

Document of
The World Bank

FOR OFFICIAL USE ONLY

Report No: PAD1273

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED CREDIT

IN THE AMOUNT OF SDR 21.4 MILLION
(US\$ 30 MILLION EQUIVALENT)

TO THE

LAO PEOPLE'S DEMOCRATIC REPUBLIC

FOR A

POWER GRID IMPROVEMENT PROJECT

June 2, 2015

*Energy and Extractives Global Practice
East Asia and Pacific Region*

This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.

CURRENCY EQUIVALENTS

(Exchange Rate Effective April 30, 2015)

Currency Unit	=	Lao Kip (LAK)
1 LAK	=	US\$0.000123
US\$ 1	=	LAK 8,077
SDR 1	=	US\$1.40642

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AEC	ASEAN Economic Community
AMI	Advanced Metering Infrastructure
BP	Bank Policy
CDM	Clean Development Mechanism
CO ₂	Carbon Dioxide
CPS	Country Partnership Strategy
DMS	Distribution Management System
E&S	Environmental and Social
ECoP	Environmental Codes of Practices
EDL	Electricité du Laos
EDL-Gen	Electricité du Laos Generation Company
EIRR	Economic Internal Rate of Return
ERM	Emergency Response Manual
ESMP	Environmental and Social Management Plan
FAP	Financial Action Plan
FDI	Foreign Direct Investment
FM	Financial Management
FMIS	Financial Management Information System
FMM	Financial Management Manual
GDP	Gross Domestic Product
GIS	Geographic Information System
GMS	Greater Mekong Sub-region
GMSPT	GMS Power Trade Project
GOL	Government of Laos
GRS	Grievance Redress Service
GWh	Gigawatt-hours
IBRD	International Bank for Reconstruction and Development
IDA	International Development Assistance
IFC	International Finance Corporation
IPPs	Independent Power Producers
JICA	Japan International Corporation Agency

kWh	Kilowatt-hours
Lao PDR	Lao People's Democratic Republic
LECS	Lao Expenditure and Consumption Survey
LHSE	Lao Holding State Enterprise
MARR	Minimum Acceptable Rate of Return
MEM	Ministry of Energy and Mines
MIGA	Multilateral Investment Guarantee Agency
MOF	Ministry of Finance
MV/LV	Medium Voltage/Low Voltage
MW	Megawatt
NPV	Net Present Value
NT2	Nam Theun 2 Project
OP	Operational Policy
PAD	Project Appraisal Document
PDO	Project Development Objective
PDSR	Power Distribution System Rehabilitation Project
PGI	Power Grid Improvement Project
PHRD	Population and Human Resources Development (Japanese Grant)
PO	Project Office
PVLD	Protocols for Voluntary Land Donation
REP I	Rural Electrification Project Phase I
REP II	Rural Electrification Project Phase II
ROW	Right of Way
RPF	Resettlement Policy Framework
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SCADA	Supervisory Control and Data Acquisition
SDR	Special Drawing Rights
T&D	Transmission and Distribution
TWh	Terawatt-hours
UNFCCC	United Nations Framework Convention on Climate Change
WBG	World Bank Group
WTO	World Trade Organization

Regional Vice President:	Axel van Trotsenburg
Country Director:	Ulrich Zachau
Senior Global Practice Director:	Anita Marangoly George
Practice Manager:	Julia M. Fraser
Task Team Leader:	Rome Chavapricha

**LAO PEOPLE’S DEMOCRATIC REPUBLIC
POWER GRID IMPROVEMENT PROJECT**

TABLE OF CONTENTS

	Page
I. STRATEGIC CONTEXT	1
A. Country Context.....	1
B. Sectoral and Institutional Context.....	1
C. Higher Level Objectives to which the Project Contributes	3
II. PROJECT DEVELOPMENT OBJECTIVES	5
A. PDO.....	5
B. Project Beneficiaries	5
C. PDO Level Results Indicators.....	6
III. PROJECT DESCRIPTION	6
A. Project Components	6
B. Project Financing	7
C. Project Cost and Financing	7
IV. IMPLEMENTATION	8
A. Institutional and Implementation Arrangements	8
B. Results Monitoring and Evaluation	8
C. Sustainability.....	8
V. KEY RISKS	9
A. Overall Risk Rating and Explanation of Key Risks.....	9
VI. APPRAISAL SUMMARY	10
A. Economic and Financial Analysis.....	10
B. Technical.....	12
C. Financial Management.....	13
D. Procurement	13
E. Social (including Safeguards).....	13
F. Environment (including Safeguards)	14
G. World Bank Grievance Redress.....	15

Annex 1: Results Framework and Monitoring	16
Annex 2: Detailed Project Description.....	23
Annex 3: Implementation Arrangements	30
Annex 4: Implementation Support Plan	44
Annex 5: Economic and Financial Analysis	48

|

PAD DATA SHEET
Lao People's Democratic Republic
Power Grid Improvement Project (P149599)
PROJECT APPRAISAL DOCUMENT

EAST ASIA AND PACIFIC
0000009058

Report No.: PAD1273

Basic Information			
Project ID P149599	EA Category B - Partial Assessment	Team Leader(s) Rome Chavapricha	
Lending Instrument Investment Project Financing	Fragile and/or Capacity Constraints []		
	Financial Intermediaries []		
	Series of Projects []		
Project Implementation Start Date 1-Jan-2015	Project Implementation End Date 31-Mar-2020		
Expected Effectiveness Date 30-Sep-2015	Expected Closing Date 31-Mar-2020		
Joint IFC No			
Practice Manager/Manager Julia M. Fraser	Senior Global Practice Director Anita Marangoly George	Country Director Ulrich Zachau	Regional Vice President Axel van Trotsenburg
Borrower: Lao People's Democratic Republic			
Responsible Agency: ELECTRICITE DU LAOS			
Contact: Telephone No.: 856-21-316-133	Mrs. Khamphiou Phounsavath	Title: Email: khamphiou2@hotmail.com	Assistant Managing Director
Project Financing Data(in USD Million)			
<input type="checkbox"/> Loan	<input type="checkbox"/> IDA Grant	<input type="checkbox"/> Guarantee	
<input checked="" type="checkbox"/> Credit	<input type="checkbox"/> Grant	<input type="checkbox"/> Other	
Total Project Cost:	30.00	Total Bank Financing:	30.00
Financing Gap:	0.00		
Financing Source		Amount	

BORROWER/RECIPIENT	0.00
International Development Association (IDA)	30.00
Total	30.00

Expected Disbursements (in USD Million)

Fiscal Year	2016	2017	2018	2019	2020	0000	0000	0000	0000	0000
Annual	2.00	8.00	8.00	8.00	4.00	0.00	0.00	0.00	0.00	0.00
Cumulative	2.00	10.00	18.00	26.00	30.00	0.00	0.00	0.00	0.00	0.00

Institutional Data

Practice Area (Lead)

Energy & Extractives

Contributing Practice Areas

Cross Cutting Topics

- Climate Change
- Fragile, Conflict & Violence
- Gender
- Jobs
- Public Private Partnership

Sectors / Climate Change

Sector (Maximum 5 and total % must equal 100)

Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Energy and mining	Transmission and Distribution of Electricity	50		50
Energy and mining	Energy efficiency in Heat and Power	50		
Total		100		

I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.

Themes

Theme (Maximum 5 and total % must equal 100)

Major theme	Theme	%
Urban development	City-wide Infrastructure and Service Delivery	100

Total	100
Proposed Development Objective(s)	
The project development objective is to help improve efficiency and reliability of power distribution in the selected load areas served by EDL.	
Components	
Component Name	Cost (USD Millions)
Smart metering, distribution improvement and distribution losses reduction	19.00
Electric utility information system	6.00
Institutional capacity building and project implementation support	5.00
Contingent emergency response	0.00
Systematic Operations Risk- Rating Tool (SORT)	
Risk Category	Rating
1. Political and Governance	Moderate
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	Substantial
4. Technical Design of Project or Program	Moderate
5. Institutional Capacity for Implementation and Sustainability	Substantial
6. Fiduciary	Substantial
7. Environment and Social	Moderate
8. Stakeholders	Moderate
9. Other	
OVERALL	Moderate
Compliance	
Policy	
Does the project depart from the CAS in content or in other significant respects?	Yes [] No [X]
Does the project require any waivers of Bank policies?	Yes [] No [X]
Have these been approved by Bank management?	Yes [] No [X]
Is approval for any policy waiver sought from the Board?	Yes [] No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X] No []
Safeguard Policies Triggered by the Project	Yes No
Environmental Assessment OP/BP 4.01	X

Natural Habitats OP/BP 4.04		X
Forests OP/BP 4.36		X
Pest Management OP 4.09		X
Physical Cultural Resources OP/BP 4.11	X	
Indigenous Peoples OP/BP 4.10		X
Involuntary Resettlement OP/BP 4.12	X	
Safety of Dams OP/BP 4.37		X
Projects on International Waterways OP/BP 7.50		X
Projects in Disputed Areas OP/BP 7.60		X

Legal Covenants

Name	Recurrent	Due Date	Frequency
Implementation of Financial Action Plan	X		CONTINUOUS

Description of Covenant

Obligation of the Recipient and EDL to implement the Second Financial Action Plan (FAP) for financial sustainability of EDL and the Lao power sector in a manner consistent with the purposes of the said plan, throughout the period covered by the said plan. (FA, Schedule 2, Section V (a); PA, Schedule, Section V (a))

Name	Recurrent	Due Date	Frequency
Update of Financial Action Plan		30-Jun-2017	

Description of Covenant

Obligation of the Recipient and EDL to jointly update the FAP by June 30, 2017, designed to ensure the continued financial sustainability of EDL and the Recipient's power sector, and thereafter ensure that the said updated plan is implemented, in a manner consistent with the purposes of the said plan, throughout the period covered by the said updated plan. (FA, Schedule 2, Section V (b); PA, Schedule, Section V (b))

Name	Recurrent	Due Date	Frequency
EDL total debt-to-equity ratio of not exceeding 2:1	X		CONTINUOUS

Description of Covenant

Obligation of EDL to maintain a financial ratio of EDL's total debt divided by total equity. (PA, Schedule, Section II B 4)

Name	Recurrent	Due Date	Frequency
Implementation of Project Operational Manual	X		CONTINUOUS

Description of Covenant

Obligation of the Recipient and EDL to ensure that the Project is carried out in accordance with the Project Operational Manual. (FA, Schedule 2, Section I B; PA, Schedule, Section I B)

Name	Recurrent	Due Date	Frequency
------	-----------	----------	-----------

Implementation of Safeguard Provisions	X		CONTINUOUS
Description of Covenant			
Obligation of the Recipient and EDL to ensure that the Project is implemented in accordance with the safeguard provisions of the Financing Agreement and the ESMP including the ECoP/RPF incorporated in it. (FA, Schedule 2, Section I D; PA, Schedule, Section I D)			
Name	Recurrent	Due Date	Frequency
Implementation of Emergency Response Activities	X		CONTINUOUS
Description of Covenant			
Obligation of the Recipient and EDL to ensure that any activities carried out under the Contingent Emergency Response component in the event of an eligible crisis or emergency, are implemented in accordance with the provisions of the Financing Agreement and the Emergency Response Manual. (FA, Schedule 2, Section I E; PA, Schedule, Section I E)			
Name	Recurrent	Due Date	Frequency
Maintaining Project Office	X		CONTINUOUS
Description of Covenant			
Obligation of EDL to maintain a Project Office responsible for project implementation, staffed with competent personnel in sufficient number, provided with adequate resources, and under the direction of qualified managers, including a Project director, all with terms of reference and qualifications acceptable to the Association. (PA, Schedule, Section I A)			
Name	Recurrent	Due Date	Frequency
Progress Reports	X		Yearly
Description of Covenant			
Obligation of the Recipient and EDL to ensure that the Association is furnished with annual progress reports on the implementation of the Project, within 45 days after each year. (FA, Schedule 2, Section II A 1; PA, Schedule, Section II A 1)			
Name	Recurrent	Due Date	Frequency
Mid-term Review		31-May-2018	
Description of Covenant			
Obligation of the Recipient and EDL to ensure that the Association is furnished with a mid-term project progress report on or about the date 24 months after effectiveness, and carry out a mid-term review on or about the date 1 month after the submission of the mid-term report. (FA, Schedule 2, Section II A 2; PA, Schedule, Section II A 2)			
Conditions			
Source Of Fund	Name	Type	
IDA	Subsidiary Agreement	Effectiveness	
Description of Condition			
The Subsidiary Agreement, on terms and conditions acceptable to the Association, between MOF and EDL has been executed, delivered and duly authorized or ratified by the Recipient. (FA, Article V, (5.01), (5.02))			

Source Of Fund	Name	Type		
IDA	Emergency Response	Disbursement		
Description of Condition				
EDL has adopted a satisfactory Emergency Response Manual for Component 4 of the Project and, in the event of an eligible crisis or emergency, ensured that the activities under said component are carried out in accordance with such manual and all relevant safeguard requirements. (PA, Schedule, Section I E)				
Team Composition				
Bank Staff				
Name	Role	Title	Specialization	Unit
Rome Chavapricha	Team Leader (ADM Responsible)	Senior Energy Specialist		GEEDR
Khamphet Chanvongnaraz	Procurement Specialist	Procurement Specialist		GGODR
Phaymany Philakone	Financial Management Specialist	Consultant		GGODR
Asad Ali Ahmed	Team Member	E T Consultant	Energy economist	GEEDR
Dejan R. Ostojic	Team Member	Lead Specialist	Energy program lead	GEEDR
Fowzia Hassan	Team Member	Energy Specialist		GEEDR
Frederick Yankey	Team Member	Senior Financial Management Specialist		GGODR
Juan Martinez	Social Safeguards	Sr Social Scientist	Social Safeguards	GSURR
Kaysone Vongthavilay	Team Member	Program Assistant		EACLF
Keomanivone Phimmahasay	Team Member	Economist	Gender coordinator	GMFDR
Manush A. Hristov	Counsel	Senior Counsel	Country Lawyer	LEGES
Masaki Takahashi	Team Member	Sr Power Engineer	Power engineer	GEEDR
Obert Pimhidzai	Team Member	Economist	Poverty economist	GPVDR
Ruxandra Maria Floroiu	Team Member	Senior Environmental Engineer	Environmental safeguards coordinator	GENDR
Satoshi Ishihara	Team Member	Senior Social Development Specialist	Social safeguards coordinator	GSURR
Siriphone Vanitsaveth	Team Member	Financial Management Specialist		GGODR

Sudeshna Ghosh Banerjee	Team Member	Senior Economist	Energy economist	GEEDR
Sybounheung Phandanouvong	Team Member	Senior Social Development Specialist	Public consultations specialist	GSURR
Vilayvanh Phonepraseuth	Team Member	Operations Analyst		GEEDR
Waraporn Hirunwatsiri	Environmental Safeguards	Senior Environmental Specialist	Environmental Safeguards	GENDR

Locations

Country	First Administrative Division	Location	Planned	Actual	Comments
Lao People's Democratic Republic	Vientiane	Vientiane Prefecture		X	Xaythany District

I. STRATEGIC CONTEXT

A. Country Context

1. With a current GDP per capita of US\$1,660 in 2013 and a population of 6.7 million, Lao People's Democratic Republic (PDR), though still one of the poorest countries in Southeast Asia, is currently undergoing a rapid economic expansion. The country is endowed with natural resources and it is in the midst of a fast growing region. This combination of comparative advantages, along with policy steps to exploit them, has yielded an average real GDP growth rate estimated at close to 7.5 percent per year for the past 15 years. Economic growth has continued to be rapid in recent years, boosted by the resource sector, including the construction and related transportation activities of major FDI-funded power projects.

2. The country has made significant strides to becoming more integrated internally as well as with the regional and international trading system. Besides the hydropower sector, continued public investment in basic infrastructure, especially roads, has fostered internal and regional integration, supporting growth in agriculture, transport and tourism. The country has also become more open to its region and to global trade. Underlining the policy shift towards establishing a rules-based system for governing trade and private sector development, Lao PDR completed its accession to the World Trade Organization in February 2013. The country is also preparing for Association of Southeast Asian Nations planned establishment of a single market, the ASEAN Economic Community, in 2015.

3. National poverty rate halved in two decades, from 46 percent in 1992/93 to 23 percent in 2012/13. This increase in welfare has led to a strain on existing infrastructure services, in particular, electricity services which see a high rate of technical and commercial losses.

B. Sectoral and Institutional Context

4. **Over the past twenty years Lao PDR's energy strategy focused on hydropower development, a national electrification program, and export of electricity** as one of the main pillars of the country's economic and social development. Access to electricity increased impressively from 15 percent in the mid-1990s to close to 90 percent in 2014. However, while the country developed significant export capacity, the domestic power market remains prone to low reliability of power supply and pressures to import electricity in certain parts of the country due to underdeveloped and inefficient transmission and distribution networks and seasonality of domestic hydropower.

5. **Demand for electricity in Laos has grown significantly in recent years along with rising electrification rate.** The electricity peak load demand within Laos rose from about 209 MW in 2003 to 805 MW in 2014, growing on average 13 percent annually. This demand increase has been driven by the commercial and the industrial sectors and by the rising rate of electrification in the country. The rising demand was met by: (i) dedicated domestic hydropower stations wholly owned by the state-owned power utility Electricité du Laos (EDL) and its subsidiary EDL-Generation (EDL-Gen), totaling 392 MW; (ii) Lao PDR's share in and purchases from export-oriented independent power producers (IPPs); and (iii) electric interconnections with Thailand, China, and Vietnam. To supplement domestic power generation,

in 2013 Laos imported about one-third of required electric energy (1,205 GWh), of which 80 percent came from Thailand, 18 percent from China and 2 percent from Vietnam. The cost of import reached US\$ 65 million, or about 0.6 percent of estimated 2013 GDP. By 2013, the total electric energy sales through the national power grid reached 3,381 GWh with residential customers accounting for 38 percent, followed by the industrial sector at 33 percent and the commercial sector at 22 percent. The latest power demand forecast, based on the official Power Development Plan for 2010–2020 revised in 2011, estimates the domestic peak load demand to exceed 2,500 MW by 2020 due to growing demand across all consumer groups. However, lower demand in recent years suggests that it may take longer than 2020 to exceed this level (see Annex 2).

6. **In parallel, export-oriented power projects and domestic projects are continuing to expand.** By end 2013 the installed capacity of export-oriented hydropower projects reached 2,580 MW, including the IDA-supported 1,075 MW Nam Theun 2 hydropower project (NT2) that was commissioned in 2010. Over 3,000 MW of export-oriented power projects are currently under construction, such as the 1,653 MW Hongsa thermal power project, the 410 MW Xepian-Xenamnoy hydropower project, the 280 MW Nam Ngiep1 hydropower project, and the 1,200 MW Xayabouly hydropower project. The drivers of development in the hydropower sector in the country have remained fundamentally unchanged in the past decade. A number of export-oriented projects include dedicated power generation capacity for Lao PDR to help meet the domestic demand for electricity, such as the 75 MW under NT2, 60 MW under Theun Hinboun hydropower project, 175 MW under Hongsa thermal power project, and 40 MW under Xepian-Xenamnoy hydropower project. In addition, about 2,000 MW of domestic-oriented power projects are under various stages of construction, which may eventually provide excess capacity for Laos and be available for export.

