Chapter 16

Thailand Country Report

September 2016

This chapter should be cited as

Padprem, S. (2016), 'Republic of Korea Country Report' in Kimura, S. and P. Han (eds.) in *Energy Outlook and Energy Saving Potential in East Asia 2016.* ERIA Research Project Report 2015-5, Jakarta: ERIA, pp.323-335.

Chapter 16

Thailand Country Report

SUPIT PADPREM, ENERGY INFORMATION SYSTEM DEVELOPMENT DIVISION, ENERGY POLICY AND PLANNING OFFICE, MINISTRY OF ENERGY, THAILAND

1. Background

Thailand is in the middle of the South East Asian mainland, with the Pacific Ocean on the south-east coast and the Indian Ocean on the south-west coast. Its land area is approximately 513,115 square kilometres, with great plains at the centre, mountainous areas up north, and highlands in the north-east. Its gross domestic product (GDP) in 2013 was around US$230.4 billion (in constant 2005 US$ terms). In 2013, the population was 67.5 million and income per capita was around US$3,420.

Thailand is an energy importer, especially crude oil, because of very limited domestic resources. Thailand's indigenous energy resources include natural gas, coal (only lignite), and biomass. In 2013, proven reserves were 0.3 billion barrels (21.6 million cubic metres) of oil, 8.4 trillion cubic feet (0.24 trillion cubic metres) of natural gas, and 1,181 million tons of lignite.

Thailand's total primary energy supply (TPES) reached 132.3Mtoe in 2013. Oil accounted for the largest share at around 38.5 percent, followed by natural gas (28.6 percent), and coal (12.9 percent). 'Others' accounted for the remaining 20 percent. In 2013, net imports of energy accounted for 56.5 percent of TPES. Due to very limited indigenous oil resources, Thailand imported around 75 percent of its oil and most of its bituminous coal. Although Thailand produces large quantities of natural gas, about 20 percent of its use was imported from Myanmar

and other countries. In Thailand, natural gas is used as a major energy source for power generation. In 2013, primary natural gas supply registered at 37.84 Mtoe, around 80.0 percent of which was sourced from domestic supply and the rest imported from neighbouring countries. Coal was mainly consumed in power generation and industry, but it was also heavily used in cement and paper production.

Thailand has 33.7 GW of installed electricity generation capacity and power generation was about 165.7 TWh in 2013. The majority of Thailand's power generation was using thermal sources (coal, natural gas, and oil), accounting for 91.5 percent of generation, followed by hydro at 3.5 percent, with geothermal, solar, small hydro, and biomass making up the remainder.

2. Modelling Assumptions

GDP growth from 1990 to 2013 was a moderate 4.2 percent per year. Thailand's GDP is assumed to grow at an average rate of 3.7 percent per year between 2013 and 2040. Population growth is also projected to be quite slow at around 0.03 percent per year between 2013 and 2040, compared with average growth of about 0.8 percent per year between 1990 and 2013.

Natural gas and coal are projected to be the largest energy sources for power generation. Conversely, the shares of fuel-oil and diesel power plants are projected to remain constant. Nuclear power and renewable energy are projected to increase their shares in the power generation mix under the Alternative Policy Scenario (APS).

Thailand's energy saving goals is expected to be achieved through the implementation of energy efficiency programmes in all sectors. In the industrial sector, improvements in technology development in manufacturing processes should help improve energy efficiency. In the residential and commercial ('other') sector, large energy savings are projected, driven by programmes to promote public awareness of energy efficiency and energy efficiency labelling. In the transportation sector, further development in the Bangkok metro area railway

network will contribute to energy savings. Significant improvements in energy efficiency in passenger vehicles are also expected to be achieved in line with new developments in car technologies and the introduction of the next phase of the Eco car programme II.

Government policies will continue to encourage the increased use of alternative fuels, especially biofuels. Reductions in the growth of carbon dioxide (CO_2) emissions are also expected to be achieved through the increased adoption of more energy efficient and lower emissions technologies. In particular, in the APS, nuclear power and renewable energy sources are expected to help reduce CO_2 emissions from electricity generation. Gasohol and biodiesel as oil alternatives are also expected to help curb CO_2 emissions from transportation.

