CHAPTER 16

Thailand Country Report

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CHAPTER 16

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1. Background

Thailand is in the middle of the Southeast Asian mainland, with the Pacific Ocean on the southeast coast and the Indian Ocean on the southwest coast. Its land area is approximately 513,115 square km, with great plains at the centre, mountainous areas up north, and highlands in the northeast. Its gross domestic product (GDP) in 2017 was around US$424.2 billion (in constant 2010 US dollar terms). In 2017, the population was 69.2 million and income per capita was around US$6,130.

Thailand is an energy importer, especially crude oil, because of its very limited domestic oil resources. Thailand's indigenous energy resources include natural gas, coal (only lignite), and biomass. In 2017, proven reserves were 0.16 billion barrels (25.4 million cubic metres) of oil and 6.4 trillion cubic feet (0.18 trillion cubic metres) of natural gas.

Thailand's total primary energy supply (TPES) reached 122.5 Mtoe in 2017. Oil accounted for the largest share at around 36.1%, followed by natural gas (31.2%), and coal (12.2%). 'Others' accounted for the remaining 20.2%. In 2017, net imports of energy accounted for 58% of TPES. Due to very limited indigenous oil and coal resources, Thailand imported around 85% of its oil and most of its bituminous coal. Although Thailand produces large quantities of natural gas, about 28% was imported from Myanmar and other countries. In Thailand, natural gas is used as a major energy source for power generation. In 2017, primary natural gas supply registered at 38.2 Mtoe, around 72% of which was sourced from domestic supplies and the rest imported

from neighboring countries. Coal was mainly used for power generation, but it was also heavily used in industrial cement and paper production.

Thailand has 38.6 GW of installed electricity generation capacity and power generation was about 167.5 TWh in 2017. The majority of Thailand's power came from thermal generation (coal, natural gas, and oil), accounting for 93.8% of generation, followed by hydro at 2.8%, together with geothermal, solar, small hydro, and biomass making up the remainder.

2. Modelling Assumptions

GDP growth from 1990 to 2017 was a moderate 4.1% per year. Thailand's GDP is assumed to grow at an average rate of 3.5% per year between 2017 and 2050. Population growth is also projected to be quite slow at around 0.3% per year between 2017 and 2050, compared with average growth of about 0.7% per year between 1990 and 2017.

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 at the lowest share. Renewable energy is projected to increase its shares in the power generation mix under the Alternative Policy Scenario (APS).

Thailand's energy-saving goals are expected to be achieved through efficiency programmes in all sectors. In the industrial sector, improvements 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 CO2 emissions are also expected to be achieved through the increased adoption of more energy-efficient technologies. In particular, in the APS, renewable energy sources are expected to help reduce CO2 emissions from electricity generation. Gasohol and biodiesel as oil alternatives are also expected to help curb CO2 emissions from transportation.

3. Outlook Results

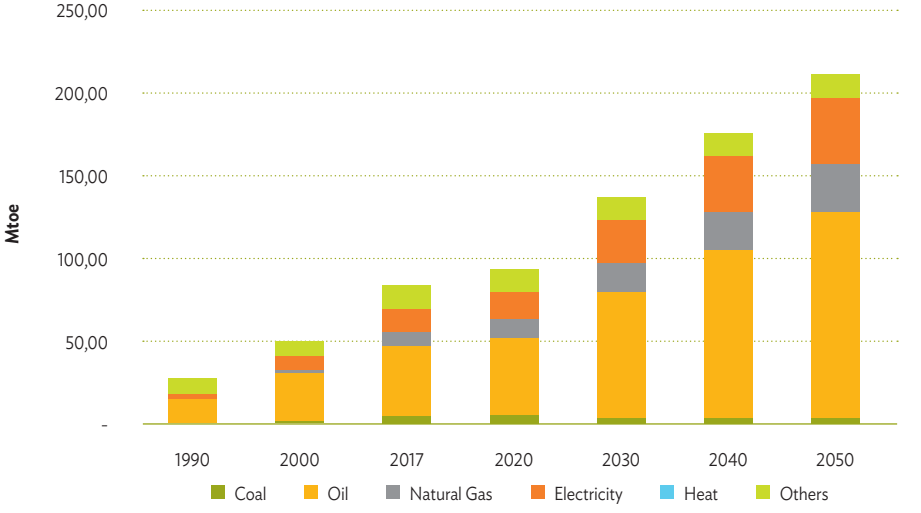
3.1. Business-as-Usual Scenario

Between 1990 and 2017, Thailand's final energy consumption grew at an average rate of 4.1% per year from 28.9 Mtoe in 1990 to 85.3 Mtoe in 2017 (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 2.8% per year between 2017 and 2050.

