

# LAO PDR COUNTRY REPORT

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## 1. Background

### 1.1. Socio-economic Situation

The Lao People's Democratic Republic (Lao PDR) is in the middle of the Southeast Asian peninsula. It is bounded by five countries: China in the north, Viet Nam in the east, Cambodia in the south, and Thailand and Myanmar in the west. The Lao PDR has a total area of 236,800 square kilometres (km<sup>2</sup>), about 70% of which is covered by mountains. In 2015, the country had a population of 6,663,967, with an average population density of 27 persons/km<sup>2</sup>. It comprises 18 provinces, with Vientiane as the capital.

Since the country shifted to an open-door economic policy in 1986, its economy has been progressing and expanding rapidly. Gross domestic product (GDP) in 2015 increased 7.56% from the previous year (Lao Statistics Bureau, 2015), increasing to KN 39,647 billion at 2002 constant prices. This is equivalent to US\$140,814 million, bringing the per capita income to US\$1,628. The economy has been gradually changing from agriculture-oriented activities to a wider range of activities such as services and industry. For example, in 2013, the services sector had a share of 37.9% of the total GDP, while the agriculture sector had only 23.5%. The share of the industry sector to GDP was 33.2% in 2013; it is expected to have a bigger share in the coming years due to large investments in the mineral and hydropower sectors.

### 1.2. Energy Supply–Demand Situation

The Lao PDR is well endowed with renewable energy resources, especially hydropower and biomass. Since 1990 hydropower resources are being intensively developed to provide electricity for the requirements of the country and its neighbours. Every year the Lao PDR receives a significant amount of hard currencies from those power exports, widely considered as a driving force to boost socio-economic development and the energy security of the country.

Lao PDR's total primary energy consumption (TPEC) in 2013 was 2.47 Mtoe. The energy mix consisted of hydro, oil, coal, and biomass. Many power plants in the country generate electricity for export, with the export figure reaching 11,548 gigawatt-hours (GWh) in 2013, equivalent to 1.18 million tons of oil equivalent (Mtoe), and accounting for more than half of the total power consumed in the country and 73.2% of total hydropower generation. Biomass continues to be an important energy source, and is mostly consumed in the country. In places where modern energy is inaccessible, Lao people use it as a main source for cooking, heating, and many other activities because it is abundant, obtainable everywhere, and free. In 2015, 1.30 Mtoe of biomass, representing 13.7% of the TPEC, was used. Consumption of oil products was the second largest after biomass. The Lao PDR does not have oil refineries; thus, the supply of all oil products has been met by imports from Thailand and Viet Nam. In 2015, the Lao PDR imported 0.99 Mtoe of oil products to supply the demand of the transport and the residential/commercial ('others') sectors. In the same year, 6.49 Mtoe of coal was consumed, mainly by the industry sector, i.e. the Hongsa Thermal Power Plant, which is the first and largest coal-fired power plant that started operation in 2015. Therefore, from 2015 onwards, coal demand is expected to increase sharply.

Due to its geographic advantage and its many rivers, the Lao PDR is a rich country in terms of hydropower resources. According to the Mekong River Commission Study in 1995, the potential of the country's hydropower resources is 26,000 megawatt-hours (MW). However, until 2015, only 3,894 MW (Department of Energy Policy and Planning, 2015) or 15% of total potential had been realised. In 2015, it produced around 16,501 GWh of electricity (Department of Energy Policy and Planning, 2015). Out of this, 65.7% (equivalent to 10,842 GWh) was exported to Thailand, Viet Nam, and Cambodia; the remaining was consumed domestically. Power exports are projected to increase sharply because of the government's agreements with neighbouring countries that, by 2020, the Lao PDR should export 7,000 MW to Thailand and 5,000 MW to Viet Nam. The power sources for export are mainly from hydropower. However, one thermal power plant, the Hongsa Thermal Power Plant, which has 1,878 MW of installed capacity and three hydropower projects in 2018 are being constructed for export purposes. All projects for export purposes are being developed by foreign private investors through the built-operate-transfer scheme.

The power sector plays a major role in the energy sector, as well as in the country's economy, as it generates substantial revenues for the country. The revenues may not be significant in the short to medium terms, but for the long term, they will be high or will increase manyfold because the ownership of private power plants will be transferred to the government. The electrification ratio in the Lao PDR is 88.94% in 2015 (Department of Energy Policy and Planning, 2015). The government plans to raise the country's

electrification ratio to 90% by 2020. This plan is amongst the government priorities to eradicate poverty in the country. Considering the increase of electricity demand in the Lao PDR and power production for export, optimisation of the power sector will be necessary for future electricity supply.

### 1.3. Energy Policies

Since the establishment of the Ministry of Energy and Mines in 2006, energy infrastructure and legislation have been developed and expanded. Also, the energy policies are developing and gaining public attention and support. The policies gradually evolved from just the power sector policy to broader energy policies towards the development of a sustainable and environment-friendly energy sector. The improvement of the energy policies could be credited to the strong support from the Association of Southeast Asian Nations (ASEAN) and other international organisations, especially the Economic Research Institute for ASEAN and East Asia for its continuous cooperation and support on energy policies of Cambodia, the Lao PDR, Myanmar, and Viet Nam to catch up with other ASEAN countries.

The Lao PDR is a landlocked country in the middle of the Mekong subregion. It is surrounded by the three big economies of China, Thailand, and Viet Nam and the two medium economies of Myanmar and Cambodia. Thus, the Lao PDR can promote itself as a land-linked country to take advantage of its geography. Based on the energy policies exchanged in the platform of ASEAN+3<sup>1</sup> energy cooperation, evidence shows that those countries have high energy demand and support the energy trade and power integration in this region because it can raise regional energy security and sustainable development. At the same time, the Lao PDR has been trading electricity with Thailand for many decades; now it expands this policy to other neighbouring countries to support regional energy cooperation. Particularly, the country will increase power exports to 15,000 MW by 2030 – 10,000 MW to Thailand and 5,000 MW to Viet Nam, Cambodia, and Myanmar.

Apart from international cooperation, the Lao PDR also aims to:

- Increase access to electricity by grid extensions and off-grid rural electrification.
- Maintain an affordable tariff to promote economic and social development.
- Increase electrification ratio to more than 95% by 2020.
- Promote energy efficiency and conservation.
- Make modern energy more affordable and accessible for every Lao citizen even in remote areas.
- Increase the share of renewable energy in total energy supply by 30% in 2030, including to blend 10% of biofuels in the oil supply for the transport sector.