3. Outlook Results

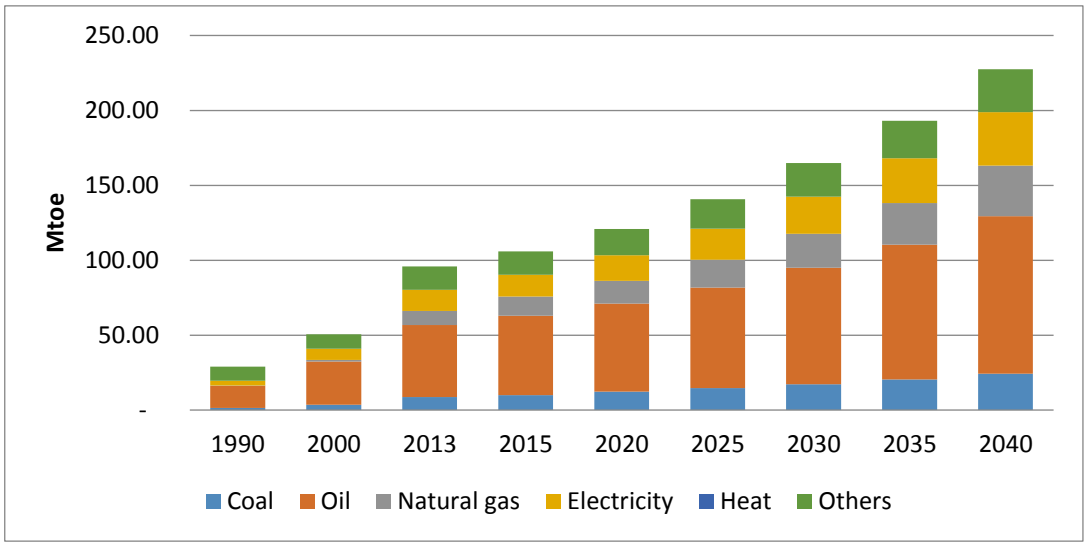
3.1. Business-as-Usual Scenario (BAU)

Between 1990 and 2013, Thailand's final energy consumption grew at an average rate of 5.4 percent per year from 28.9 Mtoe in 1990 to 95.8 Mtoe in 2013 (see Figure 16-1). Given moderate economic growth and a low population growth rate, final energy consumption is projected to grow at a slower rate of 3.3 percent per year between 2013 and 2040.

Oil has been the dominant fuel in Thailand's final energy consumption, accounting for 48.0 Mtoe or a 50.1 percent share in 2013. Electricity was the second largest energy fuel, accounting for 14.1 Mtoe or a 14.8 percent share in 2013.

Oil is expected to remain the largest final energy source throughout the projection period. Its share, however, is projected to decline from the 2013 level to 46.2 percent in 2040. In 2040, the shares of electricity, natural gas, and coal in final energy consumption are projected to increase to 15.7 percent, 14.9 percent, and 10.7 percent, respectively.

Figure 16-1. Final Energy Consumption by Fuel, BAU

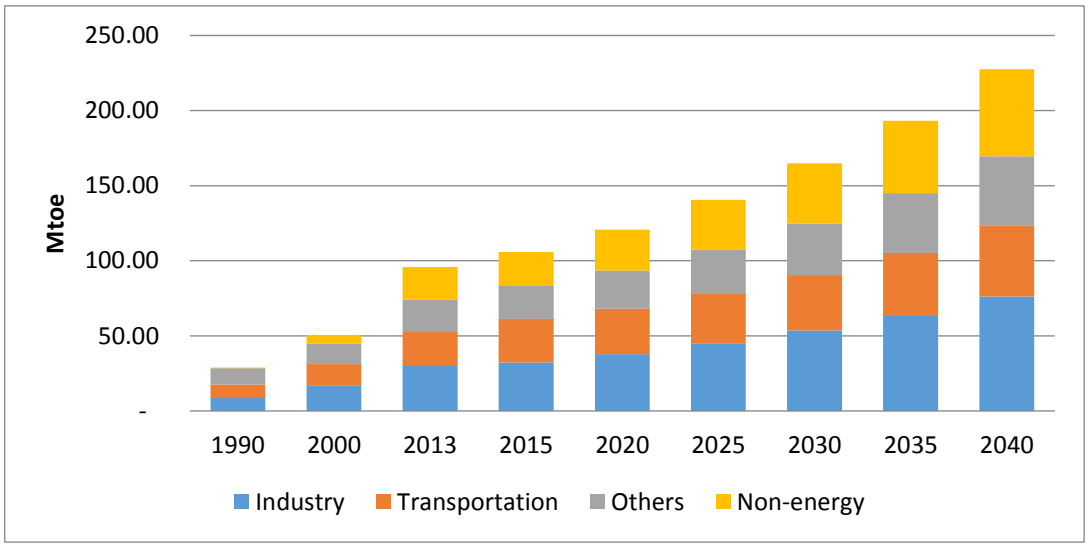


BAU = Business-as-Usual scenario; Mtoe = million tons of oil equivalent.
Source: Author's calculation.

