CHAPTER 11

Malaysia Country Report

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CHAPTER 11

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1. Introduction

Malaysia is a federal constitutional monarchy in Southeast Asia consisting of 13 states and three federal territories, separated by the South China Sea into two regions: Peninsular Malaysia and Borneo's East Malaysia. Peninsular Malaysia shares a land and maritime border with Thailand and maritime borders with Singapore, Viet Nam, and Indonesia. East Malaysia shares land and maritime borders with Brunei Darussalam and Indonesia, and a maritime border with the Philippines and Viet Nam. Malaysia's territory covers 330,621 square kilometres (km2), including Peninsular Malaysia, Sabah, and Sarawak.

Malaysia is a relatively open, state-oriented, and newly industrialised market economy. The state plays a significant but declining role in guiding economic activity through macroeconomic plans. Malaysia has had one of the best economic records in Asia, with gross domestic product (GDP) growing 6.5% annually, on average, from 1957 to 2005. Malaysia's economy in 2014–2015 was one of the most competitive in Asia, ranking sixth in Asia and 20th in the world, above countries like Australia, France, and the Republic of Korea. In 2014, Malaysia's economy grew by 6%, the second highest growth in the Association of Southeast Asian Nations behind the Philippines' growth of 6.1%. In April 2019, Malaysia's economy in terms of GDP at purchasing power parity was estimated at $999.397 billion, the third largest in the Association of Southeast Asian Nations and the 25th largest in the world. [1]

Malaysia is rich in conventional energy resources such as oil, gas, and coal, as well as renewable energy such as hydropower, biomass, and solar. As of January 2018, its conventional energy reserves included 4.553 billion barrels of crude oil, 79.531 trillion cubic feet of natural gas, and

[1] All United States dollars in this report are in constant 2010 values unless specified.

1,938.37 million tonnes of coal. Malaysia's gas reserves are four times the size of its crude oil reserves in terms of energy equivalency. Natural gas reserves off the east coast of Peninsular Malaysia are earmarked for domestic consumption, while those in Sarawak are allocated as revenue earners in the form of liquefied natural gas exports. Malaysia is a net energy exporter. Crude oil, liquefied natural gas, and petroleum products contributed RM156,665 million, 15.6% of the economy's export earnings in 2018.

Energy plays a pivotal role in achieving Malaysia's sustainable growth and development goals. The sustainability of energy resources has been strategically planned over the years and energy policies developed after careful evaluation of the current and future energy needs and supply of energy. Historically, Malaysia's energy polices have focused on increasing the accessibility and affordability of energy as well as energy security. Malaysia's National Energy Policy (1979) set out to ensure the more cost-effective use of resources and more efficient use of energy. The Four Fuel Diversification Policy (1981) aimed to reduce overdependence on oil by introducing more coal and gas as energy sources. The Five Fuel Diversification Policy, which came into effect in 2001, added renewable energy to the mix.

Malaysia is focussing intently on the sustainable use of energy and the prudent and efficient management of resources under the 11th Malaysia Plan (2016–2020) through the introduction of the National Energy Efficiency Action Plan (NEEAP) (2016–2025). The NEEAP provides instruments for the successful implementation of energy efficiency strategies in the country through the well-coordinated and cost-effective implementation of energy efficiency measures in the industrial, commercial, and residential sectors. Recognising the need to improve on its energy efficiency and conservation initiatives, Malaysia is developing a comprehensive new Energy Efficiency and Conservation Act (EECA) in pursuit of its national aspirations, as well as the effective utilisation of energy across key sectors. The EECA will outline comprehensive measures necessary to promote the efficient utilisation of energy, including target setting, communication, and education. It will also initiate steps to reduce greenhouse gas emissions as a regulatory approach.