<sup>1</sup> ASEAN countries plus China, Japan, and the Republic of Korea.

## 2. Modelling Assumptions

This study aims to forecast the Lao PDR's energy growth and demand from a base year of 2015 to 2040 and to see its energy saving and CO<sub>2</sub> emissions reduction potential if it uses or implements some Alternative Policy Scenarios (APSs). This study, therefore, uses four scenarios as described below:

- Business-As-Usual (BAU) – a scenario calculated based on the assuming growth of GDP, population, and oil price (Table 10.1);
- APS 1 – a scenario in which the Lao PDR is implementing energy saving and conservation programmes, i. e. reducing energy consumption by 10% during the study period (2015–2040);
- APS 3 – a scenario in which the Lao PDR is implementing the biofuel programme, i. e. blending 10% of biofuel with all oil to be consumed in the country during the study period;
- APS 5 – a scenario that combines APS 1 and APS 3 into one scenario.

**Table 10.1: Assumption of Annual Average Growth of GDP and Population**

Projection Period	GDP Growth, %	Population Growth, %
2015–2020	7.0	1.5
2020–2030	6.5	1.3
2030–2040	6.0	1.2
2013–2040	6.0	1.2

GDP = gross domestic product.

Source: Author's assumptions based on consultation with relevant ministries;

## 3. Outlook Results

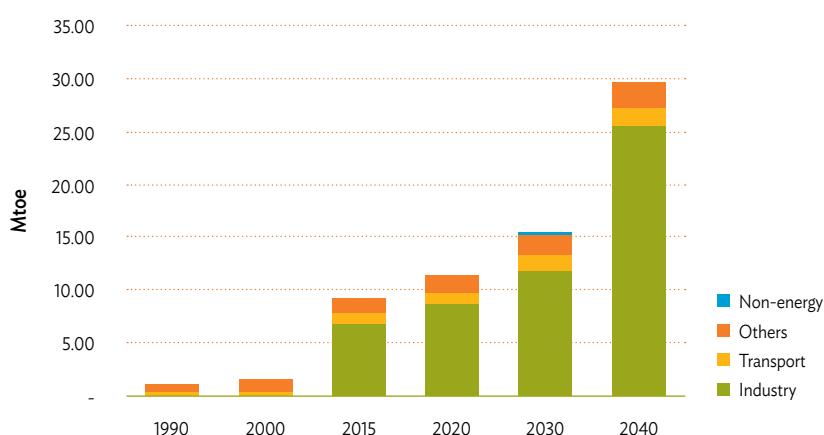
### 3.1 Business-As-Usual Scenario

#### 3.1.1 Final energy demand

In the Lao PDR, final energy consists of coal, oil, electricity, and others. Its total final energy consumption (TFEC) increased at an average annual rate of 8.6%, from 1.09 Mtoe in 1990 to 9.12 Mtoe in 2015 (Figure 10.1). The growth will continue at a faster rate of 3% per year and 6.9% per year in 2015–2020 and 2020–2030, respectively. Then after 2040, the TFEC will grow at a slower rate of 4.8% per year.

For the final energy consumption by sector, the Lao PDR, like other Southeast Asian countries, has four sectors that use energy: industry, transport, 'others', and non-energy. The 'others' sector covers sub-sectors like residential, agriculture, services, and commerce. Between 1990 and 2015, the industry sector registered the highest energy use at 22.9% per year, followed by the transport sector which grew at 7.5% per year, while the 'others' sector grew at the lowest rate of 1.9% per year. The highest growth rate of the industry sector continues until 2040. In 1990-2040, the transport sector grew at an average annual rate of 2.2%, followed by the 'others' (21%) and non-energy (0.9%) sectors. The share of final energy consumption by sectors is shown in Figure 10.2.

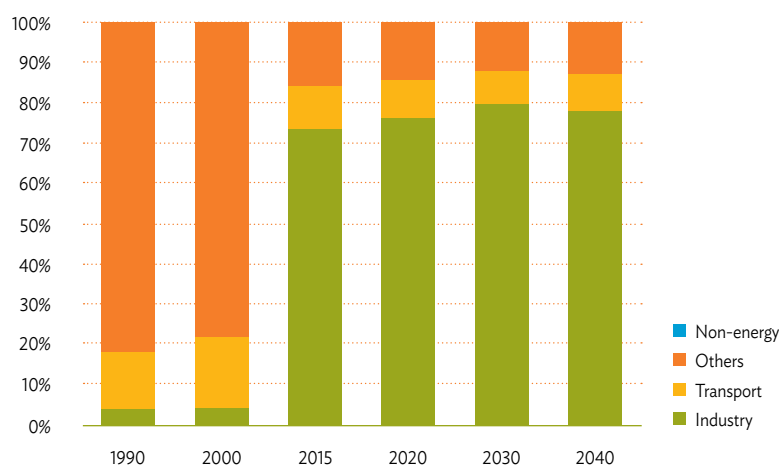
**Figure 10.1: Final Energy Consumption by Sector (1990–2040)**



Mtoe = million tons of oil equivalent.

Source: Author's calculation.

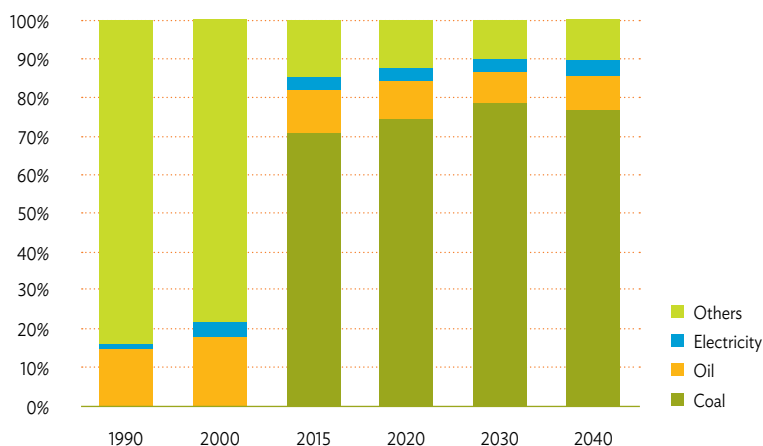
**Figure 10.2: Sectors' Share in Final Energy Consumption (1990–2040)**



Source: Author's calculation.

