperation, know-how and so on. In addition, it is difficult for the Government to systematically manage the development, according to the mid and long term power demand forecast at its own initiative, since the current IPP development scheme is on a so-called ―unsolicited' basis in which the Government sporadically accepts a proposal based on the initiative of an IPP, and then concludes memorandum of understandings (MOU) and project development agreement (PDA) in order with the developer after reviewing the feasibility of the project. Among IPP projects, some of them seem to have low project feasibility and others are demonstrating little progress. MOU or PDA for such projects should have been reviewed timely and properly in a transparent manner, and significant delays have been seen in the progress of some IPP developments accordingly. This means that Laos is losing the opportunity to develop its resource potential more effectively and efficiently, and to maximize the benefits to be obtained from the development. The improvement of the total governance mechanism of power development is therefore an urgent issue that includes the formulation of reliable

comprehensive power development plans, the introduction of competitive principle in power development, the development of explicit criteria, and transparent and fair management process on IPP projects.

Based on the background above, the Ministry of Energy and Mines, the implementing agency of the Lao side, and JICA have concluded Minutes of Discussion on February 17, 2012 for carrying out cooperation with the purposes described in 1.2.2.

1.2 Outline of Project

The following outlines of the project are described fundamentally as per the Minutes of Discussion concluded between DEPP and JICA in February 2012, and the Scope of Work[1] directed by JICA.

1.2.1 Title

Project for "the Improvement of the Governance Mechanism for Sustainable Power Development Planning" (hereinafter referred to as "the Study")

1.2.2 Overall goal

To enhance power supply, contributing to the economic growth of the Lao PDR.

1.2.3 Purpose

(1) To assist in formulating a comprehensive, accurate and reliable PDP by reviewing demand forecasts, demand and supply balance, facility development plans and investment plans, etc.

(2) To assist in identifying problems in the present mechanism for power facility development by IPPs, and propose appropriate governance solutions such as a "bid-like" mechanism to secure efficiency, accountability and sustainability.

(3) To assess the present capacity of the organizations concerned and propose appropriate institutional management measures which will effectively promote the governance mechanisms proposed above.

1.2.4 Output

(1) Present situation analysis

(a) Review of the PDP, IPP project status and relevant policies, initiatives and plans.
(b) Review of the present mechanism for power facility development by EDL and IPPs.
(c) Preliminary analysis of the power exchange mechanisms between neighboring countries and assessment of demand/supply balance.
(d) Review of the governance mechanisms regarding power facility development in countries that share a similar context to Laos, and the drawing of lessons.

Problem analyses of the present PDP from the following perspectives:

(a) Power development policy
(b) Power statistics

[1] Written in Japanese language, and no translation exists.

(c) Demand/supply balance
(d) Facility development
(e) Investment plan
(f) Institutional arrangement

(2) Improvement of PDP

(a) Proposal on how to improve the existing PDP based on the problems identified above. The following points may be proposed:
- Policy options for power development
- Upgrading demand forecasts as well as supply/demand balance
- Upgrading present facility development plans with detailed data and specifications to improve reliability of the PDP
- Upgrading power system planning with appropriate software
- Updating data on investment plan
- Manuals for developing the PDP

(b) Proposal for expected roles and functions of relevant organizations and how to enhance coordination and collaboration among them.

(3) Proposal for power facility development mechanism

(a) Proposal of a basic policy for a power facility development mechanism considering competitiveness, accountability, fairness, and efficiency.
(b) Proposal for detailed institutional design of the mechanism, which may include:
- Roles and functions of the government and IPPs
- Collaboration and coordination mechanism of relevant organizations
- A "bid-like" mechanism
- Documents and data necessary to implement a "bid-like" mechanism
- Workflow
- Monitoring system by the Government

(c) Proposal of guidelines and manuals for implementing the mechanism

(4) Proposal for institutional management and human resources development

(a) Review of present institutional management of relevant organizations and identification of problems in order to implement and update the proposed PDP sustainably, and carry out the governance mechanisms proposed above
(b) Proposal for improved institutional management, which can effectively execute the proposed governance mechanisms above. A road map and an action plan may be developed.
(c) Proposal for a human resources development plan to enable relevant organizations to execute expected functions.

(5) Proposal of potential yen-loan projects

Proposal of yen-loan priority projects with preliminary implementation plans that include

economic/financial analyses, designs/specifications, social/environmental impact assessments, etc.

(6) Capacity development

Organization of workshops and provision of practical training at important milestones in the course of implementation of the Study.

1.2.5 Implementation structure

The roles and assignments of relevant organizations are as follows:

(1) Japanese Study Team

The Japanese Study Team consists of a joint venture of two Japanese electric power utilities: Chubu Electric Power Co., Inc. (Chubu EPCo) and Electric Power Development Co., Ltd. (EPDC).

No.	Name	Assignment	Organization
1	KUTSUKAKE Takao	Leader/Power policy (1)/ System planning (1)	Chubu EPCo
2	NAKANISHI Hirokazu	Sub-leader/Power policy (2)	Chubu EPCo
3	ISHIGURO Masayasu	Power sector governance	Chubu EPCo (Ishiguro Associates LLC)
4	KAWAKAMI Yasuhiro	Power facilities development promotion	Chubu EPCo
5	HIRAI Harumi	Demand forecast (1)	Chubu EPCo (IEE-Japan)
6	KAKO Masayuki	Demand forecast (2)	Chubu EPCo (IEE-Japan)
7	FURUYAMA Yasushi	Generation planning	EPDC
8	HATANO Ryosuke	Transmission and substation planning (1)/ Distribution planning	Chubu EPCo
9	ISHIHARA Shinsuke	Transmission and substation planning (2)	Chubu EPCo
10	YANAGIDA Masanori	System planning (2)	Chubu EPCo
11	ONOZAWA Masato	Institutional management/ Human resources development	Chubu EPCo (Pionnier Research Inc.)
12	SERIZAWA Toshifumi	Environmental and social consideration	EPDC (JIN Corporation)

(2) Counterpart

i) Counterpart organization

The counterpart organization of the Study is the Department of Energy Policy and Planning (DEPP) under the Ministry of Energy and Mines (MEM) on behalf of the Government of Lao PDR.

The Director General, DEPP/MEM is the Project Director and the Vice Minister of Energy and Mines having energy policy and planning in charge chaired the Steering Committee of the Project as described in (3) below.

The roles and functions are described hereunder. The Director General commissioned some or all of the following tasks to an authorized person under his responsibility.

(a) Ensure the provision of input by the MEM including the following items described in the Minutes of Discussion signed on February 17, 2012.

- Services of MEM counterpart personnel and administrative personnel;
- Suitable office space with necessary equipment;

- Information as well as support in obtaining medical services;
- Credentials or identification cards as necessary;
- Available data (including maps and photographs) and information related to the Study;
- Modification of the MEM homepage to accommodate web-based information on the Study;
- Local costs, including allowances for counterpart personnel, necessary for the implementation of the Project; and
- Necessary facilities to the JICA experts for the remittance as well as utilization of the funds introduced into the Laos from Japan in connection with the implementation of the Project.

(b) Liaise and coordinate with the relevant organizations described in point ii) below. Periodic workshops were convened by the MEM with support from JICA experts in order to share Project progress as well as to secure commitment from the relevant organizations.

(c) Organize seminars and meetings.

ii) Relevant organizations

The following organizations participated in the project as the relevant organizations.

- Department of Energy Business (DEB), MEM
- Electricité du Laos (EDL)

iii) Counterpart personnel

The counterpart personnel was assigned in the respective fields of expertise after the discussion at the first Workshop held on June 15, 2012. Some fields of expertise such as demand forecast, generation planning and transmission planning required several counterparts from not only main counterpart organization but also the relevant organizations.

Role	Name	Organization	
− Power Policy − Power Sector Governance − Power Facilities Development Promotion − Institutional Management/ Human Resource Management	Dr. Daovong Phonekeo	DEPP	Director General (Project Director)
	Mr. Chansaveng Boungnong		Deputy Director General
	Mr. Khamso Kouphokham		Deputy Director General
	Mr. Sychath Boutsakitirath	DEB	Deputy Director General
	Mr. Boungnoung Bottavong	EDL	Deputy Director, Technical Dept.
	Mr. Sisoukan Sayarath	DEM	Director General
	Mr. Seukham Thoummavongsa	IREP	Director
− Demand Forecast	Mr. Litthanoulok Lathsapho	DEPP	Director
	Mr. Viengthong Sackdara	EDL	Deputy Manager, Technical Dept.
	Mr. Kinon Khounvisith	MIC	Director General
− Generation Planning	Mr. Sanhya Somvichith	DEPP	Director, Generation Planning
	Mr. Sychath Boutsakitirath	DEB	Deputy Director General
	Mr. Phoummy Neitibanedith	EDL-Gen	Director, Generation Dept.
− System Planning	Ms. Santisouk Phimphachanh	DEPP	Director, System Planning
− Transmission, Substation, Distribution Planning	Mr. Phao Kongmany	EDL	Deputy Manager, Technical Dept.
− Environmental and Social Consideration	Mr. Vithounlabandid Thoummabout	DEPP	Acting Director, Environmental Engineering Division
	Mr. Ketkeo Salichanh	MNRE	Director, Policy and Law Division, Department of Environment,

(3) Implementation structure

There were a broad array of outputs expected of the Study, and various governmental agencies not only the departments under MEM but also MPI, MIC and MNRE were concerned with the activities of the Study. Assigning the right agencies and involving them in the Study were indispensable for successfully implementing the Study.

In this context, steering committees was convened four times, at the inception, interim and final stage of the Study. The steering committee was chaired by the Vice Minister of Energy and Mines who is responsible for energy policy and planning, and the DEPP functions as the secretariat of the committee.

1.2.6 Project duration

The project duration was from June 2012 to May 2013 (12 months) and the overall activities in the Study are summarized as attached in Figure 1-1.

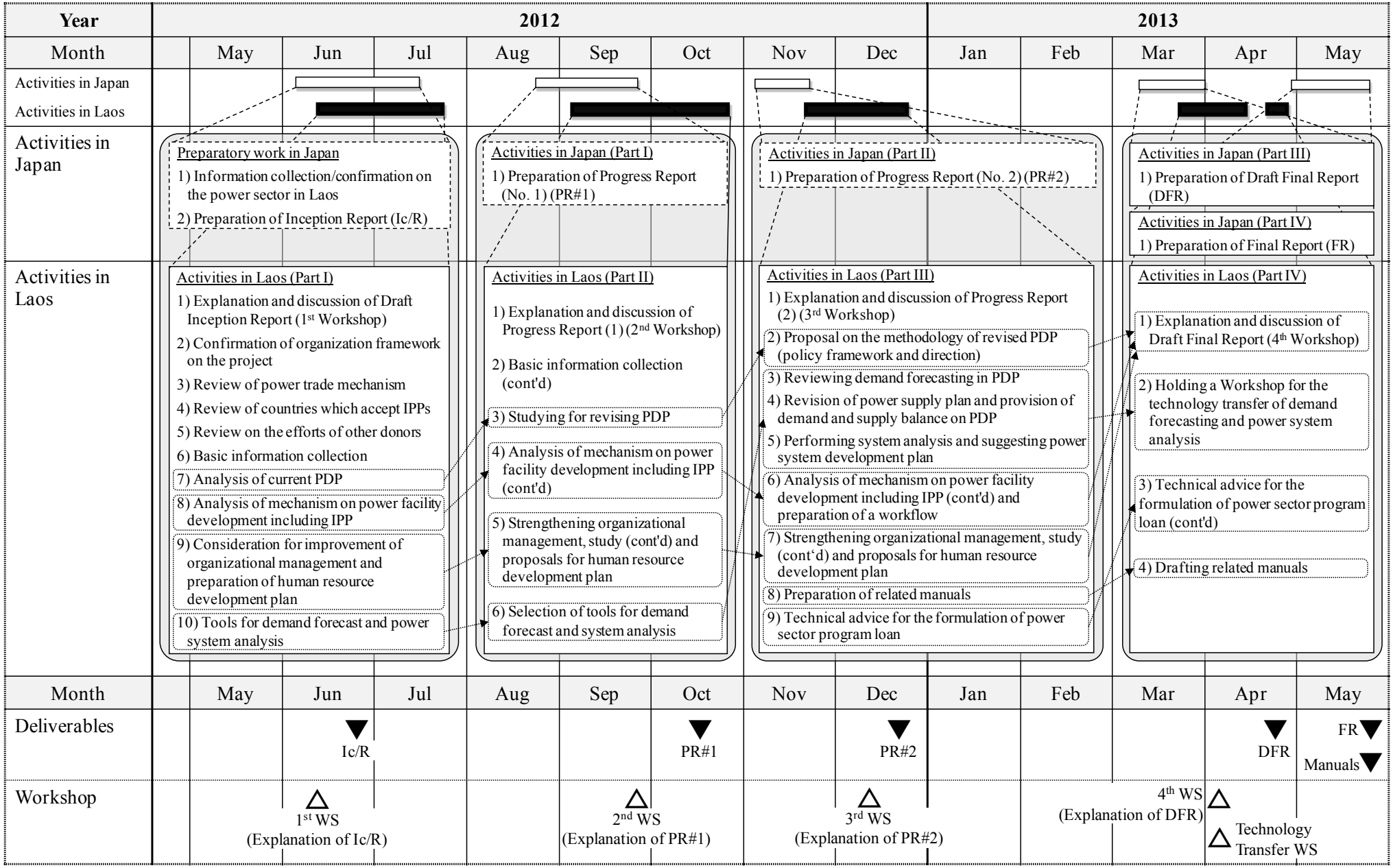

Figure 1-1: Project duration and overall activities

1.3 Route map of Study

1.3.1 JICA Power Sector Cooperation Program

JICA drafted its very first ―Power Sector Cooperation Program" in January 2012. The goal of JICA Power Sector Cooperation Program is set as:

―Secure domestic power supply in sustainable, reliable and efficient manner enough for realizing steady economic and social development," and four expected outcomes are:

i) Policy & Planning:
An energy administration which can develop energy policy/plan balancing regional and national priorities, and establish governance mechanisms for effectively promoting energy supply.

ii) Regulatory Framework:
A regulatory administration by which power facilities are planned and operated in accordance with rules & standards thereby secure safety for the citizens, and coordination necessary for interconnection is addressed.

iii) Infrastructure:
Power facilities supplying enough electricity to meet government mid-long term development plans in sustainable, manageable, and cost effective manner (including rural electrification and renewable energy development).

iv) Implementing Capacity:
Financial, management, and technical capacities of a power entity is enhanced to implement government policy/plan effectively and deliver quality service to the citizens.

Among the four expected outcomes, this Study covers the three areas of the above outcomes[2]: i) Policy & Planning, iii) Infrastructure, and iv) Implementing Capacity. In addition, the Study was expected to bring future cooperation projects in shape in accord with the program.

In this context, this Study can be categorized into a preparatory study for the full-fledged implementation of the Power Sector Cooperation Program of JICA.

1.3.2 Route map of Study

Along with the Minutes of Discussion and the Scope of Work, the Study Team started from the analysis of the current governance situation, corresponding to the expected output 1.2.4 (1). In addition to the given four issues, the framework of environmental and social considerations, and the other donors' assistance are summarized in Chapter 2.

Measures for strengthening the power sector governance are proposed in Chapter 3 as countermeasures against the challenging issues summarized in Chapter 2, other than the improvement of the current PDP.

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[2] The other outcome: ii) Regulatory Framework had already been challenged in another JICA project for Improvement of Power Sector Management (IPSM), and future cooperation was drafted as the ―roadmap for power sector regulation" in the IPSM project.

Three major measures: i) formulation of NPDP, ii) management of EDL, and iii) IPP management are described in Chapter 3. The improvement of the current PDP is one of the major expected outputs of the Study, and detailed in Chapter 4, focusing on the technical improvement. The methods of demand forecast and power system analysis are discussed in particular, including the introduction of new methodologies.

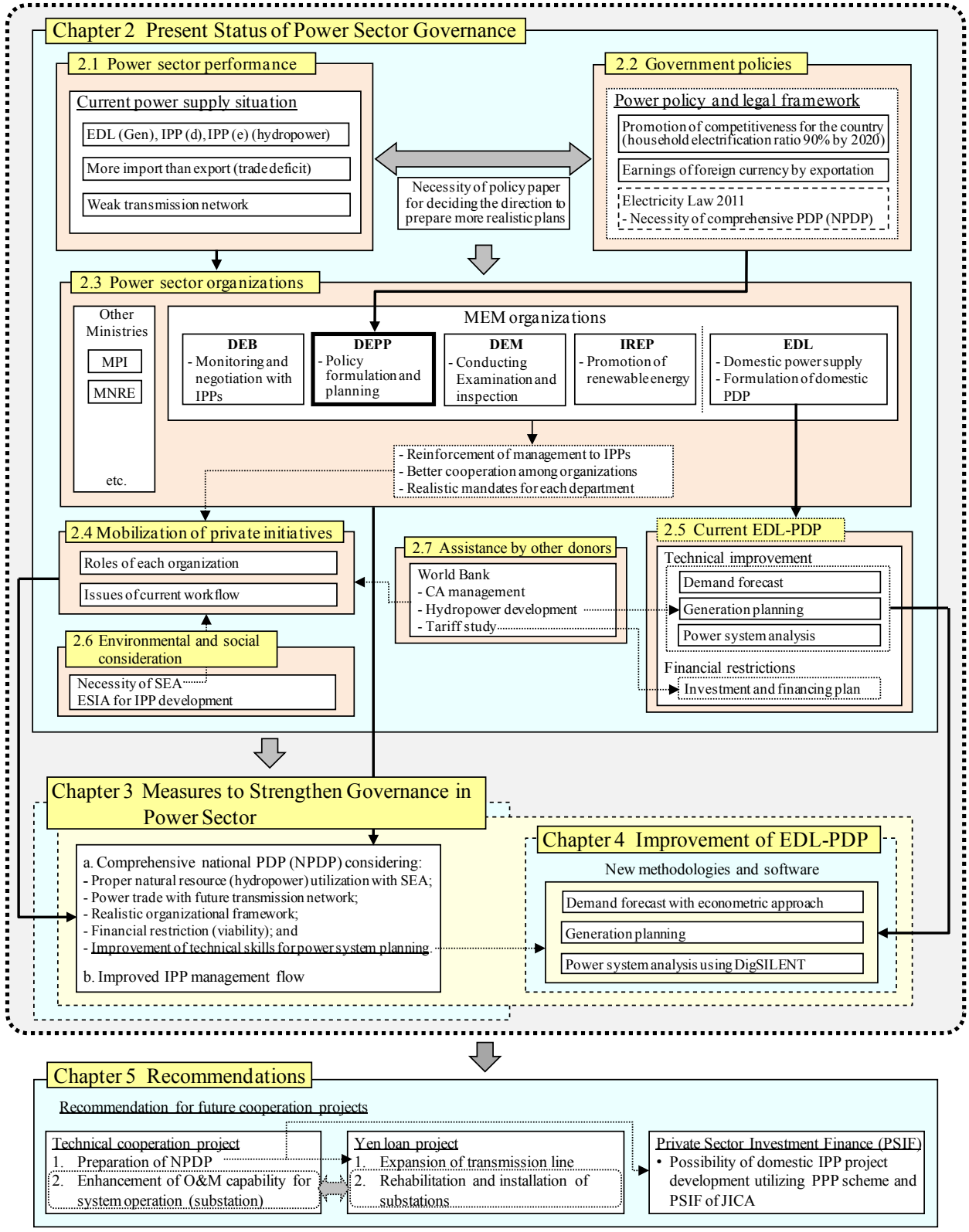
Recommendations for future cooperation projects are described in Chapter 5 as the conclusion of the Study in accord with the findings and discussion in the Study. A technical cooperation project for formulation of NPDP, and the possibility of utilization of JICA's PSIF scheme for generation sector are discussed as well as yen-loan projects for the expansion/rehabilitation of transmission lines and substations, corresponding to the expected output 1.2.4 (5).

The overall expected outputs of the Study are described in this report as shown in Table 1-1, and the structure of the report is outlined as in Figure 1-2.

Table 1-1: Expected outputs and description in the Report

Expected output	Description
(1) Present situation analysis	Chapter 2: Present Status of Power Sector Governance
(2) Improvement of PDP	Chapter 3 (3.1): Formulation of NPDP Chapter 4: Improvement of EDL-PDP Chapter 5 (5.1): Technical cooperation for preparation of NPDP
(3) Proposal for power facility development mechanism	Chapter 3 (3.3): Comprehensive management aimed at sustainable power development
(4) Proposal for institutional management and human resources development	Chapter 3 (3.1): Formulation of NPDP Chapter 3 (3.2): Perception of EDL role and future power development Chapter 5 (5.1): Technical cooperation for preparation of NPDP
(5) Proposal of potential yen-loan projects	Chapter 5 (5.2): Transmission and substation project (5.3): Private Sector Investment Finance for generation development
(6) Capacity development	Chapter 4 (4.5): Technology transfer

(Source) Study Team.



(Source) Study Team.

Figure 1-2: Overall structure of Study

Chapter 2 Present Status of Power Sector Governance

2.1 Power sector performance in Laos

2.1.1 Current power situation

2.1.1.1 Overview in comparison with neighboring countries

Laos is characterized by land-locked geography and low density, small populated demography, of which the power sector in Laos is also, bad or good, under the influence.

At first, small population along with the geographical characteristics bring some benefits to the power sector. According to WEC, the hydro potential in Laos is 63 TWh p.a. approximately equivalent to 18 GW assuming the capacity factor of 40%, which is often quoted as the hydro potential in Laos except the Mekong mainstream. The absolute amount is not so large and ranked 44th in the world falling behind China, Myanmar and Vietnam among the Indochina countries, but the per capita potential (9,844 kWh p.a.) corresponds to approximately 30 times of current per capita consumption of the country and exceeds even those of OECD countries such as Japan (7,133 kWh p.a.) and South Korea (8,883 kWh p.a.). Thus, the small population resulting in small domestic consumption affords Laos an opportunity to export its hydroelectricity. On the contrary, surrounding countries with much larger economies such as Thailand, Vietnam and China help Laos import electricity relatively easily without influencing the power supply of the exporting power systems. Annual electricity consumption in Laos is no more than 1.5% of that of Thailand and 2.6% of Vietnam.

Looking to the domestic situation, Laos has low population density along with the small population, which generally causes difficulty in expanding electrification. However, the absolute amount of targets (households, villages etc.) to be electrified is small in Laos when a target is given in terms of ratio. When the number of total households is approximately 1 million throughout the country, 1% comes to 10 thousand households and it will cost at most $4 million to electrify 10 thousand households with 100 W solar home systems respectively, for example.

On the contrary, the size of the government must be more or less constrained by the population through the government budget and human resources even though it depends on political and socio-economic systems, and other conditions. The number of the government personnel concerned with the power sector under MEM is currently 60 or so including DEPP, DEM, DEB and IREP, and remarkable increase of staff could not be expected in the future. The roles and jobs of the government should be accordingly prioritized and organized.

Statistical comparison with the surrounding countries is summarized in Table 2-1.

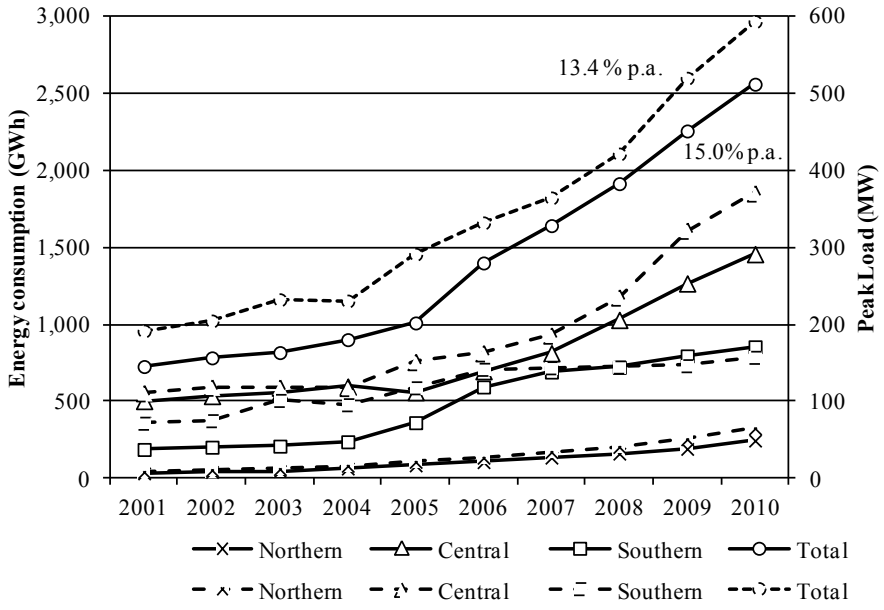
Table 2-1: Statistical comparison with the adjacent countries (as of 2010)

item		unit	China	Thailand	Vietnam	Cambodia	Myanmar	Laos
Population		millions	1,334.7	68.1	85.8	15.1	50.5	6.4
Land area		K km^2	9,600.0	513.1	331.2	181.0	676.6	236.8
Population density		People/km^2	139.0	132.7	259.1	83.4	74.6	27.0
Electricity generation		GWh p.a.	4,227,800	159,518	97,350	969	8,624	12,821
Electricity consumption		GWh p.a.	4,199,800	147,348	85,669	2,254	6,302	2,228
Per capita consumption		kWh per capita	3,147	2,162	998	149	124	346
Peak load		MW	588,230	24,010	15,560	409	1,350	476
Electrification ratio (HH)		%	99.4	86.8	97.3	23.7	25.7	73.0
Hydro potential	Gross	TWh p.a.	6,083	41	300	88	342	232
	Exploitable		2,474	16	123	30	130	63
	Per capita	kWh p.a.	1,854	235	1,434	1,987	2,574	9,844

(Source) JEPIC, WEC.

2.1.1.2 Electricity demand-supply situation

Electricity consumption has recorded remarkable growth in the last 10 years as indicated in Figure 2-1. Average annual growth ratios were 15.0% and 13.4% during the period in terms of energy consumption and peak load respectively.



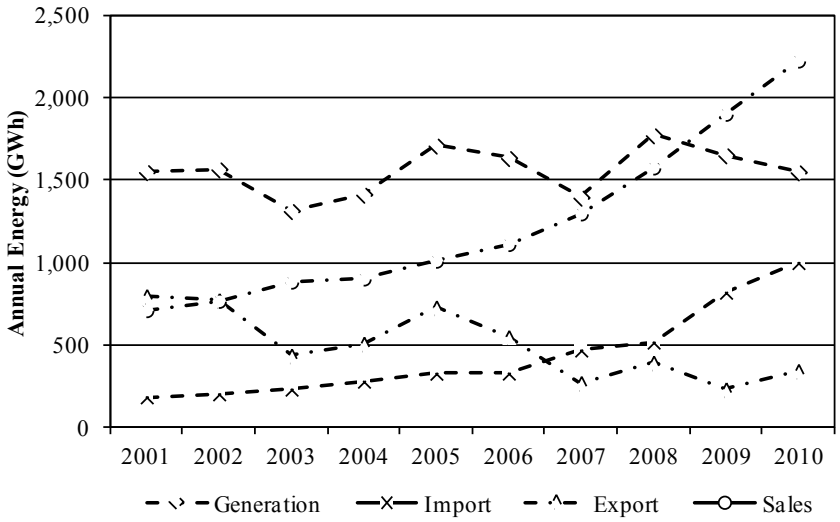
(Source) PDP 2010-2020 (Revision-1), EDL, Aug. 2011.

Figure 2-1: Energy consumption and peak load

Laos has thus far enjoyed relatively stable power supply even against the recent rapid growing demand despite its own underdeveloped power system, thanks to the power trade with neighboring countries. Historically, power systems in Laos have been developed independently around the main centers of population until recently; rather each system has been connected with its nearest power system in neighboring countries: Thailand, Vietnam and China according to its location. The power systems around

Vientiane Capital, Pakxan, Thakhek, Savannakhet and Pakse had been independent of one another and respectively connected to the EGAT system with 115 kV transmission lines and controlled by EGAT without having own load dispatching center.

Smaller systems around Bokeo, Luangnamtha, Huaphan, Laksao, etc., are still connected to foreign power systems with 22 kV lines to receive power supply. The power trade has brought not only stable power supply but also a financial benefit caused by not having extra power facilities to secure margin of safety for power supply.



(Source) EDL Electricity Statistics 2011.

Figure 2-2: Power generation and trade of EDL

2.1.1.3 Power supply system

(1) Generation facilities

Existing generation facilities in Laos are listed including both for domestic supply and for export as in Table 2-2.

Table 2-2: Existing generation facilities in Laos (as of 2012)

No.	Project	Location	Installed capacity (MW)			COD	Ownership
			Total	Domestic	Export		
1	Nam Dong	Luangprabang	1	1		1970	EDL
2	Selabam	Champasak	5	5		1970	EDL (EDL-Gen)
3	Nam Ngum 1	Vientiane	155	155		1971	EDL (EDL-Gen)
4	Xeset 1	Saravane	45	45		1990	EDL (EDL-Gen)
5	Nam Ko	Oudomxay	1.5	1.5		1996	EDL
6	Theun Hinboun	Bolikhamxay	220		220	1998	IPP (e)
	(expansion)		220		220	2012	
7	Houay Ho	Attapeu	152.1	2.1	150	1999	IPP (e)
8	Nam Leuk	Vientiane	60	60		2000	EDL (EDL-Gen)
9	Nam Ngay	Phongsaly	1.2	1.2		2003	EDL
10	Nam Mang 3	Vientiane	40	40		2004	EDL (EDL-Gen)
11	Xeset 2	Saravane	76	76		2009	EDL (EDL-Gen)
12	Nam Theun 2	Khammouane	1,075	75	1,000	2009	IPP (e)
13	Nam Ngum 2	Vientiane	615		615	2010	IPP (e)
14	Nam Lik 1/2	Vientiane	100	100		2010	IPP (d)
15	Nam Tha 3	Luangnamtha	1.25	1.25		2011	IPP (d)
16	Nam Nhone	Bokeo	3	3		2011	IPP (d)
17	Nam Phao	Bolikhamxay	1.7	1.7		2011	IPP (d)
18	Nam Song	Vientiane	6	6		2012	EDL
19	Nam Ngum 5	Luangprabang	120	120		2012	IPP (d)
20	Nam Gnuang 8	Bolikhamxay	60	60		2012	IPP (d)
Subtotal			**2,958.8**	**753.8**	**2,205**		
	Microhydro		0.15	0.15		2011	EDL
	Microhydro		1.178	1.178		2010	Province
	Solar		0.474	0.474		2011	Province
	Diesel		1.513	1.513		2011	Province
Total			**2,962.1**	**757.1**	**2,205**		

(Source) EDL Annual Report and others.

The above generation facilities are summarized by ownership and supply purpose as in Table 2-3.

All of the EDL generation facilities are categorized into domestic supply purpose in principle, but surplus electricity particularly in rainy season from Nam Ngum 1 in the central area, Xeset 1 and Xeset 2 in the southern area and others is exported to Thailand (EGAT) through the interconnection lines detailed in the following part.

Table 2-3: Summary of existing generation facilities (as of 2012)

Owner	Installed Capacity					
	Domestic		Export		Total	
	(MW)	(%)	(MW)	(%)	(MW)	(%)
EDL	390.85	51.6%	--	--	390.85	13.2%
IPP for domestic supply	285.95	37.8%	--	--	285.95	9.7%
IPP for export	77.1	10.2%	2,205	100%	2,282	77.0%
Provinces	3.165	0.4%	--	--	3.169	0.11%
Total	**757.1**	**100%**	**2,205**	**100%**	**2,962.1**	**100%**

(Source) Study Team.

In many developing countries, each government is struggling to attract foreign investment in its power sector to make up for its financial gap to develop infrastructure. Thanks to its landlocked geography and neighboring big power markets including Thailand and Vietnam, along with the various efforts of the Government, Laos has succeeded in promotion of IPP development despite its LDC status. Currently six IPP projects with the total capacity of 2,165 MW are in operation, 10 projects with 4,331 MW are under construction including Xayaburi project and Hongsa lignite thermal project, and 59 projects are in the pipeline with PDA or MOU. In recent years, IPPs for domestic supply are also becoming active, for example, Nam Lik 1/2 (100 MW) in operation and Nam Ngum 5 (120 MW) under construction.

(2) Transmission systems

The current main transmission grid in Laos consists of 115 kV lines[3] as listed in Table 2-4, and highlighted lines in the table indicate interconnection lines with adjacent countries (Thailand and China).

Table 2-4: Existing transmission lines of EDL (as of 2011)

No.	Project		Length		No. of cct	(ACSR) Conductor Size (sq-mm)	Year of Commission-ing
	from	to	(km)	(km-c)			
Northern							
1	Luang Prabang 1	Xieng Ngeun T off	15.0	15.0	1	117	1996
2	Xieng Ngeun T off	Sayaboury	74.6	74.6	1	240	1996
3	Xieng Ngeun T off	Vangvieng	132.0	132.0	1	117	1996
4	Thongkhoun	Phonsvan	105.0	105.0	1	240	2007
5	**Meng La (China)**	**Na Mo**	**34.4**	**34.4**	**1**	**185**	**2009**
6	Na Mo	Luang Namtha 1	42.7	42.7	1	240	2009
7	Na Mo	Udomxai	41.0	41.0	1	240	2009
8	Udomxai	Pakmong	51.8	51.8	1	240	2009
9	Pakmong	Luang Prabang 1	98.0	98.0	1	240	2009
10	Vangvieng	Nam Ngum 5	67.0	134.0	2	450	2010
11	Nam Ngum 5	Phonsvan	75.0	75.0	1	240	2010
Total Northern			**736.5**	**803.5**			
Central							
1	Nam Ngum 1	Thalat	4.8	4.8	1	240	1971
2	Thalat	Phonsoung	16.5	16.5	1	240	1972
3	Phonsoung	Phonsoung	52.0	52.0	1	240	1972
4	**Phontong**	**Nongkai (Thailand)**	**25.7**	**51.4**	**2**	**240**	**1972**
5	Phontong	Thanaleng	17.6	17.6	1	97	1996
6	**Thanaleng**	**Nongkai (Thailand)**	**2.0**	**2.0**	**1**	**240**	**1996**
7	Naxaythong	Tha Ngon	12.0	12.0	1	185	1996
8	Thalat	Vanvieng	63.5	63.5	1	117	1996
9	Nam Ngum 1	Naxaythong	61.0	122.0	2	240	2000
10	Nam Leuk	Pakxan	85.2	85.2	1	240	2000
11	Nam Ngum 1	Nam Leuk	55.2	55.2	1	240	2000
12	**Pakxan**	**Boungkan (Thailand)**	**11.0**	**11.0**	**1**	**240**	**2000**
13	Thalat	Ban Don	47.0	47.0	1	240	2003
14	Ban Don	Non Hai	54.0	54.0	1	240	2003
15	Naxaythong	Khoksa-at	20.6	20.6	1	240	2005

[3] 230 kV transmission lines is currently being planned and constructed; Hinheup - Naxaythong line started operation in 2012; Luangprabang - Hinheup line is under construction; and others are planned aiming commercial operation in 2014, as detailed in Chapter 4.

