Chapter 10

Lao PDR Country Report

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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 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 6,644,009 people in 2013 and the average population density is 28 persons per square kilometre. Lao PDR consists of 18 provinces and its capital city is Vientiane, with a population of 810,846 people.

Since Lao PDR changed its economic policy to an 'open door' policy in 1986, the economy has been developing and expanding rapidly. Its gross domestic product (GDP) in 2013 increased by 8.02[1] percent from 2012, to 39,647 billion kip (at 2002 constant prices). This is equivalent to US$140,814 million, which means per capita income was US$1,628 in 2013. The economy has been gradually changing in focus from agriculture-oriented activities to a wider range of activities, such as services and industry. In 2013, the share of the services sector was 37.9 percent of total GDP, that of the agriculture sector 23.5 percent, and that of the industry sector 33.2 percent. The share of the industrial sector is expected to rise in the

[1] Statistics Yearbook 2013 of Lao PDR.

coming years due to expected investments in the mineral and hydropower sectors.

1.2. Energy Supply–Demand Situation

Lao PDR's Total Primary Energy Supply (TPEC) in 2013 was 2.47 Mtoe. The country's primary energy mix consists of four types of energy – oil, hydro, coal, and biomass. In 2013, electricity exports reached 0.98 Mtoe and accounted for more than half of total power consumed and 73.2 percent of total hydropower generation in the country. Consumption of biomass continued to be the highest because it is abundant in Lao PDR; it has been used for many generations and mostly does not need to be purchased as a commercial commodity. It remains an important energy source for cooking, and for small industries; in 2013 its consumption amounted to 1.27 Mtoe, representing 51.3 percent of TPEC. Consumption of oil products was the second highest after biomass. Lao PDR does not have any refineries and all consumption of oil products has been met by imports from Thailand and Viet Nam. In 2013, oil product imports to supply the demand of the transport and other sectors amounted to 0.84 Mtoe. In the same year, only 0.004 Mtoe of coal was consumed, mainly in industrial sector. But coal demand is expected to increase sharply in the near future as the first large coal power plant has been in operation since 2015.

Due to its geographic position, Lao PDR is richly endowed with hydropower resources, as it has many rivers. According to the Mekong River Commission Study in 1995, Lao PDR has a potential hydropower resource of 26,000 megawatt (MW). However, until 2013, only 3,230 MW[2] of installed capacity or 12.4 percent of total potential had been realised. In 2013, Lao PDR produced around 15,512 GWh[3] of electricity, 81 percent of which (equivalent to 12,494 GWh) had been exported to Thailand and Cambodia and 19 percent consumed domestically. Power exports are projected to increase sharply, because the government has reached agreements with its neighbouring countries to export 7,000 MW to Thailand and 5,000 MW to Viet Nam by 2020. The power source for exports is

[2] Electricity Statistics Yearbook 2013, Department of Energy Policy and Planning.
[3] Electricity Statistics Yearbook 2013, Department of Energy Policy and Planning.

mainly hydropower. Lao PDR is constructing a thermal power plant for export purposes, however. It is the Hongsa Lignite Power Project, which has 1,878 MW of installed capacity. And another four hydropower projects are under construction for energy export as well. All export projects are being developed by foreign private investors through the Build–Operate–Transfer (BOT) scheme.

The power sector plays a major role in the energy sector and in the country's economy. Electricity has been becoming an important source of revenue from abroad and at the same time a source of energy for economic activities. Even though in the short term not much revenue will be generated for the state from power exports as most exporting power plants are owned by private parties, income from the sector will increase sharply in the longer term when the concession agreements end and their ownership is transferred to the government. This revenue is considered as more sustainable.

The electrification ratio in Lao PDR was 87 percent in 2013.[4] According to the government's plan, it will strive to increase the electrification ratio to 90 percent by 2020. This plan is one of the government's priorities to help eradicate the country's poverty. Considering the projected increase of electricity demand in Lao PDR and the planned power production for export, optimisation of the power sector will be necessary to secure the future supply of electricity.

1.3. Energy Policies

Since establishment of the Ministry of Energy and Mines in 2006, the government's energy policy has received much public attention and support. It evolved gradually from covering just power sector policy to include energy policies more broadly with a view to the development of a sustainable and environmentally friendly energy sector. The improvement of energy policy could be credited to the Association of Southeast Asian Nations (ASEAN), for the close cooperation amongst its members.

[4] Electricity Statistics Yearbook 2013, Department of Energy Policy and Planning.

Even though Lao PDR is a land locked country, it is fortunate to be located in the middle of the Mekong Sub-region, surrounded by three big economies – China, Thailand, and Viet Nam – and two medium-sized economies – Myanmar and Cambodia. Lao PDR has been promoting itself as a land-linked country, well placed to take advantage of its central location. Based on the energy policies exchanged in the ASEAN+3 (China, Japan, Korea) energy cooperation platform, it is clear that these countries have high energy demand and therefore supporting the energy trade and power integration in this region should result in energy security and sustainable development. Lao PDR has been trading electricity with Thailand for many decades and this is now being expanded to Lao PDR's other neighbouring countries, which will support regional energy cooperation. Lao PDR will increase power exports to 15,000 MW by 2030 – by 10,000 MW to Thailand, and by 5,000 MW to Viet Nam, Cambodia, and Myanmar collectively.

Apart from its international cooperation, 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 the electrification ratio to over 95 percent 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 percent in 2030, including blending 10 percent of biofuels in the oil supply for the transportation sector.

