CHAPTER 16

THAILAND COUNTRY REPORT

Supit Padrem, *Energy Policy and Planning Office, Ministry of Energy, Thailand*

1. Background

Thailand is in the middle of Southeast Asia, with the Pacific Ocean on the southeast coast and the Indian Ocean on the southwest coast. Its land area is approximately 513,115 square kilometres, with great plains in the centre, mountainous areas in the north, and highlands in the northeast. Its gross domestic product (GDP) in 2015 was about US$393.7 billion (in constant 2010 US$ terms). In 2015, its population was 65.7 million and income per capita was around US$5,989.

Thailand is an energy importer, especially of crude oil, because of very limited domestic resources. Its indigenous energy resources include natural gas, coal (only lignite), and biomass. In 2015, proven reserves were 0.2 billion barrels (26.1 million cubic metres) of oil, and 7.3 trillion cubic feet (0.21 trillion cubic metres) of natural gas. Proven reserves of lignite amounted to 1,181 million tons but this number was published in 2013.

Thailand's total primary energy supply (TPES) reached 135 million tons of oil equivalent (Mtoe) in 2015. Oil accounted for the largest share at around 38.7%, followed by natural gas (28.1%) and coal (12.5%). 'Others' accounted for the remaining 20.7%. In 2015, net imports of energy accounted for 46.5% of the TPES. Due to very limited indigenous oil resources, Thailand imported around 83.6% of its oil and most of its bituminous coal. Although the country produces large quantities of natural gas, about 29.9% 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 2015, primary natural gas supply registered at 37.9 Mtoe; around 75.3% of this level was sourced from domestic supply and the rest was imported from neighbouring countries. Liquefied natural gas was also sourced from other countries. Coal was mainly consumed in power generation and industry. It was also heavily used in cement and paper production.

Thailand generated about 165.7 terawatt-hours (TWh) of power in 2015. The majority of the country's power generation used thermal sources (coal, natural gas, and oil), accounting for 91.5% of generation. It is followed by hydro at 3.5% while geothermal, solar, small hydro, and biomass made up the remainder.

2. Modelling Assumptions

GDP growth in 1990–2015 was a moderate 4.2% per year. Thailand's GDP is assumed to grow at an average rate of 3.8% per year in 2015–2040. Population growth is also projected to be reasonably slow at around 0.03% per year in 2015–2040, compared with average growth of about 0.6% per year in 1990–2015.

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 in the Alternative Policy Scenario (APS).

Thailand expects its energy-saving goals to be achieved through the implementation of energy efficiency programmes in all sectors. In the industry sector, improvements in technology development in manufacturing processes should help improve energy efficiency. In the residential and commercial ('others') sectors, large energy savings are projected, driven by programmes to promote public awareness of energy efficiency and energy efficiency labelling. In the transport sector, further developments 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 phase 2.

Government policies will continue to encourage the increased use of alternative fuels, especially biofuels. Growth of CO_2 emissions is also expected to be reduced 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

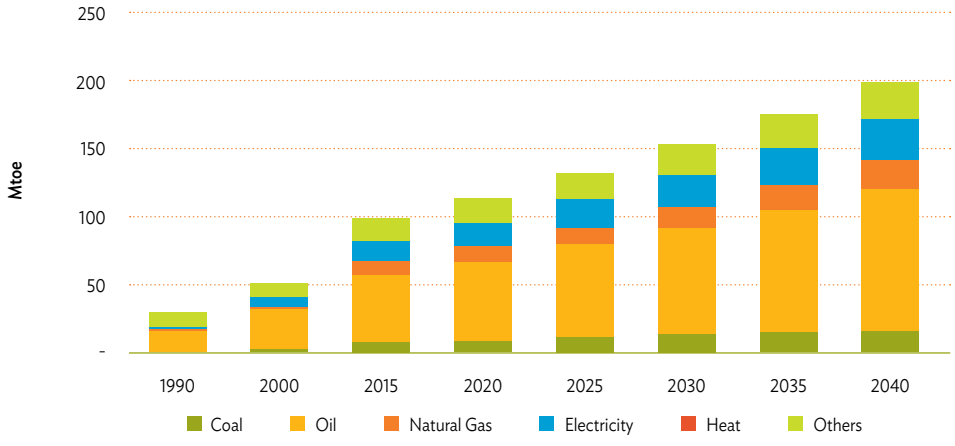
3.1. Business-As-Usual Scenario

In 1990–2015, Thailand's final energy consumption grew at a high rate of 5% per year, from 28.9 Mtoe in 1990 to 98.0 Mtoe in 2015. Given moderate economic growth and low population growth rate, final energy consumption is projected to grow moderately at around 2.9% per year between 2015 and 2040.