No.	Project		Length		No. of cct	(ACSR) Conductor Size (sq-mm)	Year of Commission-ing
	from	to	(km)	(km-c)			
16	Nam Mang 3	Khoksa-at	34.5	34.5	1	240	2005
17	Khoksa-at	Thanaleng	18.5	18.5	1	240	2005
18	Naxaythong	Phontong	12.0	24.0	2	240	2006
19	Nam Leuk	Thongkhoun	59.0	59.0	1	240	2007
20	Thongkhoun	Phubia Mining	13.0	13.0	1	240	2007
21	Vanvieng	Him Heup	40.8	40.8	1	240	2009
22	Hin Heup	Thalat	27.0	27.0	1	240	2009
23	Hin Heup	Ban Don	20.0	20.0	1	240	2009
24	Nam Lik 1/2	Hin Heup	31.0	31.0	1	240	2010
25	Nam Lik 1/2	Ban Don	16.0	16.0	1	240	2010
Total Central			**799.9**	**898.6**			
Southern							
1	**Bang Yo**	**Shilinthon (Thailand)**	**41.0**	**41.0**	**1**	**240**	**1996**
2	Jiengxai	Bang Yo	10.0	20.0	2	240	1996
3	Pakbo	Kengkok	52.0	52.0	1	240	1996
4	**Pakbo**	**Mukdahan (Thailand)**	**0.4**	**0.4**	**1**	**240**	**2000**
5	Thakhek	Mahaxai	47.0	94.0	2	240	2004
6	Mahaxai	Xepon Mining	117.0	117.0	1	240	2004
7	Thakhek	Mahaxai Cement Factory	25.0	50.0	2	240	2004
8	**Thakhek**	**Nakhon Phanom (Thailand)**	**4.0**	**8.0**	**2**	**240**	**2004**
9	Jiengxai	Xeset 1	76.0	76.0	1	240	2005
10	Jiengxai	Ban Na	59.0	118.0	2	240	2005
11	Ban Na	Ban Hat	62.0	124.0	2	240	2005
12	Ban Na	Saphaothong	45.0	90.0	2	240	2005
13	Nam Theun 2	Mahaxai	18.0	36.0	2	240	2005
14	Mahaxai	Cement Factory	27.0	27.0	1	240	2009
15	Xeset 1	Xeset 2	3.0	6.0	2	240	2009
16	Xeset 2	Pakxong	42.0	84.0	2	240	2009
17	Pakxong	Jiengxai	43.0	86.0	2	240	2010
18	Thakhek	Pakbo	87.0	174.0	2	240	2010
19	Thakhek	Pakxan	198.0	396.0	2	240	2011
Total Southern			**956.4**	**1,599.4**			
Total Laos			**2,492.8**	**3,301.5**			

(Source) PDP 2010-2020 (Revision-1), EDL, 2011.

The power supply area in Laos was once divided into four major unconnected supply areas (Northern, Central 1, Central 2 and Southern) and a number of smaller isolated systems. The major areas consisted of the provinces are indicated in Table 2-5.

Table 2-5: EDL's major supply areas in 2004

Area	Provinces
Northern	Phongsaly, Luangnamtha, Oudomxay, Huaphan and Bokeo
Central 1 (C1)	Luangprabang, Xiengkhuang, Xayaboury, Vientiane, Bolikhamxay, and Vientiane Capital, (Xaisômboun Special Region[4])
Central 2 (C2)	Khammouan, Savannakhet
Southern	Saravan, Champasak, Sekong, Attapeu

(Source) EDL Annual Report 2004, etc.

In the Northern area, no high voltage (HV) grid had been established until 2009 when 115 kV transmission line extended from Luangprabang in the Central 1 area by the finance of ADB. As shown in Table 2-2, there have been several small hydropower stations (Nam Ko, Nam Ngay, Nam Tha 3 and Nam Nhon) despite its huge hydro-potential, and microhydro and diesel generation has been operated by EDL and provinces.

In the Central 1 area where Vientiane Capital is located, electricity demand was predominant among the country and the 115 kV transmission system covered Vientiane, Luangprabang, Vangvieng, Pakxan, Xiengkhuang and Xayaboury. 115 kV interconnection lines with EGAT were developed at Phontong and Thanaleng in Vientiane Capital and Pakxan in Bolikhamxay, and the excess power from Nam Ngum 1 was exported through the Phontong – Nongkai interconnection.

In the Central 2 area, two isolated networks supplied electric power from Thakek and Pakbo both of which received electric power from Nakhon Phanom S/S and Mukdahan S/S of EGAT's 115 kV grid, respectively. The 300 km Paxkan-Thakek-Pakbo 115 kV transmission line was completed in 2011 funded by Japan's yen loan and thus the C2 area had been connected to the C1 grid.

In the Southern area, Xeset 1 (45 MW) and Selabam (5 MW) supplied electric power through the 115 kV and 22 kV grid covering Champasak and Saravan. Import from EGAT was also a major power supply source particularly in the dry season through interconnection between Bang Yo substation in Paxse in Champasak Province and Sirindhorn hydropower station in Ubon Ratchathani in Thailand. In Attapeu Province, Houay Ho IPP, which has the capacities of 150 MW for export and 2.1 MW for domestic supply, provided electricity isolatedly to the city area.

In this way, the power supply system in Laos has been gradually integrated through the extension of the 115 kV grid so far as shown in Table 2-4, and supply areas are re-defined in the current PDP as follows:

- Northern: Phongsaly, Oudomxai, Luangnamtha, Bokeo, Huaphanh, Luangpabang, Xayabuly and Xiengkhouang;
- Central: Vientiane Capital, Vientiane and Bolikhamxai; and
- Southern: Khammouan, Savannakhet, Salavan, Sekong, Champasak and Attapeu.

The study followed the above definition of supply areas unless otherwise noted.

[4] Dissolved on Jan. 13, 2006 and reassigned to Vientiane Province.

2.1.1.4 Electricity tariff

The average electricity tariff is the second lowest in ASEAN countries next to Vietnam as indicated in Table 2-6 In the case of Laos, no government subsidies have been directly infused into EDL while some grid expansion projects financed by the government are transferred to EDL, and the dividends from IPPs contribute much to the financial balance of EDL.

Table 2-6: Electricity business summary in ASEAN countries in 2010

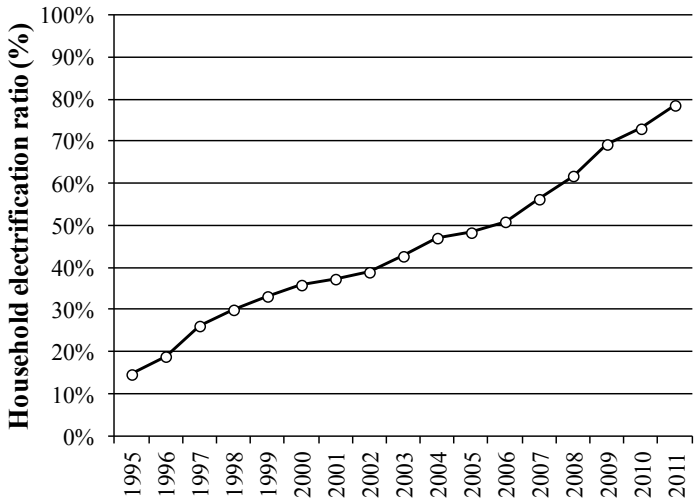
Item / Country	Population (million)	GDP per capita (US$)	Electrification ratio (%)	Electricity consumption per capita (kWh)	Average electricity rate[1] (US¢/kWh)	Currency exchange rate as of Jan. 2009 (LC/US¢)
Singapore	4.8	43,867	100.0	8,517	13.15	1.40
Malaysia	27.9	8,393	93.5	3,248	9.27	0.034
Thailand	68.1	4,730	86.8	2,162	10.15/ 9.42[2]	0.33
Philippines	93.6	2,007	73.0	543	16.63	0.46
Indonesia	232.5	2,978	67.2	633	7.44	93.95
Vietnam	85.8	1,068	97.3	998	5.72	184.7
Laos	6.4	1,069	73.0	346	6.59	84.67
Cambodia	15.1	678	23.7	149	18.97	41.45
Myanmar	50.5	702	25.7	124	--[3]	--[3]

Note: 1) defined as total power sales revenue divided by total sold electric energy, 2) MEA/PEA,
3) unreliable figure due to exchange rate

(Source) Electric Power Industry Statistics in Asia (FY2010), JEPIC.

2.1.1.5 Rural electrification

Rural electrification has been steadily expanding in Laos with the assistance of development partners such as the World Bank, ADB and JICA. Electrification ratio in terms of household has been growing from 15% in 1995 to 78.5% in 2011, and the ratio in 2012 has reportedly surpassed 80% which is the target figure in 2015. The average annual growth during 2000 to 2011 yields to 3.9 points per year, and overall records from 1995 to 2011 are shown in Figure 2-3.



(Source) Study team on EDL Statistics 2011.

Figure 2-3: Household electrification ratio during 1995-2011

In the meantime, a large regional disparity among provinces in electrification ratio still remains. Remote areas such as Phongsaly, Oudomxay and Huaphanh in the northern area, and Sekong and Attapeu in the southern area have far less electricity access than the national average, where high voltage transmission lines have not reached yet.

Table 2-7: Province-wise electrification ratio as of 2011

No.	Province	%	No.	Province	%	No.	Province	%
Northern		**64.39**	**Central**		**94.49**	**Southern**		**80.55**
1	Phongsaly	21.86	9	Vientiane	87.45	12	Khammouane	77.33
2	Bokeo	82.88	10	Vientiane Cap.	100.00	13	Savannakhet	83.42
3	Luangnamtha	71.05	11	Bolikhamxai	90.84	14	Saravane	78.03
4	Oudomxay	56.63				15	Sekong	68.03
5	Huaphanh	44.57				16	Champasak	87.20
6	Xiengkhuang	69.48				17	Attapeu	55.36
7	Luangprabang	73.96						
8	Xayaboury	78.01						

(Source) EDL Statistics 2011.

2.2 Government policies on power sector

In Laos, the power sector aims to serve two vital national priorities:

i) It provides a reliable and affordable power supply to Lao society and industry. Inexpensive electricity promotes competitiveness in Lao commerce and brings social benefits to urban and rural communities; and

ii) It earns foreign exchange from electricity exports. The country possesses abundant energy resources, principally hydropower but also coal, and the exploitation of these resources through electricity exports is at the heart of GOL‘s strategy for earning the revenues needed to fund the country‘s development.

The first objective is usually common and primary among other ordinary countries, and the second one is afforded to only limited countries such as Bhutan, Nepal, Canada, Norway etc., having not only sufficient electricity but infrastructures for power trade with neighboring countries. Considering the finite nature of natural resources or potentials, and financial constraint, these two objectives could sometimes be contradictory to each other. For example, some large potential suitable for export may be developed as a number of small projects for domestic supply, resulting in spoiling the full potential. In this context, harmonized policies to achieve the above two objectives would be more important for Laos.

2.2.1 Regional cooperation

The development of the power sector in Laos is an integral part of the regional development, and the national electricity development policies should be discussed also in the context of regional cooperation. Bilateral power trade has already been realized as mentioned earlier. Multilateral cooperation through the ASEAN and the GMS is being planned based on the basis of precedent bilateral cooperation.

(1) Bilateral agreement

1) Thailand

In 1993, the Government of the Lao PDR (GOL) and the Government of the Kingdom of Thailand signed a Memorandum of Understanding (MOU) on the power exchange program for the export of electricity up to 1,500 MW to Thailand by 2000. In 1996, the agreement was superseded by a new MOU increasing the scope of supply to 3,000 MW. Since then, further MOUs between the two countries have been signed agreeing on supply of 5,000 MW to Thailand by 2015 and another 2,000 MW after 2015.

2) Vietnam

The GOL signed the cooperation agreement with the Socialist Republic of Vietnam in 1998 that Laos would export electricity to Vietnam from 1,500 to 2,000 MW in the year 2010 and has further agreed in 2006 to export up to 3,000 MW in year 2020.

3) Cambodia

In 1999, an agreement on cooperation in the power sector was signed with Cambodia, and Electricité du Cambodge (EDC) and Electricité du Laos (EDL) signed a power purchase agreement in 2007 by which EDL will supply around 10 MW from its southern grid to meet small load demand centers in Cambodia. In the meantime, there was an agreement in place between the two governments for the supply of 200 MW from Laos to Cambodia by 2020.

(2) Multi-lateral agreement

There are two initiatives on the regional power network development which Laos is participating in: one is the ASEAN Power Grid (APG) covering all 10 member countries of ASEAN, and the other is the GMS program covering 6 countries around the Mekong River including Yunnan Province of China.

These international interconnection networks are expected to bring directly the following benefits into the member countries:

i) Reduction of electricity supply cost;
ii) Improvement of reliability of electric power supply through sharing the generation reserve margin;
iii) Promotion of international power trading and formation of a regional power market; and
iv) Reduction of environmental impact by effective use of hydropower resources.

It is also expected to contribute finally to the correction of regional economic disparities among the ASEAN countries and regional political stability.

Currently, development agencies ADB, World Bank, and JICA are putting an emphasis on supporting for less developed countries in ASEAN such as Cambodia, Laos, Myanmar, and Vietnam.

1) ASEAN Power Grid

―The ASEAN 2020 Vision" at the informal summit meeting of ASEAN in 1997, adopted two programs interconnecting energy infrastructures among the member countries: the Trans-ASEAN Gas Pipeline and

the ASEAN Power Grid, which will promote "win-win" economic relationships among the countries.

Succeeding this, the ASEAN Action Plan on Energy Cooperation (1999-2004) was adopted at the ASEAN Energy Ministers Meeting in 1999, which positioned the ASEAN power grid as one of the goals of energy cooperation among the ASEAN countries, and at the same time, the ASEAN Center for Energy (ACE) was established as an intergovernmental organization to lead and coordinate the energy cooperation, at the same time.

In the ASEAN Power Grid, 14 projects were identified, which were specifically promoted based on the bilateral agreements between the relevant electric power companies or authorities involved in each project. The Head of ASEAN Power Utilities/Authorities (HAPUA) established under the ACE, consisting of major electric power utilities, is playing a central role to materialize the ASEAN Power Grid, and conducted two master plan studies[5] in 2003 and 2008.

As shown in Figure 2-4, out of the 16 projects, 3 projects are related to Laos. They are No. 9: Thailand – Laos, No. 10: Laos – Vietnam, and No. 13: Cambodia – Laos, which are all the projects on the basis of the bilateral agreement described above. Laos is, as the battery of Indochina, increasing its influence on the mid to long term power development plans of neighboring countries.

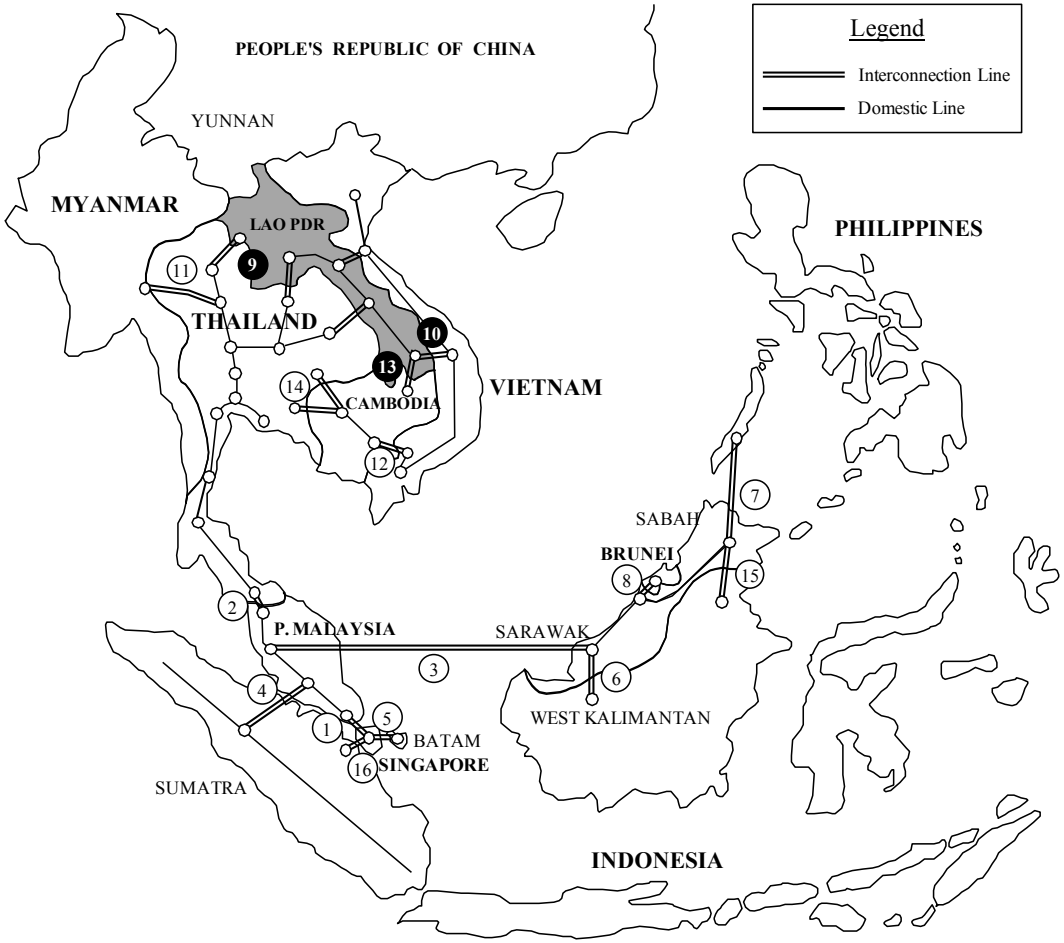
2) Greater Mekong Sub-region (GMS)

The GMS Program is a comprehensive program for regional cooperation led by the Asian Development Bank (ADB) in 1992, consisting of six countries (Vietnam, Laos, Cambodia, Thailand, Myanmar, and Yunnan Province of China). Triggered by the expansion of ASEAN[6] in the late 1990's, ASEAN countries have been strengthening their involvement in the GMS as a clue to enhance economic relationships with China. In the GMS program, multi sectoral infrastructure development for regional cooperation is being developed such as transportation and communication, energy, and telecommunication.

In the power sector, after the conclusion of the first agreement on the need to establish Regional Power Trade (RPT) in 1995, the following policy and institutional framework have been developed so far.

- GMS Policy Statement on Regional Power Trade, 2000.
- Inter-Governmental Agreement (IGA) on Regional Power Trade in the GMS, 2002.
- MOU on the Guidelines for the implementation of the regional power trade operating agreement (RPTOA) – Stage 1, 2005.
- MOU on the Road Map for implementing the Greater Mekong Sub-region cross border power trading, 2008.

[5] The ASEAN Interconnection Master Plan Study (AIMS) and AIMS II
[6] Vietnam joined ASEAN in 1995, Myanmar and Laos in 1997, and Cambodia in 1999.



	Expected COD
1) P.Malaysia - Singapore (New)	2018
2) Thailand - P. Malaysia	
• Sadao - Bukit Keteri	Existing
• Khlong Ngae - Gurun	Existing
• Su Ngai Kolok - Rantau Panjang	(Newly Proposed)
• Khlong Ngae - Gurun (additional)	2016
3) Sarawak - P. Malaysia	2015-2021
4) P.Malaysia - Sumatra	2017
5) Batam - Singapore	2015-2017
6) Sarawak - West Kalimantan	2015
7) Philippines - Sabah	2020
8) Sarawak - Sabah - Brunei	
• Sarawak - Sabah	2020
• Sabah - Brunei	Not selected
• Sarawak - Brunei	2012-2016
9) Thailand - Lao PDR	
• Roi Et 2 - Nam Theun 2	**Existing**
• Sakon Nakhon 2 - Thakhek - Theun Hinboun (exp.)	**2012**
• Mae Moh 3 - Nan - Hong Sa	**2015**
• Udon Thani 3 - Nabong (converted to 500 kV)	**2017**
• Ubon Ratchathani 3 - Pakse - Xepian Xenamnoy	**2018**
• Khon Kaen 4 - Loei 2 - Xayaburi	**2019**
• Thailand - Lao PDR (New)	**2015-2023**
10) Lao PDR - Vietnam	**2011-2016**
11) Thailand - Myanmar	2016-2025
12) Vietnam - Cambodia (New)	2016
13) Lao PDR - Cambodia	**2015**
14) Thailand - Cambodia (New)	2015-2017
15) East Sabah - East Kalimantan	Feasibility Study
16) Singapore - Sumatra	2020

(Source) Study Team based on 5th Meeting of HAPUA Working Committee, June 2012.

Figure 2-4: Progress of ASEAN interconnection projects

The development of the RPT process is described with Stages 1-4:

Stage 1: corresponds to the initial period when only country-to-country power transactions are possible, before a regional transmission network is established to enable power trading between any pair of member countries. During this period, the existing cross-border transmission lines are mostly associated with Power Purchase Agreements between the Parties or an Independent Power Producer located in any one Party country selling power to a National Power Utility in a neighboring country. The cross border trading in Stage 1 refers to opportunity exchange of power between National Power Utilities of the Parties using the excess capacity of existing cross border transmission lines over and above the transmission capacity required for power transfers associated with Power Purchase Agreements.

Stage 2: corresponds to the moment when trading will be possible between any pair of GMS countries, eventually using transmission facilities of a third regional country. However, in this stage the available cross-border capacity is limited and based on surplus capacity of lines linked to Power Purchase Agreements.

Stage 3: interconnectors will be developed expressly for cross-border power trading, and third parties (other than national utilities) will be permitted to begin trading over these.

Stage 4: a competitive regional power market would be established. A precondition for this would be the establishment of multi-seller, multi-buyer power markets in member countries.

The Road Map in the latest MOU contains actions and an indicative timeline up to 2012 required to implement Stage 1 of regional power trading and prepare for Stage 2 as follows:

- Completion of the studies on performance standards, transmission regulations, a priority interconnection plan, standard metering and communications arrangements and power trade rules by 2009–2010 for implementation of Stage 1.
- Completion of studies on a GMS grid code, expanded transmission regulations and identification of regulatory barriers to the development of power trade by 2012 in readiness for Stage 2.

2.2.2 National power sector policies

There are several governmental documents titled policy, strategy or plan in relation to the power sector, but the contents are almost common except the difference of statistical and planned figures by the year of issuance, despite their hierarchical status. Typically, the accumulation of planned projects in the near future is referred to as the targets during the period, and few specific policies or targets are mentioned in the actual sense. Only the quantitative targets are rural electrification ratios, and the amount of bilateral power trade mentioned in 2.2.1 (1).

For example, EDL says in the PDP,

"EDL has set up the policy on the power supply sources as follows:

- *EDL will put an investment on some new power plants,*
- *Purchase from Small Power Producers (SPP) and Domestic Independent Power Producers, IPP (d) projects,*
- *Purchase from off-take from IPP (e) projects,*
- *Continue to imports power from neighboring countries to the area where no network accessed, and*
- *Continue to exchange (imports/export) power from neighboring countries to increase reliability and security of power supply."*

This statement is a kind of fact for power supply options: a policy should state at least the principle for role demarcation of the power supply sources, and quantitative targets, even better.

2.2.2.1 Energy sector policies

(1) The Strategy Plan for Developing Energy and Mines from 2006 to 2020[7]

―The Strategy Plan for Developing Energy and Mines from 2006 to 2020" (Strategy Plan) is the only policy document specialized in the energy sector prepared by MEM in March 2008.

The Strategy Plan consists of three parts:

Part I: Summary of the implementation of the 5th Five Year Plan (2001-2005)
Part II: Strategy Plan for Developing of Electricity and Mines up to 2020
Part III: Establishment of Implementation Standard

In Part II, some quantitative target objectives by 2010 and 2020 are described as follows:

by the year 2010

- The contribution of energy and mines sector to GDP is higher than 15 % of the total.
- Annual growth ratio in electricity sector is 15.20 % in average.
- Nation-wide household electrification ratio is 70 %.

by the year 2020

- The contribution of energy and mines sector to GDP is higher than 25 % of the total.
- Annual growth ratio in electricity sector is 24.32 % in average.
- Nation-wide household electrification ratio is 90%.

The following issues are described in the Strategy Plan as the detailed strategy plans for developing of the electricity sector.

i) Domestic electricity demand forecast
ii) Strategy on power development for domestic supply
iii) Strategy on power development for export
iv) Transmission system development plan

[7] Originally written in the Laotian language, the following description is made under unofficial translation by IEEJ in 2012 even though the translation seems to contain a lot of errors.

v) Future activities

vi) Management of electricity business

Items ii) and iii) were entitled ―strategy", but most of the contents are project lists in the pipeline, and few strategies are described.

(2) Renewable Energy Development Strategy in Lao PDR

Renewable Energy Development Strategy in Lao PDR (RE Strategy) was formulated by MEM with the assistance of the Government of Finland, and approved by the Prime Minister in October 2011.

The Government gives an ambitious target to increase the share of renewable energies to 30% of the total energy consumption in 2025, and the breakdown is indicated as in Table 2-8.

Table 2-8: Renewable energy development until 2025

Item	Types	Potential	Existing	2015		2020		2025	
				MW	kTOE	MW	kTOE	MW	kTOE
A	**Electricity**	**MW**	**MW**	**140**	**89**	**242**	**155**	**651**	**416**
1	Small hydro	2,000	12	80	51	134	85	400	256
2	Solar	511	1	22	14	36	23	33	21
3	Wind	> 40		6	4	12	8	73	47
4	Biomass	938		13	8	24	16	58	37
5	Bio gas	313		10	6	19	12	51	33
6	Solid waste	216		9	6	17	11	36	23
7	Geothermal	59							
B	**Bio-fuel**	**ML**	**ML**	**ML**	**20**	**ML**	**417**	**ML**	**662**
1	Ethanol	600		10	7	106	178	150	279
2	Biodiesel	1,200	0.01	15	13	205	239	300	383
C	**Thermal energy**	**kTOE**	**kTOE**		**62**		**95**		**400**
1	Biomass	227			23		29		113
2	Bio gas	444			22		44		178
3	Solar	218			17		22		109
Total									
Energy demand		kTOE			2,504		4,064		4,930
RE contribution					172		668		1,479
Share of RE					6.9%		16.4%		30.0%

(Source) Renewable Energy Development Strategy, MEM, 2011.

Small scale hydropower is defined as not more than 15 MW of capacity, and the potential is estimated as 2,000 MW while the existing capacity is no more than 12 MW. Using the conversion factor defined by IEA, 256 kTOE is equivalent to 2,977 GWh, which requires 85.0% of capacity factor with 400 MW capacity. The other types of electricity generation, too, seem unrealistic, particularly solar and wind, which have a capacity factor of around 85%.

Although some questionable figures are observed, the allocation of investment until 2025 is summarized as in Table 2-9.

Table 2-9: Investment allocation in RE sector

Item	Types	2015		2020		2025	
		MW	MUSD	MW	MUSD	MW	MUSD
A	**Electricity**	**140**	**477**	**242**	**1,041**	**666**	**1,753**
1	Small Hydro	80	288	134	629	400	1,010
2	Solar	22	41	36	90	48	144
3	Wind	13	24	24	52	58	72
4	Biomass	10	21	19	45	51	192
5	Bio gas	9	48	17	105	36	168
6	Solid waste	6	55	12	120	73	168
B	**Bio-fuel**	**ML**	**MUSD**	**ML**	**MUSD**	**ML**	**MUSD**
	Ethanol	2	5	41	33	79	63
	Biodiesel	2	9	50	33	79	63
C	**Research & Development**		**5**		**10**		**17**
Total			**496**		**1,117**		**1,896**
Public investment			5		10		17
Public enterprise investment			10		22		36
Private investment			481		1,085		1,844

(Source) Renewable Energy Development Strategy, MEM, 2011.

2.2.2.2 Power sector policies

(1) Provisions of Electricity Law

The Electricity Law, the governing law of the power sector, stipulates the necessity of basic power sector policies such as electricity development plan (Article 10), technical standards (Article 22), electricity enterprises (Article 27), concession procedures (Article 29) and electricity tariff (Article 47).

Out of the above five policy issues, only the regulatory provision was so far being observed along with the technical cooperation of JICA (IPSM), and the other three issues were focused in the ongoing technical assistance (TA) of the World Bank (WB), as summarized in Table 2-10. The details of WB-TA are described in Section 2.7 together with the activities of other donors.

Article 10 (electricity development plan), in particular should be managed by DEPP, and no other assistance had been provided, so the Study Team proposed to make preparation to formulate a comprehensive electricity development plan — named as the "National Power Development Plan (NPDP)" — in the Study as detailed in Chapter 3.

Table 2-10: Provisions in Electricity Law and current situation

Article No.	Provision	Current situation	Responsible organization	Donor's assistance
10	(Electricity Development Plan) • EDP shall determine the targets, directions, mechanisms and methods in developing the technical and economical base for the electricity project; ensure the safe and regular supply of electricity, and mitigate social and environmental impacts in electricity business development. • MEM is the principal in coordination with the concerned organizations in setting up the EDP and then, submit them to the Government.	• EDL-PDP is a business plan of EDL, still necessary targets, directions, mechanisms, methods, or social environmental impact assessment. • MEM should have taken actions for setting up the EDP.	DEPP	--
22	(Establishment and Compliance with Electricity Technical Standards) • MEM is responsible to establish the Electricity Technical Standards. • Any new installation, expansion, repair, design, construction, operation and maintenance or management of electrical facilities shall be complied with the LEPTS.	• LEPTS was formulated and legitimated in 2004. • The facilities of EDL need to comply with the LEPTS.	DEM	JICA-IPSM[8]
27	(Conditions for Establishment of Electricity Enterprises) 1. Experiences in business operation; 2. Financial stability; 3. Sufficiency of electrical engineers and other specialist concerned; 4. No subject to court sentences	Specific quantities for business experiences, financial stabilities or technical sufficiency should be stipulated.	DEB	WB-TA[9]
29	(Concession Procedures: MOU, PDA and CA) The detailed procedures, contents of each task components and authorization granting shall be complied with the specific regulation issued by MEM.	The specific regulation for MOU, PDA and CA has not yet been issued.	DEB	WB-TA
47	(Electricity Prices) The electricity prices shall ensure the electricity investment return. MEM shall cooperate with other parties to study the electricity price structure to submit the Government.	• The current tariff is not enough to ensure the sufficient investment return for EDL (e.g., ROA = 1%). • Tariff study has not yet started.	DEPP	WB-TA

(Source) Study Team.

(2) Power Development Plan (PDP)

The current "Power Development Plan" (PDP) is a ten year long-term plan prepared by EDL every three years; the current one covers the period "2010-2020" succeeding the former "2004-2013" and "2007-2016" versions. Revised editions also come out in the interim years, and the latest edition is PDP 2010-2020 (Revision-1) issued in August 2011.

The latest PDP was prepared to update the preceding PDP 2010-2020 to comply with the Strategy Plan of the Ministry of Energy and Mines mentioned above and to fulfill the Government's target on the rural electrification: i.e., 80% of total country households in 2015 and 90% in 2020 to be electrified

[8] Project for Improvement of Power Sector Management.
[9] Technical Assistance for Capacity Building in the Hydropower and Mining Sectors.

respectively. The scope of work consists of the following four parts:

1) Electricity Demand Forecasts
2) Generation Development Plan
3) Transmission Line and Substation Development Plans
4) Load Dispatching Center

More detailed discussion on the current PDP is made in Chapter 4.

In the meantime, the necessity of a more comprehensive power development plan is declared in the Electricity Law amended in December 2011, succeeding the former Electricity Law 2008.

The Law says in Article 10:

"The electricity development plan shall:

1. *Ensure the principles of the use of natural resources source, energy source in appropriated, economical and highly effective manner;*
2. *Determine the targets, directions, mechanisms and methods in developing the technical and economical base for the electricity project; ensure the safe and regular supply of electricity, and mitigate social and environmental impacts in electricity business development;*
3. *Ensure the domestic consumption based on economic and social growth in each period and policy on national socio-economic development;*
4. *Determine the electricity export based on the priority of electricity consumption and needs in neighboring countries.*

The electricity development plans consist of strategic plan and long, medium and short terms plans.

Ministry of Energy and Mines is the principal in coordination with the concerned organizations in setting up the electricity development plans and then, submit them to the Government for consideration."

The existing PDP prepared by EDL is a business plan or domestic power supply plan of an electric utility and different from the said comprehensive electricity development plan, lacking most of the prescription in the Electricity Law. Specifically, issues stipulated in the clauses 1, 2 and 3 are not mentioned in the existing PDP. The allocation of primary energy including renewable energy, and the priority of development projects (order of economy) are not mentioned. Although electricity projects are listed, specific targets, directions, mechanisms and methods are not found as well as why and how such projects are planned. Also, there is no description about environmental and social consideration.