Oil has been the dominant fuel in Thailand's final energy consumption, accounting for 42.1 Mtoe or a 49.4% share in 2017. Electricity was the second-largest energy fuel, accounting for 15.0 Mtoe, or a 17.6% share in 2017.

Oil is expected to remain the largest final energy source throughout the projection period. Its share is projected to rise continuously from the 2017 level to 58.0% in 2050. In 2050, the shares of electricity and natural gas in final energy consumption are projected to increase to 18.9% and 13.8%, respectively, while the share of coal is projected to decline to 2.4%.

Figure 16.1. Final Energy Consumption by Fuel, BAU
(in Mtoe)



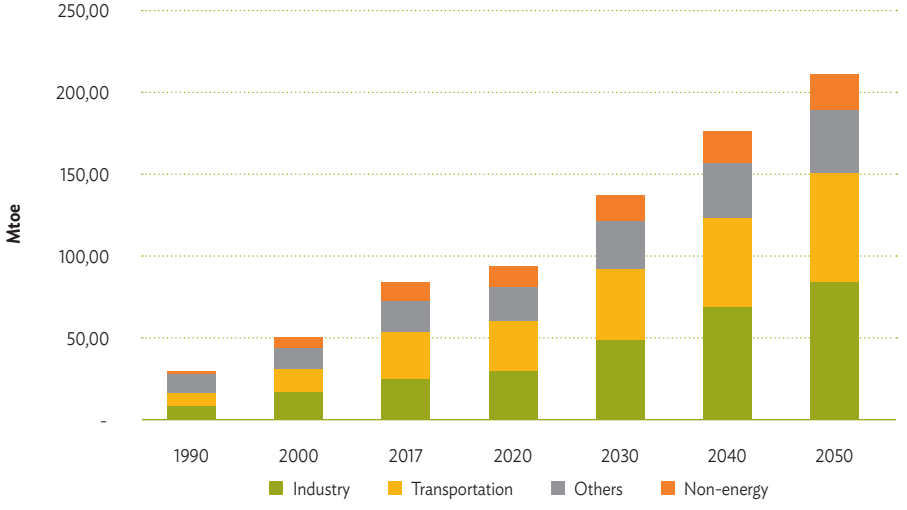
BAU = Business-as-Usual scenario; Mtoe = million tonnes of oil equivalent.

Source: Author's calculation.

The industry sector had a 30% share in the total final energy consumption 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 4.0% a year between 1990 and 2017, and its share slightly went down to 29.4% (equivalent to 25.1 Mtoe) in 2017, which made it the second-largest consuming sector. However, industry is projected to be the largest consumer, accounting for 40.4% (equivalent to 85.6 Mtoe) in 2050. In contrast, the 'others' sector (manly residential and commercial) will account for the smallest proportion of final energy consumption in 2050 at 18.4%, while previously it was 37.3% in 1990.

Primary energy supply grew at an average annual rate of 4.0% from 42.6 Mtoe in 1990 to 122.5 Mtoe in 2017, 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 2017, the major sources of primary energy were oil, natural gas, and coal with shares of 36.1% (44.3 Mtoe), 31.2% (38.2 Mtoe), and 12.2% (14.9 Mtoe), respectively.

Figure 16.2. Final Energy Consumption by Sector, BAU
(in Mtoe)



BAU = Business-as-Usual scenario; Mtoe = million tonnes of oil equivalent.

