

# Chapter 10

## Lao PDR Country Report

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June 2013

**This chapter should be cited as**

Kouphokham, K. (2013), 'Lao PDR Country Report' in Kimura, S. (ed.), *Analysis on Energy Saving Potential in East Asia*, ERIA Research Project Report 2012-19, pp.191-205. ERIA [online]. Available at:

[http://www.eria.org/RPR\\_FY2012\\_No.19\\_Chapter\\_10.pdf](http://www.eria.org/RPR_FY2012_No.19_Chapter_10.pdf)

## CHAPTER 10

# Lao PDR Country Report

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### 1. Background

#### 1.1. Socio-Economic Situation

Lao People's Democratic Republic (Lao PDR) is a small country in South East Asia. It is a land lock country which is located in the middle of the South East Asia peninsula. It has a border with five countries namely China in the North, Vietnam in the East, Cambodia in the South, Thailand and Myanmar in the West. Lao PDR has a total area of 236,800 square kilometres and about 70 percent of that is covered by mountains. Lao PDR has population of 6,256,197 people (2010) in which 3,133,059 people is female. The female population is accounted a little bit more than 50 percent of the total population. The average of the population density is 26 people per square kilometre. Laos consists of 17 provinces. Its capital city is Vientiane. It has population of 768,743 people.

Since Lao PDR had changed its economic policy to the opened door policy in 1986, the economy has been progressing and expanding rapidly. The Gross Domestic Product (GDP) in 2010 increased 8.1 percent from the previous year. It was accounted about US\$ 3,421 million at the 2002 constant price. If it is estimated by activity at the current price it was about US\$ 6,840 million and it per capita was about US\$ 1,088. The economy has been gradually changing from agriculture oriented activities to a more wide range of activities such as service and industry. In 2010, the service sector has gained 39.3 percent while agriculture sector has had only 28.4 percent of the all GDP. The industry sector also increased rapidly, because there

are a lot of investments in mineral and hydropower sectors. Even though in 2010 it has contributed to the GDP only 25.9 percent, it was projected to take the bigger share in the GDP in the next 5 years.

## **1.2. Energy Supply-Demand Situation**

Laos PDR's total primary energy demand in 2010 was 0.9 MTOE. The country's primary energy demand mix consists of four types of energy such as oil, hydro and coal. In 2009, electricity export reached 0.5 MTOE and accounted more than half of total energy consumed in the country. The export also accounted for 78.6 percent of total hydro power generation. The main fuel consumed in the country is oil products and is mainly used in the transportation sector. Since there is no refinery in Lao PDR, all of its oil product supply is imported from Thailand and Viet Nam. In 2010, Lao PDR imported 0.6 MTOE of oil products to supply the demand of transport and other sectors. Lao PDR's primary energy supply mix includes also coal. In 2010, 0.1 MTOE of coal was consumed in Lao PDR and mainly in industrial sector. In the future, coal demand is expected to increase as a coal power plant will start commercial operation 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 as source of energy for economic activities. The electrification ratio in Lao PDR is 71 percent in 2010. According to the Lao PDR Government plan, the country will increase the electrification ratio to 71 percent in 2010 and 90 percent in 2020. This plan is among 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.

Luckily, 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, Laos has a potential hydropower resource of 23,000 MW. Up to 2010, Lao PDR has only developed 8.4 percent of the total potential with total installed power capacity reaching 1927 MW. Almost 100 percent of the total power supply comes from hydro power source.

In 2010 Lao PDR produced around 8,171.6 GWh of electricity. From that, more than 81.3 percent (equivalent to 6,646.4 GWh) was exported to Thailand and the remaining, consumed domestically. Power export is projected to increase sharply because the Government has made commitment to help its neighbouring countries to fulfil their power demand. By 2020, Lao PDR 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. There is, however, one thermal power plant known as Hongsa Lignite Power Project which is being constructed for export purposes. This project alone has the installed capacity of 1,800 MW. At present, there are more than 50 hydropower sites planned for the export target in 2020. Most of exporting hydropower projects are being developed jointly between the Lao PDR Government and foreign investors.

### **1.3. Energy Policies**

Since the Ministry of Energy and Mines has been established in 2006, Energy Policy gained a lot of public attention and support and it also has been developing in more complexity. In the past, it focused solely on power sector, now it covers most of energy types and energy related activities. Lao PDR's energy policy aims to develop a sustainable and environmentally friendly energy sector. It also has been improved dramatically because Ministry of Energy and Mines cooperate with ASEAN, other countries and international agencies. Many lessons and experiences learned from overseas have been incorporated into the policy.