2.3 Power sector organizations

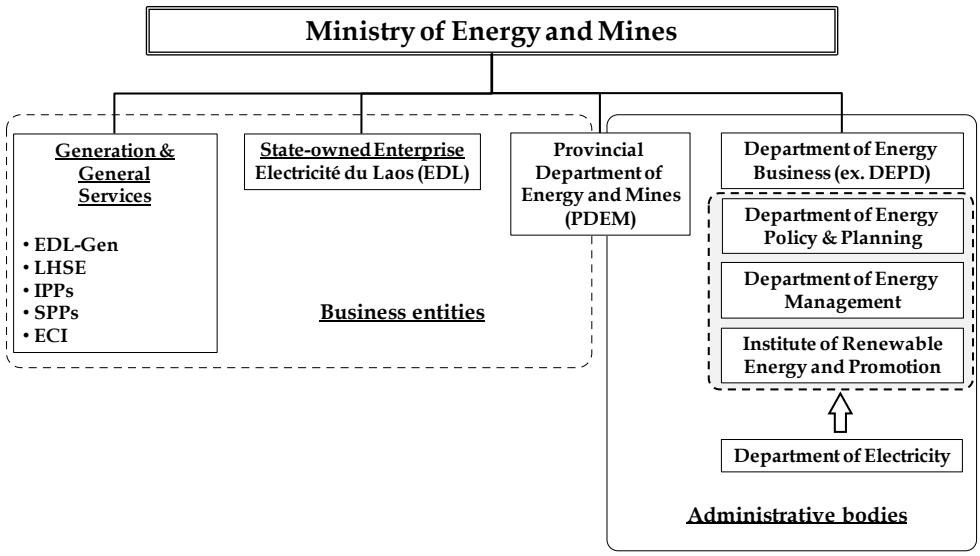
2.3.1 Institutional structure of power sector

The current power sector structure in Laos is indicated in Figure 2-4.

The governmental administrative function consists of four central administrative departments, provincial

departments placed in 16 respective provinces and the Vientiane Capital, and business entities including EDL and local government, all of which are under direct control of the MEM. Among them, PDEM has both administrative and business implementing functions; PDEMs are responsible for the formulation of policies and planning, and licensing process for private electric power undertakings, as well as implementing the electrification projects funded by the government.

Private investors including independent power producers (IPPs) for export (IPP (e)) and IPPs for domestic supply (IPP (d)) have been engaged in generation business since 1998, which are also under control of MEM through the bilateral agreement such as MOU, PDA and CA with DEB, and regulatory examination and inspection by DEM. Furthermore, some IPPs are partly owned by MEM through the shareholding by EDL or ECI.



(Source) Study Team based on the MEM information.

Figure 2-5: Institutional structure of power sector in Laos[10]

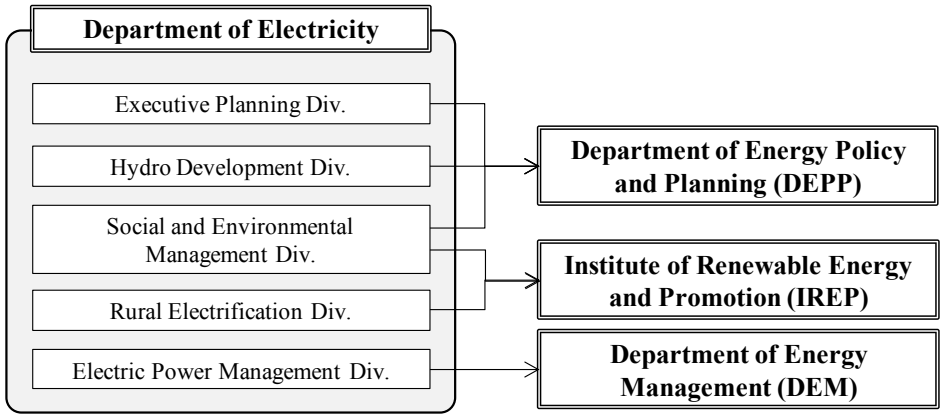
2.3.2 Administrative organizations

The Department of Energy (DOE) has long been in charge of the government's administration of the power sector in Laos, once under the Ministry of Industry and Handicraft (MIH) and then under the MEM since 2005. In addition, the Department of Energy Promotion and Development (DEPD[11]) was established under MEM in 2006 as the coordinating organization in the power sector to promote private power development which had been stagnant until then.

DOE has been governing the administration of the energy sector not as the Department of *Energy* but as the Department of *Electricity* under the Ministry of *Energy* traditionally in the context of "commercial energy = hydropower = electricity" in Laos. However energy development other than hydro has been active in recent years such as the lignite fired thermal IPP at Hongsa in the Xayabury Province which is

[10] This figure does not indicate a strict singular relationship such as a legal or ownership relation, but all the players are illustrated under the control of MEM. For instance, LHSE is a state-owned enterprise established under the Ministry of Finance, and IPPs and SPPs are independent from MEM in terms of ownership relation.
[11] The title has been changed into the Department of Energy Business (DEB) since December 2011.

currently under construction, and the exploration of high-grade coal (anthracite) in the southern region. Moreover, the development of off-grid (standalone) electricity supply in remote areas using renewable energy sources including solar home systems (SHS) in particular has been actively promoted with the technical and financial support of donor agencies in order to achieve the electrification ratio of 90% by 2020, while the current electrification ratio remains 78.5% as of the end of 2011. Against the backdrop of diversification of recent energy development noted above, organizational restructuring has been undertaken under the Ministry of Energy and Mines. More exactly as indicated in the figure below, the five divisions under the Department of Electricity were restructured and reorganized into two departments and an institution, and each agency has got more authorities and functions. The mandates (TOR: terms of reference) of the newly established agencies (DEPP, DEM and IREP) were prescribed by the ministerial decrees in May 2012, and the staffing of each agency is in the midst of preparation.



(Source) Study Team

Figure 2-6: Restructuring of DOE (as of Feb. 2012)

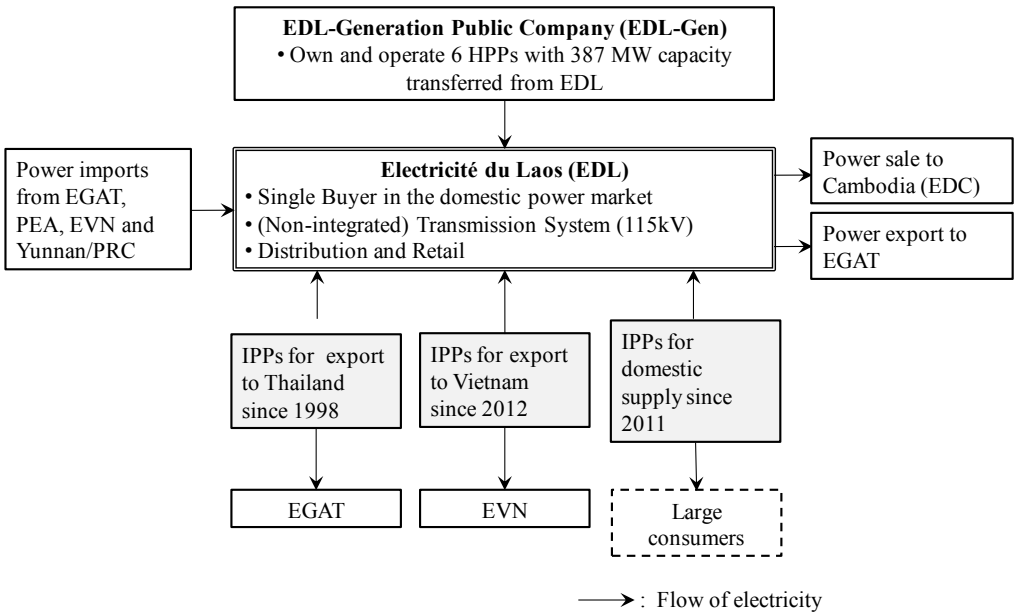
2.3.3 Business entities

The governmental electric power business entities in the Lao power sector are EDL-Gen, LHSE and ECI besides EDL.

2.3.3.1 Electricité du Laos

Electricité du Laos (EDL) is the state corporation under MEM that has long been monopolistically running domestic power supply business in Laos since 1961 in the vertically integrated form of generation, transmission and distribution. EDL is also managing the import and export of electricity with Thailand, Vietnam, China and Cambodia through its national power grid. In 2010, the generation division including six power stations was spun off and EDL-Gen was established.

Currently, EDL is the single-buyer in the domestic power market, and owns and operates transmission, distribution and retail sales business as illustrated in Figure 2-7.



(Source) Study Team.

Figure 2-7: Power sector structure in Laos

In addition, EDL has been investing in IPP business on behalf of the Government. The first two IPPs — Houay Ho and Theun Hinboun—are exporting projects to Thailand (EGAT), but after the establishment of LHSE, EDL is supposed to invest in domestic IPPs although the demarcation doesn‘t seem very strict so far.

Table 2-11: IPP projects (to be) invested by EDL (as of Mar. 2013)

No	Name of Project (Location)	Installed Capacity (MW)	COD	Investors (Sponsors)	Market
1	Theun-Hinboun (Bolikhamxay)	220	1998	•EDL 60% •Nordic Hydropower 20% •GMS Power 20%	Thailand
	Theun-Hinboun Expansion	220	2012		Thailand
	Nam Gnouang 8	60			Laos
2	Houay Ho (Champasak/Attapeu)	152	1999	•EDL 20% •Glow Co, Ltd 67.25% •Hemaraj Land & Development 12.75%	Thailand
3	Nam Lik 1-2 (IPP) (Vientiane)	100	2010	•EDL 10% •CWE 90%	Laos
4	Nam Ngum 2	615	2011	•EDL 25% •Ch. Kanchang 28.5% •PT Construction & Irrigation Co. 4% •Ratchaburi 25% •Bangkok Expressway PCL 12.5% •TEAM Consulting Engineering 1% •Shlapak Group 4%	Thailand
5	Nam Ngum 5 (Luangprabang/Xiengkhouang)	120	2012	•EDL 15% •Sinohydro 85%	Laos
6	Xekaman 3 (Xekong)	250	2012	•EDL 15% •VLP 85%	Laos/ Vietnam
7	Nam Phak (Champasak)	45	*TBD*	•EDL 20% •Kobe Green Power Co., Ltd 80%	Laos
8	Xayabouri (Xayaboury/Luangprabang)	1,285	2019	•EDL 20% •Ch. Kanchang 30% •EGCO 12.5% •Natec Synergy 25% •Bangkok Expressway 7.5% •PTT 5%	

(Source) Study Team based on DEB website (http://www.poweringprogress.com/).

2.3.3.2 EDL Generation Public Company

EDL Generation Public Company (EDL-Gen) has been established as a joint stock company unbundling the generation unit of EDL, and 75% of its shares are owned by the GOL, and an IPO of the rest were sold in the Lao Securities Exchange (LSX) in December 2010. Even though the functions of planning, design, procurement and construction of generation projects still remain in EDL, and EDL-gen is currently in charge of operation and maintenance of generation facilities transferred from EDL, EDL-Gen is planned to conduct in the future a full sequence of generation business from planning to operation with financing from the market.

Table 2-12: Generation assets of EDL-Gen

No.	Power plant	Location	Installed capacity (MW)	Annual energy (GWh p.a.)	Commercial operating date	Net asset transfer (million Kip)
1	Nam Ngum 1	Vientiane	155	1,002	1971	975,835
2	Nam Leuk	Vientiane	60	218	2000	397,351
3	Nam Mang 3	Vientiane	40	180	2005	345,009
4	Xeset 1	Saravan	45	180	1991	643,909
5	Xeset 2	Saravan	76	309	2009	
6	Selabam	Champasak	5	21	1969	23,345
Total			**381**	**1,910**		**2,385,449**

(Source) "Financial Statements" as at the incorporation date (15 December 2010), EDL-Generation Public Company

2.3.3.3 Lao Holding State Enterprise

The Lao Holding State Enterprise (LHSE) is a state-owned company under the Ministry of Finance, established in 2005 for the purpose of investing in IPP projects. Until then, EDL was the sole investor in IPP projects on behalf of the Government. However, it was considered that domestic electricity business account and dividends from IPPs should be separated to operate sound domestic electricity supply business at an appropriate tariff level, and then LHSE was established as the governmental investment vehicle in the Nam Theun 2 project. After that, LHSE is supposed to invest in IPP projects for exports[12] especially, and the existing and potential projects invested by LHSE are summarized in Table 2-13.

Table 2-13: IPP projects (to be) invested by LHSE (as of Mar. 2013)[13]

No.	Project	Installed Capacity (MW)	LHSE's share (%)	Attribution to LHSE (MW)	Status
1	Nam Theun 2	1,075	25	268.75	Operation
2	Hongsa lignite TPP	1,878	20	375.60	Construction
3	Xepian-Xenamnoy	410	24	98.40	Construction
4	Nam Ngum 3	460	23	105.80	PDA
5	Nam Ngiep 1	289	25	72.25	PDA
6	Xe Kong 4	300	20	60.00	PDA
Total		**4,412**		**980.80**	

(Source) Study Team based on DEB website (http://www.poweringprogress.com/).

2.3.3.4 Electrical Construction and Installation State Enterprise

Electrical Construction and Installation State Enterprise (ECI) is a state-owned company under the Ministry of Energy and Mines (MEM), specialized in working as a general contractor for the project both in Laos and abroad.

ECI was established in the year of 1982 as a branch of Electricité du Laos (EDL) to implement Vientiane Plain Rural Electrification (VPRE) Project Phase I (1982-1986) and Phase II (1986-1989) funded by the Asian Development Bank (ADB). After the completion of the VPRE project, ECI was established as the auto financing company by splitting from EDL, with more than 250 employees and the main objective of

[12] The demarcation between EDL and LHSE as the governmental investor is not necessarily strict. For instance, EDL is expected to invest in the export oriented Xayaboury project.

[13] Several projects such as Nam Theun 1, Nam Kong 1 etc. have been cancelled recently due to their little progress, according to the amended Electricity Law.

the establishment being to implement the Southern Provincial Rural Electrification Project (SPRE) funded by the World Bank. ECI was again unified with EDL in April 1996, and became a branch of EDL. During this period, ECI was engaged in survey, design, and installation of distribution networks (0.4 kV, 22 kV), distribution transformer; maintenance and reparation of all existing EDL networks (including 115 kV and substation).

Since early 2006, ECI has been separated again from EDL and became the auto financing state enterprise to diversify EDL's services to other forms.

ECI is also supposed to invest in IPP projects on behalf of the Government, particularly in small power projects (SPPs).

Table 2-14: IPP projects (to be) invested by ECI (as of Mar. 2013)

No.	Project (Location)	Installed Capacity (MW)	COD	Status	Investors (Sponsors)
1	Nam Sim (Houaphan)	8	2015	CA	• ECI 25% • Energy Development AS (Norway) 75%
2	Nam Phouan (Vientiane)	60	*TBD*	MOU	• ECI • Velcan Energy (France)
3	Nam Ang Thabeng (Attapeu)	30	*TBD*	MOU	• ECI • Velcan Energy (France)

(Source) Study Team based on the DEB website (http://www.poweringprogress.com/).

2.3.4 Organizational management and human resources development of MEM

This section describes the mandates of the departments and the institute under MEM focusing on power sector governance (policy, planning and management) for further discussion.

2.3.4.1 MEM

(1) Responsibilities in preparation of electric power policies

As mentioned in Section 2.3.2, MEM has four major departments and institute, i.e., DEPP, DEB, DEM and IREP, on a central basis in the power sector. The mandates of the departments and institute are attached in Appendix I. Each organization has its statutory mandates with duties, and some of the duties still look overlapping among the organizations. One of MEM's primary responsibilities is for the preparation of the electricity development plan as stipulated in Article 10 of the Electricity Law[14]:

"Ministry of Energy and Mine is the principal in coordination with the concerned organizations in setting up the electricity development plans and then, submit them to the Government for consideration."

According to Article 1 of the Decree concerning the establishment of DEPP[15], *~~"~~Department of Energy Policy and Planning (DEPP) is one of the technical administration department under the organization system of MEM, has the role to assist the Minister of Energy & Mines in the field of the policy and*

[14] Ministry of Energy and Mines, Electricity Law, Law No. 03/NA, Vientiane Capital, 20 December 2011.
[15] Ministry of Energy and Mines, Decree on the Establishment and Activities of the Department of Policy and Energy Plan, Ref. No.: 0542/EM, Vientiane Capital City, date : 10/05/2012.

planning within nation-wide".

(2) Staffing needs in MEM

The total number of staff working in the MEM headquarters is less than 200, and covers administration, mining, and energy. Of these staff, about 100 members are responsible for the energy sector in all of Laos. MEM has been quite effective and capable in terms of implementation of specific policies (e.g., promotion and regulation of power development projects, development of power grid network with neighboring countries, securing demand/supply balance, development of new and renewable energy, etc.).

The current staffing level of the MEM headquarters seems insufficient to fulfill the duties and responsibilities of the ministry.

Table 2-15: Number of personnel by work locations (FY 2011-12)

Category	Number of officers		
	Total	Male	Female
Total	**848**	**685**	**163**
Administered by the Ministry	185	133	52
Local Divisions	663	552	111
Provincial Administration	454	353	101
District Administration	209	199	10

(Source) Ministry of Energy and Mines

Table 2-15 shows the number of MEM officers assigned by their work locations. MEM is a relatively small ministry compared to others in Laos. At MEM, 848 officers cover the whole country with two major sectors (Energy and Mines). Among 845 officers in total, 185 officers are currently working in the headquarters in Vientiane Capital and 663 are in the local offices. Of 663 officers in the local level, 454 are assigned in the provincial offices and 209 are in the district offices.

Table 2-16: Number of personnel in MEM headquarters (FY 2011-12)

Category	Number of employees		
	Total	Male	Female
Officers in the Headquarters in Vientiane	**185**	**133**	**52**
Administrations & Cross-Cutting	59	36	24
Ministry Office	34	19	15
Department of Personnel	15	10	5
Department of Inspection	10	6	4
Mines sector (Department of Mines)	43	30	13
Energy sector	83	68	15
Department of Energy Business (DEB)	35	28	7
Department of Energy Management (DEM)	16	14	2
Department of Energy Policy and Planning (DEPP)	16	12	4
Institute of Renewable Energy Promotion (IREP)	16	14	2

(Source) Ministry of Energy and Mines

Table 2-16 indicates the allocation of officers in the MEM headquarters in Vientiane. Of 185 officers, 59 are assigned in the administration and cross-cutting departments, 43 are in the mines department and 83

are in the energy departments[16].

Of 83 officers working in the energy sector, 35 are assigned in the Department of Energy Business (DEB). The remaining three departments, (i.e., DEM, DEPP and IREP) are allocated 16 officers respectively.

2.3.4.2 DEPP

(1) Mandate

After the restructure of MEM, the former DOE was divided into three organizations, i.e., DEPP, DEM and IREP, and previous jobs were shared among the organizations. Specifically, the mandate of DEPP covers a wide range of duties necessary for the energy sector of Laos. According to Article 2 of the administrative decision on the establishment of DEPP, DEPP has 33 duties as highlighted in Table 2-17 (arranged in short). The duties vary field by field and the order should be re-organized in the future. Of 33 duties, the word "policy" appears in front and eight times, and the primary roles and responsibilities of DEPP should be the policy formulation of the energy sector. It should, therefore, allocate a majority of resources to activities related to policy formulation and monitoring stipulated in Article 10 of the Electricity Law for DEPP as its challenging new duty.

(2) Divisions

DEPP faces challenges due to constant under-resourcing not only restricted to the number of staff alone to cover all the duties. It consists of five divisions, namely a) Power System Planning, b) Electricity Generation Planning, c) Environmental Engineering, d) Energy Policy, and e) Administration. The former planning divisions under DOE were divided into two newly established planning divisions. Energy Policy Division was established without changing the number of core staff it had. The organizational restructuring was not only extending the areas to cover, but also to dispersing the existing capacity of the core staff of DEPP without significant enforcement of expertise and human resources.

(3) Challenges for newly established division

Power System Planning Division of DEPP, a division responsible for coordinating preparation of the NPDP was established in May 2012.

There are a couple of challenges for the division. First, the officers recently recruited have no experience in public services and policy formulation as well as power system analysis. Second, the division has two substantive duties, coordinating budget appropriation of rural electrification, and coordinating and preparing proposed NPDP. These duties, however, were assigned for the first time since May 2012. Most procedures for undertaking these tasks are nonexistent because the division, even the department, experiences first time.

[16] Energy sector covers all primary and secondary energy-related issues in MEM. The tasks at MEM, however, are mostly on the electric power subsector.

Table 2-17: Statutory duties of DEPP

Duties of DEPP	Category
1. Study, research and draft policy and the energy development plan or amended the for middle and long term period to propose to the Government for consideration.	Policy/plan
2. Propaganda of policy and energy plan and the environmental engineering task.	Policy/plan
3. Study, research and draft policy concerned the long lasting development of the environmental engineering for the energy projects.	Policy
4. Collect and analyze the statistic report on export and import of each type of energy.	Trade
5. Study, research and propose the structure and unit price of the energy.	Pricing
6. Monitor and make report to high level regularly and closely attached to the supply situation of oil world price related to trade in importation.	Oil
7. Analyze the trend and forecasting of the oil and gas consumption demand.	Oil/gas
8. Draft the policy related the national oil reserve.	Policy/oil
9. Study the price structure including set the oil price policy and gas.	Policy/oil/gas
10. Contact with various organizations both domestic and international on oil and gas.	Oil/gas
11. Study the master plan and set the feasible policy to develop nuclear energy.	Policy/nuclear
12. Study and forecast the energy demand outlook for each economic sections of the country.	Demand
13. Set up the energy balance table between the supply and usage of each type of energy.	Demand
14. Coordinate with all parties who has the investment intention, survey and to develop the energy resources development including the transmission line and power station.	Coordination
15. Being a coordination point with international energy such as GMS, ASEAN, etc.	Coordination
16. Consolidate, report and draw-up the activity work plan of the department for each period.	Work plan
17. Forecast the future energy demand of the country.	Demand
18. Collect, consolidate and the produce statistic report on the export and import of coal.	Coal
19. Draft the policy and the mechanism to promote the hydropower.	Policy/hydro
20. Draft the master plan and more study on the feasibility of hydropower project.	Hydropower
21. Inspect and accept the economic-technical of hydropower feasibility study report.	Hydro/FS
22. Research, gives technical comment in applying for and the extension of MOU.	Contract
23. Research, gives technical comment in applying for and the extension of PDA.	Contract
24. Coordinate with the MRC for implementing the notice procedures.	Hydropower
25. Coordinate with the usage of water source of various rivers in Lao PDR with various parties.	Hydropower
26. Cooperated with Chinese Drawing Design Institute to set up the experience laboratory.	Cooperation
27. Study and draft the master plan of transmission line and the power station.	Plan
28. Drafting and propaganda the long lasting hydropower development policy.	Hydro/policy
29. Study and find the solution concerned the change of water flow to minimize of the impact.	Environment
30. Study of the climate changes that may cause the impact to construct the hydropower dam.	Environment
31. Support, promote and supervise inspect the environmental engineering.	Environment
32. Research and give the technical comments on the Environment Impact Assessment (EIA).	Environment
33. Research the structure and electricity price unit for the electricity of each type consumers.	Pricing

(Source) Ministry of Energy and Mines

2.3.4.3 DEB

DEB is basically in charge of supporting the various energy business investment projects by state and private sectors through negotiation and contracting out the IPPs according to the first duty of the department. It plays a very important role to promote IPP projects through negotiation and coordination with relevant organization on the stages of MOU, PDA and CA.

There are 13 duties under the mandate most of which are related to coordination on regulation, finance, banking, etc. with the concerned organizations such as MPI and MOF, and technical duties are not included too much.

2.3.4.4 DEM

DEM was established through the replacement of (or promotion from) the former Electric Power Management Division of DOE mainly to carry out examination and inspection of power facilities in conformity to LEPTS. There are three major divisions such as Power Export Projects Management Division, State-Owned Enterprises Management Division and Energy Enterprises Management Division and the concrete demarcation of the divisions are still under discussion in the department.

DEM has 26 duties with regulatory matters including technical monitoring, examination and inspection as major fields. Also it has duties of drafting the energy related regulations. Regarding the governance of the power sector, DEM has an important role to regulate the IPP projects through LEPTS examination and inspection from design to operation stage.

2.3.4.5 IREP

IREP was established with six major duties such as a) implementation of renewable energy policy; b) promotion of renewable energy; c) promotion of rural electrification; d) promotion of energy savings; e) management of renewable energy data; and f) other activities. Regarding the planning and development of the power sector, IREP plays an important role as the data source of renewable energy including the potential of small hydropower with the capacity of less than or equal to 15 MW, solar power and wind power.

2.3.4.6 Challenges for capacity development

Establishment of the new divisions made core staff promoted to become the heads or managers of the new divisions. At the same time, more supporting staff with relevant expertise to assist the core staff are highly in need. In reality, recruitment of new staff is slow due to hiring regulations of public employees and availability of qualified new recruits in the labor market in Laos. These new staff members, if available, are still high in need of immediate training focusing on relevant subjects through carefully designed on-the-job training (OJT).

MEM is dependent on external funding sources from a variety of donors for training the staff. Some funding engages regular support for years that could be unified with MEM‘s human resources development (HRD) policy. Most training funded by external resources is not dependable to dispatch fixed numbers of staff members according to the ministry‘s own HRD policy. Many training opportunities are provided in an intermittent manner. In addition, these opportunities are not open to all staff members of MEM, specifically designated to certain positions or ranks which are defined by donors.

The range of university education offered is not wide enough to ensure new recruitment. MEM points out that recruitment of newly graduating (and graduated) students with qualifications from higher education are very limited both by number and qualifications. For example, civil engineering focuses such subjects as structural engineering, not hydraulics, hydrology or hydro-engineering.

2.3.5 Organizational management and human resources development of EDL

2.3.5.1 Roles of EDL for planning stage

Electricité du Laos (EDL) is a state-owned corporation under the Ministry for Energy and Mines which owns and operates the country's main generation, transmission and distribution systems, and manages electricity imports into its grids and exports from its stations. EDL plays a vital role for implementing electric power development projects. EDL acts as a shareholder of domestic IPP projects also on behalf of the Government.

EDL embraces 3,239 employees[17] currently employed in a variety of business offices across the country. Among the relevant departments and offices in EDL, the System Planning Office of the Technical Department is in charge of developing the current PDP through demand forecast and power system planning as shown in Figure 2-8.

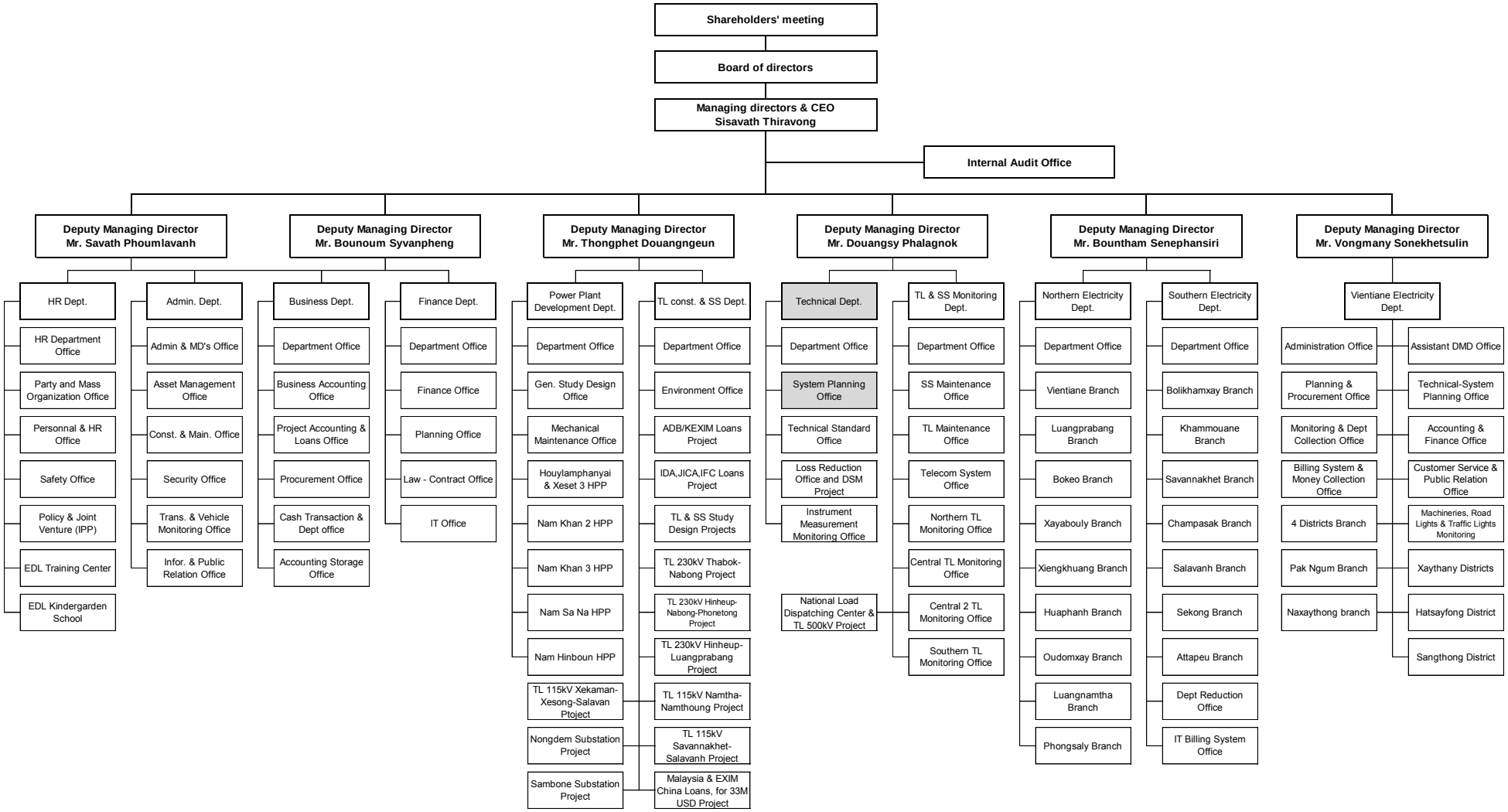
2.3.5.2 Role of System Planning Office of Technical Department

The System Planning Office is a branch of the Technical Department of EDL, and the core division drafting the Power Development Plan (PDP). According to EDL[18], the office has the following duties:

(1) Prepare the PDP for expansion of the power system,
(2) Draw the PDP in both Lao and English language with 10 year time frame for reporting to the Administrative Board of EDL and MEM,
(3) Collect technical data and socio-economic data necessary for preparation of PDP,
(4) Estimate the power demand of whole country,
(5) Analyze power system (e. g., power flow analysis, short circuit calculation, reliability, dynamic analysis),
(6) Search funding for expansion of high voltage transmission line system for domestic and international connection,
(7) Liaise with international organizations for preparation of power development projects,
(8) Provide technical consultation in relation to on-going projects for EDL grid system stability, and
(9) Liaise with international cooperation projects such as GMS, ASEAN power utility/ authority, etc.

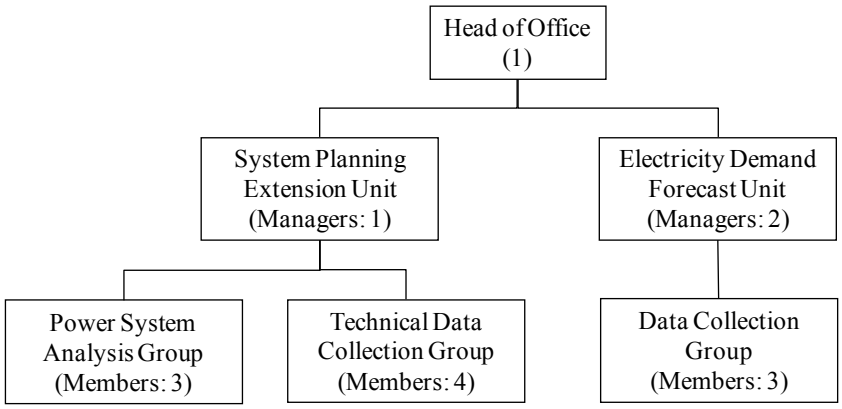
The office consists of 14 employees including a head of office and three managers. The office has two primary units of System Planning and Extension Unit, and Electricity Demand Forecast Unit. The former has two groups of Power System Analysis Group and Technical Data Collection Group. System Planning and Extension Unit has a responsibility on technical matters, particularly system analysis of the EDL grid system. The other unit, Electricity Demand Forecast Unit has responsibility of demand forecasting including socio-economic data collection. Figure 2-9 is the organization chart of the System Planning Office.

[17] EDL Electricity Statistics, 2011.
[18] Internal document of EDL, originally written in Laotian Language.



(Source) Study Team based on EDL website (http://www.edl.com.la/file_upload/documents/edl_chart_eng_2013.png.)

Figure 2-8: Organization chart of EDL



(Source) Study Team based on EDL information.

Figure 2-9: Organizational chart of System Planning Office

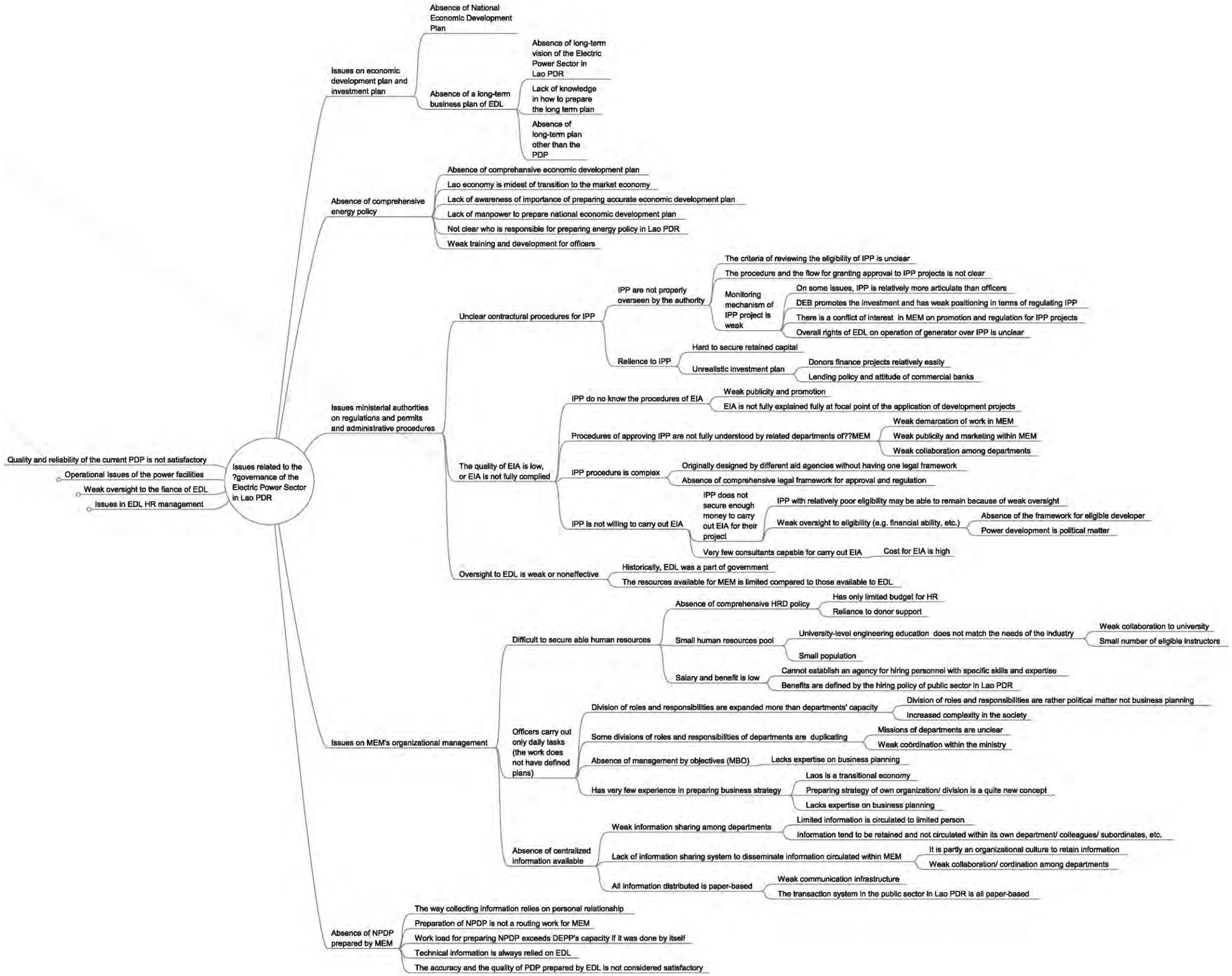
As indicated in their terms of reference above, the System Planning Office is responsible for the most up-stream planning of EDL power system including preparation of the existing PDP.