Renewable energy largely comes from hydropower plants in Peninsular Malaysia, Sabah, and Sarawak. In 2018, hydropower made up 93% of the renewable energy generation mix. The potential of geothermal, wind, and ocean energy as additional renewable energy sources is also being explored. Solar photovoltaics has been mooted as a long-term renewable energy source in Malaysia, and it contributed less than 1% of total power generation in 2018. Several schemes have been introduced to drive the growth of solar in Malaysia, such as the Feed-in-Tariff (FiT) programme and the Net Energy Metering (NEM) scheme. Both were introduced to incentivise consumers to install solar photovoltaics in buildings or in homes, but resulted in low uptake rates. Lack of funding and low return on investment for consumers are two reasons cited for this. To expedite the use of solar in the country, Malaysia introduced its Large Scale Solar (LSS) programme. In March 2016, the Energy Commission of Malaysia announced the first round of bidding to build LSS photovoltaic plants, with the aim of achieving a total capacity of 250 alternating-current megawatts in Peninsular Malaysia and 50 alternating-current megawatts in Sabah.

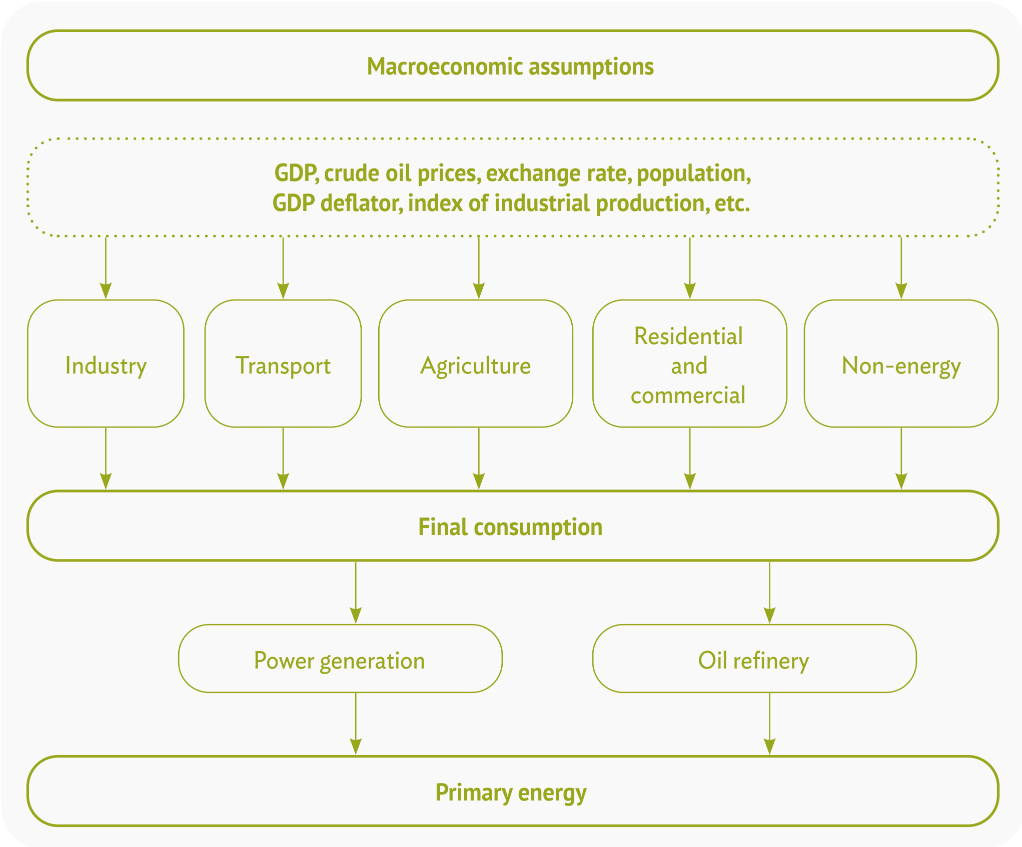
2. Modelling Assumptions

Energy demand projections up to 2050 were estimated using the econometric approach. Historical energy demand data were taken from the National Energy Balance published by the Energy Commission of Malaysia. Economic indicators used in energy modelling such as GDP were taken from the World Bank's World Development Indicators. Energy modelling involved estimating final energy consumption and the corresponding primary energy supply. Figure 11.1 shows the model structure for projecting final energy consumption and estimating transformation inputs to arrive at the primary energy supply.

The econometric approach was applied to forecast final energy consumption. The historical correlation between energy demand and macroeconomic and activity indicators were derived by regression analysis using Microfit, an interactive software package written for microcomputers and designed especially for the econometric modelling of time series data. It has powerful features for data processing, file management, graphic display, estimation, hypothesis testing, and forecasting under various univariate and multivariate model specifications.