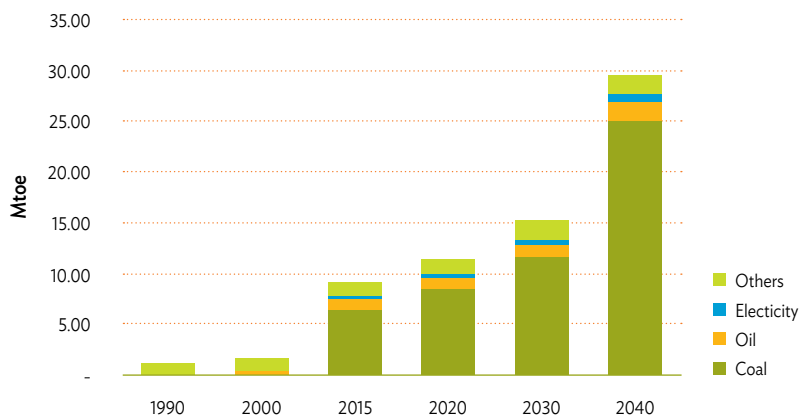
In terms of energy type, coal was mostly used in 2015; it stood at 6.49 Mtoe and shared 71.1% in the total final energy demand. It is expected to have more than 71% share until the end of the study period. For example, coal's share in the TFEC will be 74.5% in 2020, 78.5% in 2025, 76.9% in 2030, 75.0% in 2035, and 85.3% in 2040 (Figure 10.3 and Figure 10.4). The year 2015 was a turning point for the TFEC of the Lao PDR. In 1990–2000, Others included the residential and commercial sectors and always had the biggest share, 83.8% in 1990 and 78.2% in 2000. However, in 2015, coal had the biggest share because the Hongsa Thermal Power Plant started operation. Other coal-fired power plants are also expected to be developed after 2025. From 1990 to 2000, the 'others' sector used biomass, which consists of fuelwood and charcoal, the most because a majority of Lao people still live in rural areas and rely on fuelwood as a main fuel for their cooking. Although using fuelwood is inconvenient compared to other energy types like electricity and liquefied petroleum gas, which are mostly used for cooking in urban areas, fuelwood costs less.

**Figure 10.3: Fuels' Share in Total Final Energy Consumption**



Source: Author's calculation.

**Figure 10.4: Final Energy Consumption by Fuel Type (1990–2040)**



Mtoe = million tons of oil equivalent.

Source: Author's calculation.

Oil is an important energy source for the Lao PDR because the whole transport sector relies solely on this fuel. The oil price directly affects the country's socio-economic development because it is part of living and of doing business in the country. However, unlike electricity and coal, oil is the only energy that is not produced domestically; it is imported either from Thailand or Viet Nam. Therefore, it is worthwhile to closely observe and monitor its trend during this study. In 2015, 0.99 Mtoe was consumed and it is projected to grow at an average annual rate of 2.1% in 2015–2040. Oil demand is expected to rise from 0.99 Mtoe in 2015 to 1.09 Mtoe in 2020, 1.21 Mtoe in 2025, 1.35 Mtoe in 2030, 1.50 Mtoe in 2035, and 1.68 Mtoe in 2040. In terms of average annual growth rate (AAGR), oil is projected to increase at a rate of 2.0% in 2015–2020, 2.1% in 2020–2030, 2.2% in 2030–2040, and 2.1% in 2015–2040. Compared with coal, electricity, and biomass, coal will rank third in 2015–2040.

### 3.1.2 Primary energy supply

The country's primary energy supply consists of coal, oil, hydro, and others. Others cover biomass, biofuels, and exported electricity. The Lao PDR's total primary energy consumption (TPEC) increased at an average annual rate of 8.6%, from 1.20 Mtoe in 1990 to 9.49 Mtoe in 2015 (Figure 10.5). The growth is expected to continue at a faster rate of 7.2% per year in 2015–2020 because a big amount of coal has been used since 2015 for a thermal power plant. The TPEC growth rate is then projected to continue at a slower rate of 3.3% per year during 2020–2030 and at a faster rate again of 7.1% in 2030–2040. However, primary energy is forecasted to grow at a rate of 5.6% per year in 2015–2040.

In 2015, coal was the energy used the most (7.04 Mtoe), followed by hydro (1.33 Mtoe) and biomass (1.3 Mtoe). The reason for coal being used the most is the beginning of the operation of the Hongsa Thermal Power Plant. This plant will also increase coal consumption at a high rate of 10.6% in 2015–2020, and its share in the TPEC will increase from 74.3% in 2015 to 86.8% in 2020. Coal's share is projected to continuously have a higher percentage of more than 86% until 2040.

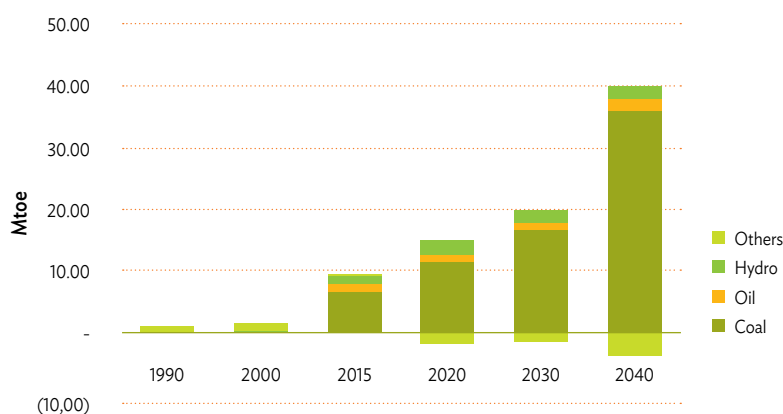
In 2015, 1.33 Mtoe of hydro with a 14.1% share in the TPEC was used; it is expected to increase to 2.42 Mtoe at 18% TPEC share in 2020. Its AAGR is forecast to reach 2.2% in between 2015 and 2040, so hydro demand will increase to 2.30 Mtoe by 2040. The increase in hydro is due to the country's intensive development of hydropower projects to meet increasing domestic demand and to export 7,000 MW to Thailand by 2025 and 5,000 MW to Viet Nam by 2030 per agreement.

Biomass is also used a lot in the Lao PDR because it is a cheaper fuel for cooking and is the main fuel for most rural people. In 1990, 1.01 Mtoe of biomass was used and this increased to 1.30 Mtoe in 2015. It is projected to increase to 1.39 Mtoe in 2020, 1.48 Mtoe in 2025, 1.56 Mtoe in 2030, 1.66 Mtoe in 2035, and 1.75 Mtoe in 2040. In terms of its growth rate, like the projection of biomass in final energy, it is also estimated to grow at 1.2% between 2015 and 2040.