The industry sector had a 30 percent share in the total final energy consumption (TFEC) of Thailand in 1990 at a level of 8.7 Mtoe (see Figure 16-2). The demand of the sector grew at an average rate of 5.5 percent a year between 1990 and 2013, and its share increased to 31.2 percent (equivalent to 29.9 Mtoe) in 2013, which made it the largest consuming sector. The industry sector is projected to remain the largest consumer, accounting for 33.5 percent (equivalent to 76.3 Mtoe) in 2040. In contrast, the sector called 'others' (manly residential and commercial sector) will account for the smallest proportion of final energy consumption in 2040 at 20.3 percent, while previously it was 37.3 percent in 1990.

Primary energy supply grew at an average annual rate of 5.0 percent from 42.6 Mtoe in 1990 to 132.3 Mtoe in 2013, driven largely by fast economic development between 1990 and 1996. This growth in primary energy supply was achieved despite the severe economic crisis in 1997–1998 and the world economic crisis in 2008. In 2013, the major sources of primary energy were oil, natural gas, and coal with shares of 38.5 percent (50.9 Mtoe), 28.6 percent (37.8 Mtoe), and 12.9 percent (17.1 Mtoe), respectively.

Figure 16-2. Final Energy Consumption by Sector, BAU



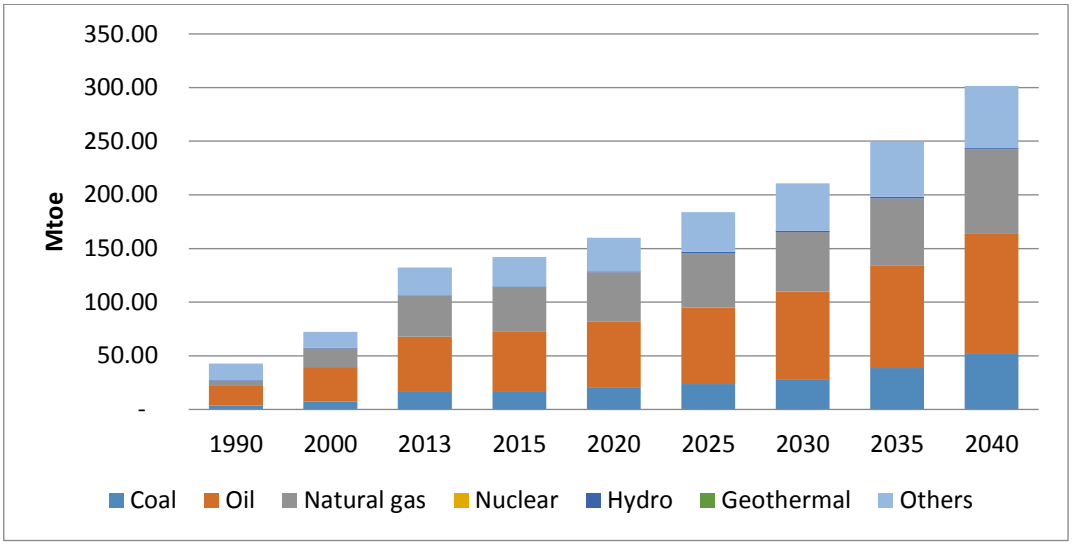
BAU = Business-as-Usual scenario; Mtoe = million tons of oil equivalent.
Source: Author's calculation.

Although oil remained the largest source between 1990 and 2013, its share in primary energy supply decreased slightly from 42.8 percent in 1990 to 38.5 percent in 2013. Natural gas, which is mainly consumed in the power generation sector, became an important source of energy with its share in primary energy supply increasing significantly from 11.9 percent in 1990 to 28.6 percent in 2013. The share of hydropower declined from 1.0 percent in 1990 to only 0.4 percent in 2013.