2. Modelling Assumptions

This study aims to forecast the energy growth and demand of Lao PDR from a base year of 2013 to 2040, and to evaluate its energy saving and carbon dioxide (CO_2) emission reduction potential if it were to adopt certain Alternative Policy

Scenarios (APS). In this study four scenarios – the Business-as-Usual (BAU), Alternative Policy Scenario (APS)1, APS3, and APS5 – are used, as described below:

- BAU is a scenario based on the assumed growth of GDP, population, and oil price;
- APS1 is a scenario in which Lao PDR implements energy saving and conservation programmes that reduce energy consumption by 10 percent during the study period (2013–2040);
- APS3 is a scenario in which Lao PDR implements a biofuel programme, blending 10 percent of biofuel with all oil to be consumed in the country during the study period (2013–2040);
- APS5 is a scenario that combines APS1 and APS3 into one scenario.

Table 10-1. GDP and Population Growth Assumptions (Annual Averages)

Projection Period	GDP Growth, %	Population Growth, %
2013–2020	7.1	1.5
2020–2030	6.4	1.5
2030–2040	5.7	1.5
2013–2040	6.3	1.5

GDP = gross domestic product (GDP).
Source: Author's calculations.

3. Outlook Results

3.1 Business-as-Usual Scenario (BAU)

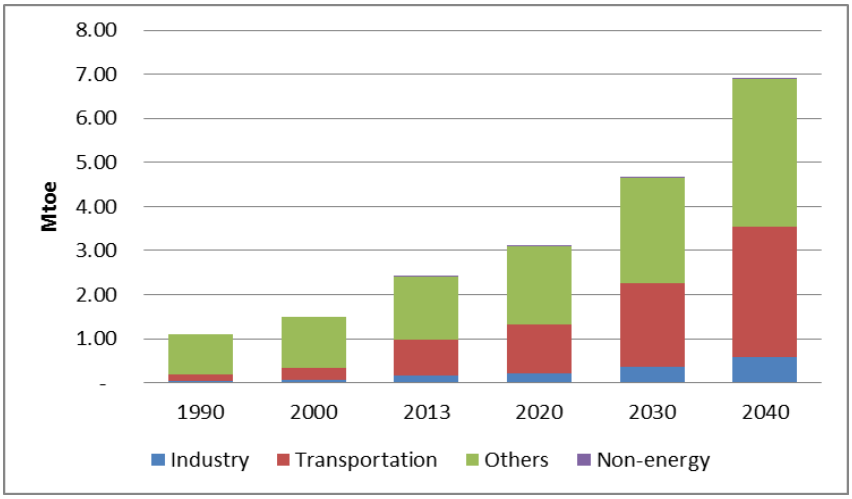
3.1.1. Final energy consumption

In Lao PDR, final energy consists of coal, oil, electricity, and others. The country's Total Final Energy Consumption (TFEC) increased at an average annual rate of 3.5 percent from 1.09 Mtoe in 1990 to 2.41 Mtoe in 2013. The growth is forecast to continue at faster average annual rates of 3.7 percent from 2013 to 2020 and 4.2

percent from 2020 to 2030. From 2030 to 2040 it is expected to grow at a slower rate of 4.0 percent per year.

Like other Southeast Asian countries, Lao PDR has four sectors that use energy – industry, transportation, 'others,' and non-energy. 'Others' cover sub-sectors such as residential, agriculture, services, and commerce. During the 1990–2013 period, the transportation sector increased at the highest rate of 7.3 percent per year followed by the industry sector at 6.4 percent per year, whereas the 'others' sector grew at the lowest rate of 2.1 percent per year. The transportation sector is forecast to continue growing fastest until 2030, from which time it is expected to be the industry sector. However, for the 2013 to 2040 study period as a whole, of all sectors the transportation sector is still expected to register the highest growth at 4.9 percent per year. This is followed by the industry sector at an average annual rate of 4.8 percent, others at 3.2 percent, and non-energy at 2.2 percent.

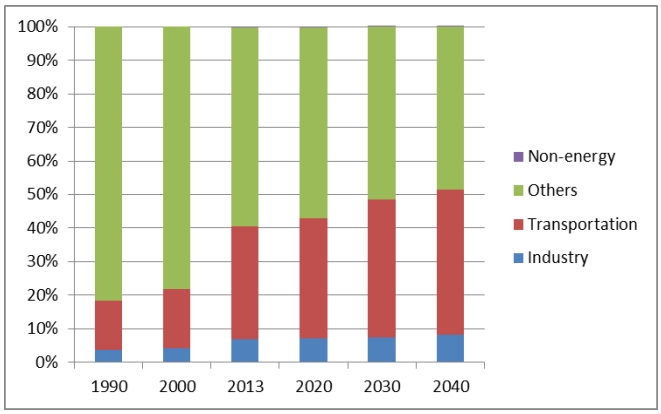
Figure 10-1. Final Energy Consumption by Sector



Mtoe = million tons of oil equivalent.
Source: Author's calculation.

In terms of energy types, 'others,' which is mainly biomass, was the most consumed energy in 2013, at 1.27 Mtoe, and it made up 52.7 percent of TFEC. It is expected that 'others' will continue to have more than half the share until 2015, from which time its share will be less than half, but it will remain the dominant share until 2020, compared with other energy types.