The demand for oil has been experiencing a high growth in the Lao PDR. Many people can afford to buy private cars for their daily commute, thus, significantly increasing the number of vehicles. Until 2015, the country did not have any refinery, and all oil products were imported. More than 20 oil companies did business in the Lao PDR, and they were authorised to import and sell oil in the country. In 1990, only 0.16 Mtoe of oil was used. Oil usage increased at an AAGR of 7.5% in 1990–2015 and with a 13.6% share in the TPEC in 1990. It increased from 0.28 Mtoe in 2000 to 0.99 Mtoe in 2015. Its share in the TPEC also went down from 17.2% in 2000 to 10.4% in 2015; it is projected to have shares of 8.1% in 2020, 6.7% in 2025, 7.3% in 2030, 7.9% in 2035, and 4.6% in 2040 (Figure 10.6). However, in terms of the AAGR, oil, being the fourth energy source, is expected to have a rate of 2.1% per year after those of coal, electricity (exported), and hydro between 2015 and 2040.

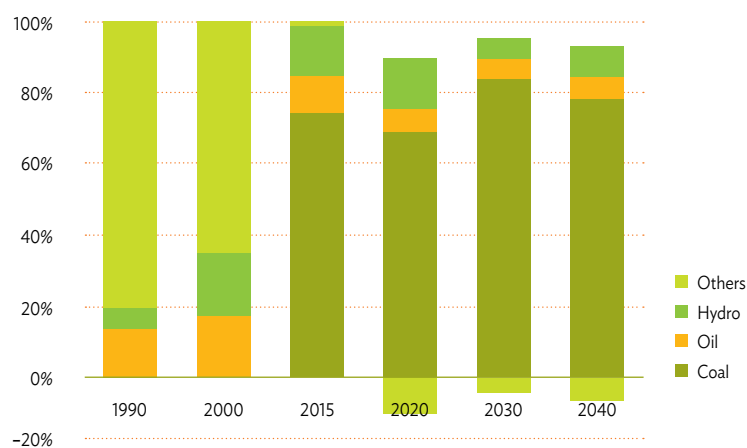
Apart from the primary energy described above that are related to those that could be produced domestically and imported from its neighbours, the Lao PDR still exports a significant amount of electricity to Viet Nam, Cambodia, and mostly to Thailand. Figure 10.5 shows that 'others' show negative signs from 1990 onwards because the exported electricity is greater than biomass. The Lao PDR has been exporting power to Thailand since Nam Ngum Dam started operation in 1971; later, many power plants followed suit. The exported figures increased from 0.05 Mtoe in 1990 to 1.18 Mtoe in 2015. Exported electricity is also projected to increase to 3.12 Mtoe in 2020, 2.38 Mtoe in 2025, 3.02 Mtoe in 2030, 2.88 Mtoe in 2035, and 5.24 Mtoe in 2040. Although the AAGR of electricity for export showed a high rate of 21.4% per year in 1990–2020, it is forecasted to grow only at a rate of 6.1% per year in 2015–2020.



**Figure 10.5: Primary Energy Supply by Source**

Mtoe = million tons of oil equivalent.

Source: Author's calculation

**Figure 10.6: Fuels' Share in Primary Energy Supply**

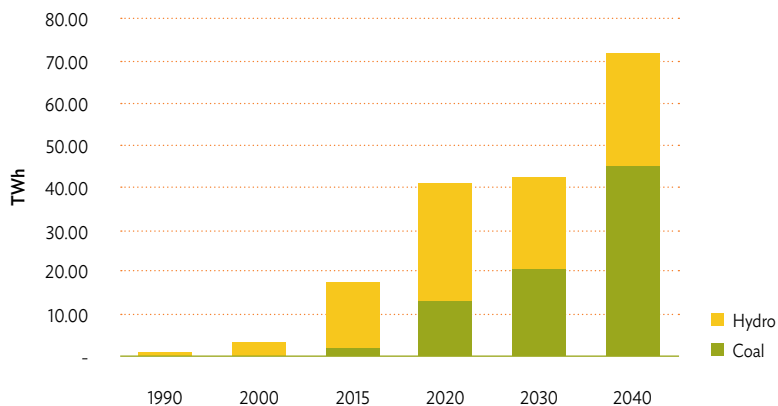
Source: Author's calculation.

### 3.1.3 Power generation

The history of Lao PDR's power generation can be divided into periods. The first period is 1970–2015, during which all power is generated from one source like hydropower. The second period is after 2015, during which the country has both hydro and thermal power plants because the Hongsa Lignite Power Plant started operation in 2015. In 1990, the Lao PDR produced only 0.82 TWh of electricity, then increased to 3.44 TWh in 2000 and to 17.76 TWh in 2015. Its generation is forecasted to increase to 41.12 TWh in 2020. The outputs of power generation are estimated to go up dramatically from 2015 to 2040; they are forecasted to reach 33.63 TWh in 2025, 42.32 TWh in 2030, 42.32 TWh in 2035, and 71.86 TWh in 2040 (Figure 10.7). All power generated before 2015 was from

hydropower sources. Over that period, power generation grew at an AAGR of 13.1%. This rate is then expected to be greater than 18.3% in 2015–2020, at 0.3% in 2020–2030, and at 5.4% in 2030–2040. Because of the first thermal power plant being put into operation in 2015, the power generation mix in the Lao PDR has changed since 2015 (Figures 10.7 and 10.8). For example, in 2015, out of the output of power generation, hydropower plants are projected to share 87.3%, while the thermal power plant will share 12.7% of total generation. Hydropower plants are forecasted to continue to have the bigger share over the thermal power plant until 2020.

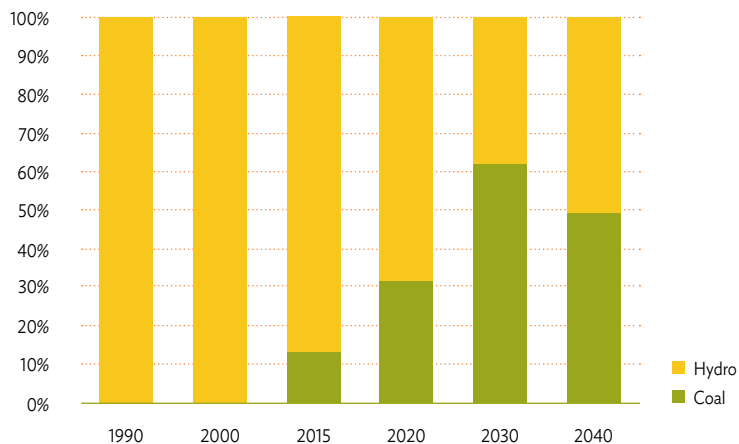
**Figure 10.7: Electricity Generation in 2040**



TWh = terawatt-hour.