In the Business-as-Usual scenario (BAU), primary energy supply is projected to grow on average by 3.6 percent per year from 2013 to 2040, reaching 301.5 Mtoe in 2040 (see Figure 16-3). The highest average annual growth rate is expected in coal (6.5 percent), with consumption projected to reach 51.6 Mtoe in 2040. Natural gas will follow at an annual average growth rate of 3.6 percent, reaching 112.1 Mtoe in 2040. Oil growth in the same period will be slower than from 1990 to 2013; it is projected to increase at an average rate of 3.1 percent per year. Although coal and natural gas increased faster than oil, the latter will retain its highest share in the total primary energy supply. The share of oil will decline to 37.2 percent in 2040 while the shares of coal and natural gas will be around 17.1 percent and 26.1 percent, respectively. Biomass is expected to grow at an average rate of 2.8 percent per year between 2013 and 2040.

This rate is slower than the annual average growth rate of total primary energy supply (3.6 percent), and as a result the share of biomass in the total primary energy mix will decline from 17.6 percent in 2013 to 15.4 percent in 2040.

Figure 16-3. Primary Energy Supply by Fuel, BAU

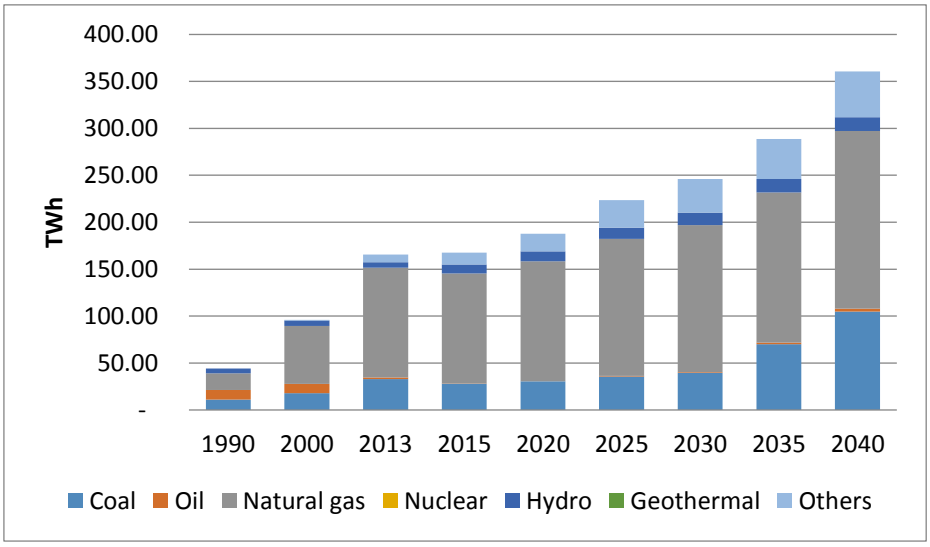


BAU = Business-as-Usual scenario; Mtoe = million tons of oil equivalent.
Source: Author's calculation.

In 1990, the total power generation was 44.2 TWh and it reached 165.7 TWh in 2013, with an average growth rate of 5.9 percent per year. As shown in Figure 16-4, natural gas has been a major fuel for power generation since 1990. Natural gas in power generation grew at a robust rate of 8.5 percent per year from 17.8 TWh (40.2 percent share) in 1990 to 117.0 TWh (70.6 percent share) in 2013. Coal had the second largest share at 25.0 percent in 1990, but it fell to 19.9 percent in 2013. Oil was the least used fuel in power generation, with only 1.7 TWh in 2013.

In the BAU, power generation is expected to grow at around 2.9 percent per year from 2013 to 2040 and will reach 360.8 TWh in 2040. In 2040, natural gas will remain the dominant fuel used in power generation with the highest share of 52.5 percent or 189.3 TWh. Coal will still be the second largest source of power generation with a 29.1 percent share or a level of 105.0 TWh expected in 2040. Power generation from hydro will increase by 3.6 percent per year from 5.8 TWh in 2013 to 14.8 TWh in 2040.