Oil was the dominant energy source in final energy consumption, accounting for 49.3 Mtoe, or a 50.2% share, in 2015. Electricity was the second-largest energy source, accounting for 15 Mtoe, or a 15.3% share, in 2015.

Oil is expected to remain the largest final energy source throughout the projection period. Its share is projected to increase from 2015 level to 52% in 2040. In 2040, the shares of electricity will remain the same at the current level, 15.3%, but natural gas and coal in final energy consumption are projected to slightly increase to 10.7% and 8.5%, respectively (Figure 16.1).

Figure 16.1: Final Energy Consumption by Fuel Type, BAU (1990–2040)

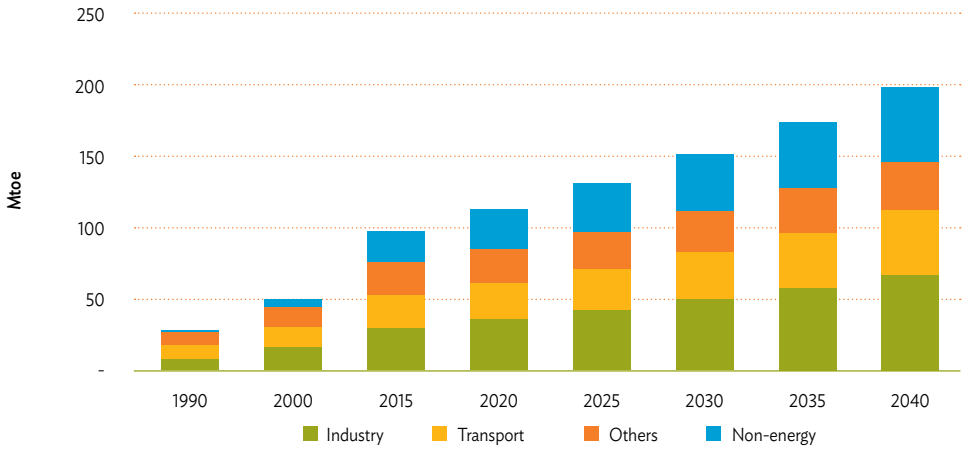


BAU = Business-As-Usual, Mtoe = million tons of oil equivalent.

Sources: 1990–2015 compiled by IEA (2017), 2020–2040 compiled by author.

The industry sector has the smallest share, 8.7 Mtoe, in the total final energy in 1990. While consumption in the sector highly increased at an average rate of 5.2% a year in 1990–2015, the share of industry increased from 30.0% in 1990 to 31.2% in 2015, making it the largest consuming sector. The industry sector is projected to remain the largest consumer, accounting for 34.1% in the final energy consumption in 2040. In addition, non-energy use, which consists mainly of naphtha, will also increase its consumption like the industry sector. As a result, the 'others' (residential and commercial) sector, will account for the smallest proportion of final energy consumption at 17.2% in 2040, showing the declining trend of its share as has been observed since 1990.

Figure 16.2: Final Energy Consumption by Sector, BAU (1990–2040)



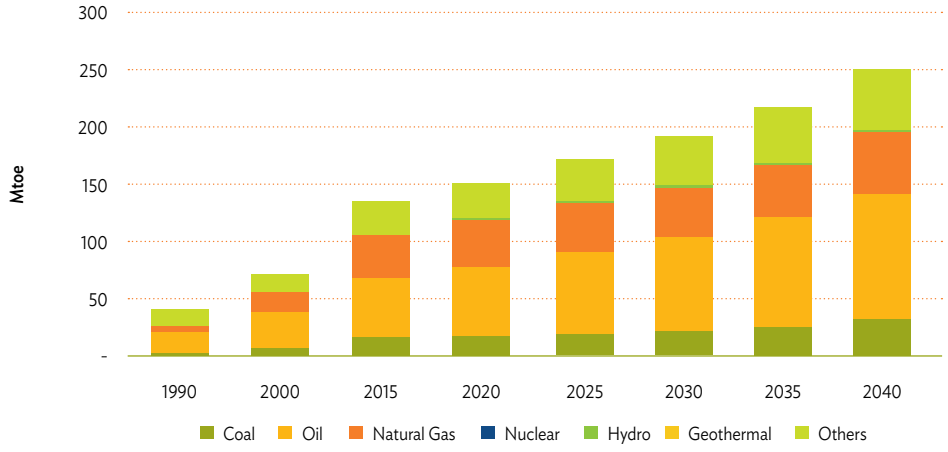
BAU = Business-As-Usual, Mtoe = million tons of oil equivalent.