7. **The energy sector institutional framework is well defined.** The Ministry of Energy and Mines (MEM) is the focal point for overall energy policy. Under MEM, the state-owned utility EDL is responsible for the electricity transmission and distribution (T&D) network and acts as a single-buyer of electricity for the domestic market. EDL's majority-owned subsidiary EDL-Gen is responsible for hydropower generation, with an installed capacity of 387 MW as of mid-2014. In addition, the Lao Holding State Enterprise (LHSE) is the Government's investment vehicle in export-oriented power projects where it holds Government's equity stakes in projects such as NT2 and the Hongsa thermal power project.

8. **The main challenges facing the Lao electricity sector** include: (i) inadequate available power generation capacity for domestic consumption especially in the dry season months (November–April); (ii) inadequate transmission/distribution fees for T&D business; and (iii) end-user tariffs averaged around 9 US cents per kWh in 2013, providing limited room for further increase due to affordability constraints; (iv) the lack of a nationally connected power transmission grid; and (v) the prospect of building-up a significant surplus of hydropower requires a new energy strategy which will recognize the importance of improving quantity and quality of power supply in the domestic market, while integrating the power grid both internally and in the regional power market.

9. **WBG support for the Lao electricity sector.** The WBG has been supporting Lao's power sector since the 1960s with specific focus on rural electrification since the 1980s. The WBG assistance began with administration of a development fund to construct the first phase of the Nam Ngum Hydroelectric Project, completed in 1971. In 1987, IDA financed the Southern Provinces Electrification Project, which specifically targeted grid-connected rural electrification in Savannakhet, Champasak, and Saravane provinces. In 1992, the Provincial Grid Integration Project further expanded grid-connected rural electrification in Savannakhet, Champasak, and Sekong provinces. In 1998, IDA supported another Southern Provinces Electrification Project that for the first time included an off-grid rural electrification pilot project in remote communities, which was a predecessor to a larger off-grid rural electrification program under the Rural Electrification Phase 1 Project (REP I) in 2006 and the soon to be completed Rural Electrification Phase 2 Project (REP II) in 2009. REP I and II focused on both expanding access and the financial sustainability of the power sector and EDL. Under REP I, about 63,000 households were connected to electricity, including 5,900 off-grid connections. Under REP II, the target is to connect 37,700 households to electricity, including 10,000 off-grid connections. In parallel, during 2005 IDA and MIGA approved financial support for NT2, which added about 75 MW generation capacity for Laos and about 995 MW of export capacity. IFC provided US\$ 15 million co-financing to EDL under REP II. Most recently in June 2014, EDL engaged IFC to conduct a diagnostic of EDL's billing and collection systems, which will help inform the final design of EDL's corporate financial management system component under this proposed project.

10. **The power sector development in Lao PDR has entered a new “post-electrification” phase which brings new challenges and requires sustained improvements in the sector.** The development of Lao power sector has achieved major success by increasing electrification. While the electrification program nears its completion, the power grid is increasingly facing new challenges related to the fast growth of electricity demand. The main challenges are persistently high distribution losses, (averaging about 13 percent in 2014 with some areas experiencing losses of over 20 percent) and sub-standard electricity services, including low reliability of electricity supply due to overloading of the distribution grid particularly in major load centers such as Vientiane capital, Savannakhet, Takek, and Pakse.

C. Higher Level Objectives to which the Project Contributes

11. By focusing on these new challenges in the power distribution sector, the proposed Power Grid Improvement (PGI) Project will complement the Bank's on-going assistance and help support sustainable development of the power sector in Lao PDR.

12. **EDL investment program in power grid improvement.** Following a PHRD-funded study on power distribution loss reduction in 2005 and subsequent technical assistance, EDL carried out a number of distribution improvement activities leading to the large-scale power distribution system rehabilitation project (PDSR), initiated in 2013. PDSR covers four major electricity load centers in four provinces: Vientiane capital, Savannakhet, Takek, and Pakse. These activities are divided into two implementation phases, subject to implementation feasibility and budget availability. Phase 1 is budgeted at US\$ 90 million and is reaching the end of implementation period 2013–2016; Phase 2 is budgeted at US\$ 60 million over 2015–2018. Both phases are financed by a MOF-guaranteed loan from Thailand. These investments represent

a substantial investment in comparison with EDL existing power grid assets book value of about US\$ 1.2 billion. In addition to rehabilitation activities, PDSR will be introducing distribution automation system and fault detection, investigation, and restoration system in the four provinces. In addition a new supervisory control and data acquisition (SCADA) system for power distribution will be implemented by EDL. The proposed project will complement PDSR by targeting a fast-growing area with the highest distribution loss in Laos in Vientiane capital, and expanding distribution automation and advance metering applications.

13. Linkages with on-going WBG energy activities in Lao PDR. The proposed project shifts the focus of WBG engagement from increasing access and rural electrification towards improvement of efficiency and reliability of electricity supply. To help achieve such improvements, the proposed project also targets building institutional capacity in EDL, including upgrading the corporate financial management, billing and collection systems. The proposed project builds on the on-going REP II in the area of distribution loss reduction, utility information system improvement, and demand side management. Specifically, the proposed project builds on the following REP II components: (i) a consultancy to reduce non-technical distribution losses; (ii) a consultancy to diagnose EDL's FMIS existing system and advise on system upgrade/replacement; (iii) pilot project for energy efficient lighting and appliances; (iv) pilot project for upgrading electric meters. The proposed project has a strong synergy with the Technical Assistance for Capacity Building in the Hydropower and Mining Sectors Project (H5390, H9470 and Cr. 5449), which in part will help create power market and regulatory conditions favorable for the financial recovery of EDL and its future strengthening as a major power market operator in the GMS region. Finally, improvements in the power sector under the proposed project will help create a favorable environment for scaling-up private sector participation which the Bank Group promotes in Lao PDR.

14. Linkages with development partners' energy activities in Lao PDR The Asian Development Bank, the Australian Department of Foreign Affairs and Trade, the Japan International Cooperation Agency and the Norwegian Agency for Development Cooperation have been active development partners in the development of the Lao power sector. These institutions have provided financing support for Lao's electrification program and related capacity building activities. In addition, Laos has received bilateral government-to-government support from various countries that benefit power sector development, including support for capital investment and capacity building.

15. The Country Partnership Strategy (CPS) FY12–16¹ for Lao PDR focuses on three themes (report number 66692-LA, dated January 25, 2012, discussed by the Board of Executive Directors on March 8, 2012): (1) competitiveness and connectivity, (2) sustainable natural resource management, and (3) inclusive development with a crosscutting theme of stronger public sector management. The proposed project would support Theme 3 by improving the quality of electricity supply in the project area. The project also supports the cross-cutting theme

¹ The World Bank Group's Country Partnership Strategy FY12-16 (Report # 66692-LA) discussed by the Executive Directors on March 8, 2012 and the Country Partnership Strategy Progress Report (Report # 90281-LA) of September 16, 2014.

of stronger public sector management by improving the financial management system for the state-owned electric utility EDL.

16. The Project is aligned with the WBG's 2013 Energy Sector Directions Paper, which pledges to support clients in delivering the affordable, reliable, and sustainable energy needed to help achieve the Bank Group's twin goals of eliminating extreme poverty and promoting shared prosperity. This will be achieved through supply side efficiency gains and improving sector financial performance through improved management information systems.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

17. The project development objective is to help improve efficiency and reliability of power distribution in the selected load areas served by EDL.

B. Project Beneficiaries

18. Direct beneficiaries of the project would be residential, commercial and industrial consumers served by EDL in Xaithany District of Vientiane capital. There are currently about 46,000 residential and 1,100 non-residential customers in Xaythany. They would benefit from (a) reduced occurrence and duration of power supply disruptions; (b) better quality of power supply (e.g. more stable voltage and frequency) which would extend the operating life of electrical appliances; and (c) improvement in billing and increased bill payment options. The project would also bring direct temporary benefits for skilled and unskilled workers that would be employed for project implementation.

19. Indirect beneficiaries would include all consumers, including poor people, who would benefit from reduced distribution losses and improved quality of supply. The cost-saving from distribution loss reduction will reduce pressure on electricity tariff increases, which is proportionally more beneficial to low-income customers. The improved reliability of electricity supply will also benefit low-income customers since these customers struggle to afford relatively more expensive back-up or alternative sources of electricity. It is envisaged that some project net financial benefits can be channeled toward the existing rural electrification Power to the Poor Program (P2P) if additional capital is required. P2P was established in 2008 by the GOL and EDL as a revolving financing facility to support poor and women-headed households to pay grid connection charges over three-year installments. P2P has supported about 35,000 eligible households² to connect to the power grid by early 2015.

20. Gender assessment is carried out as part of the project social assessment. The project would proportionately benefit female and male population through improved efficiency and reliability of power distribution. In addition, targeted training of female EDL staff (about 20

² P2P eligible households meet one of the following poverty criteria: (i) Household has a rice shortage at least 6 months per year; (ii) Household does not have any livestock; (iii) Household has access to less than 1 hectare of land for rice cultivation; (iv) Household cannot finance medical costs; or (v) Female-headed households.

percent of total staff) on capacity building activities under Component 3 will be carried out during implementation phase, which will be monitored and evaluated under the project results framework. Additional potential financial support for P2P from this proposed project's financial benefits will benefit more women-headed households.

C. PDO Level Results Indicators

21. The PDO indicators include: (i) electricity distribution losses per year in the project area; (ii) average interruption frequency per year in the project area; and (iii) number of beneficiaries.

III. PROJECT DESCRIPTION

A. Project Components

22. **Component 1: Smart metering, distribution improvement and distribution losses reduction** [US\$ 19 million]: This component will support rehabilitation, improvement and automation of power distribution and metering infrastructure and equipment in the selected load areas to introduce smart metering, improve the reliability of power supply and reduce distribution losses. The component is expected to introduce advanced metering infrastructure (AMI) technology and digital meters in the project area. In addition, it is expected to help improve reliability of power supply and reduce losses in selected parts of the distribution network through strengthening of power distribution infrastructure and distribution automation. This component includes rehabilitating power distribution lines, upgrading of conductors, increasing transformer capacity, placement of capacitors for reactive power and voltage control, installation of load break switches and reclosers, etc.

23. **Component 2: Electric utility information system** [US\$ 6 million]. This component has three sub-components that will support: (i) the development of an improved information system of EDL, including supply and installation of optical fiber communication links to support advanced metering and distribution automation; (ii) extension of the geographic information system to support power distribution operation and maintenance; and (iii) supply and installation of an updated corporate financial management information system. This sub-component is expected to take a modular approach in modernizing financial management in EDL, including through the improvement of billing and collection system, which can be subsequently scaled up to a full enterprise resources planning system or be disaggregated according to EDL corporate structure.

24. **Component 3: Institutional capacity building and project implementation support** [US\$ 5 million] This component will provide technical and operational assistance to enhance EDL's institutional capacity to utilize new technologies in addressing distribution losses and improving power grid efficiency, and to carry out the day-to-day management, monitoring and evaluation of project activities, including audits. The component is expected to include (i) financing for EDL's distribution materials and equipment testers and related trainings, (ii) applications of advanced metering infrastructure, (iii) applications of energy balancing and power flow software, (iv) consultancy for electric utility information system, (v) support to measure distribution system performance indicators, and (vi) project implementation support including incremental operating costs. This component is expected to enhance EDL institutional

capacity to utilize new technologies to address distribution losses and improve power grid efficiency.

25. **Component 4: Contingent emergency response** [US\$ 0 million]. This component will provide immediate response to an eligible crisis or emergency, as needed. The objective of the contingent emergency response component with a provisional zero allocation is to allow for the reallocation of financing in accordance with the IDA Immediate Response Mechanism in order to provide a rapid response to disaster or emergency events. This component would finance expenditures on a positive list of goods and/or specific works and services required for emergency recovery. An Emergency Response Manual (ERM) will apply to this component, detailing streamlined financial management, procurement, safeguard and any other necessary implementation arrangements.

26. The project area is located in Xaythany district of Vientiane capital, about 10 kilometers north of Vientiane city center, with a distribution loss of around 24 percent in 2014 (higher than national average of 13 percent). The selected load areas are those served by all the existing medium-voltage distribution lines in Xaythany district (22 lines totaling about 127 km), connected to low-voltage lines (about 239 km). Further details of the selected load areas are described in the Project Operational Manual. The Vientiane capital area accounts for about 40 percent of the country's demand for electricity. The Xaythany district comprises low- and high-income residential customers, commercial, and industrial customers. The experience to be gained from the project can be subsequently scaled up to other load areas with high losses.

B. Project Financing

Lending Instrument

27. The proposed operation will be financed by an Investment Project Financing instrument. A Financing Agreement between Lao PDR and IDA will govern the terms of the IDA credit. A Project Agreement between IDA and EDL and a Subsidiary Agreement between the MOF and EDL will govern the on-lending of IDA credit from the Ministry of Finance to EDL and EDL's project implementation obligations.

C. Project Cost and Financing

28. Project cost and financing requirements for the investment components are presented in the table below. The project will be wholly financed by IDA, inclusive of eligible retroactive financing.

Table 1: Estimated Project Costs and Financing (US\$ million)

Project Components	Project cost	IDA Financing
1. Smart metering, distribution improvement, and distribution losses reduction	19.00	19.00
2. Electric utility information system	6.00	6.00
3. Institutional capacity building and project implementation support	5.00	5.00
4. Contingent emergency response	0.00	0.00
Total Costs and Financing Required	30.00	30.00

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

29. EDL is the implementing agency and will be responsible for overall project coordination and management including financial management, procurement, monitoring and reporting. EDL will ensure that fiduciary requirements are met and complied with throughout the project implementation.

30. EDL has experience in managing many World Bank-funded projects such as Southern Provinces Rural Electrification, REP I, REP II and GMS Power Trade (Laos). The same Project Office structure will be used for this project, and three staff involved with financial management of the previous project has been assigned to manage this project. Over the years, EDL has developed internal capacity to implement Bank-funded projects although some experienced staff has been rotated to other responsibilities. The Bank will be providing refresher training and hands-on implementation support for the current EDL staff to implement the project.

B. Results Monitoring and Evaluation

31. EDL will monitor progress of the components against the performance indicators listed in Annex 1 and prepare annual progress reports on project implementation. In addition, EDL will prepare to establish baseline indicators which are not yet available. Data and statistics on actual project outputs and outcomes will be gathered, analyzed, and included in the progress reports to be submitted to the Bank. The technical assistance activities will have their own monitoring and evaluation mechanisms, some of which will be built into project design. A mid-term review is scheduled to be carried out 24 months after effectiveness to take stock of implementation progress.

C. Sustainability

32. Sustainability of the Project depends largely on the ability of EDL to implement the project according to technical specifications, E&S requirements, and in a timely manner. EDL's experience in power distribution improvement and automation from implementing the on-going PDSR project since 2013 can be carried over to this proposed project.

33. The Project includes capacity building on the applications of advanced metering infrastructure and applications of energy balancing and power flow software. These activities will help build capacity for EDL to improve efficiency and reliability of power distribution in a sustainable manner.

34. More broadly, the Project sustainability also depends on the financial soundness of EDL to carry out its power grid business. EDL's power grid business is being cross-subsidized by the generation business. EDL financial soundness is being addressed under the framework of the Second Financial Action Plan (FAP) for Financial Sustainability of EDL and the Power Sector. This action plan, covering 2013–2017, was jointly developed and endorsed by EDL, MEM and MOF with support from the Bank and IFC. The action plan provides a framework for EDL, MEM and MOF to consult and propose actions toward financial sustainability, delivering affordable electricity to Lao consumers, and having an electricity tariff structure that encourages efficient use of energy. The highlights of the Second FAP include: (i) a review of electricity tariff adequacy on an annual basis; (ii) a periodic review of investment program by EDL and EDL-Gen in power generation, transmission and distribution; (iii) an immediate review of EDL financial management system, including billing and payment system; and (iv) performance targets on receivables, payables, and electricity losses. Under the on-going World Bank supported Hydro and Mining TA, the Government has requested Bank support to carry out a review of electricity tariffs and a social assessment on tariff affordability in designing a new tariff instruction after 2017.

V. KEY RISKS

A. Overall Risk Rating and Explanation of Key Risks

35. The overall risk rating for the proposed project is Moderate. The main project risks that could substantially impact the project development objectives revolve around sector strategies and policies, institutional capacity for implementation and sustainability, and fiduciary aspects.

36. Regarding sector strategies and policies, the electricity tariff policies directly impact the financial soundness of EDL to implement the project. In the past few years, the T&D business incurred financial losses and was subsidized by the generation business. The T&D business has also experienced financial liquidity problems from fronting new generation investment on behalf of the generation business. This risk can be mitigated by more balanced tariff policies among these related businesses, and by a clear separation of investment responsibilities among the generation, transmission and distribution businesses. Another area of risk involves the disconnection between policy makers and EDL companies. Despite the existence of a Power Development Plan, the experience in recent years has shown that a number of unplanned projects may arise, forcing EDL companies to take on new debt financing for these projects. This makes it challenging for EDL companies to manage their finance and prevailing financial contracts with existing creditors.

37. The Lao authorities have acknowledged the above sector/financial risks. The Bank and IFC jointly facilitated the Lao authorities in developing the Second Action Plan for Financial Sustainability of EDL and the Lao PDR Power Sector, covering the period 2013–2017. This has paved the way for the creation of a working group comprising officials from the Ministry of

Finance, the Ministry of Energy and Mines, and EDL to propose actions to be undertaken to ensure financial sustainability of the power sector. Under this working group framework, the Lao authorities are considering the following activities during the proposed project implementation: (i) review of electricity tariffs beyond 2017; (ii) clear separation of investment and debt borrowing by EDL and EDL-Gen; (iii) review a recapitalization of EDL; (iv) centralized billing and payment of electricity charges for public sector customers starting in FY2015; (v) additional transmission and distribution loss reduction activities.

38. Regarding institutional capacity for implementation, EDL has employed external contractors for the complex part of distribution rehabilitation activities (e.g. implementation of the new distribution SCADA system, supply and installation of distribution automation equipment, etc.). Under the proposed project, external expertise is still required to mitigate implementation risk. The project will include capacity building component to facilitate the transfer of expertise from external contractors back to EDL. As for fiduciary aspects, many EDL experienced staff in procurement, financial management, disbursement, and environmental and social safeguards in Bank-funded projects have moved on to other responsibilities. To address this risk, procurement and safeguards consultants will be hired and additional trainings will be provided to assist EDL.

39. Other risks on the project development objectives are assessed as moderate. The government and political support for increasing electricity access and improving service quality have been strong. Laos' macroeconomic conditions have been improving and will benefit from efficiency gain from the project. The technical design of the project is based on proven technologies, sound specifications, and adequate implementation expertise. The environmental and social risks are limited due to the rehabilitation nature of the project, with no involuntary resettlement or involuntary land acquisition. And the project is well-supported by electric customers in the project area who will benefit from improved reliability of electric services. The experience gained through this project can be directly applied to other service areas.

