

Lao People's Democratic Republic

Energy Sector Assessment, Strategy, and Road Map

2013 Update



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2013 Update

Asian Development Bank

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Currency Equivalents

(as of 15 March 2013)

Currency Unit	=	kip (KN)
KN1.00	=	\$0.000129971
\$1.00	=	KN7,694.00

Weights and Measures

cct-km	-	circuit kilometer
GWh	-	gigawatt-hour
km	-	kilometer
km ²	-	square kilometer
kgoe	-	kilogram of oil equivalent
ktoe	-	kiloton of oil equivalent
kV	-	kilovolt
kWh	-	kilowatt-hour
mtoe	-	million tons of oil equivalent
MVA	-	megavolt-ampere
MW	-	megawatt

Abbreviations

ADB	– Asian Development Bank
ASR	– assessment, strategy, and road map
CPS	– country partnership strategy
DEB	– Department of Energy Business
DEPP	– Department of Energy Policy and Planning
DOM	– Department of Mines
DSM	– demand-side management
EEC	– energy efficiency and conservation
EDL	– Electricité du Laos
EDL-GEN	– EDL Generation Public Company
EGAT	– Electricity Generating Authority of Thailand
GMS	– Greater Mekong Subregion
HPP	– hydropower plant
IPP	– independent power producer
IREP	– Institute of Renewable Energy Promotion
JICA	– Japan International Cooperation Agency
Lao PDR	– Lao People’s Democratic Republic
LHSE	– Lao Holding State Enterprise
MEM	– Ministry of Energy and Mines
MONRE	– Ministry of Natural Resources and the Environment
NSEDP	– National Socio-Economic Development Plan
PPP	– public–private partnership
SPP	– small power producer

Acknowledgments

This report was prepared by a team led by Duy-Thanh Bui (senior energy economist, Energy Division [SEEN], Southeast Asia Department [SERD]), with team members Phoxay Phommachanh (project officer [energy], Lao Resident Mission) and Thiphasone Donekhamyoy (associate project analyst, Lao Resident Mission). Guidance and support were provided by SERD management: Kunio Senga (director general, SERD), Jong-Inn Kim (officer-in-charge, SEEN/SERD), Chi Nai Chong (country director, Lao Resident Mission), Anthony Jude (senior advisor, Regional Sustainable Department and former director, SEEN/SERD), Richard Bolt (advisor, Office of the Director General, SERD), and Rehan Kausar (unit head, project administration, SEEN/SERD).

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I Sector Assessment: Context and Strategic Issues

A. Introduction

1. This energy sector assessment, strategy, and road map (ASR) highlights development constraints and challenges in the energy sector in the Lao People's Democratic Republic (Lao PDR). Consistent with the government's plans and strategy, the ASR proposes support actions for the sector during the period to 2020. It also provides sector background information, which will be updated as needed, for investment and technical assistance operations. The ASR is a working paper based on a systematic review of the Lao PDR energy sector and consultations with the government and other development partners.

2. The ASR is linked to the Asian Development Bank (ADB) country partnership strategy (CPS) for the Lao PDR, 2012–2016.¹ The CPS, approved by the ADB Board in 2011, sets out principles for assistance and partnership between ADB and the Lao PDR. The CPS is aligned with the government's policies and priorities in the Seventh Five-Year National Socio-Economic Development Plan (NSEDP), 2011–2015. Further, the ASR draws upon ADB's Strategy 2020, which sets out a framework for ADB's overall operations for 2008–2020.²

B. Overall Sector Context

3. The Lao PDR is a country rich in natural resources, traditionally agrarian but in transition to becoming a more urbanized, market-oriented economy increasingly integrated with neighboring countries in the Greater Mekong Subregion (GMS). Between 2002 and 2012, the Lao PDR has experienced robust economic growth averaging 7%–8% annually. Mining and hydropower investments have increased significantly in recent years, making important contributions to economic growth. Hydropower output rose by almost 20% in 2011, spurred on by the commissioning of new plants, including the 615 megawatt (MW) Nam Ngum 2. Gross national income has more than doubled since 2006.

4. With a population of only 6.4 million people, the overall population density is very low—at about 26 people per square kilometer (km²). Almost three-quarters of the population live in rural areas. Numerous ethnic groups live in remote, mountainous regions with very limited access to services (including electricity) and markets. Table 1 shows key economic indicators for 2011. The average income in the Lao PDR is marginally over \$1,200 (Atlas method), and approximately 25% of the population lives below the poverty line (less than \$1 daily in purchasing power parity terms).

5. The main objectives of the government's NSEDP for 2011–2015 include rapid economic growth and poverty eradication; achievement of the Millennium Development Goals by 2015; graduation from least-developed country status by 2020; and sustainable economic, social, and environmental development.

¹ ADB. 2011. *Country Partnership Strategy: Lao People's Democratic Republic, 2012–2016*. Manila.

² ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank, 2008–2020*. Manila.

Table 1 Key Economic Indicators

Indicator	Unit	Value
Land area	km ²	236,800
Population	million	6.4
GDP	billion KN	64,960
GDP per capita	\$	1,272

GDP = gross domestic product, km² = square kilometer.

Source: ADB. 2011. *Key Indicators for Asia and the Pacific*. Manila.

6. The NSEDP, 2011–2015 identifies the energy sector as a strategic development factor, both for the short and longer terms. Its performance is vital to meeting the country's energy requirements, notably with respect to the still-elusive goal of nationwide electrification. Development of the sector is central to modernization and industrialization of the country, which is the primary basis for raising living standards and poverty reduction. In light of its huge hydropower potential and extensive coal deposits, the Lao PDR is seen as a future “battery” for the GMS.

1. Energy Consumption

7. **Structure of final energy use.** The primary energy source in the Lao PDR, as in many developing countries in the region, is biomass. However, in terms of final energy use, biomass accounts for less than 60%, petroleum products account for about 17%, electricity for 12%, and charcoal and coal for 14%.

8. **Sector energy use.** In 2012, total final energy consumption was 2,336 kilotons of oil equivalent (ktoe). Households account for 54% of total final energy consumption, the transport sector for 22%, the commercial sector for 14%, and the industry and agriculture sectors 10%. The high share accounted for by households reflects their reliance on biomass, which has low efficiency. It also reflects the relatively low level of industrial and commercial activity. While petroleum fuels are used for transport and industry, they are also used to generate electricity by households yet to be connected to the grid. All petroleum fuels are imported. Table 2 depicts the key energy indicators.

Table 2 Key Energy Indicators

Indicator	Unit	Value
Final energy consumption per capita	kgoe	366
Total electricity consumption	GWh	2,400
Total installed capacity	MW	2,570
Electrification rate	%	78.5
Per capita electricity consumption	kWh	376
Hydropower potential	MW	20,000
Coal resource	million tons	700
Renewable potential	MW (eq)	500

GWh = gigawatt-hour, kgoe = kilogram of oil equivalent, km² = square kilometer, kWh = kilowatt-hour, MW = megawatt.

Source: Asian Development Bank (ADB).

2. Energy Resources

9. **Hydropower potential.** The Mekong river subbasins in the Lao PDR have an estimated 20,000 MW of technically viable hydropower capacity. By 2011, 2,570 MW of this capacity had been developed and is operational for both domestic consumption and export. A further 2,623 MW of capacity, involving 12 power plants, is in various stages of construction (Appendix 3, Table A3.1). Additionally, 60 new hydropower projects are in various stages of study, approval, and design (Appendix 3, Tables A3.2–A3.3). Hydropower plants (HPPs) provide electricity both to domestic customers (through the grid) and foreign markets (Thailand and Viet Nam). By 2020, when all of the 12 projects presently under construction have been completed, it is expected that the Lao PDR will have harnessed about 8,100 MW of its 20,000 MW of potential capacity (Table 3).

Table 3 Generating Capacity (megawatts)

Item	2011	2015	2020	2025
For domestic market	579	1,103	1,954	2,448
For export market (Thailand, Viet Nam)	1,987	2,261	6,209	8,925
Total	2,566	3,364	8,163	11,373

Source: Electricité du Laos Statistics. 2011.

10. **Coal and lignite.** The Lao PDR's coal reserves are estimated to be about 600 million–700 million tons, occurring mostly as lignite with smaller amounts of anthracite. The largest reserve of lignite has been found in Hongsa in Xayabouly province; it is estimated to contain about 400 million tons, or more than half the estimated total reserves for the country. The mid-grade lignite is suitable for electricity generation and meeting other industrial thermal energy requirements. Coal consumption is currently limited to a cement factory, using about 35,000 tons per year, and a few smaller users. However, this is about to change as an independent power producer (IPP) commenced construction in 2011 of an 1,800 MW coal-fueled thermal plant in Hongsa. Most of the electricity will be exported to Thailand, with 100 MW reserved for sale to Electricité du Laos (EDL).

3. Renewable Energies and Energy Efficiency and Conservation

11. Apart from large-scale hydropower, the Lao PDR's other renewable energy resources include biomass, hydro energy (small and mini, less than 15 MW), solar energy, wind, and geothermal energy resources (Appendix 3, Box 1).

12. **Biomass.** Every year the agriculture and forestry sectors produce large amounts of waste, such as rice straw and husks, sawdust, and corn cobs. The annual potential of this waste is estimated at 500 million tons of oil equivalent (mtoe), which can be used as feedstock for power generation. So far, biomass is only used at the household level, as more than 80% of the Lao population still relies on biomass energy, especially for cooking; biomass is also used for small-scale rural industrial production (e.g., alcohol production and tobacco processing). The country has high potential for biofuel production from oily crops such as jatropha, oil palm, and soybean. There have been some pilot projects to plant jatropha for biodiesel production; for example, the Kolao Company has invested in a 2,500-hectare jatropha plantation and biodiesel factory (2,000 liters per day) in Xayabouly province.

13. **Solar.** The Lao PDR has an average of 200–300 sunlight days per year, with more sunlight days in the south. The potential capacity of solar energy is estimated at around 4.5–5.0 kilowatt-hours (kWh) per square meter (m²) per day. Solar power plays a role in providing off-grid electric power for remote rural areas. At present, 25,000 households, mostly in remote areas, have been supplied with solar home

systems. Local companies are capable of supplying and installing solar home systems, but the quality of service needs to be improved.

14. **Small hydropower projects.** Hydropower installations in the Lao PDR with capacity less than 15 MW are considered small. Although the potential total generation from small-scale hydropower projects is considerable, to date only 11.5 MW has been developed. Projects with total capacity of 22.5 MW are currently under construction, and a number of other projects totaling 100.0 MW are at the feasibility study stage. ADB has assisted in providing standardized procedures for tendering small hydropower projects.

15. Energy efficiency and conservation (EEC) in the Lao PDR is at an early stage. The government has yet to develop a comprehensive national strategy for EEC. There has been some assistance provided by multilateral and bilateral donors, most notably the World Bank Rural Electrification Project concerning demand-side management.

16. With the creation of the Institute of Renewable Energy and Promotion (IREP) and Department of Energy Management (DEM) under the Ministry of Energy and Mines, EEC initiatives are now more coordinated. The IREP is preparing a national EEC strategy and draft EEC laws and regulations. The DEM is preparing requirements concerning monitoring of energy use and labeling for appliances.

4. Organization of the Energy Sector

17. Management of energy-related activities in the Lao PDR is mainly the responsibility of the Ministry of Energy and Mines (MEM), EDL, and Lao Holding State Enterprise (LHSE), with support from the Ministry of Finance and the Ministry of Natural Resources and the Environment (MONRE).

18. The MEM is responsible for energy policy and overall strategic guidance, as well as management of sector development. In 2011, the MEM, with technical assistance from ADB and other development partners, undertook a major reorganization so as to better align departmental responsibilities, duties, and authorities. The newly organized departments and their tasks are summarized as follows:

- (i) **Department of Energy Business.** Formerly the Department of Energy Promotion and Development, the Department of Energy Businesses (DEB) is in charge of private sector investments in the power sector. Until recently, DEB focused mainly on supervising private sector investment in large hydropower projects. With the rapid increase in private sector investment in the Lao PDR power sector, DEB has expanded its supervisory role to include investment in transmission projects and coal-fired thermal power projects. While DEB is involved in planning, development, and appraisal of project proposals, its main role is negotiating project development agreements, concession agreements, and power purchase agreements. DEB's duties include monitoring project implementation. The department has four divisions: Administrative Division, Contract Division, Project Development Division, and Project Monitoring Division.
- (ii) **Department of Energy Policy and Planning.** The main responsibility of the Department of Energy Policy and Planning (DEPP) is formulating national energy policies and plans. The DEPP collects and analyzes energy consumption data, both by consumer categories (industry, household, and business) and fuel type. It also analyzes energy supply options, based on the Lao PDR's energy resources and import and export considerations. The DEPP prepares energy balance tables, energy demand forecasts, and supply projections. Further, and importantly, the DEPP proposes and implements pricing policies for all types of energy supply, including for electricity and petroleum products. Another key responsibility of the DEPP is to formulate policies and

mechanisms to promote development of Lao PDR hydropower resources. In support of the DEB, DEPP takes part in the review of feasibility studies, project development agreements, concession agreements, and memoranda of understanding for power projects. The department provides assistance to investors and developers interested in power generation and transmission for domestic consumption and export. Finally, the DEPP is responsible for ensuring sustainable development of the energy sector. In this regard, the DEPP conducts research on the impact of hydropower projects on river flows, sediment, and fish stocks. It reviews environmental impact assessments and the anticipated impact of climate change on the Lao PDR's hydropower potential. The department consists of five divisions: Administration Division, Energy Policy Division, Electricity Generation Planning Division, Power System Planning Division, and Environmental Engineering Division.