Figure 16-4. Power Generation by Fuel, BAU



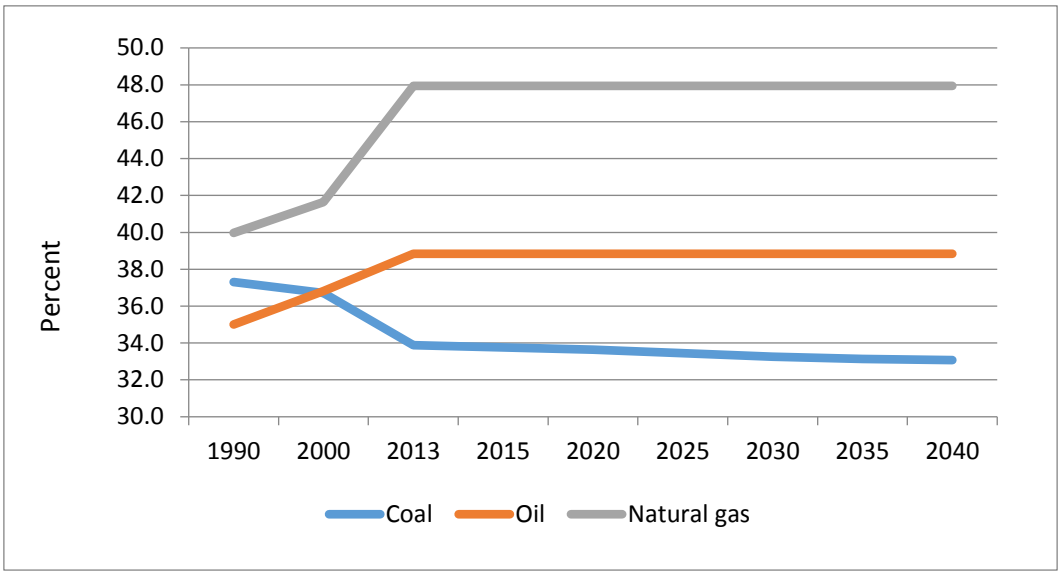
BAU = Business-as-Usual scenario; TWh = terawatt-hour.
Source: Author's calculation.

Natural gas has the highest thermal efficiency improvement. A 40 percent efficiency of natural gas in 1990 improved to almost 48 percent in 2013 and is expected to remain unchanged until 2040. Coal thermal efficiency declined by almost 0.4 percent from 1990 to 2013, and is not expected to improve over the study period (Figure 16-5).

Figure 16-6 shows the energy indicators. Energy intensity reached 574 toe/million at 2005 US$ in 2013. In the BAU, energy intensity is projected to decline by 0.6 percent per year to reach 491 toe/million 2005 US$ in 2040. Energy per capita will increase from almost 2.0 toe per person in 2013 to 4.4 toe per person in 2040.

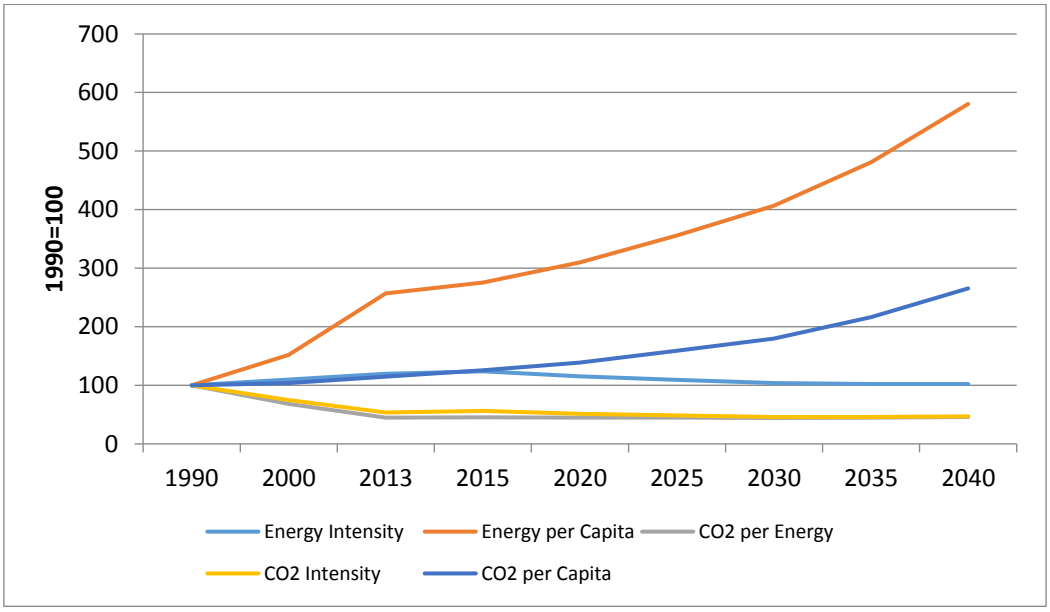
Energy elasticity between 1990 and 2013 was 1.2, which indicates that energy demand rose at a faster rate than economic output. In the BAU, energy elasticity is projected at 0.8 between 2013 and 2040, which means that energy demand will grow at a slower rate than economic output.