40. In terms of climate and geophysical hazards, as a result of the WBG Climate and Disasters Risk Screening Tool, the project is moderately exposed to strong winds and slightly exposed to drought that may directly impact project implementation and operation. For instance, strong wind may disrupt construction activities or cause physical damages to infrastructure during operating phase. Excess drought may cause fire accidents, which may cause physical damages. The project is less exposed to flooding as most of distribution equipment is above ground-level, and may continue to operate safely during flooding.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analysis

Project Economic and Financial Analysis

41. This project aims to help improve efficiency and reliability of power distribution in the Xaythany district of Vientiane capital, which has a distribution loss of almost 24 percent. The project aims to reduce the distribution losses to 14 percent, generating energy savings of 42GWh in 2019 and cumulative energy savings of 2.3TWh by 2040. The cost savings from distribution

loss reduction will reduce pressure on electricity tariff increases. The improved reliability of electricity supply will also benefit low-income customers since these customers normally do not have back-up or alternative sources of electricity which can be afforded only by high-income consumers.

Methodology, assumptions and results

42. The economic analysis of the proposed PGI project is based on a standard cost benefit analysis, which identifies and compares economic costs and benefits in two cases, one ‘with project’ and the other ‘without project’. The analysis focuses on the quantifiable benefits resulting from the project. The expected project economic internal rate of return (EIRR) is 37 percent.

Table 2: Project Economic Analysis Results

Results Summary Table	Base Case		Reduction of Technical Losses Only - Top Down Approach	Reduction of Technical Losses Only – Bottom Up Approach	Losses Decrease to 19% instead of 14%	Reduction of Losses Valued at Cost of Supply	Reduction of Losses Valued at Weighted Avg. Domestic Tariff
	With CO ₂	Without CO ₂					
EIRR (%)	37%	33%	15%	18%	22%	20%	29%
NPV (USD Mn)	62.86	53.52	10.55	18.22	24.46	21.23	40.05
MARR (10%)	2022	2022	2031	2028	2026	2026	2023
NPV goes to 0 as the economic capital cost increases by 4.2 times to US\$ 104 million							

Project Financial Analysis

43. The financial analysis is based on the financial costs and revenues for the distribution company deriving from project implementation. The estimated FIRR of the project is 20 percent and the financial NPV is US\$153 million. Given that the project is IDA funded at concessional rate, the weighted average cost of capital is about 0.42 percent. Sensitivity analysis was conducted to test the robustness project with respect to key parameters of project costs and revenue streams. The revenue from loss reduction can decrease to US\$44 million or capital cost can increase to US\$183 million, for NPV to arrive at zero and for the project to turn financially unviable. Similar to the economic analysis, the financial return from the project is highly dependent on the benefits gained from loss reduction.

Financial Analysis of Implementing Agency

44. **Background:** The latest EDL financial results for FY2013 show an overall group level (combining generation and T&D) profitability of about 5 percent of revenue inclusive of investment income in private power projects. Net operating cash flow equaled 48 percent of operating revenue. However, the T&D business *alone* incurred losses of about 1.6 percent of revenue. (Note: total electricity-related sales were about US\$ 355m and investment revenues in private power projects were about US\$ 43m). The overall return on total assets was only 0.8 percent and return on equity was 2.3 percent, confirming that T&D business is loss-making and cross-subsidized by generation business. The total assets were about US\$ 2.7 billion. The overall

indebtedness of the group is now 1.6 times of equity, increasing substantially from 0.5 times only three years ago. The average tariff across all customer groups was 730 kips/kWh (9.1 cents). Actual tariffs ranged 328 to 1347 kips/kWh. Bill collection performance was quite good. Average *outstanding* bills (unpaid) amounted to about 2-month worth of sales. About half of these outstanding bills are with government/public sector customers.

45. The financial risk of EDL is moderate to high because of inadequate T&D margin for its T&D business. Adding to the financial risk is EDL's role in fronting new generation investment on behalf of EDL-Gen, which requires substantial upfront capital including through debt financing.

46. A financial projection of EDL suggests declining profitability until 2017 under the prevailing tariff instruction. Beyond 2017, improved financial performance can be expected from slightly higher tariffs and a decline in T&D losses from an estimated 17 percent in 2014 toward 13 percent. EDL's indebtedness is estimated to exceed two times its equity without recapitalization. EDL's financial performance is sensitive to the average selling tariffs, dividend income, dividend payment (through EDL-Gen), level of capital expenditures, investment and associated financing expenses, and the level of T&D losses (see Annex 5 for details). As indicated in paragraph 34, the Second FAP framework has been designed to assist the Lao authorities in regaining financial sustainability of EDL and the power sector in the medium- to long-term.

B. Technical

47. The technical criterion for customer selection is based on the medium voltage (MV) 22 kV level and below. The project area is currently served by 22 feeder lines at this MV level. The selected distribution improvement equipment, technologies and computing software are commercially proven, have been widely used by utilities in developed and developing countries worldwide, and will be implemented according to internationally accepted technical standards and practices. The investment cost was estimated by EDL based on the previous experiences including PDSR and other pilot projects where similar equipment and technologies have been applied. There are, however, implementation risks related to limited internal capacity at EDL, which will be mitigated through outsourcing to qualified contractors and capacity building of EDL staff to manage the project. In addition, qualified international consultants will be recruited to assist EDL in designing advanced meter infrastructure system and rollout plan.

48. Distribution losses. EDL keeps records of energy supply at substations, billed energy consumptions, and thus energy loss of the distribution network at country, province, and district levels. Xaythany district is identified as having the highest distribution loss of 24.3 percent in 2014, among the nine Vientiane capital districts (15.8 percent on average), and in Lao PDR (13.5 percent on average). Investment in smart meters and digital meters, transformers, MV/LV conductor upgrade, and information systems will help cut distribution losses toward the country's level.

C. Financial Management

49. A financial management capacity assessment of EDL was undertaken in January 2015 to determine whether the implementation agency has adequate financial management systems and related capacity in place to satisfy the World Bank's Operational Policy/Bank Procedure 10.00 with respect to financial management.

50. EDL will be responsible for overall Project coordination and management including financial management, procurement, monitoring and reporting. EDL will ensure that fiduciary requirements are met and complied with throughout the project implementation. EDL has experience in managing many World Bank funded projects such as Southern Provinces Rural Electrification, REP I, REP II and GMSPT. The existing Project Office structure will be used for this project and three staff involved with financial management of the previous project have been assigned to manage this project.

51. The overall financial management risk for this project is assessed as "Moderate". The proposed financial management arrangements for the project are deemed acceptable and meet the Bank's minimum requirements for project financial management as per OP/BP 10.00. The implementation of the agreed mitigation measures will help strengthen the systems further. More detailed information is presented in Annex 3: Implementation Arrangements.

D. Procurement

52. Procurement for the project will be carried out in accordance with the World Bank's "Guidelines: Procurement of Goods, Works and Non-consulting Services under IBRD Loans and IDA Credits and Grants by World Bank Borrowers" dated January 2011 and revised in July 2014; "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits and Grants by World Bank Borrowers" dated January 2011 and revised in July 2014; and the provisions stipulated in the Financing Agreement.

53. EDL will be responsible for the procurement activities of this proposed project through its Procurement Office under the Department of Business. An international procurement consultant will be recruited to assist the Procurement Office. For each contract to be procured and financed under the project, the different procurement methods, estimated costs, prior review requirements, and timeframe will be defined in a procurement plan. The plan will be updated at least annually, or as required, to reflect actual project implementation needs and improvements of the institutional capacity.

54. Based on a procurement capacity assessment undertaken in preparation of the project, the overall procurement risk is considered "Substantial". More detailed information is presented in Annex 3: Implementation Arrangements.

E. Social (including Safeguards)

55. The social issues associated with the project are expected to be limited. The physical installations of meters, communication links, computing hardware, testing equipment are expected to be done on existing power lines, and buildings owned by EDL or by electricity

customers. EDL has already established procedures and communication methods to inform its customers of upcoming power cuts necessary for the project implementation. It is expected that under this project no physical relocation of existing residences and no involuntary land acquisition is expected as construction work will be done on existing power distribution infrastructure. However, minor losses of private assets such as land, crops and fences may occur as a result of upgrading of existing or adding new power poles under the existing right of way.

56. The expected social impact applied to the project is voluntary land donation for the installation of about 50 new power poles along a nine-kilometer section of provincial public road and located in the paddy fields. These belong to suburban and rural area with low density population or in less populated areas; these areas are on private land under the existing right of way.

57. The project triggers OP4.12 Involuntary Resettlement. The Protocols for Voluntary Land Donation (PVLD) and Resettlement Policy Framework (RPF), adopted by EDL and acceptable to the World Bank and included within the Environmental and Social Management Plan (ESMP), was disclosed on the World Bank website on March 25, 2015 and in country on March 26, 2015 in order to address project impacts in compliance with both GOL and World Bank's policies. The PVLD include detailed documentation indicating the appropriateness of the voluntary land donation, description of owners and users of land donated, procedures for consultation and disclosure, informed consent of the person donating the land, legal documentation indicating the transference of land donated, and grievance redress procedure and mechanism. The World Bank has reviewed the PVLD and RPF adopted by EDL and appraised them as acceptable. Following public consultations, the ESMP was updated and disclosed on the World Bank website on May 13, 2015 and in country on May 20, 2015.

F. Environment (including Safeguards)

58. The activities involved in the PGI project would include small scale installation works pertaining to the rehabilitation of medium voltage (127 km of 22 kV MV project) and low voltage (239 km of 0.4 kV LV system) distribution lines and the installation of electronic meters, replacement of capacitors (LV line), upgrading of conductors (on LV and MV lines) and replacement and upgrading of transformers (for MV). Given the nature of the rehabilitation works, the project is category B and triggers Environmental Assessment OP 4.01 as certain mitigation measures and monitoring actions will have to be implemented during the civil works both during the construction and operation and maintenance phases in order to minimize, prevent and reduce possible temporary and site specific impacts on the environment.

59. The key impact of the project during project construction and operation phase may include soil and surface water pollution due to disposal of fuel oils and disposal of construction debris and waste materials from installations to be replaced, in particular old PCB-based transformers, and physical hazard to workers. In addition, trimming of trees and bushes during project construction for additional poles and regular maintenance of vegetation within the 22 kV distribution right-of way which is necessary to avoid disruption to overhead power lines and poles will have minor impact to biological resources in the project right of way. An ESMP including the Environmental Codes of Practices (ECoP) in line with the World Bank's Safeguard policies, the WBG Environmental, Health and Safety (EHS) Guidelines for Power Transmission

and Distribution and the National applicable legislation that appropriately addressed the environmental issues identified from E&S due diligence was adopted by EDL and acceptable to the World Bank. The ESMP was disclosed on the World Bank website on March 25, 2015 and in country on March 26, 2015. Following public consultations, the ESMP was updated and disclosed on the World Bank website on May 13, 2015 and in country on May 20, 2015.

60. The project also triggers Physical Cultural Resources OP4.11 as precautionary measure to avoid impacts to stupas, pagodas or other cultural and historical resources. From the initial site survey, there are no physical cultural resources found within the existing 22 kV distribution right of way, which is located along the existing road (National Road 13 South). A detailed survey to identify physical cultural resources at the location of the additional poles will be conducted during implementation phase.

61. **Greenhouse gas emissions.** Lower electricity generation resulting from a reduction in distribution losses will also yield a reduction in CO₂ emissions since part of the generation comes from fossil fuel fired power plants. The emissions factor used to calculate the avoided CO₂ emissions from energy savings is based on the average operating margin emission factor (EF_{grid,OM-ave,y}) methodology as prescribed by the UNFCCC. The average operating margin emission factor is calculated as the average emission rate of all power plants serving the grid. The emissions factor used in this analysis is derived from the CDM projects registered in Lao in 2014. Using an emissions factor of about 560tCO₂/GWh the project leads to a cumulative CO₂ emissions savings of 1.27 million tons. These emissions value at US\$30/tCO₂.

G. World Bank Grievance Redress

62. Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit <http://www.worldbank.org/GRS>. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

Annex 1: Results Framework and Monitoring

Country: Lao People's Democratic Republic

Project Name: Power Grid Improvement Project (P149599)

Project Development Objectives

PDO Statement

The project development objective is to help improve efficiency and reliability of power distribution in the selected load areas served by EDL.

These results are at | Project Level

Project Development Objective Indicators

Indicator Name	Baseline	Cumulative Target Values				
		YR1	YR2	YR3	YR4	End Target
1. Average interruption frequency per year in the project area (Number) - (Core)	Not Available	Not available	Not available	Baseline to be determined upon implementation	Baseline to be determined upon implementation	10% or more improvement of the baseline
Customers served in the project area (Number - Sub-Type: Supplemental) - (Core)	47,060	52,000	57,000	62,000	67,000	67,500
2. Electricity	24.00	24.00	<=24.00	<=20.00	<=16.00	<=14.00

losses per year in the project area (Percentage) - (Core)						
Total net injected generation (Megawatt hour(MWh) - Sub-Type: Supplemental) - (Core)	239,100	Not applicable	Not applicable	Not applicable	Not applicable	335,500
3. Direct project beneficiaries (Number) - (Core)	207,000 ³	229,500	252,000	274,500	297,000	297,000
Female beneficiaries (Percentage - Sub-Type: Supplemental) - (Core)	50.00	50.00	50.00	50.00	50.00	50.00

Intermediate Results Indicators

Indicator Name	Baseline	Cumulative Target Values				
		YR1	YR2	YR3	YR4	End Target
Residential electric meters installed	0.00	1,000	5,000	9,000	14,000	15,000

³ 46,000 residential household customers times assumed average 4.5 persons per household. Plus 1,060 non-residential customers.

(Number)						
Non-residential electric meters installed (Number)	0.00	200	600	1,000	1,400	1,500
Distribution lines rehabilitated under the project (Kilometers)	0.00	0.00	100	200	300	300
Fiber optic cables (Kilometers)	0.00	0.00	0.00	50	100	100
Average duration of outages in the project area (Hours)	Not Available	Not available	Not available	Baseline to be determined upon implementation	Baseline to be determined upon implementation	10% or more improvement of the Baseline
Number of months to issue audited financial statements (Number)	9	9	9	6	4	4
Updated financial action plan for financial sustainability (Number)	0	0	1	1	1	1
Number of staff undergo training (Number)	0	0	20	40	50	50

EDL publishing summary reports of impacted household feedback received during project implementation (Yes/No)	No	No	Yes	Yes	Yes	Yes
EDL publishing reports on grievance redress mechanism and how issues were resolved (Yes/No)	No	No	Yes	Yes	Yes	Yes

Indicator Description

Project Development Objective Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Average interruption frequency per year in the project area	This measures the average number of interruptions per year in the project area. The indicator is computed by dividing the total number of customer interruptions in a year by the total number of customers in the project area. The baseline is the actual average interruption frequency per year in the project area at the beginning of the project.	Yearly	EDL	EDL
Customers served in the project area	The number of customers (by household, commercial, industrial accounts) served by EDL in the project area.	Yearly	EDL	EDL
Electricity losses per year in the project area	This indicator is calculated by dividing total electricity losses (i.e. the sum of technical and non-technical losses) by the total net injected generation in the project area. The baseline is the actual electricity losses in the project area at the beginning of the project.	Yearly	EDL	EDL
Total net injected generation	The number of electric energy, measured in kilo Watt hours that is supplied to the project area. This is measured at the distribution substations serving the project area.	Yearly	EDL	EDL
Electricity losses per year in the project area	The difference, measured in percentage, between Total net injected generation and total energy billed to customers.	Yearly	EDL	EDL
Direct project beneficiaries	Direct beneficiaries are people or groups	Yearly	EDL billing and customers	EDL

	who directly derive benefits from an intervention (i.e., children who benefit from an immunization program; families that have a new piped water connection). Please note that this indicator requires supplemental information. Supplemental Value: Female beneficiaries (percentage). Based on the assessment and definition of direct project beneficiaries, specify what proportion of the direct project beneficiaries are female. This indicator is calculated as a percentage.		data	
Female beneficiaries	Based on the assessment and definition of direct project beneficiaries, specify what percentage of the beneficiaries are female.	As available	Laos' population statistics	EDL
Intermediate Results Indicators				
Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Residential electric meters installed	Number of new residential electric meters installed under the project.	Yearly	EDL billing and customers data	EDL
Non-residential electric meters installed	Number of non-residential meters installed under the project.	Yearly	EDL billing and customers data	EDL
Distribution lines rehabilitated under the project	22 KV and 0.4 kV distribution lines rehabilitated under the project. Expected work done include enlarging the size of conductor, introducing insulated conductor, installing capacitors, load break switches and reclosers.	Yearly	EDL	EDL
Fiber optic cables	Installation of fiber optic cables to enable data transfer between smart meters and distribution control center.	Yearly	EDL	EDL
Average duration of	SAIDI is the average outage duration for	Yearly	EDL	EDL

outages in the project area	each customer served. SAIDI is calculated by dividing the sum of outages for all customers served (in hours) by the numbers of customers served in the project area.			
Number of months to issue audited financial statements	Number of months after the end of a fiscal year for EDL to issue audited financial statements	Yearly	EDL	EDL
Updated financial action plan for financial sustainability	Update of the Second Financial Action Plan for Financial Sustainability of EDL and the Lao PDR Power Sector. At least once every three years.	At least once every three years.	EDL	EDL, Ministry of Energy and Mines, Ministry of Finance
Number of staff undergo training	Number of EDL staff undergo training under the project, including breakdown for female staff.	Yearly	EDL	EDL
EDL publishing summary reports of impacted household feedback received during project implementation	EDL to publish summary reports that summarize feedback received from households in each year of project implementation.	Yearly	EDL	EDL
EDL publishing reports on grievance redress mechanism and how issues were resolved	EDL to publish summary reports that summarize grievance issues and grievance redresses in each year of project implementation.	Yearly	EDL	EDL

Annex 2: Detailed Project Description
LAO PDR: Power Grid Improvement Project

1. Proposed Project Components and Project Area Characteristics

a. The proposed project include the following components:

1. **Component 1: Smart metering, distribution improvement and distribution losses reduction** [US\$ 19 million]: This component is expected to introduce advanced metering infrastructure (AMI) technology and digital meters in the project area. In addition, it will help improve reliability of power supply and reduce losses in selected parts of the distribution network through strengthening of power distribution infrastructure and distribution automation. This component is expected to include rehabilitating power distribution lines, upgrading of conductors, increasing transformer capacity, placement of capacitors for reactive power and voltage control, installation of load break switches and reclosers, etc.

2. Electric meters: Mechanical (analog) residential meters are often installed incorrectly and do not provide accurate readings. EDL has piloted replacing old residential analog meters with new digital meters in Xaythany district, which has resulted in a large drop in distribution losses to less than 10 percent. This experience will be scaled up through the proposed project with about 15,000 residential digital meters. These digital meters will facilitate automatic meter-reading, which improves accuracy and efficiency in meter reading and billing. These meters can also support time-of-use tariff structure in the future. In addition, the proposed project will also install around 1,500 AMI smart meters for non-residential customers, replacing old mechanical meters. These AMI smart meters can support time-of-use tariffs and demand response management in the future.