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

On the energy supply side, the Lao PDR's Government has set up a number of measures and strategies to ensure the greater security of energy supply and promote sustainable development in the energy sector. The Government would like to provide sufficient energy for socio-economic development without shortage and disruption of energy supply. At the same time, the Government attempts to reduce the dependence on energy import 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 in 2020. This targeted obligation also includes blending 10 percent of bio-fuels in the oil

supply for the transportation sector. This policy will help the country to reduce oil import. For the nuclear energy policy, although there is no nuclear power plant to be developed in the medium term, the Government is attempting to build its personal capacity to be ready to cooperate with other countries and develop the nuclear power plants in the long term when it is necessary.

### *1.3.2. Consumption (Energy Efficiency and Conservation, etc)*

During the past decade, energy demand of Lao PDR increased significantly. In 1990, only 0.3 MTOE of energy had been consumed. In 2010, it increased to 0.9 MTOE and it is projected to grow to 6.8 MTOE by the year 2035. This requires a lot of investments in energy supply. In this regard, the country needs to use more its natural resources and to import more oil from abroad. These can cause negative impacts to the environment and increase greenhouse gas emission to the atmosphere. Therefore the Lao PDR's Government as well as the Ministry of Energy and Mines are taking this energy consumption aspect into account seriously. One of the most effective measures and policies to minimize the associated issues, which the Government is currently promoting, is the Energy Efficiency and Conservation program. In this program, 10 percent reduction in energy consumption by 2020 in all sectors is being proposed to the Government. If it has been approved the specific measures and activities will be discussed, developed and implemented in different sectors.

### *1.3.3. Energy Market Reforms, New Energy Policies under Consideration, etc*

To promote greater security and sustainable development in energy supply, the energy organization structures have been frequently being reviewed and improved by the Government. Based on new developments in the country, suitable energy organizations are needed efficiently manage the energy sector. For example, the Department of Electricity is proposed to become the Department of Energy Policy and Planning. Its mandatory responsibilities are 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, there are many new independent power producers (IPPs) that emerged to produce electricity for domestic and export requirements. Recently, Electricite du Laos, the state-owned power utility has been also divided into two companies: Electricite du Laos and Electricite du Laos-Generation (EdL-Gen).

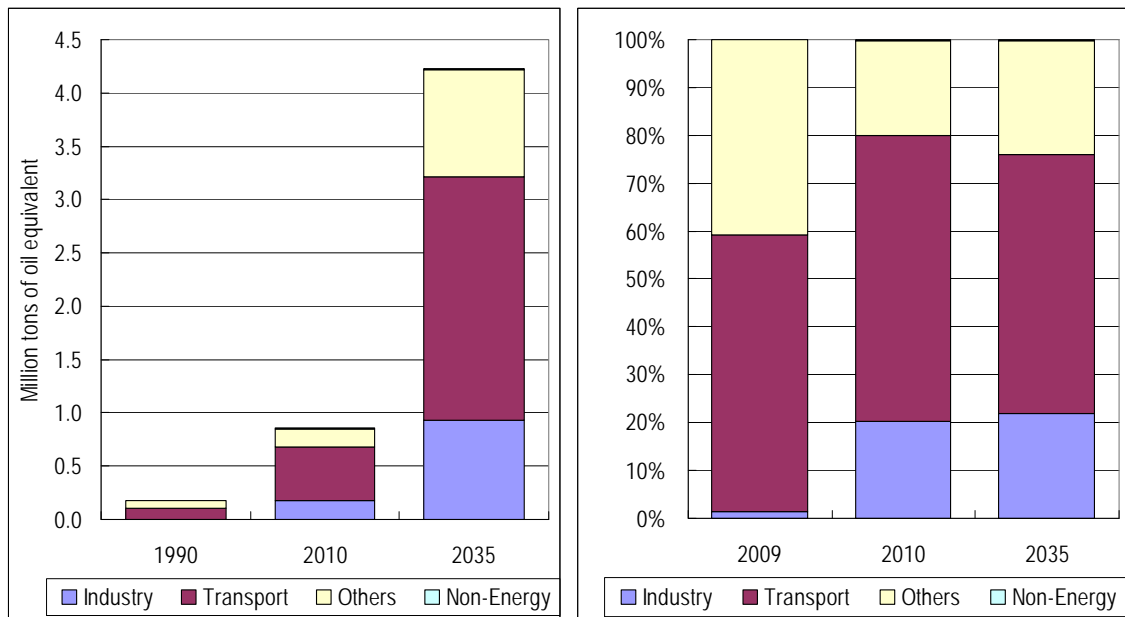
## **2. Energy and CO<sub>2</sub> Emission Outlook**