2.3.6 Problem analysis on organizational management of power sector

2.3.6.1 Methodology of analysis

To help understand the current situation better, the Study employs problem analysis an analytical tool commonly used for total quality management. Problem tree analysis is central to many forms of project planning and is well developed among development agencies. Problem tree analysis (also called ‗situational analysis' or just ‗problem analysis') helps to find solutions by mapping out the anatomy of cause and effect around an issue with a structure.

Based on the discussion above, the Study Team further conducted an analysis of the current status of governance mechanism in Laos mainly for DEPP and EDL staff. It focuses on constraints and barriers for realization of proper governance in the power sector. Such constraints are summarized and compiled in order with cause-effect relation to highlight interrelations among the constraints listed. Problems mostly associated by MEM are shown in Figure 2-10 and those associated with EDL and EDL-gen are shown in Figure 2-11.



(Source) Study Team.

Figure 2-10: Analysis of governance mechanism in Laos (mostly related to bellow)

(Source) Study Team.

Figure 2-11: Analysis of governance mechanism in Laos (mostly related to EDL)

2.3.6.2 Results from problem analysis

Based on the analysis, root causes of the problems listed in the tree diagram are analyzed. A summary of root causes of the problems from MEM (DEPP) are as follows:

- Necessity of clarification in governing the power sector entities;
- Future role and responsibly of DEPP in the power sector;
- Weak inter-department collaboration;
- Sub-division and fragmentation despite small organization (and scarcity in resources);
- Some work shall be out-sourced; ambiguous priority of work necessary;
- Avoidance to present and involves policy issues;
- Many items stipulated in mandate not been practiced;
- Need of strengthening (technical & non-technical) competency; and

In the meantime, most of the issues from EDL are technical matters for the development of the current PDP and its internal business management. Issues to be resolved for the improvement of EDL are summarized as follows:

- Technical capacity for preparation of PDP;
- Demand forecasting (modeling, data collection, analysis, etc.);
- Investment planning (IPP (d) & IPP (e));
- Power trade (export & import);
- Power system planning and analysis;
- Inter-department collaboration;
- Involvement in policy formulation, and;
- Explicit linkage between investment and HR policy (staffing, hiring and training, etc.);
- Technology succession; and
- Power system planning (network, generation, etc.) — how to transfer the planning know-how to young engineers of EDL and EDL-Gen.

In light of Lao electric power sector, EDL is a business unit of the sector and its day-to-day business activities are not fully controlled by MEM. In this sense, EDL currently looks enjoying a great autonomy from the government on its management and operational issues. On the other hand, MEM (DEPP) acknowledges a need of aligning EDL‘s activities in line with the governmental policies. The analysis highlights that the problems related to the organizational management for the power sector seems to be caused by the gap between MEM and EDL on the management policy of each organization. MEM intends to oversee EDL effectively as stipulated in the laws and regulation in near future.

2.4 Mobilization of private initiatives

2.4.1 Procedure of agreements for power development with IPPs

Promotion of IPP projects in Laos starts from an unsolicited proposal from a developer, and then a Memorandum of Understanding (MOU) is drawn up after negotiation. Concessions are finally awarded without competition through the project promotion process after the developer has completed technical and environmental studies on the proposed project.

Hydropower is characterized by relatively highly concentrated and un-transportable potential. Fossil fuels such as oil, natural gas, coal, and nuclear fuels are on the contrary transportable with high energy density, so that thermal power plants could be developed theoretically at any place under certain conditions such as sufficient land, cooling water etc. Meanwhile natural renewable energy is in general characterized by low energy density. Solar and wind power generation need the wide land area almost proportionate to the installation capacity due to their low density. Hydropower has much higher energy density usually in the form of rivers, than solar or window, but cannot be transported. As a result, the potential of a hydro generation project is almost uniquely identified by the natural conditions of the site, and thus the potential of a hydropower project cannot be specified without certain studies. In this sense, unsolicited basis promotion seems reasonable because the government could expedite hydropower development without financial burden.

The construction of power stations, hydropower stations especially needs several years to be completed. Prior to the construction of a power station, developers of IPP projects should conclude a series of contracts with GOL and power purchasers. Furthermore, developers should execute a set of survey and research on both the environment and social matters which will take some years to complete. Then an additional three to six years are required to complete the construction of dam and power station. Therefore, it can be said that it is required at least six to seven years to start electricity supply from IPP power station after the developer concludes the MOU with GOL.

All the procedures of IPP development are illustrated in Figure 2-12.

The Ministry of Planning and Investment (MPI), has the one-stop-service office for investment prescribed in the Law on Investment Promotion 2009, which is responsible for management of the investment in concession business including hydropower development.

The Department of Energy Business (DEB) under the MEM has the functions as the coordinating organization on behalf of the line ministry in charge of power development, i.e., MEM, which is to negotiate MOU, PDA and CA with developers on the specialized issues in power development.

Among the departments under MEM, DEPP and DEM are also involved in IPP development. While DEB has an administrative function, DEPP and DEM are responsible for technical issues of projects. Inspection and approval of feasibility study (F/S) conducted by developers are the mandate of DEPP from economical and technical viewpoints, coordinating with DEB, DEM and the Department of Environmental and Social Impact Assessment (DESIA) under the Ministry of Natural Resources and

Environment (MNRE). DEM is in charge of examining and ensuring basic design, and issuing the certificate of construction work in compliance with the Lao Electric Power Technical Standards (LEPTS).

In this way, detailed procedures related to IPP development are legally prescribed, but incompletely complied due to various reasons such as insufficient understanding of relevant staff and the lack of coordination among the concerned organizations.

The following issues are remarkably observed among others that may affect sound IPP development with fairness and transparency:

(Unclear selection of project developer)

According to Article 27 of the Electricity Law, the electricity business enterprise should have:

i) experiences in electricity business operation;
ii) financial stability; and
iii) sufficient electrical engineers and other specialists concerned.

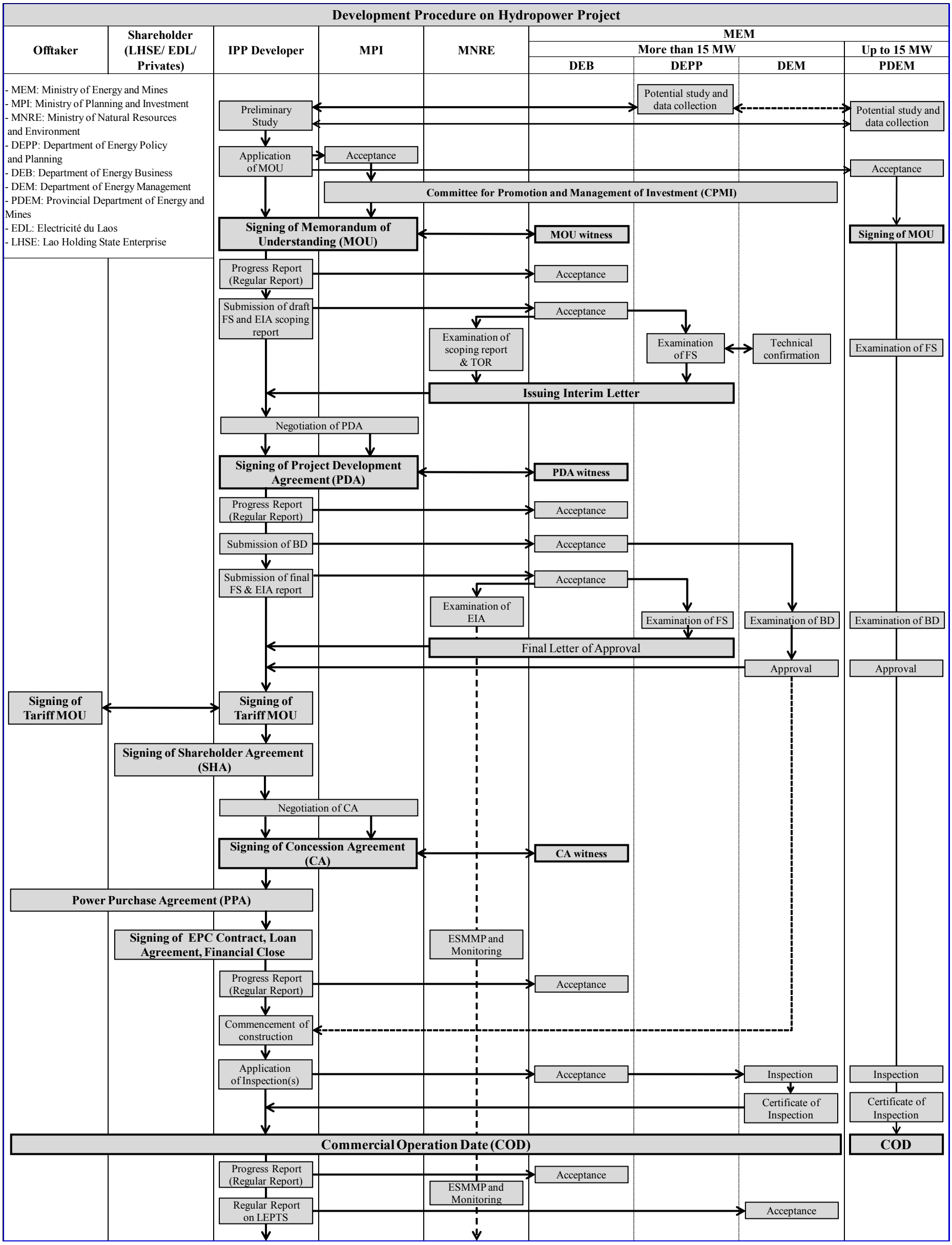
However, MOUs with developers have thus been concluded without considering any qualification on the above conditions, and some developers are showing lack of experience, financial or technical background, which resulted in unreasonable delay of projects.

(Examination and inspection under legal framework)

The Electricity Law requires construction and installation of electrical facilities to be conducted in compliance with LEPTS. Since the formulation and promulgation of the ministerial decrees on the electric power technical standards (LEPTS) in 2004 and its Guidelines in 2007, examinations and inspections for IPP projects have been carried out according to the LEPTS. However, all processes of examination and inspection are not yet fully covered to all the IPP projects and it is still necessary for the MEM to improve the regulatory activities.

(Procedure for EDL and EDL-Gen projects)

Currently, EDL is still developing hydropower projects and EDL-Gen receives the assets for operation and maintenance. As of April 2013, examination and inspection are not yet conducted for EDL‘s facilities in compliance with LEPTS even if the EDL should be regulated as one of the power utilities. Future arrangement for EDL projects was discussed in JICA Technical Cooperation Project entitled ―Project for Improvement of Power Sector Management in the Lao PDR” as way forward.



(Source) Study Team based on MEM information.

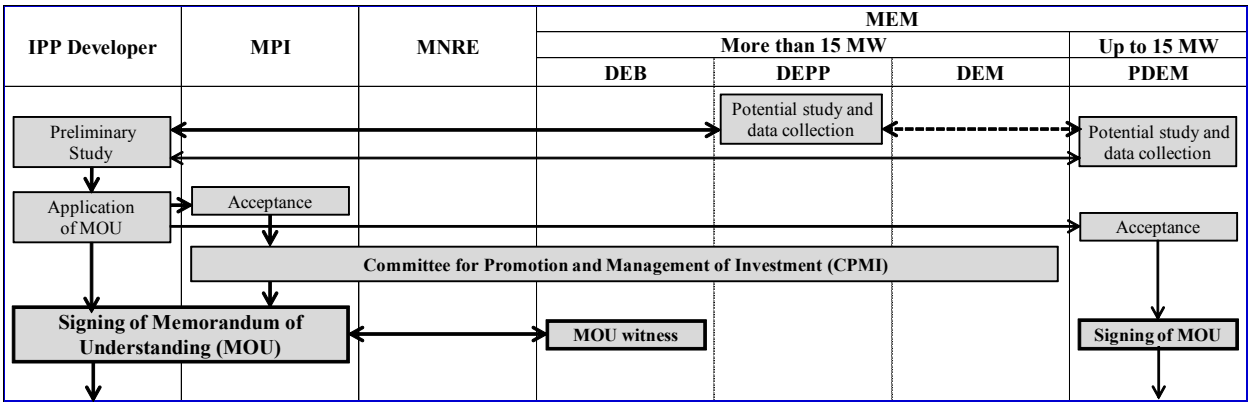
Figure 2-12: Comprehensive flow of IPP development

(1) Before MOU stage

Before a developer obtains the exclusive right to carry out a feasibility study (F/S), they will submit the MOU application to the MPI with their own project findings.

According to the Electricity Law (2011), hydropower projects with capacity up to 15 MW shall be approved by the provincial governor. Then a developer for such a small project will apply for the MOU to provinces without any consultation of the Central Government (DEPP). If the small project is located in the reservoir of a large-scale project and will be given a MOU by the province, this issue may disturb the effective river system development.

It is also observed that the consensus of development order of priority is not clear because of less clear policy indication for ideal composition of power sources. Figure 2-13 shows the development flow before the MOU stage.



(Source) Study Team.

Figure 2-13: Development flow before MOU

< Reference: IPP development procedure in India – Bidding scheme on the participation of developers for hydropower projects >

The Government of India has been accelerating the private participation in the power sector with formulation of the National Electricity Policy in 2005 for the full development of feasible hydropower potential. Regarding the development procedure, the way of project development rights authorization is similar even if details vary State by State:

1. Gazette by the State on the development of hydropower projects;
2. Pre-qualification and preparation of related documents such as pre-FS report by the State for tender;
3. Tender/bidding with minimum upfront premium from the developers;
4. Signing the PDA;
5. Preparation of Detailed Project Report (similar to FS report) by the developers with stipulated period;
6. Signing the Implementation Agreement (IA);
7. Acquisition of official clearances; and
8. Construction works to operation.

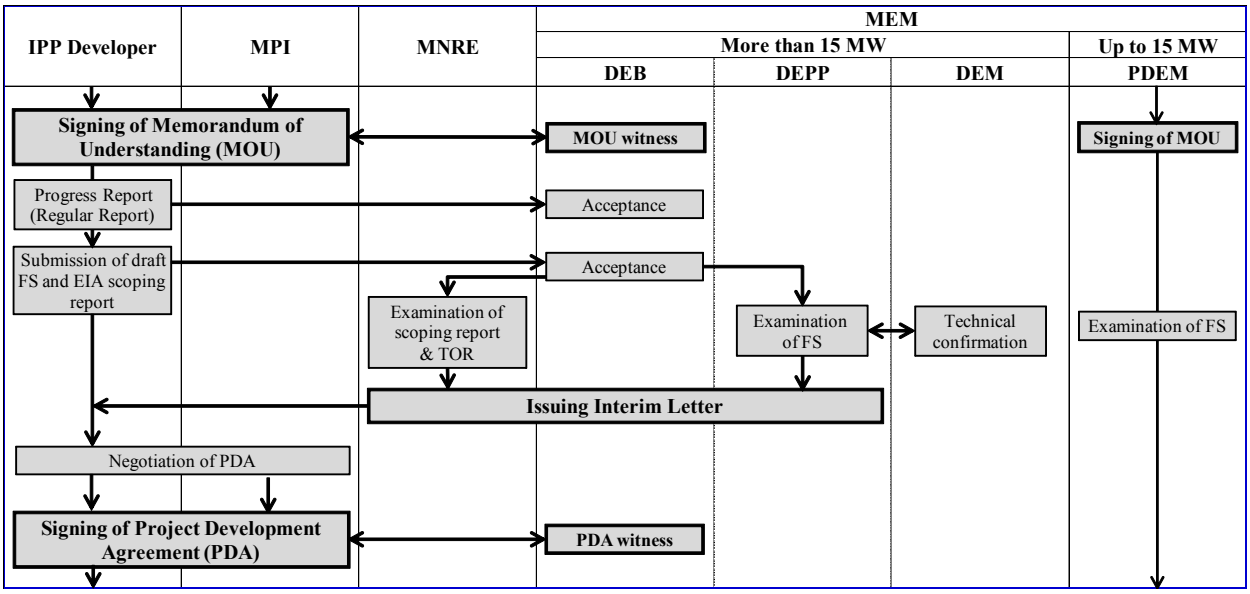
The process includes the non-refundable upfront premium and processing fee to the State with free power. The amount of the premium is stipulated based on the size of the project. In the case of Arnachal Pradesh State, 1.00 Lakh (100,000 Rupee =1,750 USD) per MW for the projects with 25 - 100 MW.

In this case, developers who intend to participate in hydropower projects have to have sufficient financial resources and experiences to be qualified from the beginning stage of the projects. This India‘s case may be applicable in Laos for selecting the developers from the F/S stage (MOU stage).

(2) Between MOU and PDA stage

Developers carry out F/S in line with the MOU and submit the draft F/S report to DEB. DEPP will conduct the examination and issue the interim letter with some comments for the developers to finalize the F/S. Then PDA will be signed and the developers will start negotiation of PPA and project formulation as a special purpose company (SPC). The process of decision to the PDA stage seems to not be clear even if DEPP judges that the project could be feasible.

It may happen that the central government cannot grasp the progress of F/S examination of small hydropower being conducted by the PDEM. Figure 2-14 shows the development flow between MOU to PDA stage.



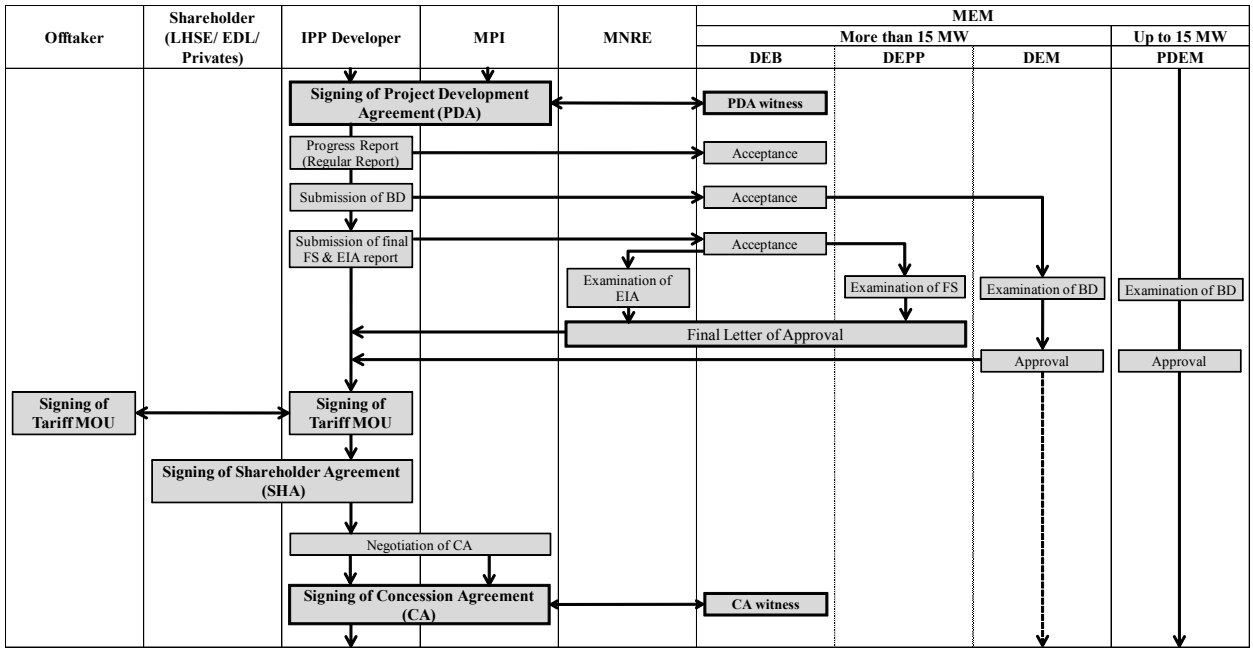
(Source) Study Team.

Figure 2-14: Development flow between MOU and PDA

(3) Between PDA and CA stage

Developers continuously carry out F/S to receive final approval from DEPP and also prepare basic design (B/D) to receive approval from DEM in line with the MOU and submit the draft F/S report to DEB. The approval processes are complicated for the developers (refer to Section 2.4.2 hereafter) and the process of decision to CA stage seems to be not clear.

Developers also start formulating special purpose company (SPC) with negotiation of shareholder agreement (SHA) and power purchase agreement (PPA) during this period. Figure 2-15 shows the development flow from PDA to CA stage.

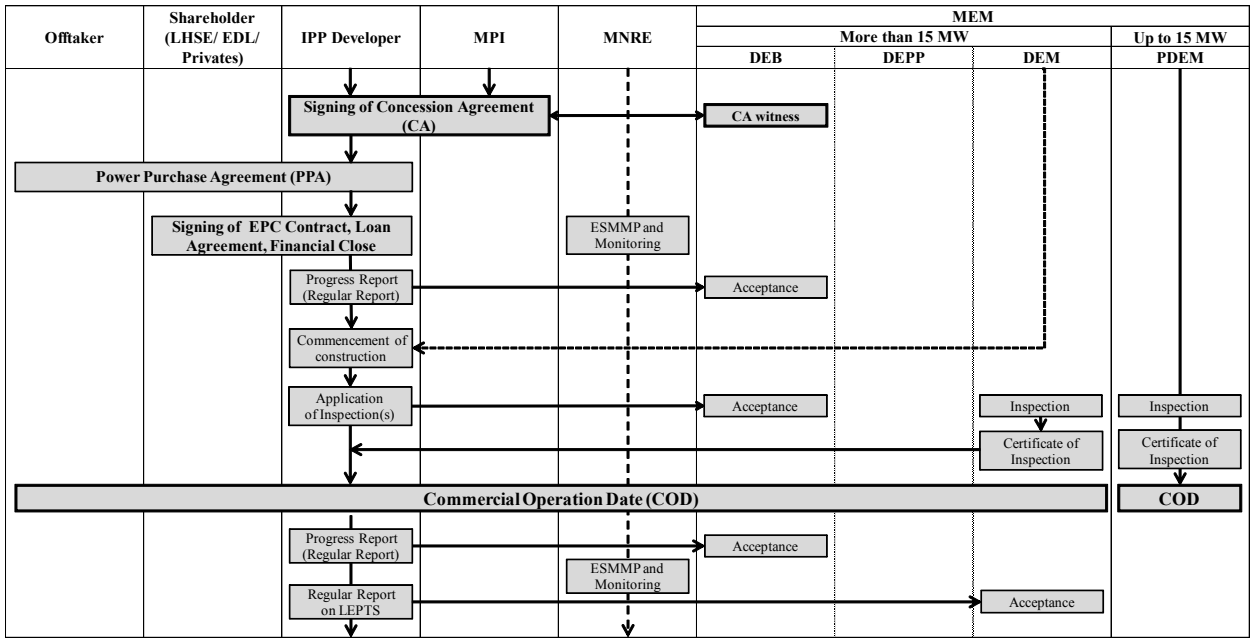


(Source) Study Team.

Figure 2-15: Development flow between PDA and CA

(4) After CA through construction to operation stage

In this period, the work of MEM is shared with DEB and DEM for project monitoring and regulation as described thereafter. Figure 2-16 shows the development flow from CA to operation stage.



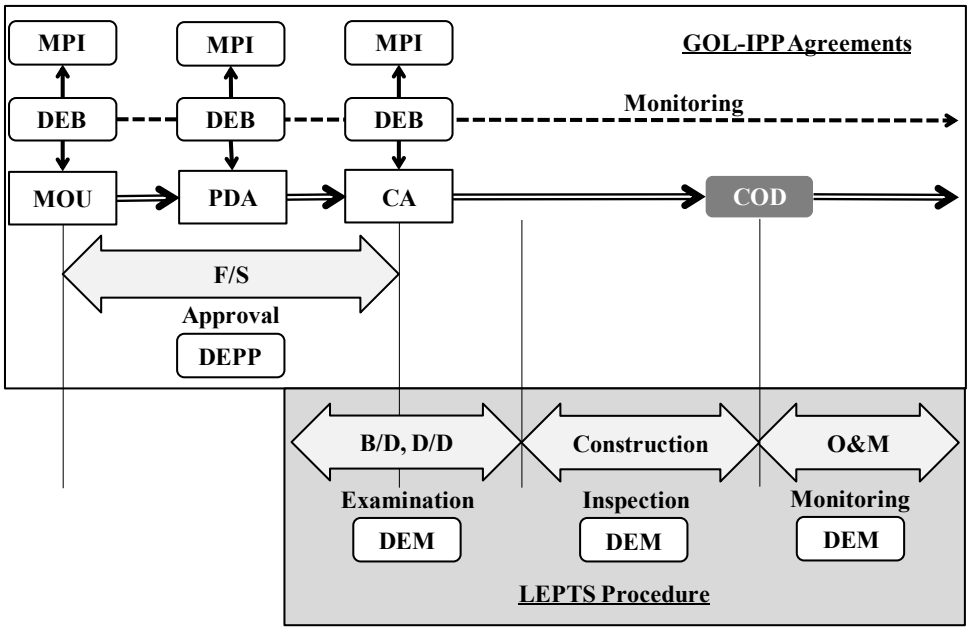
(Source) Study Team.

Figure 2-16: Development flow between CA to commercial operation

2.4.2 Supervision of IPP activities (regulation, monitoring, reporting and statistics)

As already indicated, the MPI is in charge of private investment and the DEB of the MEM is the contact department in charge of technical and regulatory issues for the IPP power development. After the

restructuring of the MEM, it was concluded that examination of F/S to be carried out by the DEPP and examination and inspection of basic design (B/D) and construction works to be carry out by DEM to check the conformity of the Lao Electric Power Technical Standards (LEPTS) as shown in Figure 2-17.



(Source) Study Team

Figure 2-17: Relationship between contract and examination/inspection for hydropower IPP

The DEB receives regular reports (monthly or quarterly reports) from the developers based on the contracts between the Government of Laos (GOL) and developers such as Memorandum of Understanding (MOU), Project Development Agreement (PDA) and CA, monitor the project and disclose the progress of the projects on their web-site[19].

On the other hand, the LEPTS Guidelines, managed by the DEM, stipulates the submission of regular reports listed in Table 2-18. However, it seems that, there is not a clear outline on the contents of the two types of reports in the operation stage.

Table 2-18: Regular reports stipulated in LEPTS Guidelines

Name of Documents	Submission Date
1. Statistical List of Power Facilities in Electricity Enterprise	End of December
2. Monthly Report of Power Generation and Receiving	Every month
3. Financial Report of the Owner	End of December
4. Annual Report of Fixed Assets and Operating Income and Expenses of Power Facilities	End of December
5. Monitoring and Inspection Report of Dam	End of December
6. Monitoring Report of Sedimentation in Reservoir	End of December
7. Annual Summary Reports of Electrical Accidents' Number	End of December
8. Annual Reports of Accidents and Damages in Hydropower Station and Substation	End of December

(Source) Study Team.

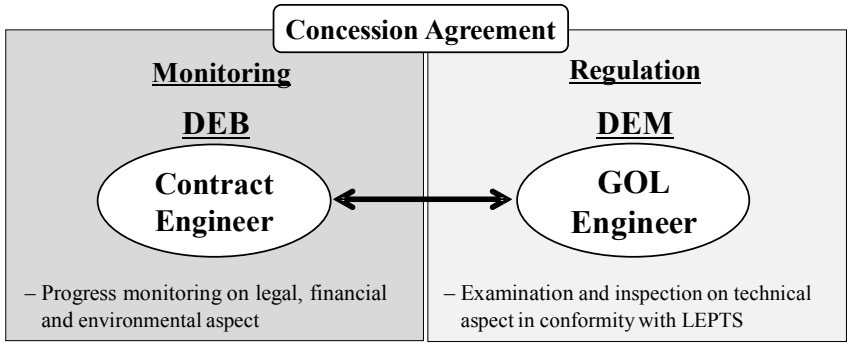
[19] http://www.poweringprogress.org/index.php?option=com_jotloader&cid=10&Itemid=91

2.4.3 Functional structure for monitoring, examination and inspection of power facilities

The DEB (former DEPD) was established to coordinate and monitor the IPP projects among the concerned ministries and within the MEM in terms of compliance with laws, banking, finance and technical advice (socio-economic aspects for F/S) according to its mandate. The DEB will be provided a technical assistance in the field of hydropower concession management by the World Bank as detailed in Section 2.7.1.

The DEM and partly DEPP for FS (former DOE) have been established to manage, monitor and inspect the power facilities technically. However, the roles of DEB and DEM seem overlapped from the developer's viewpoint, specifically in the field of project monitoring during construction period. As a result, the responsibilities for the IPP projects are unclear including the events of accidents and natural disasters. The TA above to the DEB also includes the provision of resources and technical assistance to support site inspection or monitoring of on-going hydropower project construction in line with CAs.

At present, the MEM is trying to develop the terms of reference (TOR) in the CA as the Monitoring Engineer for DEB and GOL Engineer as shown in Figure 2-18.



(Source) Study Team

Figure 2-18: Relationship between DEB and DEM

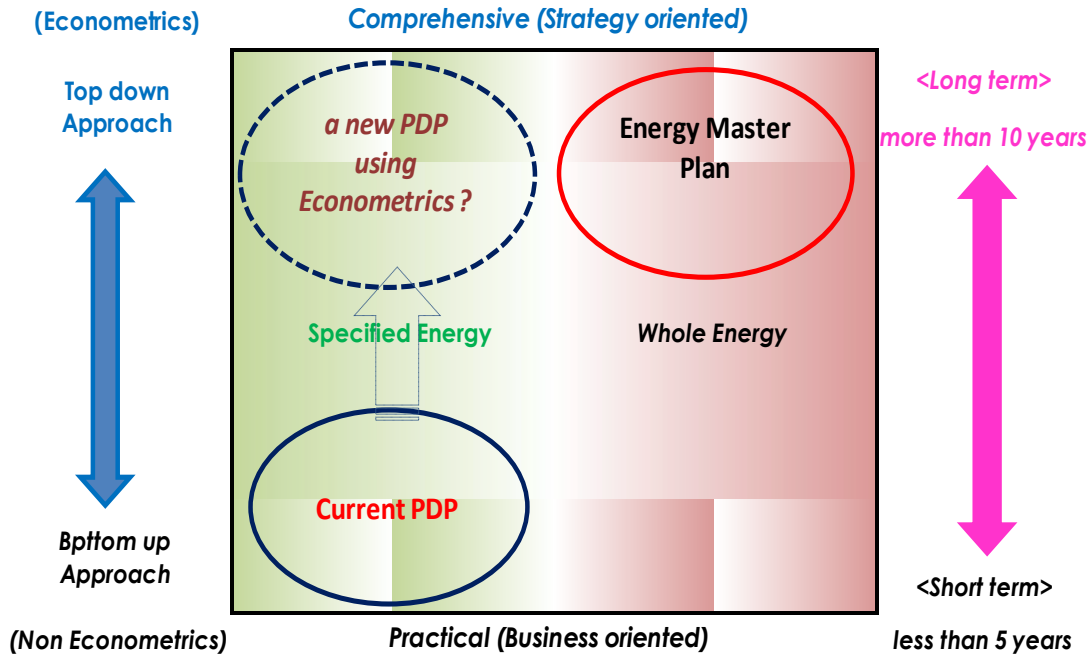
2.5 Current power development plan (PDP)

2.5.1 Demand forecast

There are two major approaches to forecasting demand: bottom-up approach and top-down (econometric model) approach. These approaches are generally used according to the objectives because both have their own characteristics (strengths and weaknesses). Figure 2-19 shows the two approaches in the light of 1) short term or medium to long term, 2) practical and business oriented or comprehensive strategy oriented, and 3) specified energy or whole energy. The model oriented for a strategy such as an energy master plan is based on an econometric approach for the long term (more than 20 or 30 years), covering overall energy in Laos, while a short-term forecasting (less than five years) such as a kind of business plan is almost based on a non-econometric approach. Which is a more suitable approach for the power development plan (PDP) of EDL for the coming 10 years depends on what decision makers or policy makers think is the most important. But whichever methodology is adopted, a demand forecasting model or a methodology needs to maintain the consistency between economic conditions and estimation results.

When demand is too low, econometric approach based on actual past data (time series data) is not always practical because it requires a system consuming energy (a country or a region) to develop to the advanced in some degree. At this moment, Laos is just in the front of the gate called ―high economic growth". The current method is no longer reasonable but introducing the econometric approach is a little too early – it might be much better in three years.

But in the other aspects, it is the right way to introduce econometric approach at this moment because it requires the algorithm of demand forecasting to be based on the inter-relation between economy and energy demand − regrettably the current method is in no consideration of the inter-relation. There is no perfect projection in the world. Accuracy is important but a second mater in some sense. More important is to analyze the gap between an actual figure and an estimator from the economic point of view, and to understand why and how inaccurate or inappropriate economic assumptions are set. This leads to more realistic and persuasive estimation for policy makers.