Source: Author's calculation

**Figure 10.8: Technologies' Share in Electricity Generation (1990–2040)**

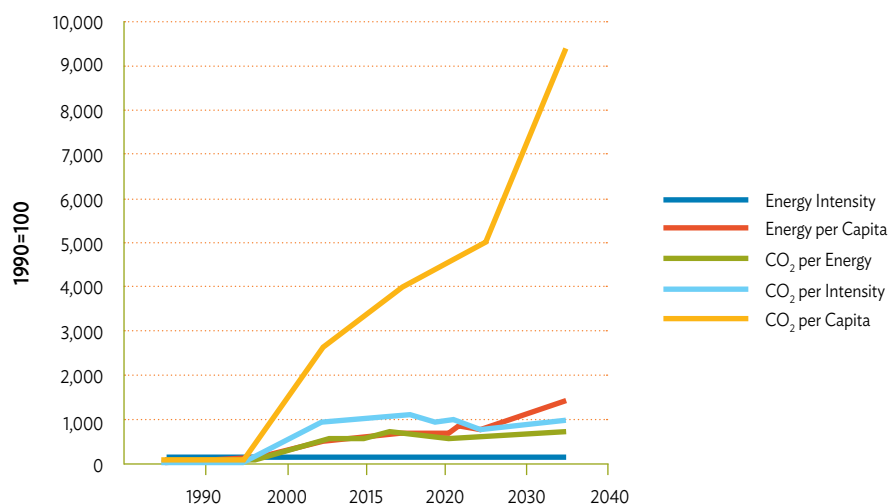


Source: Author's calculation.

### 3.1.4 Energy indicators

In 2020, the Lao PDR's primary energy intensity (TPES/GDP) will reach the highest level of 1,872 toe/million 2010 US\$ and is expected to decline to 1,076 toe/million 2010 US\$ in 2035 (Figure 10.9). Similarly, final energy intensity will decline even lower; from 1,791 toe/million 2010 US\$ in 2020, it will decrease to 888 toe/million 2010 US\$ in 2035. This indicates that energy consumers are implementing energy efficiency and conservation (EEC) programmes.

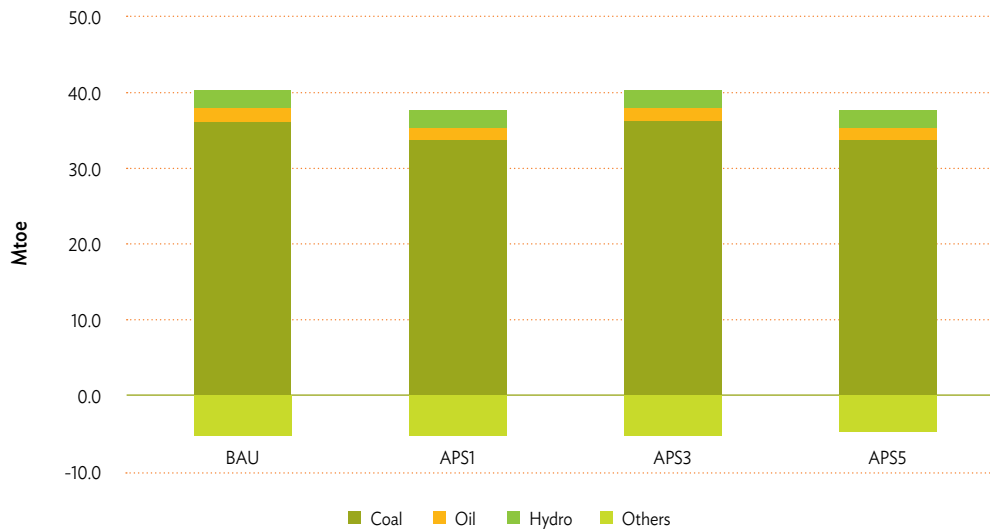
**Figure 10.9: Energy Intensity and Other Energy Indicators (1990–2040)**



Source: Author's calculations.

## 3.2 Energy Saving and CO<sub>2</sub> Reduction Potential (APS)

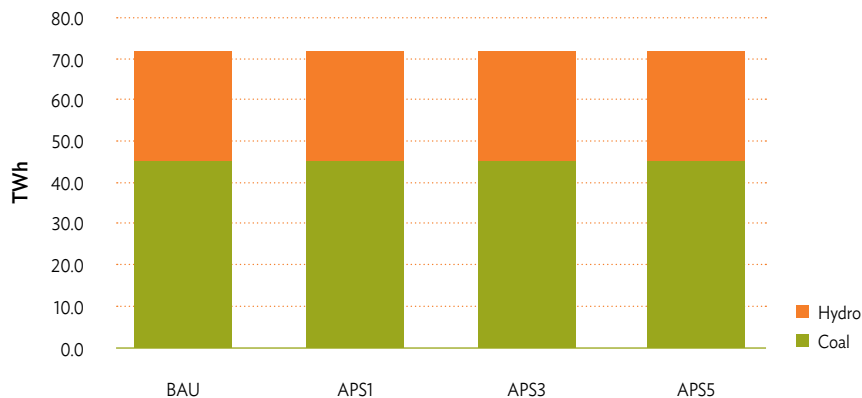
For this study, the Lao PDR uses three APSs for its energy saving and CO<sub>2</sub> reduction potential: (i) EEC scenario (APS1), (ii) development of renewable energy (APS3), and (iii) APS5 that combines APS1 and APS3. These three APSs yield the following changes. First, the TPEC of APS1 amounting to 2.76 Mtoe has decreased; compared with the BAU scenario, it declined from 35.055 Mtoe in the BAU scenario to 32.289 Mtoe in APS1. Second, there is no change in primary energy consumption of APS3. Third, primary energy consumption of APS5 has been reduced to the same amount as APS1. The 10% reduction in the TPEC mainly comes from the implementation of EEC programmes. All existing primary energies such as coal, oil, hydro, and others are reduced (Figure 10.10).