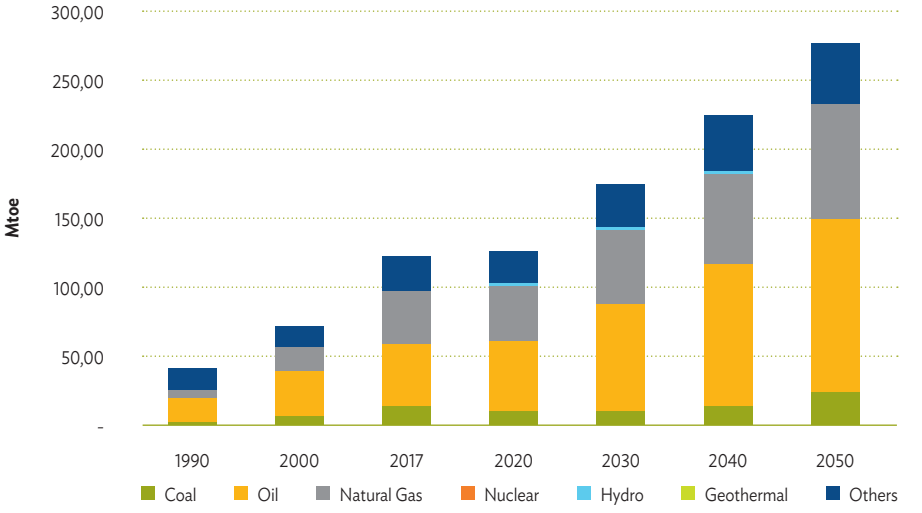
Source: Author's calculation.

Although oil remained the largest source between 1990 and 2017, its share in primary energy supply decreased slightly from 42.1% in 1990 to 36.1% in 2017. Natural gas, which is mainly consumed in the power generation sector, became an important source of energy with its share in primary supply increasing from 11.7% in 1990 to 31.2% in 2017. The share of hydropower declined from 1.0% in 1990 to only 0.3% in 2017.

In the Business-as-Usual scenario (BAU), primary energy supply is projected to grow on average by 2.5% per year from 2017 to 2050, reaching 277.6 Mtoe in 2050 (see Figure 16-3). The highest average annual growth rate is expected in oil (3.2%), with consumption projected to reach 125.1 Mtoe in 2050. Natural gas will follow at an annual average growth rate of 2.3%, reaching 81.9 Mtoe in 2050. Coal growth in the same period will be slower than from 1990 to 2017; it is projected to increase at an average rate of 1.6% per year. The share of oil will increase again to 45.0% in 2050 while the shares of coal and natural gas will be around 9.2% and 29.5%, respectively. Biomass is expected to grow at an average rate of 0.9% per year between 2017 and 2050.

This rate is slower than the annual average growth rate of total primary energy supply (2.5%), and as a result the share of biomass in the total primary energy mix will decline from 16.8% in 2017 to 9.9% in 2050.

Figure 16.3. Primary Energy Supply by Fuel, BAU
(in Mtoe)

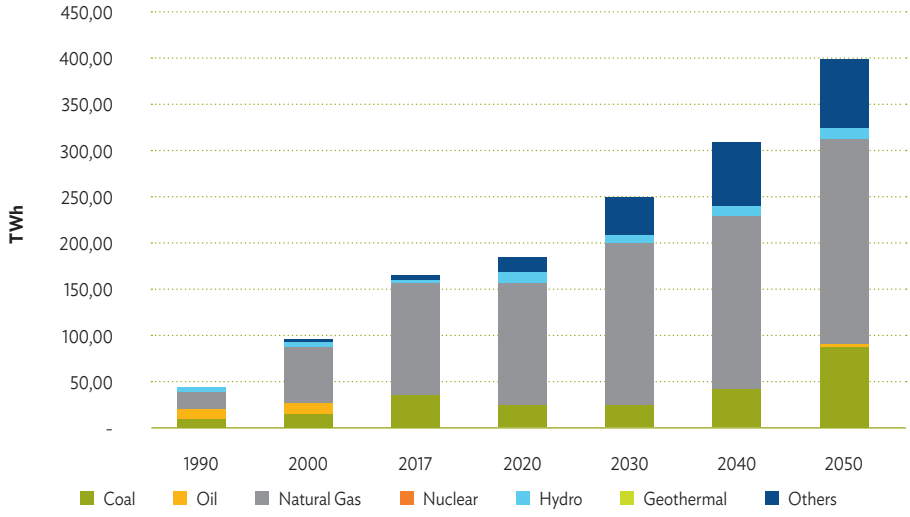


BAU = Business-as-Usual scenario; Mtoe = million tonnes of oil equivalent.
Source: Author's calculation.