Sources: 1990–2015 compiled by IEA (2017), 2020–2040 compiled by author.

Primary energy supply grew at an average annual rate of 4.7%, from 42.6 Mtoe in 1990 to 135.0 Mtoe in 2015, driven largely by fast economic development between 1990 and 1996 and moderate economic growth after 1997. This growth in primary energy supply was achieved despite the severe economic crisis in 1997–1998 and the world economic crisis in 2008. In 2015, the major sources of primary energy were oil, natural gas, and coal with shares of 38.7% (52.3 Mtoe), 28.1% (37.9 Mtoe), and 12.5% (16.8 Mtoe), respectively. Although oil remained the largest source in 1990–2015, its share in primary energy demand declined a little from 42.1% in 1990 to 38.7% in 2015. Natural gas, which is mainly consumed in the power generation sector, became an important source of energy with its share in primary energy demand increasing significantly from 11.7% in 1990 to 28.1% in 2015. Contrastingly, the share of hydropower declined from 1.0% in 1990 to only 0.4% in 2015 (Figure 16.2).

In the Business-As-Usual (BAU) scenario, primary energy demand is projected to grow at about 2.5% per year from 2015 to 2040, reaching 250.8 Mtoe in 2040. The highest average annual growth rate is expected in oil (3%), with consumption expected to reach 109.1 Mtoe in 2040, followed by coal and natural gas. The growth rate of coal is expected to be around 2.8% in 2015–2040. Natural gas growth is expected to be slower than that of primary energy demand. Its average growth rate is about 1.4% per year between 2015 and 2040.

Figure 16.3: Primary Energy Supply by Fuel Type, BAU (1990–2040)

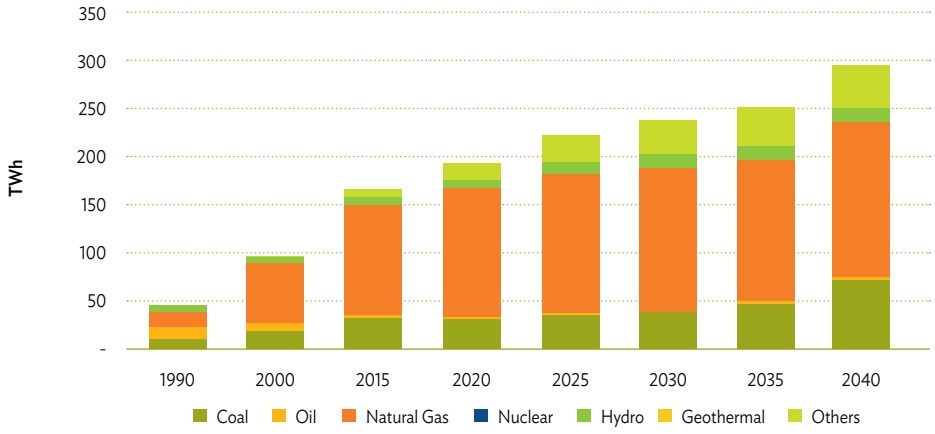


BAU = Business-As-Usual, Mtoe = million tons of oil equivalent.

Sources: 1990–2015 compiled by IEA (2017), 2020–2040 compiled by author.

In 1990, total power generation registered at 44.2 TWh and reached 167.7 TWh in 2015 with an average growth rate of 5.4% per year. Figure 16.4 shows that natural gas has been a major fuel for power generation since 1990. Natural gas power generation grew with a robust rate of 7.8% per year from 17.8 TWh (40.2% share) in 1990 to 117.0 TWh (70.6% share) in 2015. Coal has the second-largest share at 25.0% in 1990, but its share shrank to 19.9% in 2015. Power generation by oil was the smallest, with only 1.7 TWh in 2015.

