

# Chapter 10

## Lao PDR Country Report

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## CHAPTER 10

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### 1. Background

#### 1.1. Socio-Economic Situation

Lao People's Democratic Republic (Lao PDR) is a landlocked country located in the middle of the Southeast Asian peninsula. It has a border with five countries – China in the north, Viet Nam in the east, Cambodia in the south, and Thailand and Myanmar in the west. Lao PDR has a total area of 236,800 square kilometres, about 70 percent of which is covered by mountains. Its population was 6,514,432 as of 2012, and the average population density is 27 persons per square kilometre. Lao PDR consists of 17 provinces, and its capital city is Vientiane with a population of 783,032.

Since Lao PDR had changed its economic policy to an 'open door' policy in 1986, the economy has been progressing and expanding rapidly. Gross domestic product (GDP) growth in 2012 was 8.0 percent, year-on-year, increasing to 36,659 billion kip at 2002 constant prices.<sup>1</sup> This is equivalent to US\$9.36 billion and amounts to a per capita income of US\$1,408. The economy has been changing gradually changing from agriculture-oriented activities to a wider range of activities such as services and industry. In 2012, the service sector had a share of 37.1 percent and the agriculture sector a share of 26.0 percent of total GDP. The share of the industry sector to GDP was 31.2 percent in 2012, and its share is expected to rise in the coming years due to large investments in mineral and hydropower sectors.

#### 1.2. Energy Supply–Demand Situation

Laos PDR's Total Primary Energy Consumption (TPEC) in 2012 was 2.63 Mtoe. The country's primary energy mix consists of four types of energy – oil, hydro, coal, and biomass. In 2012, electricity exports amounted to 0.47 Mtoe and accounted for more than half of total power consumed and 82.2 percent of total hydropower generation. The main fuel consumed in Lao PDR is biomass, because it is abundant and does not need to be purchased as a commercial commodity. Biomass remains an important energy source for cooking and for small industries, for which in 2012 it has accounted 1.5 Mtoe representing 65.6 percent of the TPEC. Consumption of oil products was the second largest after biomass. Lao PDR does not have any oil refineries and all consumption of oil products has

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<sup>1</sup> The World Bank (2015), *World Development Indicators*.  
<http://databank.worldbank.org/data/views/reports/tableview.aspx> (accessed June 2015).

been met by imports from Thailand and Viet Nam. In 2012, Lao PDR imported 0.54 Mtoe of oil products to supply the demand of the transport and other sectors. In 2012, 0.11 Mtoe of coal was consumed in Lao PDR, mainly in the industrial sector. In the near future, coal demand is expected to increase sharply as the first large coal power plant will start operating in 2015.

The power sector plays a major role in the country's economy. Electricity became a source of revenue from abroad and at the same time a source of energy for economic activities. The electrification ratio in Lao PDR was 80 percent in 2012. According to the Government of Lao PDR's plan, the country will strive to raise the electrification ratio to 90 percent in 2020. This plan is amongst the priorities of the government to eradicate the country's poverty. Considering the increase of electricity demand in Lao PDR and the power production for export, optimisation of the power sector will be necessary for the future supply of electricity.

Due to its geographic advantage, Lao PDR is known as a rich country in terms of hydropower resources, because it has many rivers. According to the Mekong River Commission Study in 1995, Lao PDR has a potential hydropower resource of 23,000 MW. However, up until 2012, only 2,966 MW of installed capacity or 12 percent of its total potentials had been realised. In 2012, Lao PDR produced around 12,760 GWh of electricity, of which 81 percent (equivalent to 10,319 GWh) was exported to Thailand and the remainder consumed domestically. Power export is projected to increase sharply because the government has made a commitment to help Lao PDR's neighbouring countries to meet their power demand. By 2020, it has agreed to export 7,000 MW to Thailand and 5,000 MW to Viet Nam. The power source for export is mainly from hydropower. One thermal power plant with 1,800 MW installed capacity named Hongsa Lignite Power Project, however, is being constructed for export purposes. More than 50 hydropower sites have been planned to meet the 2020 export target. Most hydropower projects for electricity export purposes are being developed by private foreign investors through the Build-Operate-Transfer (BOT) scheme.

## **2. Energy Policies**

Since the establishment of the Ministry of Energy and Mines in 2006, energy policy has gained much public attention and support in Lao PDR. The policy gradually evolved from just the power sector policy to broader energy policies towards development of sustainable and environmentally friendly energy sector. The improvement of energy policy could be credited to ASEAN for its close cooperation with its members.