### **2.1. Final Energy Demand**

#### *2.1.1. Business as Usual (BAU)*

As Lao PDR strives to be industrialization and modernization, many sectors have been remarkably achieving their development targets in recent years and there is no exception for energy sector. Ultimate goals for energy sector are to supply energy to all economic sectors with timely, sufficient and secured manner. According to BAU estimation, total final energy demand has gone up from 0.25 MTOE in 1990 to 0.85 MTOE in 2010 with an annual growth rate of 7.6 percent a bit lower than that of TPES. For the period 2010 to 2035, the TOTAL FINAL ENERGY DEMAND is estimated to continuously increase from the figure in 2010 to 4.23 MTOE in 2035. For the growth rate of each sector, from 1990 to 2010 industrial sector has increased at a highest growth rate compared with two remaining sectors such as transport and other ones, it has grown at 24 percent while transport sector and other sector increased at only 8.5 percent and 4.4 percent respectively. In terms of a sectors' share, in 2009 transport sector has had 71.1 percent, others sector with 27.9 percent and industry sector 0.92 percent of the total final energy demand. However by the year 2035, unlike transport and other sectors, the share of the industry sector is estimated to rise to 21.9 percent, while the shares of transport and other sectors are expected to decrease to 54.27 percent and 23.79 percent respectively.

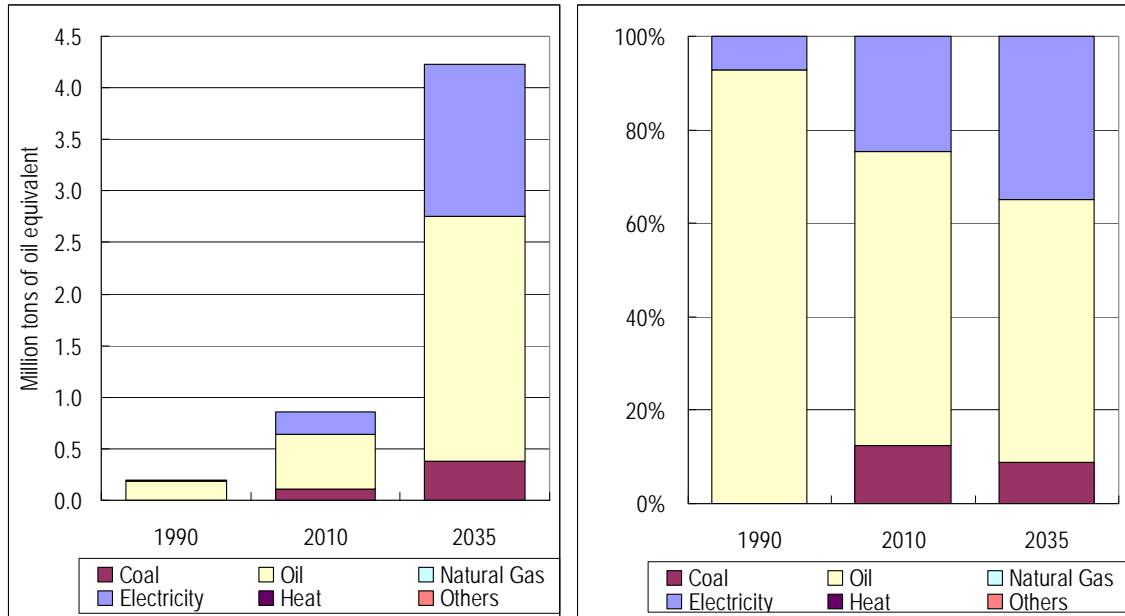
**Figure 10-1: Final Energy Demand by Sector, BAU**



The energies that Laos has been using so far are petroleum products, electricity, coal and biomass. The petroleum products, in the study referring to Oil, that are being used in the country are diesel, gasoline, bunker oil, and LPG. No natural gas and heat are being used in Laos so the concerned energies in this study would be only coal, oil and electricity. Biomass is not included in the study both for BAU and APS. Even though these final energies have been used not much in terms of energy type, and aggregated energies as well as per capita and per country compared with other ASEAN member states, they have been increasing rapidly during two decade ago. For example, in BAU in 1990 TOTAL FINAL ENERGY DEMAND estimated being used only 0.25 MTOE but increasing to 0.85 MTOE in 2010 with an annual growth rate of 7.6 percent and then increasing to 4.23 MTOE in 2035 with an annual growth rate of 6.6 percent. In TOTAL FINAL ENERGY DEMAND, 0.11 MTOE of coal had been used in 2010 and projected to increase to 0.38 MTOE in 2035 at a annual rate of 5.2 percent. Oil has gone up from 0.18 MTOE in 1990 to 0.54 MTOE in 2010 at an annual growth rate of 5.54 percent and it increased further to 2.28 MTOE in 2035 with an annual growth rate of 6.1 percent. Electricity has also been increasing fast in recent years. In 1990, it has been used only 0.01 MTOE but increased to 0.21 MTOE and 1.47 MTOE in 2010 and 2035 respectively, because

from 1990 to 2010 and from 2010 to 2035 its annual growth rate was 14.4 percent and 8.1 percent respectively.