Figure 16.4: Power Generation by Fuel Type, BAU (1990–2040)



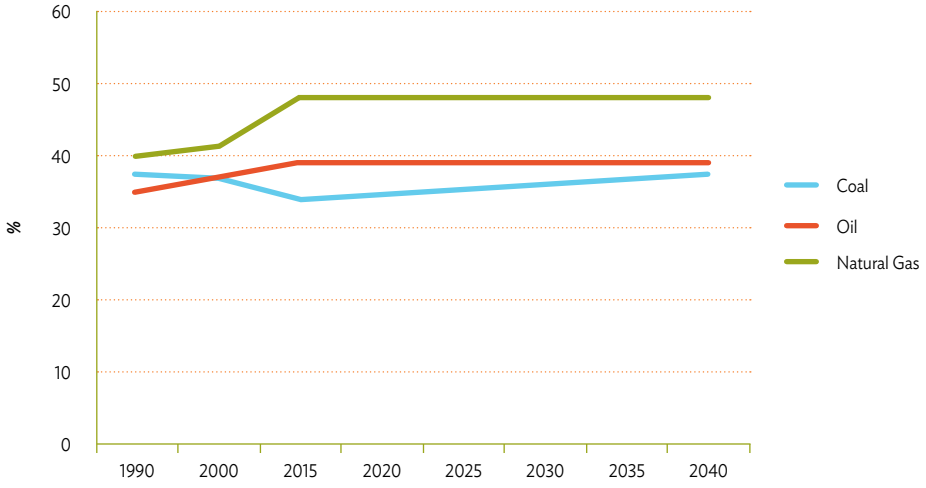
BAU = Business-As-Usual, TWh = terawatt-hours.

Sources: 1990–2015 compiled by IEA (2017), 2020–2040 compiled by author.

In the BAU scenario, power generation is expected to grow at around 2.3% per year in 2015–2040 and will reach 294.6 TWh in 2040. In 2040, natural gas will remain to be a dominant fuel in power generation, with the highest share of 54.6% or 161.0 TWh. Coal will still be the second-largest source of power with 24.4% share, or 71.8 TWh during the period. Power generation from hydro will increase slightly by 3.8% per year, from 5.8 TWh in 2015 to 14.6 TWh in 2040 (Figure 16.4).

Thermal efficiency of natural gas improved the highest improvement as combined cycle gas turbines technology was applied. The 40.0% efficiency of natural gas in 1990 jumped to 47.9% in 2015 and is expected to remain unchanged until 2040. Coal thermal efficiency declined almost 4.0% from 1990 to 2015, but the efficiency is also assumed to improve from 33.9% in 2015 to 37.3% in 2040 (Figure 16.5).

Figure 16.5: Thermal Efficiency by Fuel Type, BAU (1990–2040)

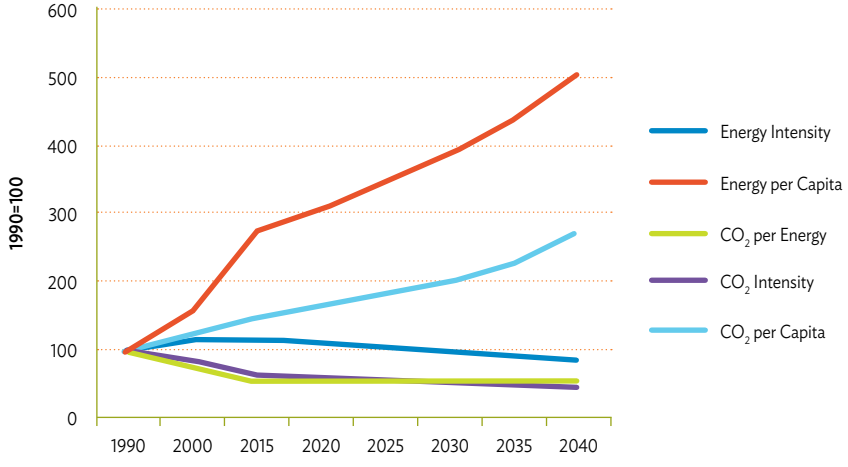


BAU = Business-As-Usual.

Sources: 1990–2015 compiled by IEA (2017), 2020–2040 compiled by author.