### **1.3.1. Supply (Fossil, NRE, Nuclear, Biofuels, etc.)**

On the energy supply side, Lao PDR's government has taken a number of measures and devised strategies to ensure greater security of energy supply and promote sustainable development in the energy sector. For economic and social development, the government's aim is to provide energy security with sufficient energy supply at affordable prices without shortage or disruption. At the same time, the government attempts to reduce dependence on energy imports and gradually diversify its energy supply. Now the renewable energy policy has been approved as a government decree. It aims to increase the share of renewable energy in total energy supply by 30 percent by 2020. This policy

also targets a 10 percent blending of biofuels in the oil supply for the transportation sector and it is expected to help the country to reduce oil imports. As part of the energy mix, although there is no plan to construct a nuclear power plant in the medium term, the government is attempting to build its personal capacity to be ready to cooperate with other countries and develop nuclear power plants in the long term when it considers it to be necessary.

### 1.3.2. Total Primary Energy Consumption (Energy Efficiency and Conservation)

Lao PDR's Total Primary Energy Consumption (TPEC) increased significantly, from 1.20 Mtoe in 1990 to 2.63 Mtoe in 2012, and is projected to grow to 8.55 Mtoe by 2035. To meet this increase in demand, large investments will be required in the energy sector and the country will need to both to exploit more of its natural resources and import more oil from abroad. These can have a negative impact on the environment and increase greenhouse gas emissions. Therefore Lao PDR's government, through the Ministry of Energy and Mines (MoEM), is trying to tackle this energy issue, as reflected in its energy policy. For instance, one of the most effective measures and policies to minimise the associated issues, which the government is currently promoting, is the Energy Efficiency and Conservation programme. In it, a 10 percent reduction in energy consumption by 2020 in all sectors is being proposed to the government.

### 1.3.3. Creation of New Department

To promote greater security and sustainable development in energy supply, the government has frequently reviewed and improved energy organisation structures. Based on new developments in the country, suitable energy organisations are needed to efficiently manage the energy sector. For example, the Department of Electricity has been split into Department of Energy Policy and Planning, Department of Energy Management and Institute of Renewable Energy Promotion. The change aims to increase mandated responsibilities to accommodate a wide range of energy activities. Moreover, the energy market has been opened up to local and international investors. This strategy is aiming to promote competition and more investments in the energy industry. As a result, many new independent power producers (IPPs) have emerged to produce electricity for domestic and export requirements. Recently, Electricité du Laos (EdL), the state-owned power utility has been also divided into two companies: Electricité du Laos and Electricité du Laos–Generation (EdL–Gen).

## 2. Modelling Assumption

Lao PDR's GDP is projected to grow at an average annual rate of 7.0 percent from 2012 to 2035 and its population is projected to grow at an average annual rate of 1.5 percent. Since there are no national projections of growth rates up to 2035, the previous workshops recommended Lao PDR use growth rates of 7 percent for GDP and 1.5 percent for population, for the purpose of this study.

### 3. Energy and CO<sub>2</sub> Emission Outlook

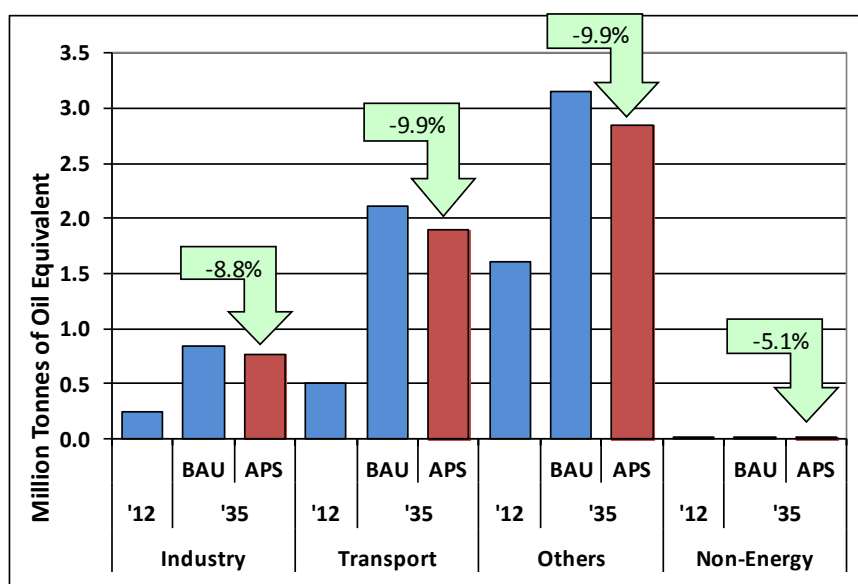
#### 3.1. Total Final Energy Consumption