3. MV transformers, MV and LV lines: MV transformers are transforming MV (22kV) to LV (0.4 kV) for residential, commercial and industrial consumers. There are 234 transformers in Xaythany. The project will replace 56 overloaded MV transformers and add 94 new MV transformers. Depending on the load level there are several conductor sizes of MV lines: 35, 50, 70 and 95 mm². The lines near load centers are overloaded, and voltage drops and conductor losses are high. The project will upgrade these lines to 70, 150, and 240 mm² conductors. Total length of MV upgrade is estimated to be 127 km, and the total length of LV line upgrade is estimated to be 239 km.

4. Load break switches (LBS) and Re-closers (RCS): About 84 load break switches and 63 re-closers will be installed to enable the limited Fault Location Isolation and Service Restoration (FLISR) system to improve the reliability of the grid by identifying the location of faults, isolating the faulted feeder, and many other consumers without faulted feeder to be reconnected immediately.

Table 1.1: Description of Investments Financed Under Component 1 and Rationale

Description of Works	Rationale
Meters for large customers (smart meters) and residential customers	Replacement from mechanical meters to digital smart meters will have accurate reading, recording, and data tracking system, reduce losses and interruption frequency and duration
MV transformers, MV and LV lines	Reducing loss of overloaded MV transformers, and MV and LV lines
Capacitors	Controlling VAR and reducing loss
Load break switches and re-closers	Improving reliability of the distribution grid

5. **Component 2: Electric utility information system** [US\$ 6 million]. There are three subcomponents to improve information system of EDL: (i) Supply and installation of optical fiber communication links to support advanced metering and distribution automation; (ii) Extension of Geographic Information System (GIS) to support power distribution operation and maintenance; and (iii) Supply and installation of an updated corporate financial management information system (FMIS).

6. The fiber optic cable installation and GPS handsets as extension of GIS system will improve the communication security and speed, especially in the case of outage. Data from AMI and digital meters, distribution automatic systems and various devices are integrated and send to the distribution central control center (located in Vientiane city center) so that Distribution Management System would automatically optimize the distribution system in real time. GIS improves the speed to dispatch maintenance crew and enable quick recovery from the faulted feeders. GPS handsets will provide information on the geographic data to GIS system.

7. The FMIS update will take a modular approach to modernizing financial management in EDL, including through the improvement of billing and collection system, which can be subsequently scaled up to a full enterprise resources planning system or be disaggregated according to EDL corporate structure. The detailed specifications and sequencing of the updated FMIS will be prepared by an international FMIS consultant under the on-going REP II.

8. **Component 3: Institutional capacity building and project implementation support** [US\$ 5 million]. This component is expected to include (i) financing for EDL's distribution materials and equipment testers and related trainings, (ii) applications of advanced metering infrastructure, (iii) applications of energy balancing and power flow software, (iv) consultancy for electric utility information system, (v) support to measure distribution system performance indicators, and (vi) project implementation support and incremental operating cost. This component will enhance EDL institutional capacity to utilize new technologies to address distribution losses and improve power grid efficiency.

9. This component is expected to support Component 1 and 2 for smooth implementation of the project. EDL will procure distribution materials and equipment testers (e.g. insulator tester, transformer tester, nuts and bolts tester, fuse tester, meter reader tester, etc.) and receive

necessary training to operate these testers and enable certification of tested materials and equipment. The component is expected to provide training of AMI applications, and detailed design of AMI system. This component will also provide comprehensive energy balance system with power flow analysis software, and necessary training. Lastly, this component will finance a procurement consultant, an E&S consultant, an auditor, and miscellaneous expenses for project implementation supports.

10. Institutional development and capacity building under the project will directly benefit EDL. Improved institutional performance in the power sector would indirectly benefit all stakeholders and consumers.

11. The value-added of the WBG support is in line with the project beneficiary assessment. In particular, the institutional development and capacity building under the project would help strengthen financial management of a key state-owned enterprise in Laos. In parallel, continuing Bank engagement in the sector will deepen the dialogue on post-electrification power sector reform.

12. **Component 4: Contingent emergency response** [US\$ 0 million]. The objective of the contingency emergency response component with a provisional zero allocation is to allow for the reallocation of financing in accordance with the IDA Immediate Response Mechanism in order to provide a rapid response to disaster or emergency events, as needed. This component would finance expenditures on a positive list of goods and/or specific works, and services required for emergency recovery. An Emergency Response Manual (ERM) will apply to this component, detailing streamlined financial management, procurement, safeguard and any other necessary implementation arrangements.

13. The use of public sector financing for the project is considered appropriate given the ongoing reform in the power sector, especially on power grid business, which remains solely under the public sector. Laos has been successful in attracting private sector financing in the generation business, and the ongoing reform will eventually open door for more commercial financing for power grid in the future. However, at present the business model of the power grid business in Laos continues to evolve with substantial uncertainties on revenue generation necessary for private sector financing.

b. Project Area Characteristics

14. The intended project area is located in Xaythany district of Vientiane capital, about 10 kilometers north of Vientiane city center, with a distribution loss of around 24 percent in 2014 (higher than national average of 13 percent). The Vientiane capital area accounts for about 40 percent of the country's demand for electricity. The Xaythany district comprises low- and high-income residential customers, commercial, and industrial customers. There are currently about 46,000 residential and 1,100 non-residential customers in Xaythany. The experience to be gained from the project can be subsequently scaled up to other load areas with high losses.

15. Xaythany distribution system has four (4) substations and 22 feeders, while Vientiane capital region has 68 feeders altogether. Xaythany has growing residential, commercial and industrial areas, and therefore the demand grows faster than the distribution network investment. This causes the highest distribution loss of 24.3% in 2014, among the nine Vientiane capital districts (15.8% in average), and in Lao PDR (13.5% in average) as shown in the following table.

Table 1.2: Distribution Losses

	District	2013	2014
1	4 central districts	8.05	13.23
2	Hadxaifong	14.31	12.18
3	Naxaitong	21.17	22.08
4	Xaythany	23.02	24.27
5	Pak ngum	17.81	18.35
6	Sung thong	9.70	9.19
	Vientiane Capital Region	13.26	15.78
	Lao PDR	12.02	13.49

16. Power supply reliability. System Average Interruption Frequency Index (SAIFI) and the System Average Interruption Duration Index (SAIDI) are commonly used indicators to monitor the reliability of distribution systems. However, EDL does not have data to calculate these indexes since EDL does not record the interruption data at final consumer level. Once the digital meters, and utility information management systems are installed during the implementation of the project, the data for accurately calculating the SAIFI and SAIDI will be available. Also technical assistance will help EDL to train staff to establish the capacity for monitoring, report and verifying the key performance indicators, including defining calculation methods for indicators, determining baseline values and establishing target values, improving procedures for collecting and verifying information. The following steps have been agreed are recommended: (i) establish the reporting structure and system in the first year, (ii) calculate the baseline SAIFI and SAIDI as soon as practicable during project implementation, and (iii) target at least 10 percent improvement over the baseline as the end-of-project target.

17. The feeder outage frequency and duration records are available, but the average results are unrealistically low, and will need to be confirmed during project implementation.

Table 1.3: Feeder Outages in EDL, Vientiane Capital and Xaythany

	Number of unplanned Outages per feeder (numbers)	Duration of unplanned Outage per feeder (minutes)
EDL		
Vientiane Capital	2011	
	14.28	162.69
	2012	
	11.82	178.14
	2013	
	13.14	131.66

Xaythany	2011	
	9.36	149.36
	2012	
	8.91	141.77
	2013	
	7.73	185.73

18. Level of automation: EDL’s distribution network is controlled manually and automation is limited to the local equipment. In case of failure of a feeder, switching to another feeder (back up) is done manually initiated by telephone calls by customers, or detection of failures at the substation. No Fault Location Isolation and Service Restoration (FLISR), or Volt-VAR Optimization (VVO) systems are applied. Pilot activities have started for feeder level data collection and monitoring. Supervisory Control and Data Acquisition (SCADA) system has been installed to monitor eight feeders in four districts of Vientiane capital. The power distribution system rehabilitation (PDSR) project is introducing distribution automation system and fault detection, investigation, and restoration system, Distribution Management System (DMS)/SCADA system in Vientiane, Savannakhet, Takek, and Pakse provinces. The proposed project is coordinating with these activities. For example, the smart meters installed, the optical fiber network, and the upgraded FMIS can be linked to the DMS/SCADA system to share information/data.

2. Overview of Lao PDR Electricity Demand and Supply

19. The electricity peak load demand within Laos rose from about 209 MW in 2003 to 805 MW in 2014, growing on average 13 percent annually. This demand increase has been driven by the commercial and the industrial sectors and by the rising rate of electrification in the country.

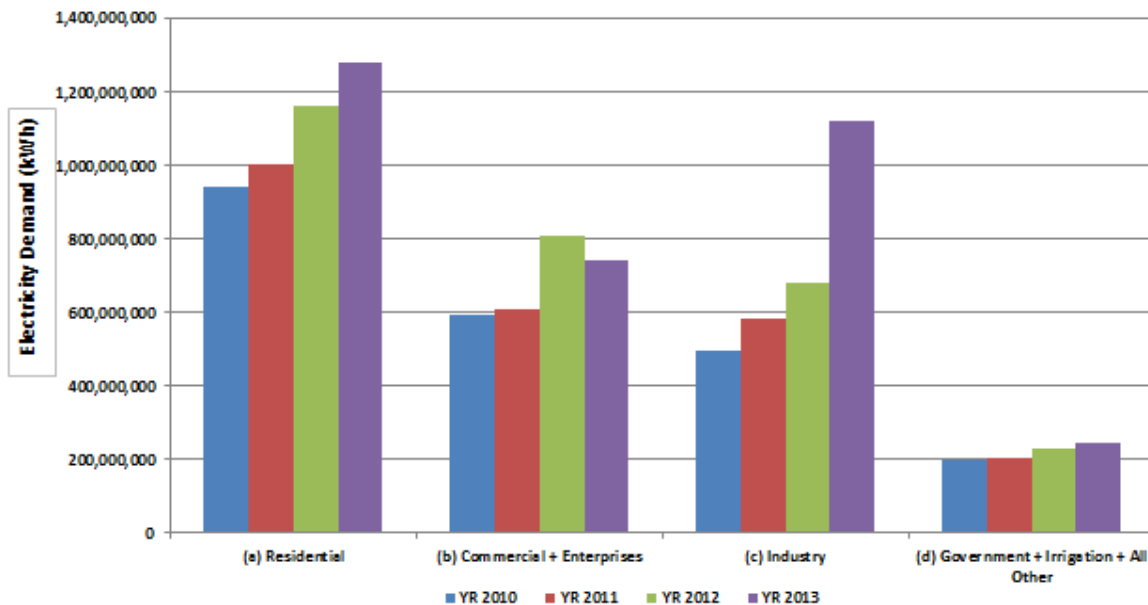


Figure 2.1: Consumption of Electricity (kWh) by Consumer Category (2010 – 2013)

20. By 2013, the total electric energy sales through the national power grid reached 3,381 GWh with residential customers accounted for 38 percent, followed by the industrial sector at 33 percent and the commercial sector at 22 percent.

Electricity Demand Forecast

21. Forecasting electricity demand in Laos is challenging due to uncertainties on the country’s industrial policy. The electricity demand forecast in Lao Government’s latest Power Development Plan for 2010–2020 revised in 2011 (PDP) contains two broad scenarios, which differ substantially due to the assumed industrial demand. Specifically, the difference is due to potential new electricity demand for Sino Lao Aluminum Corporation Limited (SLACO)’s bauxite production in Special Economic Zone. The first stage of SLACO project was envisaged to require about 900 MW, second stage 1,800 MW, and the last stage 3,600 MW respectively. The revised PDP 2011 has developed two scenarios: with and without SLACO demand of the first stage of 900 MW.



SLACO = Sino-Lao Aluminum Corporation.
Source: ADB.

Figure 2.2: Load Demand (MW) Forecast till 2020

22. The revised PDP forecasts the domestic peak load demand to reach 2,670 MW by 2021 (3,570 MW if the bauxite processing, SLACO plant, is included). This represents a fourfold (to fivefold) increase in peak load compared to 2013. However, lower demand in recent years suggests that it may take longer than 2020 to exceed this level.

23. Even without considering the demand of SLACO, the energy demand grows from 10 TWh in 2015 to 14 TWh in 2021 at 5.7% growth rate in 2015-2021. Large industrial sector has 3% growth rate at the same period from 7.0TWh to 8.5TWh. Small industrial sector has 17% growth rate from 0.9TWh to 4.3 TWh. Residential, commercial (service) and agriculture sectors

growth rate are estimated at around 7% from 1.3TWh to 2.0TWh, around 9% from 0.6TWh to 1.1TWh, and at 6% from 50GWh to 69GWh in the same period, respectively.

Supply Capacity

24. The rising demand was met by dedicated domestic hydropower stations wholly owned by the state-owned power utility Electricité du Laos (EDL) and its subsidiary EDL-Generation (EDL-Gen), totaling 392 MW, Laos' share in and purchases from export-oriented independent power producers (IPPs), and electric interconnections with Thailand, China, and Vietnam. To supplement domestic power generation, in 2013 Laos imported about one-third of required electric energy (1,205 GWh), of which 80 percent came from Thailand, 18 percent from China and 2 percent from Vietnam. The cost of import reached US\$ 65.1 million, or about 0.6 percent of estimated 2013 GDP. By 2013, the total electric energy sales through the national power grid reached 3,381 GWh with residential customers accounted for 38 percent, followed by the industrial sector at 33 percent and the commercial sector at 22 percent.

25. EDL provides transmission services in Laos in four service areas: north, central, and two southern zones. The power grid is not integrated and there is no power exchange at high voltage levels between these zones, which necessitates imports of electricity at the distribution level. Also, there are high voltage lines (230 kV and 500 kV) associated with export IPPs – such as Theun Hinboun, Houay Ho, Nam Theun 2, and Nam Ngum 2 – but these currently bypass the Lao grid. EDL has 115kV, 35kV, high voltage transmission lines, 25kV, 22kV, 12.7 kV medium voltage, and 0.4kV low voltage distributions lines. The 115kV, 22kV and 0.4kV are the major ones, and total length were around 4,500 km, 20,613 km and 15,172 km respectively in 2012.

26. EDL is a fully state-owned, vertically integrated utility responsible for the transmission and distribution of power in Laos. EDL has been transferring generation functions to EDL-Gen since late 2010. Under the current market structure, EDL is a single buyer of electricity to serve its domestic customers and also has sole responsibility for the transmission and distribution businesses. It served a total of 963,000 customers, including 908,000 residential, 27,000 commercial, and 14,000 industrial customers in 2012.

Annex 3: Implementation Arrangements
LAO PDR: Power Grid Improvement Project

Project Institutional and Implementation Arrangements

Project administration mechanisms

1. The project will be implemented between September 2015 and March 2020. Closing for IDA Credit will be on March 31, 2020.
2. EDL is the implementing agency. The implementation arrangements are based on EDL's existing organization and business processes, which will be strengthened through implementation supports in key areas. The project procurement activities will be carried out by EDL Procurement Department, assisted by a procurement consultant. The environmental and social safeguards activities are carried out by EDL E&S Department, assisted by an E&S consultant. The Financial Management (FM), disbursement, and associated reporting will be carried out by EDL Financial Division and Business Division Department, supported by the Bank task team.
3. Management of the implementation of the Project will be vested within the Electricity du Laos (EDL). *EDL's Project Office is shown in Exhibit 1.* It involves a Project Management team, Project Administration and Finance team, Procurement team, Environmental and Social team, and Technical team. The Project Office has been set up in EDL's Headquarters. The Project Office will be responsible for overall management and control of the project execution, as well as administration, monitoring and reporting in accordance with Bank requirements and will maintain close coordination with the Technical Team in both EDL Vientiane capital and EDL Xaythany district branch offices.

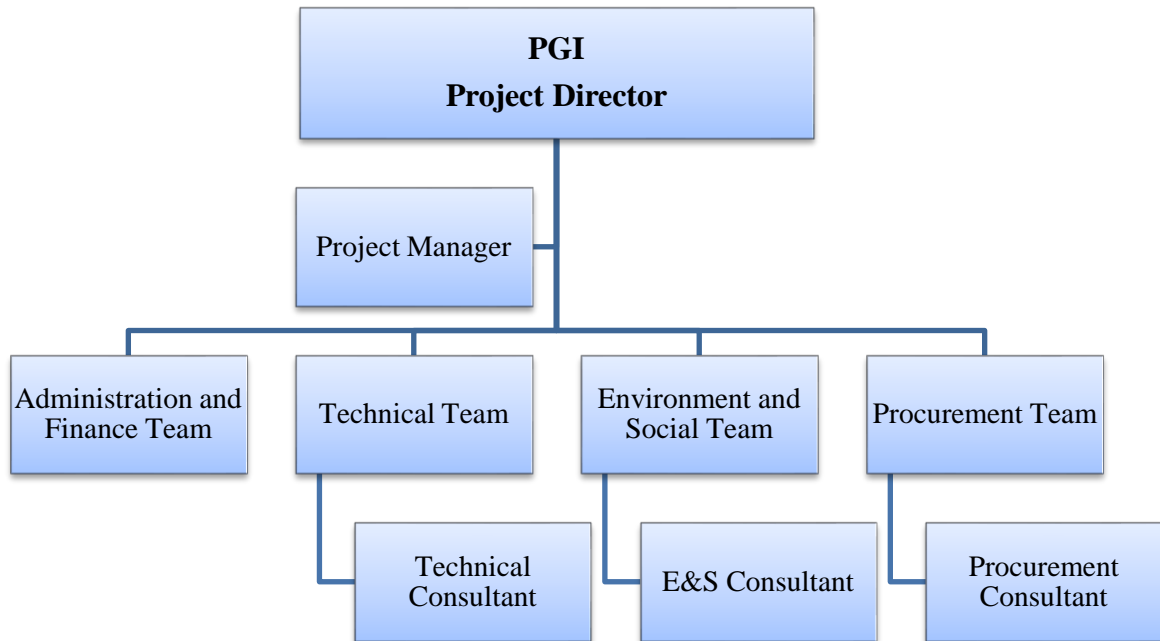


Exhibit 1: PGI Project Office Chart

4. A Project Director and a Project Manager have been appointed in the Project Management Team. A Project Director will be responsible for providing overall guidance to the PGI implementation. The Project Manager is assigned to assist Project Director for planning, design, review, and procurement of smart metering, distribution improvement and distribution losses reduction works and electric utility information system activities.

5. Project Technical Team includes members from Technical Departments from EDL Vientiane capital and EDL Xaythany district branch offices. The Project Technical Team will have a shared responsible for supervision of installation for Smart metering, distribution improvement and distribution losses reduction works carried out by the contractors.

6. Administration and Finance Team will include an Administration Officer, an Accounting Officer, and several team assistants. The Administration Officer will be responsible for all administrative work regarding the execution of the Power Grid Improvement Project. The Accounting Officer will be responsible for all the accounting work and financial management of the execution of the Power Grid Improvement Project, including monitoring and reporting functions.