Energy intensity reached 343 toe/million at 2010 US$ in 2015. In the BAU scenario, energy intensity is projected to decline by 1.2% per year to reach 251 toe/million 2010 US$ in 2040. Energy per capita will move upward from 2.1 toe per person in 2015 to 3.8 toe per person in 2040 (Figure 16.6).

Figure 16.6: Energy Indicators (1990–2040)



Sources: 1990–2015 compiled by IEA (2017), 2020–2040 compiled by author.

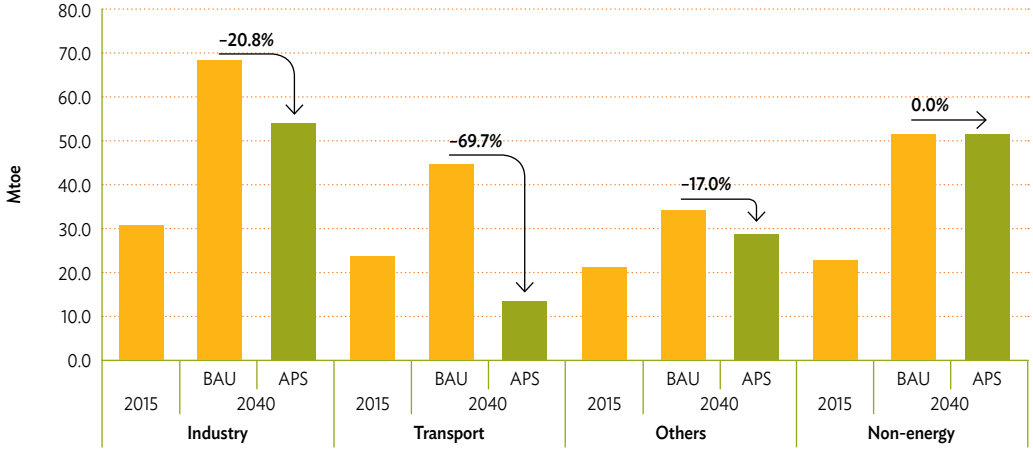
Energy elasticity in 1990–2015 was 1.2, indicating that energy demand rose faster than economic growth. In the BAU scenario, energy elasticity is projected at 0.8 between 2015 and 2040. It means that energy demand will grow at a slower rate than economic output.

3.2 Energy Saving and CO_2 Reduction Potential

3.2.1 Final Demand

In the APS (APS5), final energy consumption is projected to grow at 1.6% per year, from 98.0 Mtoe in 2015 to 147.2 Mtoe in 2040. This is lower by 25.8% than the BAU scenario, which will grow at an average annual rate of 2.9% in 2040. The majority of energy savings will be achieved through energy efficiency improvement programmes implemented in the industry (20.8%) and the transport (69.7%) sectors. Improvements will also be achieved in the 'others' sector (17%) (Figure 16.7).

Figure 16.7: 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.

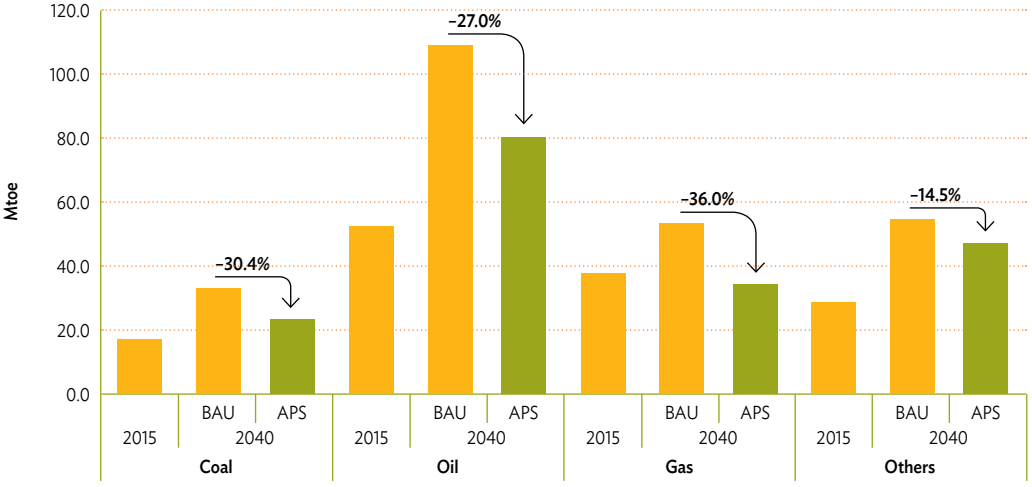
Sources: 2015 compiled by IEA (2017), 2040 compiled by author.