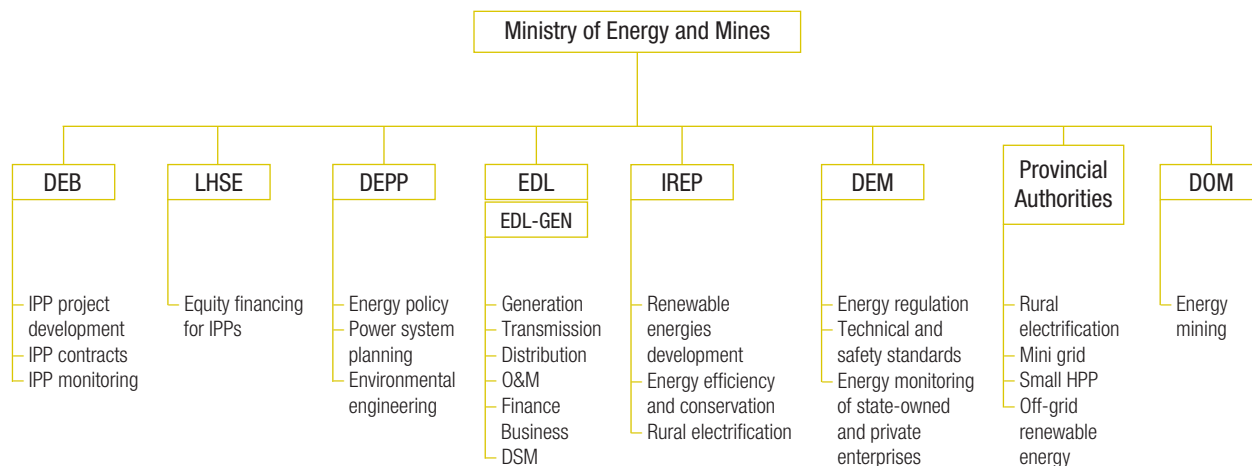
- (iii) **Department of Energy Management.** This newly created department is in charge of drafting energy-related laws, regulations, guidelines, and technical and safety standards. The DEM also monitors government agencies, state-owned enterprises, and private operators to ensure that they operate in accordance with the rules and regulations. Further, the DEM monitors the energy use of enterprises, factories, and buildings and presents energy awards to the most efficient users. Another important function of the DEM is inspecting the technical standards of electrical equipment and appliances, either domestically produced or imported. The department issues energy business licenses and approves or rejects extensions. The DEM also provides technical consultation services and information on energy administration and management.
- (iv) **Institute of Renewable Energy Promotion.** Equivalent to a department, the IREP is mainly responsible for promoting renewable energy and conservation by implementing the Renewable Energy Policy and Strategy prepared in 2011. In support of renewable energy, the IREP is tasked with developing small-scale hydro, biodiesel, and biogas projects and with preparing a manual on renewable energy production and use. In support of rural electrification, the institute formulates and implements a rural electrification master plan. In support of EEC, the IREP will formulate regulations, guidelines, and a user's manual on EEC. Its conservation targets include developing more efficient cooking stoves and implementing a model project on EEC.

19. **Electricité du Laos.** EDL is a vertically integrated electricity utility and it performs the functions of generation, transmission, distribution, and services to all electricity customers served by the national grid in the Lao PDR. EDL also holds shares in four export-oriented HPPs which are in operation and a number of other independent power projects under construction.³ Recently, EDL-Generation Public Company (EDL-GEN), a public company owned by EDL, was put in charge of EDL's generation functions. As another indication of the Lao PDR's market opening, in 2012 the government sold about 30% of its stake in EDL-GEN through an initial public share offering.

20. **Lao Holdings State Enterprise.** LHSE was established in February 2005 by the Government of the Lao PDR to facilitate investment in energy generation. LHSE manages the state's holdings in hydroelectric power projects built by foreign and private investors. It may also hold shares in non-hydro-generation projects, including transmission projects. Currently, the hydropower projects in which LHSE has a stake are Nam Nghiep 1, Nam Ngum 3, Nam Theun 1, Nam Theun 2, Nam Kong 1, Xepian Xe Nam Noi, Xekong 4, Xekong 5, and Hongsa Thermal Electric power project. Under the current reorganization, LHSE is put under the MEM. Figure 1 provides an organization chart for the energy sector showing the key agencies involved.

³ EDL holds 60% of the shares of the Theun Hinboun hydropower projects, 20% of the shares of the Houay Ho and Nam Lik 1/2 hydropower projects, and 25% of the shares of the Nam Ngum 2 hydropower project.

Figure 1 Organizational Chart



DEB = Department of Energy Business, DEM = Department of Energy Management, DEPP = Department of Energy Policy and Planning, DOM = Department of Mines, DSM = demand-side management, EDL = Electricité du Laos, EDL-GEN = EDL Generation Public Company, HPP = hydropower plant, IPP = independent power producer, IREP = Institute of Renewable Energy Promotion, LHSE = Lao Holding State Enterprise, O&M = operation and maintenance.

Source: Ministry of Energy and Mines.

C. Core Sector Issues

21. Until recent reforms, development of the energy sector was held back by the limited capacity of the MEM and poor overall organization of agencies responsible for the sector.

22. Before the reorganization in 2011, MEM functions were structured as three departments: Department of Electricity, Department of Energy Promotion and Development, and Department of Mines. The focus of both the Department of Electricity and Department of Energy Promotion and Development was on the electricity subsector. MEM's broader responsibilities, including policy formulation, planning, development, and efficient use of all forms of energy, were not properly addressed.

23. The Lao PDR lacks a comprehensive national energy policy, setting out a systematic approach to energy planning, policy formulation, and sector development. Formulation of a national energy policy is urgently needed and is a priority for the MEM. With a firm national energy policy as a framework, the MEM will be better placed to undertake its responsibilities for energy planning and strategic guidance. The MEM is mandated to determine current and future demand for energy, and to analyze cross-sector issues such as energy substitution. Systematic planning would lead to efficient utilization and economic development of all energy resources, beyond the present planning approach which is largely focused on development of the Lao PDR's hydropower export potential.

24. The MEM's capacity to promote renewable energy and energy efficiency is limited. Its staff need to be able to conduct resource assessments and mapping to (i) better facilitate on-grid and off-grid electricity generation, (ii) coordinate research and planning concerning pricing policies, and (iii) establish procedures for streamlined review of private investment proposals. Further, capacity for promotion of energy demand-side management (DSM), energy auditing, and regulatory interventions (such as energy labeling of appliances) needs to be strengthened.

25. Royalties, taxes, and dividends from the export of hydropower is an important source of revenue for the government. Foreign and private sector investors are participating extensively in developing the

Lao PDR's hydropower export potential. In addition, the government encourages foreign and private sector investors to develop projects for the supply of electricity to the domestic market. As noted earlier, the DEB is responsible for promoting and overseeing the involvement of foreign and private sector investors in power generation. Experience in numerous power projects over the past decade has resulted in the DEB acquiring skills in planning, technical evaluation, and project implementation and monitoring. However, the department remains relatively weak in four critical areas: social and environmental assessments, managing arbitration proceedings, financial modeling and analysis, and strategic leadership.

26. The Lao PDR's vast hydropower potential, fortuitously located in the center of the GMS, provides the opportunity for it to be a "battery" for energy-deficit neighboring countries. Pursuit of this opportunity requires optimal development of the country's hydropower resources, retaining ample electricity for rural electrification and harnessing the potential on a sustainable basis. The energy sector, in short, is very much dominated by interest in hydropower.

1. Electric Power Subsector

a. Current Status

27. The electric power industry in the Lao PDR consists essentially of EDL, a state-owned utility, and IPPs. EDL owns, manages, and operates generation, transmission, distribution, and supply of electricity for domestic consumption. In 2010, EDL established a generating company—EDL-GEN—which is in charge of generating power and operating the power plants that belong to EDL. Most IPPs produce electricity for export to neighboring countries, with small percentages retained for domestic consumption. Both EDL and IPPs have experienced rapid growth in recent years. For example, the Se Xet 2 plant was commissioned in 2009 and the Nam Song extension was commissioned in 2011, adding 82 MW to EDL's generating capacity. Between 2009 and 2012, three large independent power plants were commissioned: Nam Theun 2 (1,070 MW), Nam Ngum 2 (615 MW), and the Theun Hinboun extension (200 MW). EDL draws a total of 130 MW from these plants for the domestic market.

b. Generation

28. EDL's own generating capacity is almost 100% hydro based. The utility has 10 HPPs (Table 4), mostly of small capacity (less than 50 MW). Its largest power plant is Nam Ngum 1 (155 MW), commissioned in 1971. In 2012, EDL's generating capacity totaled 391 MW, producing 2,083 gigawatt-hours (GWh) of electricity. EDL's own generation is insufficient for supplying the domestic market, hence it buys power from a number of domestic IPPs. Currently, the largest domestic IPP is the Nam Lik 1/2 HPP, with a capacity of 100 MW, generating 562 GWh per year.

c. Transmission and Distribution

29. Prior to 2009, EDL's operations in the Lao PDR's 17 provinces were divided into four areas—northern, central 1, central 2, and southern. Each area had a 115 kilovolt (kV) grid but they were not interconnected. During the 2009–2011 period the 115 kV network has been expanded and interconnected, consolidating to three areas (central 1 and 2 have been combined). In total, there are now 2,500 kilometers (km) of 115 kV transmission lines. The transmission and distribution network includes 38 115/22 kV substations with transformer capacity of 1,343 megavolt-amperes (MVA). The transmission and transformer capacity are concentrated in the central region, which serves the Vientiane Capital and Luang Prabang.

Table 4 Electricité du Laos System Capacity (2012)

Plant Name	MW
Nam Dong Hydropower	1.0
Nam Ko Hydropower	1.5
Nam Leuk Hydropower	60.0
Nam Ngay Hydropower	1.2
Nam Mang 3 Hydropower	40.0
Nam Ngum 1 Hydropower	155.0
Selabam Hydropower	5.0
Se Xet 1 Hydropower	45.0
Se Xet 2 Hydropower	76.0
Nam Song extension	6.0
Total	390.7

MW = megawatts.

Source: Electricité du Laos Statistics, 2011.

30. In addition to EDL's network, the provincial authorities operate 85 mini grids, supplied either with diesel generators or small hydropower stations. These facilities primarily serve remote areas not yet in the EDL grid. In addition, EDL imports power from neighboring countries to help serve these areas; imported power is generally at the medium-voltage level (22 kV and 35 kV). Presently, the Lao PDR has 13 cross-border connections for importing electricity from the People's Republic of China (three), Thailand (five) and Viet Nam (five). In 2011, EDL imported 747 GWh of electricity in this manner.

d. Power for Export

31. As of 2012, there were four export IPP HPPs with combined capacity of 2,262 MW: Houay Ho, 152 MW; Theun Hinboun, 420 MW; Nam Theun 2, 1,075 MW; and Nam Ngum 2, 615 MW (Appendix 3, Table 5). In 2012, they produced 9,864 GWh, of which 8,867 GWh was exported to Thailand and 997 GWh supplied the domestic market.

32. Each of the four export IPPs has dedicated transmission lines linking the power plants concerned to their designated export markets: (i) Theun Hinboun to Sakhonnakhon (Electricity Generating Authority of Thailand [EGAT], Thailand) 230 kV, 176 km; (ii) Houay Ho to Ubon 2 (EGAT, Thailand) 230 kV, 230 km; (iii) Nam Theun 2 to Roi Et (EGAT, Thailand) 500 kV, 300 km; and (iv) Nabong to Udon 3 (EGAT, Thailand), 500 kV, 100 km. A new line has also been constructed to export power from Xekaman 3 HPP to Viet Nam: Xekaman 3 to Thanh My (Viet Nam Electricity, Viet Nam) 230 kV, 150 km.

2. Subsector Challenges

33. Subsector challenges include meeting domestic demand, expanding generation and transmission capacity in a sustainable manner, and overcoming financial constraints.

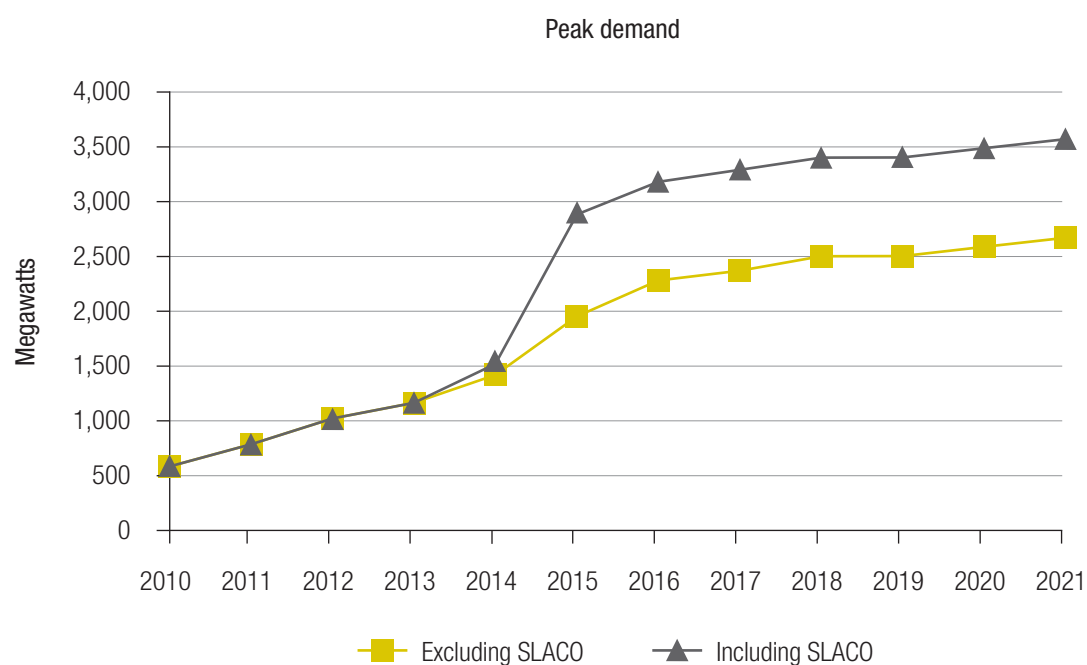
a. Meeting a Fast-Growing Domestic Electricity Demand

34. Domestic demand for electricity is expected to increase rapidly, by 15%–18% annually, reflecting the government's policy to accelerate rural electrification and industrial development.