(Source) Study Team.

Figure 2-19: Demarcation between bottom-up and econometric approaches

(1) Outline of PDP

The methodology of PDP is anything but a bottom-up approach. It is, however, lacking in understanding the relationships of energy and economic factors, so that it has become a little strange in some sense in which it is calculated as planning for planning by neglecting actual past figures and setting the preconditions not supported by rational or economic reasons.

According to PDP, the object of demand to be estimated consists of two categories――Large Industry" and ―Others". The former demand is counted as project by project while the latter demand is aggregated and uncountable like one by one. The latter demand (―Others") consists of four sectors: ―Residential",

―Commercial (Service)", ―Agriculture" and ―Industry".

The former (―Large Industry") is as follows:

1. Industry: Mining, Cement, Metal refining, Steel making, etc.
2. Dam construction
3. Railway construction
4. SEZ (Special Economic Zone)
5. Aluminum Industry (SLACO and others)

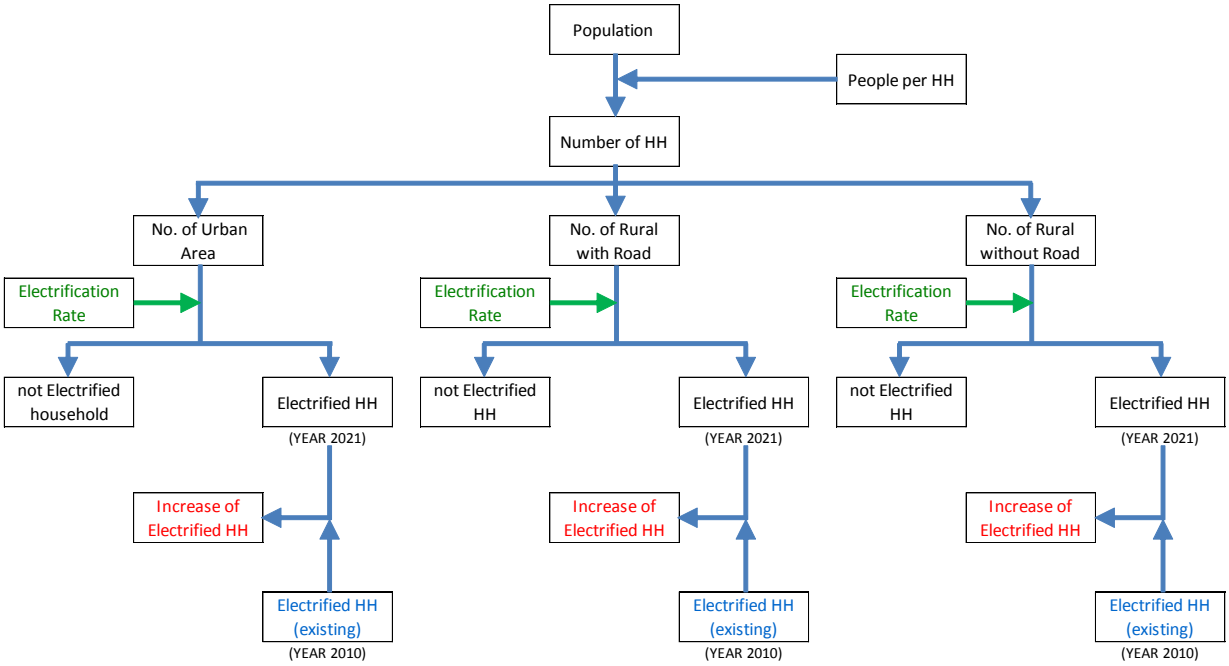
All the above demand is compiled as project by project based on the information given by the relevant ministries and organizations. As most of them are unclear and unconfirmed, the sum of ―Large industry" and ―Others" cannot be simplistically called as ―Total demand". It is because the difference of probability between the former and the latter is very wide.

(2) Methodology of ―Others" demand estimation in PDP of 2010 (revision-1)

Analyzing the calculation excel file, ―Demand Forecast Case-2 (including SLACO & non klum)" and the relevant files that were used for formulating PDP of 2010 (revision-1), the algorithm of calculation was found to be very simple and unreasonable (problematic). For example, Figure 2-20 indicates the calculation way of ―Residential demand". The households of each province are separated into three categories: the household of urban, the household of rural with road access and the household of rural without road access. Furthermore, by setting the future electrified rate, the number of electrified household of each category will be given.

If the starting year of projection is 2011, the figure of year 2010 is an actual and the ones between 2011 and 2021 are estimated. Accordingly, demand to be estimated by category is further divided into two ― the demand of already electrified household and the demand of newly electrified between 2011 and 2021. Residential demand estimation is hence just like calculating the following four equations.

(Calculation way of electrified household in Residential sector)



(Preconditions for demand estimation)

	Newly connected						Existing	
	Electricity Demand per Household (kWh/y)			Annual Increase Rate (%)			Electricty Demand per Household (kWh/y)	Annual Increase Rate (%)
	Urban	Rural with Road Access	Rural without Road Access	Urban	Rural with Road Access	Rural without Road Access		
Vientiane Cap.	1,500	1,500	300	3.0	3.0	3.0	**Actual**	5.0
Phongsaly	1,000	1,000	200	3.0	3.0	3.0	**Actual**	5.0
Luang Namtha	1,000	1,000	200	3.0	3.0	3.0	**Actual**	5.0
-----	1,000	1,000	200	3.0	3.0	3.0	**Actual**	5.0
-----	1,000	1,000	200	3.0	3.0	3.0	**Actual**	5.0
Attapeu	1,200	1,200	270	3.0	3.0	3.0	**Actual**	5.0

Note: Demand (newly connected) = (Electricity Demand per household) × (annual increase rate) × (No. of household)
Demand (existing) = (2010 actual: Electricity Demand per household) × (annual increase rate) × (No. of household)

(Source) The above calculation way is abstracted from ―Demand Forecast Case-2 (including SLACO & non klum" and the relevant files in PDP 2010-2020 (Revision-1).

Figure 2-20: Calculation way of electricity demand by province in residential sector

Table 2-19: Set of demand equations in residential sector

(Urban)
1. Demand (newly connected) = (**Electricity Demand per HH**) × (annual increase rate) × (No. of HHs)
2. Demand (existing) = (2010 actual: Electricity Demand per HH) × (annual increase rate) × (No. of HHs)
(Rural with road access)
3. Demand (newly connected) = **(Electricity Demand per HH)** × (annual increase rate) × (No. of HHs)
4. Demand (existing) = (2010 actual: Electricity Demand per HH) × (annual increase rate) × (No. of HHs)
(Rural without road access)
5. Demand (newly connected) = (**Electricity Demand per HH)** × (annual increase rate) × (No. of HHs)
6. Demand (existing) = (2010 actual: Electricity Demand per HH) × (annual increase rate) × (No. of HHs)
7. Total demand = Sum of (Demand Nos. 1. to 6.)

(Source) Study Team.

On the table of Figure 2-20, there is "Electrified demand per household" and "annual increase rate" by category. By putting these figures into each equation in Table 2-19, the demand of each category is calculated and aggregated into province demand in residential sector.

There are many questions about how they are calculated and what economic reason they are based on (for example, the reason an annual increase rate of 3% is determined). Forecasting needs to be conducted objectively, theoretically and based on the past actual data by whomever. The targeted electrified rate is generally set as a policy variable (exogenous). But electricity demand per household (kWh per household) and its increase rate in future are not allowed to be intentionally or unintentionally decided before forecasting. They have to be calculated (or set) based on some economic and rational reason acquired through analyzing the past actual data (time series data).

Next focuses are "Agriculture", "Commercial" and "Industry" sectors. As indicated in Table 2-20, the increase rate of demand in each sector is set as precondition before projection. The future demand to be estimated means to be a precondition to be decided before estimation. In short, the current method of PDP is almost close to "planning demand" or "deciding demand beforehand" rather than estimating demand. What is worse, it is unclear how these preconditions are decided.

Table 2-20: Demand estimation in Industry, Agriculture and Commercial

(%)

	Industry			Agriculture			Commercial		
	2011-17	**2018-22**	**2023-31**	**2011-17**	**2018-22**	**2023-31**	**2011-17**	**2018-22**	**2023-31**
Vientiane Capital	20.0	25.0	28.0	8.0	12.0	15.0	15.0	20.0	25.0
Phongsaly	10.0	15.0	20.0	8.0	12.0	15.0	12.0	15.0	18.0
Luang Namtha	10.0	15.0	20.0	8.0	12.0	15.0	12.0	15.0	18.0
----	10.0	15.0	20.0	8.0	12.0	15.0	12.0	15.0	18.0
----	10.0	15.0	20.0	8.0	12.0	15.0	12.0	15.0	18.0
Attapeu	8.0	13.0	18.0	8.0	12.0	15.0	15.0	17.0	18.0

Note: Demand (existing) = (2010 actual: Electricity Demand) × (annual increase rate)

(Source) The above calculation way is abstracted from "Demand Forecast Case-2 (including SLACO & non klum)" and the relevant files in PDP of 2010 (revision-1).

(3) ―Large Industry" demand in PDP 2010-2020 (Revision-1)

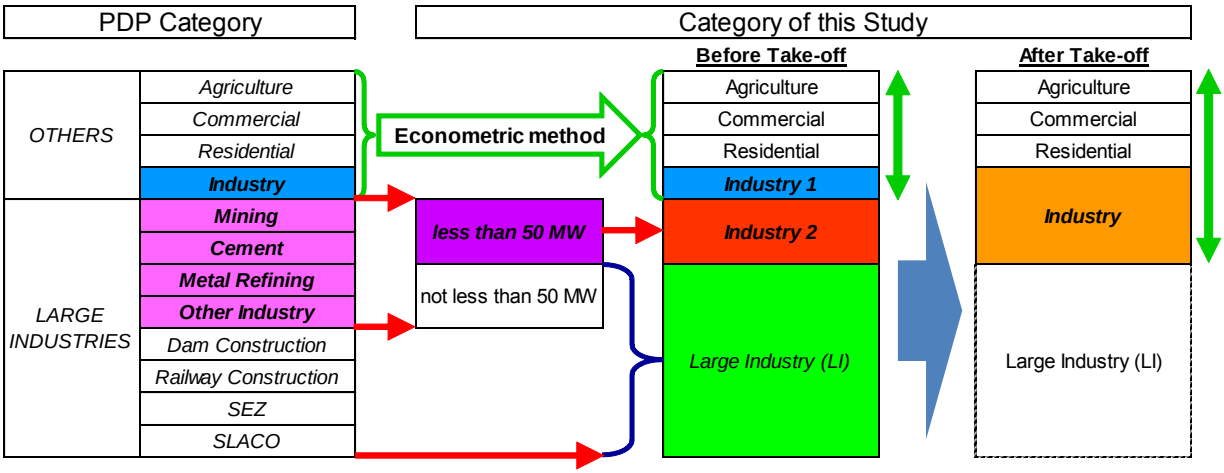
As mentioned above, ―Large Industry" is separated into five categories. Such ―one-by-one" demand, not aggregated, has to be set project by project as exogenous data in whatever type of model because it is too enormous or decided due to political intentions other than economic reasons.

(Categories)

1. Industry: Mining, Cement, Metal refining, Steel making, etc.
2. Dam construction
3. Railway construction
4. SEZ (Special Economic Zone)
5. Aluminum Industry (SLACO and others)

But, some of them, ―Category 1", are likely to be changing from ―one by one" to ―aggregated" because Category 1 generally belongs to ―Industry" of ―Others" in advanced countries. As it is too small as aggregated demand compared with a project in Category 1, most of the demand of Category 1 is required to be set as exogenous one by one for the time being. As the take-off begins and the economy grows, such demand will be absorbed into the demand of the industry of ―Others" in which consumption per factory are relatively small but the number of factory is immense. On the other hand, ―Large Industry" from Category 2 to Category 5 and the rest of Category 1, which are projects with relatively large demand, are counted project by project as ever.

According to Figure 2-21, ―Industry" of ―Large Industry" (Category 1) is divided into two categories (Less than 50 MW and more than 50 MW). The former is called ―Industry 2" while ―Industry" of ―Others" is called ―Industry 1". ―Large Industry" excluding less than 50 MW of Category 1 is redefined as ―Large Industry (LI)". Before take-off, Industry 2 and LI are exogenous. But after take-off, Industry 1 and Industry 2 are merged into ―Industry", which will become endogenous.



(Source) ―Demand Forecast Case-2 (including SLACO & non klum)" and the relevant files in PDP 2010-2020 (Revision-1).

Figure 2-21: Category of demand in PDP and this Study

When listing the exogenous data as a big project, how to judge the probability of implementing a project seems to be critical. But judging the probability depends on various complicated situations under a specified institution originated from historical, traditional and cultural legacies, and what is worse, nobody knows about the risk of the cancellation, pending, delay, and downsizing of the project; in other words, the problem lies in which data, how much and by whom is determined to be set to the exogenous data list. Such uncertainty could not be avoided by even more accurate estimation method. In advanced countries, they are not excluded from demand forecasting and regarded as just reference.

2.5.2 Power supply

2.5.2.1 Power development plan (PDP 2010-2020 Revision-1)

The latest PDP for domestic supply in Laos is the "Power Development Plan 2010-2020 Revision-1 (PDP 2010 Rev.-1) formulated in August 2011. In PDP 2010 Rev.-1, power projects are assigned to meet the rapid growth of domestic electricity demand during the planning period.

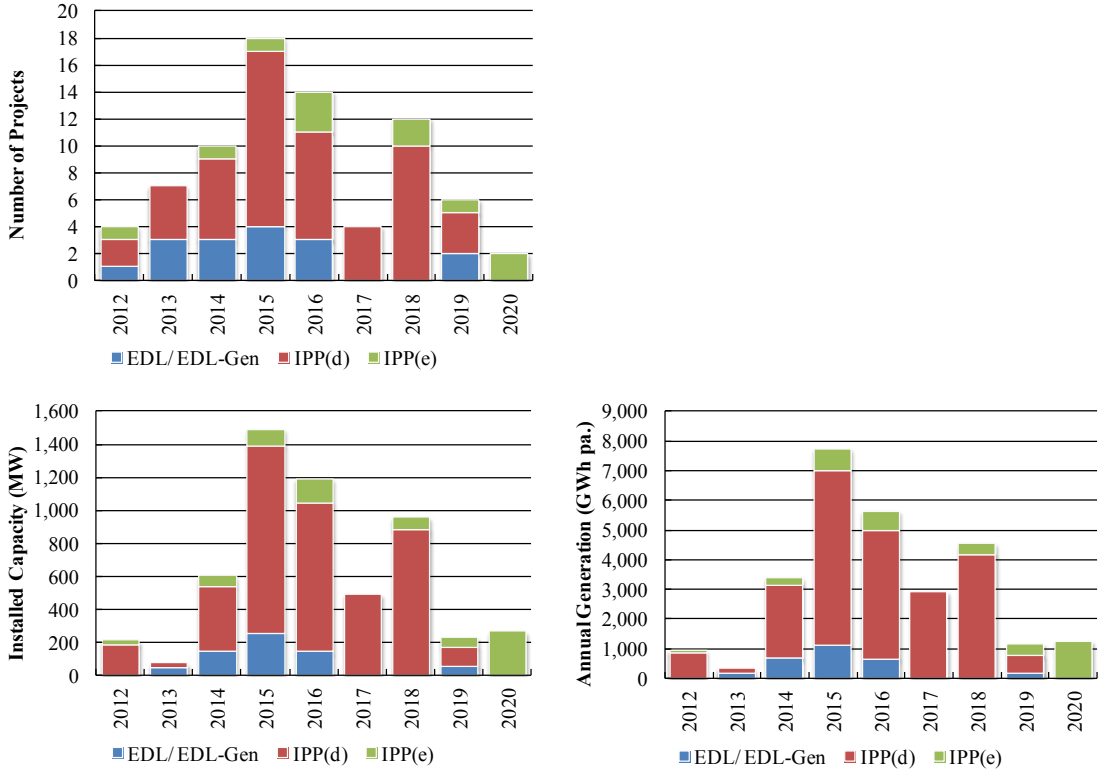
As shown in Table 2-21 and Figure 2-22, 77 projects are to be developed by EDL, EDL-Gen, IPP (d) and off-take from IPP (e) are planned as generation projects for domestic supply in PDP 2010 Rev.-1. The total capacity and generation of these projects to be developed in the planned period are summed up as approximately 5,500 MW and 28,000 GWh p.a. respectively.

Table 2-21: Generation projects in current EDL-PDP

COD	Name of Project	Area	Owner -ship	Capacity (MW)	Energy (GWh)	Status
2012	Xekaman 3 (Off take)	Southern	IPP (e)	25	96	Under Construction
2013	Nam Sana	Central	EDL	14	50	CA
	Xeset 3	Southern	EDL	23	86	FS
	Selabam (Extension)	Southern	EDL	7.7	37	FS
	Nam Long	Northern	IPP (d)	5	37	Under Construction
	Nam Ham 2	Northern	IPP (d)	5	16	FS
	Tadsalen	Southern	IPP (d)	3.2	17	Under Construction
	Xenamnoy 1	Southern	IPP (d)	15	100	FS Approval
2014	Nam Boun 2	Northern	EDL	15	80	FS
	Nam Ngum 1 (Extension)	Central	EDL	40	88	FS
	Houay Lamphan Gnai	Southern	EDL	88	495	Under Construction
	Nam Ngiew	Northern	IPP (d)	20	63	FS
	Nam Lik 1	Central	IPP (d)	60	256	FS
	Nam Kane	Central	IPP (d)	5	20	FS
	Houay Kaphuek	Southern	IPP (d)	5	21	FS
	Houay Champi	Southern	IPP (d)	5	27	FS
	M. Kalum (Lignite)	Southern	IPP (d)	300	2,100	FS
	Xekaman 1 (Off take)	Southern	IPP (e)	64	240	Under Construction
2015	Nam Khan 2	Northern	EDL	130	558	Under Construction
	Nam Chein	Northern	EDL	80	330	FS
	Nam Phak	Northern	EDL	30	170	FS
	Xeset 4	Southern	EDL	10	40	FS
	Nam Beng	Northern	IPP (d)	34	137	FS Approval
	Nam Sim	Northern	IPP (d)	8.6	33	CA
	Nam Pot	Northern	IPP (d)	15	71	FS

COD	Name of Project	Area	Owner -ship	Capacity (MW)	Energy (GWh)	Status
	Nam Ngiep 2	Northern	IPP (d)	180	723	FS Approval
	Nam Pha	Northern	IPP (d)	130	720	FS
	Nam Mang 1	Central	IPP (d)	64	225	FS Approval
	Nam Bak	Central	IPP (d)	160	744	FS
	Nam Phouan	Central	IPP (d)	30	140	FS
	Nam Phai	Central	IPP (d)	60	280	FS Approval
	Nam San 3	Central	IPP (d)	48	325	FS
	Nam Kong 2	Southern	IPP (d)	66	263	FS Approval
	Nam Kong 3	Southern	IPP (d)	42	158	FS Approval
	M. Kalum (Lignite)	Southern	IPP (d)	300	2,100	FS
	Hongsa (Lignite/Off take)	Northern	IPP (e)	100	701	Under Construction
2016	Nam Khan 3	Northern	EDL	47	222	FS
	Kengseuaten	Central	EDL	54	213	FS
	Nam Hinboun	Southern	EDL	40	220	FS
	Nam Tha 1	Northern	IPP (d)	168	721	FS
	Nam Ou 2	Northern	IPP (d)	120	546	FS Approval
	Nam Ou 6	Northern	IPP (d)	180	818	FS Approval
	Nam Ou 5	Northern	IPP (d)	240	1,156	FS Approval
	Nam Phak/Houaykatam	Southern	IPP (d)	45	307	FS
	Thakho (Mekong)	Southern	IPP (d)	50	360	FS
	Xepon 3 (Down)	Southern	IPP (d)	30	150	FS
	Xepon 3 (Up)	Southern	IPP (d)	70	280	FS
	Nam Xam 1 (Off take)	Northern	IPP (e)	47	143	FS
	Sekong 4 (Off take)	Southern	IPP (e)	60	318	FS
	Xepian-Xenamnoy	Southern	IPP (e)	40	179	FS
2017	Nam Seung 1	Northern	IPP (d)	42	167	FS
	Nam Seung 2	Northern	IPP (d)	134	621	FS
	Xekatam	Southern	IPP (d)	75	381	FS
	Donesahong	Southern	IPP (d)	240	1,750	FS
2018	Nam Ou 1	Northern	IPP (d)	160	799	FS
	Nam Ou 3	Northern	IPP (d)	150	710	FS
	Nam Ou 4	Northern	IPP (d)	116	569	FS
	Nam Ou 7	Northern	IPP (d)	190	915	FS
	Nam San 3 (Down)	Central	IPP (d)	30	120	FS
	Nam Ngum (Down)	Central	IPP (d)	60	300	FS
	Xe Neua	Southern	IPP (d)	53	209	FS
	Xelanong 1	Southern	IPP (d)	60	300	FS
	Xelanong 2	Southern	IPP (d)	45	170	FS
	Xedon 2	Southern	IPP (d)	20	80	FS
	Nam Theun 1 (Off take)	Central	IPP (e)	50	250	FS Approval
	Nam Ngiep 1 (Off take)	Central	IPP (e)	22	122	FS
2019	Small hydropower plants		EDL	40	123	FS
	Solars		EDL	15.63	27	FS
	Nam Ma #1, 2, 3, 4, 5	Northern	IPP (d)	22.4	76	FS
	Nam Ngum 4	Northern	IPP (d)	33	165	FS
	Xebanghieng 1	Southern	IPP (d)	60	357	FS
	Mekong Sayaboury (Off take)	Northern	IPP (e)	60	420	Under Construction
2020	Mekong Luangprabang (Off take)	Northern	IPP (e)	114	599	FS
	Mekong Pakbeng	Northern	IPP (e)	150	660	FS Approval

Notes: FS: Feasibility Study Phase, FS Approval: FS approved by MEM, CA: Concession Agreement
(Source) PDP 2010-2020 (Revision-1), EDL.



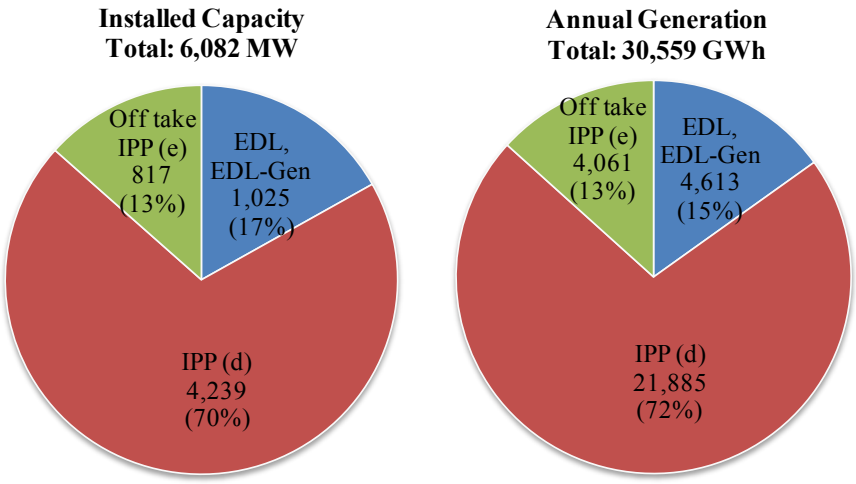
(Source) Study Team base on PDP 2010-2020 (Revision-1).

Figure 2-22: Power development in PDP 2010 Rev.-1

In the development plan of PDP 2010 Rev.-1, more than 90% of newly developed power plants from 2012 to 2020 are constructed and operated by private companies under the IPP scheme. No power development by EDL and EDL-Gen is scheduled after 2017 except small hydro and solar in 2019. In recent years, IPP projects designed for electricity export (IPP (e)) have been changing their schemes to project supplying to domestic demand (IPP (d)). As a result of the conversion of the development scheme, most of the power stations in PDP 2010 Rev.-1 are developed as IPP (d) projects; about 70% of electricity will be supplied by IPP (d) projects in 2020.

Figure 2-23 shows the composition of power supply for domestic demand in 2020 planned in PDP 2010 Rev.-1. The share of the generation by EDL and EDL-Gen is only about 15% (energy base) of the total domestic supply, and the rest will be coming from IPP power stations. The share of IPP power projects in domestic supply will be drastically increasing from 30% in 2011 to 85% in 2020; 72% sourced from IPP (d) and 13% from IPP (e) through the off-take PPA.

It is obvious that the role of EDL and EDL-Gen for the electricity generation in Laos becomes less significant in the coming 10 years. The development of the power projects by 2020 and domestic power supply in 2020 are heavily dependent on the IPP developers. Therefore, it is critically important for the GOL to manage the development of IPP projects in the most appropriate manner in order to achieve the socio-economic development plan through ensuring the sufficient and stable electricity supply to the domestic market.



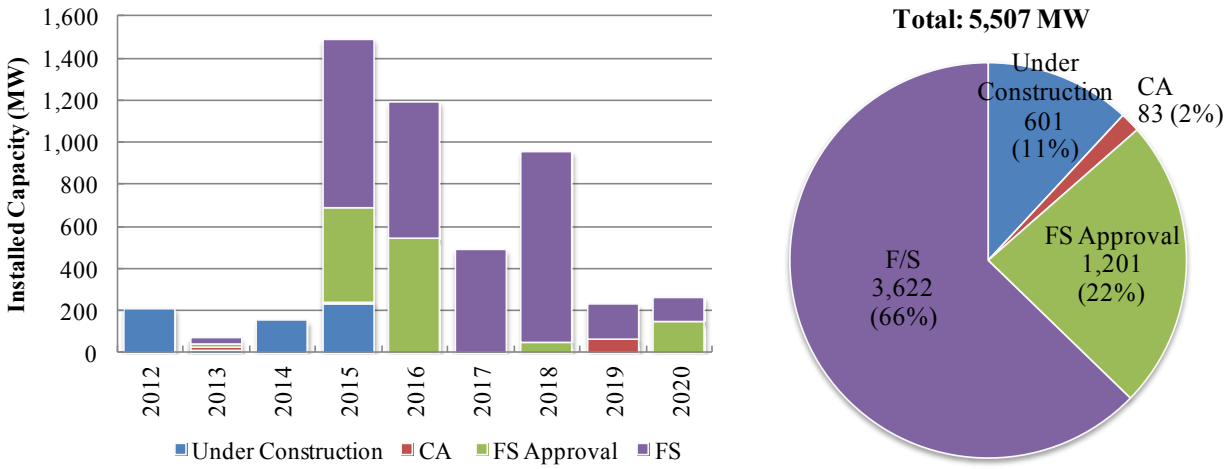
(Source) Study Team base on PDP 2010-2020 Revision-1

Figure 2-23: Composition of power supply in 2020

The current status of the development of the IPP projects, however, is relatively behind the schedule in PDP 2010 Rev.-1.

The present situation of IPP projects listed in PDP 2010 Rev.-1 is shown in Figure 2-24. The progress of IPP projects is affected by a number of factors both characteristics of the project itself and surrounding condition; generation cost, tariff negotiation, financial capability of the developer, natural and social environment, technical issues and so on. Some IPP projects in PDP have not shown progress in term of negotiation of agreement on MOU/PDA/CA and approval of technical specification. At present, only 11% of the projects in PDP with the total capacity of 600 MW are on the phase of construction. On the other hand, 66% of the project planned to be developed by 2020 are still on the study stage. Even the projects assumed to start operation in 2014 and 2015, more than half of the projects have not obtained the technical approval on F/S by MEM.

To meet the rapid increase of domestic demand especially from commercial and industrial sectors forecasted in PDP, development of the power sources in some years ahead should be stimulated and accelerated.



(Source) Study Team base on PDP 2010-2020 (Revision-1).

Figure 2-24: Status of development of projects in PDP

2.5.2.2 Power system development plan

(1) Current status of power system

EDL has been exclusively performing transmission business in Laos and the service areas consist of four areas: the north (Phongsaly, Oudomxai, Luangnamtha, Bokeo, Huaphanh, Luangprabang, Xayaboury and Xiengkhuang), the central (Vientiane Capital, Vientiane and Bolikhamxai), the south 1 (Khammouan, Savannakhet), and the south 2 (Saravan, Sekong, Champasak and Attapeu). The 115 kV on-grid power system of EDL which supplies these areas was somewhat limited so far. Although the grid in the central, where the Vientiane capital city locates, is a relatively steady grid, the other areas used to have only small scale grid.

However, the 115 kV systems in each area are gradually interconnected with each other. As shown in Figure 2-25, the central area and the south 1 area has been already interconnected by a yen loan project (Paxan—Pakbo). Then the south1 area and the south 2 area will be interconnected in 2016 also by another yean-loan project (Pakbo—Saravan).

The 115 kV grid is also interconnected with six connecting points to neighboring countries (five to Thailand and one to China), and power has been traded among the countries (import during dry season, and export during rainy season in principle).

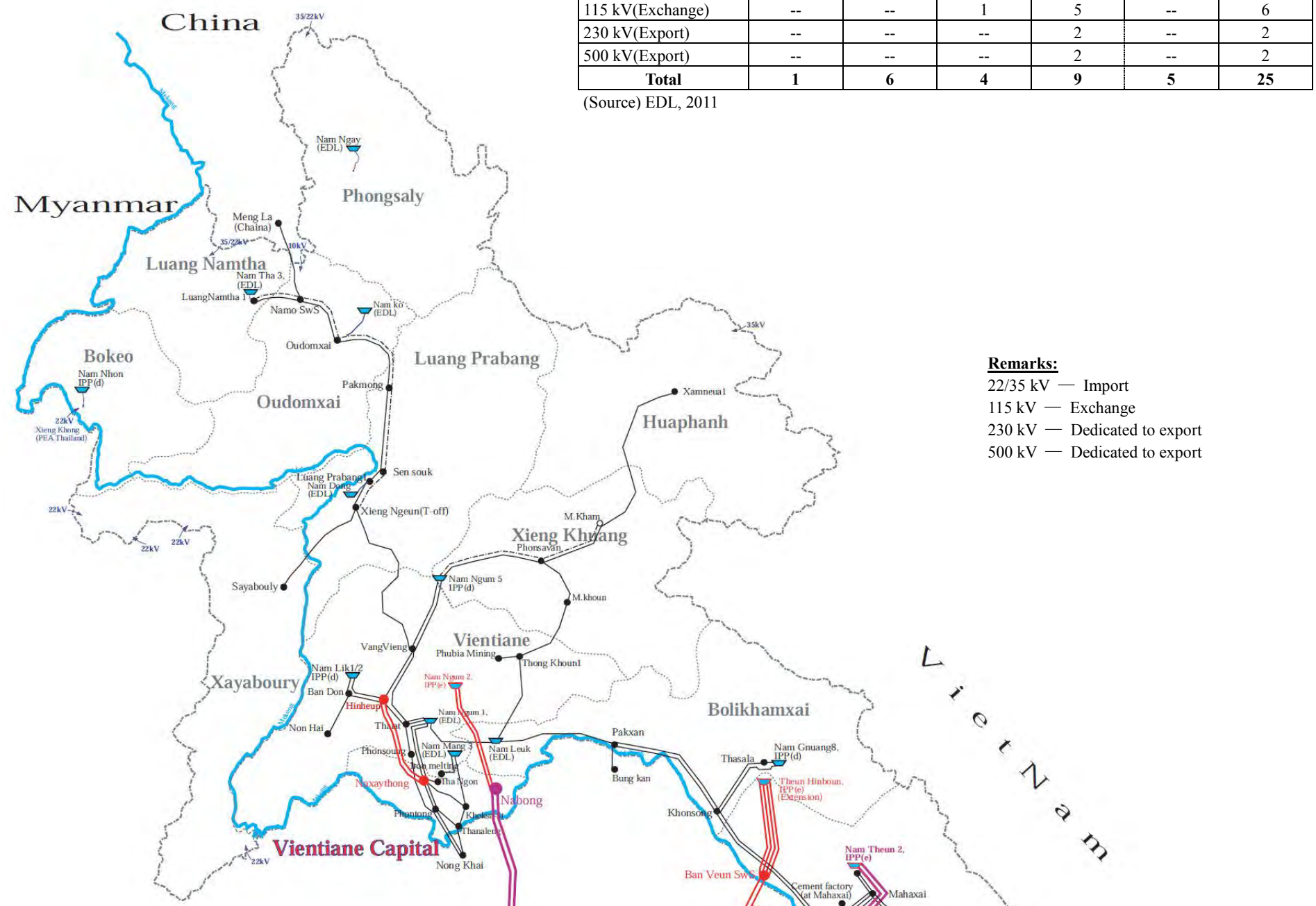
The forms of supply other than the on-grid are the off-grid supply by small hydro or diesel, or those imported from neighboring countries at 15 points through 22/35 kV distribution lines.

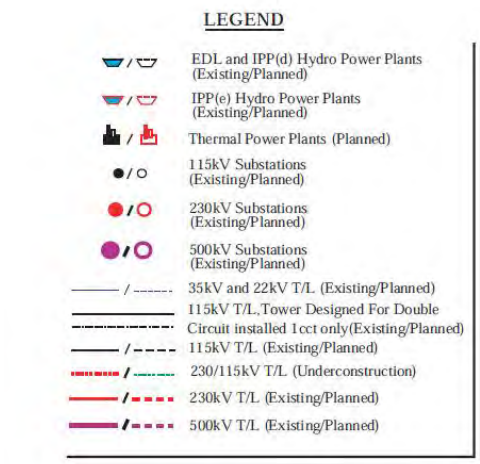
There are already four routes in operation (Theun Hinboun, Houay Ho, Nam Ngum 2, and Nam Theun 2) of ultra high voltage international interconnection lines (230 kV and 500 kV) that are used for the large scale IPP hydropower to export solely to Thailand. These have been constructed independently by IPPs in disregard of the EDL power system development plan. There are still many plans to construct large scale IPPs and related international interconnections in Laos, which is a country having the national strategy to export electricity generated by hydropower.