3.2.2 Primary Energy Supply

In the APS, growth in primary energy supply is projected to be much slower than in BAU, increasing at 1.2% per year (compared with 2.5% in the BAU scenario) to reach 184 Mtoe in 2040. Primary energy supply is expected to be about 26.6% lower than in the BAU scenario in 2040, an energy saving of about 66.8 Mtoe.

Oil and coal are projected to increase at slower average annual rates of 1.7% and 1.3%, respectively (3.0% and 2.8% in the BAU scenario). Natural gas is projected to decrease at an average annual rate of -0.4% (1.4% in the BAU scenario) from 53.4 Mtoe in 2015 to 34.2 Mtoe in 2040. The lower growth rates compared to the BAU scenario 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 Demand by Source, BAU and APS (2015 and 2040)



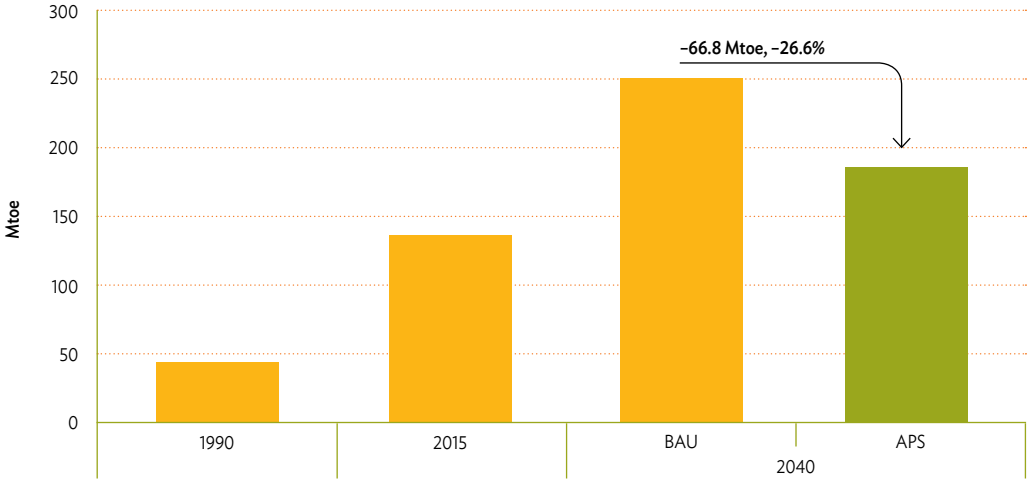
APS = Alternative Policy Scenario, BAU = Business-As-Usual, Mtoe = million tons of oil equivalent.

Sources: 2015 compiled by IEA (2017), 2040 compiled by author.

3.3 Projected Energy Savings

The difference between primary energy supply in BAU and the APS in 2040 is 66.8 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 will contribute the largest energy savings at 29.4 Mtoe. Meanwhile, energy savings from natural gas and coal will reach 19.2 Mtoe and 10.1 Mtoe, respectively, in 2040. However, the contribution of non-fossil energy sources will also be 10.6 Mtoe lower than in the BAU scenario.

Figure 16.9: Total Primary Energy Supply, BAU and APS (1990, 2015, and 2040)



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

Sources: 1990 and 2015 compiled by IEA (2017), 2040 compiled by author.