**Figure 10-2: Final Energy Demand by Energy, BAU**

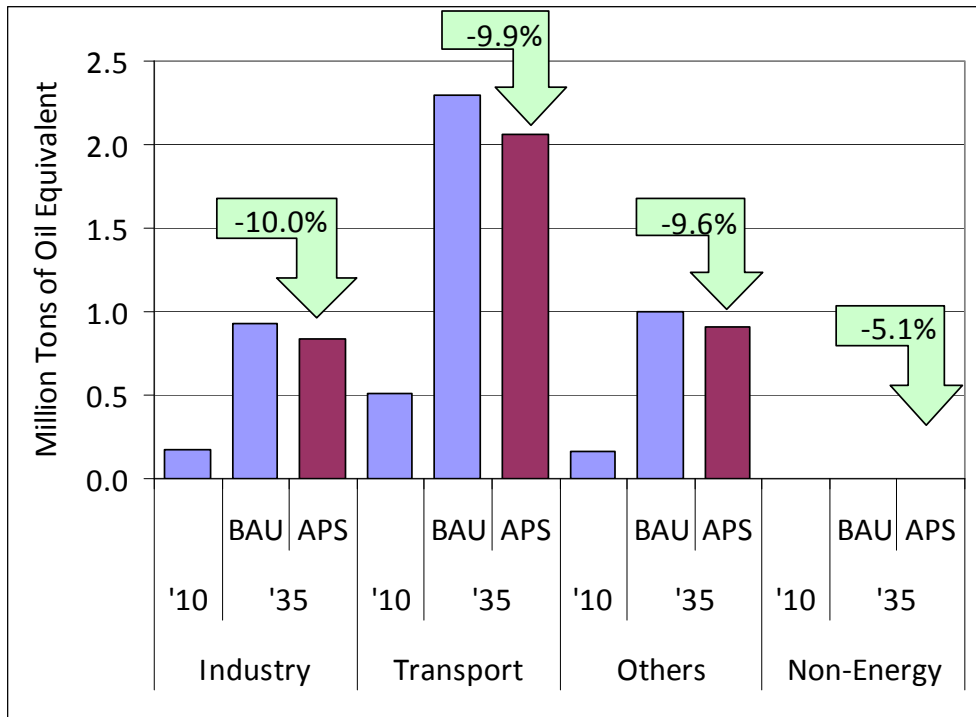


*2.1.2. Alternative Policy Scenario (APS)*

In the APS, the growth of total final energy demand will be slightly lower than in the BAU. This is due to the energy policy of the Lao PDR Government planned 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 bio-fuels in oil supply for the transportation sector and the reduction of 10 percent in energy demand of all sectors. By implementing these measures, the total final energy demand is estimated to reduce from 4.2 MTOE in BAU to 3.8 MTOE in APS.



**Figure 10-3: Final Energy Demand by Sector, BAU vs. APS**



## 2.2. Primary Energy Demand

The total primary energy demand in Lao PDR increased from 0.3 MTOE in 1990 to 0.9 MTOE in 2010 at an average annual rate of 6.6 percent. Oil demand increased at an annual rate of 5.5 percent on the average while hydro electricity production increased by 12.4 percent per annum on the average. Coal started to figure in the primary energy mix in the late 2000's and had a 11.9 percent share in 2010.