The future energy demand for various energy sources was estimated using assumed values of the macroeconomic and activity indicators. Future values of these indicators were also derived using historical data depending on the sufficiency of such analysis. In the model structure, energy demand is modelled as a function of activity such as income, industrial production, number of vehicles, number of households, number of appliances, and floor area of buildings. In the residential sector, for example, the demand for electricity could be a function of the number of households, disposable income, and penetration rate of electrical appliances. In the commercial sector, energy consumption could be driven by building floor area, private consumption, and other factors that encourage commercial activities. However, because of a lack of information on the activity indicators, macroeconomic data

Figure 11.1. **Modelling Structure**



GDP = gross domestic product.

Source: Author.

(GDP) was the best variable to use to search for the relationship with the energy demand trend. GDP information was broken down into industry GDP, services GDP, agriculture GDP, and manufacturing GDP. These macroeconomic indicators were mainly used to generate the model equations. In some cases, where regression analysis is not applicable because of insufficient data or failure to derive a statistically sound equation, other methods such as share of%age approach or growth rates are used.

GDP growth rates are a main driver of the modelling assumption. The GDP growth rates assumption forecast was based on IHS[2] data from a study conducted by the Economic Planning Unit of Malaysia (IHS Energy Insight, 2016). Most energy demand equations for Malaysia use GDP as the key factor in determining future projections, because of the high correlation between energy demand and GDP. Table 11.1 shows assumptions of GDP growth

[2] IHS Markit Ltd is a London-based global information provider formed in 2016 by the merger of IHS Inc. and Markit Ltd.

rates by sector.

Annual average population growth was also a key driver of future energy growth. Malaysia's population is projected to increase from 31.1 million in 2017 to 41.4 million by 2050, a 32.9%

Table 11.1. Gross Domestic Product Growth Assumptions by Sector to 2050 (% per year)

GDP growth rate (%)	2021–2025	2026–2030	2031–2035	2036–2050
Agriculture	2.26	2.09	1.91	1.74
Mining and quarrying	1.01	3.03	3.74	5.17
Manufacturing	3.16	2.77	2.47	2.30
Construction	3.01	2.54	2.26	2.09
Services	4.42	3.67	3.07	2.67
Total GDP	**3.77**	**3.19**	**2.74**	**2.43**

GDP = gross domestic product.

Source: IHS data from the Economic Planning Unit (2016).

increase. However, the annual population growth rate is projected to decrease from 1.02% in 2021–2026 to 0.87% in 2026–2030, 0.74% in 2031–2035, and 0.63% in 2036–2040. This situation is in tandem with the targeted decline in fertility rates and international migration. This assumption of future population growth rates was obtained from the Department of Statistics Malaysia (Table 11.2).

Under the energy efficiency and conservation scenario, potential savings of 8% from business as usual (BAU) are projected (Table 11.3), based on the NEEAP findings. As NEEAP only

Table 11.2. Population Growth Assumption to 2050

	2021–2025	2026–2030	2031–2035	2036–2050
Population (million)	36.0	38.1	39.9	41.5
Population growth (%)	1.02	0.87	0.74	0.63

Source: Department of Statistics (2016) from 2021 to 2050.

focusses on the electricity sector, this 8% savings is applied to all fuel types for this project. The NEEAP's time horizon is through 2025; however, for this project the projection period will extend until 2050. The 8% savings target will start from 2017 and will increase to 16% by 2050. These assumptions were made to reflect the effectiveness of the NEEAP activities and programmes until 2050. Furthermore, the newly proposed EECA will increase the potential savings from energy efficiency in the energy efficiency and conservation scenario.

As Malaysia aims to increase renewable energy's share in the capacity mix to 20% by 2025, the government has implemented several renewable energy-related programmes, including FiT, NEM, LSS, and Self Consumption for Solar Installations. Renewable energy started in Malaysia with small renewable energy programmes and FiT projects, mainly in oil palm estates. Now, the country has progressed to LSS, and is moving increasingly toward solar energy as the preferred renewable energy source. Solar appears to be the most promising renewable energy source because it is most easily implemented, compared to biogas, biomass, and others. For biomass, the challenge is having several biomass plants sourcing feedstock from the same area; after a few years, these plants are unable to operate because of a feedstock shortage. Biogas is limited to palm oil millers and its energy generating capacity is very low. Furthermore, biogas plants are usually in remote locations, where sparse populations lead to a low uptake rate. Although there is huge potential for mini-hydropower to be developed in Malaysia, this resource is located mostly in rural areas, and connection to the main grid is very costly. As indicated in Table 11.3, the renewable energy scenario combines all potential renewable energy capacity from existing and future power generation programmes in the country. Although Malaysia's Power Development Plan only extends to 2035, for this project the targeted number will be extended to 2050.