7. Environmental and Social team will include staff members from EDL Environmental and Social Department with support from the E&S consultant, having the responsibility to minimize the social and environmental impact of the project during the construction/installation and after completion of the project. The E&S team will monitor the preparation and implementations of the ESMP and ECoP as necessary to minimize the social and environmental impacts according to agreed policy frameworks for safeguards.

8. Procurement team will include staff members from EDL Procurement Department with support from the Procurement consultant, having the responsibility to ensure that all procurement

is conducted in accordance with the procurement procedures and the procurement plan of the project agreed between the World Bank and the Government of Lao PDR in a manner of economy, efficiency and transparency.

Financial Management, Disbursements and Procurement

Financial Management

Summary of the Financial Management Assessment

9. A financial management capacity assessment of EDL was undertaken in January 2015 to determine whether the implementation agency has adequate financial management systems and related capacity in place to satisfy the World Bank's Operational Policy/Bank Procedure 10.00 with respect to financial management. Under the policy, all implementation entities are supposed to have and maintain adequate financial management systems, which include budgeting, accounting, internal controls, funds flow, financial reporting, and auditing arrangements, to ensure that they can readily provide accurate and timely information on the use of project resources and expenditures. These arrangements are deemed acceptable if they: (a) are capable of correctly and completely recording all financial transactions and balances relating to the project resources; (b) can facilitate the preparation of regular, timely, and reliable financial statements; (c) safeguard the project's assets; and (d) are subject to auditing arrangements acceptable to the Bank. The assessment was conducted through FM questionnaire, discussion with management team and the finance team, review of the documentations such as previous FM assessment, findings of existing internal and external reviews, the earlier supervision reports of REP II and GMSPT projects capacity and performance.

10. EDL will be responsible for overall Project coordination and management including financial management, procurement, monitoring and reporting. EDL will ensure that fiduciary requirements are met and comply with throughout the project implementation. EDL has experiences in managing many World Bank funded projects such as SPRE, REP I, REP II and GMSPT, existing Project Office structure will be used for this project and three staff involved with financial management of the previous project has been assigned to manage this project.

11. The overall financial management risk for this project is assessed as “**Moderate**”. The main risks that need to be addressed include: (i) frequent change in EDL organizational structure resulting in staff rotations, affecting changes in project management team and financial management teams with consequent effect of lack of ownership and limited coordination between departments; (ii) information lost due to no proper work transfers; (iii) a system of budget preparation, budget approval and variance analysis does not exist; and (iv) existing accounting software is not fully operational, and resulting in the use of multiple software with limited linkages between them. IFRs are manually produced. These risks will be mitigated by:

- (a) Financial management and disbursement officers with experience working under existing REP II and GMSPT projects to work on PGI project (two FM staff from Project

Accounting & Loan Office and one FM staff from Finance office) have been assigned to this project and retained for the duration of the project life.

- (b) Provide refresher trainings on financial management and disbursement requirements of the World Bank immediately after the project effectiveness.
- (c) Revise / update existing Financial Management Manual (FMM) used in REP II and GMSPT projects and distribute it to FM team.
- (d) Annual budget will be subjected to No objection procedures.
- (e) Upgrade EDL FMIS software to enable automatic project financial statements generation.

12. In conclusion, the proposed financial management arrangements for the project are deemed acceptable and meet the Bank's minimum requirements for project financial management as per OP/BP 10.00. However, the implementation of the agreed mitigation measures will help strengthen the systems further.

Country Issues

13. The overall fiduciary risk in Lao PDR is considered to be high, despite the fact that there are elaborate built-in controls within the Government FM system. There is insufficient transparency in public finances and access to Government financial information is limited. These weaknesses have been compounded by insufficient awareness of modern practices of internal control in the public sector and by the Government's ongoing decentralization initiative, which needs to be supported with a sufficiently robust institutional framework that clearly defines the new responsibilities at lower levels. Technical capacity of staff at these levels needs to be strengthened and the oversight functions and the State Audit Organization need improvement. A Public Expenditure Review combined with a Public Expenditure and Financial Accountability has been completed and disseminated whose findings demonstrate the weak accounting environment.

14. The recent Joint Country Portfolio Review (JCPR) also identified similar issues and weaknesses and it was agreed that a series of remedial measures in a time bound action plan would be implemented, including: (i) delegation of authority over the management of project designated accounts to executing agencies that have in place adequate quality and control system; (ii) streamlining of approval processes; (iii) harmonization of a FM manual; (iv) utilization of uniform FM software; (v) consolidation of project FM functions; and (vi) implementation of a consolidated training program. While these actions have started to improve specific fiduciary issues, the country FM environment for externally-funded projects remains weak as the effects of some of the measures being implemented have not yet taken effect.

Financial Management Arrangements

15. The current arrangement for the implementation of World Bank financed REP II and GMSPT projects will be maintained. The project will be implemented by EDL. Project Office (PO) for PGI has been formed within EDL Company Head Office. The Administration and Finance Team of the PO (including financial management) has been assigned to work for PGI by EDL Managing Director. PO at EDL will assume responsibilities for day-to-day managing and recording sources and uses of funds and produce the project financial reports to be submitted to the Bank.

Staffing

16. The same three counterpart staffs working under REP II and GMSPT at EDL (two FM staff from Project Accounting & Loan Office and one FM staff from Finance office) have been assigned to be responsible for financial management of the project including accounting and reporting functions and they will be retained till the project closing. It has been determined that the current staffing numbers are adequate considering that REP II and GMSPT will close before PGI becomes effective.

17. Although EDL had extensive experience in managing many World Bank funded projects such as SPRE, REP I, REP II and GMSPT, a recent organizational structure changes from the spin off between EDL parent company and EDL-Gen subsidiary company and the previous frequent management restructuring during REP I results in department separations, staff rotations and information lost due to no proper work transfers. Refresher trainings on financial management and disbursement requirements of the World Bank will be conducted after the project effectiveness.

Accounting Policies, Procedures, and Information Systems

18. *Financial Management Manual and Accounting Policies:* Accounting policies and procedures described in the Financial Management Manual (FMM) used under REP II project will be used for the project. Under current REP II, a local consultant financed by EDL own fund is updating / revising the company wide Financial Management Manual as it was out of date. The consultant is incorporating the project key accounting policies and procedures on fund flow, budgeting, recording, financial reporting, auditing and disbursement arrangements into one FMM. The project will be accounted for on a cash basis. All accounting and supporting documentation will be retained by the Finance Unit of EDL in a system that allows authorized users easy access.

19. *Accounting Software:* At present EDL carries out double entries in two accounting systems AFMIS and ALIS. AFMIS was developed by an International Consulting / Utility Firm (ESBI- Electricity Supply Board of Ireland International). ALIS was locally supplied software for general ledger. AFMIS General Ledger did not tally with ALIS system and currently AFMIS is not fully operational, only three modules of the AFMIS system namely inventory, fixed assets and payroll are operational. Under current REP II, the Bank is financing an International Consulting Firm to assist EDL in strengthening and modernizing its existing AFMIS system. The objective of this consulting firm is to bring online a functional FMIS general ledger for EDL. This consultancy will continue under PGI to ensure IFR can be automatically generated.

20. *Segregation of duties:* Job descriptions and responsibilities among financial staff are clearly defined. The segregation of duties will be enforced at all times to ensure that no single person can initiate, verify, and authorize individual payment transactions.

21. *Payment:* Payments in cash will be minimized. A petty cash float of US\$1,000 will be set up to facilitate the payment of small transactions. Any payment exceeding US\$300 will be made by check. Payment to consultant will be done through bank transfer. All consultants will be requested to open a bank account at a commercial bank and payments will be made directly to

their bank accounts. Two signatures will be required for each check or bank transfer. The payment procedures and controls of payments are described in detail in the FMM.

22. *Safeguard over Assets:* A fixed asset register is required to be maintained by procurement staff, including all necessary information. The register will be reconciled with the books of account by the financial staff to ensure the completeness and accuracy of the register. A physical inventory of all fixed assets will be conducted by the parties concerned at least once a year. The team may consist of procurement staff, financial staff and users as well as internal auditor.

23. *Daily Subsistence Allowances and Overseas Travel.* The project shall follow the rates provided in the Ministry of Finance Ministerial Decision on Public Administration Budget that are applicable at the time of project implementation or as otherwise indicated/advised by the Ministry of Finance. Any modifications should be clearly stated and agreed with relevant parties and documented in the FMM which will be revised from time to time subject to the acceptance by the Bank.

Budgeting

24. The PO at EDL will be responsible for the overall preparation of the annual budget. Each component will be responsible for activities planning and budgeting under their implementation. Annual budgets based on annual work plan shall be prepared by components and sub-components, completed and approved by EDL and the Bank before the next fiscal year plan of each year. The budget will also be divided into quarters and reviewed against actual expenditure made on a semi-annual basis with significant variances between the budget and actual expenditure properly explained in the Interim Unaudited Financial Report. Approvals for variations from budget are required to be obtained in advance.

Internal Controls and Internal Audit

25. The existing systems of internal controls in the current FMM was revised and updated by a local consultant. The first version of FMM was submitted to the Bank by negotiations and included in the Project Operational Manual (POM). The FMM will be refined prior to effectiveness and during project implementation as needed. EDL's Internal Audit Office has in total 10 staff. However, majority of the staff do not have degrees in accounting, finance or auditing. Capacity to perform the internal audit work is low.

Funds flow

26. One Designated Account (DA), denominated in U.S dollars, will be opened at the Bank of Lao to receive IDA funds. The Designated Account will have authorized allocation of US\$ 3,000,000. This level of allocation is considered to be adequate for the project startup, given the use of direct payment wherever possible. As the project progresses, the need for decreases/increases the authorized allocation will be assessed. Although the Designated Account will be administered by the MoF, day-to-day management and replenishment to the Designated Account will be handled by the implementing agency. The Designated Account should be replenished on a monthly basis (irrespective of the amount involved) to assure liquidity of funds. All replenishment applications will be accompanied by reconciled bank statements from the depository bank showing all transactions through the Designated Accounts. The designated account will be audited annually by an independent external auditor acceptable to the Bank.

Allocation of Proceeds

27. PGI project would be implemented over a 4 year period, starting from September 2015 to March 2020 with an IDA credit of SDR 21.4 million. All project expenditure will be financed 100 percent by the project. The maximum amount of the proposed retroactive financing is SDR 700,000, starting on January 1, 2015. The allocation of credit proceeds against eligible expenditures is outlined below:

Categories	IDA Credit (SDR)	Percentage to be financed
Goods, works, non-consulting services, consultants' services, Training and Workshops, and Operating Costs under Parts 1, 2 and 3 of the Project	21,400,000	100%
Emergency Expenditures under Part 4 of the Project	0	100%
TOTAL	21,400,000	

Financial Reporting

28. The unaudited six monthly interim financial reports (IFR) will be prepared by PO Administrative and Finance Team at EDL on cash basis. The IFR shall include at minimum financial statements, project progress including variance analysis. The IFR will be prepared and submitted to the Bank no later than 45 days after each 6 month period to which it relates. EDL will also be responsible for the preparation of annual financial statement for audit by external auditors. The reporting period will follow EDL company fiscal year being from January 1 to December 31 same as the arrangement in REP II project. The format of the interim financial reports will follow the same as the current one used under REP II project but with relevant modification to fit the components and expenditure categories of this project.

External Audit Arrangements

29. All Government ministries and departments are supposed to be audited by the Supreme Audit Office (SAO) under the audit law. However, at the moment SAO only does compliance audits because of its limited capacity. Under SPRE, REP I, REP II and GMSPT projects, the Bank financed projects implemented by EDL have been audited by private external auditors. Therefore, under PGI project, a private independent external auditor shall be appointed no later than 6 months after the project effectiveness, against TOR acceptable to the Bank. The auditor will be required to: (a) express an independent audit opinion on the annual project financial statements for each year from inception of the project; and (b) assess the extent of compliance with the provisions of the underlying funding agreements. A separate management letter will also be submitted that will report on material weaknesses in accounting and internal controls. Audit reports and management letters are to be submitted to the Bank no later than 6 months after the fiscal year ends. The audit report and audited financial statements are required to be publicly disclosed following the Bank Policy on Access to Information.

Implementation Support and Supervision Plan

30. Financial management implementation support will be semi-annual and include field visits. The financial management missions will include reviews of the continued adequacy of financial management arrangements, transaction review and an integrated fiduciary review (procurement and financial management) of the project training, administrative expenditures, etc. Review will also include the review of operation of designated account, evaluating quality of budgets, project financial management reports, assessing relevance of financial management manual, reporting and follow up of audit and mission findings. At each time of supervision, the projects financial management risks will be assessed and influence the frequency of supervision.

Financial Management Action Plan*

No.	Action	Responsible	Completion
1	Assign financial management and disbursement officers to work for PGI project till the project closing.	EDL	After effectiveness
2	An external auditor to be appointed for the project.	EDL	Six months after effectiveness.
3	Provide refresher training on financial management and disbursement requirements.	WB	As part of readiness towards start of implementation and ongoing implementation support.
4	Submit revised / updated existing FMM to the Bank for review	EDL	At negotiation (completed)
5	Upgrade EDL existing FMIS accounting software.	EDL	On going
6	Agree mechanism for disclosure of the project's audit report	EDL	At negotiation (completed)
7	Submit annual budget for the Bank review and no objection.	EDL	Before the next fiscal year plan of each year

* Action items due after effectiveness are included in the Project Operational Manual, which, in turn, has been referred to in the Financing Agreement

Disbursements

Disbursement Arrangements

31. A DA will be opened for the project denominated in US\$. The account will be maintained at the Bank of Laos and managed by the National Treasury, Ministry of Finance. The DA ceiling is estimated to be US\$ 3,000,000.

32. Disbursement methods allowed are advance, reimbursement, direct payment and special commitment. The supporting documentation required for eligible expenditures paid from the DA are the Summary Sheets with Records and Statement of Expenditures (SOE). The frequency for documenting expenditures paid from the DA will be monthly. Reimbursements will also be documented by Summary Sheets with Records and SOEs. Direct payments will be documented

by records. The minimum application size for reimbursement, direct payment and special commitment will be US\$ 100,000. All documentation for expenditure submitted for disbursements will be retained by the PO at EDL and be made available to the external auditors for their annual and interim audits, and to IDA and its representatives if requested.

33. The project will have a Disbursement Deadline of four months after the Closing Date. All expenditures that incur before the Closing Date will be eligible for reimbursements.

Procurement

A. Assessment of the Agency's Capacity to Implement Procurement

34. The World Bank carried out the procurement capacity and risk assessment of EDL. According to the new EDL policy, all procurement is centralized at the Procurement Office under the Department of Business. The assessment reviewed the staffing and institutional arrangement of EDL for procurement. The major risks and mitigations are summarized as follows:

- a. Need for increased experience and capacity of staff in the Procurement Office: Procurement training and capacity development will be provided to the staff of the Procurement Office to increase their knowledge and capacity to carry out procurement in accordance with Government and the World Bank procedures. The training will be provided by the international procurement consultant. Staff in the procurement office also will be invited to attend the World Bank's procurement training workshop.
- b. Turnover of staff: Restructuring and staff turnover is not avoided within EDL. However, EDL has a clear policy that in the future all procurement shall be conducted by the procurement office within the Department of Business, which can ensure institutional continuity for procurement. Additionally, refreshing training will be provided to the new staff whenever necessary.
- c. Relatively complex procurement (ICB, QCBS, etc.): all complex procurement of goods and consulting services shall be carried out with the assistance by the international procurement consultant.
- d. Coordination between the Procurement Office and other departments: the Procurement Office belongs to the Department of Business; as all communications between the procurement office and other departments will be done through Deputy Director of Department of Business. The Deputy Director of Department of Business is assigned as Deputy Project Director. For each of the contracts to be procured, a detailed monitoring schedule will be prepared by the Procurement Office which will indicate the time to be used by the related departments in each of the steps of procurement process. This schedule will be used for monitoring progress by both EDL and the World Bank task team.

35. To strengthen the capacity, EDL will recruit a full time international procurement consultant to work for this project. At the same time, EDL will assign enough staff to work with the consultant for on-the-job training.

36. The overall procurement risk is rated as “Substantial”.

37. In addition to prior review, the Procurement Capacity Assessment Report has recommended that the procurement supervision missions take place during the project implementation support mission at least twice per year. The post review will be done by the Bank once a year in case there are sufficient contracts for review.

B. Applicable Guidelines

38. Procurement for the proposed Project will be carried out in accordance with the World Bank “Guidelines: Procurement of Goods, Works and Non-consulting Services under IBRD Loans and IDA Credits and Grants by World Bank Borrowers”, dated January 2011 and revised in July 2014; and “Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits and Grants by World Bank Borrowers”, dated January 2011 and revised in July 2014, and the provisions stipulated in the Financing Agreement for the proposed Project.

C. Procurement plan

39. For project implementation, a detailed Procurement Plan for the first 18 months of project implementation has been prepared and agreed with the World Bank. The Procurement Plan will be updated in agreement with the World Bank at least annually or as required to reflect the actual project implementation needs and improvements. The procurement plan is summarized as follows:

General

1. **Bank’s approval Date of the procurement Plan:** May 12, 2015
2. **Date of General Procurement Notice:** To be processed
3. **Period covered by this procurement plan:** until December 31, 2016

Goods, Works and Non-consulting Services.