Existing cross-border interconnections

	Cambodia	Vietnam	China	Thailand		Total
	EDC	EVN	CSG	EGAT	PEA	
22/35 kV(Import)	1	6	3	--	5	15
115 kV(Exchange)	--	--	1	5	--	6
230 kV(Export)	--	--	--	2	--	2
500 kV(Export)	--	--	--	2	--	2
Total	**1**	**6**	**4**	**9**	**5**	**25**

(Source) EDL, 2011





(Source) EDL, 2012.

Remarks:
22/35 kV — Import
115 kV — Exchange
230 kV — Dedicated to export
500 kV — Dedicated to export

Figure 2-25: Current power system of Laos

(2) Power system plan

Meanwhile, Laos recently has been reinforcing the domestic power systems. Transmission lines of 115 kV or 230 kV owned by EDL or IPP (d) have been increasing in order to deal with the domestic demand surge. The central area and the south1 area have already been interconnected by 115 kV transmission line (Pakxan-Pakbo), and the south 1 and the south 2 areas will be interconnected (Pakbo-Saravan).

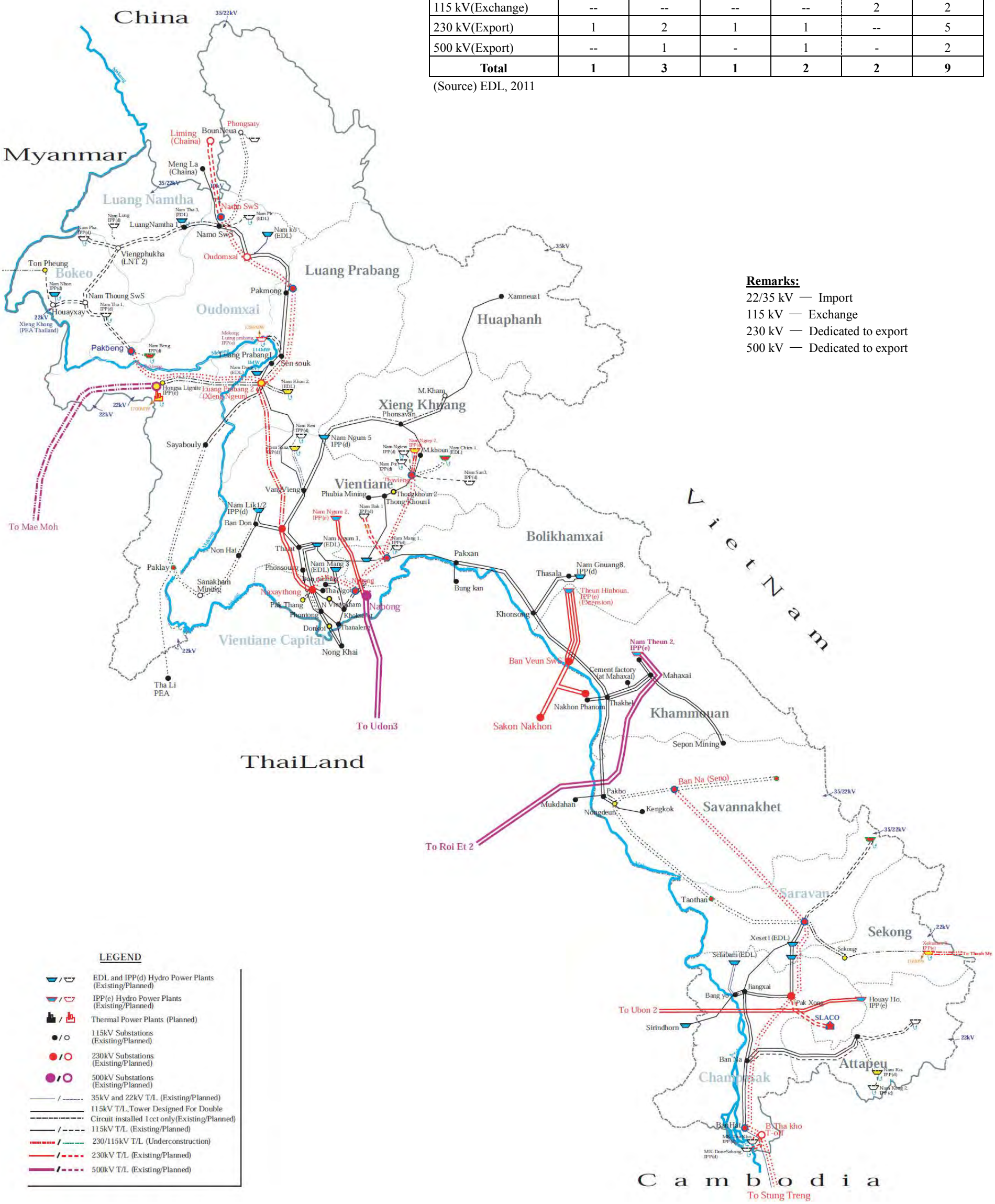
According to the current PDP, there are many projects of 230 kV transmission lines. After 2016 especially, the north and the south areas are planned to be interconnected with 230 kV lines.

There are also many transmission line construction projects for exporting IPPs as shown in Figure 2-26 and Figure 2-27. For example, a 500 kV transmission line to Mae Moh in Thailand for Hongsa Lignite project in the northern area will be commissioned in 2015. On the other hand, an IPP (e) in the central, Nam Ngiep 1, wishes to connect to Nabong substation, and to share the 500 kV transmission line to Udon 3 in Thailand, which was constructed for IPP (e) Nam Ngum 2. However, as the substation and the line are dedicated to Nam Ngum 2, sharing the facilities is not agreed yet. By contrast, in case of the south, a 500 kV exporting transmission line (Pakse-Udon 3) is planned to be commissioned in 2018, which is to be shared by some IPPs including Xepian-Xenamnoy. As the number of IPPs increases, this scheme is preferable to avoid the duplex investment. Thus, Laos is reinforcing its power system in order to meet the domestic demand hike while majorities of its hydro powers, which have enormous potential, are designed to be exported to neighboring countries such as Thailand through ultra high voltage international interconnection.

Cross-border interconnections planned during 2013-2015

	Cambodia	Vietnam	China	Thailand		Total
	EDC	EVN	CSG	EGAT	PEA	
22/35 kV(Import)	--	--	--	--	--	--
115 kV(Exchange)	--	--	--	--	2	2
230 kV(Export)	1	2	1	1	--	5
500 kV(Export)	--	1	-	1	-	2
Total	**1**	**3**	**1**	**2**	**2**	**9**

(Source) EDL, 2011



Remarks:
22/35 kV — Import
115 kV — Exchange
230 kV — Dedicated to export
500 kV — Dedicated to export

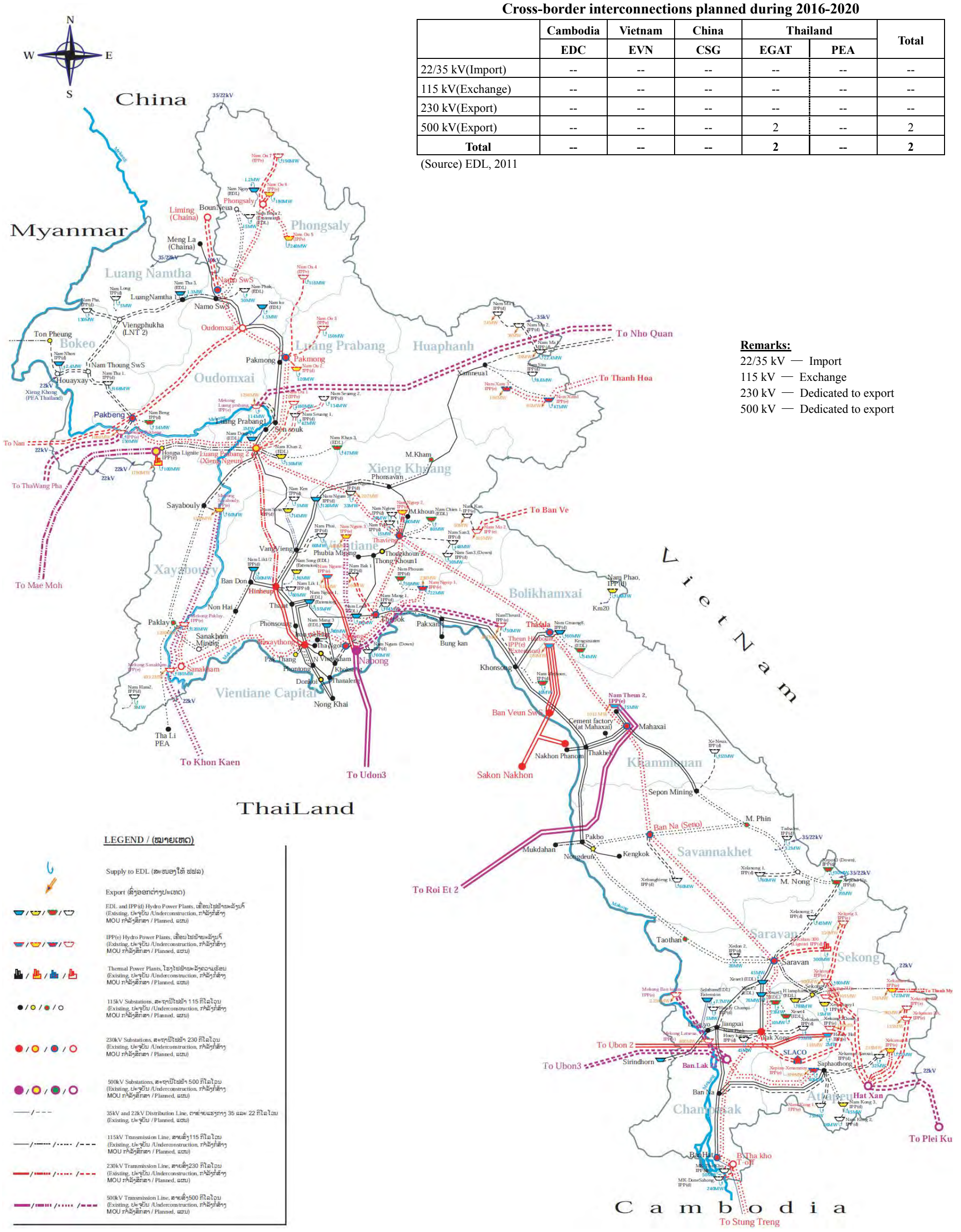
(Source) EDL, 2012.

Figure 2-26: Power system plan during 2013-2015

Cross-border interconnections planned during 2016-2020

	Cambodia	Vietnam	China	Thailand		Total
	EDC	EVN	CSG	EGAT	PEA	
22/35 kV(Import)	--	--	--	--	--	--
115 kV(Exchange)	--	--	--	--	--	--
230 kV(Export)	--	--	--	--	--	--
500 kV(Export)	--	--	--	2	--	2
Total	**--**	**--**	**--**	**2**	**--**	**2**

(Source) EDL, 2011



Remarks:
22/35 kV — Import
115 kV — Exchange
230 kV — Dedicated to export
500 kV — Dedicated to export

(Source) EDL, 2012.

Figure 2-27: Power system plan during 2016-2020

(3) Issues on domestic power system and current PDP

Current issues of the domestic power system operation and power system planning are described as below.

1) EDL‘s power system operation

The power system operation by EDL is just locally conducted at large substations, as EDL currently doesn‘t have the load dispatching center. The maintenance of voltage and frequency of the EDL system is subject to the EGAT system which is interconnected. In this manner, EDL is not yet implementing the centralized and autonomous power system operation. The need for the optimized system operation by EDL itself is increasing as new transmission lines are successively constructed and each local power system is gradually integrated.

2) Need for rational power system plan

A lot of transmission lines are planned in EDL‘s PDP (PDP 2010-2020 (Revision-1)), but the necessity of each line is not fully clarified. For example, compared with the previous PDP, the 230kV north-south transmission line is included, and this line seems to be planned to be connected to China. But the aims and effects of the north-south connection and the interconnection with China are not clear. A rational power system plan has to be formulated from the long-term view in order to realize stable power supply and to avoid excess investment.

3) Current situations and issues of power system analysis

The power system planning has been updated annually by the Technical Department of EDL. As shown in the right table, data is collected from January to March, and based on the data, the power system is analyzed from April to June. The reporting document is made during July and August, and it is approved around October.

Outline of schedule of power system planning

Jan -Mar	Data collection
Apr -Jun	System analysis
Jul -Aug	Report drafting
Oct	Approval

Power system analysis is implemented using the software PSS/E, and power flow analysis of 115 kV and 230 kV systems, and N-1 reliability analysis are conducted. In addition, four cases, namely "Peak", "Off-peak", "Rainy-season", and "Dry-season", of power flow calculation are implemented.

In order to conduct proper analysis, the data of the EGAT system is also necessary as well as EDL‘s own system‘s. This is because the state of the EGAT system affects the EDL system, as both systems are interconnected with each other (via 5 routes of 115kV transmission lines). However, unlike EDL, EGAT is using the analysis software DigSILENT. As a result, when conducting the system analysis, EDL cannot utilize the EGAT‘s data directly. This situation makes it difficult for EDL to adequately conduct system analysis.

The need for more detailed analysis including the stability analysis is increasing, as the EDL system becomes more complicated and heavily loaded in the future. In preparation for that, EDL needs to use the

same analysis software as EGAT's and conduct the system analysis sharing the same data.

In addition, it is necessary to check the results of the system analysis by comparing them with the actual values, but it is difficult to conduct this process without the SCADA system.

(4) Foundation of central load-dispatching center

National Load Dispatching Center (NLDC) will be founded in 2013, which enables EDL to accurately grasp the status of the power system for the proper operation and planning. The functions of the SCADA system in NLDC are as follows:

i) Transmission dispatching:

- Monitoring of transmission grid security
- Transmission system switching
- Sub-transmission system switching directly, or authorization and monitoring of sub-transmission switching
- Evaluation and approval of planned outage requests involving transmission and sub-transmission

ii) Generation dispatching:

- Real time monitoring of all the generation units (hydropower plants)
- Control of EDL-owned units
- Monitoring of PPA operational parameters of all the IPPs
- System-reserve monitoring
- Same-day and short-term purchase and sales
- Monitoring of power interchange with other power systems

iii) Operational planning:

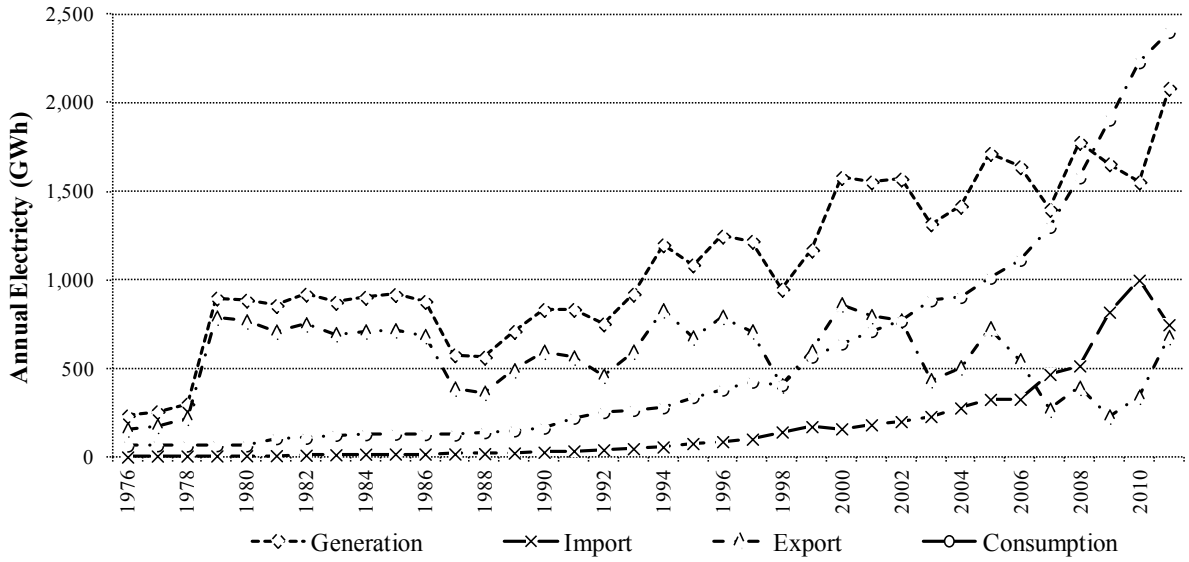
- Power exchange and scheduling
- Hydro scheduling
- Stream forecast
- Load forecast
- Weather forecast
- Coordination and optimization of hydropower and thermal generation

The training program is also planned by the manufacturer who is installing the SCADA system. The program is expected to enable EDL engineers to have better control over various devices.

2.5.3 Finance

2.5.3.1 Overview of import and export balance

The power balance between export and import has been negative since 2007 due to fast increasing of power consumption even if the power generation is also stable as shown in the Figure 2-28.



(Source) Study Team base on EDL Annual Report 2010 and EDL Statistics 2011.

Figure 2-28: EDL generation, export, import and consumption by year

It seems that the total power balance in 2011 was not more than previous four years. However, there are some issues on power export and import observed on a monthly basis as shown in the Table 2-22. In dry season, electricity import was more than export while export was more than import in rainy season between July to October. Moreover, the annual average price gap between export (3.91 US cent/kWh) and import (5.47 cent/kWh) was remarkable due to the PPA structure between neighboring countries (refer to the case of Table 2-23 for EGAT).

Table 2-22: Power and price balance between export and import 2011

Month	Energy trade (MWh)			Price[20] (cent/kWh)		
	Export	Import	Balance	Export	Import	Balance
January	25,129	65,405	-40,276	4.0533	5.3878	-1.3345
February	15,036	73,067	-58,031	4.3298	5.3026	-0.9728
March	9,054	92,580	-83,526	4.3709	5.2693	-0.8984
April	9,118	108,960	-99,842	4.2062	5.0999	-0.8937
May	10,001	95,622	-85,621	4.1528	5.3124	-1.1596
June	37,258	77,563	-40,305	3.9810	5.4728	-1.4918
July	95,021	37,330	57,691	3.9509	6.0933	-2.1424
August	140,223	16,403	123,820	3.8826	7.6241	-3.7415
September	147,347	24,329	123,018	3.8410	6.4913	-2.6503
October	131,194	38,109	93,085	3.8239	6.0615	-2.2376
November	27,194	59,969	-32,775	3.8470	5.3742	-1.5272
December	16,336	58,561	-42,225	4.0790	5.3119	-1.2329
Average	--	--	--	3.9122	5.4695	-1.5573
Total	662,911	747,897	-84,986	--	--	--

(Source) Study Team based on MEM data given in US dollar terms.

Table 2-23: Tariff structure between EDL and EGAT

	Peak tariff (Baht/kWh)	Off-Peak tariff (Baht/kWh)
(a) EDL exports to EGAT	1.60	1.20
(b) EDL imports from EGAT	1.74	1.34
(c) Export < Import (EDL & EGAT)	3.6781	2.0412

(Source) Study Team based on MEM data given in US dollar terms.

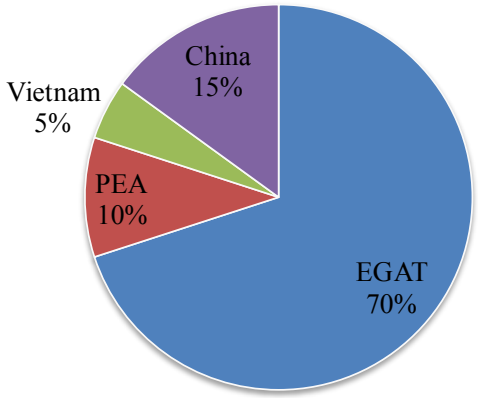
Regarding the power balance in consideration of new development and better operation of hydropower, at least 85GWh in total was necessary to avoid over export and 100 GWh on monthly basis was necessary to bridge the gap.

2.5.3.2 Price balance analysis

Electricity is exchanged with neighboring countries: 85% is exchanged with EGAT and China through high voltage transmission lines of 115kV and above, while 15% is exchanged with PEA, Vietnam and small part of China through distribution lines. When only high voltage power trade is considered average import tariff will be 4.76 US cent/kWh (refer to Figure 2-29).

[20] Prices of export and import (cent/kWh) were calculated on monthly and annual basis: export sales/ export energy trade , or import expenditure / import energy trade.

Average import tariff: 5.47 cent/kWh	
EGAT system	4.46
Khammouane	4.43
Savannakhet	4.51
Vientiane	4.47
Champasak	4.21
China (Grid)	6.46
Grid total	4.76
PEA (Bokeo)	10.75
Vietnam	6.00
China (Distribution)	7.30



(Source) Study Team based on MEM data given in US dollar terms.

Figure 2-29: Average prices of importthrough high voltage system

2.5.3.3 Financial constraint and difficulty of implementation of investment plan

The first PDP (i.e., PDP 2007-16) was compiled six years ago and revised twice (i.e., PDP 2010-20 and PDP 2010-20 (Revision-1)). Perspectives in PDP 2007-16 drastically changed in the revised PDP 2010-20. One of the big changes with regards to the growth of power demand after 2014 is stemming from the power demand in the industrial sector (see Figure 2-30).

However, the outlook for mining-related industries contains great uncertainty; in particular, the project of Sino Laos Aluminum Corporation Limited, the so-called SLACO project, will have a substantial impact on the balance of power demand and supply in the mid-2010s.

For this reason, in PDP 2010-20 (Revision-1), two cases were used to forecast demand: one excludes power supply to the SLACO project, and the other includes it.

In either case, this large demand arising from the industrial sector in the mid-2010s will strongly affect the on-going power development plan of EDL, even if some of the large mining projects are postponed and suspended.

Under the current plan, EDL is compelled to increase its power supply capacity quickly and largely — a more than four-fold increase in 10 years. For EDL, which is a very capital-intensive industry, this quite aggressive power development plan bears a substantial risk due to the size of the investment and uncertainty of the demand in the industrial market.

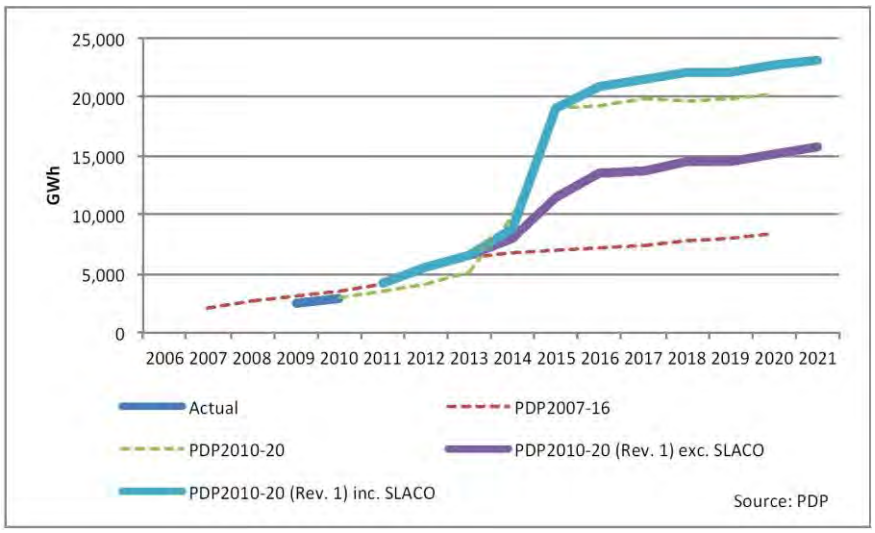


Figure 2-30: Comparison of energy demand forecast between PDP 2010-2020 and PDP 2010-2020 (Revision-1)

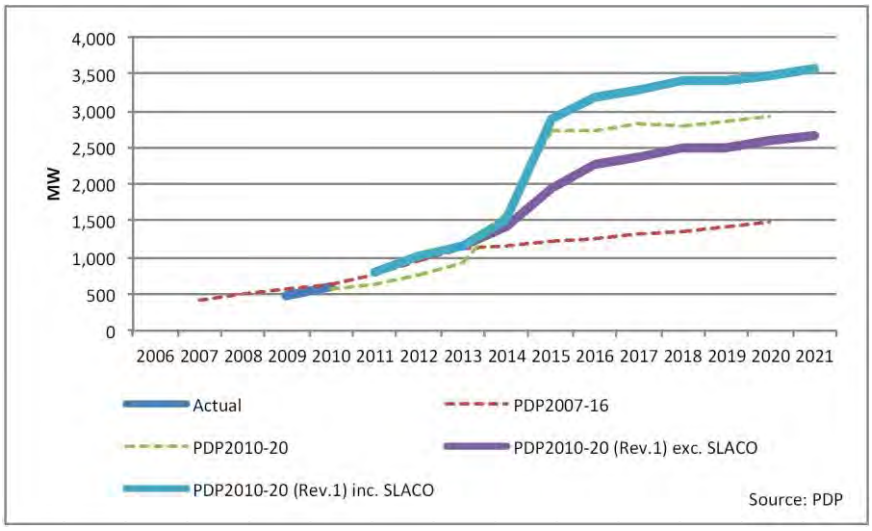


Figure 2-31: Comparison of peak load forecast between PDP 2010-2020 and PDP 2010-2020 (Revison-1)

2.5.3.4 Financial constraints—weak financial performance of EDL

Along with both the size and the uncertainty of the increase in the future power demand, constraints on the EDL financial capacity are another concern. Before discussing the future investment capability of EDL, let us review the current financial performance of EDL.

While the EDL turnover rapidly increased during the 2000s—quadrupled from 2001 to 2010, profit did not follow the increase in turnover (although some fluctuation of increase and decrease in profit is observed). As shown in Figure 2-32, the ratio of profit to sales deteriorated year by year, in other words, the EDL profitability continued to decline.

To make the EDL power development sustainable, cash generation is definitely needed because part of

the fund necessary for the future investment must be generated from today's profit. In the first half of the 2000s, investment by EDL did not greatly exceed the cash generation from operating activities, but in the second half of the 2000s EDL started to accelerate investment. To cope with the rapid increase in power demand beyond 2010, in particular, EDL has made major investments based on debt-finance since 2009. As a result, its free cash flow[21] has fallen into deficit (see the Figure 2-33). This situation is apparently behind the current investment-debt downward spiral.

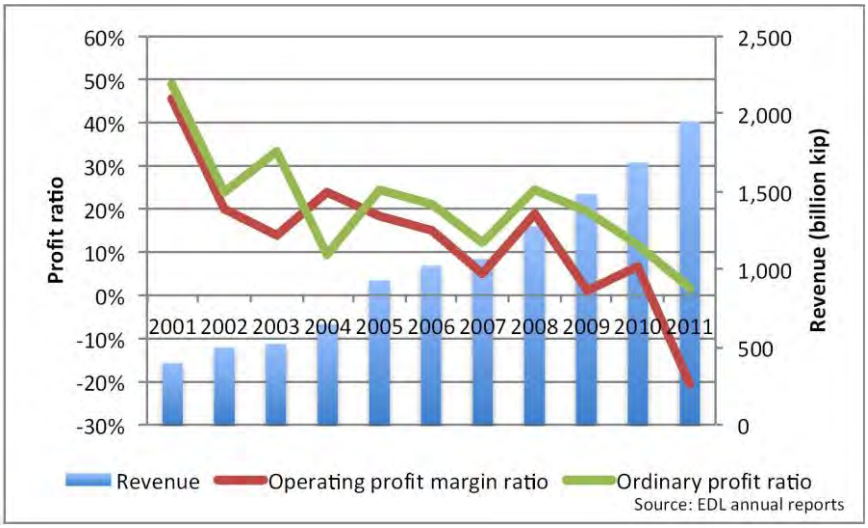


Figure 2-32: Trend of EDL revenue and profit, 2001-2011

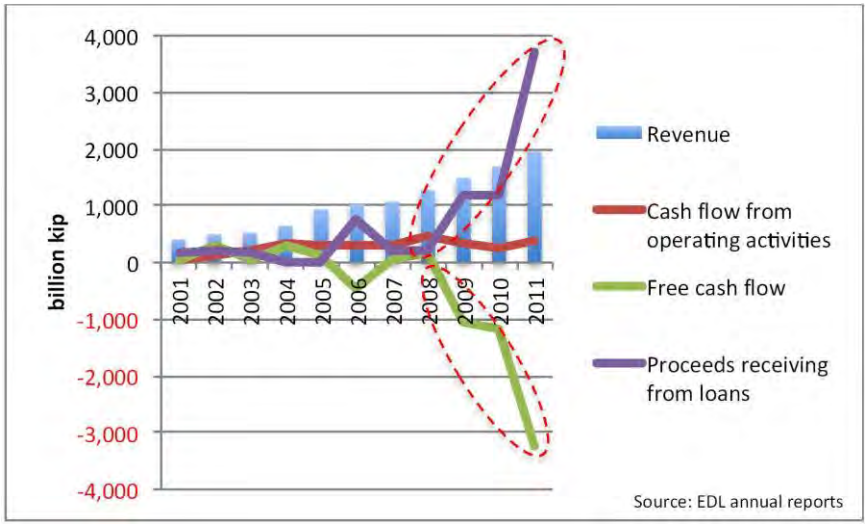


Figure 2-33: Trends of EDL cash flow, 2001-2011

To make the financial position of EDL clearer, it would be better to compare its performance with those of other utilities in ASEAN countries: the Electricity Generating Authority of Thailand (EGAT), PLN in Indonesia, Tenaga Nasional Berhad (TNB) in Malaysia, and Melarco in the Philippines.

[21] Free cash flow represents the cash that a company is able to generate after laying out the money required to maintain or expand its asset base.

One important indicator for measurement of profitability is the return on assets (ROA), which is defined by the operating profit divided by total assets. The ROA of EDL is now the worst among the ASEAN utilities, although those of Indonesia‘s PLN and the Philippines‘ Melarco were much lower in the past (up to 2008; see Figure 2-34).

However, we need to understand individual business environments in the two countries. The power tariffs in Indonesia have been politically controlled, and PLN could not (also cannot) recover its operating cost by the power-sales revenue. As a result, the company received subsidies from the government to compensate the operating loss. Moreover, the size of these subsidies has continued to increase since the mid-2000s. In the Philippines, in the early and mid-2000s, Melarco faced the turbulence of power sector reform triggered by the bankruptcy of the National Power Corporation (NPC), and struggled to make a profit from power sales. But in the late-2000s it recovered normality and began to make a reasonable level of profit.

Another indicator for measuring the profitability of a company is the return on equity (ROE), which is defined by the net profit divided by shareholder‘s equity. As shown in Figure 2-35, the result of the comparison of the ROE is very similar to that of the ROA comparison. The performance of EDL is very poor.

Among the other utilities, PLN also performed poorly due to the above-mentioned reason, but the continued improvement of its performance is clear. Melarco also experienced a difficult business environment (i.e., the sector reform) in the past, but its recovery of profitability is obvious in the second half of the 2000s. TNB showed good financial performance in the early and mid-2000s but recorded poor results in 2009 and 2011. Although this is only a snapshot figure, its ROE in 2011 plunged to below 2%.

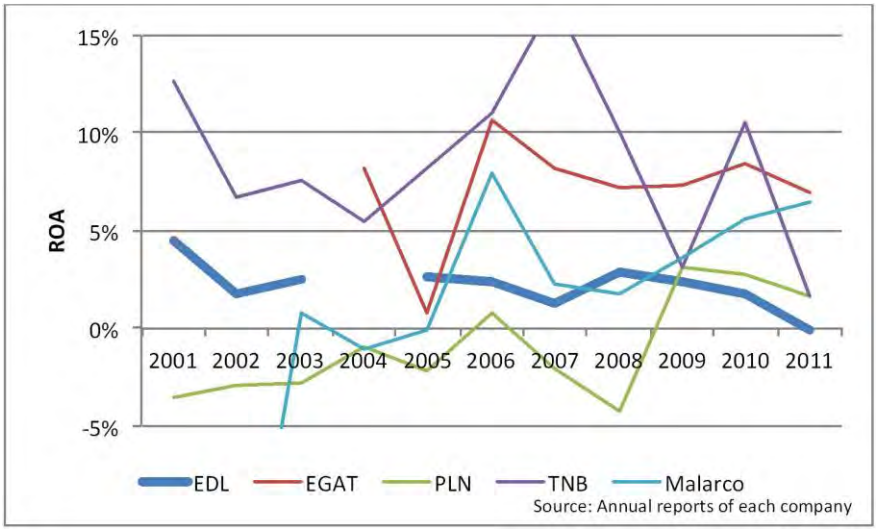


Figure 2-34: Comparison of ROAs of ASEAN utilities

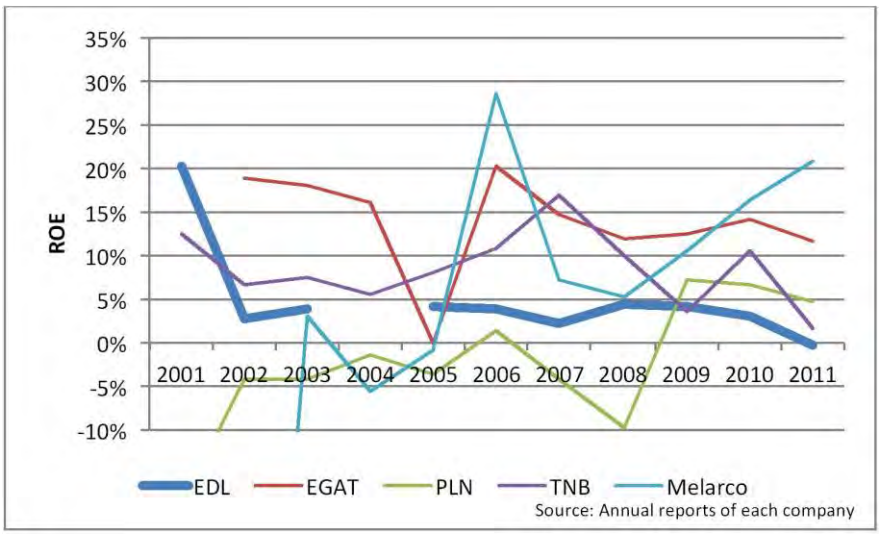


Figure 2-35: Comparison of ROEs of ASEAN utilities

Alongside profitability, the debt to equity (D/E) ratio is an important indicator for measurement of the soundness of a company's financial position. Here, the D/E ratio is calculated by the interest-bearing debt divided by shareholder's equity. One of the concerns about EDL is its high D/E ratio, which was between 4 and 5 in the 2000s and jumped up to 8.1 in 2011 (see Figure 2-36).