In 1990, the total power generation was 44.2 TWh and it reached 167.5 TWh in 2017, with an average growth rate of 5.1% 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 7.4% per year from 17.8 TWh (40.2% share) in 1990 to 121.0 TWh (72.3% share) in 2017. Coal had the second largest share at 25.0% in 1990, but it fell to 21.3% in 2017. Oil was the least-used fuel in power generation, with only 0.3 TWh in 2017.

In the BAU scenario, power generation is expected to grow at around 2.7% per year from 2017 to 2050 and will reach 401.7 TWh in 2050. In 2050, natural gas will remain the dominant fuel used in power generation with the highest share of 56.0% or 224.9 TWh. Coal will still be the second largest source of power generation with a 22.2% share or a level of 89.3 TWh expected in 2050. Power generation from hydro will increase by 2.6% per year from 4.7 TWh in 2017 to 11.2 TWh in 2050.

Figure 16.4. Power Generation by Fuel, BAU
(in TWh)



BAU = Business-as-Usual scenario; TWh = terawatt-hour.

Source: Author's calculation.

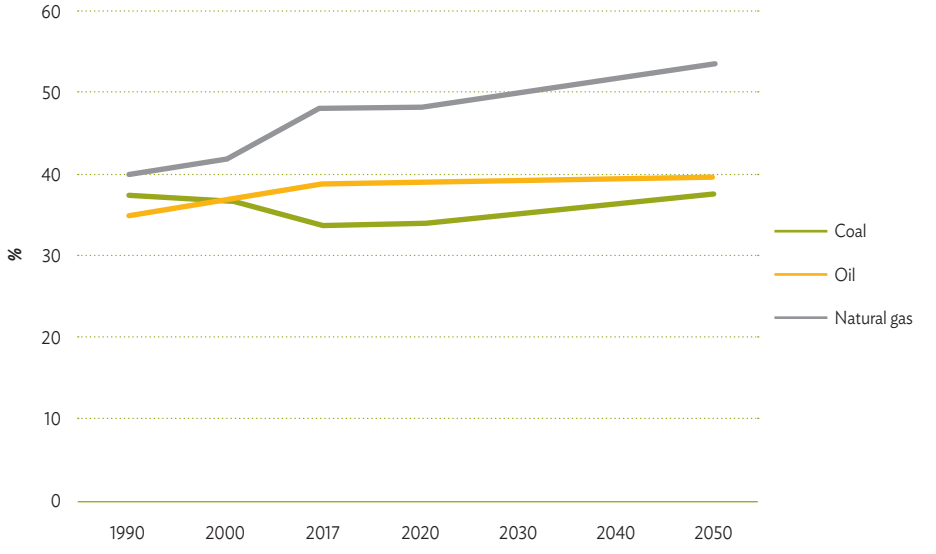
Natural gas has the highest thermal efficiency improvement. A 40% efficiency of natural gas in 1990 improved to almost 48% in 2017 and is expected to increase to 53.4% in 2050. Coal thermal efficiency declined by almost 3.4% from 1990 to 2017, and is expected to improve to 37.3% over the study period (Figure 16-5).

Figure 16-6 shows the energy indicators. Energy intensity reached 289 toe/million in 2017, calculated in 2010 US dollars. In the BAU, energy intensity is projected to decline by 0.9% per year to reach 213 toe/million in 2050, calculated in 2010 US dollars. Energy per capita will increase from almost 1.8 toe per person in 2017 to 3.6 toe per person in 2050.

Energy elasticity between 1990 and 2017 was 0.98, which indicates that energy demand rose at almost the same rate as economic output. In the BAU, energy elasticity is projected at 0.71 between 2017 and 2050, which indicates that energy demand will grow at a slower rate than economic output.