Figure 10-2. Sectors' Share in Final Energy Consumption



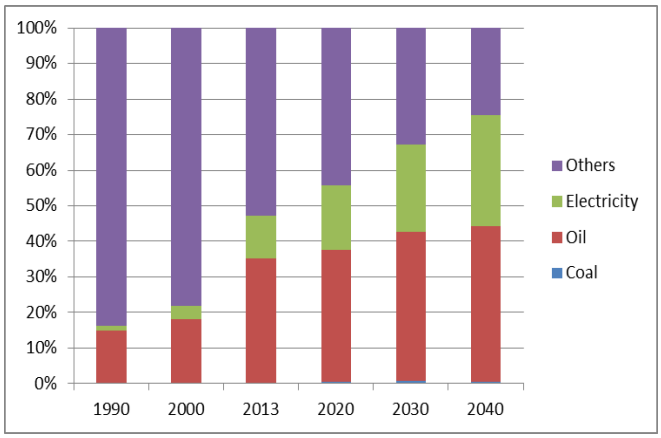
Source: Author's calculation.

In 2020, its share is estimated to be 44.2 percent and that of oil 37.0 percent of TFEC. Biomass from fuel wood and charcoal is the most prevalent in Lao PDR because a majority of Lao people still live in rural areas and rely on fuel wood as their main cooking fuel. Although use of fuel wood is inconvenient compared with other energy types like electricity and liquefied petroleum gas (LPG), mostly used for cooking purposes in urban areas, it costs less or nothing for the consumers. Another important factor in this study concerns the average annual growth rate of 'others' or biomass: even though it has a higher share in final energy consumption, it grew at a lower rate of 1.1 percent per year during the 2013–2040 period. 'Others' accounted for consumption of 1.27 Mtoe in 2013 and this is expected to increase to 1.69 Mtoe in 2040.

Oil is one of the important energy sources for Lao PDR because the transportation sector relies totally on this fuel. The oil price directly affects the country's socio-economic development, i.e. in part it determines the cost of living and doing business in the country. But unlike electricity and coal, oil is the only energy that is not produced domestically and for which Lao PDR is still dependent on other countries; it is imported from Thailand and Viet Nam.

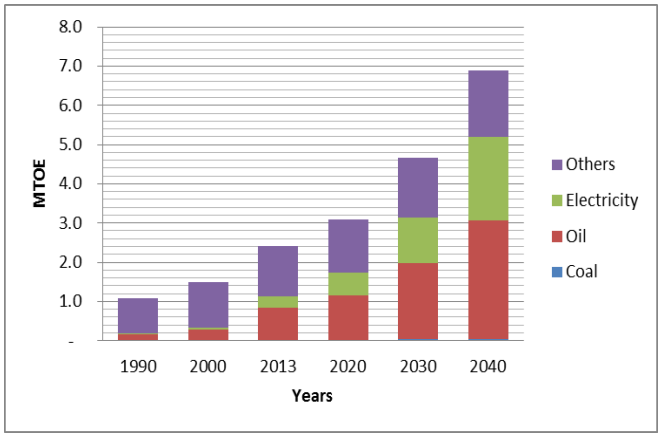
Its trend should be closely examined in this study, therefore. In 2013, 0.84 Mtoe of oil was consumed and consumption is projected to grow at an average annual rate of 4.8 percent during the 2013–2040 period.

Figure 10-3. Final Energy Consumption by Fuel



Source: Author's calculation.

Figure 10-4. Fuels' Share in Final Energy Consumption



Mtoe = million tons of oil equivalent.
Source: Author's calculation.

It is also forecast to take up a bigger share of TFEC from 2024 onwards, even though it ranks second after biomass from 1990 to 2020. Oil demand is expected to rise from 0.88 Mtoe in 2015 to 1.53 Mtoe in 2025, to 2.44 Mtoe in 2035, and to 3.02 Mtoe in 2040. Oil is projected to increase at an average annual growth rate of 4.5 percent from 2013 to 2020, by 5.5 percent from 2020 to 2030 period, by 4.5 percent from 2030 to 2040, and by 4.8 percent during the 2013–2040 period. This is the third highest growth rate compared with coal, electricity, and biomass in the 2013–2040 period.

3.1.2. Primary energy supply

Lao PDR's primary energy consists of coal, oil, hydro, and 'others,' the latter covering biomass, biofuels, and electricity for export. Lao PDR's Total Primary Energy Supply (TPEC) increased at an average annual rate of 3.2 percent from 1.20 Mtoe in 1990 to 2.47 Mtoe in 2013. Growth is expected to continue at a faster rate of 11.4 percent per year from 2013 to 2020 as a lot of coal will need to be used from 2015 for a new thermal power plant. From 2020 to 2030, TPEC's annual growth rate is projected to continue at a slower rate of 3.2 percent per year and at 2.8 percent from 2030 to 2040. Lao PDR's primary energy supply, however, is forecast to grow at an average annual rate of 5.1 percent over the whole period of this study, i.e. in 2013–2040.

In 2013, hydro was the most used energy, at 1.33 Mtoe, followed by biomass (1.27 Mtoe) and oil (0.84 Mtoe). Coal was little used in 1990–2015, but is estimated to have increased sharply from 2015 as the Hongsa Lignite Coal Power Plant started operation then. This causes coal to increase at a very high rate of 155.4 percent on average per year in the 2013–2020 period and its share in TPEC is forecast to increase from 0.3 percent in 2015 to 59.3 percent in 2020. Coal's share is projected to remain high and above 50 percent continuously until 2030, but to fall to 44.2 percent in 2035 and 38.4 percent in 2040. Demand for coal is forecast to grow slowly at an average annual rate of 1.6 percent from 2020 to 2030 and will see no increase at all from 2030 to 2040, although over the entire period of study from 2013 to 2040 it is expected to increase by 28.3 percent, which is higher than any of the other primary energy sources.