Lao PDR’s Total Final Energy Consumption (TFEC) grew at 3.6 percent from 1.09 Mtoe in 1990 to 2.36 Mtoe in 2012. The industry sector had the highest growth rate during this period, at 8.7 percent per year, followed by the transportation sector, at 5.4 percent per year. The share of other sectors remains large and accounted for 68.2 percent of TFEC in 2012. In terms of energy types, biomass was the most consumed in 2012, with a share of 63.5 percent, followed by oil, which accounted for 22.7 percent.

#### **TFEC in Business as Usual (BAU)**

From 2012 to 2035, Lao PDR will experience high growth in TFEC at 4.2 percent per year on average. The transportation sector will have the highest growth rate of 6.4 percent followed by the industry sector at 5.6 percent. The others sector will have a slower growth rate of 3 percent.

**Figure 10-1. Final Energy Consumption by Sector, BAU vs. APS**



BAU = Business-as-Usual; APS = Alternative Policy Scenario.

Source: Author’s calculation.

#### **TFEC in Alternative Policy Scenario (APS)**

In the APS, the growth of TFEC from 2012–2035 will be 3.8 percent slightly lower than the 4.2 percent in the BAU scenario. This is due to the energy policy of the Government of Lao PDR that is to be implemented in the near future. The policy includes an increase of the renewable energy share in total energy supply by 30 percent by 2025, 10 percent blend of biofuels in oil supply for the transportation sector and the reduction of 10 percent in energy consumption in all sectors. By implementing these measures, the TFEC is estimated to reduce from 6.12 Mtoe in BAU to 5.52 MTOE in APS.

### 3.2. Total Primary Energy Consumption

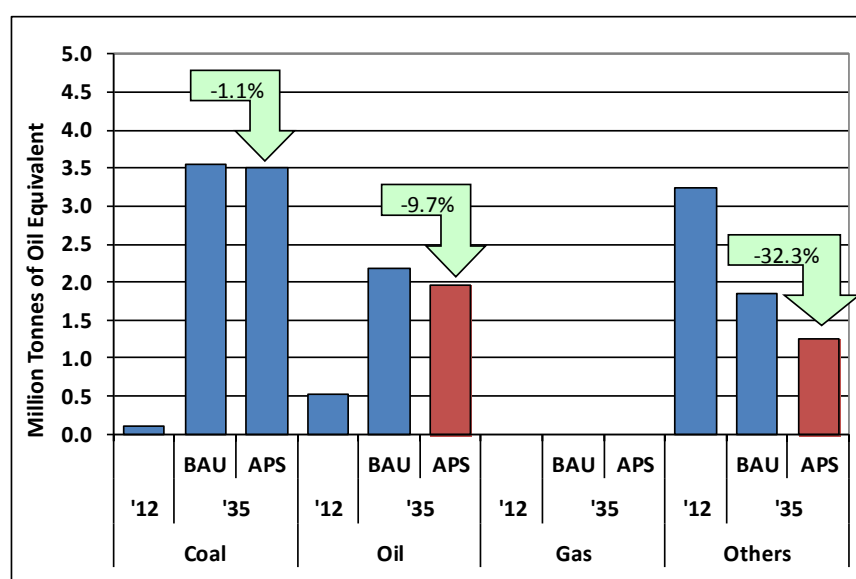
The TPEC in Lao PDR increased from 1.20 Mtoe in 1990 to 2.63 Mtoe in 2012 at an average annual growth rate of 3.6 percent. Oil consumption increased at an annual average growth rate of 5.6 percent, and hydro electricity production increased by 11.2 percent. Coal started to figure in the primary energy mix in the late 2000's and had a 4.3 percent share in 2012.

#### *TPEC in the BAU*

The TPEC of Lao PDR will grow at an average annual rate of 5.3 percent from 2012 to 2035 under the BAU scenario, reaching 8.55 Mtoe by 2035. Coal will grow at the fastest rate of 16.2 percent during the same period due to development of the first ever coal-fired power plant in the country, the Hongsa Lignite Power Plant, which will be operated from 2015 onwards.