Conversely, the D/E ratios of the other utilities are very low; specifically, those of the three utilities — EGAT, TNB, and Melarco — are less than unity.

This result evidences that EDL depends heavily on debt-finance as compared to the other utilities. Heavy dependence on debt carries a potential financial risk, when a company has difficulty in making a profit. This is because a company is obligated to pay interest on the outstanding debt and perform amortization regardless of black or red ink in incomes.

It is a question how heavy the interest expense of EDL at present is. To understand the burden of the interest expense, let us compare the interest coverage ratio of EDL with those of the other utilities.

The interest coverage ratio is defined by the following equation: earnings before interest and taxes (EBIT[22]) divided by interest expense. Here, the general definition of earnings is operating revenue minus operating expenses plus non-operating income.

The result is shown in Figure 2-37. While data on interest expenses of other utilities are available in their annual reports, interest-expense data for EDL are available only for 2010 and 2011. Although the amount of EDL data is limited, the interest coverage ratio of EDL seems to be low as compared to other utilities except for the PLN.

[22] Another definition is ordinary profit plus interest paid minus interest and dividend received.

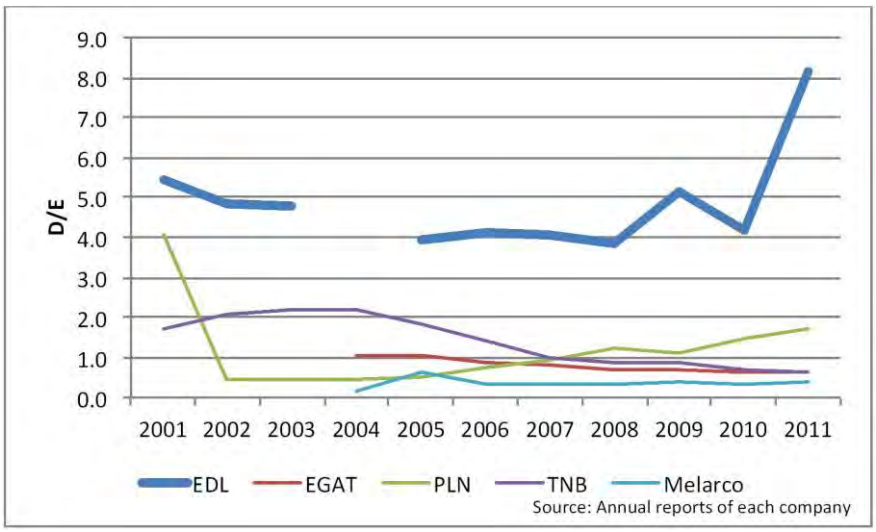


Figure 2-36: Comparison of D/E ratios of ASEAN utilities

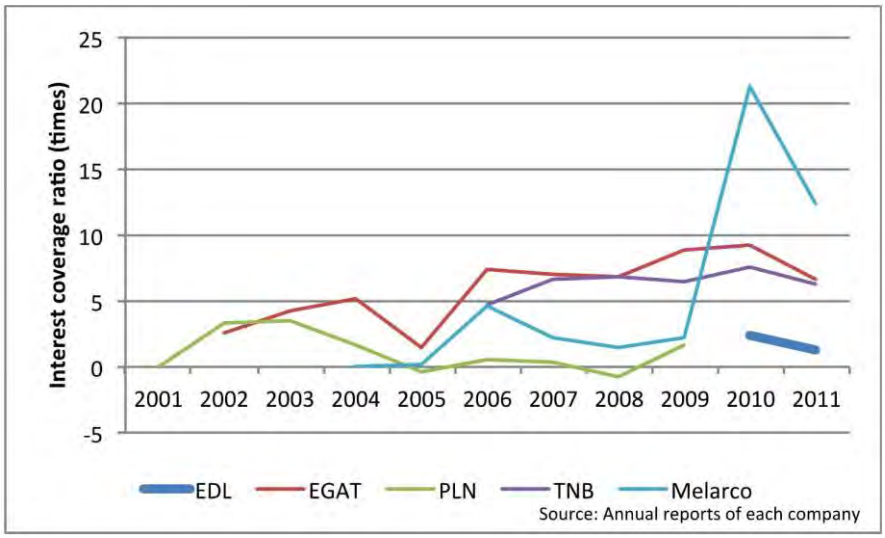


Figure 2-37: Comparison of interest coverage ratios of ASEAN utilities

2.5.3.5 Difficulties in EDL fund procurement necessary for PDP 2010-2020 investment plan

In the current projection of PDP 2010-2020 (Revision-1), the fund procurement required for EDL is estimated at 43,452 billion kip (or 5,431.5 million US dollars) between 2010 and 2015, and 47,798 billion kip (or 5,974.7 million dollars) between 2016 and 2020.

Of this total fund requirement, 7.6% is planned to be financed by cash, and the balance by loans. In other words, EDL must invest a total of 3,316 billion kip, or 553 billion kip a year, during the 2010-15 period by equity finance. Furthermore, during the 2016-20 period, this equity portion will increase to a total of 3,647 billion kip, or 729 billion kip a year.

One big question is whether or not EDL can shoulder this financial burden. The answer is very negative. Let us look at the past financial records again. During the 2000s, although numbers fluctuated year by year, a firm estimate of EDL cash generation would be in the range of 250 and 350 billion kip a year (see

Figure 2-38). Under this premise, the amount of equity-finance requirement is far beyond EDL capacity: 553 billion kip a year during the 2010-15 period and 729 billion kip a year during the 2016-20 period.

In addition, the requirement for investment by debt finance will cause another big problem. EDL must borrow a total of 29,200 billion kip during the 2010-15 period, and 32,121 billion kip during the 2016-20 period. Sometime in the future after the grace period, EDL must pay back the borrowed money. If the loans are paid back in 20 years, annual amortizations of the loans borrowed during the 2010-15 and the 2016-20 periods are 1,500 billion kip and 1,600 billion kip respectively excluding interest. As a result, a total of 3,100 billion kip (1,500 plus 1,600 billion kip) must be paid back every year. In contrast, EDL turnover in 2011 was only 1,952 billion. Even if the level of the EDL turnover more than tripled in 10 years in accordance with the growth of the EDL power supply, it would still be quite difficult for EDL to pay back 3,100 billion kip (i.e., only amortization of loans) a year.

In addition, EDL must pay interest in principle. The next question is how much interest EDL needs to pay. EDL borrows money via the government, which receives concessional loans from bi- and multilateral institutions, and must pay additional spread on the original interest rates. Although the interest rate of a concessional loan varies from institution to institution, EDL generally pays 3 - 6% interest to the government. If so, interest on the principal of 61,321 billion kip (i.e., borrowings of 29,200 billion kip in 2010-15 and 32,121 billion kip in 2016-20), which EDL must pay every year even during the grace period, is 1,840 - 3,679 billion kip a year. Given that EBIT was 330 billion kip in 2010 and 166 billion kip in 2011, EDL does not seem to be able to pay even the interest (see Figure 2-33).

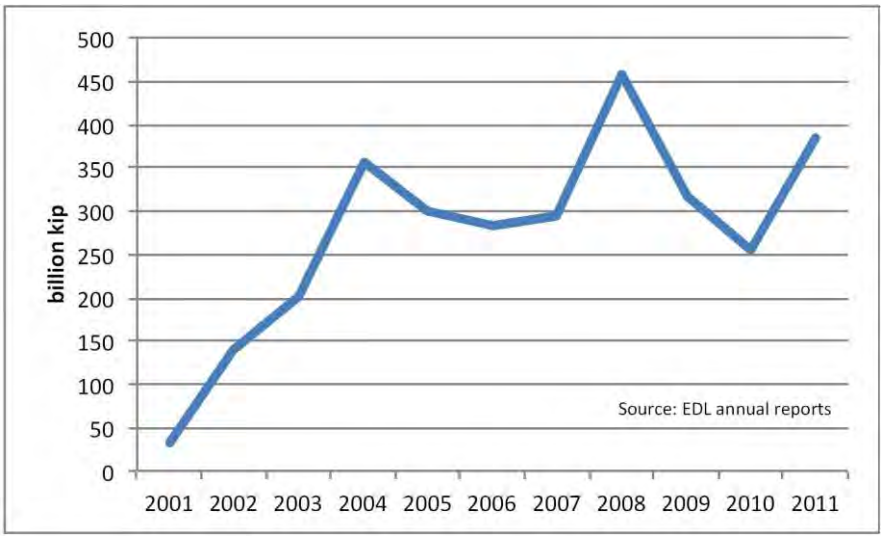


Figure 2-38: Cash flow from operating activities of EDL, 2001-2011

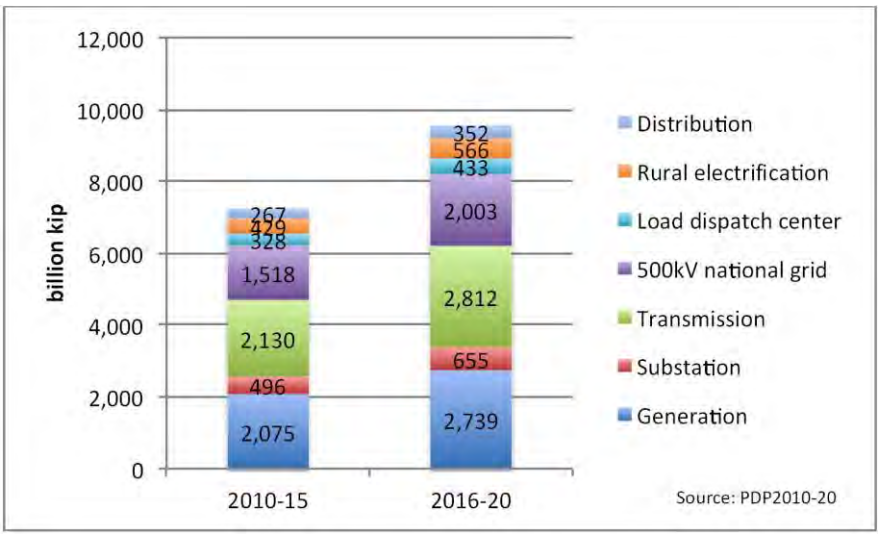


Figure 2-39: Requirement of equity investment planned in PDP 2010-2020

Table 2-24: Fund requirement planned in PDP 2010-2020

(Unit: billion kip)

	2010-15		2016-20		2010-20	
	Total cost	**Annual cost**	**Total cost**	**Annual cost**	**Total cost**	**Annual cost**
Generation	11,619	1,937	12,782	2,556	24,401	2,218
Loan	9,634	1,606	10,597	2,119	20,230	1,839
Equity	1,406	234	1,546	309	2,951	268
Substation (new)	2,043	341	2,248	450	4,291	390
Loan	1,886	314	2,074	415	3,960	360
Equity	158	26	174	35	331	30
Substation (reconstruction)	934	156	1,028	206	1,962	178
Loan	701	117	770	154	1,471	134
Equity	234	39	257	51	490	45
Transmission & sub-transmission lines	12,779	2,130	14,058	2,812	26,837	2,440
Loan	9,206	1,534	10,126	2,025	19,333	1,758
Equity	930	155	1,023	205	1,954	178
500 kV national grid	9,106	1,518	10,016	2,003	19,122	1,738
Loan	1,393	232	1,533	307	2,926	266
Equity	0	0	0	0	0	0
Load dispatch center	1,970	328	2,166	433	4,136	376
Loan	1,893	315	2,082	416	3,975	361
Equity	77	13	84	17	161	15
Rural electrification	2,571	429	2,829	566	5,400	491
Loan	2,385	397	2,623	525	5,009	455
Equity	186	31	205	41	392	36
Overhaul of existing power plants	829	138	912	182	1,741	158
Loan	663	111	730	146	1,392	127
Equity	166	28	182	36	348	32
Reinforcement of distribution lines	1,600	267	1,760	352	3,360	305
Loan	1,440	240	1,584	317	3,024	275
Equity	160	27	176	35	336	31
Total	43,452	7,242	47,798	9,560	91,250	8,295
Loan	29,200	4,867	32,121	6,424	61,321	5,575
Equity	3,316	553	3,647	729	6,963	633

Note: 1 US dollar = 8,000 kip

(Source) Prepared by the Study Team based on PDP 2010-2020 (Revision-1).

2.5.3.6 Apprehension about power tariffs: Difficulties in EDL fund procurement necessary for PDP 2010-2020 investment plan

Hike of tariff levels did not contribute to EDL earnings.

The share of revenue occupied by domestic power sales has continued to increase, and this trend of high dependence on the domestic market is also expected to continue.

However, the hike in the tariff levels did not contribute to earnings. While the tariffs steadily increased from 240 kip/kWh in 2001 to 559 kip/kWh in 2011, operating profit did not follow the tariff hike. As shown in Figure 2-41, the decrease in operating profit was steep during the second half of the 2000s especially.

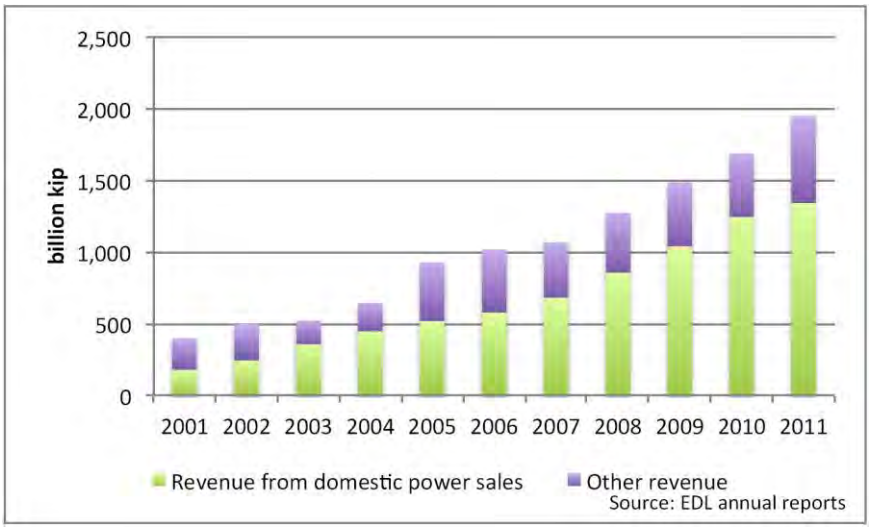
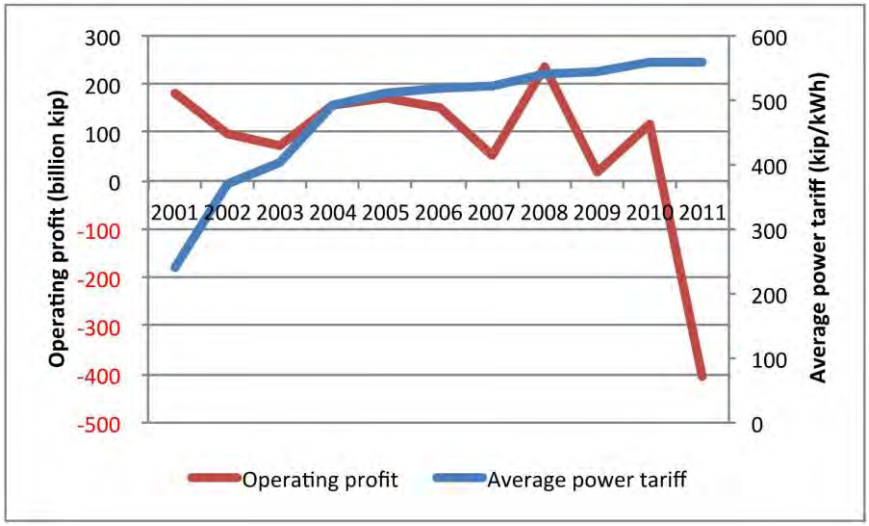


Figure 2-40: Make-up of EDL revenue, 2001 – 2011



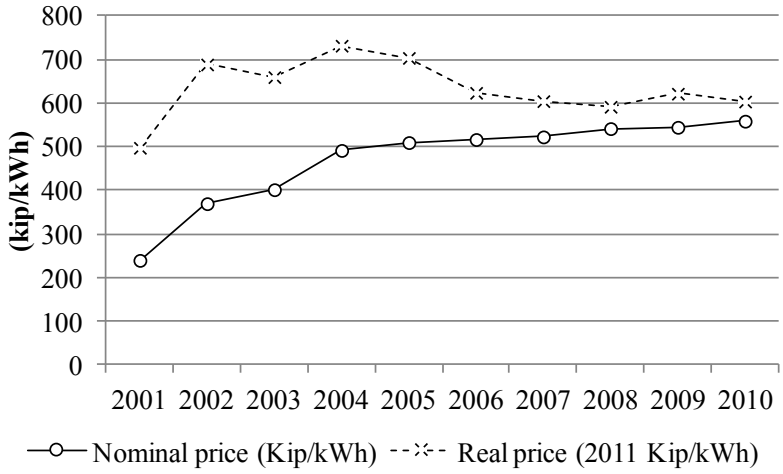
(Source) EDL annual reports.

Figure 2-41: Trend of average tariff vs. operating profit, 2001 - 2011

Past tariff hikes in real terms

Power tariffs have been increased year after year, and the average growth rate between 2001 and 2011 was 8.8% p.a. However, this rate of tariff increase is in nominal terms. By taking into account inflation, the tariff increase must be evaluated in real terms. As shown in Figure 2-42, power tariffs in real terms did not change substantially during the 2001-11 period. In particular, in the second half of the 2000s, they remained in the range of 560-630 kip/kWh in terms of 2011 real value.

In March 2012, the government also approved a tariff hike during the period of March 2012 - December 2017. Tariffs will increase 19% by the end of December 2012, and 2% p.a. between 2013 and 2017. As a result, tariffs in 2017 will be 32% higher than in 2011. This increase, however, is still calculated in nominal terms. If tariff levels are adjusted using the GDP deflator, the increase is nil in real terms. This is the same as the situation as observed over the past 10 years.



(Source) Prepared by Study Team.

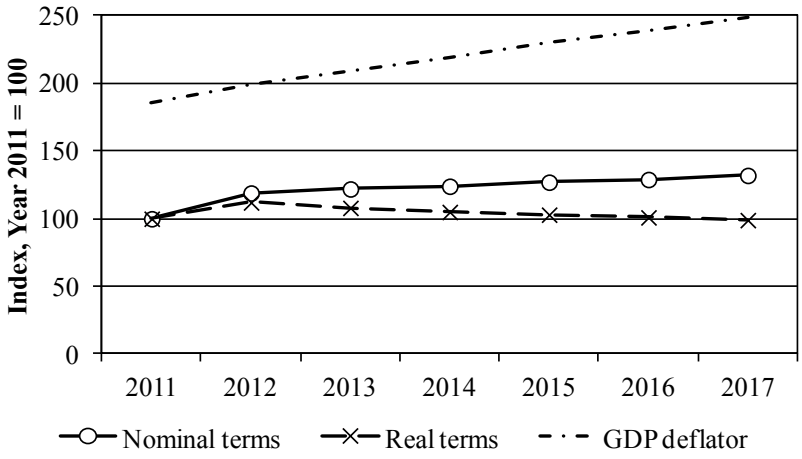
Figure 2-42: Average power tariffs, 2001-2011

Table 2-25: Average power tariffs, 2001-2011

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Nominal price (Kip/kWh)	240	370	402	492	510	517	523	542	545	559
Real price (2011 Kip/kWh)	498	689	660	732	704	624	605	592	622	604
Real price (2011 ¢/kWh)	6.2	8.6	8.2	9.1	8.7	7.8	7.5	7.4	7.7	7.5
GDP deflator	89.8	100.0	113.3	125.1	134.9	154.3	161.0	170.5	163.1	172.2

Notes: 1. Tariffs up to 2006 are as of the end of each year.
2. Prices in real terms are calculated using the GDP deflator.
3. Exchange rate = 8,048.09 kip to one US dollar (average reference rate in 2011)

(Source) Prepared by the Study Team based on EDL annual reports, IFS, and BOL data



(Index, the year 2011 = 100)

	2011	2012	2013	2014	2015	2016	2017
Nominal terms	100	119	122	124	127	129	132
Real terms	100	112	108	105	103	101	99
GDP deflator	186	199	209	219	230	239	248

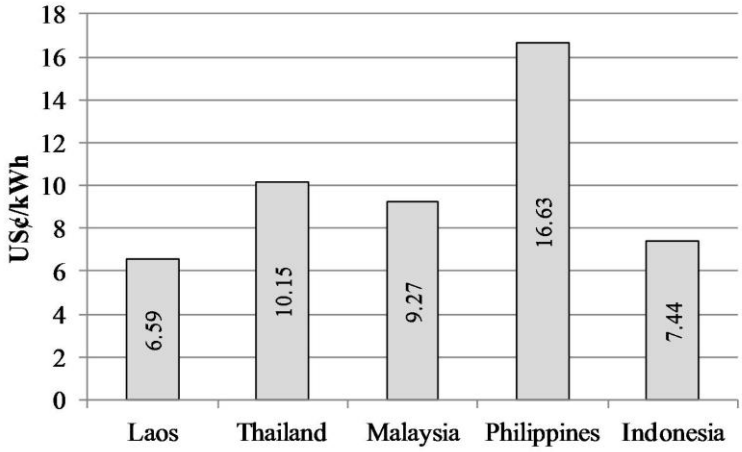
Note: GDP deflator was estimated by the IMF.
(Source) MEM, IMF World Economic Outlook (Apr. 2012).

Figure 2-43: Scheduled tariff increase from March 2012 to 2017

Evaluation of the current tariff levels

The current EDL tariff levels are not high as compared to those of the other ASEAN utilities (see Figure 2-44), and consumers appreciate the benefit of inexpensive electricity.

However, the big question is whether EDL will be able to generate sufficient cash necessary for the future investment under the current schedule of tariff increase. One commonly used indicator to evaluate the tariff levels is the ROA archived by a power utility, although there are various opinions on justification regarding tariff level appropriateness, e.g., that cost reduction through improvement of EDL business performance is the first priority and that the actual cost of power supply is also not clarified.



(Source) Japan Electric Power Information Center, Inc.

Figure 2-44: Comparison of average power tariffs of ASEAN utilities, 2010

As discussed in the previous section, the average ROA of EDL in the 2000s was on the order of 1 or 2%, and dropped to less than 1% in the late 2000s due to the continued deterioration of the profitability. In contrast to EDL, EGAT, which is commonly known as a financially sound utility in the ASEAN region, performed much better; its ROA was in the range of 7 – 8% except for the year 2005, when the operation experienced a loss of profit. Melarco, which is also known as a self-supporting privately-owned utility, achieved the ROA level of 6% in 2010 and 2011 after its recovery from the difficult business environment (i.e., the NPC bankruptcy and the following sectoral reform) in the early and mid-2000s.

Given that EDL continues to be exposed in rapid demand increase in double digits, profit-making to guarantee future investment is, needless to say, a prerequisite. The main source of profit must be the revenue from power sales, and this revenue simply depends on power tariff levels.

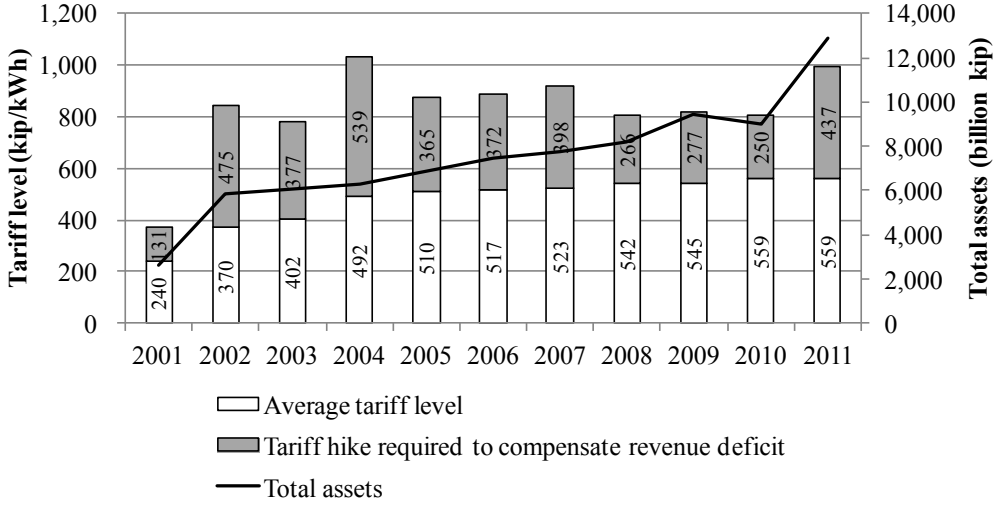
As already mentioned, the tariff levels have not been hiked high enough to secure the future investment. Historically, bi- and multilateral organizations, which provide concessional loans to developing countries, recommended that the ROA of utilities be on the level of 8%. Although there is some question as to whether the figure of 8% is theoretically appropriate, the current ROA performance of EDL is too low (e.g., on the order of 1 or 2% in the 2000s).

For these reasons, the current tariff levels of EDL must be carefully evaluated, and there should be discussion of the need for a further hike in tariff levels to make future power development financially sustainable.

Tariff hike needed to achieve the ROA of 8%

Next question is how high the tariff levels must be hiked to achieve the targeted ROA rate of 8%. Figure 2-45 and Table 2-26show the result of the calculation. The ROA achieved by EDL was 1.8% in 2010 and -0.1 % in 2011. The net profit required to achieve the targeted ROA of 8% would have been 719 billion kip in 2010 and 1,032 billion kip in 2011. However, actual net profit was only 162 billion kip in 2010, and -16 billion kip in 2011. In other words, the shortage came to 557 billion kip in 2010 and 1,048 kip in 2011. To compensate for this profit shortage, hikes of 298 kip/kWh for 2010 and 437 kip/kWh for 2011 would have been needed on the top of the actual tariff level of 559 kip/kWh.

The target rate of 8% quoted here is still debatable, but the past profit level of 1 – 2% ROA is none the less unquestionably low.



(Source) EDL annual reports.

Figure 2-45: Theoretical tariff level needed to achieve 8% ROA

Table 2-26: Theoretical tariff level needed to achieve 8% ROA

(Unit: GWh, kip/kWh, billion kip)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Domestic power sales	710	767	884	903	1,011	1,112	1,298	1,578	1,901	2,228	2,399
Average tariff level	240	370	402	492	510	517	523	542	545	559	559
Revenue from domestic power sales	176	242	355	445	516	576	679	855	1,039	1,245	1,341
Other revenue	223	253	166	202	414	445	389	419	446	444	611
Operating profit	119	106	151	18	181	183	104	233	228	162	-16
Total assets	2,645	5,875	6,048	6,299	6,879	7,460	7,768	8,165	9,434	8,987	12,901
Target operating-profit necessary for the achievement of 8% ROA	212	470	484	504	550	597	621	653	755	719	1,032
Surplus (deficit) of power sales to achieve 8% ROA	-93	-364	-333	-486	-369	-414	-517	-420	-527	-557	-1,048
Tariff hike required to compensate revenue deficit	131	475	377	539	365	372	398	266	277	250	437

(Source) Prepared by the Study Team based on EDL annual reports.

2.6 Environmental and social considerations

2.6.1 EIA related policies, and laws and regulations

Table 2-27 shows the laws and regulations relevant to environmental and social considerations. In addition to the constitution, the laws and regulations are classified into three categories: 1) main EIA related laws and regulations defining MONRE's jurisdictions; 2) EIA related laws and regulations concerning power development projects defining MEM's jurisdictions; and 3) other EIA related laws and regulations.

Regarding the establishment of the regulatory framework and practices of EIA in the power sector, the contributions of former Department of Electricity of MEM are significant. Under the category 2) in Table 2-27 there is one policy, one law, five regulations, and one set of guidelines have been established by MEM. Such EIA responsibilities for the power sector have been shifted from MEM to MONRE (or former WREA). Currently MONRE plays a major role of EIA process cutting across all the sectors. Laws and regulations defining MONRE's jurisdictions are cited under category 1) in Table 2-27. There are one law, two decrees, two regulations, and two set of guidelines.

In addition, a decree and guidelines concerning Strategic Environmental Assessment have been drafted, and they are to be proclaimed in 2013. Although the capacity of MONRE is said to be insufficient to handle and maintain quality of a large number of EIA reports prepared by project developers, it should be noted that MONRE is actively leading the improvement of EIA process. As shown in Table 2-27. Environment Impact Assessment Guidelines, Decree on Strategic Environmental Assessment, and Guideline - Strategic Environmental Assessment of Government Plans and Programs are under preparation. These new set of regulations will streamline and standardize EIA processes which are perceived by IPP operators and investors confusing. The regulations will also introduce policy-level and early-stage strategic environmental assessment (SEA) to provide flexible choices of alternatives including non-implementation of an individual project.

Table 2-27 Laws and regulations relevant to environmental and social consideration

Laws and regulations	Enacted year and no.	Contents
Constitution	May 2003 No.25/NA	The article 19 states responsibility for all organization and citizen to protect the natural environment and natural resources of the State.
1) Main EIA related laws and regulations under MONRE		
Environmental Protection Law	April 1999 No. 02-99/NA (Law)	The law specifies principles, rules and measures to manage, monitor, restore, and protect the environment, natural resources, and biodiversity to ensure sustainable socio-economic development. The law is expected to be amended for inclusion of clauses regarding Strategic Environmental Assessment by the end of 2012 or early 2013.
Regulation on Environment Assessment	October 2000 No.1770/STEA (Regulation)	The regulation establishes uniform environmental assessment requirements and procedures for all development projects. It also provides contents of EIA and Initial Environmental Examination (IEE) reports, requests developers for obtaining Environmental Compliance Certificate (ECC), and Water Resource and Environmental Agency (a predecessor of MONRE) as ECC granting organization.
Decree on Environmental Impact Assessment	February 2010 No.122/PM (Decree)	The decree defines principles and rules, and measures on establishment, functions, management and monitoring of environmental impact assessment, and to ensure development and implementation of impact prevention and mitigation plans, and monitoring of their implementation.
Environment Impact Assessment Guidelines	Will be enacted by the end of 2012 (Guidelines)	The guidelines provide a common framework for EIA reporting, presents project developers and their environmental consultants with clear guidance on structure, content and scope of EIA reports, and ensures that EIA reporting is consistent with legal requirements, good practices, and professional standards.
Decree on Compensation and Resettlement of People Affected by Development Projects	July 2005 No.192/PM (Decree)	The decree defines principles, rules, and measures on compensation and resettlement of the development project.
Regulation for Implementing Decree No.192/PM on Compensation and Resettlement of People Affected by Development Projects	November 2005 No.2432/STEA (Regulation)	The regulation defines detailed measures on and procedures of compensation and resettlement of the development project. It also defines legal functions of technical guidelines.
Technical Guidelines on Compensation and Resettlement in Development Projects	May 2005 STEA (Guidelines)	The guidelines provide instructions for implementing social impact assessment of development project focusing on the principles and procedures on compensation and resettlement.
Decree on Strategic Environmental Assessment	(Decree) (to be proclaimed in 2013)	The decree defines principles of EIA, and measures on establishment, functions, management, and monitoring of SEA to ensure policies, strategies, and programs are designated in a way that the negative impacts are prevented, minimized, or mitigated.
Guideline - Strategic Environmental Assessment of Government Plans and Programs	(Guidelines) (to be proclaimed in 2013)	The guidelines provide a simple instruction of how the planning authority can implement SEA. The guidelines describe the different steps of SEA.
2) EIA related laws and regulations under MEM		
National Policy - Environment and Social Sustainability of the Hydropower Sector in Laos (Updated version)	2011 (Policy)	The policy states that EIA should be exercised for the development of large-scale hydropower projects to form environmental management plan (EMP) and risk assessment to prevent, minimize, or mitigate environmental and social impacts.
Electricity Law	December 2008 No.03/NA (Law)	The law requires the minimization of impact on natural environment and society in design, construction and operation phase of electricity development project. It also states the

Laws and regulations	Enacted year and no.	Contents
		necessity for conducting Environmental Assessment (EA) for the development project.
Environmental Impact Assessment for Electricity Projects	October 2001 No.585/MIH.DOE (Regulation)	Provides the minimum requirements of an EIA for electricity project in accordance with the Environmental Protection Law and the Regulation on Environmental Assessment.
Regulation on Implementing Environmental Assessment for Electricity Projects	November 2001 No.447/MIH.DOE (Regulation)	The regulation provides uniform EIA requirements and procedures of Regulation on Environmental Assessment for electricity projects. It stipulates the requirements and procedures for EIA and institutional responsibilities to conduct EIA for electricity projects.
Environmental Management Plans for Electricity Project	October 2001 No.584/MIH.DOE (Regulation)	The regulation provides requirements for developing Environmental Management Plan as a part of EIA process.
Environmental Management Standard for Electricity Project	June 2003 No.0366/MIH.DOE (Regulation)	The regulation provides minimum requirements of the Environmental Screening, Social Impact Assessment, Environmental Impact Assessment, Environmental Management Plan, Resettlement Action plan for electricity projects. It also stipulates former Environment and Social Management Division, Department of Electricity (currently Environmental Engineering Division, DEPP) is the responsible institution conducting above tasks.
Electric Power Technical Standards	February 2004 No.052/MIH.DOE (Regulation)	The regulation provides technical standards for electricity project, and specifies necessity of clearance area under the transmission line to secure the transmission line from falling trees.
Instruction and Information on Compensation for Power Transmission Line Project	Under preparation (Guidelines)	The guidelines provide principles, procedures, and process for compensation resulting from power transmission line project.
3) Other EIA related laws and regulations		
Water and Water Resources Law	October 1996 No.02-96/NA (Law)	The law regulates the management, exploitation, development, protection and sustainable use of water and water resources. The law defines that Ministry of Agriculture and Forestry is the major responsible organization for water resource management.
Land Law	October 2003 No.04/NA (Law)	The law provides rules on management, protection, and use of land. According to the law acquisition of land requires approval from Land Management Authority, and compensation for the acquisition is mandatory.
Forest Law	December 2007 No.6/NA (Law)	Forest law states principles, regulations, and standards for the use of forestlands and resources in the forests. The law defines roles and authorities of forest management and inspection organization, and promotes the conservation and rehabilitation of forest resources. For the public benefit forest land can be converted to other land use by parliament approval.
Wildlife and Aquatic Law	December 2007 No.07/NA (Law)	The law provides principles and measures to protect and manage wildlife and aquatic animals, and define Ministry of Agriculture and Forestry as principle organization for wildlife management.
Regulation on Development and Promotion of Long Term Tree Plantation	August 2000 No.0196/MAF (Regulation)	The regulation defines the management, exploitation, and development of tree plantation. The regulation also provides procedures and methods of compensation estimation under a development project.
Law on National Heritage	November 2005 No.08/NA (Law)	The law determines the principles, regulations and measures for the administration, use, protection, conservation, restoration, rehabilitation of the natural and cultural heritage, and historical sites. The law also defines reporting and protection procedures in case of discovery of objects assumed to have cultural and natural values.