**Figure 10.10: Comparison of Scenarios to Total Primary Energy Supply in 2040**

APS = Alternative Policy Scenario, BAU = Business-As-Usual, Mtoe = million tons of oil equivalent.

Source: Author's calculation.

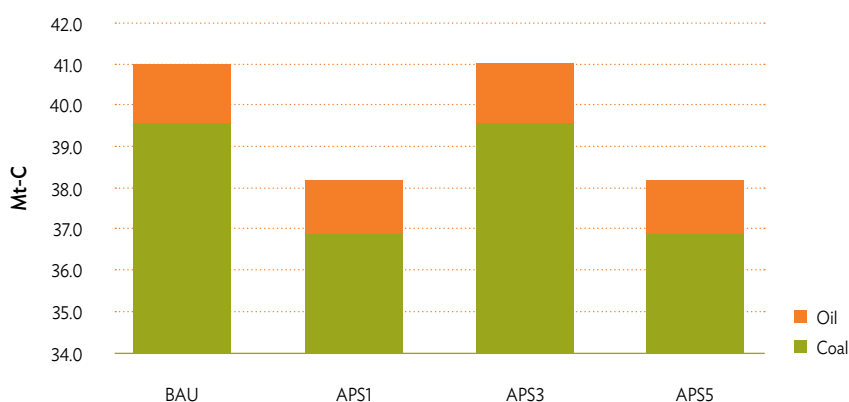
Figure 10.11 shows no change in power generation from the BAU scenario to APS1, APS3, and APS5.

**Figure 10.11: Comparison of Scenarios to Electricity Generation in 2040**

APS = Alternative Policy Scenario, BAU = Business-As-Usual, TWh = terawatt-hour.

Source: Author's calculation

Figure 10.12 illustrates energy saving potential amounting to 2.797 million tons of carbon (Mt-C) in APS1 and APS5. CO<sub>2</sub> emissions declined from 40.943 Mt-C in the BAU scenario to 38.146 Mt-C in APS1 and to 38.146 Mt-C in APS5. This reduction is a result of the EEC programmes.

**Figure 10.12: Comparison of Scenarios to Carbon Emissions in 2040**

APS = Alternative Policy Scenario, BAU = Business-As-Usual, Mt-C = million tons of carbon.

Source: Author's calculation.

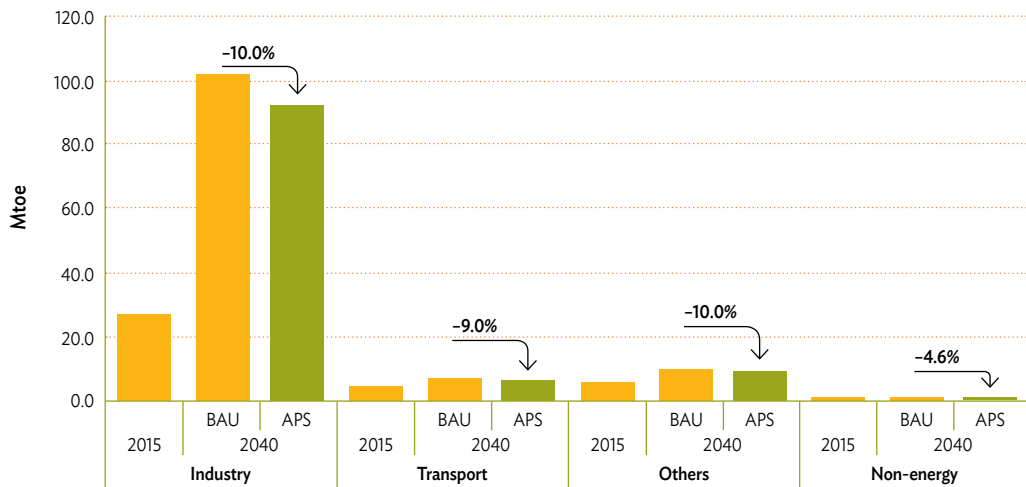
### 3.2.1 Final energy consumption

For trends of final energy demand of the BAU scenario and the APS in each sector, the model shows that, in APS1, final energy demand is expected to increase from 9.19 Mtoe in 2015 to 26.65 Mtoe in 2040. Industry demonstrates the highest trends both in consumption and share in the TFEC in 2015–2040. This dominance of industry in the TFEC is due to the high use of coal in the Hongsa Thermal Power Plant and other coal-fired power plants that have operated since 2015. In APS1, industry consumed 6.70 Mtoe of energy in 2015, and is forecast to consume 7.80 Mtoe in 2020, 10.72 Mtoe in 2025, 10.76 Mtoe in 2030, 10.78 Mtoe in 2035, and 22.94 Mtoe in 2040. Likewise, it always keeps larger shares throughout the study period, i.e. 73.5% in 2015, 76.4% in 2020, 80.0% in 2025, 78.3% in 2030, 76.5% in 2035, and 86.1% in 2040. Industry also shows the highest growth rate per year in 2015–2040 during which it is expected to grow at 5% per year. After industry, the ‘others’ sector is forecast to use the most energy for the study period: 1.44 Mtoe in 2020, 1.59 Mtoe in 2025, 1.76 Mtoe in 2030, 1.96 Mtoe in 2035, and 2.20 Mtoe in 2040 (Figure 10.13).

For the AAGR, APS1 is expected to grow more slowly than in the BAU scenario in 2015–2040. The growth rate is forecast to be 4.8% per year in the BAU scenario and 4.4% in APS1.

For final energy demand by fuel, similar to the BAU scenario, in APS1 coal also showed a majority share of 71.1% in 2015. It is forecast to increase gradually to 78.4% in 2025, decline gradually to 76.8% in 2030 and to 74.9% in 2035, then go up again to 85.2% in 2040.

Figure 10.13 shows that, in 2040, the final energy demand in industry is expected to be reduced from the BAU scenario to the APS at 10.0%; in transport, 9.0%; ‘others’, 10.0%; and non-energy, 4.6%.