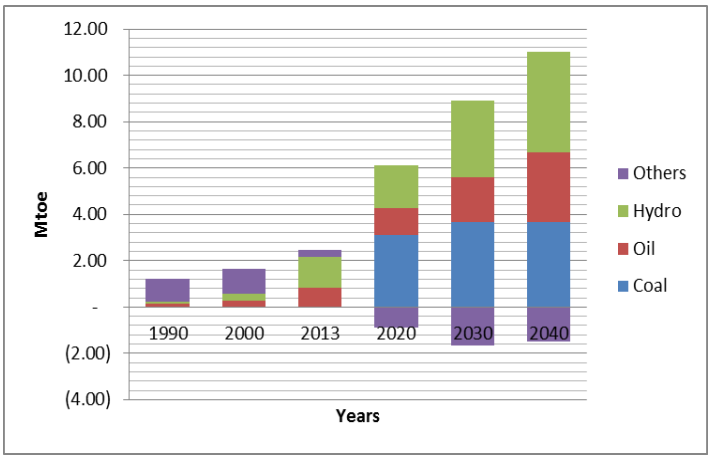
Hydro use is estimated to amount to 1.33 Mtoe in 2013 and is estimated to have a share of 67.6 percent of TPEC in 2015. It is forecast to grow at an average annual rate of 4.5 percent during the 2013–2040 period, so hydro demand will increase to 4.35 Mtoe by 2040. The increase in hydro is due to Lao PDR's intensive efforts to develop hydropower projects to be able to meet increasing domestic demand and increase exports to its neighbouring countries. Lao PDR has agreements to export 7,000 MW to Thailand and 5,000 MW to Viet Nam by 2020.

Biomass has also been much used in Lao PDR as it is a cheaper fuel for cooking and the main fuel used by most rural people. Consumption of biomass increased from 1.01 Mtoe in 1990 to 1.27 Mtoe in 2013, and is projected to increase to 1.30 Mtoe in 2015, 1.37 Mtoe in 2020, 1.44 Mtoe in 2025, 1.52 Mtoe in 2030, 1.61 Mtoe in 2035, and 1.69 Mtoe in 2040. In terms of its growth rate, similar to the projection for biomass in final energy, biomass in primary energy is estimated to grow at 1.1 percent from 2013 to 2040.

Oil has also been growing strongly in Lao PDR because many people can increasingly afford to buy private cars for their commutes, so the number of vehicles has been growing steadily. So far, Lao PDR has not had any refineries, so all oil products are imported. More than 20 oil companies are doing business in Lao PDR; they are authorised to import and sell oil within the country. In 1990, oil use amounted to a mere 0.16 Mtoe, and it increased at an average annual rate of 7.4 percent during the 1990–2013 period. In 1990, its share of TPEC amounted to 13.6 percent. Oil use increased to 0.28 Mtoe in 2000 and 0.84 Mtoe in 2013, with its share of TPEC rising accordingly, from 17.2 percent in 2000 to 34.1 percent in 2013, but it is estimated to be down to 33.3 percent in 2015, and projected to fall to 21.8 percent in 2020, before increasing again to 23.9 percent in 2025, 27.0 percent in 2030, 29.6 percent in 2035, and 31.7 percent in 2040. The average annual growth rate of oil is expected to be the second highest at 4.8 percent, after that of coal, during the 2013–2040 period.

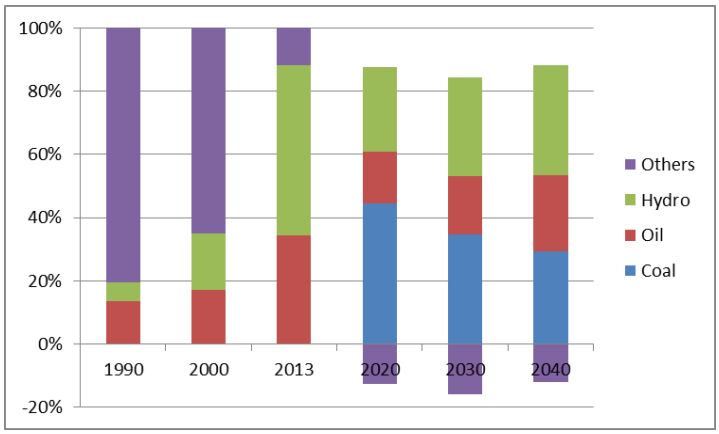
Apart from the primary energies described above that are produced domestically and imported from its neighbours, Lao PDR still exports a significant amount of electricity to Viet Nam, Cambodia, and above all to Thailand. Therefore, in Figure 10-5, 'others' from 2020 onwards shows negative growth because exported electricity is greater than biomass. Lao PDR has been exporting power to Thailand since the Nam Ngum dam was built and started operation in 1971, and many other power plants followed suit after that. Exports increased from 0.05 Mtoe in 1990 to 0.98 Mtoe in 2013, are estimated at 1.33 Mtoe in 2015, and are projected to increase to 2.24 Mtoe in 2020, 3.16 Mtoe in 2025, and 3.19 Mtoe in 2030, 2035, and 2040. Electricity for export is expected to have a high average annual growth rate of 13–14 percent from 1990 to 2020, but over the longer term, for the 2013–2040 period, it is forecast to grow at a rate of 4.5 percent only.

Figure 10-5. Primary Energy Supply by Source



Mtoe = million tons of oil equivalent.
Source: Author's calculation.