Currently, electricity consumption in the Lao PDR is very low (2,400 GWh of energy consumed and 528 MW peak load in 2011). Households account for about 40% of electricity consumption while commercial and industrial enterprises account for almost 50%.

35. The government's rural electrification program is targeting provision of electricity services to 90% of households by 2020. This in itself will require a substantial increase in generation and transmission capacity. More significant, though, will be the impact on demand as a result of the planned expansion of mining activities (especially bauxite mining and processing), cement production, construction of a railway, and the opening of six special economic zones. By 2020, domestic demand for power is projected to reach 2,670 MW (3,570 MW if bauxite processing is included), compared with 584 MW today. This represents a fourfold to sixfold increase in domestic demand (Figure 2). Further compounding the challenge of meeting the increase in domestic demand, the supply sources are largely in the north and south while the growth in demand will be most rapid in the central region. Heavy investment in transmission and distribution systems will need to accompany major investments in power generation.

Figure 2 Domestic Electricity Demand Forecast, 2010–2020



SLACO = Sino-Lao Aluminum Corporation.

Source: ADB.

b. Investment Requirements

i. Generation Expansion

36. EDL's Power Development Plan for meeting the domestic demand projections includes reliance on three sources of supply: (i) expansion of EDL's generating capacity, (ii) increased purchases from export IPPs, and (iii) increased purchases from small power producers (SPPs) and domestic IPPs. During the period to 2016, EDL plans to construct 300 MW of new capacity in the northern region, 114 MW in

the central region, and 170 MW in the southern region. Even if this impressive expansion plan is realized, EDL will not be able to fully meet the expected increase in domestic demand; it will have to purchase power from SPPs and IPPs. EDL is investing in domestic independent power plants, which are under construction, and will receive electricity from these plants, e.g., Nam Ngum 5 (10%), Nam Nghiep 2 (10%), and Xekaman 3 (10%). If a smelter for aluminum production goes ahead, EDL purchases from SPPs and IPPs in the southern region will need to be significantly higher.

ii. Transmission and Distribution Network Development

37. In parallel to increasing its generating capacity, EDL needs to considerably expand its transmission and distribution network. EDL will develop most of the additional transmission lines and substations required, and all of the distribution facilities. EDL is responsible for delivering power to final domestic consumers regardless of whether it generates the power or purchases it from SPPs and/or IPPs. Foreign and private sector investors already play a major role in both generation and transmission in the Lao PDR, and are expected to make a major contribution to expansion of the transmission network. It is estimated that between 2011 and 2015 about 5,500 km of transmission line will be constructed, including 3,922 km to be constructed by EDL and 1,567 km by private developers. Another 1,515 km will be added to the transmission network (552 km by EDL and 963 km by private developers) during 2016–2020. In total, an estimated 12,250 circuit-km of additional transmission lines will be installed by 2020 (Appendix 3, Tables A3.6a–A3.6c). A similar level of construction is required for substations, including substations to transform power from the 115 kV level down to 22 kV and then to the 400 volt level.

3. Subsector Constraints

38. Clearly, the above rapid expansion of power generation, transmission, and distribution will be very demanding on EDL's staff and financial resources. While EDL's technical capability has improved quite strongly over the past decade or more, it is still not at the level needed to cope with such expansion. In turn, the financial requirements needed are huge and are well beyond EDL's reach. These two constraints will have to be overcome if the Lao PDR is to achieve its electrification and industrialization goals.

a. Financial Resources Constraints

39. It is estimated that EDL will need to mobilize \$1.45 billion for increased generation and \$2.1 billion for expansion of the transmission system, including for substations (Table 5).

**Table 5 Investment Requirement
(\$ million)**

Generation	Amount
EDL	1,451
Independent power producer (for domestic consumption)	8,370
Independent power producer (for export)	16,119
Subtotal	25,940
Transmission and distribution	2,134
Total	28,074

EDL = Electricité du Laos.

Source: ADB.

40. EDL's sources of revenue are from the sale of electricity and dividends from the IPPs in which EDL holds shares (at present four HPPs).⁴ For many years, however, the electricity tariff has been set at a low level, seriously undermining EDL's financial position, and arrears by some government agencies have further weakened EDL's financial situation. ADB and the World Bank advisory consultations have led to the government deciding to increase electricity tariffs to cover production and transmission and distribution costs. According to the government's decision of March 2012, electricity tariffs will increase on average by 2% or more annually. For example, high electricity use residential consumers will pay KN1,019 per kWh in 2017 compared with KN773 per kWh in 2011—an increase of more than 30%.

b. Meeting Demand for Power Export

41. Power export to neighboring countries is an important policy objective of the Lao energy sector. The Lao PDR has signed memoranda of understanding with Thailand and Viet Nam, under which the Lao PDR will export 7,000 MW of hydropower to Thailand and 3,000 MW to Viet Nam by 2020. Since the commissioning of the Theun Hinboun, Nam Theun 2, and Nam Ngum 2 HPPs, power exports have become a vital source of income for the Lao PDR.

42. Revenues generated from electricity exports are in the form of royalties, taxes, and dividends. These revenues help the government improve funding for education, health, and other social services critical to poverty reduction. In the framework of the Nam Theun 2 project, the government, with assistance from ADB and the World Bank, designed a revenue management scheme under which revenues received from the project will be channeled to eligible rural development and poverty reduction programs. The scheme includes a set of eligibility criteria, procedures for appraisal, and approval of programs to be funded by revenues from the project. Since commercial operation started in 2010, the project has been an important source of revenue for the government (Table 6).

Table 6 Revenue from Power Export (Example of Nam Theun 2 Project)
(\$ million)

Item	2010	2011	2012
Royalties	9.02	11.66	14.91
Dividends		14.67	15.50
Total	9.02	26.33	30.41

Source: Nam Theun 2 Power Company.

43. There are, however, challenges associated with large hydropower projects that have to be addressed:

- (i) ensuring that negative social and environmental impacts are properly assessed and minimized,
- (ii) balancing domestic consumption needs and export opportunities,
- (iii) optimizing trade-offs between short-term benefits (e.g., dividends from equity participation in IPPs) and longer-term benefits (e.g., unified transmission network with interconnection to GMS countries), and
- (iv) mobilizing and managing financial resources in a manner that avoids damage to other components of the economy (e.g., exchange rate effects on agriculture and other exports).

⁴ EDL receives electricity equivalent of 60 MW from Theun Hinboun and 20 MW from Nam Lik 1/2. For the rest of its share holdings, EDL receives cash dividends.

44. As described earlier, IPPs build and own dedicated high-voltage transmission lines directly connected to demand centers outside the country but not connected to the Lao PDR network. Many more lines are being planned by investors to serve electricity exports to Thailand and Viet Nam, including the Hongsa–Mae Moh (EGAT Thailand) transmission line. These dedicated lines cross the Lao countryside without providing service to any customers or towns en route, and do not assist in improving the national grid. The IPPs and importers often use reliability and stability concerns as reasons for not connecting to the Lao national grid. These concerns can and will be effectively addressed in the longer term by improving the stability and reliability of the Lao network, as well as by implementing binding grid codes and technical performance standards among GMS countries.

A. Government Strategy, Policy, and Plans

45. As noted in the background context for this report, the Seventh NSEDP includes the following objectives: poverty eradication; sustainable economic growth and rural development; achievement of the Millennium Development Goals by 2015; graduation from least-developed country status by 2020; and sustainable economic, social, and environmental development. Energy efficiency is emphasized, including through regional integration, to help optimize energy generation and use among GMS countries. Development of the energy sector will focus on the twin goals of meeting domestic demand and realizing the Lao PDR's electricity export potential. Investment in hydropower and other renewable energy sources will be a priority.

46. The NSEDP sets specific targets for the energy sector, including eight new hydropower stations with an installed capacity of 2,862 MW (15,321 GWh annual production); expansion of the on-grid and off-grid transmission networks to reach 80% of households by 2015; integration of the power grids between the northern, central, and southern parts of the country; and construction of a 500 kV transmission line system with neighboring countries, especially Thailand and Viet Nam.

47. The NSEDP also includes measures necessary to achieve the specified targets: improving the legal and regulatory framework, streamlining coordination procedures among government agencies, developing a strategic forward investment plan for the sector, strengthening human resources in the Lao PDR's energy agencies, and mobilizing the necessary financial resources. While EDL has prepared a power development plan, formulation of a national energy policy is still a work in progress.

B. ADB Sector Support Program and Experience

48. The Asian Development Bank's (ADB) country partnership strategy (CPS) 2012–2016 for the Lao PDR is designed to promote pro-poor sustainable growth, foster inclusive social development, and support good governance. Key themes to be addressed through ADB activities include capacity building, empowering women, promoting private sector development, improving environmental management, and seeking greater synergies between regional and national programs. The CPS indicates that ADB assistance will focus on (i) policy and institutional reform, (ii) strategic investments in priority sectors, (iii) improved public expenditure management, and (iv) a national sector-specific approach rather than a regional geographic approach.

49. The CPS points out that the Lao PDR is well endowed with a vast quantity of economically viable hydropower resources and has already established a strong GMS presence in the export of electricity. Forging suitable public–private partnerships (PPPs) to develop the country's vast hydropower resources in an environmentally, socially, and fiscally responsible manner is central to the country's long-term development.

50. **ADB experience.** Through its long-term engagement, ADB has made substantial contributions to development of the Lao PDR's energy sector. ADB's total assistance from 1971 to 2012 amounted to \$602 million in loans and grants⁵ and almost \$15 million in technical assistance (Appendix 3, Tables A3.7b–A3.7c). Between 2000 and 2011, ADB approved support for four major energy projects: (i) Nam Theun 2 HPP, (ii) Northern Area Rural Power Distribution project, (iii) GMS–Northern Power Transmission project, and (iv) GMS Nam Ngum 3 hydropower project.⁶ ADB support to the Lao PDR energy sector has focused mainly on the following:

- (i) **Helping the Lao PDR increase its generation capacity.** This assisted the country in meeting increasing demand for electricity by households and industry. In so doing, ADB emphasized development of hydropower in an environmentally sustainable manner through PPPs. Notable examples of ADB's role in promoting PPPs are the financing arrangements for supporting the Theun Hinboun, Nam Theun 2, and Nam Ngum 3 hydroelectric projects,⁷ whereby ADB provided both public sector loans to the government and private sector loans to the project companies. ADB financing provided security to private investors while ensuring best practices in social and environmental matters. Total loans to the energy sector, including for PPPs, was \$497 million by the end of 2012.
- (ii) **Helping the Lao PDR significantly expand its transmission and distribution network.** This directly contributes to achieving the rural electrification objectives of the government. ADB projects focused on providing electricity access to the rural poor through its Power-to-Poor program.⁸ Total loans and grants for this dimension of ADB's support amounted to \$84 million.
- (iii) **Enhancing the capacity of EDL's staff in technical and procurement matters.** This included training in social safeguard policies (e.g., ADB and World Bank policies) and strengthening capacity of MEM and MONRE staff in monitoring the implementation of social and environmental protection programs.

51. ADB support in the Lao PDR will continue to focus on stimulating economic growth and achieving poverty eradication. ADB will continue supporting the government's initiatives to (i) increase household access to electricity, (ii) build a national unified transmission and distribution network with cross-border interconnections, and (iii) develop hydropower in an environmentally and socially sustainable manner.

52. ADB support will be provided primarily through the GMS Program of Economic Development, which will work with ADB's Private Sector Operations Department to promote opportunities for PPPs for investing in the energy sector. ADB will also draw on its new financial instruments, including partial risk and other forms of guarantees, to help improve the availability and terms of financing for private-sector-led power generation projects.

53. Under the GMS program, ADB will continue to facilitate cross-border grid interconnections and power trade with countries bordering the Lao PDR. It will also contribute to strengthening and

⁵ This includes private sector loans to the Nam Theun 2 project (\$50 million) and Nam Ngum 3 project (\$200 million).

⁶ ADB. 2003. *Loan to the Lao People's Democratic Republic (PDR) for the Northern Area Rural Power Distribution Project*. Manila (Loan 2005); ADB. 2005. *Loan to the Lao PDR for the Greater Mekong Subregion (GMS) Nam Theun 2 Hydropower Development Project*. Manila (Loan 2162); ADB. 2010. *Grant to the Lao PDR for the GMS Northern Power Transmission Project*. Manila (Grant No. 0195); ADB. 2011. *Loan to the Lao PDR for the Nam Ngum 3 Hydropower Project*. Manila (Loan 2818/2819).

⁷ ADB. 1994. *Loan to Lao PDR for the Theun-Hinboun Hydropower Project*. Manila (L1329); ADB. 2005. *Loan to the Lao PDR for the Greater Mekong Subregion (GMS) Nam Theun 2 Hydropower Development Project*. Manila (Loan 2162); ADB. 2011. *Loan to the Lao PDR for the Nam Ngum 3 Hydropower Project*. Manila (Loan 2818/2819).

⁸ ADB. 2010. *Grant to the Lao PDR for the GMS Northern Power Transmission Project*. Manila (Grant No. 0195).

expanding the national transmission grid. Priority will be accorded to high-voltage transmission facilities to help the Lao PDR build a nationally unified transmission and distribution network that is technically suitable for interconnection with GMS countries. ADB will also support promotion of renewable energy and energy efficiency through regional technical assistance projects. ADB expects that its activities will lead to steady improvement in the national electrification ratio and increased electricity exports, thereby contributing to the government's revenue base and ability to provide services critical to poverty reduction.

C. Other Development Partner Support

54. Other major external supporters of the Lao PDR's energy sector are the World Bank, the Japan International Cooperation Agency (JICA), and the Government of Finland. Additional development partners include the Australian Agency for International Development, KfW of Germany, the People's Republic of China, the Republic of Korea, and the Swedish International Development Cooperation Agency.