40. **Prior Review Threshold:** Procurement Decisions subject to Prior Review by the World Bank as stated in Appendix 1 to the Guidelines for Procurement:

Ref. No.	Procurement Method	Procurement Method Threshold (US\$’000)	Comments (Prior Review Requirement)
1.	International Competitive Bidding (ICB) (Goods)	>= 600	All
2.	National Competitive Bidding (NCB) (Goods)	100 - <600	First contract
3.	Shopping (Goods)	<100	First contract
4.	ICB (Works)	>= 2,000	All
5.	NCB (Works)	200 - <2,000	First contract
6.	Shopping (Works)	<200	First contract

41. **Prequalification.** Bidders shall not be prequalified in accordance with the provisions of paragraphs 2.9 and 2.10 of the Guidelines

Reference to (if any) Project Operational/Procurement Manual: *Project Operational Manual Summary of the Procurement Packages planned during the first 18 months after project effectiveness (including those that are subject to retroactive financing and advanced procurement)*

1	2	3	4	5	6	7
Ref. No.	Description	Estimated Cost US\$ million	Packages	Domestic Preference (yes/no)	Review by Bank (Prior / Post)	Comments
1	Summary of the ICB (Goods) packages	22.5	5	No	Prior	
2	Summary of the NCB (Goods) packages	0.95	2	No	Post	<i>1st contract for Prior Review</i>

Selection of Consultants

42. **Prior Review Threshold:** Selection decisions subject to Prior Review by Bank as stated in Appendix 1 to the Guidelines Selection and Employment of Consultants:

Ref. No.	Selection Method	Procurement Method Threshold (US\$000)	Prior Review Requirements
1.	Quality and Cost based Selection (QCBS), and Quality Based Selection (QBS)	>= 300	All
2	Least Cost Selection (LCS) and Consultant Qualification Selection CQS (Firms)	<300	>= 100 and/or first Contract for each selection method regardless of value
3.	Single Source (Firms)		All
4.	Individual		>10 for Single Source Selection (SSS) and contracts for fiduciary or legal assignments

43. **Short list comprising entirely of national consultants:** Short list of consultants for services, estimated to cost less than \$ 200,000 equivalent per contract, may comprise entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

Consultancy Assignments with Selection Methods and Time Schedule

1	2	3	4	5	6
Ref. No.	Description of Assignment	Estimated Cost US\$ million	Packages	Review by Bank (Prior / Post)	Comments
1	Summary of number of contracts that will be let under QCBS	0.8	1	Prior	
2	Summary of number of contracts that will be let under other methods	0.85	1	Prior/Post	<i>Individual Consultant</i>

Procurement Plan

Goods

Ref. No.	Contract (Description)	Estimated Cost (US\$)	Procurement Method	Pre-qualification (yes/no)	Domestic Preference (yes/no)	Review by Bank (Prior/Post)	Expected Bid-Opening Date
G-01	MV (22kV) & LV (0.4 kV) conductors, capacitors, transformers, reclosers, load break switches.	10.0 m	ICB	No	No	Prior	Multiple packages, starting October 2015
G-02	Electric meters	9.0 m	ICB	No	No	Prior	Multiple packages, starting October 2015
G-03	Fiber-optic cables	0.8 m	NCB	No	No	Prior (first contract)	Multiple packages, starting July 2016
G-04	Geographic Information System, GPS handsets, energy balance system software, other software	1.0 m	ICB	No	No	Prior	
G-05	Financial Management System	5.0 m	ICB	No	No	Prior	
G-06	Testing lab equipment	2.0 m	ICB	No	No	Prior	Multiple Packages, starting July 2016
G-07	Vehicles	0.15 m	NCB	No	No	Post	

Consultant Services

Ref. No.	Contract (Description)	Estimated Cost (US\$)	Selection Method	Review by Bank (Prior/Post)	Expected Proposal Submission Date	Comment
C-01	Consultancy for Advanced Meter Infrastructure system	0.8 m	QCBS	Prior	July 2015	Draft REOI and TOR was prepared by project negotiations
C-02	Procurement consultant	0.3 m	Individual Consultant	Prior	February 16, 2015	Completed
C-03	Financial auditor	0.3 m	Least cost selection	Prior	October 2015	
C-04	Environmental and social consultant	50,000	Individual Consultant	Post	December 30, 2014	Completed
C-05	Consultancy for FMIS system upgrade	0.2 m	SS	Prior		Continuation from REP II Project

Environmental and Social (including safeguards)

44. The environmental and social safeguards activities are carried out by EDL E&S Office, assisted by an E&S consultant. An ESMP, including Environmental Codes of Practices (ECoP), Protocols for Voluntary Land Donation (PVLD) and Resettlement Policy Framework (RPF), has been adopted and disclosed to address project impacts in compliance with both GOL and World Bank's policies for small scale installation works pertain to the rehabilitation of distribution of medium voltage (127 km of 22kV MV system) and low-voltage (239 km of 0.4 kV LV system) lines and the installation of electric meters, replacement of capacitors (LV line), upgrading of conductors (on LV and MV lines) and replacement and addition of transformers and power poles (for MV).

Measures to Be Taken:

45. Mitigation and management have been proposed in the ESMP to address all of the impacts identified, including ECoP, PVLD and RPF for implementation during construction and operation of the scheme. The ESMP details the environmental management and supervision organizations and responsibilities, mitigation measures, capacity training plan, monitoring plan, and budget estimates for implementation. Relevant elements of ESMP and ECoP will be incorporated into project management by EDL in order to ensure effective implementation throughout the preconstruction, construction and operation phases of the project.

46. Appropriate PVLD and RPF of new power poles installation include detailed documentation indicating the appropriateness of the VLD, description of owners and users of land donated, procedures for consultation and disclosure, informed consent of the person donating the land, legal documentation indicating the transference of land donated, and grievance redress procedure and mechanism.

Institutional and Implementation Arrangements:

47. The E&S Office of EDL will be responsible for the implementation of the proposed mitigation measures in the ESMP, ECoP, PVLD and RPF. The E&S Office will be responsible for ensuring, on a day-to-day basis, that the mitigation measures and monitoring activities identified in these safeguards documents are implemented. EDL capacity for implementing environmental and social safeguard is strong. EDL has also experienced working with the Bank on multiple power sector projects. With EDL capacity, they will provide training to contractors involved in project construction on the environmental and social safeguards. The training will be focused on: environmental protection laws and regulations, environmental management good practices for power grid improvement, including training on PVLD and RPF.

48. In addition, EDL's individual E&S consultant will provide oversight and advice to EDL as required to ensure the ESMP, ECoP, PVLD and RPF and the monitoring plan are effectively implemented. Detailed institutional arrangements are described in the ESMP.

Monitoring & Evaluation

49. The project monitoring and evaluation activities will be carried out by EDL's Project Office. The Project will be monitored and evaluated on the basis of the indicators and targets set out in the results framework provided in Annex 1. The Bank will carry out regular implementation support missions during which project progress, outputs and work plan updates will be reviewed. The Project Office will be responsible for monitoring the progress of project implementation and achievement of the performance indicators in Annex 1 and accordingly report to the Bank. It will further require to submit comprehensive progress reports on implementation aspects annually that would include reporting on procurement, financial management, physical implementation and environmental aspects among others.

50. The technical assistance activities will have their own monitoring and evaluation mechanisms, some of which will be built into project design.

Annex 4: Implementation Support Plan
LAO PDR: Power Grid Improvement Project

Strategy and Approach for Implementation Support

1. The project activities financed by the Power Grid Improvement Project (PGIP) started in January 2015 and will be completed in March 2020. The IDA Credit is scheduled to close on March 31, 2020.
2. The strategy for implementation support (IS) has been developed based on the nature of the project and its risk profile. It aims at making implementation support to the client flexible and effective, and will focus on implementation of the risk mitigation measures defined in the SORT.
 - a) **Risks related to the sector policies:** The Bank will support the borrower in addressing these important issues through its engagement in related analytical work and policy discussions. The Bank budget provides resources for policy dialog, complementing IDA Credit financing for capacity building under the project. The main counterpart agencies for this work include Ministry of Finance, Ministry of Energy and Mines and the Electricité du Laos.
 - b) **Project Management:** The Bank task team will monitor the capacities of the project management teams in EDL throughout project implementation to ensure that they are adequate to implement the project. The Bank will provide additional training where needed in relation to the Bank fiduciary and reporting requirements, as well as in the areas of environmental and social safeguards management.
 - c) **Procurement:** Implementation support will include: (i) reviewing of the Procurement Plan and providing suggestions; (ii) reviewing procurement documents and providing timely feedback; and (iii) monitoring procurement progress against the agreed Procurement Plan. More intensive support will be provided during the first 12 months to ensure the timely procurement and contracting of the large packages.
 - d) **Financial Management:** Supervision of project financial management will be performed on a risk-based approach. Supervision will review the project's financial management system, including but not limited to, accounting, reporting and internal controls. The Bank team will assist EDL in improving financial management and reporting. The financial management supervision will be conducted by financial management specialists.
 - e) **Environmental and Social Impact Management:** The Bank will provide support through the regular review of the semi-annual environmental monitoring and evaluation reports and will follow up any issues with EDL and their consultants. The Bank team, including environmental and social specialists, will provide regular (twice a year) support to EDL in developing, implementing, evaluating and updating its capacity building program under the Component 3 of the Project.

- f) **Implementation Progress:** The Bank will closely monitor the overall progress of project implementation by reviewing the annual progress report, the execution of the Procurement Plan, the actual disbursement of the IDA credit etc. The Bank will provide support by regularly visiting the project, helping to identify arising issues, which impede project progress, and discussing and agreeing on actions to resolve critical issues.

Implementation Support Plan

3. The Bank team members for procurement, financial management, and safeguards will be based in EAP country offices (Bangkok and Vientiane) to ensure closer support to the client. Formal supervision and field visits will be carried out semi-annually. Detailed inputs from the Bank team are outlined below:

- a) **Technical inputs:** Inputs of technical specialists will be required to review bid documents and associated technical specifications to ensure that adequate technical standards are observed and that they enable a fair competition. Technical specialists will also be needed to review bid evaluation reports and monitor implementation of the project during construction and commissioning.
- b) **Fiduciary requirements and inputs:** The Bank team will help EDL to identify capacity building needs to strengthen its financial management capacity and to improve procurement management efficiency. Training will be provided by the Bank's financial management specialist and procurement before the commencement of, and during, project implementation to the extent needed. Both the financial management and the procurement specialist will be based in EAP country offices to provide timely support. Formal supervision of financial management will be carried out semi-annually, while procurement supervision will be carried out as required by the client and project implementation timeline.
- c) **Safeguards:** Inputs from an environment specialist and a social specialist will be required, though the project's social and environmental impacts are limited. The support will focus on institutional capacity building for environmental and social safeguards at the operations level. Field visits will be based on the project needs and are expected to be semiannual during the first 18-24 month of project implementation.
- d) **Financial review of EDL financial performance:** Input will be required from a financial specialist for regular review of EDL financial status to monitor its financial capability.
- e) **Sector policies:** The Bank will provide, through its staff and consultants as needed, experts that will engage in policy support to Ministry of Energy and Mines and EDL.

4. The main focus of implementation support is summarized below:

Time	Focus	Skills Needed	Resource Estimates (Staff Cost)	Resource Estimates (Travel Cost)
First twelve months	<p>Monitor and assist in procurement of the main contracts, as appropriate</p> <p>Monitor implementation of institutional capacity building on environmental and social safeguards</p> <p>Sector policies including financial viability of EDL and other sector entities</p> <p>Monitor financial management and disbursement</p>	Procurement and Technical	US\$ 40,000	US\$ 5,000
		Environment and Social	US\$ 30,000	US\$ 5,000
		Power Sector Policy and Financial	US\$ 15,000	US\$ 5,000
		Financial	US\$ 10,000	US\$ 5,000
			<u>US\$ 95,000</u>	<u>US\$ 20,000</u>
12-48 months	<p>Monitor and assist in procurement of the main contracts, as appropriate</p> <p>Monitor implementation of institutional capacity building on environmental and social safeguards</p> <p>Sector policies including financial viability of EDL and other sector entities</p> <p>Monitor financial management and disbursement</p>	Procurement and Technical	US\$ 120,000	US\$ 15,000
		Environment and Social	US\$ 90,000	US\$ 15,000
		Power Sector Policy and Financial	US\$ 45,000	US\$ 15,000
		Financial	US\$ 30,000	US\$ 15,000
			<u>US\$ 285,000</u>	<u>US\$ 60,000</u>

Skills Mix Required

Skills Needed	Number of Staff Weeks per Year	Number of Trips per Year	Comments
Procurement	10		Field based
Financial Management	4		Field based
Technical Specialists	8	4	Field and HQ based
Environmental	3	2	Field and HQ based
Social	3	2	Field and HQ based
Financial Analyst	3	2	Field and HQ based
Sector Specialist	4	2	Field and HQ based
Others	6		Field and HQ based

Annex 5: Economic and Financial Analysis

LAO PDR: Power Grid Improvement Project

A. Economic Analysis

1. Reliability of electricity supply contributes to ensuring socio-economic welfare. The impact of an unreliable electricity supply on a consumer depends on the activities affected, the nature of and extent to which the impacted activities are reliant on electricity, the availability of an alternative backup source of electricity, and the capacity to continue the impacted activity normally after power is restored. In addition, the economic costs of an unreliable supply of electricity depend upon the degree of preparedness of consumers, frequency of outages and other power events, and the type of consumer affected⁴.

2. For the residential consumers, electricity has a number of end-uses that can have different utility to the household at different times of the day. An unreliable supply of electricity interrupts the preferred consumption pattern and thus leads to a loss in total utility gained from the consumption of electricity. For industrial consumers, they produce output by combining intermediate inputs with four factors of production: labor, land, capital, and entrepreneurship. An unreliable electricity supply can result in opportunity costs due to one or more of these factors being forced to be idle. Thus, unlike in the residential sector, the industrial sector impacts of an unreliable supply of electricity are more directly quantifiable in terms of the dollar losses associated with the cost of idle resources, equipment damage, material losses, process re-start costs, and human health and safety effects. The latter can spill over and place the nearby population in danger with accidental emissions, and spills. For the commercial consumers, the effect of an unreliable supply of electricity on the commercial sector is to temporarily disrupt production, including, the sales of goods and services. Thus, several cost components of this impact can be identified and measured; idle resource costs, product damage costs, consumer surplus (indirect) costs.

3. In Laos, distribution losses have experienced a decline from 24 percent to 12 percent over the period 1995 to 2013. Figure 1 illustrates the evolution of losses, which in terms of share have decreased but in absolute terms have increased substantially, from about 110GWh in 1995 to about 350GWh in 2013, an increase equivalent to about a 40MW base load power plant.

4. This project aims to help improve efficiency and reliability of power distribution in the Xaythany district of Vientiane capital, which has a distribution loss of almost 24% - about double the national average. The project aims to reduce the distribution losses to 14%, generating energy savings of 42GWh in 2019 and cumulative energy savings of 2.3 TWh by 2040. The cost savings from distribution loss reduction will reduce pressure on electricity tariff increases which could be beneficial to all customers. Particularly, the poor consumers, who could face affordability constraints, can gain from stable tariff regime. The improved reliability of

⁴ Sanghvi, A. P. (1982). Economic costs of electricity supply interruptions: US and foreign experience. *Energy Economics*, 180-198

electricity supply will also benefit poor customers as these customers normally do not have back-up or alternative sources of electricity which can be afforded only by high-income consumers.

5. Improving reliability of supply is an integral attribute to define and measure energy access in a more nuanced way. A new framework, called multi-tier metric, was unveiled in the Global Tracking Framework (2013)⁵ of the Sustainable Energy for All Initiative. This global initiative is co-led by the UN Secretary General and World Bank President and aims to reach universal energy access, double the share of renewables in global energy mix, and double to rate of improvement of energy efficiency, all by 2030. Traditionally, energy access has been measured in a binary way – connected to electricity or not. However, such a framework ignores quality of energy supply (poor voltage limiting the use of electrical appliances, few hours in the night, sporadic availability) as well as affordability and sustainability of energy supply - failing to capture the multi-faceted nature of energy access. The multi-tier metric measures energy access according to successive thresholds for supply attributes that allow increased use of services. The key attributes are: (i) Capacity, (ii) Duration (including daily supply and evening supply), (iii) Reliability, (iv) Quality, (v) Affordability, (vi) Legality, and (vii) Health & safety. The tiers can also be defined through increasing levels of electricity consumption, calculated through number of hours for a range of appliances by their power load in watts.

6. Improving quality of supply is relevant to the shared prosperity goal of the World Bank Group. Aside from directly affecting the consumers, electricity is an intermediate input to many industries, and thereby its shortages affects firm behavior. For households, power outages not only affect those already connected to the grid but acts as a barrier for unconnected households to move into the fold of electricity use. Evidence from India suggests that adoption of electricity reduces dramatically as number of hours of outages increase (Banerjee et al, 2014⁶). Poor quality of supply limits the ability to benefit for children to study at night as well as to start and sustain home businesses. For businesses, outages result in direct expenses in the form of back-up supply and limiting profitability and job creation potential. There are also macroeconomic effects of quality of infrastructure. For instance, the studies by Calderón and Servén (2010a, 2010b)⁷ found that the quality of infrastructure (measured by T & D losses for power supply) were both significant and positive. They found that on average, between 1991–1995 and 2001–2005, annual world growth increased by 1.6 percentage points due to the increase in infrastructure, of which 1.1 percentage points were due to the accumulation of infrastructure stocks, and 0.5 percentage points to the increase in quality. They also found that increase in infrastructure was related to a decline in the Gini coefficient of three percentage points, of which two percentage points were due to quantity and one to quality—that is, the increase in quality of infrastructure supply led to a reduction in the measure of inequality within the economy. Further, Seneviratne

⁵ World Bank; International Energy Agency. 2014. *Sustainable Energy for All 2013-2014 : Global Tracking Framework*. World Bank, Washington, DC

⁶ Banerjee, Sudeshna Ghosh; Barnes, Douglas; Singh, Bipul; Mayer, Kristy; Samad, Hussain. 2015. *Power for All : Electricity Access Challenge in India*. Washington, DC: World Bank.

⁷ Calderón, César, and Luis Servén. 2010a. Infrastructure and Economic Development in Sub-Saharan Africa. *Journal of African Economies* (19), AERC Supplement 1, 13–87.

Calderón, César, and Luis Servén. 2010b. “Infrastructure in Latin America”. Policy Research Working Paper 5317, World Bank, Washington, DC.

and Sun (2013)⁸ focused solely on the impact of infrastructure quantity and quality on inequality and found that the elasticity of inequality (as measured by a Gini coefficient) was 0.18 (negative) with respect to the quantity of infrastructure and 0.19 (negative) with respect to quality. That is, better infrastructure, represented by both quantity and quality, supports income equality.

7. This project, by improving the quality of supply in Xaythany district of Vientiane capital, serves to raise the energy access tier. As the project area is contained in a single district, it will be possible to showcase this experience as a pilot to improve energy access. A baseline survey that establishes the tier of energy access before the intervention and a follow-up survey after project implementation can allow an explicit understanding of improvement of supply and therefore energy access.

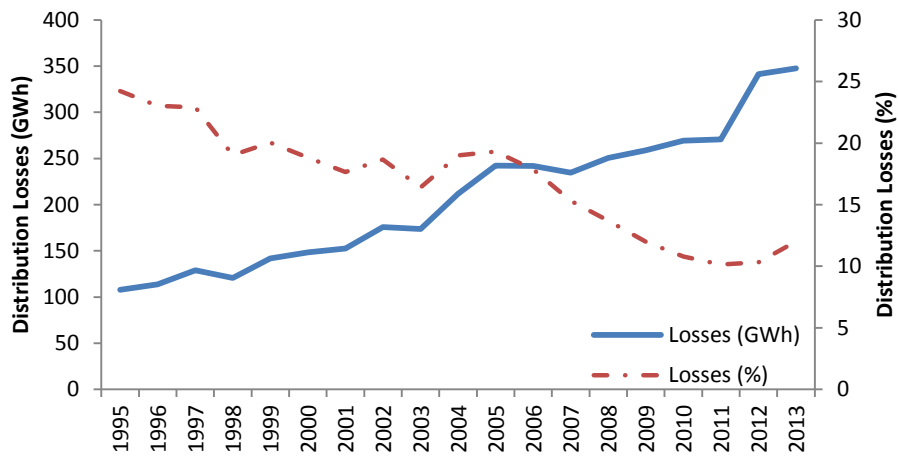


Figure 1: Loss reduction trajectory

Methodology and Assumptions

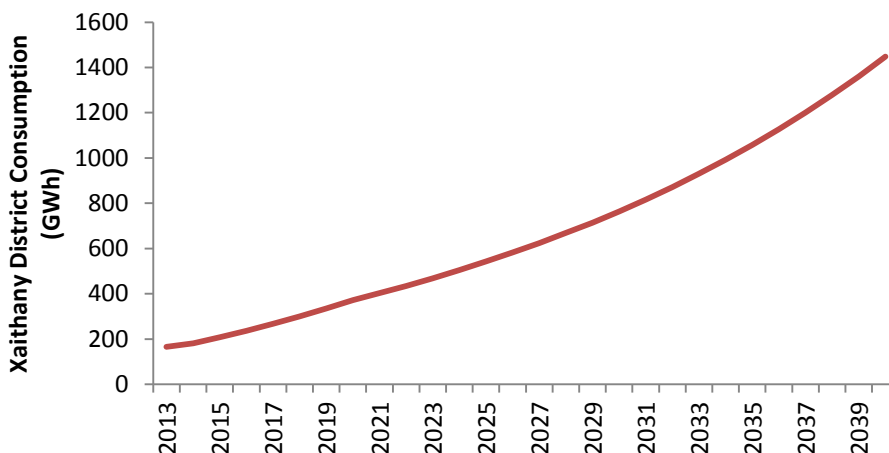
8. The economic analysis of the proposed PGI project is based on a standard cost benefit analysis, which identifies and compares economic costs and benefits in two cases, one ‘with project’ and the other ‘without project’. Rehabilitation and upgradation investments will primarily focus on the distribution network with an IDA contribution of US\$30 million, significantly improving EDL efficiency and reliability in the district.