Figure 10-6. Fuel Shares in Primary Energy Supply



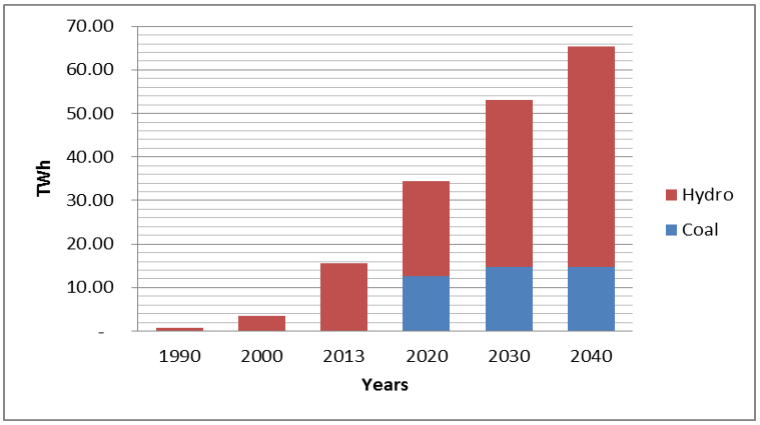
Source: Author's calculation.

3.1.3. Power generation

The history of power generation in Lao PDR can be divided into several periods. During the first period, from 1970 to 2015, all power was generated from one source, i.e. hydropower. The second period is from 2015, when Lao PDR has both hydropower and thermal power plants, as the Hongsa Lignite Power plant started operating in 2015. In 1990, Lao PDR produced only 0.82 TWh of electricity; it increased to 3.44 TWh in 2000 and 15.51 TWh in 2013 and is estimated at 20.79 TWh in 2015. Power generation output is forecast to increase sharply from 2015 to 2040, to 34.40 TWh in 2020, 48.79 TWh in 2025, 53.12 TWh in 2030, 58.35 TWh

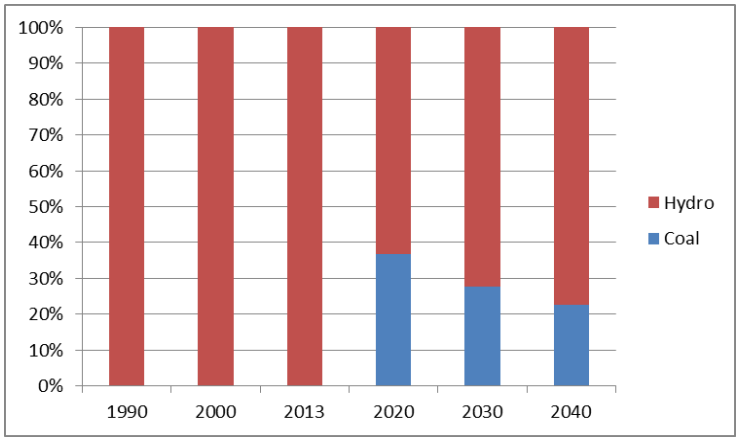
in 2035, and 65.30 TWh in 2040. All power generated before 2015 was from hydropower sources. From 1990 to 2013, power generation grew at an average annual rate of 13.6 percent. It is expected to grow by 12.1 from 2013 to 2020, by 4.4 percent from 2020 to 2030, and by 2.1 percent from 2030 to 2040. As a result of the first thermal power plant coming into operation in 2015, the power generation mix in Lao PDR will change – which can be seen in Figures 10-7 and 10-8 – from 2020 onwards. For example, in 2020 hydropower plants are forecast to account for 63.3 percent of total power generation output and thermal power plants will account for 36.7 percent of total generation. The share of hydropower plants is forecast to remain higher than that of thermal power plants throughout the study period.

Figure 10-7. Electricity Generation in 2040



TWh = terawatt-hour.
Source: Author's calculation.

Figure 10-8. Technologies' Share in Electricity Generation in 2040

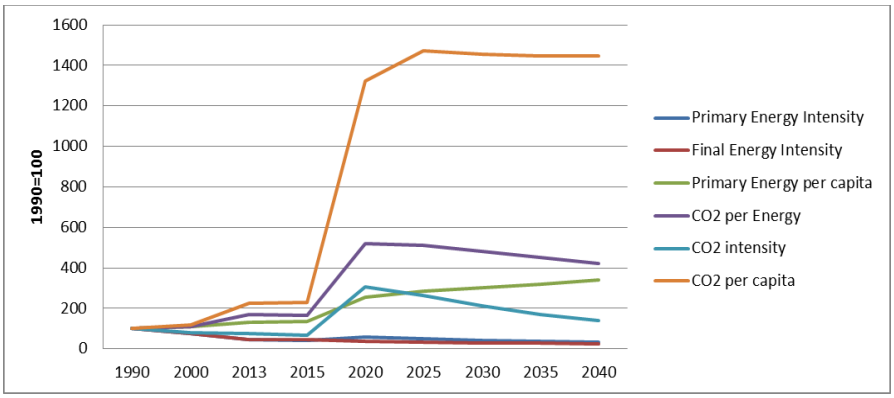


Source: Author's calculation.

3.1.4. Energy indicators

Lao PDR's primary energy intensity (TPES/GDP) peaked in 1990, reaching its highest level of 1,080 toe/million 2005 US$. It is expected to decline very strongly to its lowest level of 359 toe/million 2005 US$ in 2040. Similarly, final energy intensity was at a very low 984 toe/million 2005 US$ in 1990 and fell to 473 toe/million 2005 US$ in 2013. It is estimated at 437 toe/million 2005 US$ in 2015, and forecast to fall further, to 377 toe/million 2005 US$ in 2020, 335 toe/million 2005 US$ in 2025, 305 toe/million 2005 US$ in 2030, 280 toe/million 2005 US$ in 2035, and 260 toe/million 2005 US$ in 2040. These figures are a good indication that energy consumers are implementing energy efficiency and conservation programmes.