55. The World Bank is engaged in technical assistance and in financing energy projects. The World Bank's technical assistance is focused on tariff reform and energy efficiency. Investment support is focused on energy efficiency and loss reduction, and rural electrification. Currently, the following programs are active:

- (i) **Strengthening capacity building for the hydropower and mining sectors.** A training center for the hydropower and mining sectors will be established, supervised by the MEM. Training will include mapping of resource areas and understanding of the regulatory framework and procedures.
- (ii) **Electricity tariff study.** The study is an update of a previous study which reviews the tariff structure, tariff levels, and adherence to covenants. It also assesses the financial resources needed to realize the ambitious investment plans for the sector.
- (iii) **Rural electrification.** Phases 1 and 2 of the World Bank's rural electrification project were implemented during 2005–2012. The project was designed to both increase access to electricity for rural households in targeted provinces and improve the financial performance of the power sector. The project extends electrification to about 42,000 rural households through connection to EDL's grid and provides electrification to about 10,000 households through off-grid technologies.
- (iv) **Load dispatch center.** The World Bank is providing technical assistance and financial assistance to establish three load dispatch centers (north, central, and south); the central region's dispatch center will also function as the national load dispatch center. Financing supplementary to that provided by the World Bank is being negotiated with the China Export–Import Bank.
- (v) **Demand-side management.** The World Bank is assisting EDL to continue DSM initiatives. Initially, 10 ministries (buildings) will be selected and energy audits will be conducted.

56. JICA's focus areas of assistance have included planning and feasibility studies of HPPs and investment support for power transmission and distribution.⁹ To help foster industrialization and poverty reduction, JICA's assistance will include (i) expanding power facilities including transmission networks, (ii) promoting rural electrification, and (iii) supporting institution building and human resource development.

⁹ All projects funded by Japan Bank for International Cooperation, which was merged with JICA, are listed and identified in this report as JICA projects.

Box 1 The Lao People's Democratic Republic Demand-Side Management and Energy Efficiency Program

The Lao People's Democratic Republic demand-side management and energy efficiency program (DSM/EE) was supported under the World Bank's Rural Electrification Project Phase 1. Implementation of DSM/EE Phase 1A commenced in February 2007 and was completed in September 2008. This phase included establishment and building capacity of a DSM cell within Electricité du Laos (EDL), focusing on public sector consumption (which accounts for most of EDL's current billing arrears), developing an energy use database, conducting energy audits in selected public buildings, implementing energy efficiency measures in pilot sites, launching a public awareness campaign, and developing a results monitoring program for the DSM/EE component of the Rural Electrification Project Phase 1.

DSM/EE Phase 1B included revising the DSM/EE program plan for 2008–2012, preparing career development and capacity building plans for the DSM cell staff and energy coordinators, implementing energy efficiency measures for the initial 50 audited buildings, implementing an air-conditioner maintenance program, conducting detailed audits in selected hospitals, expanding the energy database to include all public sector accounts, designing residential sector efficient lighting programs, and conducting appliance saturation surveys to facilitate an appliance energy standards and labeling program.

57. JICA only supports those initiatives that improve services to customers in the Lao PDR; JICA's assistance is, therefore, limited to projects and programs executed by EDL and excludes projects for the export of electricity.

58. The focus for Government of Finland support is renewable energy. A project titled Preparation of Renewable Energy Strategy and Capacity Building has recently been completed. Support also included capacity building for energy efficiency.

59. This review of assistance by the Lao PDR's development partners (Appendix 2, Table 2.2) indicates that the assistance has been in line with the policies and plans of the government to increase electrification, improve transmission, further interconnect the regional grids, increase hydropower generating capacity, and strengthen institutional capacity. Greater support, however, is needed in the following areas: small hydropower development and engagement of the private sector in such efforts; capacity building in national energy planning, policy analysis, and information management; and energy efficiency, including DSM. ADB will consider undertaking new activities in the area of energy planning, energy efficiency, and associated capacity building to complement the work being done by the World Bank. Similarly, on renewable energy development, ADB will complement the work being initiated by the Government of Finland.

D. ADB Self-Evaluation

60. **Self-evaluation.** A sector assistance program evaluation report conducted in 2010¹⁰ assessed ADB's assistance to the Lao PDR energy sector *successful*, based on relevance, efficiency, effectiveness, sustainability, development impact, and strategic positioning.¹¹ ADB interventions have been consistent with government policies, programs, and priorities and have enabled positive outcomes at the national level (e.g., boosting foreign exchange earnings) and the local level (e.g., increasing electricity access).

61. The sector assistance program evaluation report for the energy sector recommended the following:

- (i) ADB's public and private sector operations should continue to provide financial assistance, particularly for large hydropower projects meeting environmental and social safeguards and for grid expansion and rural electrification projects.

¹⁰ ADB. 2010. *Energy Sector in Lao Peoples' Democratic Republic Program Evaluation Report*. Manila.

¹¹ A weighted score of 2.1 was assessed out of a total of 3.0. A score of between 1.6 and less than 2.7 is rated *successful*.

- (ii) ADB's capacity building interventions should focus on increasing electricity access, improving operational and financial efficiency of the power utility, and better management of large hydropower projects.
- (iii) ADB should conduct policy dialog in support of formulating a comprehensive energy policy and the integration of power systems in the GMS.

62. **Lessons learned.** Based on the above, the following lessons are relevant to the energy sector:

- (i) One-off and/or stand-alone capacity building interventions are ineffective in addressing environmental and social concerns linked to the energy sector. A continuous stream of interventions is necessary to improve the capability of MONRE, including at the provincial and local levels, to address environmental and social impact analysis and management capabilities. ADB's capacity building interventions should enable MONRE to certify only well-prepared environmental and social studies, ascertain that the findings from stakeholder consultations are properly taken into account in the proposed environmental and social impact mitigation plan, assure that the hydropower developers allocate sufficient financial resources to manage environmental and social risks, and support inputs to the MEM in negotiating the concession agreements.

Environmental and social interventions regarding energy projects need to be carefully designed, taking into account the large number of issues, stakeholders, and interest groups and the extensive geographic area involved. Compliance with environmental and social safeguards may be more sustainable if the responsibilities are shared among the government, developer, and sponsor according to their capabilities and comparative advantage. ADB monitoring of environmental and social implementation is critical to ascertaining compliance of hydropower projects with environmental and social safeguards. ADB experience with the Theun Hinboun and Nam Theun 2 HPPs demonstrates that, even after loan closure, environmental and social safeguards must continue to be closely monitored and enforced. The Nam Theun 2 concession agreement makes specific provision for this.

- (ii) Affordability of electricity tariffs is critical to achieving the government's goals of rural electrification and 90% electricity access. EDL needs to pursue measures that will help to reduce the cost of supply (and hence mitigate the need to raise tariffs), including reducing technical and nontechnical transmission and distribution losses, more strictly managing accounts receivable, implementing DSM measures, and extending credit for payment of service connection costs.

E. ADB Sector Forward Strategy

1. Knowledge Gaps

63. There is a significant knowledge gap between the current capacity of the energy sector and its envisaged role as a major spur to socioeconomic development in the Lao PDR. This gap is illustrated by the lack of a national energy policy framework, without which it is very difficult to reconcile consumer, producer, and market needs and forces.

64. The knowledge gap is further illustrated by limitations in the government's capacity to keep pace with IPP developments, and in balancing long-term objectives and short-term perspectives (e.g., increased electricity exports independent of development of the national transmission network).

65. ADB's forward strategy in support of the Lao PDR energy sector is based on prioritization of the list of desired actions, interventions, and projects. Table A3.7a in Appendix 3 gives a list of

activities that the MEM would like to see undertaken during 2010–2020. Energy sector needs fall into six thematic areas:

- (i) improved access to electricity,
- (ii) meeting the rapidly increasing domestic demand and grid integration,
- (iii) maximizing the benefits of hydropower export projects,
- (iv) renewable energy and energy efficiency promotion,
- (v) energy policy and planning, and
- (vi) capacity building.

66. ADB has drawn on this list consistent with the CPS, which emphasizes hydropower development, exports of hydropower, transmission development, rural electrification, renewable energy, and energy efficiency.

2. Lending and Nonlending Program and Resource Needs

67. For 2012–2017, it is proposed that ADB assistance programs for the Lao PDR energy sector focus on three thematic areas: rural electrification, maximizing benefits from hydropower development, and renewable energy and EEC. In addition, the Lao PDR will benefit from the ADB GMS program, which provides technical assistance for six countries in the GMS. The program will consist of lending and nonlending products as detailed in the sector results framework (section III of this report).

a. Lending and Nonlending Program

i. Lending Products

68. **Rural electrification.** ADB loan and grant assistance for rural electrification will continue to focus on the poorest regions of the country, notably the north. ADB financed the now-completed Northern Area Rural Power Distribution Project¹² and is now implementing the GMS Northern Power Transmission Project.¹³ EDL estimates that about 46,000 new connections will be needed between 2013 and 2016 to reach the national goal for increased electrification. To achieve this goal, effective implementation of the ongoing GMS Northern Power Transmission Project at the 115 kV level and the distribution system in northern provinces with power access to the poor will be crucial.

69. **Maximizing the benefits of hydropower development and exports.** ADB loan support (for both the private and public sectors) will focus on strengthening the enabling environment for investment in hydropower development and increased power exports, while ensuring that the benefits for the Lao PDR are maximized. ADB's support will be double-tracked: (i) development of hydropower projects through financing by the Private Sector Operations Department; and (ii) loan and grant support for new 115 kV, 230 kV, and 500 kV transmission systems. This two-tracked support will enable EDL to channel its share of electricity from hydropower export projects to domestic customers. It will also enable EDL to link the national transmission system with the high-voltage transmission systems serving export customers, maximizing the benefits of such infrastructure for the Lao PDR.

¹² ADB. 2003. *Loan to the Lao People's Democratic Republic for the Northern Area Rural Power Distribution Project*. Manila (Loan 2005).

¹³ ADB. 2010. *Grant to the Lao People's Democratic Republic for the Greater Mekong Subregion Northern Power Transmission Project*. Manila (Grant No. 0195).

The Lao PDR has reached the stage where development of a national high-voltage network is essential. Planned activities include development of the Nabong 500 kV substation and transmission facility in the central region, and the Ban Hatxan Pleiku 500 kV transmission line in the southern region. Financing of hydropower projects with public-private participation will be continued through ADB's Private Sector Operations Department.

ii. Nonlending Products

70. **Promoting renewable energy and energy efficiency.** ADB technical assistance for renewable energy and energy efficiency will focus on support for capacity building in the MEM. Specific areas of technical assistance will include the following:

- (i) Renewable energy:
 - (a) support for the comprehensive renewable energy strategy and action plan;
 - (b) investment support for small hydropower projects;
 - (c) a mechanism to enable local investors to develop small HPPs and supply the grid (or mini grids), using a yet-to-be-developed standardized agreement and pricing policy; and
 - (d) off-grid projects.
- (ii) Energy efficiency:
 - (a) promotion of off-grid projects;
 - (b) support for a comprehensive energy efficiency strategy and action plan;
 - (c) continued implementation of energy efficiency initiatives for government buildings;
 - (d) capacity to conduct energy audits and formulate projects;
 - (e) energy efficiency standards and labeling; and
 - (f) legislation to promote energy efficiency.

71. GMS regional cooperation focuses on developing the regional electricity trade in an environmentally sustainable manner. This is to make use of the diverse regional energy resources and optimize power supply in meeting varying demand profiles across the subregion. ADB strongly supports regional power trade as an important element of its emphasis on regional economic cooperation. The next development in this regard is establishment of a regional power coordination center to represent the GMS countries on coordination matters, prepare technical standards and grid codes for intercountry connections, and enhance the regulatory framework of GMS countries for advancement of a regional power market.

b. Resource Needs

i. Lending Products

72. The government plans to tender 12 HPPs over the period until 2020, including Nam Ngum 3, Nam Nghiep 1, Nam Nghiep 2, Nam Theun 1, Xepian Xenamnoi, Xekaman 4, and the Xekong HPP. The total investment required for these projects is estimated to be \$4 billion. The ADB Private Sector Operations Department will consider providing loans to these HPPs, subject to their compliance with ADB technical economic and financial requirements and, very importantly, ADB's Safeguard Policy Statement (2009). It is estimated that the total financing support in this sector amounts to \$400 million for the Nam Nghiep 1 and Xepian Xe Nam Noi projects.

73. A number of high-voltage transmission lines are planned for exporting electricity to Thailand and Viet Nam. ADB will consider providing loans to the government for construction of these transmission lines and incorporating them with the EDL network. It is estimated that about \$300 million will be needed to finance development of the Nabong 500 kV substation and transmission facility in the central region and the Ban Hatxan Pleiku 500 kV transmission line in the southern region.

ii. Nonlending Products

74. It is proposed that \$3 million will be provided in technical assistance in support of EEC-related capacity building and implementing the renewable energy policy and strategy, including comprehensive resource assessment; promotion of applications of solar energy; and small and mini hydro, especially for off-grid rural uses.

75. **Risk and assumptions.** The fundamental assumption for ADB's proposed strategy of support for the energy sector is that the government will implement the NSEDP, 2011–2016, which includes targets for provision of reliable and sustainable energy for domestic and export markets. Since a comprehensive national energy policy is still under preparation, the Power Development Plan for 2010–2030 serves as the basis for ADB's energy strategy for the Lao PDR.

76. As highlighted in this report, there are many challenges that must be addressed in endeavoring to achieve the government's targets for the energy sector. Financing is a key challenge and one for which ADB can make an important contribution—through leveraging both public and private sector funding. It is assumed that other development partners will continue to support the energy sector in a collaborative manner with ADB.