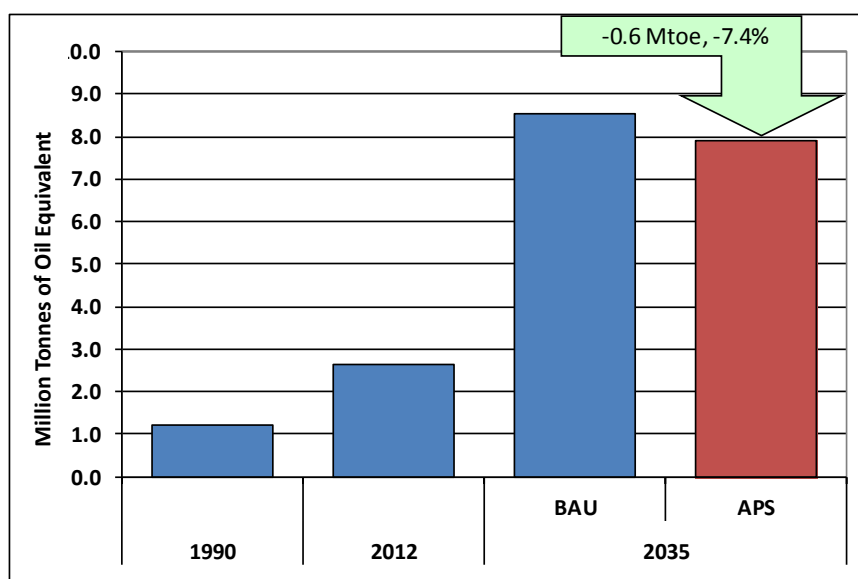
Hydropower will also increase at an average annual growth rate of 7.5 percent but at a lower rate compared with that of coal for the period 2012–2035. In absolute amount, hydropower production will increase from 0.72 Mtoe in 2012 to 3.81 Mtoe in 2035. Oil demand will rise at 6.3 percent per year on average, from 0.54 Mtoe in 2012 to 2.18 Mtoe in 2035.

**Figure 10-2. Total Primary Energy Consumption, BAU vs. APS**



BAU = Business-as-Usual; APS = Alternative Policy Scenario.

Source: Author's calculation.

**Figure 10-3. Evolution of Total Primary Energy Consumption, BAU vs. APS**

BAU = Business-as-Usual; APS = Alternative Policy Scenario.

Source: Author's calculation.

### Scenario Analysis

The APS consists of scenarios such as energy efficiency and conservation (EEC) scenario (APS1), improvement of Energy Efficiency in power generation (APS2), development of renewable energy (APS3). The scenarios were individually modelled to determine the impact of each scenario to reduction of energy consumption and CO<sub>2</sub> emissions. Below are the assumptions in each scenario:

- APS1: focus on EEC on the demand side, such as reduction 10 percent of final energy consumption in all sectors up to 2025.
- APS2: focus on installation of more efficient thermal power plants. However this APS2 has been not practical for this study.
- APS3: focus on an increase 10 percent of biofuels blending with total fuel used by the country by 2025.
- APS4: focus on installation of Nuclear Power Plants. However this APS4 has been not practical in the power plan of Lao PDR, therefore this scenario is not used in the study.
- APS5: Combination with APS1 and APS3.

### Result of TPEC in Alternative Policy Scenario (APS)

In the APS, the TPEC will increase at an average rate of 4.9 percent throughout the projection period between 2012 and 2035. It is projected to increase from 2.63 Mtoe in 2012 to 7.92 Mtoe in 2035. If compared with BAU, the TPES in APS will be 7.4 percent lower or equivalent to 0.63 MTOE. The reduction in TPES will result from the implementation of a number of energy strategies and measures as mentioned above.

### 3.3. CO<sub>2</sub> Emissions

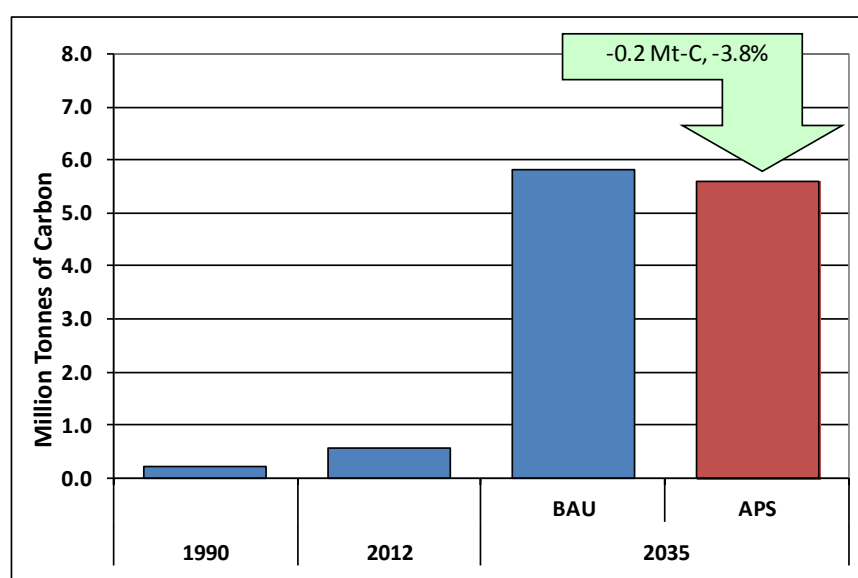
#### *CO<sub>2</sub> in Business-as-Usual (BAU)*