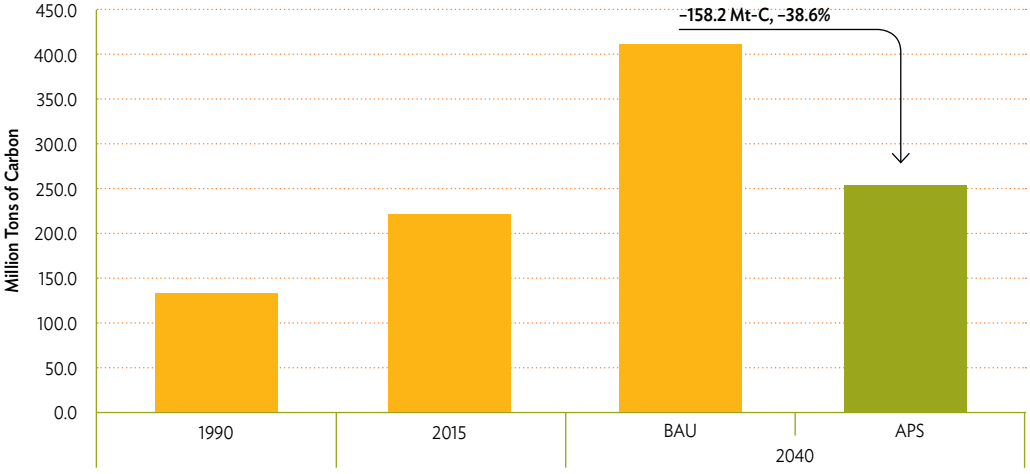
In final energy consumption, the savings in the APS in 2040 will reach 51.1 Mtoe. The largest savings are expected to be achieved in the transport sector at 31.3 Mtoe. On the other hand, the industry and the 'others' sectors are expected to save 14.1 Mtoe and 5.8 Mtoe of energy, respectively.

3.4 CO_2 Emissions from Energy Consumption

CO_2 emissions from energy consumption are projected to increase by 2.5% per year on average, from 220.6 million tons of carbon (Mt-C) in 2015 to 410.1 Mt-C in 2040 under the BAU scenario.

Under the APS, the average annual growth in CO_2 emissions in 2013–2040 is projected to be 0.5%, with emissions level of 252 Mt-C in 2040. The difference in the CO_2 emissions between the BAU scenario and the APS is 158.2 Mt-C or 38.6%. This reduction in CO_2 emissions highlights the range of benefits that can be achieved through energy efficiency improvements and savings via action plans as well as shifting to lower carbon energy (Figure 16.10).

Figure 16.10: CO_2 Emissions from Energy Consumption, BAU and APS (1990, 2015, and 2040)



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

Sources: 1990 and 2015 compiled by IEA (2017), 2040 compiled by author.

3.5 Thailand's Intended Nationally Determined Contributions (INDC)

3.5.1 Thailand's INDC in Greenhouse Gases

Thailand submitted its INDC in greenhouse gas to the United Nations Framework Convention on Climate Change on 1 October 2015. The target of greenhouse gas reduction, according to its INDC, would be 20% off from BAU by 2030; this was forecast nationally in 2005. CO_2 emissions in the BAU scenario were estimated at 555 Mt-C in 2030. Consequently, the INDC also targets reduced CO_2 of 113 Mt-C in the energy sector.

3.5.2 INDC Achievement and the APS

Under the APS, carbon emission reduction in 2030 was estimated at 80 Mt-C, about 227 Mt-C lower than 307 Mt-C of the BAU scenario (East Asia Summit outlook). This reduction amount of 80 Mt-C is equal to 288 Mt-C. In this regard, the APS's CO_2 reduction targets can be achieved through the INDC targets (reduction of 113 Mt-C) in the energy sector. Thailand's policy on energy savings should be satisfied adequately based on the target of CO_2 reduction commitment described in its INDC.

4. Implications and Policy Recommendations

Strong economic growth before the 1997 Asian financial crisis contributed to relatively high energy intensity in Thailand in 1990–2011. However, energy intensity has declined since the economy recovered from the 1997 crisis. Furthermore, Thailand's energy efficiency programmes in a wide range of areas (including the industry, transport, and building sectors) and higher oil prices in the world market will contribute to a continued decline in energy intensity.

Improving energy efficiency will also help Thailand (which is an oil importer) address the challenges posed by high world oil prices. Thailand is committed to reduce the intensity of energy consumption, particularly oil consumption, and is looking for more sustainable energy sources and environment-friendly fuels. 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 savings is important; thus, the country should put more effort into it.

Although the country has an alternative policy for the next 23 years, oil will remain a major energy source. Oil is one of the most sensitive energy sources in terms of price and security. Thailand should focus more on saving oil to be less dependent on this fuel. Furthermore, energy use in the transport sector will become the smallest in the future compared to other sectors. Nonetheless, this sector is also less productive than the others. It means that it consumes more energy, but adds less value. The more energy saving effort in the transport sector, the more benefit it will be for the economy as a whole.