### 2.2.1. Business as Usual (BAU)

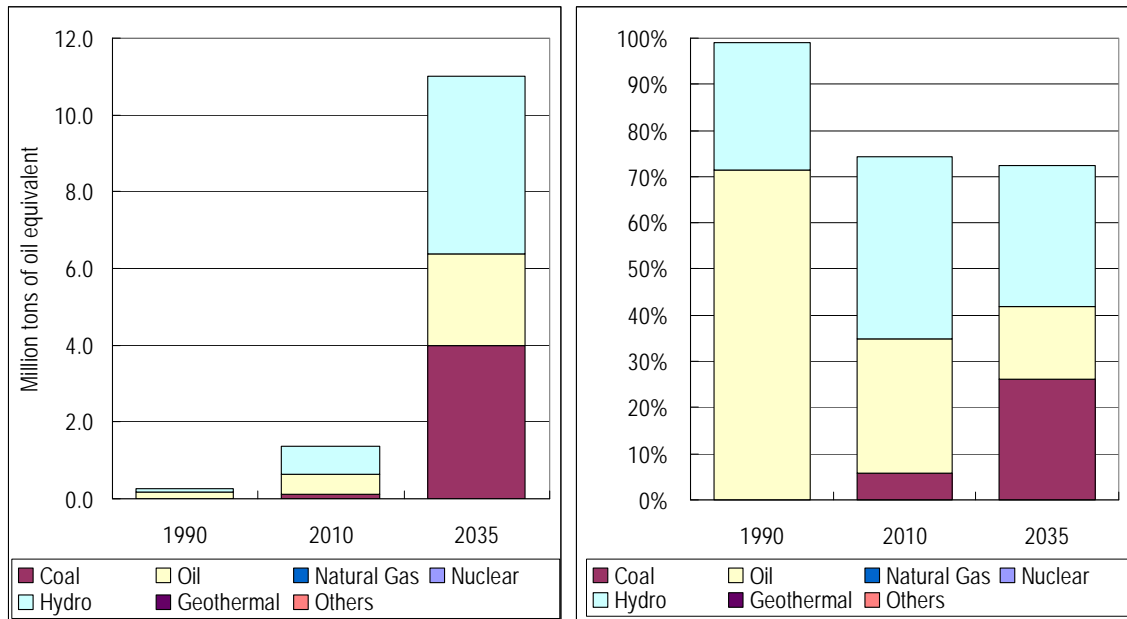
The total primary energy demand of Lao PDR will grow at an average annual rate of 8.5 percent from 2010 to 2035 under the BAU scenario, reaching 6.8 MTOE by 2035. Looking at a share of that total in 2010, hydro has had a biggest share of 81.3 percent but most of the hydro energy had been exported to Thailand. The exporting figure shared 52 percent of the TPES in that year. So if considering only energy supplying domestically, hydro would share 29.3 percent of the TPES. Oil and coal shared in that total 60 percent and 11.9 percent respectively.

Coal will grow at the fastest rate of 15.6 percent during the period due to development of one big and first coal power plant in the country, the Hongsa Lignite

Power Plant which will be operated from 2015 onwards.

Hydro will also increase but at a lower rate compared with that of coal. It will increase from 0.7 MTOE in 2010 to 4.7 MTOE in 2035, at an average of 7.7 percent per year. Oil demand will rise at 6.1 percent per year on the average, from 0.5 MTOE in 2010 to 2.4 MTOE in 2035.

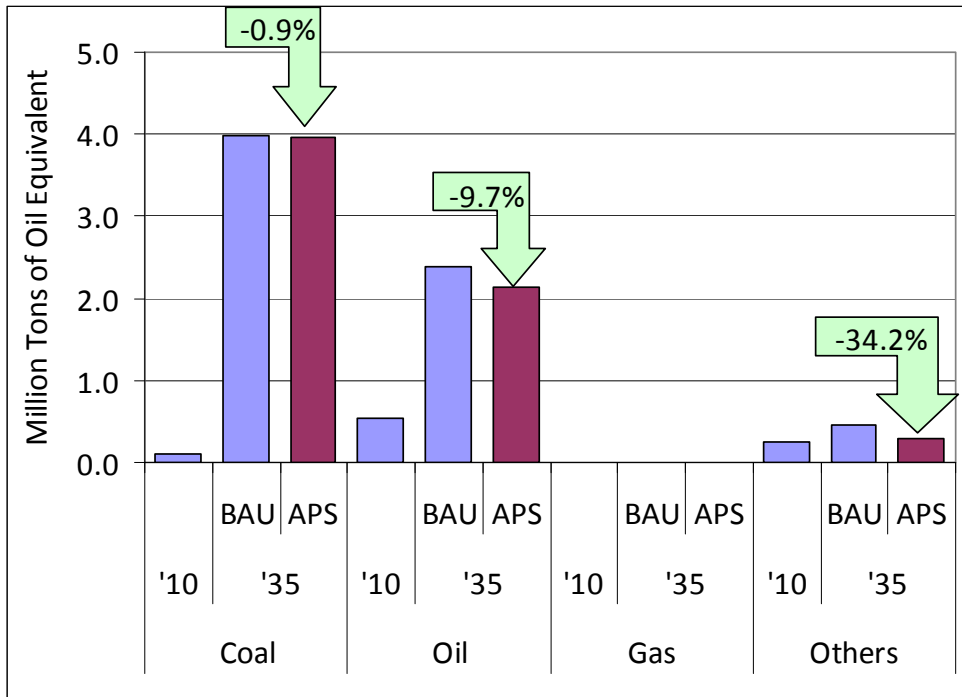
**Figure 10-4: Primary Energy Demand in BAU**