**Figure 10.13: Final Energy Consumption by Sector, BAU and APS (2015 and 2040)**

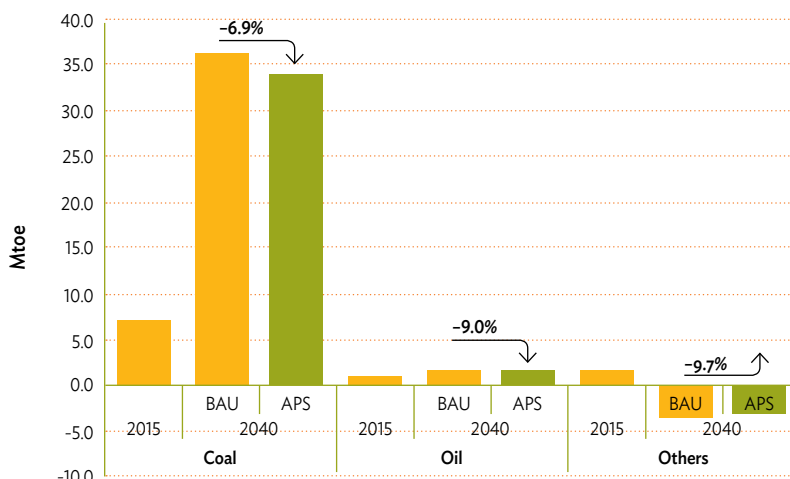
APS = Alternative Policy Scenario, BAU = Business-As-Usual, Mtoe = million tons of oil equivalent.

Source: Author's calculation.

### 3.2.2 Primary energy consumption

In APS1, 9.49 Mtoe of primary energy was consumed in 2015; it is expected to increase to 12.30 Mtoe in 2020, 17.05 Mtoe in 2030, and 33.87 Mtoe in 2040. In terms of the AAGR, primary energy grew at 8.6% per year between 1990 and 2015. It is expected to grow at 5.3% in 2015–2020, 3.3% in 2020–2030, and 7.1% in 2030–2040. But for 2015–2040, primary energy is expected to increase at 5.2%.

Figure 10.14 shows that, by comparing the BAU scenario and the APS in 2040, coal and oil are expected to decrease by 6.9% and 9.0, respectively. However, 'others' is forecast to increase by 9.7% because of the increase in power exports to Lao PDR's neighbours.

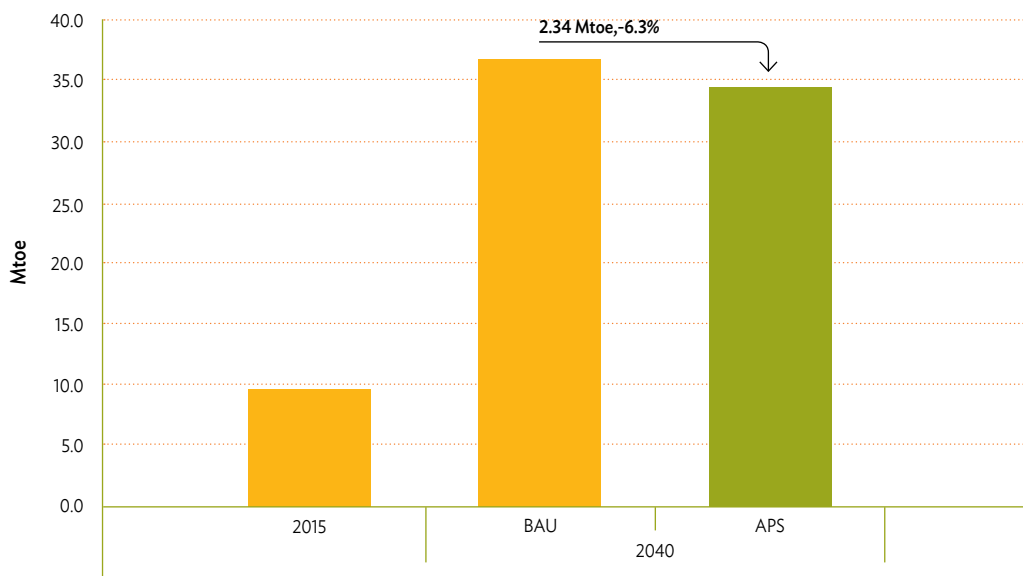
**Figure 10.14: Primary Energy Demand by Source, BAU and APS (2015 and 2040)**

APS = Alternative Policy Scenario, BAU = Business-As-Usual, Mtoe = million tons of oil equivalent.

Source: Author's calculation.

### 3.2.3 Projected energy savings

Figure 10.15 shows that, in 2040, primary energy is expected to decrease from the BAU scenario to the APS by 2.34 Mtoe or 6.3%. This decrease in the TPEC is due to implementation of the 10% reduction in energy consumption from 2015 to 2030.

**Figure 10.15: Total Primary Energy Supply, BAU and APS (2015 and 2040)**

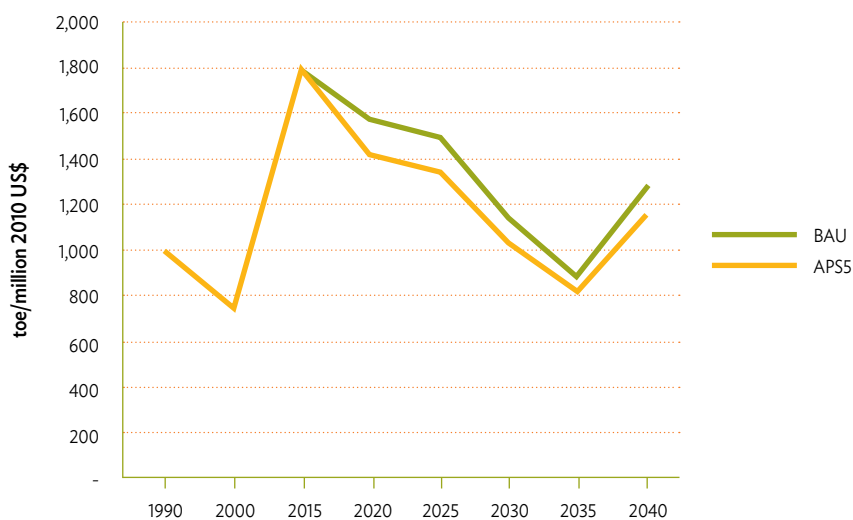
APS = Alternative Policy Scenario, BAU = Business-As-Usual, Mtoe = million tons of oil equivalent.

Source: Author's calculation.