77. ADB's proposed strategy of support for the Lao PDR energy sector is subject to three main risks. First, the Lao PDR has a limited capability to manage energy projects. Skilled human resources are required to actively participate in project identification and development in assessing social and environmental impacts, project appraisal, and project implementation and management. Second, there is the risk that the influx of private developers looking for business in the Lao PDR will increase the risk that government agencies will make the wrong choices—choosing “easy” projects at the expense of environmental protection and social impact mitigation. Third, and related to the first two risks, delays in securing IPPs would impact negatively on the government's export target. For the ADB program, this would affect support for a unified national transmission network, as well as for high-voltage transmission interconnection projects.

78. The proposed ADB strategy in support of the Lao PDR energy sector integrates risk mitigation. The importance of capacity building for MEM and EDL staff is emphasized. With appropriate training, staff of the MEM and EDL will be better able to appraise and approve the most technically sound and economically efficient project proposals. In the same manner, well-trained and experienced staff of key government agencies (e.g., the MEM and MONRE) will be able to properly prioritize power projects and ensure that project developers apply the best practices in meeting social and environmental safeguards. The proposed ADB strategy includes nonlending program support for capacity building to mitigate the first and second risks. The third risk will be mitigated through synchronization of project implementation. The ADB strategy includes support in partnership with both the public sector (for transmission network projects) and the private sector (for hydropower projects).

79. In summary, the proposed ADB strategy in support of the Lao PDR energy sector is based on the needs of the country as identified by the government. While there are some risks associated with implementation of the strategy, appropriate risk mitigation measures have been incorporated.

Sector Road Map and Results Framework

Sector Results Framework (Energy Sector, 2012–2017)

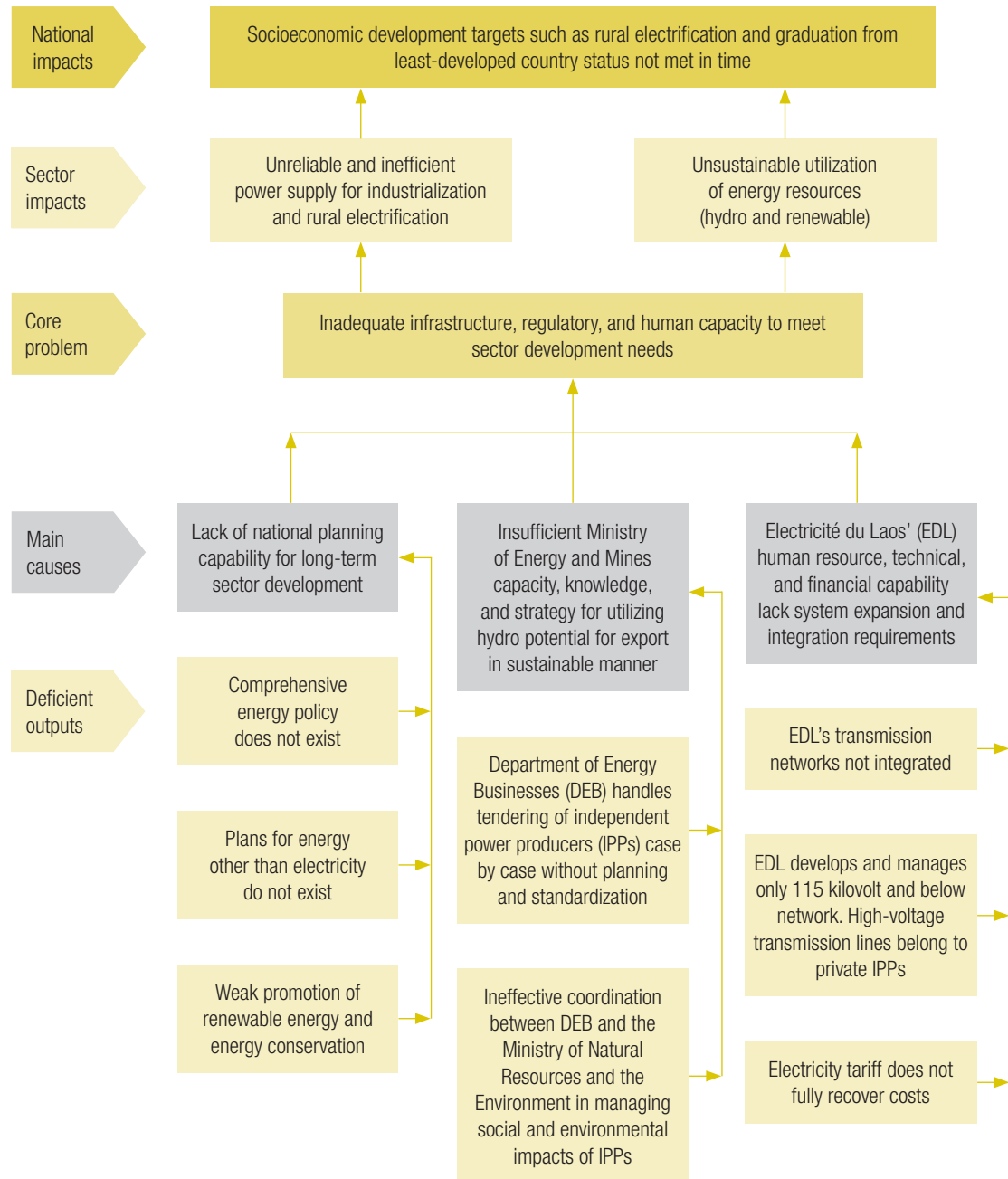
Country Sector Outcomes		Country Sector Outputs		ADB Sector Operations	
Outcomes with ADB Contribution	Indicators with Targets and Baselines	Sector Outputs with ADB Contribution	Indicators with Incremental Targets	Planned and Ongoing ADB Interventions	Main Outputs Expected from ADB Interventions
Improved physical infrastructure and enhanced institutional, regulatory, and human resource capacity to provide reliable and sustainable energy/ electricity supply	National transmission and distribution network unified with high-voltage system by 2020	Increased grid connection including high-voltage network and rural electrification	90% households having access to grid electricity by 2020; 400 km of 115 kV and 100 km of 500 kV transmission lines built by 2020	Planned key activity areas Transmission and distribution network including high voltage (85% of funds) Capacity building for renewable energy and EEC (15% of funds) Pipeline projects with estimated amounts Nam Ngum 3 hydroproject (SERD: \$115.4 million; PSOD: \$400 million) Nam Nghiep 1 hydro project (\$200 million) Na Bong Substation and Transmission Facilities (\$130 million) Ban Hatxan Pleiku 500 kV Transmission Project (\$130 million) Ongoing projects with approved amounts Northern Power Transmission Project (\$20 million and \$37 million cofinancing) Small and mini hydropower for electricity supply in rural areas	Planned key activity areas About 400 km transmission and distribution line built including 100 km of 500 kV lines National policy on renewable energy National policy on EEC Pipeline projects 440 MW hydropower station built 270 MW hydropower station built 2,000 megavolt-ampere substation built 27 km 500 kV line acquired 70 km 500 kV line built Electricité du Laos able to operate high-voltage substations Ongoing projects 400 km of 115 kV line built 16,000 households provided with access to grid electricity
	Capacity for effective energy policy formulation and planning in place by 2017	Institutions and institutional capacity established for renewable energy and energy efficiency and conservation	A division in charge of renewable energy development under the Department of Electricity; resource and technical assessment for small hydro, biomass, solar, and wind power projects		
	Effective institutional framework established by 2017 for coordinating the process for tendering hydropower projects for export; focus on improving the capacity of the DEB and MONRE	Improved coordination and approval of hydropower for export between DEB and Ministry of Energy and Mines and other government agencies	National EEC strategy and action plan prepared; full implementation of energy efficiency initiatives for government buildings		
Renewable energy and EEC frameworks by 2017	Increased use of renewable energy and practice of EEC	Detailed household and industry energy consumption surveys and audits			

ADB = Asian Development Bank, DEB = Department of Energy Businesses, EEC = energy efficiency and conservation, km = kilometer, kV = kilovolt, MONRE = Ministry of Natural Resources and the Environment, MW = megawatts, PSOD = Private Sector Operations Department, SERD = Southeast Asia Department.

Source: ADB.

Appendix 1

Sector Problem Analysis



Source: ADB.

Appendix 2

Sector Issues, Government Actions, and ADB Support

Table A2.1 Links between Sector Issues, Government Plan, Gaps, and ADB Summary Assessment of Plan Feasibility

Core Sector/ Subsector Issues (Constraints and Problems)	Government Plan	Policy, Institutional, Investment Action, and Resource Gap Needs	Remarks (On Plan Relevance and Feasibility, Implications)
Lack of national planning capability and institution to undertake long-term sector development	Preparation of a comprehensive national energy policy with assistance of JICA	Government reorganized Department of Electricity	Establishment of DEPP is a step in the right direction
	Regular update of Power Development Plan	Department of Energy Policy and Planning established, in charge of policy formulation	Assigning DEPP responsibilities for national energy policy and power development planning is sustainable
		DEPP needs to establish a standardized procedure for energy policy making and PDP	
Insufficient MEM capacity and strategy for developing hydro potential for export in a sustainable manner	No clear plan to improve the situation	Need to establish standardized set of criteria for large IPP hydropower projects	
	DEB and MEM still appraise projects on case-by-case basis without standardized set of criteria and procedures	Financing need is large	
	Often developers identify possible projects and make proposals to DEB		
EDL's human resource and technical and financial capability lack system expansion and integration requirements	Reorganize EDL toward unbundling (EDL-GEN created)	Need support for sector reorganization	Government program for enhancement of EDL financial and technical capability is relevant and feasible
	Mobilize financing from diversified sources leveraging development partner support	Need support in electricity pricing mechanism	
	Educate staff through project implementation	Need financing support (loans and grants)	

DEB = Department of Energy Businesses, DEPP = Department of Energy Policy and Planning, EDL = Electricité du Laos, EDL-GEN = EDL Generation Public Company, IPP = independent power producer, JICA = Japan International Cooperation Agency, MEM = Ministry of Energy and Mines, PDP = power development plan.

Source: ADB.

Table A2.2 Summary of Sector Issues, Government Action, Development Partner and ADB Support, and Key Lessons

Core Issue and Government Action	Other Development Partner Support	ADB Support
Need to increase EDL generating capacity to meet fast-growing demand	Development partners (e.g., World Bank and JICA) provide support for small off-grid hydro generating capacity for remote areas	ADB financed a number of hydropower generating plants
Government and EDL to implement Power Development Plan 2010–2030	Bilateral partners fund some hydropower projects	
Need to develop hydropower for export to generate revenue for country development	Development partners participate in financing a number of large hydropower projects	ADB provides support for selected large hydropower projects and leads the assessment, mitigation, and monitoring of social and environmental impacts
Government to call on diversified financing and technical sources		
Need to build a unified national transmission network and strong distribution system covering the entire country for universal electrification	Development of 115 kV and lower voltage level received strong support from many development partners	ADB strongly supported national electrification by providing two consecutive loans for constructing 115 kV transmission and distribution systems in northern region
Government is implementing rural electrification programs	The World Bank provided technical assistance and funding for rural electrification in the south and national dispatching centers	
	JICA supports rural electrification and integration of 115 kV systems	ADB support will continue upon government request
Need to develop high-voltage transmission system for interconnection with neighboring countries for integration within GMS	None	ADB to finance high-voltage transmission line projects: the Nabong–Udon Thani interconnection and the Ban Hatxan–Pleiku interconnection
Government is working with ADB in building up technical know-how, and financing interconnections with Thailand and Viet Nam		
Need to regularly conduct and update power master planning	JICA provided technical assistance and studies on power master plan	Not yet
Government established the Department of Energy Planning and Policy under MEM		
Need to regularly update National Energy Policy	Policy formulation supported by JICA and the World Bank	ADB plans to support
Need for institutional and organizational capacity improvement of energy and power sector	World Bank and JICA strong support	In plan
Need to establish appropriate electricity pricing mechanism to sustain power sector expansion and encourage electricity savings	The World Bank provided technical assistance for electricity tariff study, resulting in tariff reform	Not yet
Government established the Department of Energy Planning and Policy and called on development partners to support		
Need to establish a national policy framework for EEC	None	ADB provided a support to study the framework
Demand-side management	Support by the World Bank	
Need to establish a national policy framework for development and promotion of renewable energy	Support by the Government of Finland	ADB plans to support

ADB = Asian Development Bank, EEC = energy efficiency and conservation, EDL = Electricité du Laos, DEPP = Department of Energy Policy and Planning, GMS = Greater Mekong Subregion, JICA = Japan International Cooperation Agency, kV = kilovolt, MEM = Ministry of Energy and Mines.

Source: ADB.

Appendix 3

Data Tables and Figures

Table A3.1 Power Projects under Construction

No.	Project Name	Location (Province)	Installed Capacity (MW)	COD	Investor	Market
1	Hongsa Lignite	Xayabouly	1,878.0	2015	(i) Ratchaburi (Thailand) 40% (ii) BANPU (Thailand) 40% (iii) LHSE (Lao PDR) 20%	Thailand (95%) Lao PDR (5%)
2	Nam Long Hydropower	Luangnamtha	5.0	2013	Louangpaseuth Construction Company (Lao PDR)	Lao PDR
3	Nam Nghiep 2 Hydropower	Xiengkhouang	180.0	2015	CWE (PRC)	Lao PDR
4	Nam Ou 2	Phongsaly	120.0	2017	(i) EDL 10%–25%	Lao PDR
	Nam Ou 5	Luangprabang	240.0		(ii) Sinohydro (PRC) 75%–90%	
	Nam Ou 6 (Cascade)		180.0			
5	Nam Sim Hydropower	Houaphanh	8.0	2015	(i) Energy Development (Norway) 55% (ii) ECI (Lao PDR) 25% (iii) MDX (Thailand) 20%	Lao PDR
6	Xayaburi Hydropower (Mekong)	Xayabouly/ Luangprabang	1,285.0	2019	(i) EDL 20.0% (ii) Ch. Kanchang & PT 30.0% (iii) EGCO 12.5% (iv) Natec Synergy 25.0% (v) Bangkok KIK Expressway 7.5% (vi) PTT 5.0%	Lao PDR/ Thailand
7	Xekman 1 Hydropower	Attapeu	322.0	2015	(i) EDL (Lao PDR) 15% (ii) VLP (Viet Nam) 85%	Lao PDR/ Viet Nam
8	Xenamnoy 1	Attapeu	14.8	2013	Phongxubthavy Road and Bridge Construction Company	Lao PDR
9	Houy Lamphan Gnai Hydropower	Attapeu	88.0	2015	EDL	Lao PDR
10	Nam Khan 2	Luangprabang	130.0	2015	EDL	Lao PDR
11	Nam Sana	Vientiane	14.0	2014	EDL	Lao PDR
12	Nam Hinboun Hydropower	Khammouane	30.0	2015	EDL	Lao PDR

COD = expected commercial operation date, EDL = Electricité du Laos, Lao PDR = Lao People's Democratic Republic, LHSE = Lao Holding State Enterprise, MW = megawatts, PRC = People's Republic of China.