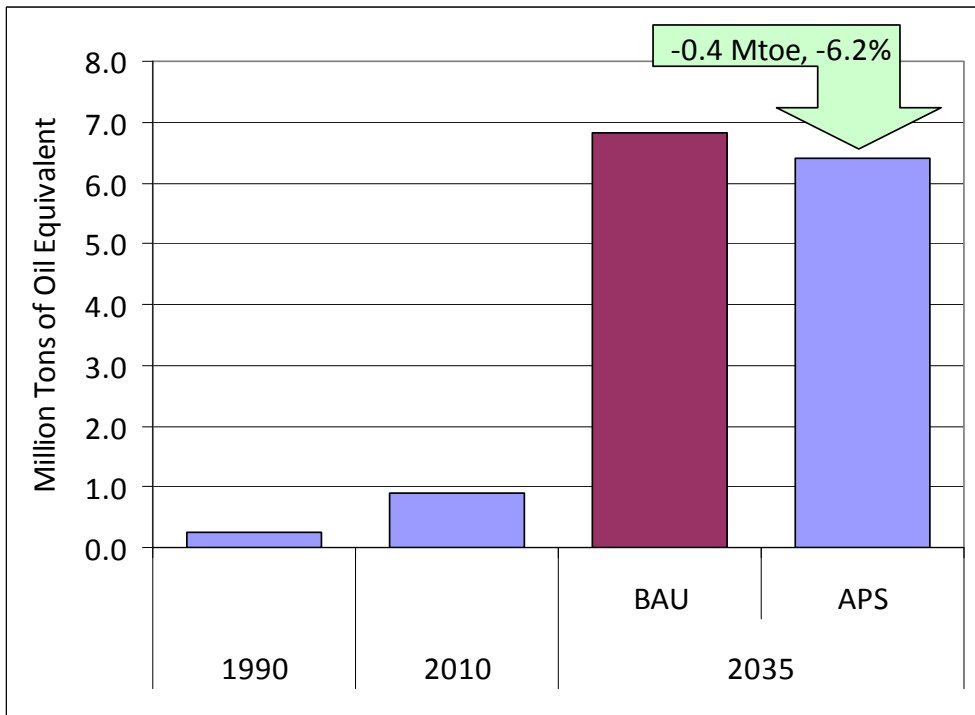
*2.2.2. Alternative Policy Scenario (APS)*

In the APS, the total primary energy demand will increase at an average rate of 8.2 percent throughout the projection period between 2010 and 2035. It is projected to increase from 0.9 MTOE in 2010 to 6.4 MTOE in 2035. If compared with BAU, the total primary energy demand in APS will be 6.2 percent lower or equivalent to 0.4 MTOE. The reduction in total primary energy demand resulted from the implementation of a number of energy strategies and measures as mentioned above.

**Figure 10-5: Primary Energy Demand by Energy, BAU vs. APS**



**Figure 10-6: Evolution of Primary Energy Demand, BAU vs. APS**



### 2.3. CO<sub>2</sub> Emission

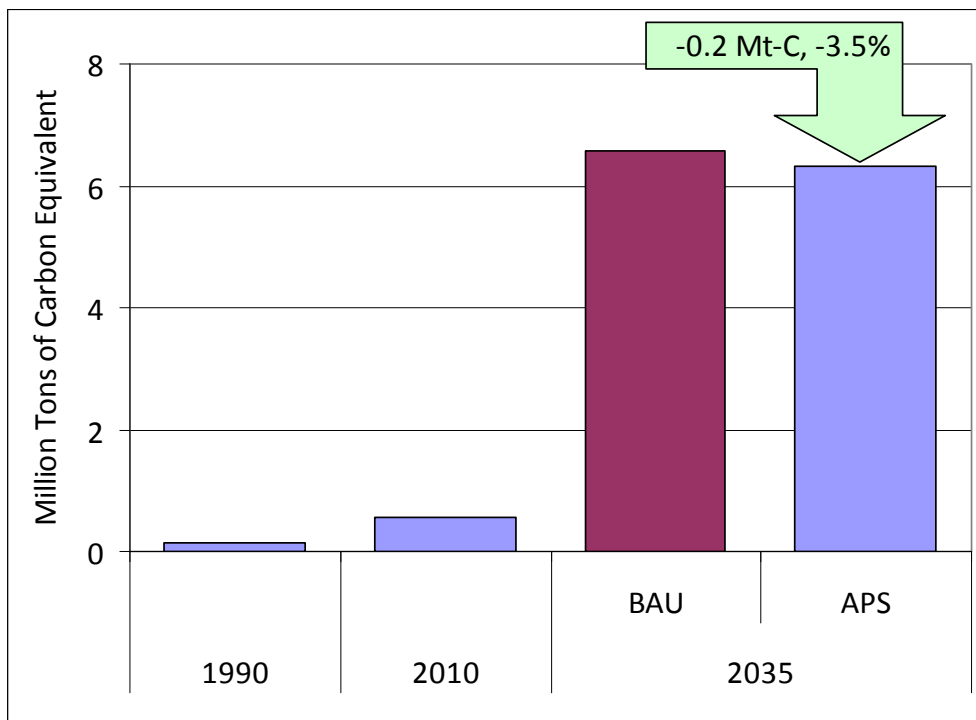
#### 2.3.1. Business as Usual (BAU)