Palm biodiesel, which is produced from palm oil through a chemical process, is an environmentally friendly biofuel used as a substitute for petroleum diesel. Biodiesel is a renewable resource while petroleum diesel is a limited resource. Types of diesel sold at pump stations are Euro 2M (black nozzle) and Euro 5 (blue nozzle), which are mixed with palm biodiesel at 10% (B10) for Euro 2M and 7% (B7) for Euro 5. Argentina, Brazil, Colombia, the European Union, Indonesia, and the United States have been using B10 and B20 biodiesel blends since the early 2000s. Malaysia implemented a B5 programme in June 2011 and a B7 programme in December 2014 in the transport sector. The B10 programme was implemented in the transport sector by phases starting on 1 December 2018, and mandatory implementation nationwide was introduced in February 2019. Recently, the B20 programme was launched in January 2020, and this will be extended nationwide by stages until the middle of 2021. By 2030, the government would like to increase the share of blended biodiesel by 30%.

Malaysia's Third National Communication and Second Biennial Update Report to the United Nations Framework Convention on Climate Change (UNFCCC), set a mitigation action target for advanced technologies in coal and natural gas power plants. The target for highly efficient technologies for new power plants was set at 46% for coal and 60% for natural gas. This assumption was made as old and inefficient power plants will be retired and replaced by high-efficiency plants, thus lowering fuel consumption and directly reducing carbon dioxide (CO_2) emissions.

Plans for Malaysia to have its own nuclear power plant to cope with the country's high energy consumption were recently nullified when the government decided not to pursue nuclear energy in Malaysia. The government set up the Malaysia Nuclear Power Corporation in 2011 to research nuclear energy usage for the country, and the corporation originally planned to build two nuclear power plants by 2030. However, after several months of planning, the decision to stop its development was announced, and the government clarified that Malaysia will not use nuclear energy due to concerns about radioactive waste. Cancelling the construction of the nuclear power plants also resulted in the closure of the Malaysia Nuclear Power Corporation. As a replacement for nuclear energy, the government has suggested that Malaysia should opt for renewable energy such as biomass, biogas, and solar energy. As a result, this project does not include a nuclear scenario.

The details of the scenarios considered by this project as well as several assumptions or scenarios are outlined in Table 11.3.

Table 11.3. Potential Mitigation Scenarios

Scenario	Mitigation Actions
Energy Efficiency and Conservation (EEC)	Improve final energy consumption of all energy types by 8% in 2017 and by 16% in 2050.
Renewable Energy (RE)	(i) Achieve the following targets for use of renewable energy in the power sector by 2035:
	(a) Hydropower: 8,573 megawatts (MW)
	(b) Solar: 6,279 MW
	(c) Biomass: 947 MW
	(d) Biogas: 525 MW
	(e) MSW: 212 MW
	Total: 16,536 MW
	(ii) Increase the share of biodiesel in the energy mix to 10% by 2019, 20% by 2020, and 30% by 2030.
Energy Efficiency in the Power Sector (EEP)	Improve the efficiency of power plants as follows:
	(i) Natural gas by 60% by 2050
	(ii) Coal by 46% by 2050
Alternative Policy Scenario (APS)	Combination of all scenarios:
	APS = EEC + RE + EEP