Figure 16-5. Thermal Efficiency by Fuel, BAU



BAU = Business-as-Usual scenario.
Source: Author's calculation.

Figure 16-6. Energy Indicators



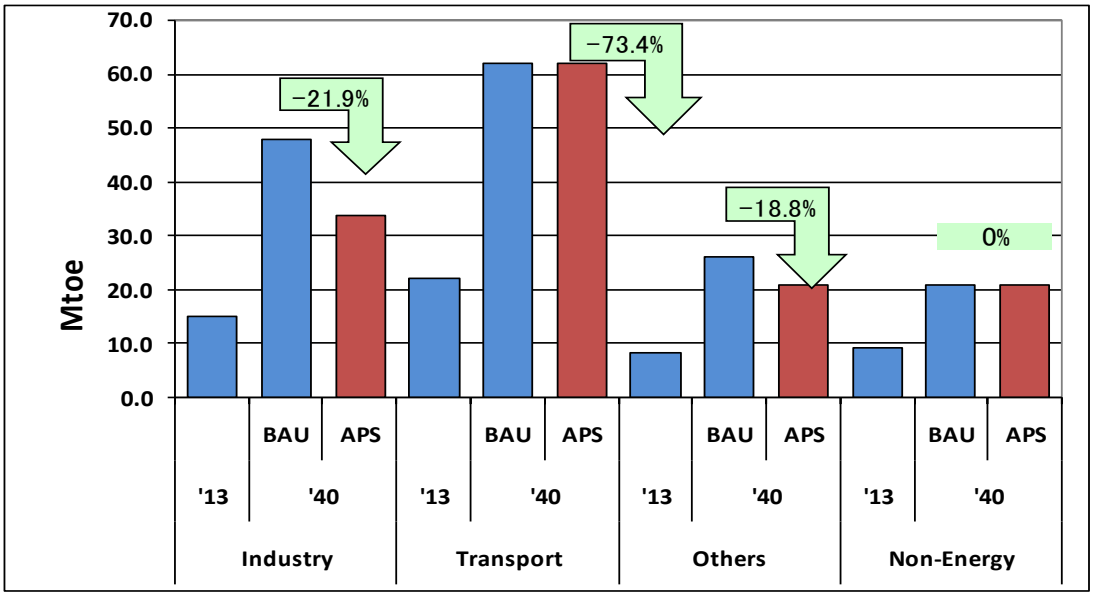
CO_2 = carbon monoxide.
Source: Author's calculation.

3.2. Energy Saving and CO_2 Reduction Potential

3.2.1. Final energy consumption

In the APS, final energy consumption is projected to grow by 2.1 percent per year, from 95.8 Mtoe in 2013 to 167.6 Mtoe in 2040. This is 26.4 percent lower than in the BAU, in which it will grow at an average annual rate of 3.3 percent over the projection period. The majority of energy savings will be achieved through energy efficiency improvement programmes implemented in the industry (21.9 percent) and transportation (73.4 percent) sectors. Improvements will also be achieved in 'other' sectors (18.8 percent), as shown in Figure 16-7.