Figure 10-9. Energy Intensity and Other Energy Indicators (1990=100)



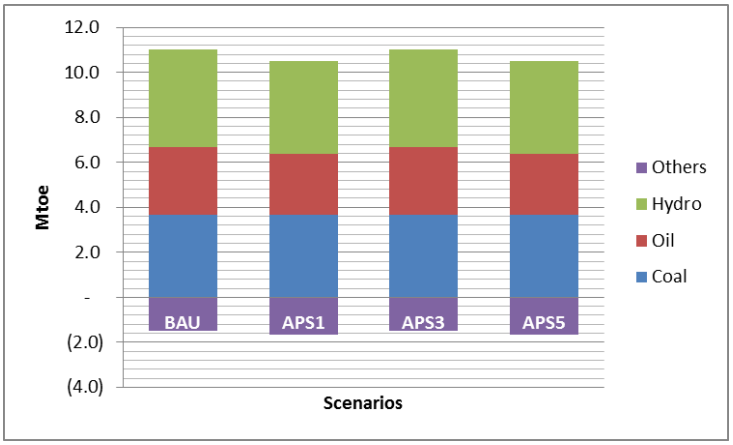
CO_2 = carbon dioxide.
Source: Author's calculation.

3.2. Energy Saving and CO_2 Reduction Potential

As mentioned above, for this study Lao PDR uses three APS for its energy saving and CO_2 reduction potential: Energy Efficiency and Conservation (EEC) scenario (APS1); development of renewable energy (APS3); and APS5, which combines APS1, APS2, and APS3. Implementation of these three APS result in some changes. Firstly, the primary energy supply of APS1 is reduced by 0.520 Mtoe compared with the BAU, i.e. it declined from 7.830 Mtoe in the BAU to 7.309 Mtoe in APS1. Secondly, there is no change in primary energy supply under APS3.

Thirdly, the primary energy supply of APS5 is reduced by the same amount as in APS1. The reduction in primary energy supply mainly comes from the implementation of energy efficiency and conservation programmes, i.e. a reduction of 10 percent in energy consumption. In particular, all existing primary energies such as coal, oil, hydro, and others are reduced (Figure 10-10).

Figure 10-10. Comparison of Scenarios to Primary Energy Supply in 2040

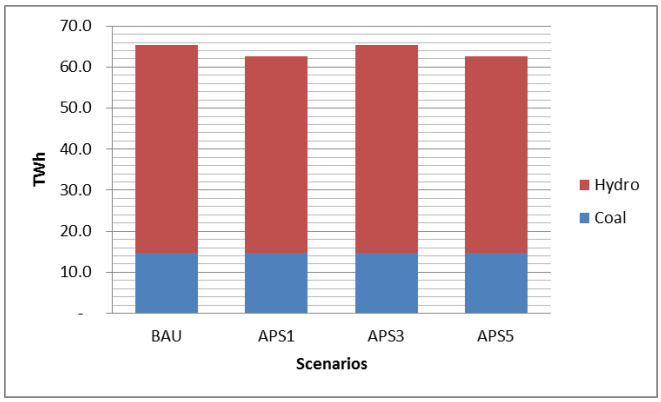


Mtoe = million tons of oil equivalent.
Source: Author's calculation.

Figure 10-11 shows that power generation falls from 65.296 TWh in BAU to 62.671 TWh in APS1, i.e. there is a difference of 2.625 TWh. As APS5 is the combination of APS1 and APS3, and there is no energy saving under APS3, the amount of power generation reduced in APS5 is the same as in APS1. Similar to those for the primary energy supply, that reduction was mainly from the implementation of energy efficiency and conservation programmes, which reduced energy consumption by 10 percent.

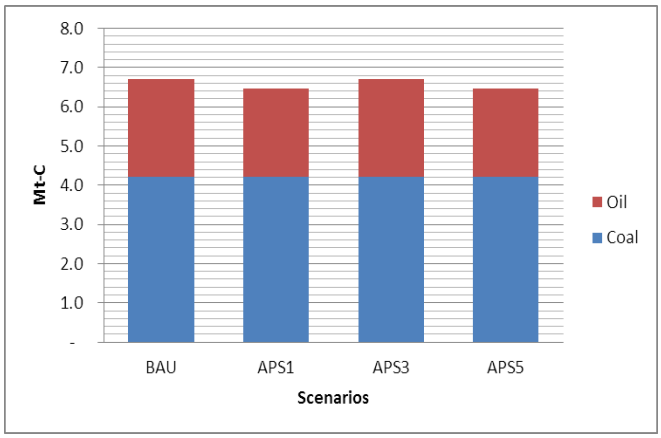
Figure 10-12 illustrates that by comparing levels of CO_2 emission across the four scenarios, CO_2 emission was reduced by 0.224 Mt-C in APS1 as well as in APS5. The CO_2 emission declined from 6.704 Mt-C in the BAU to 6.460 Mt-C in APS1 and to 6.460 Mt-C in APS5. This reduction is mainly due to energy efficiency and conservation programmes.

Figure 10-11. Comparison of Scenarios to Electricity Generation in 2040



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

Figure 10-12. Comparison of Scenarios to Carbon Emissions in 2040



Mt-C = million tons of carbon; BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario.
Source: Author's calculation.