Source: ADB.

Table A3.2 Hydropower Projects with Project Development Agreements

No.	Project Name	Location (Province)	Installed Capacity (MW)	COD	Investor	Market
1	Don Sahong Hydropower (Mekong)	Champasack	240	TBD	(i) EDL (Lao PDR) 20% (ii) Mega First (Malaysia) 80%	Lao PDR/ Thailand
2	Nam Beng Hydropower	Oudomxay	34	2015	China National Electrical Equipment Corporation (PRC)	Lao PDR
3	Nam Kong 1 Hydropower	Attapeu	75	TBD	(i) LHSE (Lao PDR) 20% (ii) Region Oil (Russia) 80%	Thailand
4	Nam Kong 2 Hydropower	Attapeu	66	2015	Hoang Anh Gia Lai	Lao PDR
5	Nam Lik 1 Hydropower	Vientiane	60	2015	(i) EDL (Lao PDR) 20% (ii) Hydro Engineering Company (Thailand) 80%	Lao PDR
6	Nam Mang 1 Hydropower	Bolikhamxay	57	2015	Far-East Industrial Company	Lao PDR
7	Nam Mo Hydropower	Xiengkhouang	120	TBD	(i) NH. CIT 65% (ii) VLECG 35%	Viet Nam
8	Nam Nghiep 1 Hydropower	Bolikhamxay	289	2018	(i) LHSE (Lao PDR) 25% (ii) Kansai & Nippon Keoi (Japan) 45% (iii) EGAT Inter (Thailand) 30%	Lao PDR/ Thailand
9	Nam Ngum 3 Hydropower	Vientiane/ Xiengkhouang	460	2018	(i) LHSE (Lao PDR) 23% (ii) Marubeni (Japan) 25% (iii) Ratchaburi (Thailand) 25% (iv) GMS (Thailand) 27%	Thailand
10	Nam Phay Hydropower	Vientiane	86	TBD	Norinco International Corporation (PRC)	Lao PDR
11	Namphoun	Xayabouly	50	TBD	SOK Corporation	Lao PDR
12	Nam Phak Hydropower	Champasack	45	TBD	(i) EDL (Lao PDR) 20% (ii) Kobec Green Power Company (Japan) 80%	Lao PDR
13	Nam Pha Hydropower	Luangnamtha/ Bokoe	130	TBD	AP Bizlink Group (Malaysian)	Lao PDR
14	Nam Seuang 1 Hydropower	Luangprabang	94	2017	Bru Thai International	Lao PDR/ Thailand
15	Nam Seuang 2 Hydropower	Luangprabang	96	2017	Bru Thai International	Lao PDR/ Thailand
16	Nam Sum 1	Houaphanh	194	TBD	Saigon Investment Group	Lao PDR/ Viet Nam
17	Nam Sum 3	Houaphanh	196	TBD	Saigon Investment Group	Lao PDR/ Thailand
18	Nam Tha 1	Bokeo	168	TBD	(i) Government of Lao PDR 25% (ii) China Southern Grid 75%	Lao PDR

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Table A3.2 *Continued*

No.	Project Name	Location (Province)	Installed Capacity (MW)	COD	Investor	Market
19	Pakbeng (Mekong) Hydropower	Oudomxay/ Xayabouly	921	2018	(i) Government of Lao PDR 19% (ii) Datang Overseas Investment 81%	Lao PDR/ Thailand
20	Phou Ngoy (Mekong) Hydropower	Champasack	651	2018	Charoen Energy and Water Asia	Thailand/ Lao PDR
21	Sanakham (Mekong) Hydropower	Xayabouly/ Vientiane	660	2018	(i) Government of Lao PDR 19% (ii) Datang Overseas Investment 81%	Thailand/ Lao PDR
22	Se Kong 4 Hydropower	Xekong	300	TBD	(i) Region Oil (Russia) 80% (ii) LHSE (Lao PDR) 20%	Thailand
23	Se Kong 5 Hydropower	Xekong	330	TBD	(i) Region Oil (Russia) 80% (ii) Strategic partners to be invited	Thailand
24	Nam Pod	Xiengkhouang	15	TBD	ACE Consultant	Lao PDR
25	Xepian-Xenamnoy Hydropower	Attapeu/ Champasak	400	2018	(i) LHSE (Lao PDR) 24% (ii) SK Engineering & Construction (Republic of Korea) 26% (iii) Korea Western Power 25% (iv) Rachaburi Electric Generating Holding 25%	Lao PDR/ Thailand

COD = expected commercial operation date, EDL = Electricité du Laos, Lao PDR = Lao People's Democratic Republic, LHSE = Lao Holding State Enterprise, MW = megawatts, PRC = People's Republic of China, TBD = to be determined.

Source: ADB.

Table A3.3 Hydropower Projects at Feasibility or Memorandum of Understanding Stage

No.	Project Name	Location (Province)	Installed Capacity (MW)	Investor	Market
1	Ban Khoum (Mekong) Hydropower	Champasack	1,872.0	(i) Italian Thai (ii) Asia Corporation Holdings	Thailand/Lao PDR
2	Dake e meule Hydropower	Xekong	130.0	(i) EDL 25% (ii) Viet-Lao Power Company 75%	Viet Nam/Lao PDR
3	Houay Champi Hydropower	Champasack	5.0	SV Group	Lao PDR
4	Louangprabang (Mekong) Hydropower	Luangprabang	1,200.0	Petrovietnam Power Corporation	Lao PDR/Viet Nam
5	Nam Bak 1 Hydropower	Vientiane	160.0	Nam Ngum 2 Power Company	Thailand
6	Nam Bak 2 Hydropower	Vientiane	40.0	Nam Ngum 2 Power Company	Lao PDR/Thailand
7	Nam Feuang Hydropower	Vientiane	28.0	Yuan Provincial Power Investment	Lao PDR
8	Nam Ham Hydropower	Xayabouly	3.5	(i) EDL 20% (ii) Cobri Company 80%	Lao PDR
9	Nam Kong 3 Hydropower	Attapeu	45.0	Hoang Anh Gia Lai	Lao PDR
10	Nam Leng	Phongsaly	60.0	Hventure Capital and Equity	Lao PDR
11	Man Ma 1, 2, 3 Hydropower	Houaphanh	149.0	Linh JFC Electrical Construction Investment Joint Stock Company	Lao PDR/Viet Nam
12	Nam Mo 1 Hydropower	Xiengkhouang	55.0	(i) EDL 15% (ii) EVN International Joint Stock Company 85%	Viet Nam
13	Nam Mouan Hydropower	Bolikhambay	124.0	Chubu Electric Power (Japan)	Viet Nam
14	Nam Nga	Luangprabang	110.0	Douang Chalern Construction	Lao PDR
15	Nam Neun Hydropower	Houaphanh	65.0	(i) EDL 25% (ii) Indochina Consulting Group (Republic of Korea) 75%	Viet Nam
16	Nam Ngiep Mouang Mai Hydropower	Bolikhambay	38.0	Phongxubthavy Bridge Company	Lao PDR
17	Nam Ngum 4 Hydropower	Xiengkhouang	220.0	Saigon Investment Group	Lao PDR/Viet Nam
18	Nam Et 1, 2, 3 Hydropower	Houaphanh	420.0	Hoang Anh Gia Lai	Lao PDR/Viet Nam
19	Nam Phouan Hydropower	Xayabouly	60.0	(i) ECI Laos (ii) Velcan Energy	Lao PDR
20	Nam Poui Hydropower	Xayabouly	60.0	Mudajaya Corporation	
21	Nam Theun 1	Bolikhambay	523.0	Phongxubthavy Bridge Company	Lao PDR
22	Paklay (Mekong) Hydropower	Xayabouly	1,320.0	(i) CEIEC (ii) Sinohydro	Thailand/Lao PDR
23	Xekong Downstream Hydropower	Attapeu	76.0	V & H Corporation (Lao PDR)	
24	Xekong 3A, 3B Hydropower	Xekong	3A: 105.0 3B: 100.0	Song Da Corporation (Viet Nam)	Lao PDR/Viet Nam

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Table A3.3 *Continued*

No.	Project Name	Location (Province)	Installed Capacity (MW)	Investor	Market
25	Thakho Hydropower	Champasack	172.0	(i) EDL (ii) CNR (France)	Lao PDR
26	Xebanghieng 1 Hydropower	Savannakhet	50.0	CWE	Lao PDR
27	Xebanghieng 2 Hydropower	Savannakhet	52.0	CWE	Lao PDR
28	Xekaman 4 Hydropower	Xekong	80.0	Viet-Lao Power Company	Viet Nam
29	Xe Neua Hydropower	Khammouan	53.0	Phonesack Bridge & Road Construction Company	Lao PDR
30	Nam Ang Thabeng Hydropower	Attapeu	30.0	(i) ECI (Lao PDR) (ii) Velcan Energy (France)	Lao PDR
31	Xepien-Houaysoy Hydropower	Attapeu	100.0	Houay Ho Power Company	Thailand
32	Xelanong 1 Hydropower	Savannakhet	80.0	(i) Sunpaper Holding Lao (ii) Daosavanh Investment & Construction Group	Lao PDR
33	Xelanong 2 Hydropower	Savannakhet	50.0	China Gezlouba Corporation	Lao PDR
34	Xetanuan	Savannakhet	30.0	China Gezlouba Corporation	Lao PDR
35	Xesu	Attapeu	60.0	Hoang Anh Gia Lai	Lao PDR

CNR = Compagnie Nationale du Rhone, COD = expected commercial operation date, ECI = Electrical Construction and Installation Enterprise, EDL = Electricité du Laos, Lao PDR = Lao People's Democratic Republic, MW = megawatts.

Source: ADB.

Box A3.1 Renewable Energy Policy Target

The Government of the Lao People's Democratic Republic has targeted to increase the share of renewable energy to 30% of total energy consumption by 2025. Biofuel is expected to contribute 10% of total fuel consumption for the transport sector. A road map for achieving these targets has been drafted under the Renewable Energy Development Strategy.

With regard to promotion of biofuel (biodiesel and bioethanol), it is envisaged that the government will issue a decree on biofuels, creating an agency for regulating oil crop plantation, setting price references, and standardizing biofuels. Further, the decree is expected to address the promotion of partnership between crop production and biofuels production, public-private partnerships in pilot projects, and marketing.

The road map for small hydro projects sets out the necessary steps, including resource assessment and project planning, tendering procedures, and maintenance obligations. The road map for solar energy foresees the following steps: evaluation of previous programs, identification of suitable localities for new solar projects, pilot and demonstration projects, and scaling-up of pilot projects to service a large consumer base.

The potential for meeting the 30% target of total energy consumption through renewable energy sources is shown in the table.

Renewable Energies						
	Potential	2013	2020		2025	
Electricity Produced from	MW	MW	MW	ktoe	MW	ktoe
Small hydro	2,000	12	134	85	400	256
Solar	511	1	36	23	33	21
Wind	40		12	8	73	47
Biomass	938		24	16	58	37
Biogas	313		19	12	51	33
Solid waste	216		17	11	36	23
Geothermal	59					
Biofuels	million liters	million liters	million liters	ktoe	million liters	ktoe
Ethanol	600		106	178	150	279
Biodiesel	1,200	0.01	205	239	300	383
Thermal Energy from	ktoe	ktoe		ktoe		ktoe
Biomass	227			29		113
Biogas	444			44		178
Solar	218			22		109
Total	6,766			667		1,479

ktoe = kiloton of oil equivalent, MW = megawatts.

Source: Lao People's Democratic Republic. 2011. *Renewable Energy Development Strategy in Lao PDR*. Vientiane.

Table A3.4 Hydropower Plants under Electricité du Laos Administration

No.	Hydro Power Plant	Location (Province)	Installed Capacity (MW)	COD
1	Nam Dong Hydropower	Luangprabang	1.0	1970
2	Nam Ko	Oudomxay	1.5	1996
3	Nam Leuk Hydropower	Vientiane	60.0	2000
4	Nam Ngay	Phongsaly	1.2	2001
5	Nam Mang 3 Hydropower	Vientiane	40.0	2004
6	Nam Ngum 1 Hydropower	Vientiane	155.0	1971
7	Selabam Hydropower	Champasack	5.0	1970
8	Se Xet 1 Hydropower	Saravan	45.0	1990
9	Se Xet 2 Hydropower	Saravan	76.0	2009
Total			384.7	

COD = commercial operation date, MW = megawatts.

Source: EDL.