9. The primary beneficiaries of the project are EDL and the electricity customers in the Xaythany district of Vientiane capital. There are currently about 46,000 residential and 1,100 non-residential customers in the district. System upgrading is expected to reduce technical losses from the current 24% to 14% by 2019, leading to significant energy savings (42.3GWh in 2019 and 2.3TWh cumulatively by 2040). In addition, customers will be able to obtain higher volume

⁸ Senerviratne, Dulani, and Yan Sun. 2013. “Infrastructure and Income Distribution in ASEAN-5: What are the Links?” Working Paper WP/13/41, International Monetary Fund, Washington, DC.

of energy which would not be otherwise be possible given the limited transfer capacity of the distribution network.

10. The analysis focuses on the quantifiable benefits resulting from the project. In particular, three main categories of benefits are assessed and estimated – (1) Incremental consumption in Xaythany district as a result of reduction in outages; (2) Energy savings from lower technical and commercial losses in the system; (3) Reduction in CO₂ emissions from lower energy imports / generation. This analysis assumes that electricity consumption in Xaithany district will grow as a function of the number of households and the consumption per household (figure 2). The number of households are assumed to grow at a rate of 5000 per year until 2020, according to EDL, and then at the urban population growth rate, as forecasted by the UN, till 2040. The consumption per household in Xaithany is assumed to grow, at a rate of 4.2%, the same as Thailand’s annual household consumption growth rate from 2000-2012, according to the World Energy Council. Thailand’s household consumption growth rate was chosen as a proxy, as it represents a middle income East Asian economy which has achieved a steady growth rate and a reasonable household consumption level.



Note: Non-residential consumers excl. large industrial

Figure 2: Evolution of electricity consumption in Xaithany for residential & non-residential customers

11. Project costs comprise all costs associated with distribution system upgrades. Both benefits and costs are estimated in economic terms at constant 2014 prices. Taxes (5%) and physical and price contingencies (5%) are stripped out from the financial capital cost of infrastructure investment, \$27.7 million, to yield an economic capital cost of about \$24.9 million. The O&M of 2% is applied from the year 2017. The analysis is built over a period of 25 years and uses a discount rate of 10 percent.

12. Benefits are assumed to start accruing evenly during the project implementation over 4 years from 2016 to 2019. The benefit stream is valued at consumer willingness to pay drawing from a socio-economic survey of electrified and non-electrified villages and households conducted under REP I in 2004. The ICR for REP I revised the WTP estimates to 13.6 c/kWh, which is employed in this analysis (table 1). The ICR estimates that WTP for electricity for purposes other than lighting, radio and TV is set at the weighted average domestic retail tariff.

The ICR also revises down the WTP estimates for lighting, radio and TV. This analysis uses the weighted average WTP for lighting, radio, TV and other electricity services.

Table 1: Willingness to pay

Type of Consumption	Consumption (kWh/Month)	WTP (Kip/Month)	WTP (Kip/kWh)	WTP (USc/kWh)
Other Usage*	42.3		731.0	9.3
Lighting	10.6	55292.0	5778.7	73.5
Radio	2.2	16745.0	8499.6	108.1
TV	8.3	23252.0	3123.3	39.7
Total	63.3	97716.0	1711.6	21.8
Weighted Average			1071.8	13.6

*For purposes other than lighting, radio and TV valued at the weighted average domestic retail tariff
Source: ICR – Lao Rural Electrification Phase I

13. (1) *Benefits of incremental consumption*: The infrastructure rehabilitation is expected to reduce undersupply as a result of reduction in the frequency and duration of power outages and abnormal voltage drops. In addition infrastructure upgrades will remove critical distribution bottlenecks and support the growth in electricity consumption.

14. Enterprise survey results from 2012 estimate that for Vientiane capital the average outage duration for a month was about 5.5 hours, leading to a sales loss of 2% and forcing about 8.4% of firms to buy or share generators. Figure 3 reveals that compared to its regional peers Vientiane does relatively well in these infrastructure indicators with just 18% of firms identifying electricity as a major constraint, compared to Phnom Penh and Yangon, where 36.8% and 24.4% of firms, respectively, identified electricity as a major constraint.

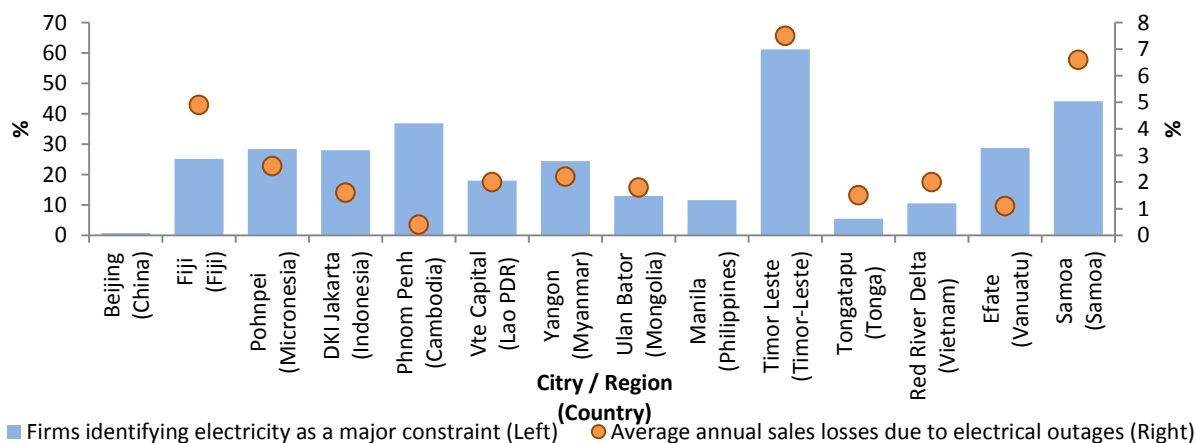


Figure 3: Losses from electrical outages, East Asian countries

15. For this analysis, feeder level outage data was used to conservatively estimate the outage duration for Xaithany district. It is assumed that outages decrease by about 20% as a result of the project. As the demand for electricity increases, the reduction in outages leads to a cumulative increase in sales of 1.3GWh by 2040. The economic benefits from the reduction of outages are valued at the costs of electricity to the end users (i.e. the average opportunity cost of the energy

when outages occur). For this analysis this cost is assumed to be US\$30/kWh, typically assumed as cost of diesel based generation, anticipated as the opportunity cost of outages.

16. (2) *Benefits of reduction in technical and commercial losses*: Investments in rehabilitation, reinforcement and upgrading of distribution infrastructure will reduce technical and commercial losses as a result of reduction in power dissipation of components in the distribution network. The project aims to decrease losses from 24% to 14% by 2019. With increasing demand the cumulative energy savings due to reduction in losses amounts to about 2.3TWh by 2040 due to the project. For this analysis, the value for the saved energy is measured as the willingness to pay at US\$13.6/kWh. This analysis assumes that both technical and commercial losses are economic benefits of the project. Typically only the reduction in technical losses can be considered as an economic benefit, however, due to lack of data commercial and technical losses cannot be separated. The sensitivity analysis tries to address this by valuing the economic benefits from technical loss reduction only, based on a consultant report⁹ prepared for EDL and the World Bank in 2013.

17. (3) *Benefits of reduction in CO₂ emissions*: Lower electricity generation resulting from a reduction in technical losses will also yield a reduction in CO₂ emissions since part of the generation comes from fossil fuel fired power plants. The emissions factor used to calculate the avoided CO₂ emissions from energy savings is based on the average operating margin emission factor (EF_{grid,OM-ave,y}) methodology as prescribed by the UNFCCC. The average operating margin emission factor is calculated as the average emission rate of all power plants serving the grid. The emissions factor used in this analysis is derived from the CDM projects registered in Lao in 2014. Using an emissions factor of about 560tCO₂/GWh the project leads to a cumulative CO₂ emissions savings of 1.27 million tons. These emissions value at US\$30/tCO₂ based on a World Bank Guidance Note¹⁰.

Economic Rate of Return

18. Based on the methodology and assumption described above, the estimated EIRR of the project at a 10 percent discount rate with accounting for CO₂ emissions benefits is 37 percent, the NPV is US\$63 million and the project reaches the hurdle rate in 2022. Excluding the CO₂ benefits, the EIRR is 33 percent and the NPV is \$53 million (Table 2). The project is robust to changes in cost, for instance, it can withstand the cost increase up to 320 percent before the rate of return of the project equals the hurdle rate of 10 percent.

⁹ AF-Mercados EMI & Xanglao Engineering Consultant Co. Ltd. (2013). *Consultant Services for Non-Technical Loss Reduction for EDL – Final Report*

¹⁰ Social Value of Carbon in project appraisal: Guidance note to the World Bank Group Staff

Table 2: Economic cost and benefits

Baseline	Cost (USD Million)				Benefits (USD Million)				Net Benefits (USD Million)			
Year	Economic Capital Cost	Cost of Incremental Sales due to Reduction in Outages	O&M Cost	Total Cost	Value of Increase in Sales due to Reduction in Outages @ Opp. Cost	Value of Reduction in Losses @ WTP	Value of Reduction in CO2 Emissions @ \$30/CER	Total Benefits	With CO2	W/O CO2		
2016	6.23	0.00	0.00	6.23	0.00	1.02	0.13	1.15	-5.09	-5.21		
2017	6.23	0.00	0.06	6.29	0.00	2.30	0.28	2.59	-3.71	-3.99		
2018	6.23	0.00	0.19	6.42	0.00	3.87	0.48	4.36	-2.06	-2.54		
2019	6.23	0.00	0.37	6.61	0.01	5.77	0.71	6.49	-0.12	-0.83		
2020	0.00	0.00	0.37	0.38	0.01	6.41	0.79	7.21	6.84	6.05		
2021	0.00	0.00	0.37	0.38	0.01	6.94	0.85	7.80	7.42	6.57		
2022	0.00	0.00	0.37	0.38	0.01	7.49	0.92	8.42	8.04	7.12		
2023	0.00	0.00	0.37	0.38	0.01	8.07	0.99	9.08	8.70	7.71		
2024	0.00	0.00	0.37	0.38	0.01	8.69	1.07	9.77	9.39	8.32		
2025	0.00	0.00	0.37	0.38	0.01	9.34	1.15	10.50	10.13	8.98		
2026	0.00	0.00	0.37	0.38	0.01	10.03	1.23	11.28	10.90	9.66		
2027	0.00	0.00	0.37	0.38	0.01	10.75	1.32	12.09	11.71	10.39		
2028	0.00	0.00	0.37	0.38	0.01	11.51	1.42	12.94	12.57	11.15		
2029	0.00	0.00	0.37	0.38	0.02	12.31	1.52	13.84	13.46	11.95		
2030	0.00	0.00	0.37	0.38	0.02	13.16	1.62	14.79	14.42	12.80		
2031	0.00	0.00	0.37	0.38	0.02	14.06	1.73	15.80	15.43	13.70		
2032	0.00	0.00	0.37	0.38	0.02	15.01	1.85	16.87	16.50	14.65		
2033	0.00	0.00	0.37	0.38	0.02	16.02	1.97	18.01	17.63	15.66		
2034	0.00	0.00	0.37	0.38	0.02	17.09	2.10	19.21	18.83	16.73		
2035	0.00	0.00	0.37	0.38	0.02	18.22	2.24	20.48	20.11	17.86		
2036	0.00	0.00	0.37	0.38	0.02	19.42	2.39	21.83	21.45	19.06		
2037	0.00	0.01	0.37	0.38	0.03	20.69	2.55	23.26	22.88	20.33		
2038	0.00	0.01	0.37	0.38	0.03	22.03	2.71	24.76	24.38	21.67		
2039	0.00	0.01	0.37	0.38	0.03	23.44	2.89	26.36	25.98	23.09		
2040	0.00	0.01	0.37	0.38	0.03	24.94	3.07	28.04	27.66	24.59		
									NPV @ 10%	62.86	53.52	
									EIRR	37%	33%	
									MARR (10%) achieved by	2022	2022	

19. Sensitivity analysis was conducted to test the robustness of the profitability of the project to key parameters of project costs and benefits. The rates of return were examined for the following cases – (i) Valuation of technical losses only: Based on the methodology¹¹ outlined by the Mercados Report, the technical losses are estimated to be 7.34%, using a top down approach, and 9.76% using a bottom up approach. If the technical losses are assumed to decrease by 40%¹² because of the project, then for the top down approach the NPV decreases from the base case to US\$10.55 million and the EIRR to 15%, and for the bottom up approach the NPV decreases to US\$18.22 million and the EIRR to 18%. (ii) Decrease in loss reduction - If the losses decrease to 19% instead of the assumed 14%, then the NPV decreases to US\$38.08 million and the EIRR to 22%. The economic return from the project is highly dependent on the benefits gained from loss reduction. (iii) Valuation of benefits: If benefits are valued at the cost of supply, US\$5/kWh, then the NPV decreases to US\$24.5 million and the EIRR to 22%.

¹¹ The Mercados report evaluates technical and non-technical losses based on two approaches. The top-down approach uses TEPCO’s Power Distribution System Loss Reduction study to estimate technical losses. In this approach non-technical losses are evaluated as the difference between total distribution and technical losses. The bottom-up approach assesses EDL’s operational processes to estimate non-technical losses. This approach evaluates non-technical losses as a result of billing and meter reading processes, collection disconnection processes, meter accuracy, fraud detection and meter installation standards.

¹² Similar to the targeted loss reduction of the project from 24 % to 14%, a reduction of about 40%

Table 3: Sensitivity analysis

Results Summary Table	Base Case	Reduction of Technical Losses Only - Top Down Approach	Reduction of Technical Losses Only - Bottom Up Approach		Losses Decrease to 19% instead of 14%	Reduction of Losses Valued at Cost of Supply	Reduction of Losses Valued at Weighted Avg. Domestic Tariff
		With CO ₂	Without CO ₂				
	EIRR (%)	37%	33%	15%	18%	22%	20%
NPV (USD Mn)	62.86	53.52	10.55	18.22	24.46	21.23	40.05
MARR (10%)	2022	2022	2031	2028	2026	2026	2023

NPV goes to 0 as the economic capital cost increases by 4.2 times to US\$ 103.83 million

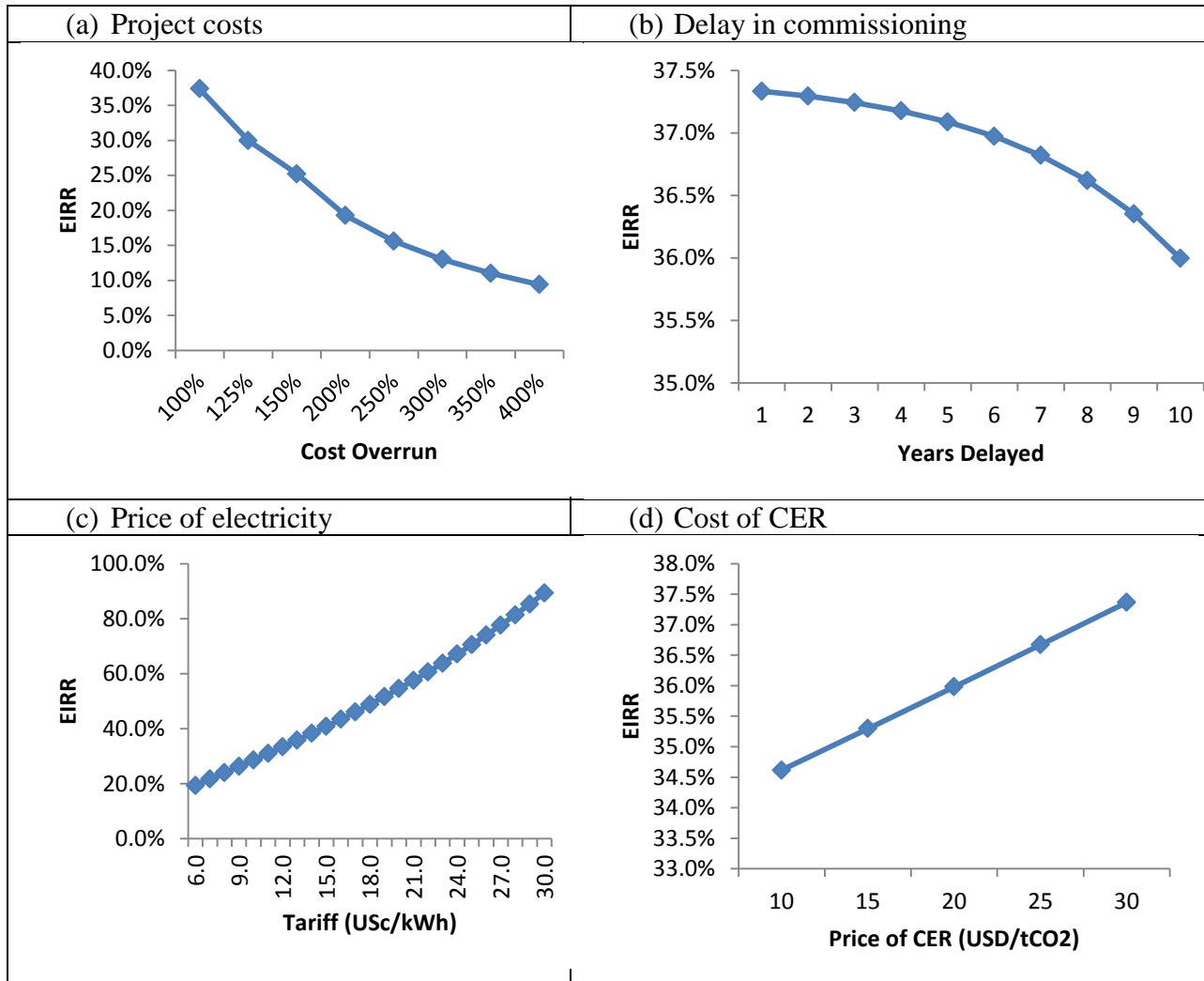


Figure 4: Sensitivity to key parameters

B. Project Financial Analysis

20. The analysis is based on the financial costs and revenues for the distribution company deriving from project implementation. On the cost side, the capital cost considered including taxes and contingencies, totals US\$27.7 million. Furthermore, the IDA project fee of 0.75% was applied to the disbursed amount. In addition, O & M cost of 2 percent was applied from year 4 onwards. On the revenue side, the project gains revenue from two sources: i) higher electricity revenues due to decrease in outages and ii) higher electricity revenues from reduction in losses. The revenues are valued at the weighted average retail tariff of US\$9.3/kWh.