In the BAU, CO<sub>2</sub> emissions will increase from 0.4 Mt-C in 2010 to 16.8 Mt-C in 2035 at an average annual growth rate of 15.8 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.

#### 2.3.2. 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 15.8 percent, reducing the total CO<sub>2</sub> emission to 0.2 Mt-C, roughly 0.9 percent lower than BAU.

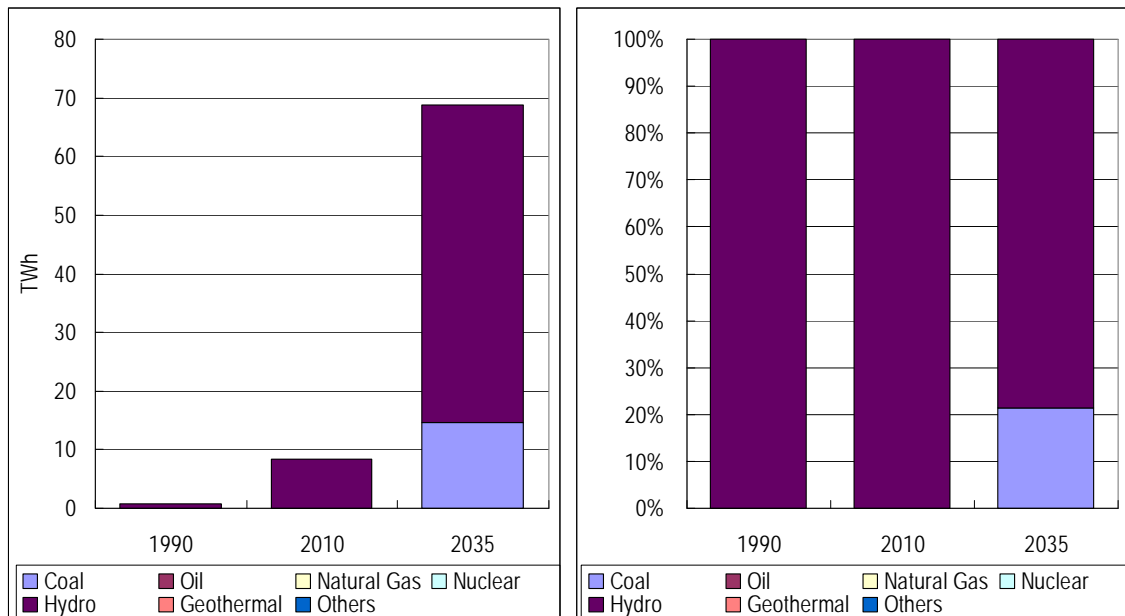
**Figure 10-7: CO<sub>2</sub> Emission from Energy Combustion, BAU vs. APS**



## 2.4. Power Generation

For many decades since Lao PDR started using electricity in 1960s, the power sources have been remaining hydropower types. The generation mix is only hydropower. Up to date there is still 100 percent of powers are being generated from hydropower. However in 2016 the first ever thermal power plant called Hongsa thermal power plant will be commissioning with an installed capacity of 1,878 MW. Its thermal efficiency is estimated to be around 35 percent. In 1990, there were 0.82 MTOE of power having generated. The power production has increased to 8.45 MTOE in 2010 and 54.1 MTOE in 2035 in which hydropower will still be shared by a largest as 78.6 percent of the total generation.