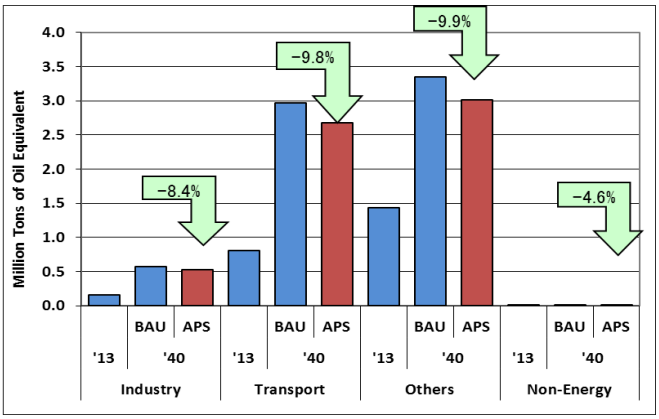
3.1.5. Final energy consumption

When comparing the trends of final energy consumption of the BAU and the APS in each sector, the model gives the following results: In APS1, final energy consumption is expected to increase from 2.41 Mtoe in 2013 to 6.22 Mtoe in 2040. The 'others' sector in APS1 has had the majority share in total final energy consumption since the beginning of the study period (in 2013 its share was 59.5 percent), it is forecast to decline gradually and in 2040 its share is expected to be

48.5 percent. The transportation sector is projected to have the second highest energy demand over the forecast period. In 2013, its final energy consumption was 0.81 Mtoe, it is estimated to have decreased to 0.71 Mtoe in 2015, and is expected to increase to 1.00 Mtoe in 2020, 1.34 Mtoe in 2025, 1.72 Mtoe in 2030, 2.16 Mtoe in 2035, and 2.68 Mtoe in 2040. Average annual final energy consumption during the 2013–2040 period in APS1 is expected to grow less fast than under the BAU; it is forecast to grow by 4.0 percent per year in the BAU and by 3.6 percent in APS1.

As shown in Figure 10-13, final energy consumption in the industry sector is projected to be 8.4 percent lower in the APS than in the BAU in 2040.

Figure 10-13. Final Energy Consumption by Sector, BAU and APS



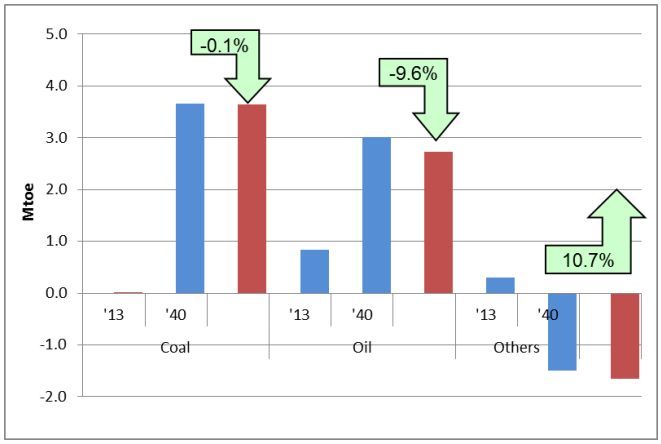
BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario.
Source: Author's calculation.

3.1.6. Primary energy supply

In APS1, 2.47 Mtoe of primary energy was consumed in 2013 and consumption is expected to increase to 4.96 Mtoe in 2020, 6.78 Mtoe in 2030, and 8.84 Mtoe in 2040. Primary energy grew at an average annual growth rate of 3.2 percent from 1990 to 2013. It is expected to grow by 10.4 percent per year from 2013 to 2020, by 3.2 percent per year in the 2020–2030 period, and by 2.7 percent per year in the 2030–2040 period. From 2013 to 2040, primary energy is expected to increase at an annual average rate of 4.8 percent.

Figure 10-14 shows that when comparing BAU and APS in 2040, 0.1 percent less coal is expected to be consumed in the APS, and 9.6 percent less oil, but 10.7 percent more 'other' due to a forecast increase of power exports to Lao PDR's neighbours.

Figure 10-14. Primary Energy Supply by Source, BAU and APS



BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario; Mtoe = million tons of oil equivalent.
Source: Author's calculation.

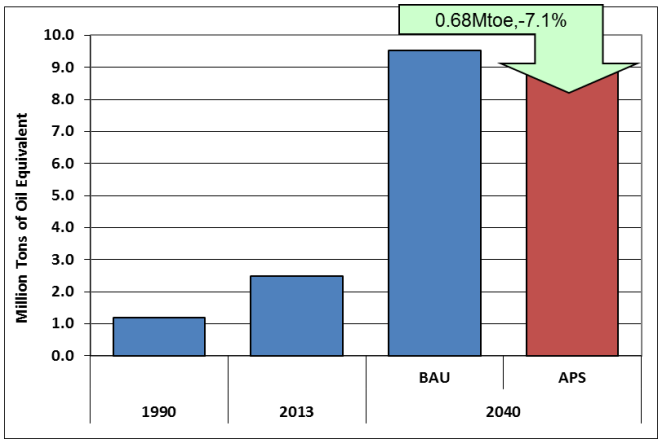
3.1.7. Projected energy savings

Figure 10-5 shows that in 2040 primary energy is expected to decrease from the BAU level to the APS level by 0.68 Mtoe or 7.1 percent. This decrease in total primary energy supply is due to implementation of the planned 10 percent reduction in energy consumption from 2013 to 2030.

3.1.8. Energy intensities

As Lao PDR endeavours to improve itself towards an efficient and competitive economy and promote sustainable development, energy intensity both for final energy and primary energy will be reduced significantly.