### 3.2.4 Energy intensities

As the Lao PDR endeavours to move towards an efficient and competitive economy and promote sustainable development, energy intensity for both final and primary energy has been reduced significantly. Final energy intensity is projected to decrease from 1,791 toe/million 2010 US\$ in 2015 to 1,279.2 toe/million 2010 US\$ in 2040. Primary energy intensity is expected to decline from 1,862.1 toe/million 2010 US\$ in 2015 to 1,591.7 toe/million 2010 US\$ in 2040. Figures 10.16 and 10.17 show that energy intensity in APS5 is less than that in the BAU scenario. This is due to the implementation of the 10% energy saving from 2015 to 2030. However, Figure 10.17 shows an increase in energy intensity between 2035 and 2040 because of the end of the energy savings programme.

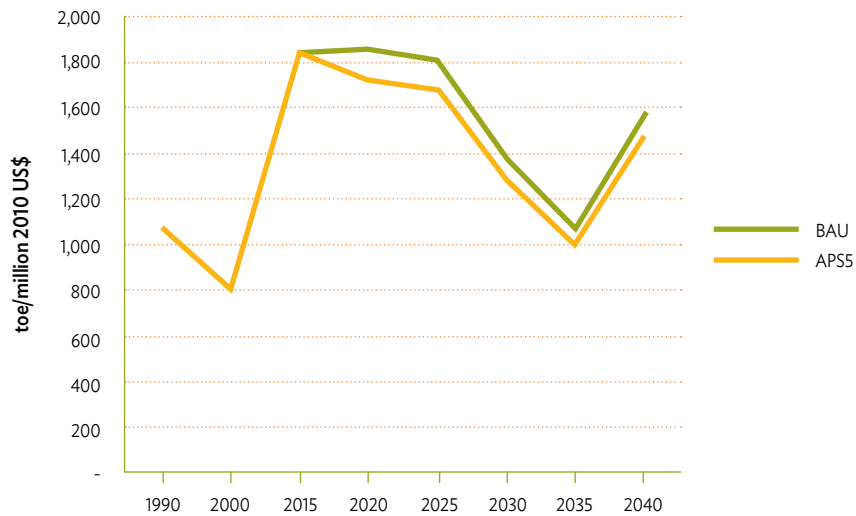
**Figure 10.16: Final Energy Intensity, BAU and APS (1990–2040)**



APS = Alternative Policy Scenario, BAU = Business-As-Usual, toe = tons of oil.

Source: Author's calculation.



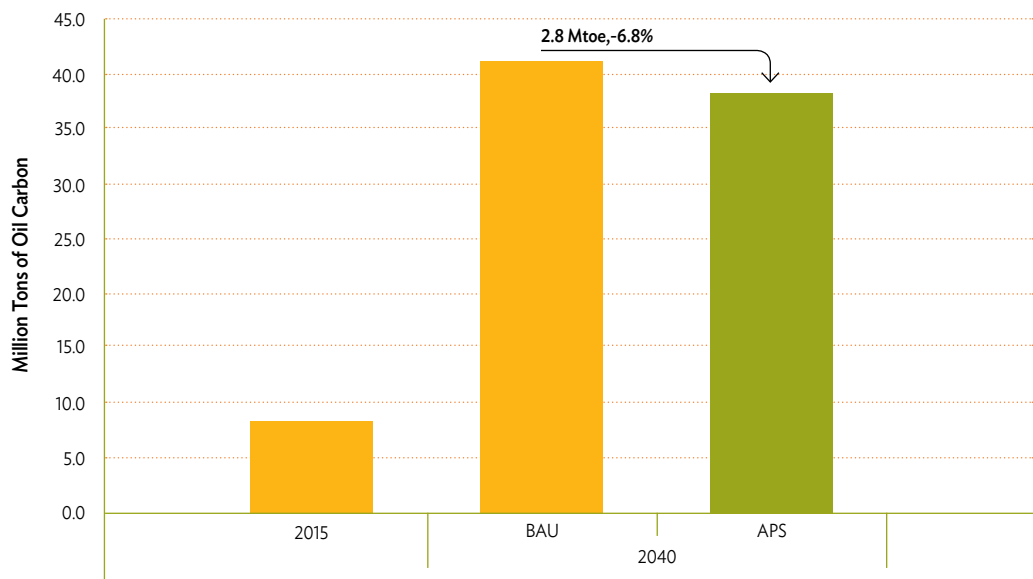
**Figure 10.17: Primary Energy Intensity, BAU and APS (1990–2040)**

APS = Alternative Policy Scenario, BAU = Business-As-Usual, toe = tons of oil.

Source: Author's calculation.

### 3.2.5 CO<sub>2</sub> emissions from energy consumption

By reducing energy consumption by 10%, the Lao PDR can reduce CO<sub>2</sub> emissions by 2.8 Mt-C (or 6.8%) in the APS in 2040 (Figure 10.18).

**Figure 10.18: CO<sub>2</sub> Emissions from Energy Combustion, BAU vs. APS (2015 and 2040)**

APS = Alternative Policy Scenario, BAU = Business-As-Usual, Mtoe = million tons of oil equivalent.

Source: Author's calculation.

## 4. Implications and Policy Recommendations

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

To reduce both the TPEC and the TFEC, as well as CO<sub>2</sub> emissions, the Lao PDR should extend the implementation of the renewable EEC programmes until 2040. As these programmes are most important in reducing energy, these should be proposed as a national policy. At the same time, it should implement sound projects and programmes. The industry sector should implement an energy management system, develop and implement its own energy saving or reduction plans, cooperate with the government on energy security, and regularly conduct seminars on energy-saving measures. The transport sector should increase public transport in big cities and conduct campaigns to promote the use of public transport. The 'others' sector should raise public awareness in energy conservation and implement energy management systems in the building sector. In addition, a study on the correlation between GDP and energy consumption should be carried out and energy statistics should be improved accordingly. The government should also consider the following:

1. Implement EEC programmes in all sectors.
2. Establish an EEC fund (like that of Thailand) to support EEC programmes and energy-saving companies.
3. Increase public transport and use electric vehicles (including public buses and tuk-tuks) to reduce oil imports, CO<sub>2</sub> emissions, and worsening traffic congestion.
4. Reform electricity tariff to encourage more EEC activities, e.g. time of use pricing.
5. Increase the share of coal thermal power generation in the power generation mix by using local coal and clean coal technology to stabilise electricity supply.
6. Promote power trade within ASEAN.

## References

Department of Energy Policy and Planning (2015), *Electricity Statistics Yearbook*. Ministry of Energy and Mines.

Lao Statistics Bureau (2015), *Statistical Yearbook 2015*, Vientiane: Lao Statistics Bureau, Ministry of Planning and Investment, Lao PDR. [www.lsb.gov.la](http://www.lsb.gov.la).