(Source) Study Team.

2.6.2 Establishment of institutional framework for Strategic Environmental Assessment

Although the application of SEA for the development of the NPDP is necessary in Laos, the establishment of legal and institutional framework for SEA is still underway. However, the development of EIA capacity in Laos has been significant. Since 1990s the establishment of legal, institutional, and procedural arrangements of EIA, and the related capacity building efforts have been focusing on introduction and adoption of project-wise EIA and Initial Environmental Examination (IEE). The EIA capacity has been strengthened through the identification, planning, construction, and operation of the large hydropower projects such as Nam Theun 2 IPP project. Under this project the implementation and evaluation of EIA and IEE, establishment, implementation, and monitoring and evaluation of various Environmental and Social Management and Monitoring Plans (ESMMPs), and Development Plans have been conducted by MONRE, its predecessor Water Resource and Environment Administration (WREA), former Department of Electricity (DOE) of Ministry of Energy and Mines (MEM), Electricité du Laos (EDL), and public and private power developers. Technical and financial assistance from donors such as the World Bank contributed to the capacity building significantly.

The introduction of SEA concept and formulation of SEA implementation framework have begun recently, and currently MONRE is preparing the SEA decree which is expected to be proclaimed in 2013.[23] The ministry is also preparing the amendment of Environmental Protection Law (EPL) and SEA guidelines.[24] According to the draft decree, the central and provincial governments are required to conduct SEA in an early stage of policy, strategy, master plan, or program development, revisions, or modifications. The draft defines that SEA is a process for the evaluation of likely significant environmental effects, including social and health effects, of a proposed policy, strategy, master plan, or program to ensure that any such effects are fully included and appropriately addressed at an early stage in the decision-making process for these policy, strategy, master plan, or program.[25] Prior to the expected proclamation of SEA decree, MEM has already applied SEA concept for the formulation of Renewable Energy Development Strategy in Lao PDR, 2011. The introduction and practice of SEA regulations are also ongoing process in the neighboring countries. For example, the government of Vietnam introduced SEA before 2005, and the government of Thailand is considering establishing SEA regulations.

2.6.2.1 Organizations responsible for EIA report evaluation and monitoring of power development projects

Primary responsibility of EIA report evaluation and monitoring of power development project rests with the Ministry of Natural Resources and Environment (MONRE), and coordinating and supporting responsibility is given to the Division of Environmental Engineering, DEPP, MEM, and DEB, MEM. Subject area specific evaluation is responsibility of the various line ministries dependent on the types of concerned development projects. The capacity of Technical Department of EDL as an executing agency is

[23] According to information obtained from MONRE in December 2012.
[24] The working group consisting of staff members of MONRE, MEM, and MPI has drafted SEA decree and guidelines. The drafting work is facilitated by MONRE's Environment Management Support Programme (EMSP) which has been supported by the government of Finland.
[25] MONRE. 2011. Draft Decree on Strategic Environmental Assessment. Vientiane.

observed to be sufficient for conducting SEA, and thus, collaboration between Division of Environmental Engineering and the Technical Department should be considered for appropriate implementation of SEA as a part of the NPDP development process. In addition to these agencies Ministry of Agriculture and Forestry, Land Management Authority, and the National Regulatory Authority for UXO/Mine Action Sector may be involved with the development and implementation of power projects. In this section newly established MONRE responsible for overseeing EIA and proposed SEA processes, and Division of Environmental Engineering of DEPP, MEM responsible for the assessment of EIA report from the point of view of engineering will be described.

(1) Ministry of Natural Resources and Environment (MONRE)

Ministry of Natural Resources and Environment (MONRE) was created in November 28, 2011 by merging the Water Resource and Environment Administration (WREA) with parts of the National Land Management Authority (NLMA) and the Geology Department, as well as the Protection and Conservation Divisions of the Department of Forestry.[26] The finalization of the functions and roles of the departments and divisions of MONRE is in progress and is to be completed soon.

As of July 2012 MONRE has the following 12 Departments and three specialized institutions under its Cabinet:

Departments:

1) Department of Administration
2) Department of Climate Change
3) Department of Environment Promotion
4) Department of Environmental and Social Impact Assessment
5) Department of Forest Resources Management
6) Department of Inspection
7) Department of Land Development
8) Department of Land Service and Enterprise Development
9) Department of Metrology
10) Department of Mineral
11) Department of Pollution Control
12) Department of Water Resources

Specialized institutions:

1) Information Center
2) Institute of Environment Research
3) National Mekong River Committee

In addition to the above departments and institutions, MONRE has provincial, district, and local level offices and units. MONRE also hosts the Climate Change Office that acts as the Designated National

[26] http://www.theredddesk.org/resources/organisations/ministry_of_natural_resource_and_environment_ lao_pdr

Authority or national focal point for the UNFCCC.

EIA reports submitted by hydropower developers including EDL are reviewed and commented by Department of Environment and Social Impact Assessment (DESIA). The DESIA is also responsible for issuing an Environmental Compliance Certificate to a project developer or company based on examination of the EIA reports. If it is necessary DESIA requests a developer correction and/or improvement of its EIA reports. A strategic environment assessment bill has been drafted by MONRE and it is envisaged that SEA reports developed by other line ministries will also be reviewed and commented by DESIA.

The total number of officials of DESIA is 74 within which 16 officials are permanent and 58 are term employment officials. DESIA is comprised of the following seven Divisions and Centers[27].

1) Planning and Financing Division
2) Law and Information Division
3) Review of Hydropower Project Center
4) Review of Infrastructure Project Center
5) Review of Agriculture Forestry and Tourism Project Center
6) Review of Mining and Industry Project Center
7) Environment Action Plan Monitoring Center

In case of hydropower projects their EIA reports are examined by Review of Hydropower Project Center.

(2) Division of Environmental Engineering

The counterpart organization of MONRE in terms of power development EIA report review is Division of Environmental Engineering (DEE), Department of Energy Policy and Planning, Ministry of Energy and Mining. Once MONRE officially receives EIA or Initial Environmental Examination (IEE) reports, MONRE distributes the reports to the ministries which have jurisdictions over processes of planning and implementation of proposed projects subject to the EIA or IEE. For power development projects MONRE transmits the reports to DEE for its examination form the point of views of engineering and compliance with EIA related laws and regulations under MEM. Currently, five officials, Director (acting) and four professional staff, are assigned to DEE.

2.6.3 Project-by-project EIA procedures and need of SEA capacity development

Figure 2-46, Figure 2-47 and Figure 2-48 show the entire IPP development and EIA processes, and detailed EIA steps during the prefeasibility and feasibility phases, respectively. As shown in Figure 2-46 and Figure 2-47, EIA procedures are defined on project-by-project basis and do not cover developer selection and MOU phases. The current project-by-project EIA procedures covers pre-feasibility study phase, feasibility study phase, design and procurement phase, construction phase, operation phase, and decommissioning phase. The current EIA procedures do not cover the earlier phases necessary for the

[27] Since there are no formal English names of Divisions and Centers are determined at the time of this study Lao names are translated to English name temporarily.

government to develop national-level power development plan. The earlier phases include the phases of selection and prioritization of candidate sites of, for example, hydropower dams based on examination and comparison of environmental, social, economic, and financial parameters. This suggests that adoption and application of SEA for the examination of all the identified sites, including the sites where projects are planned or ongoing, are necessary for the development of the NPDP as a power development strategy.

According to the interviews with the key officials, EIA procedures were not well understood by some of IPPs, and in many cases the quality of EIA and IEE reports needed improvement. The relatively complicated step-by-step procedures indicated in Figure 2-48 may be one of the reasons for the confusions felt by not only IPPs and investors but also concerned government officials. Regarding the quality of the reports, due to the fact that the costs of EIA and IEE are borne by the IPPs and investors, there is likely to be an incentive to conduct environmental assessment as a cost as low as possible, and this low cost EIA may have a consequence of low quality reports. This indicate that the quality assurance function of the reports by MONRE and other line ministries needs to be strengthened and maintained to secure credible report examinations.

Implementation of EIA is the responsibility of IPPs and investors whereas the responsibility of SEA primarily rests with the government for its policy-making and regulatory activities. SEA is to be practiced by a line ministry and its results are to be reviewed by MONRE. Thus, the application of SEA in the process of the NPDP development should be the responsibility of MEM, and its SEA implementation capacity needs to be strengthened.

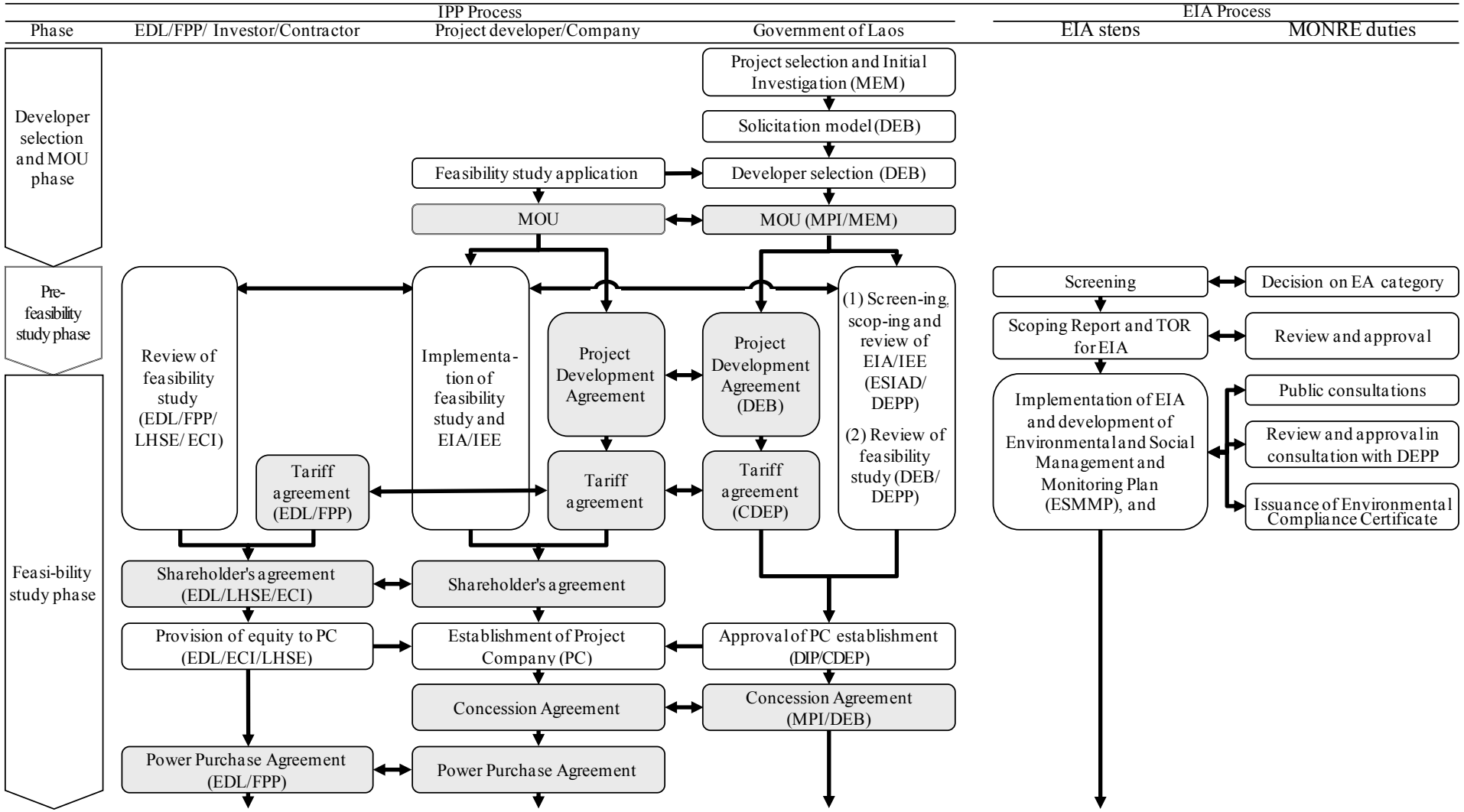
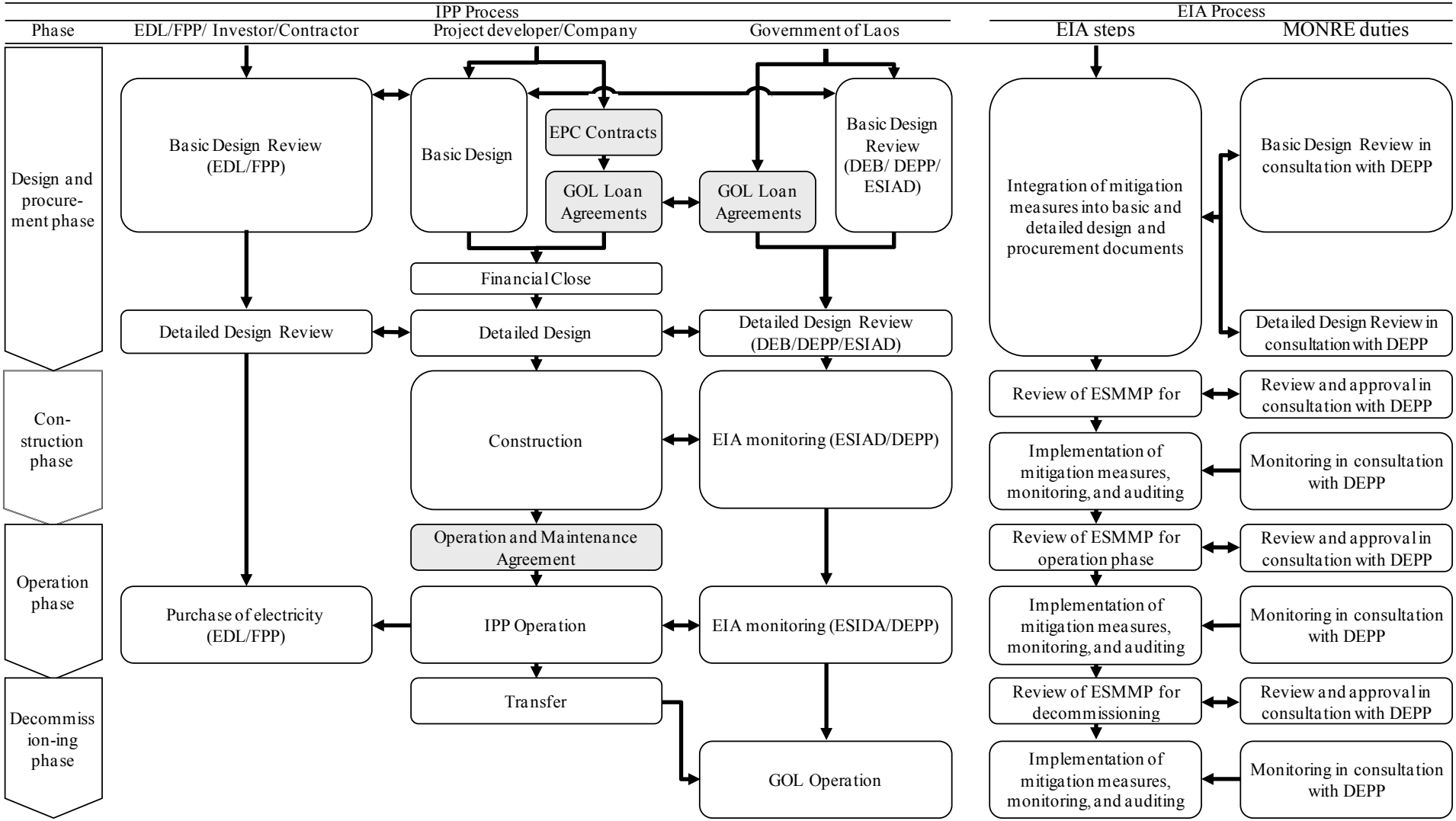


Figure 2-46: IPP project implementation process (to be continued to next page)

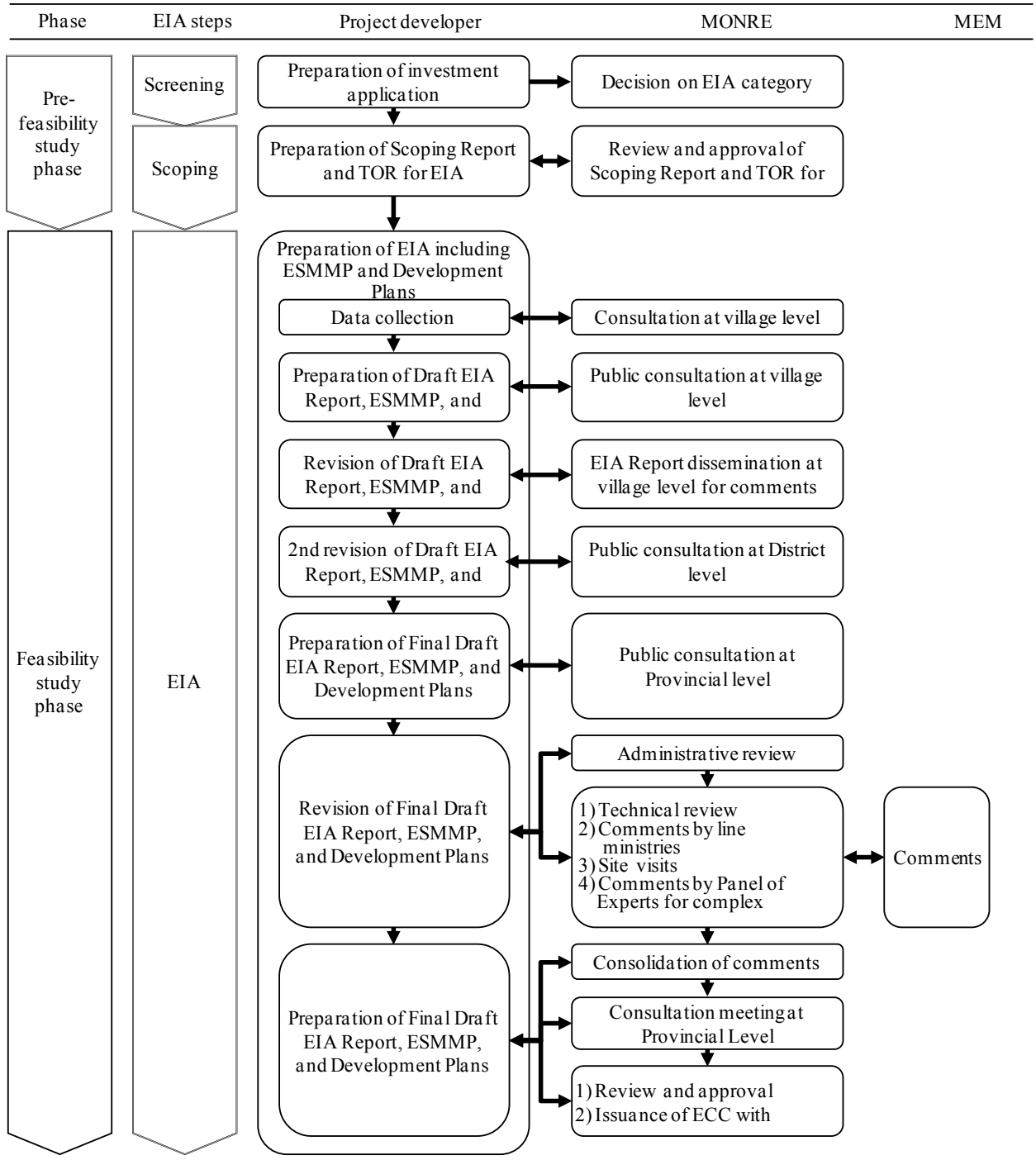


(Source) Ministry of Natural Resources and Environment. 2012. Environmental Impact Assessment Guidelines (draft).

Figure 2-47: IPP project implementation process (cont.)

Note 1: 1) CDEP: Coordinating Committee for Development of Electric Power; 2) DEB: Department of Energy Business (former Department of Energy Promotion and Development, Ministry of Energy and Mines); 3) DEPP: Department of Energy Policy and Planning; 4) DIP: Department of Investment Promotion, Ministry of Planning and Investment (to be confirmed); 5) ECC: Environmental Compliance Certificate; 6) ECI: Electricity Construction and Installation Enterprise; 7) EDL: Electricité du Laos; 8) EIA: Environmental Impact Assessment; 9) EPC Contracts: Engineering, procurement, and construction contracts; 10) EPD: Department of Energy Promotion and Development (changed to Department of Energy Promotion and Development (DEB) in December 2011); 11) ESIAD: Environmental and Social Impact Assessment Department; 12) IEE: Initial Environmental Examination; 13) LHSE: Lao Holding State-Owned Enterprise; 14) MEM: Ministry of Energy and Mines; 15) MONRE: Ministry of Natural Resources and Environment; 16) MOU: Memorandum of Understanding; 17) MPI: Ministry of Planning and Investment; 18) PC: Project Company; and 19) PDA: Project Development Agreement.

Note 2: The agreements shown in shaded boxes are preceded by negotiations among concerned parties.



(Source) MoNRE. 2012. Environmental Impact Assessment Guidelines (draft).

Figure 2-48: Responsibilities during preparation of EIA report for project of Category 2

2.6.4 Past EIA report review and issuance of ECC by MONRE

Table 2-28 and Table 2-29 present the number of Environment Compliance Certificate (ECC) issued by MONRE or its predecessor organization to hydropower development projects and transmission line projects, respectively. The trend of annual numbers of ECC reflects the recent (i.e., late 2000s and early 2010s) rapid increase in number of hydropower development projects resulting from the aggressive promotion of the IPP scheme. In contrast to the recent trend, during the 1990s and early 2000s power development had been slow and only EDL was the player of the development. To a lesser extent the transmission line projects show the same trend partly due to their association with the power development projects.

The numbers of issued ECC also indicate the recent development of EIA-report-review capacity of MONRE and its predecessor organization with the financial and technical support from, for example, World Bank and Government of Finland. An example of such capacity building effort is the development of a draft Environmental Impact Assessment Guidelines which is expected to obtain government's approval by the end of 2012. The Guidelines consolidated and restructured the various EIA report types indicated in Table 2-28 and Table 2-29, emphasized the importance of the EIA scoping, and streamlined report structure and responsibilities of project implementer and government authorities concerned.[28]

[28] MONRE. June 2012. Environment Impact Assessment Guidelines (draft). Vientiane.

Table 2-28: Number of Environmental Compliance Certificate (ECC) issued by MONRE or its predecessor organization to hydropower development projects

Year	No. of ECC issued	Report type reviewed by MONRE[*1]
1994	1	EIA
1995	1	EIA
1996		
1997		
1998		
1999		
2000		
2001	1	EIA
2002		
2003		
2004	3	EIA, ESIA, and IEE
2005	3	EIA, EMP, and IEE
2006	2	EMDP, ESMP, SDP, and EMDP
2007	2	EIA, EMP, RAP, SIA, and SMP
2008	7	EIA, EMMP, EMP, ESIA, RAP, RMP, SDP, SIA, and SMP
2009	1	EIA, and EMP
2010	8	EIA, EMDP, EMP, IEE, RAP, SDP, and SIA
2011	10	EIA, EMMP, EMP, IEE, RAP, SDP, and SIA
2012 (year not ended)	5	EIA, EMMP, EMP, HIA, RAP, SDP, SIA, and SMMP
Total	44	

Note 1: 1) EIA: Environmental Impact Assessment; 2) EMDP: Environmental Management and Development Plan; 3) EMMP: Environmental Management and Monitoring Plan; 4) EMP: Environmental Management Plan; 5) ESIA: Environmental and Social Impact Assessment; 6) ESMP: Environmental and Social Management Plan; 7) HIA: Human Impact Assessment; 8) IEE: Initial Environmental Examination; 9) RAP: Resettlement Action Plan; 10) RMP: Resettlement Management Plan; 11) SDP: Social Development Plan; 12) SIA: Social Impact Assessment; 13) SMMP: Social Management and Monitoring Plan; and 14) SMP: Social Management Plan.
(Source) Study Team.

Table 2-29: Number of Environmental Compliance Certificate (ECC) issued by MONRE or its predecessor organization to transmission line projects

Year	No. of ECC issued	Report type reviewed by MONRE[*1]
2002	1	IEE and EMP
2003		
2004	2	IEE
2005	2	IEE
2006		
2007	7	EIA, IEE, IESE, and RAP
2008		
2009	7	EIA, IEE, and RAP
2010	1	IEE
2011	4	EDP, IEE, and RAP
2012 (year not ended)	1	EMP and RAP
Total	25	

Note 1: 1) EDP: Environmental Development Plan; 2) EIA: Environmental Impact Assessment; 3) EMP: Environmental Management Plan; 4) IEE: Initial Environmental Examination; 5) IESE: Initial Environmental and Social Exanimation: and 6) RAP: Resettlement Action Plan.
(Source) Study Team.

2.7 Assistance by other donors for power sector

As mentioned in Section 2.2.2.2, the World Bank has started various technical assistance programs related to the power sector policies such as IPP management by DEB, tariff study including trade tariff between EDL and EGAT, and hydro potential study. Some of them are closely related to this Study, and moreover, JICA technical cooperation program is so comprehensive as introduced in Chapter 1 that cooperation and demarcation among donor agencies are essential to avoid duplication and to enhance the effect of assistance through collaboration. In this context, technical assistance programs of other donor agencies are overviewed in this section.

2.7.1 World Bank

The World Bank is providing technical assistance (TA) entitled "Technical Assistance for Capacity Building in the Hydropower and Mining Sectors." The TA was approved by the bank board on January 12, 2010, as a grant project of the International Development Agency (IDA), and a budget of eight million US dollars was allocated for it. The closing date of the project is September 30, 2014. AusAID also provides supplemental funding for the project.

The objective of the project is to increase human capacity and improve the performance of government oversight institutions for the hydropower and mining sectors. The project consists of four components (detailed information is described in Appendix II):

Component 1. Joint Hydropower and Mining Learning Program (US$2.26 million).
This component aims at building critically needed capacity and generating public awareness across the hydropower and mining sectors. The provision of adequate skills and training to government staff and the next generation of leaders for the two sectors would remove critical bottlenecks to the development of both sectors.

Component 2. Hydropower Sector Development (US$2.71 million).
This component aims at capacity building in support of sustainable hydropower development in Laos. Activities will cover the entire value chain, from planning, concession negotiation, construction, and operation to revenue management.

Component 3. Mining Sector Development (US$2.31 million).
This component will provide funding for subcomponents pertaining to the mining sector.

Component 4. Project Administration and Management (US$0.72 million).
The project will support consultancy services for the Project Secretariat established within the MEM for coordination and management of the project implementation, and acquisition of logistical and equipment support necessary for its smooth functioning.

As part of Component 2, implementation of Subcomponent 2a—Water Resource Management and Hydropower Planning—was carried out in 2011, and terms of reference (TOR) for three consultants to be hired were prepared: one international consultant for updating the least cost analysis, one for training and

capacity building, and one for the national consultant. However, due to the organizational restructuring in the Department of Electricity (DOE), the procurement of TORs was put on hold.

The DEPP is to be the lead agency for Subcomponent 2a. The work plan for Subcomponent 2a will be revised, although specific objectives will not be changed. Additional funding from AusAID will be used to strengthen capacity of the DEPP.

Subcomponent 2b—Hydropower Concession Management—is the TA for the Department of Business (i.e., the former Department of Energy Promotion and Development) on project supervision to ensure project construction and operation complying with the concession agreement (CA) signed. In this subcomponent, consultants whose expertise lies in the areas of engineering, finance, legal, and management will presumably be hired, but the procurement of TOR for consultants has not yet been decided.

For such reasons, the project has been delayed as compared to the original schedule.

2.7.2 Asian Development Bank

The ADB shifted to providing finance for power projects, while the World Bank and JICA play major roles in the provision of technical assistance (TA) for capacity building. It is now carrying out several projects in two areas: rural electrification and IPP projects based on the public-and-private-partnership (PPP) scheme.

It has been implementing a TA project entitled ―Small and Mini Hydropower Development Project" since 2010 as the supplementary component of the proposed grant whose budget is estimated with ten million US dollars allocation. The TA was approved by the bank on October 8, 2010 with a budget of six hundred thousand US dollars.

Expected outcome is a project design, with CDM registration, of one or two small or mini hydroelectric power plants whose installed capacities are between 1 MW to 15 MW to be used as demonstration projects for further small-scale hydropower development leading to increased use of clean energy.

The TA provides the technical assistance of the identification for potential sites where capacity is needed, preparation of projects in batches, hydrological documentation from automatic stations and preparation of standard concession with fixed tariffs.

Feasibility study (FS) of the first four sites would be completed in May 2012 and the MEM would start the tender process to invite developers by mid-end 2012. Additional five projects have already installed and FS are expected to be completed in 2013. Further identification of new projects and new installation of automatic stations for the projects will be expected in 2014 – 2015.

In 2010, the ADB also commenced the Greater Mekong Subregion Northern Power Transmission Project. Although the title is ―power transmission project," the objective is on-grid rural electrification, which is designed to supply power to the target customers in western Vientiane, Xaignabouli, and Phongsali provinces. Like the ADB, the Korea ExIm-Bank also provided funds to the project. The type of the

finance is grant, and the project is expected to be completed by 2014.

In the area of PPP, the ADB provides two types of funds to the Greater Mekong Subregion Nam Ngum 3 Hydropower Project: a soft loan to the GOL, which is to be re-loaned to the Lao Holding State Enterprise (LHSE), which uses the fund to take minor equity of the project company, i.e., the Nam Ngum 3 Power Company (NN3PC); and a loan to the project itself (detailed information is described in Appendix II).

2.7.3 Others

At present, one advisor from the Republic of Korea, who is assigned by the National IT Promotion Agency of Korea, is working for EDL. He arrived in EDL in August 2011 and will complete his job by August 2013.

Although his task as an advisor is not specifically clarified, he supports directors of departments and managing directors with regard to finance and budget related issues.

2.8 Summary

There are a number of issues to be the barriers and bottlenecks for the better power sector governance, as described and analyzed in this chapter. GOL sets two vital national priorities for the power sector: i) affordable power supply to Lao society and industry with competitiveness; and ii) earnings of foreign currency from electricity export. However, power supply in the country is not sufficient (power import has been more than export since 2009) specifically in the dry season together with the un-developed transmission networks. Current PDP is being developed by EDL as its domestic business plan and there has been no comprehensive PDP developed by the GOL with consideration of power trade with future transmission networks, efficient utilization of river water with socio-environmental issues, financial constrains, etc. even if it is stipulated in the Article 10 of the Electricity Law 2011 (Section 2.1).

Regarding the relevant organizations in MEM, former Department of Electricity (DOE) was divided in three organizations, namely DEPP, DEM and IREP in May 2012. DEPP, DEM, IREP and DEB as the department to monitor and negotiate with IPP developers and EDL as the organization to prepare domestic PDP, work for the power sector under MEM from planning to operation of power facilities including IPP management even if still they need more staff with expertise. Specifically DEPP should be in charge of the compilation of the NPDP as the Secretariat (Section 2.3). According to the further analysis through the interviews to DEPP and EDL staff, capabilities to manage IPP developers, coordination of related ministries and departments, review of mandates to realistic operation, etc. were observed as key issues to organizational reinforcement (Section 2.3.6).

The current PDP developed by EDL (EDL-PDP) was reviewed. Regarding the demand forecast, a gap between forecasted and real demand was found because the current methodology is bottom-up (summing up) type and it cannot reflect econometric phenomena correctly. Generation planning, demand-supply balance and power system planning have been conducted based on the annual peak and the necessity of monthly analysis was proposed to reflect the gap between rainy and dry seasons. EDL‘s financial status is

not as good as before, specifically in recent five years as well as in the future because of increasing investment cost, low tariff level (less income), etc. (Section 2.6).

Environmental and social considerations are a key issue for the GOL to plan and implement the power projects minimizing the risks for the nature and public. In the planning stage (NPDP stage), SEA should be carried out to find out risks and alternatives from the beginning of the projects (regulations related to SEA are expected to be completed by end 2013) (Section 2.6). Among other assistance programs from donor agencies, the World Bank TAs for CA management to DEB, hydropower planning to DEPP and tariff study for EDL are closely related to this Study (Section 2.7).

Based on the review and analysis of the current issues for the power sector in Chapter 2, the Study Team proposes mainly the necessity, contents and organizational framework of NPDP, and also IPP management mechanism for the better governance in Chapter 4. Technical matters on the improvement of PDP such as demand forecast, generation planning and power system planning are separately explained in Chapter 3.

Table 2-30 summarizes the major issues and necessities discussed in this chapter and the measures highlighted in the following chapters/ sections of the Report.

Table 2-30: Issues and necessities

Category	Issues and necessities	Chapter/ Section of measures
Policy	Concrete power policy in the MEM to reflect current and future power supply-demand situations	Section 3.1 (Formulation of NPDP)
Institute	Comprehensive national PDP (NPDP) considering power trade with transmission network, efficient utilization of water, financial constraints, etc.	Section 3.1 (Formulation of NPDP)
Organization	Better coordination among the related organizations (ministries and departments) for the development of the NPDP	Section 3.1 (Formulation of NPDP) Section 3.3 (Comprehensive management aimed at sustainable power development)
	Better coordination among the departments under MEM for the better power development mechanism (IPP management)	Section 3.3 (Comprehensive management aimed at sustainable power development)
Environmental consideration	Introduction of the SEA in earlier (NPDP) stage ESIA coordination during implementation stages of the projects	Section 4.3 (Generation plan) Section 3.3 (Comprehensive management aimed at sustainable power development)
Technical skills	Better technical skills for power demand and detailed (monthly) power system analysis and power planning	Chapter 4 (Improvement of EDL-PDP)
Collaboration with other donors	Collaboration with WB TA programs (CA management, hydropower planning and tariff study)	Section 3.2 (Perception of EDL role and future power development) Section 3.3 (Comprehensive management aimed at sustainable power development)

(Source) Study Team.