Figure 16-7. Final Energy Consumption by Sector, BAU and APS



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

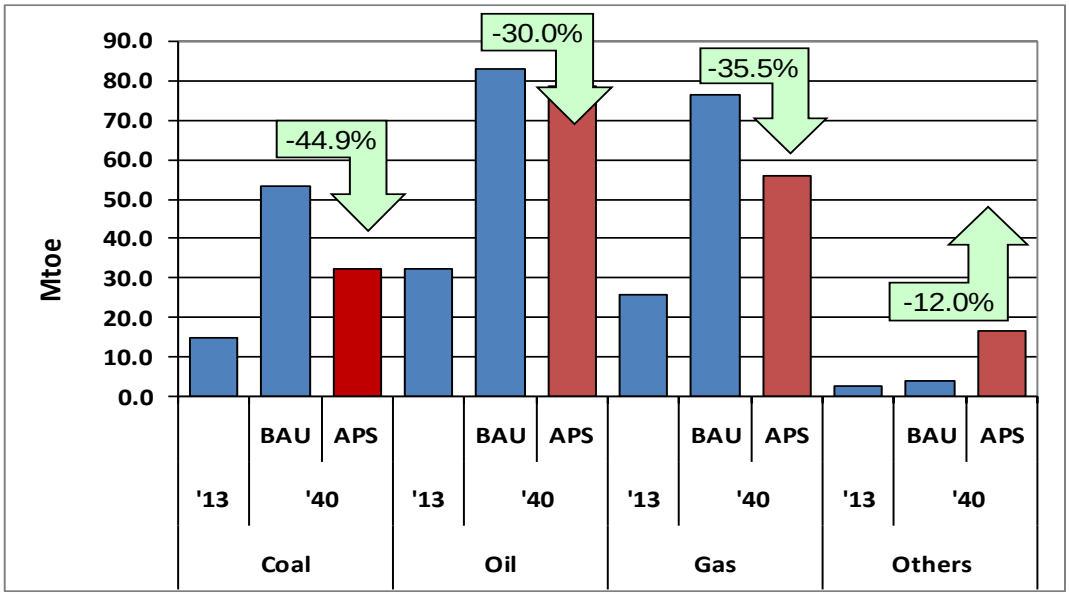
3.2.2. Primary energy supply

In the APS, growth in primary energy supply is projected to be much slower than in the BAU, increasing at 1.7 percent per year (compared with 3.1 percent in the BAU) to reach 209.7 Mtoe in 2040. Primary energy supply is expected to be about

30.4 percent lower in the APS than in the BAU in 2040 – an energy saving of about 91.8 Mtoe.

Coal and oil are projected to increase at slower annual average rates of 1.9 percent and 1.6 percent, respectively (4.2 percent and 3.0 percent in the BAU). Natural gas use is projected to increase at an annual average rate of 1.1 percent (2.8 percent in the BAU) from 37.8 Mtoe in 2013 to 50.8 Mtoe in 2040. The lower growth rates compared with the BAU are mainly achieved through energy efficiency and conservation measures on the demand side. The differences in the projections between the two scenarios are shown in Figure 16-8.

Figure 16-8. 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.

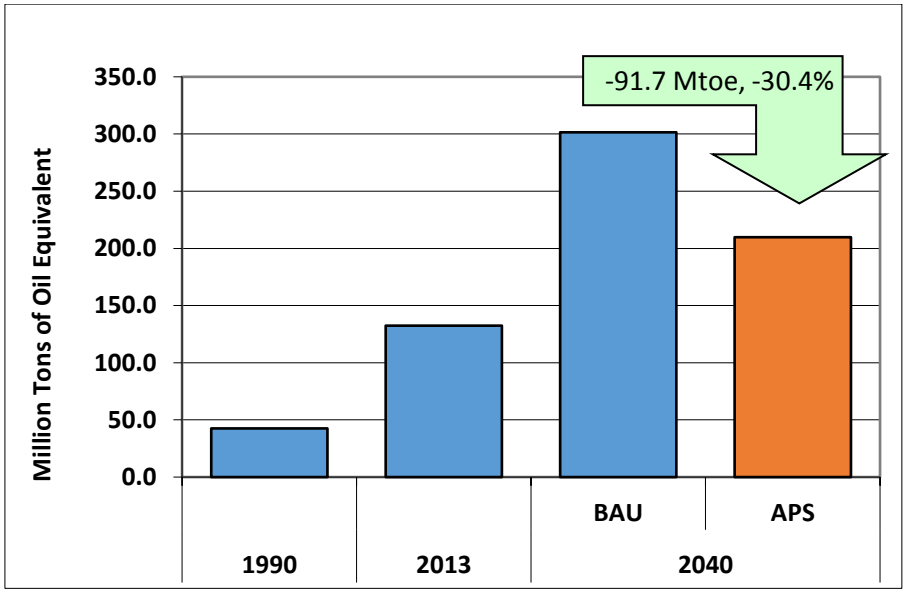
3.2.3. Projected energy savings

The difference between primary energy supply in the BAU and the APS in 2040 is 91.7 Mtoe (Figure 16-9). This represents the potential energy savings that could be achieved if energy efficiency and conservation goals and action plans were implemented. Oil and natural gas will contribute the largest energy savings at

33.6 Mtoe and 27.9 Mtoe, respectively. Energy saving from coal will reach 23.2 Mtoe in 2040, but the contribution of non-fossil energy sources will also be 7.1 Mtoe lower than in the BAU.