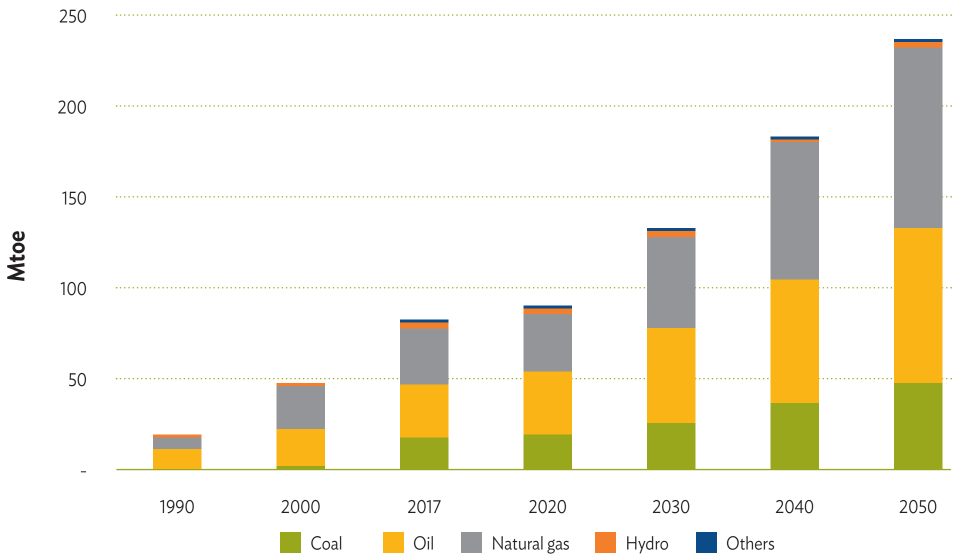
Source: Author's assumptions.

3. Outlook Results

3.1. Business as Usual Scenario

Under BAU, the total primary energy supply (TPES) registered an average annual growth rate (AAGR) of 5.6% from 1990 to 2017. The outlook results showed that the TPES is projected to increase by 3.3% per year from 2017 to 2050 (Figure 11.2). Other sources (biomass, solar, and biofuel) will increase from 0.15 million tonnes of oil equivalent (Mtoe) in 2017 to 1.79 Mtoe in 2050, an AAGR of 7.7%. The supply of natural gas will increase at 3.7% per year from 2017 to 2050, and oil will increase from 29.23 Mtoe in 2017 to 84.18 Mtoe in 2050, an AAGR of 3.3%. Coal (consumed mainly by the power sector) is expected to increase by 2.8% per year in 2017–2050.

Figure 11.2. Primary Energy Supply by Fuel Type, Business as Usual (1990–2050)



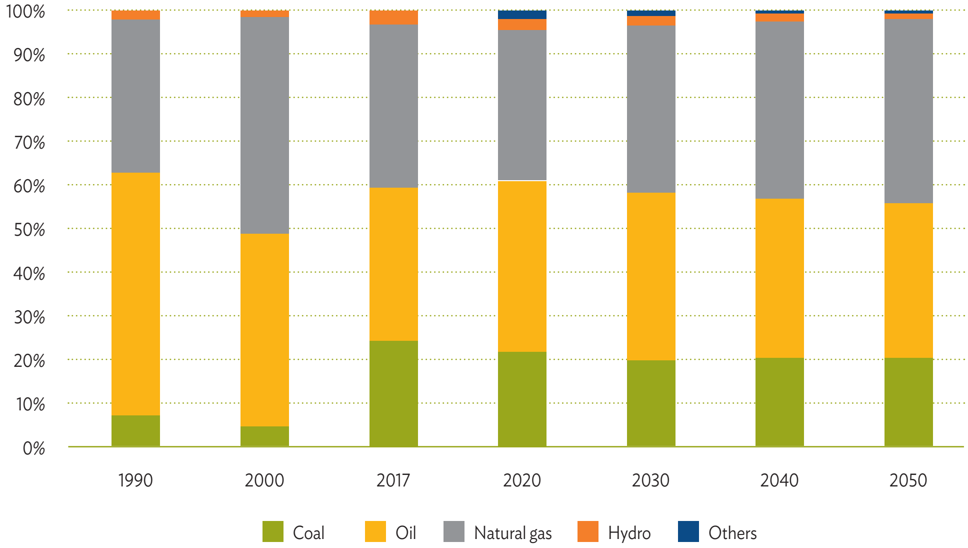
BAU = business as usual, Hydro = hydropower, Mtoe = million tonnes of oil equivalent.

Source: Author's calculation.