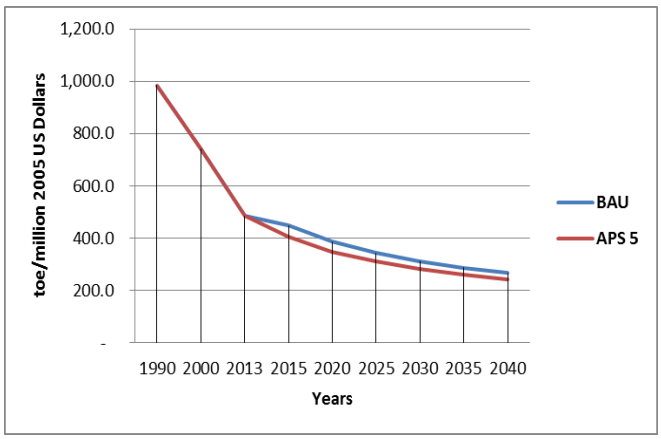
Figure 10-15. Total Primary Energy Supply, BAU and APS



BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario; Mtoe = million tons of oil equivalent.
Source: Author's calculation.

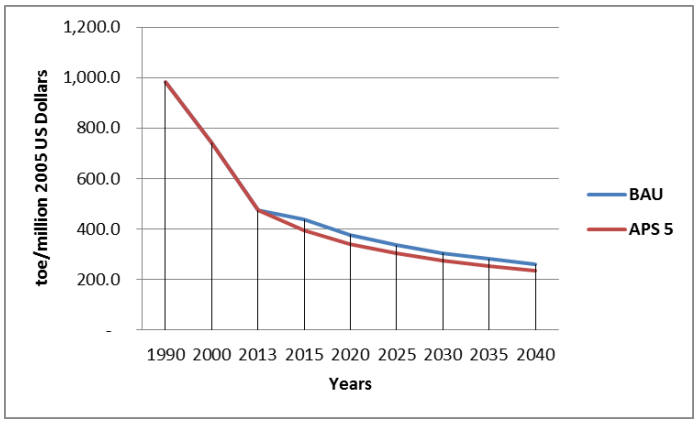
Final energy intensity is projected to decrease from 473 toe/million 2005 US$ in 2013 to 260 toe/million 2005 US$ in 2040. Primary energy intensity is expected to decline from 486 toe/million 2005 US$ in 2013 to 359 toe/million 2005 US$ in 2040. As the graphs in Figure 10-16 and Figure 10-17 show, energy intensity in APS5 is less than in the BAU. This is due to the implementation of the planned 10 percent energy saving from 2013 to 2030. However, Figure 10-17 shows an increase in energy intensity during 2015 to 2020 because of the coming into operation of the Hongsa Lignite thermal power plant in the North.

Figure 10-16. Final Energy Intensity, BAU and APS



BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario; toe = tons of oil equivalent.
Source: Author's calculation.

Figure 10-17. Primary Energy Intensity, BAU and APS

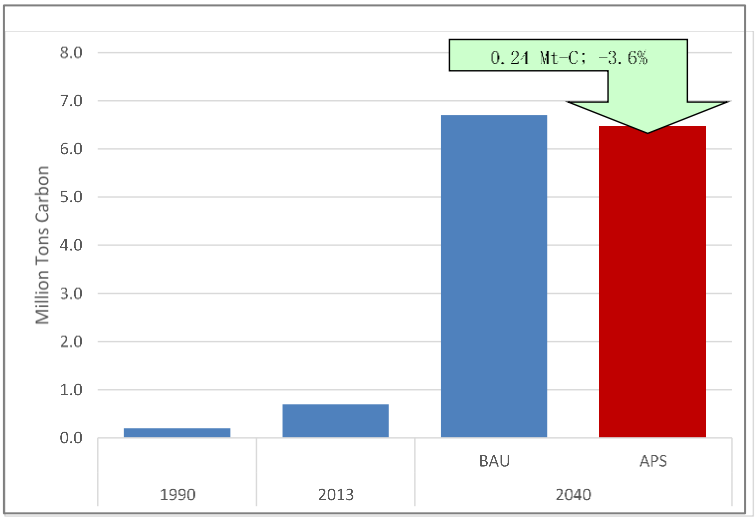


BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario; toe = tons of oil equivalent.
Source: Author's calculation.

3.1.9. CO_2 Emissions

By implementing a 10 percent reduction in energy consumption, Lao PDR can reduce CO_2 emission by 0.24 Mt-C or by 3.6 percent compared with the BAU in 2040 (Figure 10-18).

Figure 10-18. CO_2 Emission from Energy Consumption, BAU vs APS



BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario; Mtoe = million tons of oil equivalent.
Source: Author's calculation.

4. Implications and Policy Recommendations

According to this study, Lao PDR is expected to achieve its projected 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, a 10 percent decrease of biofuels in oil supply for the transportation sector, and a reduction of 10 percent in energy consumption of all sectors.

To achieve energy reduction both in TPEC and TFEC, as well as the desired reduction in CO_2 emissions, Lao PDR should extend the implementation of its renewable energy and energy conservation programmes until 2040. As the energy conservation programmes are the most important in achieving the planned energy reduction, it should be adopted as a national policy. The industry sector should implement the 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 the big cities and conduct campaigns to promote the use of thereof. And the 'other' sector should raise public awareness on energy conservation and implement energy management in the building sector. Moreover, a study on the correlation between GDP and energy consumption should be carried out and energy statistics should be improved accordingly. In addition, the government should consider the following measures:

- Implement EEC programmes in all sectors;
- Establish an EEC fund (similar to that of Thailand) to support EEC programmes and ESCOs;
- Increase public transport and switch to the use of electric vehicles (including public buses and tuk-tuk), which would reduce not only oil imports and CO_2 emissions, but also traffic congestion, which has been getting worse and worse;
- Reform electricity tariffs to encourage more EEC activities, e.g. time of use pricing;

- Increase the share of coal thermal power generation in the power generation mix by using local coals and clean coal technology (CCT) to secure a stable supply of electricity;
- Promote power trade within ASEAN.