In final energy consumption, the savings in the APS compared with the BAU in 2040 will reach 59.9 Mtoe. The largest savings are expected to be achieved in the transport sector, at 34.6 Mtoe. The industry and 'other' sectors are expected to achieve energy savings of 16.7 Mtoe and 8.6 Mtoe, respectively.

Figure 16-9. Total Primary Energy Supply, BAU and APS



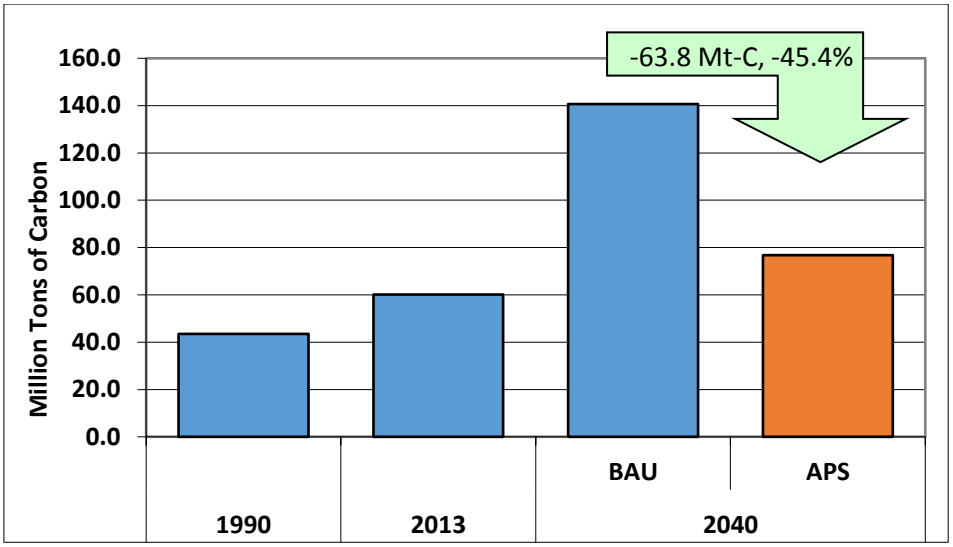
BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario; Mtoe = million tons of oil equivalent.
Source: Author's calculation.

3.3. CO_2 Emissions

CO_2 emissions from energy consumption are projected to increase by 3.2 percent per year on average from 60.2 Mt-C in 2013 to 140.6 Mt-C in 2040 under the BAU. Under the APS, the average annual growth in CO_2 emissions from 2013 to 2040 is projected to be 0.9 percent, with an emission level of 76.8 Mt-C in 2040. The difference in CO_2 emissions between the BAU and the APS is 63.8Mt-C or 45.4 percent.

This reduction in CO_2 emissions highlights the range of benefits that can be achieved through energy efficiency improvements and savings via action plans (Figure 16-10).

Figure 16-10. CO_2 Emissions from Energy Consumption, BAU and APS



CO_2 = carbon dioxide; BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario; Mt-C = million tons of carbon.
Source: Author's calculation.

4. Implications and Policy Recommendations

Strong economic growth prior to the Asian Financial Crisis in 1997 contributed to relatively high energy intensity in Thailand between 1990 and 2011. However, the energy intensity of the economy has declined since it recovered from the crisis. Furthermore, with Thailand's energy efficiency programmes in a wide range of areas (including industry, transportation, and residential sectors), and high oil prices in the world market, a further decline in the energy intensity of the Thai economy is to be expected.

Improving energy efficiency will also help Thailand (which is an oil importer) to address the challenges posed by high world oil prices. Thailand is committed to reducing the intensity of energy consumption, particularly oil consumption, and to looking for more sustainable energy sources and environment-friendly fuels. It was recognised that the more Thailand saves energy, the less sensitive it will be to

fluctuations in world energy prices and supply. Furthermore, Thailand has realised that energy saving is important and that it should put greater efforts into it.

Although Thailand has an alternative policy for the next 23 years, oil will remain a major energy source for its economy. Oil is one of the most sensitive energies in terms of price and security. Thailand should focus more on oil savings in future to become less dependent on this fuel. Furthermore, energy use in the transportation sector in future will be lower than in the other sectors. The sector is also less productive than the others, meaning it consumes more energy but produces less value added. The greater the energy savings that can be achieved in the transport sector, the greater the benefits for the economy as a whole.