In terms of share by fuel type, from 2017 to 2050 oil will decrease from 35.8% to 35.5%, natural gas will increase from 37.3% to 42.1%, and coal will decrease from 23.9% to 20.5%. Finally, hydropower will decrease from 2.8% in 2015 to 1.2% in 2050 (Figure 11.3).

Under BAU, total final energy consumption will increase from 59.88 Mtoe in 2017 to 177.18 Mtoe in 2050, an AAGR of 3.3%. Final consumption of natural gas will see the highest AAGR at 3.7% from 2015 to 2050. From 2017 to 2050, oil demand will grow from 28.27 Mtoe to

Figure 11.3. Share of Primary Energy Supply by Fuel Type, Business as Usual (1990–2050)

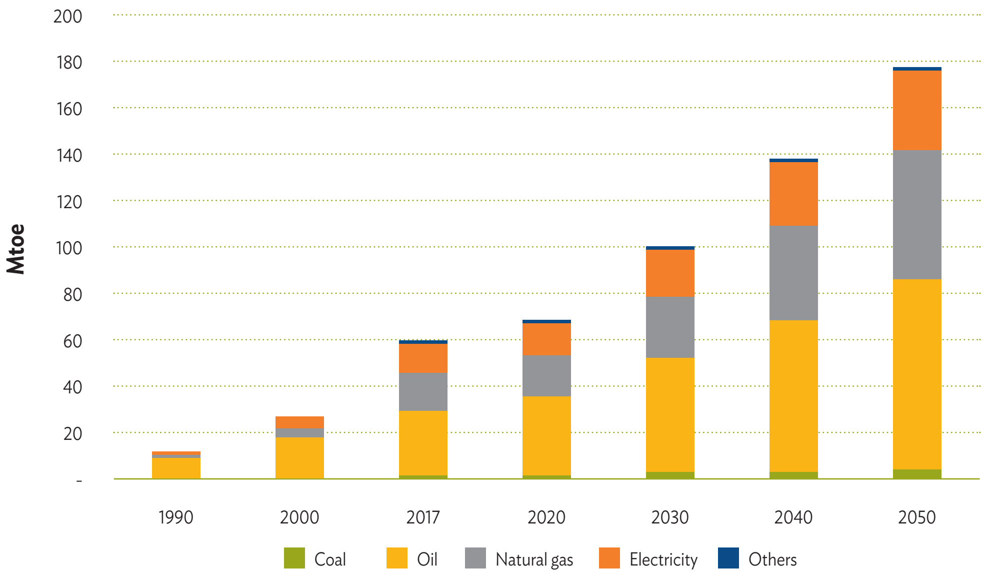


BAU = business as usual, Hydro = hydropower.

Source: Author's calculation.

82.17 Mtoe (an AAGR of 3.3%), coal demand will increase 3.2% per year, and electricity will grow from 12.60 Mtoe to 34.23 Mtoe (an AAGR of 3.1%). Demand for other sources such as biodiesel is expected to increase from 0.38 Mtoe to 0.53 Mtoe, an AAGR of 1.0% (Figure 11.4).

Figure 11.4. Final Energy Consumption by Fuel Type, Business as Usual (1990–2050)