Figure 16.5. Thermal Efficiency by Fuel, BAU

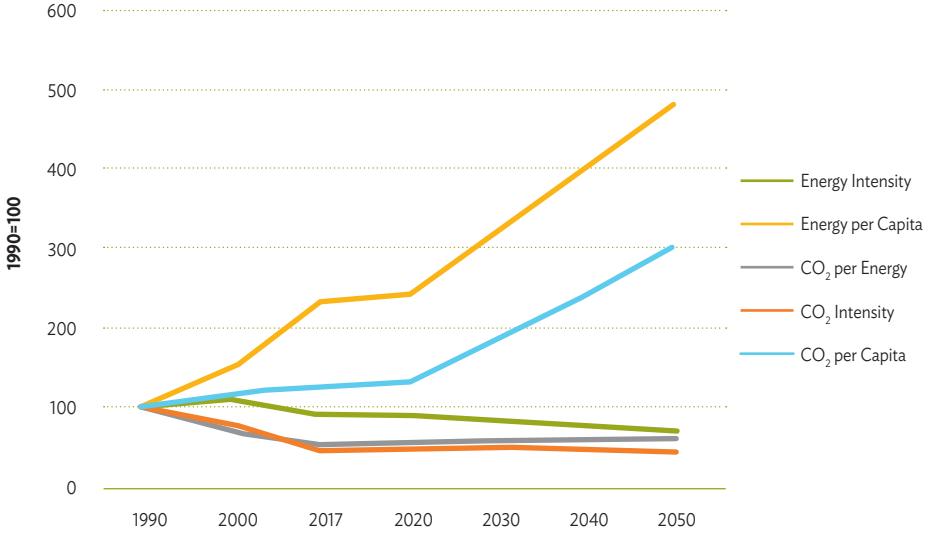
(%)



BAU = Business-as-Usual scenario.

Source: Author's calculation.

Figure 16.6. Energy Indicators



CO_2 = carbon dioxide.

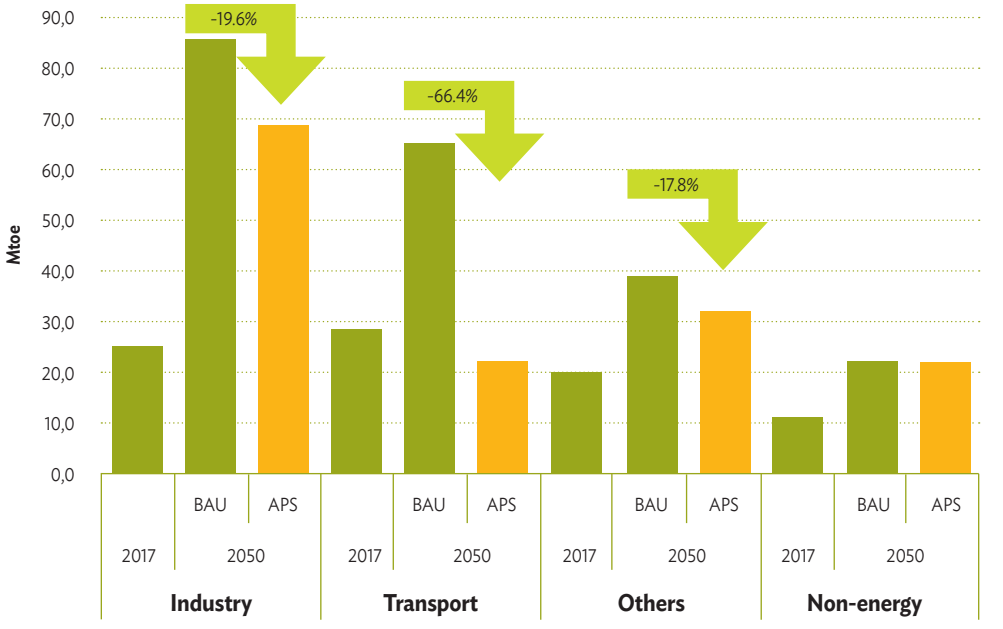
Source: Author's calculation.

3.2. Energy Savings and CO2 Reduction Potential

3.2.1. Final energy consumption

In the APS, final energy consumption is projected to grow by 1.6% per year, from 85.3 Mtoe in 2017 to 145.0 Mtoe in 2050. This is 31.6% lower than in the BAU. The majority of energy savings will be achieved through energy efficiency improvement programmes implemented in the industry (19.6%) and transportation (66.4%) sectors. Improvements will also be achieved in 'other' sectors (17.8%), as shown in Figure 16-7.

Figure 16.7. Final Energy Consumption by Sector, BAU and APS
(in Mtoe)



BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario; Mtoe = million tonnes of oil equivalent.

Source: Author's calculation.