Financial Rate of Return

21. Based on the methodology and assumptions described above, the estimated FIRR of the project is 20 percent and the financial NPV is US\$153.77 million. Given that the project is IDA funded at concessional rate, the weighted average cost of capital is about 0.4%¹³.

Table 4: Financial Costs and Revenues

Baseline Year	Cost (USD Million)				Benefits (USD Million)			Net Revenue (USD Million)	
	Capital Cost	IDA Financing Fee	O&M Cost	Total Cost	Revenue - Increase in Sales due to Reduction in Outages @ Avg. Tariff	Revenue - Increase in Sales due to from Reduction in Losses @ Avg. Tariff	Total Revenue		
2016	6.92	0.05	0.00	6.97	0.00	0.69	0.69		-6.28
2017	6.92	0.10	0.06	7.09	0.00	1.57	1.57		-5.52
2018	6.92	0.16	0.19	7.26	0.00	2.64	2.64		-4.62
2019	6.92	0.21	0.37	7.50	0.00	3.93	3.93		-3.57
2020	0.00	0.21	0.50	0.71	0.00	4.37	4.38		3.67
2021	0.00	0.21	0.50	0.71	0.00	4.73	4.73		4.03
2022	0.00	0.21	0.50	0.71	0.00	5.11	5.11		4.40
2023	0.00	0.21	0.50	0.71	0.00	5.51	5.51		4.80
2024	0.00	0.21	0.50	0.71	0.00	5.93	5.93		5.22
2025	0.00	0.21	0.50	0.71	0.00	6.37	6.38		5.67
2026	0.00	0.21	0.50	0.71	0.00	6.84	6.84		6.14
2027	0.00	0.21	0.50	0.71	0.00	7.33	7.34		6.63
2028	0.00	0.21	0.50	0.71	0.00	7.85	7.86		7.15
2029	0.00	0.21	0.50	0.71	0.00	8.40	8.40		7.69
2030	0.00	0.21	0.50	0.71	0.01	8.97	8.98		8.27
2031	0.00	0.21	0.50	0.71	0.01	9.59	9.59		8.89
2032	0.00	0.21	0.50	0.71	0.01	10.24	10.24		9.54
2033	0.00	0.21	0.50	0.71	0.01	10.93	10.93		10.23
2034	0.00	0.21	0.50	0.71	0.01	11.65	11.66		10.95
2035	0.00	0.21	0.50	0.71	0.01	12.43	12.43		11.73
2036	0.00	0.21	0.50	0.71	0.01	13.24	13.25		12.55
2037	0.00	0.21	0.50	0.71	0.01	14.11	14.12		13.41
2038	0.00	0.21	0.50	0.71	0.01	15.02	15.03		14.32
2039	0.00	0.21	0.50	0.71	0.01	15.99	16.00		15.29
2040	0.00	0.21	0.50	0.71	0.01	17.01	17.02		16.31
								NPV @ 0.4%	153.77
								FIRR	20%
								MARR (10%) achieved by	2027

22. Sensitivity analysis was conducted to test the robustness of the project with respect to key parameters of project costs and revenue streams. The revenue from loss reduction can decrease to US\$44.25 million or capital cost can increase to US\$183 million, for NPV to arrive at zero and for the project to turn financially unviable. Similar to the economic analysis, the financial return from the project is highly dependent on the benefits gained from loss reduction. The

WACC is based on IDA's regular financing terms of a 38-year maturity, 6-year grace period, 0.75% p.a. fee on a declining balance and principal pay down starting in year 7. Using these terms the equivalent interest rate is 0.42%

sensitivity analysis also assessed the sensitivity of financial returns to similar parameters as the economic analysis, including, valuation of financial benefits from reduction in non-technical losses only, as typically only reducing non-technical losses brings financial benefits to the utility, but as mentioned before due to lack of data these losses cannot be separated.

Table 5: Sensitivity analysis

Results Summary Table	Base Case	Reduction of Non-Technical Losses Only - Top Down Approach	Reduction of Non-Technical Losses Only - Bottom Up Approach	Losses Decrease to 19% instead of 14%
FIRR (%)	20%	14%	11%	9%
NPV (USD Mn)	153.77	92.89	67.89	52.11
MARR (10%)	2027	2033	2038	-

C. Financial Analysis of the Implementing Agency EDL

23. This analysis reviews the financial situation of EDL as the project implementing agency. EDL is an integrated electric utility, responsible for power generation, transmission and distribution in Lao PDR. EDL is also the single buyer of electricity from independent power producers and from neighboring countries. In late 2010, EDL Generation Company (EDL-Gen) was established to take over a substantial part of the power generation business of EDL. However, EDL continues to invest directly in the generation business on behalf of EDL-Gen.

24. The financial risk of EDL is moderate to high because of inadequate T&D margin for its T&D business. Adding to the financial risk is EDL’s role in fronting new generation investment on behalf of EDL-Gen, which requires substantial upfront capital including through debt financing.

25. The latest EDL financial results for FY2013 show an overall group level (combining generation and T&D) profitability of about 5 percent of revenue inclusive of investment income in private power projects. Net operating cash flow equaled 48 percent of operating revenue. However, the T&D business *alone* still incurred losses of about 1.6 percent of revenue. (Note: total electricity-related sales were about US\$ 355m and investment revenues in private power projects were about US\$ 43m). The overall return on total assets was a small 0.8 percent and return on equity was 2.3 percent. This confirms that T&D business is loss-making and being cross-subsidized by generation business. The total assets were about US\$ 2.7 billion. The overall indebtedness of the group is now 1.6 times of equity, increasing substantially from 0.5 times only three years ago. The average tariff across all customer groups was 730 kips/kWh (9.1 cents). Actual tariffs ranged 328 to 1347 kips/kWh. Bill collection performance was quite good. Average *outstanding* bills (unpaid) amounted to about 2-month worth of sales. About half of these outstanding bills are with government/public sector customers.

26. For the next 5–10 years, the main financial risks for EDL may arise from the continuing high capital expenditures in generation and T&D network improvement and expansion. In addition, the terms of EDL’s debt financing have shortened, which increases debt repayment amount each year. The authorities may need to inject additional equity into EDL in order to keep

its leverage level in check. The outlook for EDL's future financial performance is supported by the expected decrease in T&D losses, including as a result of distribution system rehabilitation in four major cities. In addition, the current electricity tariff instruction is expiring in 2017, and the new tariff instruction can help address tariff gaps, especially for customers who are being supplied below the cost of supply (e.g. middle residential block, MV industrial customers and all HV customers).

27. The latest 2013 financial results indicate that EDL did not meet the debt-to-equity ratio covenant (1.6 achieved versus 1.5 target), but met the self-financing ratio covenant (29 percent achieved versus 15 percent target) and the debt service coverage ratio covenant (2.9 achieved versus 1.3 target) under the on-going REP II. Under the proposed PGI a financial covenant debt-to-equity ratio not exceeding 2:1 is proposed to monitor EDL's indebtedness. With the separation of EDL and EDL-Gen, some individual financial ratios become less informative and are not proposed as covenant. For instance, the debt service coverage ratio could be below 1 in the next few years as EDL reduces existing payables. In addition, the self-financing ratios are expected to be negative because of declining operating cash flow (including from paying down payables) and increasing debt repayment.

28. A medium-term financial projection has been carried out for 2015–2021 (see Table 6 below). EDL's financial performance is sensitive to the average selling tariffs, dividend income, dividend payment (through EDL-Gen), level of capital expenditures, investment, and associated financing expenses, and the level of T&D losses. The projection shows declining profitability until 2017 under the prevailing tariff instruction. Beyond 2017, improved financial performance can be expected from slightly higher tariffs and a decline in T&D losses from an estimated 17 percent in 2014 toward 13 percent. The projection also suggests that EDL's indebtedness will continue to increase, exceeding two times its equity, and could be even higher with higher capital expenditures and no capital increase.

29. Under the Second FAP framework, key financial drivers that will enhance financial sustainability include: (i) Recapitalize EDL. The Lao state enterprise regulations require a maximum debt-to-equity of 1.5 times. So, EDL will need additional equity (recapitalize) to ensure compliance with the regulations. (ii) Subsidies in tariffs. The financial cost of supplying electricity to all consumers averaged 9.1 US cents per kWh in 2013¹⁴. There are three residential tariff blocks. The first block is 0-25 kWh per month, middle block 26-150 kWh, last block 150+ kWh. The first and middle block (4.2 and 5 cents/kWh) are below cost of supply. Most residential customers fall in the middle block. With much higher electrification rate now, there is a need to address subsidies, especially for the middle block. The last block is already quite high (12.2 cents) and has limited room for further increase. Also, tariffs for MV *industrial customers* and all HV customers (around 8 cents) should be reviewed because they are also below the cost of supply. (iii) Investment in domestic transmission. An update of EDL's investment in transmission is needed to provide clarity on future financial obligations; (iv) Improve payment of bills by government/public sector customers. Starting this FY2015, the MOF will centralize payment of bills for this group of customers to address the recurring issue of government arrears.

¹⁴ Financial cost as reported in EDL audited financial statements. This included operating costs, depreciation charges and borrowing costs.

(v) T&D loss reductions. EDL has been switching large distribution customers to be served directly by HV and MV lines. This switch over should continue. Also, distribution losses should reduce further after rolling out distribution rehabilitation in four major cities, including replacement of electric meters.

Table 6: EDL – Summary Consolidated Financial Statements (2012–2013), Estimates and Projections (2014–2021)

Summary Consolidated Financial Statements										
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Profit and Losses	Actual	Actual	Estimates	Projected	Projected	Projected	Projected	Projected	Projected	Projected
Revenue	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips
Electricity sales	2,284,902	2,683,642	2,989,550	3,332,350	3,716,532	4,147,137	4,675,211	5,272,813	5,949,170	6,714,735
Other operating income	149,628	157,534	161,472	165,509	169,647	173,888	178,235	182,691	187,258	191,940
Non-operating income (e.g. dividend receipt)	182,306	343,943	343,943	343,943	343,943	343,943	343,943	343,943	343,943	343,943
Total revenue	2,616,836	3,185,119	3,494,966	3,841,802	4,230,122	4,664,969	5,197,389	5,799,447	6,480,372	7,250,618
Expenses										
Electricity purchases	1,278,298	1,403,197	1,512,147	1,650,244	1,901,661	2,152,101	2,461,354	2,697,576	3,070,474	3,486,789
Administrative and general	268,084	339,635	373,599	410,958	452,054	497,260	546,986	601,684	661,853	728,038
Depreciation	346,580	442,718	478,713	506,288	534,413	563,102	592,364	622,211	652,655	683,708
Interest expenses	141,422	227,144	422,488	472,287	517,901	568,282	614,822	645,736	666,506	683,374
Corporate income taxes	239,468	27,327	31,510	34,979	38,862	43,210	48,534	54,555	61,364	69,067
Net income (after taxes)	(7,398)	161,963	46,900	77,609	29,980	13,371	26,052	182,812	276,290	402,421
Cash Flow Statement										
Operations	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips
Changes in non-cash working capital										
Operating cash flow, net	687,114	1,365,504	(839,516)	(259,048)	(328,980)	(497,379)	(100,320)	386,697	520,990	671,628
Investing										
Capital expenditures	(3,356,142)	(3,174,361)	(901,120)	(919,142)	(937,525)	(956,276)	(975,401)	(994,909)	(1,014,807)	(1,035,103)
Investment	(1,676,602)	(307,608)	(150,000)	(150,000)	(150,000)	(150,000)	(150,000)	(150,000)	(150,000)	(150,000)
Dividend receipt	211,959	0	313,128	313,128	313,128	313,128	313,128	313,128	313,128	313,128
Investing cash flow, net	(4,006,667)	(3,557,379)	(707,177)	(725,199)	(743,582)	(762,333)	(781,458)	(800,966)	(820,864)	(841,160)
Financing										
Loan disbursement & adjustment	2,186,311	2,684,298	1,840,479	1,742,005	1,829,180	2,005,461	1,634,091	1,220,820	1,111,318	1,003,041
Loan repayment	(371,525)	(338,822)	(528,023)	(720,610)	(743,979)	(734,083)	(730,029)	(720,603)	(704,943)	(689,126)
Dividend paid	(121,602)	(146,628)	(18,760)	(31,043)	(11,992)	(5,348)	(10,421)	(73,125)	(110,516)	(160,968)
Financing cash flow, net	3,250,315	2,198,848	1,282,545	993,749	1,083,201	1,271,625	896,365	430,764	318,530	190,636
Change in cash flow for the year	(69,238)	6,217	(264,148)	9,502	10,639	11,914	14,587	16,495	18,655	21,103
Beginning cash balance	413,498	344,260	350,477	86,329	95,832	106,471	118,384	132,971	149,466	168,121
Ending cash balance	344,260	350,477	86,329	95,832	106,471	118,384	132,971	149,466	168,121	189,224

Table 6 (continue):

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips	Million Kips
Balance Sheet										
Current assets, of which	1,319,960	1,163,553	1,121,933	1,214,912	1,316,377	1,427,304	1,557,494	1,701,602	1,861,407	2,038,927
<i>Cash</i>	344,260	350,477	86,329	95,832	106,471	118,384	132,971	149,466	168,121	189,224
<i>Account receivables</i>	475,087	444,545	517,976	574,991	638,824	710,306	797,827	896,795	1,008,728	1,135,344
Non-current assets, of which	16,512,032	20,379,818	20,952,224	21,515,079	22,068,191	22,611,365	23,144,402	23,667,100	24,179,252	24,680,647
<i>Net fixed assets</i>	11,064,928	12,512,158	12,934,564	13,347,419	13,750,531	14,143,705	14,526,742	14,899,440	15,261,592	15,612,987
<i>Work in progress</i>	3,659,263	5,063,424	5,063,424	5,063,424	5,063,424	5,063,424	5,063,424	5,063,424	5,063,424	5,063,424
<i>Investments</i>	960,795	1,270,066	1,420,066	1,570,066	1,720,066	1,870,066	2,020,066	2,170,066	2,320,066	2,470,066
Total assets	17,831,992	21,543,371	22,074,157	22,729,991	23,384,567	24,038,668	24,701,897	25,368,702	26,040,660	26,719,575
Current liabilities, of which	2,590,537	3,639,496	3,033,424	2,641,269	2,172,768	1,537,818	1,269,203	1,306,774	1,368,095	1,240,152
<i>Current-portion of long-term loans</i>	875,713	528,023	720,610	743,979	734,083	730,029	720,603	704,943	689,126	475,325
<i>Account payables</i>	1,411,969	2,646,266	2,312,814	1,897,290	1,438,684	807,790	548,600	601,831	678,968	764,827
Non-current liabilities, of which	8,155,708	10,755,375	11,875,244	12,873,270	13,968,367	15,243,799	16,157,287	16,673,164	17,095,355	17,623,072
<i>Loans</i>	8,155,708	10,755,375	11,875,244	12,873,270	13,968,367	15,243,799	16,157,287	16,673,164	17,095,355	17,623,072
Total liabilities	10,746,245	14,394,871	14,908,668	15,514,539	16,141,134	16,781,617	17,426,490	17,979,938	18,463,450	18,863,223
Total equity, of which	7,085,747	7,148,500	7,165,489	7,215,452	7,243,433	7,257,051	7,275,406	7,388,764	7,577,210	7,856,351
<i>Non-controlling interest</i>	1,374,698	1,440,851	1,429,700	1,433,098	1,443,090	1,448,687	1,451,410	1,455,081	1,477,753	1,515,442
Total Liabilities + Equity	17,831,992	21,543,371	22,074,157	22,729,991	23,384,567	24,038,668	24,701,897	25,368,702	26,040,660	26,719,575

Table 6 (continue):

Financial & Other Indicators	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Electricity sales per kWh sold, kip/kWh	760	731	746	761	776	792	815	840	865	891
Total revenue per kWh sold, kip/kWh	817	775	785	797	809	821	842	863	885	909
Total expenses pre-tax per kWh sold, kip/kWh	744	729	761	767	790	806	824	823	835	846
Pre-tax margin per kWh sold, kip/kWh	72	46	25	30	19	15	17	40	50	63
Profitability										
EBITDA margin	22%	18%	21%	22%	21%	20%	20%	22%	22%	22%
Net margin	-0.3%	5.1%	1.3%	2.0%	0.7%	0.3%	0.5%	3.2%	4.3%	5.6%
Return on equity	-0.1%	2.3%	0.7%	1.1%	0.4%	0.2%	0.4%	2.5%	3.6%	5.1%
Return on assets	0.0%	0.8%	0.2%	0.3%	0.1%	0.1%	0.1%	0.7%	1.1%	1.5%
Depreciation rate, % of gross fixed assets	2.6%	2.9%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Average interest rate, % of loans	1.6%	2.0%	3.4%	3.5%	3.5%	3.6%	3.6%	3.7%	3.7%	3.8%
Dividend payout, % of net income	-1644%	91%	40%	40%	40%	40%	40%	40%	40%	40%
Cashflow										
Debt service coverage, times	3.7	2.9	0.3	0.4	0.4	0.3	0.6	1.0	1.1	1.2
Self finance	10%	29%	-69%	-62%	-70%	-83%	-46%	-2%	12%	25%
Liquidity and leverage										
Current ratio	0.5	0.3	0.4	0.5	0.6	0.9	1.2	1.3	1.4	1.6
Receivable outstanding, # day of revenue	71	57	60	60	60	60	60	60	60	60
Payables outstanding, # day of external costs	305	496	400	300	200	100	60	60	60	60
Long-term debt to equity, times	1.3	1.6	1.8	1.9	2.0	2.2	2.3	2.4	2.3	2.3
Cash balance (# days of revenue)	52	45	10	10	10	10	10	10	10	10
Technical										
EDL GWh sold	3,205	4,112	4,450	4,822	5,231	5,681	6,176	6,720	7,319	7,978
EDL T&D losses, GWh	621	1,070	940	837	937	981	1,085	976	1,070	1,166
T&D loss rates, %	16.2%	20.7%	17%	15%	15%	15%	15%	13%	13%	13%
Overall average tariffs / kWh sold, kips	713	653	672	691	711	730	757	785	813	842
Domestic average tariffs / kWh sold, kips	760	731	746	761	776	792	815	840	865	891
GWh sold changes, % from prior year	3%	28%	8%	8%	8%	9%	9%	9%	9%	9%