Table A3.5 Independent Hydropower Plants for Export

No.	Project Name	Location (Province)	Installed Capacity (MW)	COD	Investor	Market
1	Houay Ho Hydropower	Champasak/Attapeu	152	1999	(i) Glow Co. 67.25% (ii) EDL (Lao PDR) 20.00% (iii) Hamaraj Land & Development 12.75%	Thailand (86%) Lao PDR (14%)
2	Nam Ngum 2 Hydropower	Vientiane Province	615	2011	(i) Ch. Kanchang (Thailand) 28.5% (ii) LHSE (Lao PDR) 25.0% (iii) Ratchaburi (Thailand) 25.0% (iv) Bangkok Expressway PCL (Thailand) 12.5% (v) PT Construction & Irrigation Company (Lao PDR) 4.0% (vi) Shalapak Group (USA) 4.0% (vii) TEAM Consulting Engineering (Lao PDR) 1.0%	Thailand
3	Nam Theun 2 Hydropower	Khammouane/Bolikhamxay	1,075	2010	(i) EdF (France) 40% (ii) EGCO (Thailand) 35% (iii) LHSE (Lao PDR) 25%	Thailand (93%) Lao PDR (7%)
4	Theun-Hinboun Hydropower	Bolikhamxay/Khammouane	210	1998	(i) EDL (Lao PDR) 60% (ii) Nordic Group (Norway) 20% (iii) GMS (Thailand) 20%	Thailand (95%) Lao PDR (5%)
Total			2,052			

COD = expected commercial operation date, EdF = Électricité de France, EDL = Electricité du Laos, EGCO = Electricity Generating Public Company, GMS = Greater Mekong Subregion, LHSE = Lao Holding State Enterprise.

Source: EDL.

Table A3.6a Transmission Lines Development Plan in Northern Area, 2010–2020

No.	Project		Voltage (kV)	No. of Circuit	Length		Ownership	Status as of December 2012
	From	To			km	cct-Km		
1	Nam Nhon	Houayxay	22	1	32	32	IPP(d)	Completed
2	Nam Tha 3	Luangnamtha 1	22	1	5	5	EDL	Under Construction
3	Nam Ngum 5	Phonsavan	115	1	67	67	EDL	Completed
4	Nam Ngum 5	Vangvieng	115	2	75	150	EDL	Completed
5	Phonsavan	Muang Kham	115	1	56	56	EDL	Completed
6	Muang Kham	Xam Nuea 1	115	1	120	120	EDL	Completed
7	Pakmong	Oudomxay	115	1	52	52	EDL	Under Construction
8	Oudomxai	Na Mo	115	1	41	41	EDL	Under Construction
9	Sansouk	Pakmong	115	1	86	86	EDL	Completed
10	Nam Long	Viengphukha	22	1	44	44	IPP(d)	Planned
11	Na Mo	Boun Neua	115	1	102	102	EDL	Loan
12	Nam Ham 2	Paklay	22	1	50	50	EDL	Planned
13	Paklay	Tha Li	115	2	86	172	EDL	Loan
14	Paklay	Xayabouly	115	2	134	268	EDL	Loan
15	Paklay	Non Hai	115	2	104	208	EDL	Loan
16	Nam Sim	Xam Nuea 1	22	1	50	50	IPP(d)	Under Construction
17	LiMing (China)	Na Mo	230	2	108	216	IPP(d)	Study
18	Hinheup	Luangprabang 2	230	2	210	420	EDL	Under Construction
19	Na Mo	Oudomxay	230	2	50	100	IPP(d)	Study
20	Pak Beng	Luangprabang 2	230	2	145	290	IPP(d)	Study
21	Oudomxai	Pakmong	230	2	55	110	IPP(d)	Planned
22	Pakmong	Luangprabang 2	230	2	120	240	IPP(d)	Planned
23	Nam Thoung	Houayxay	115	2	55	110	EDL	Planned
24	Nam Boun 2	Boun Neua	22	1	45	45	EDL	Planned
25	Houayxay	Ton Pheung	115	2	65	130	EDL	Planned
26	Thavieng	Tha Bok	230	2	120	240	EDL	Planned
27	Tonphueng	Houayxay	115	2	62	124	EDL	Planned
28	Nam Ngiew	Thavieng	115	1	14	14	IPP(d)	MOU EDL Shareholder
29	Nam Ken	Nam Sana	22	1	16	16	IPP(d)	Planned
30	Nam Tha 1	Nam Thoung	115	2	42	84	EDL	Planned
31	Hongsa Lignite	Luangprabang 2	115	2	105	210	IPP(d)	Under Construction
32	Nam Khan 2	Luangprabang 2	115	2	36	72	EDL	Under Construction
33	Nam Beng	Pakbeng	115	1	12	12	IPP(d)	Study
34	Nam Pot	Thavieng	115	1	10	10	IPP(d)	Planned
35	Na Mo	Boun Neua	115	1	98	98	EDL	Planned
36	Luangnamtha 1	Nam Thoung	115	2	91	182	EDL	Loan
37	Na Mo	Luangnamtha 1	115	1	43	43	EDL	Loan
38	Nam Chien	Thavieng	115	2	35	70	EDL	Planned
39	Nam Phak	Na Mo	115	1	29	29	EDL	Planned
40	Nam Nghiep 2	Thavieng	230	2	19	37	IPP(d)	Planned

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Table A3.6a *Continued*

No.	Project		Voltage (kV)	No. of Circuit	Length		Ownership	Status as of December 2012
	From	To			km	cct-Km		
41	Nam Pha	Luangnamtha 2	115	2	50	100	IPP(d)	Planned
42	Nam San 3	Thavieng	115	1	21	21	IPP(d)	Planned
43	Nam Ou 6	Phongsaly	230	2	18	36	IPP(d)	Planned
44	Nam Khan 3	Nam Khan 2	115	2	45	90	EDL	Planned
45	Phongsaly	Nam Ou 5	230	2	48	96	IPP(d)	Planned
46	Pakmong	Nam Ou 2	230	1	28	28	IPP(d)	Planned
47	Nam Xam 1	Xam Nuea	115	1	90	90	IPP(e)	Planned
48	Muang Beng	Nam Tha 1	115	2	57	114	IPP(d)	Planned
49	Na Mo	Phongsaly	230	2	115	230	IPP(d)	Planned
50	Luangprabang 2	Xayabouly	115	1	76	76	EDL	Planned
51	Phongsaly	Nam Ou 7	230	2	55	110	IPP(d)	Planned
52	Nam Ou 1	Luangprabang 2	230	1	34	34	IPP(d)	Planned
53	Nam San 3 (Down)	Nam San 3	115	1	10	10	IPP(d)	Planned
54	Mekong Xayabouly	Xayabouly	115	2	21	42	IPP(e)	Planned
55	Mekong Luangprabang	Sensouk	115	2	16	32	IPP(e)	Planned
56	Mekong Pakbeng	Pakbeng	115	2	23	46	IPP(e)	Planned
57	Nam Ngum Xayabouly	Pak Ngen	115	2	18	36	IPP(d)	Planned
TOTAL (2010–2015)					2,760	4,525		
EDL					1,909	3,023		
IPP(d)					851	1,502		
IPP(e)					0	0		
TOTAL (2016–2020)					636	1,034		
EDL					121	166		
IPP(d)					365	658		
IPP(e)					150	210		
TOTAL (2010–2020)					3,413	5,595		
EDL					2,030	3,189		
IPP(d)					1,233	2,196		
IPP(e)					150	210		

cct-km = circuit kilometer, EDL = Electricité du Laos, GMS = Greater Mekong Subregion, IPP = independent power producer, km = kilometer, kV = kilovolt, MOU = memorandum of understanding.

Note: (d) denotes domestic IPP and (e) denotes IPP for export.

Source: EDL.

Table A3.6b Transmission Lines Development Plan in Central Area, 2010–2020

No.	Project		Voltage (kV)	No. of Circuit	Length		Ownership	Status as of December 2012
	From	To			km	cct-Km		
1	Pakxan	Thakhek	115	2	198	396	EDL	Completed
2	Nam Song	Vangvieng	22	1	28	28	EDL	Completed
3	Nam Gnuang 8	Khonsong	115	2	58	116	EDL	Under Construction
4	Vangvieng	Hinheup	115	1	41	41	EDL	Completed
5	Naxaythong	Pakthang	115	2	12	24	EDL	Study
6	Nam Sana Naxaythong	Vangvieng	22	2	40	80	EDL	Under Construction
7	Naxaythong	Nabong 1	230	2	40	80		Planned
8	Ban Don	Non Hai	115	1	54	54	EDL	Planned
9	Nam Mang 1	Tha Bok	115	1	12	12	IPP(d)	Planned
10	Khoksa at	Nabong 1	115	2	22	44	EDL	Planned
11	Tha Bok	Nabong 1	230	2	52	104	EDL	Planned
12	Nabong 1	Nong Khai 2	230	2	37	74	EDL	Planned
13	Nam Phai	Vangvieng	115	2	57	114	IPP(d)	Planned
14	Nam Bak	Tha Bok	230	2	50	100	IPP(d)	Planned
15	Nam Gnuang 8	Kengseuaten	115	1	20	2,035	EDL	Planned
16	Nam Theun 1	Khonsong	115	1	35	35	IPP(d)	Planned
17	Pakxan	Bungkan	115	1	11	11	EDL	Planned
18	Nam Ngum (Down)	Nabong 1	115	2	18	36	IPP(d)	Planned
19	Nam Ngiep 1	Pakxan	115	1	35	35	IPP(e)	Planned
20	Nam Phouan	Thavieng	115	2	38	76	EDL	Planned
21	Nam Theun 1	Thasara	230	2	53	106	IPP(e)	Planned
22	Nam Theun 1	Tha Bok	230	2	101	202	IPP(e)	Planned
TOTAL (2010–2015)					721	1,287		
EDL					602	1,061		
IPP(d)					119	226		
IPP(e)					0	0		
TOTAL (2016–2020)					137	193		
EDL					49	87		
IPP(d)					53	71		
IPP(e)					35	35		
TOTAL (2010–2020)					1,012	1,788		
EDL					651	1,148		
IPP(d)					172	297		
IPP(e)					189	343		

cct-km = circuit kilometer, EDL = Electricité du Laos, IPP = independent power producer, km = kilometer, kV = kilovolt.

Note: (d) denotes domestic IPP and (e) denotes IPP for export.

Source: EDL.

Table A3.6c Transmission Lines Development Plan in Southern Area, 2010–2020

No.	Project		Voltage (kV)	No. of Circuit	Length		Ownership	Status as of December 2012
	From	To			km	cct-Km		
1	Bang Yo	Jiengxay-Pakxong	115	2	10	20	EDL	Completed
2	Thakhek	Pak Bo	115	2	87	174	EDL	Completed
3	Xeset 1	Saravan	115	2	25	50	EDL	Under Construction
4	Xekaman 3	Xekong	115	1	100	100	EDL	Under Construction
5	Tadsalen	Muang Nong	22	1	37	37	IPP(d)	Under Construction
6	Saravan	Xekong	115	2	50	100	EDL	Under Construction
7	Xeset 3	Pak Xong	115	2	3	6	EDL	Planned
8	Xekaman-Xanxai	Saphaothong	115	2	51	102	EDL	Planned
9	Houaylamphan Gnai	Xekong	115	2	18	36	EDL	Under Construction
10	Sirinthon	Bang Yo	115	1	61	61	EDL	Planned
11	Taothan	Saravan	115	2	65	130	EDL	Planned
12	Nongdeun	Taothan	115	2	230	460	EDL	Planned
13	Pak Bo	Ban Na (Seno)	115	2	48	96	EDL	Planned
14	Ban Hat	Stungteng	230	2	91	182	EDL	Planned
15	Houay Champi	Salabam	22	1	38	38	IPP(d)	Planned
16	Saphaothong	Ban Na	115	1	123	123	IPP(d)	Planned
17	Muang Kalum (Lignite)	Saravan	230	2	46	92	IPP(d)	Planned
18	Nam Kong 2	Nam Kong 3	115	1	10	10	IPP(d)	Planned
19	Nam Kong 3	Saphaothong	115	1	26	26	IPP(d)	Planned
20	Pak Bo	Mukdahan	115	1	14	14	EDL	Planned
21	Ban Na (Seno)	Saravan	230	2	170	340	EDL	Planned
22	Ban Na (Seno)	Muang Phin	115	2	140	280	EDL	Planned
23	Muang Phin	Sepon Mining	115	2	136	272	EDL	Planned
24	Jiengxai	Bang Yo	115	1	10	10	IPP(d)	Planned
25	Pak Xong	Ban Hat	230	2	175	350	IPP(d)	Planned
26	Saravan	Pak Xong	230	2	75	150	IPP(d)	Planned
27	Muang Phin	Muang Nong	115	2	89	178	EDL	Planned
28	Xeset 3	Xeset 4	115	1	8	8	EDL	Planned
29	Nam Hinboun	Khonsong	115	1	15	15	EDL	Planned
30	Sepon 3 (Up)	Sepon 3 (Down)	115	1	6	6	IPP(d)	Planned
31	Sepon 3 (Up)	Muang Nong	115	2	49	98	IPP(d)	Planned
32	Mekong Tha kho	Tha kho T-Off	230	1	2	2	IPP(d)	Planned
33	Thavieng	Thasala	230	2	172	344	EDL	Planned
34	Thasala	Mahaxai	230	2	110	220	EDL	Planned
35	Mahaxai	Ban Na (Seno)	230	2	100	200	EDL	Planned
36	Sekong 4	Sekong	115	2	25	50	IPP(e)	Planned
37	Xekatom	Pak Xong	115	2	35	70	IPP(d)	Planned
38	Nam Phak/Houaykatam	Pak Xong	115	2	26	52	IPP(d)	Planned

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Table A3.6c *Continued*

No.	Project		Voltage (kV)	No. of Circuit	Length		Ownership	Status as of December 2012
	From	To			km	cct-Km		
39	Mekong Donsahong	Thakho T-Off	230	2	4	8	IPP(d)	Planned
40	Xelanong 2	Saravan	115	2	88	176	IPP(d)	Planned
41	Xelanong 1	Muang Nong	115	2	16	32	IPP(d)	Planned
42	Xeneua	Sepon Mining	115	1	60	60	IPP(d)	Planned
43	Xedon 2	Saravan	115	1	41	41	IPP(d)	Planned
44	Xebanghieng 1	Seno	115	2	65	130	IPP(d)	Planned
45	Xebangnouan	Taothan	115	2	36	72	IPP(d)	Planned
TOTAL (2010–2015)					2,008	3,566		
	EDL				1,411	2,624		
	IPP(d)				597	942		
	IPP(e)				–	–		
TOTAL (2016–2020)					742	1,383		
	EDL				382	764		
	IPP(d)				335	569		
	IPP(e)				25	50		
TOTAL (2010–2020)					2,786	5,021		
	EDL				1,793	3,388		
	IPP(d)				968	1,583		
	IPP(e)				25	50		
Whole Country								
TOTAL (2010–2015)					5,488	9,379		
	EDL				3,922	6,709		
	IPP(d)				1,567	2,670		
	IPP(e)				0	0		
TOTAL (2016–2020)					1,515	2,610		
	EDL				552	1,017		
	IPP(d)				753	1,298		
	IPP(e)				210	295		
TOTAL (2010–2020)					7,211	12,251		
	EDL				4,474	7,726		
	IPP(d)				2,373	4,076		
	IPP(e)				364	449		

cct-km = circuit kilometer, EDL = Electricité du Laos, IPP = independent power producer, JBIC = Japan Bank for International Cooperation, km = kilometer, kV = kilovolt.