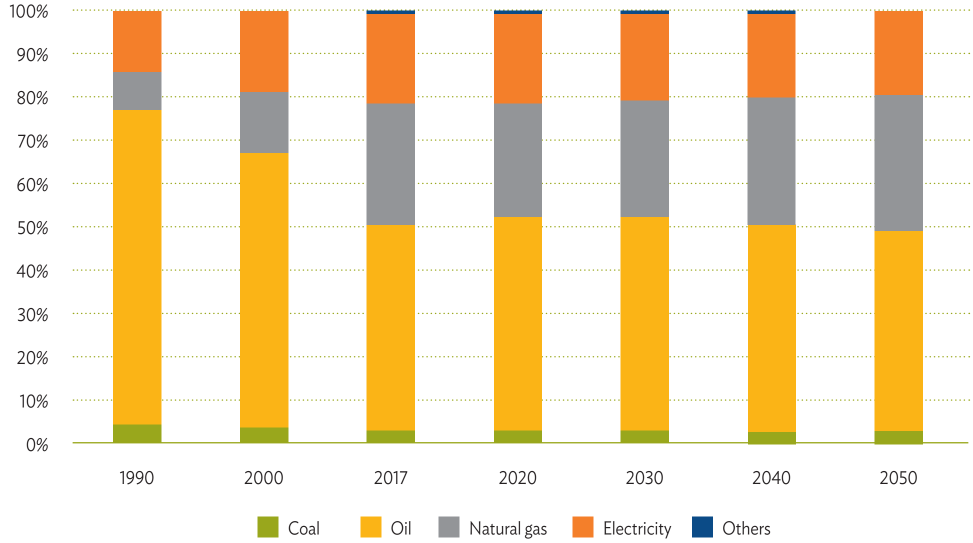


Mtoe = million tonnes of oil equivalent

Source: Author's calculation.

Analysis by share shows that oil will still dominate in 2050 with 46.4%, a slight decrease from 47.2% in 2017. It will be followed by natural gas (31.2%) and electricity (19.3%) in 2050. The share of coal will decrease from 3.0% in 2017 to 2.8% in 2050 (Figure 11.5).

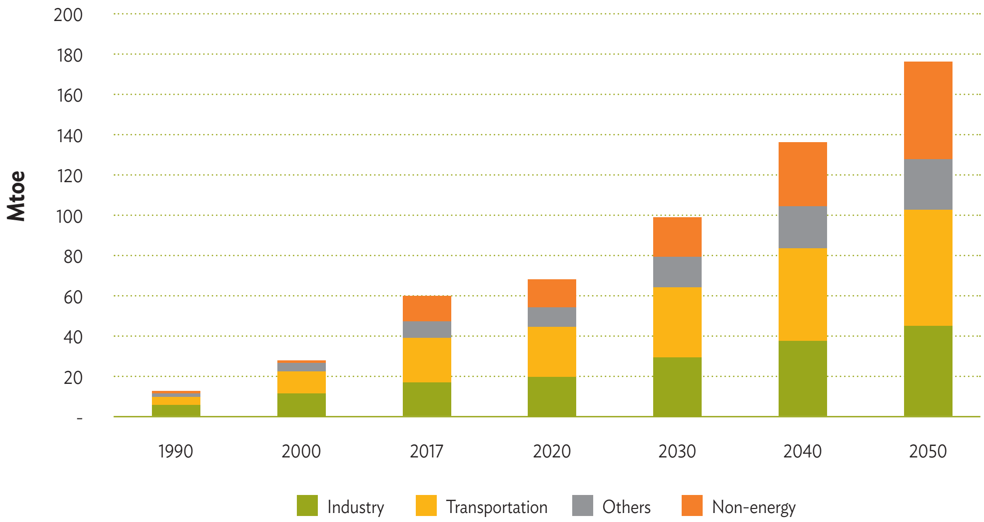
Figure 11.5. Share of Final Energy Consumption by Fuel Type, Business as Usual (1990–2050)



Source: Author's calculation.

In terms of final energy consumption by sector, from 2017 to 2050, the non-energy use sector will lead the growth with 4.2% per year, followed by the 'others' sector, which will grow from 8.46 Mtoe to 25.78 Mtoe, an AAGR of 3.4%. Over the same period the transport sector is expected to increase from 21.45 Mtoe to 58.45 Mtoe (an AAGR of 3.1%), and the industry sector will see an AAGR of 2.9% (Figure 11.6).

Figure 11.6. Final Energy Consumption by Sector, Business as Usual (1990–2050)