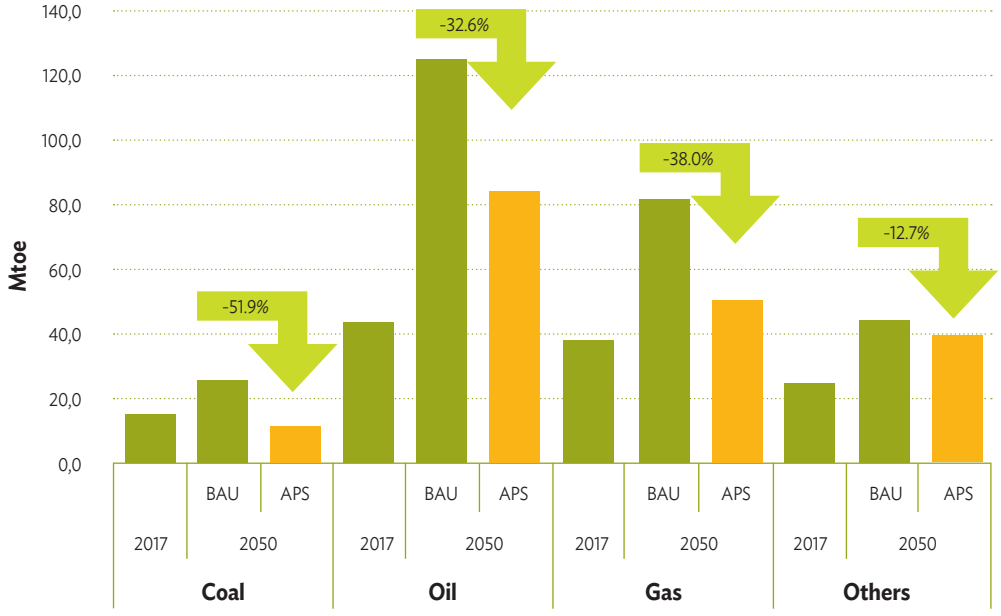
3.2.2. Primary energy supply

In the APS, growth in primary energy supply is projected to be much slower than in the BAU, increasing at 1.3% per year (compared with 2.5% in the BAU) to reach 186.6 Mtoe in 2050. Primary APS energy supply is expected to be about 32.8% lower the BAU in 2050—an energy savings of about 91.0 Mtoe.

Coal and oil are projected to increase at slower annual average rates of -0.6% and 2.0%, respectively (1.6%and 3.2% in the BAU). Natural gas use is projected to increase at an annual

average rate of 0.9% (2.3% in the BAU) from 38.2 Mtoe in 2017 to 50.8 Mtoe in 2050. 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
(in Mtoe)



BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario; Mtoe = million tonnes of oil equivalent.

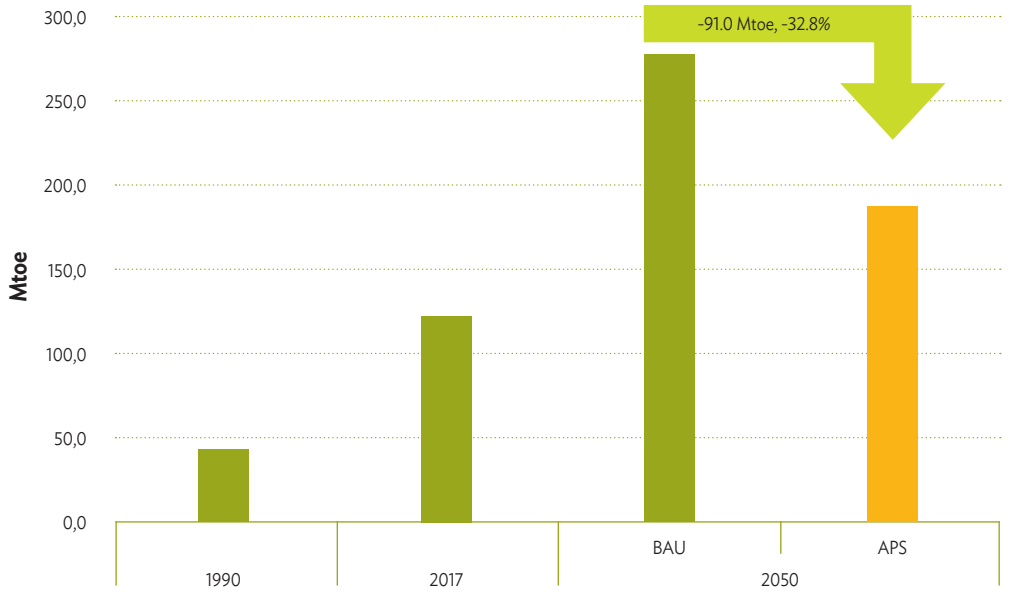
Source: Author's calculation.