**Figure 10-8: Power Generation and its mix in BAU**

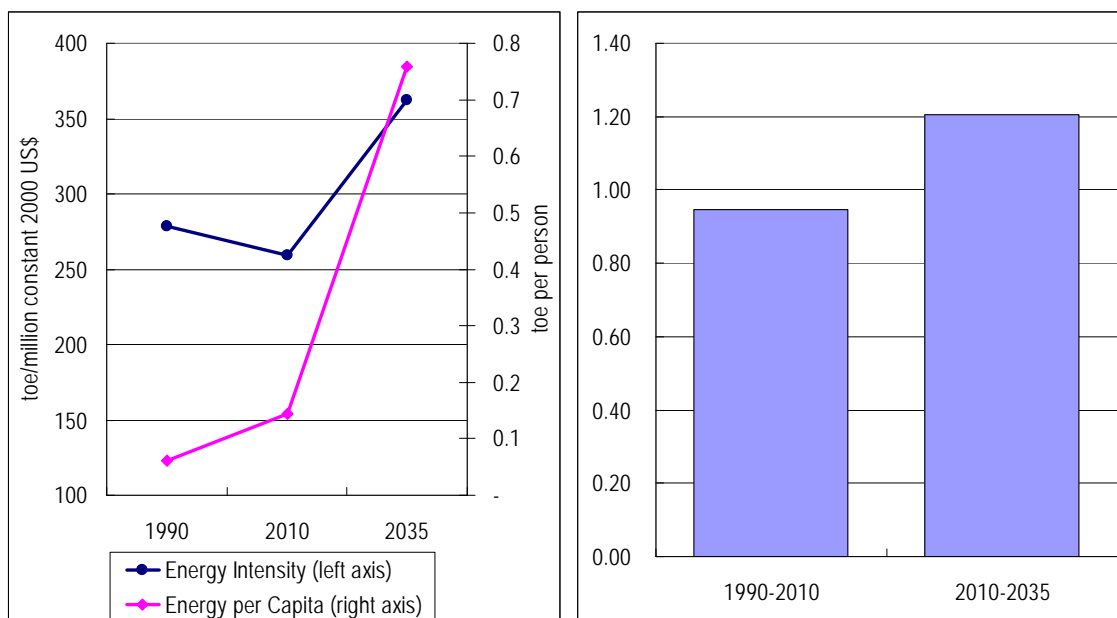


## 2.5. Energy intensity, energy per capita and energy elasticity

As the country has been accelerating the development in all sectors and increasingly exporting power to its neighbouring countries resulted to energy intensity fluctuated from 278.67 toe/million constant 2000 US\$ in 1990 to 259.54 toe/million constant 2000 US\$ and 339.49 toe/million constant 2000 US\$ in 2010 and 2035 respectively. Therefore it has been still expecting to -0.31 from 2010 to

2035. In the same time, TPES per capita has been also increasing from 0.06 TOE in 1990, to 0.22 TOE and 1.22 TOE.

**Figure 10-9: Energy Intensity, Energy per Capita and Energy Elasticity, BAU**



Based on the annual growth rates of energy and GDP, during the years from 1990 to 2010 the energy elasticity was 0.94 while from 2010 and 2035 it will be 1.21. The periodical energy elasticity is shown in the below figure.

### 3. Findings and Policy Implication

#### 3.1. 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 2010 to 2035 while population growth is assumed to grow at an average annual growth rate of 1.6 percent. By the year 2035, if the three energy measures of the Government are implemented, the total primary energy demand will decrease from 6.8 MTOE in the BAU to 6.4 MTOE in APS.

Consequently, the energy intensity of the APS in 2035 will also be smaller than the BAU, almost 22 toe/million US\$ lower. The energy per capita of Lao PDR will

also be 0.51 TOE lower in the APS as compared to the BAU, i.e.: 1.22 toe/capita versus 0.71 toe/capita respectively.

The CO<sub>2</sub> intensity will increase over the 2010-2035 period for both BAU and APS. However, in 2035 the CO<sub>2</sub> intensity of the APS will only reach 0.88 t-c/million 2000 US Dollar, 0.005 t-C lower than that of the BAU.

### **3.2. Issues**

As Lao PDR strives to develop itself to modernization and industrialization, to achieve the Millennium Development Goals by 2015 and to get rid of the status of the least developed countries by 2020, the Lao Government has been focusing on the development of basic infrastructure. For the energy sector, the government endeavours increasing the modern energy consumption to all sectors and all regions of the country because using ratio or energy consumption per capita is still very low. Therefore energy saving is still not getting public attentions and support. But in recent years, this aspect is being seen as importance because every year the country has been using a lot of foreign currency to import energy especially oil. In addition, some months during the dry season the country encountered the shortage of electricity. So the government encourages the public to use energy more efficiently and save energy. To have effectiveness of energy saving the government has to develop policy, strategy, energy saving goals and law.

### **3.3. Policy Implication**

In this study, Lao PDR will get the energy savings mainly through the implementation of the government's renewable energy and energy conservation programs. The programs consist of an increase of the renewable energy share in total energy supply by 30 percent by 2025, input 10 percent of bio-fuels 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 total primary energy supply and total final energy demand, as well as the reduction in CO<sub>2</sub> emissions, Lao PDR should extend the implementation of the renewable energy and energy conservation programs until 2035. As the energy conservation programs are 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 programs to be implemented. In addition, the study on correlation between GDP and energy consumption should be carried out and energy statistics should be improved accordingly.