Note: (d) denotes domestic IPP and (e) denotes IPP for export.

Source: EDL.

Table A3.7a Long List of Sector Needs

Function	Description of Need	Outputs	Institutional Responsibility	Related Ongoing Work, If Any	Will Be New for ADB
Sector: Energy	Subsector: Electricity	Thematic area in road map: (i) Improved access to electricity			
Improved access to grid electricity	Finance new transmission and distribution investments	A higher pace of grid-connected rural electrification	EDL	Rural electrification (grid) project financed by the World Bank	no
Off-grid/mini-grid services to remote communities	Finance new development of renewable energy-based off-grid facilities	A higher share of households provided with electricity services	Provincial departments of electricity	Off-grid rural electrification project financed by the World Bank	yes
Sector: Energy	Subsector: Electricity	Thematic area in road map: (ii) Meeting the rapidly increasing demand and grid integration			
Planning power generation investment and operations	Review the entire group of HPPs in various stages of planning and development, for optimal benefits Establish tools to optimize operation of the cascades and the entire generating system, for optimum benefits	Investment optimization model for the hydroelectric system	EDL MRC DOE/DEPD	<i>Mainstream Dam Cascade Optimization Study</i> , Compagnie Nationale du Rhone (CNR), 2008 <i>Power System Development Plan for Lao PDR</i> , Laymeyer International and Maunsell, 2004	yes
		DOE/DEPD uses the model in decision making			
		Operations planning model implemented and used for decision making EDL to use the optimization model for power development plan updates			
Verification of the status of older power plants	Examine efficiency across the operating regime of hydroelectric power plants	Recommendation for economically efficient repowering or upgrading of HPPs	EDL or IPP(d)	JICA has developed studies for several capacity expansion initiatives	yes
Power generation investments	Support development of new hydropower generation feasibility studies and project preparation	New power plants to meet the growing demand for electricity from existing customers and newly electrified areas	DEPD and EDL	A number of hydropower projects in various stages of development	no
	Investments in new projects				
	Support with equity				
Planning of power transmission	Examine the optimal timing of power transmission investments, especially for regional interconnections to establish the national grid	Regularly updated optimal transmission plan	EDL	Network master plan study (ongoing), JICA	yes
		Prioritization of investments		Studies conducted by EDL	
	Conduct regular optimization studies, with updates from generation project progress				

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Table A3.7a *Continued*

Function	Description of Need	Outputs	Institutional Responsibility	Related Ongoing Work, If Any	Will Be New for ADB
Investments in power transmission	Finance new transmission projects prioritized and included in the power development plan Specific transmission projects to absorb EDL share from export projects	A stronger regional as well as interconnected transmission network in Lao PDR Increase the present use of 1% to the maximum allowed in each concession agreement	EDL	Network master plan study (ongoing), JICA Power development plan, EDL	no
Sector: Energy	Subsector: Electricity	Thematic area in road map: (iii) Maximizing the benefits of hydropower export projects			
Long-term export planning and implementation	Long-term investment planning of export power plants and transmission lines Strategy for LHSE	A robust plan in which investment opportunities are prioritized Development of a transmission network up to 500 kV to serve both export and Lao PDR requirements, and an institutional mechanism for commercial implementation of transmission projects A strategic plan for LHSE, to achieve maximum benefits to Lao PDR from the export industry	DEPD, LHSE	Power System Development Plan for Lao PDR, Laymeyer International and Maunsell, 2004	yes
Generation projects for export	Invest in new power generation project and associated transmission lines	More export power plants built, and incomes contribute to economic growth	DEPD	Several projects at an advanced stage of preparation	
Sector: Energy	Subsectors: All	Thematic area in road map: (iv) Renewable energy and energy efficiency promotion			
Promotion and implementation of energy efficiency	Develop a new institution, strengthen capacity of existing institution Energy efficiency action plan and its implementation Legislation and promotion of energy efficiency	A new institution to promote and manage energy efficiency initiatives Energy efficiency action plan Capacity to conduct energy audits and formulate projects Data and instrument services Energy efficiency standards and labeling	A new a unit or a department under MEM, possibly with joint responsibilities for renewable energy	The World Bank has financed a limited capacity building program, some training opportunities, energy audits in government buildings	yes

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Table A3.7a *Continued*

Function	Description of Need	Outputs	Institutional Responsibility	Related Ongoing Work, If Any	Will Be New for ADB
Renewable energy development	Conduct resource assessment	A new institution to promote renewable energy	A new institution or a department under MEM, possibly with joint responsibilities for energy efficiency	Ongoing technical assistance by ADB to prepare a policy paper, rank small hydro projects and prepare feasibility for one model CDM-PDD	One activity ongoing
	Promote development	Renewable energy action plan			
	Facilitate investment works on both grid and off-grid facilities; includes use of renewable energy for electricity and thermal/motive power applications	Coordinate ongoing and future work on renewable energy			
	Develop a standardized agreement and tariffs for private investments in small power plants	Resource information services			
		A mechanism to enable small, local investors to develop small HPPs and supply the grid (or mini grids), using a standardized agreement and pricing policy, yet to be developed	EDL for any agreements and pricing policy for small renewable power plants	World Bank's project to serve 10,000 households with off-grid technologies	
				Finland's assistance to develop a renewable energy strategy, possibly the institutional structure and capacity building	
Sector: Energy	Subsectors: All	Thematic area in road map: (v) Energy policy and planning			
Policy, planning, and information	Develop: <ul style="list-style-type: none"> a national energy policy an energy plan an energy database Update regularly Conduct policy analysis	National energy policy	MEM	DOE/MEM prepares the <i>Electricity Statistics Yearbook</i> (most recent edition 2006)	yes
		20-year energy plan			
		Energy database (ex-post)			
		Future energy balance and strategic assessments			
		Annual publications			
Sector: Energy	Subsectors: All	Thematic area in road map: (vi) Capacity building			
Capacity building at LHSE	Build capacity of LHSE staff in: <ul style="list-style-type: none"> management of equity risk and reward-related advice financial evaluation of projects and contracts technical, engineering and environmental evaluation of projects 	A more responsive staff at LHSE actively participating in project evaluations and negotiations	LHSE	None	yes
		Maximum benefits to Lao PDR from the export of electricity			
Coal/Lignite	Building capacity at DOM to: <ul style="list-style-type: none"> evaluate resource potential assess mining applications monitor mining activities 	Overall capacity of MOM to evaluate mining proposals and monitor projects improved	DOM	None	yes
		Proposed coal/lignite mining for power generation assessed			

ADB = Asian Development Bank, CDM-PDD = Clean Development Mechanism Project Development Document, DEPD = Department of Energy Promotion and Development, DEPP = Department of Energy Policy and Planning, DOE = Department of Electricity, DOM = Department of Mines, EDL = Electricité du Laos, HPP = hydropower plant, IPP = independent power producer, IPP(d) = independent power producer for domestic consumption, JICA = Japan International Cooperation Agency, Lao PDR = Lao People's Democratic Republic, LHSE = Lao Holding State Enterprise, MEM = Ministry of Energy and Mines, MRC = Mekong River Commission.

Source: ADB.

Table A3.7b ADB-Approved Loans and Grants for the Energy Sector in the Lao People's Democratic Republic, 1994–2012

Project No.	Project Name	Fund Type	Date Approved	Amount Approved (\$ million)
I. Loans				
A. Hydropower Generation				
1. 1329	Theun-Hinboun Hydropower	ADF	8-Nov-94	60.00
2. 1456	Nam Luek Hydropower	ADF	10-Sep-96	52.00
3. 2162	GMS: Nam Theun 2 Hydroelectric	OCR	4-Apr-05	20.00
4. 2161/7210	Nam Theun 2 Power Company	OCR	4-Apr-05	50.00
5. 2818/2819	Nam Ngum 3 Hydropower Project	OCR ADF	3-Nov-11	115.12
6.	Nam Ngum 3 Hydropower Project (PSOD)	OCR	3-Nov-11	200.00
Subtotal				497.12
B. Transmission and Distribution				
7. 1308	Nam Ngum-Louang Prabang Power Transmission (Supplementary)	ADF	30-Aug-94	4.00
8. 1558	Power Transmission and Distribution	ADF	30-Sep-97	30.00
9. 2005	Northern Area Rural Power Distribution	ADF	18-Sep-03	30.00
Subtotal				64.00
C. Multisector (with energy-related component)				
10. 1867	Environment and Social Program	ADF	16-Dec-01	20.00
Total Loans				581.12
II. Grants				
11. 9034	Reduction Poverty Among Ethnic Minority Women in the Nam Ngum River Basin	ADF	12-Nov-03	0.53
12. 0195	GMS Northern Power Transmission Project	ADF	26-Jan-10	20.00
Subtotal				20.53
Total Loans and Grants				601.65

ADF = Asian Development Fund, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, OCR = ordinary capital resources, PSOD = Private Sector Operations Department.

Source: ADB.

Table A3.7c ADB-Approved Technical Assistance Projects in the Energy Sector in the Lao People's Democratic Republic, 1994–2012

TA No.	TA Name	Fund Source	Date Approved	Amount Approved (\$'000)
A. Energy Sector Development				
1. 2569	Corporate and Financial Development of Electricité du Laos	JSF	15-May-96	340.00
2. 2583	Power System Planning in the Ministry of Industry and Handicraft	JSF	7-Jun-96	600.00
3. 2728	Study for Establishing the National Grid Company	JSF	23-Dec-96	600.00
4. 3374	Power Sector Strategy Study	JSF	23-Dec-99	800.00
Subtotal				2,340.00
B. Hydropower Generation				
5. 2054	Theun-Hinboun Power (SSTA)	TASF	4-Jan-94	100.00
6. 3225	Analyzing and Negotiating Financing Options for Nam Leuk Hydropower Project Cost Overruns	TASF	16-Jun-99	140.00
7. 4213	GMS: Nam Theun 2 Hydropower Development	TASF	9-Nov-03	700.00
8. 4323	GMS: Nam Theun 2 Hydropower Development (Phase II)	TASF	29-Mar-04	1,000.00
9. 4921	Cumulative Impact Assessment for the Nam Ngum 3 Hydropower Project	JSF	21-Feb-07	983.00
10. 7094	GMS: Nam Theun 2 Hydroelectric Project – Social Safeguards Monitoring	TASF	7-Jul-08	400.00
11. 7227	Small and Mini-Hydroelectric Development	Finland	14-Jan-09	1,000.00
12. 7866	Renewable Energy Development in Remote Communities	JFPR	9-Sep-11	1,000.00
Subtotal				5,323.00
C. Transmission and Distribution				
13. 2479	Power Transmission and Distribution	JSF	18-Dec-95	250.00
14. 2926	Nam Ngum 500 kV Power Transmission	JSF	28-Nov-97	580.00
15. 3087	Northern Area Rural Power Distribution	JSF	14-Oct-98	510.00
16. 4816	GMS Northern Power Transmission	JSF	19-Jul-06	800.00
17. 7026	Na Bong–Udon Thani Power Transmission	JSF	12-Dec-07	760.00
Subtotal				2,900.00
Grand Total				10,563.00

GMS = Greater Mekong Subregion, JFPR = Japan Fund for Poverty Reduction, JSF = Japan Special Fund, kV = kilovolt, Lao PDR = Lao People's Democratic Republic, SSTA = small-scale technical assistance, TASF = Technical Assistance Special Fund.

Source: ADB.

Table A3.7d ADB Projects in Pipeline, 2011–2013

Project Name	Expected year for approval	Estimated Amount (\$ million)
A. Hydropower Generation		
Small and Mini-Hydroelectric Development	2014	15.00
Renewable Energy Development in Remote Communities	2014	25.00
Subtotal		40.00
B. Transmission and Distribution		
Na Bon–Udon Thani Power Transmission (500 kilovolt [kV])	2013	88.87
Ban Hatxa–Pleiku Power Transmission (500 kV)	2014	to be estimated
Nam Nghiep 1 Hydropower Project	2013	200.00
Xepian Xe Nam Noi Hydropower Project	2014	200.00

Source: ADB.

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Lao People's Democratic Republic: Energy Sector Assessment, Strategy, and Road Map 2013 Update

The Asian Development Bank (ADB) is preparing sector assessments, strategies, and road maps (ASRs) to help align future ADB support with the needs and strategies of developing member countries and other development partners. ASRs are a working document that helps inform the development of country partnership strategies. This energy sector ASR updates development issues, needs, and priorities of the Lao People's Democratic Republic (Lao PDR) for ADB's assistance in the coming years, with a focus on the electricity subsector. It highlights sector performance, priority development constraints, the government's strategy and plans, other development partner support, lessons learned from past ADB support, and possible future ADB assistance. The product serves as a basis for further dialogue on how ADB and the government can work together to achieve the government's goals of 90% electrification and sustainable development electricity sector in the Lao PDR in the coming years.

About the Asian Development Bank

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