3.2.3. Projected energy savings

The difference between primary energy supply in the BAU and the APS in 2050 is 91.0 Mtoe (Figure 16-9). This represents the energy savings that could be achieved if efficiency, conservation goals and action plans were implemented. Oil will contribute the largest energy savings at 40.8 Mtoe, followed by coal at 13.3 Mtoe. Energy savings from natural gas will reach 31.1 Mtoe in 2050, but the contribution of non-fossil energy sources will also be 5.6 Mtoe lower than in the BAU.

In final energy consumption, the savings in the APS compared with the BAU in 2050 will reach 66.9 Mtoe. The largest savings are expected to be achieved in the transport sector, at 43.2 Mtoe. The industry and 'other' sectors are expected to achieve energy savings of 16.7 Mtoe and 6.9 Mtoe, respectively.

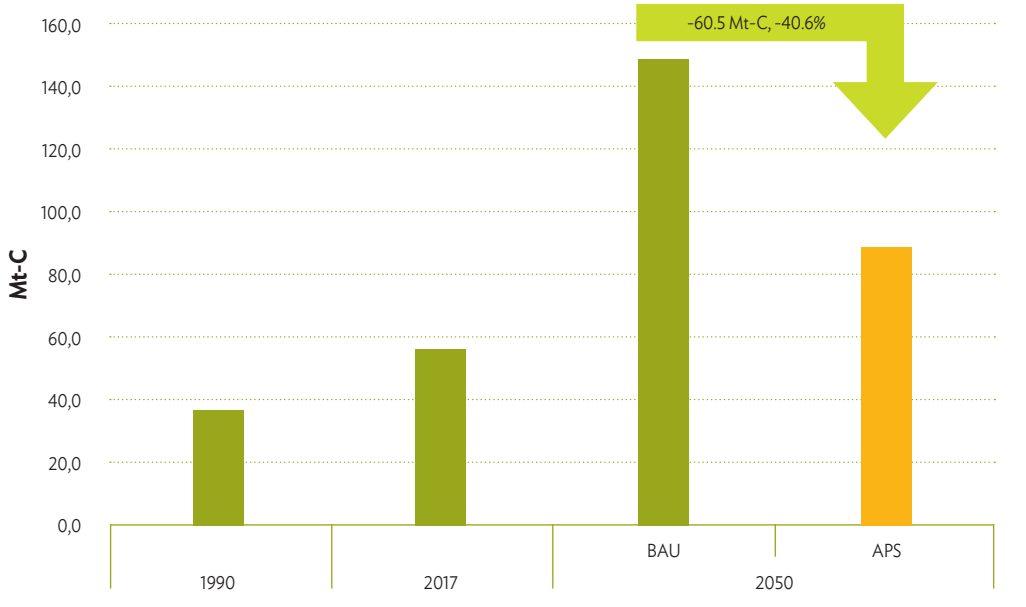
Figure 16.9. Total Primary Energy Supply, BAU and APS
(in Mtoe)



BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario; Mtoe = million tonnes of oil equivalent.

Source: Author's calculation.

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 tonnes of carbon.

Source: Author's calculation.

3.3. CO2 Emissions

CO2 emissions from energy consumption are projected to increase by 3.0% per year on average from 55.8 Mt-C in 2017 to 148.9 Mt-C in 2050 under the BAU. Under the APS, the average annual growth in CO2 emissions from 2017 to 2050 is projected to be 1.4%, with an emissions level of 88.4 Mt-C in 2050. The difference in CO2 emissions between the BAU and the APS is 60.5 Mt-C, or 40.6%. This reduction in CO2 emissions highlights the range of benefits that can be achieved through energy efficiency improvements and savings via action plans (Figure 16-10).

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 (especially during the period 2011–15). 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 energy Thailand saves, the less it would be affected by fluctuations of 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 alternatives policy for the next 20 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 order to become less dependent on this fuel. Furthermore, Thailand intends to reduce transport consumption in the future, in particular through the use of electric and fuel-cell electric vehicles. The greater the energy savings that can be achieved in the transport sector, the greater the benefits for the economy as a whole.