In the Business-as-Usual (BAU) scenario, CO<sub>2</sub> emissions are projected to increase from 0.6 Mt-C in 2012 to 5.8 Mt-C in 2035 at an average annual growth rate of 10.6 percent per annum. The high increase of CO<sub>2</sub> emission is due to the operation of a lignite power plant. Before the operation of this coal power plant, almost 100 percent of electricity generation in Lao PDR is from hydropower.

#### *Alternative Policy Scenario (APS)*

In the APS, the CO<sub>2</sub> emissions will be increasing but at a slower rate than the BAU case. The average annual growth rate of CO<sub>2</sub> emission in the APS will be 10.5 percent for the period 2012–2015, reducing the total CO<sub>2</sub> emission to 0.2 Mt-C, roughly 3.8 percent lower than BAU.

**Figure 10-4. CO<sub>2</sub> Emission from Energy Combustion, BAU vs. APS**



BAU = Business-as-Usual; APS = Alternative Policy Scenario.  
Source: Author's calculation.

## 4. Findings and Policy Implications

### 4.1 Findings

In this energy outlook, the GDP of Lao PDR is assumed to grow at an average annual growth rate of 7.0 percent from 2012 to 2035 and population growth is assumed to grow at an average annual growth rate of 1.5 percent. By the year 2035, if the three energy measures of the government are implemented, the total primary energy consumption will decrease from 8.55 Mtoe in the BAU to 7.92 Mtoe in APS.

In the APS, the primary energy intensity and the final energy intensity in 2035 will be at 382 and 266 toe/million 2005 US\$, and they are smaller than the BAU (412 and 295



toe/million 2005 US\$, respectively). The primary energy consumption per capita of Lao PDR in 2035 will be 0.86 toe/person in the APS – lower than the BAU's 0.93 toe/person.

The CO<sub>2</sub> intensity will increase over the 2012–2035 period for both BAU and APS. However, in 2035 the CO<sub>2</sub> intensity of the APS will reach 270 t-C/million 2005 US\$, and it is lower as compared to the BAU (281 t-C/ million 2005 US\$).

## 4.2 Policy Implications

In this study, Lao PDR will get the energy savings mainly through the implementation of the government's renewable energy and energy conservation programmes. The programmes consist of an increase of the renewable energy share in total energy supply by 30 percent by 2025, 10 percent of biofuels in oil supply for the transportation sector and the reduction of 10 percent in energy consumption of all sectors.

In order to have energy reduction both in TPEC and TFEC, as well as the reduction in CO<sub>2</sub> emissions, Lao PDR should extend the implementation of the renewable energy and energy conservation programmes until 2035. As the energy conservation programmes are the most important in achieving the energy reduction, it should be proposed to be a national policy. At the same time, there should be sound projects and programmes to be implemented. Industry sector should implement the energy management system, develop and implement its own energy saving or reduction plans, to cooperate with the government energy security and regularly conduct seminars on energy saving measures; Transport sector should increase the public transport in the big cities and conduct campaign to promote the use of that transportation; And other sector should raise a public awareness on energy conservation and implement energy management in building sector. In addition, the study on correlation between GDP and energy consumption should be carried out and energy statistics should be improved accordingly. In addition, the government should consider implementing the following:

1. Implement EEC programmes in all sectors
2. Establish EEC fund (similar to that of Thailand) to support EEC programmes and ESCOs;
3. Increase the public transport and use electric vehicles (including public buses and tuk-tuk) which can reduce not only the oil import and CO<sub>2</sub>, but also traffic congestion which is getting worse and worse.
4. Reform electricity tariff to encourage more EEC activities, e.g. time of use (ToU) pricing
5. Increase a share of coal thermal power generation in power generation mix by using local coals and Clean Coal Technology (CCT) to secure the stable supply of electricity.
6. Promote power trade within ASEAN.