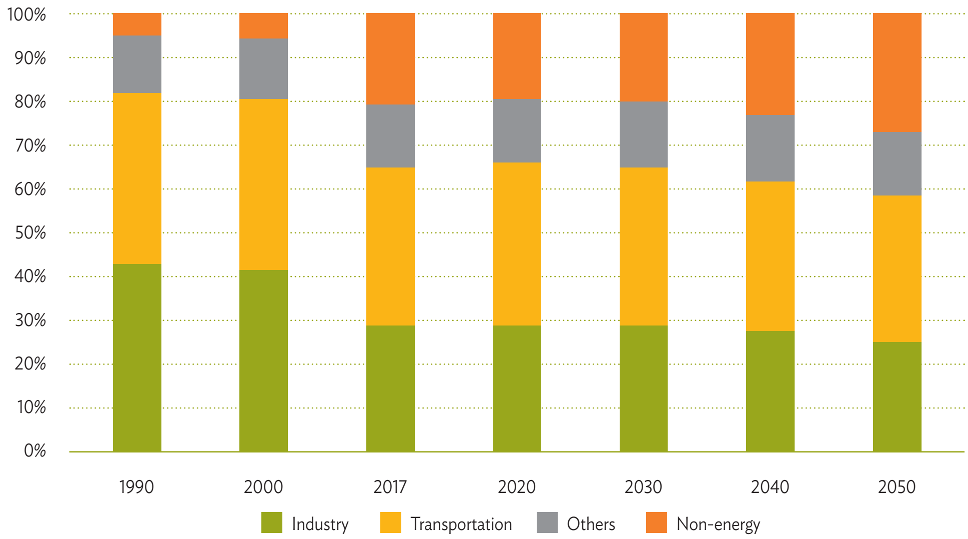


Mtoe = million tonnes of oil equivalent.

Source: Author's calculation.

Analysis by share shows that the transport sector will still dominate energy use in 2050, with 33.0% compared to 35.8% in 2017. This will be followed by the industry sector with a 25.4% share in 2050 compared to 29.1% in 2017. Non-energy use is projected to account for 27.1% of TFEC in 2050, compared to 20.9% in 2017, while the 'others' sector is expected to account for 14.6% in 2050 (Figure 11.7).

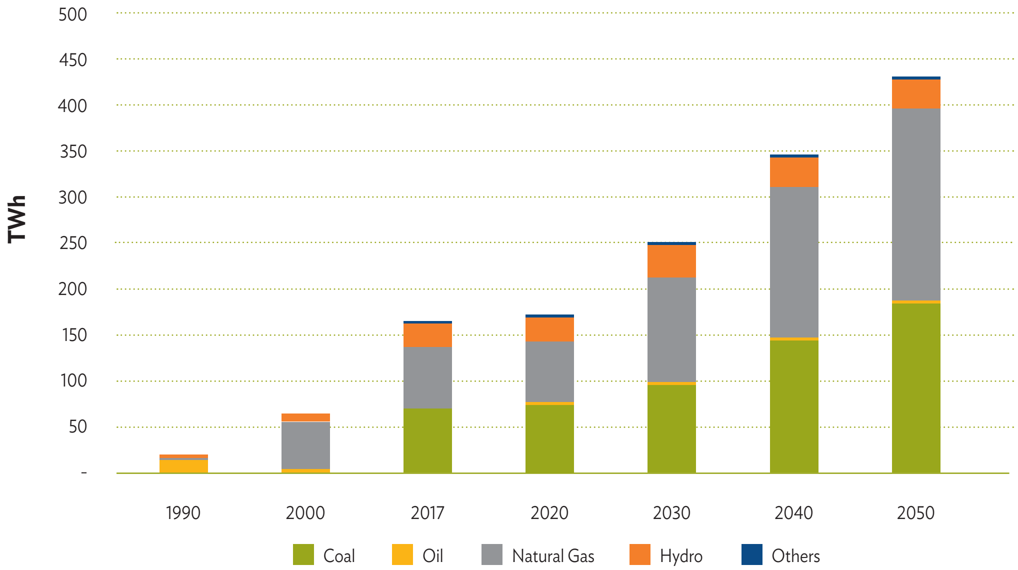
Figure 11.7. Share of Final Energy Consumption by Sector, Business as Usual (1990–2050)



Source: Author's calculation.

Under BAU, total power generation is expected to grow by around 3.0% per year from 2017 until 2050, reaching 431.91 terawatt-hours (TWh). Power generation from other types of fuel (biomass, biogas, solar, and municipal solid waste) will see the fastest growth at 4.4% per year during this period. From 2017 to 2050, power generation from natural gas is projected to increase from 63.27 TWh to 207.45 TWh, power generation from coal will grow 2.9% per year from 71.96 TWh to 184.64 TWh, power generation from oil is expected to increase by 1.6% per year from 1.53 TWh to 2.59 TWh, and electricity generated from hydropower is expected to increase by 0.6% per year (Figure 11.8).

Figure 11.8. Power Generation by Fuel Type, Business as Usual (1990–2050)

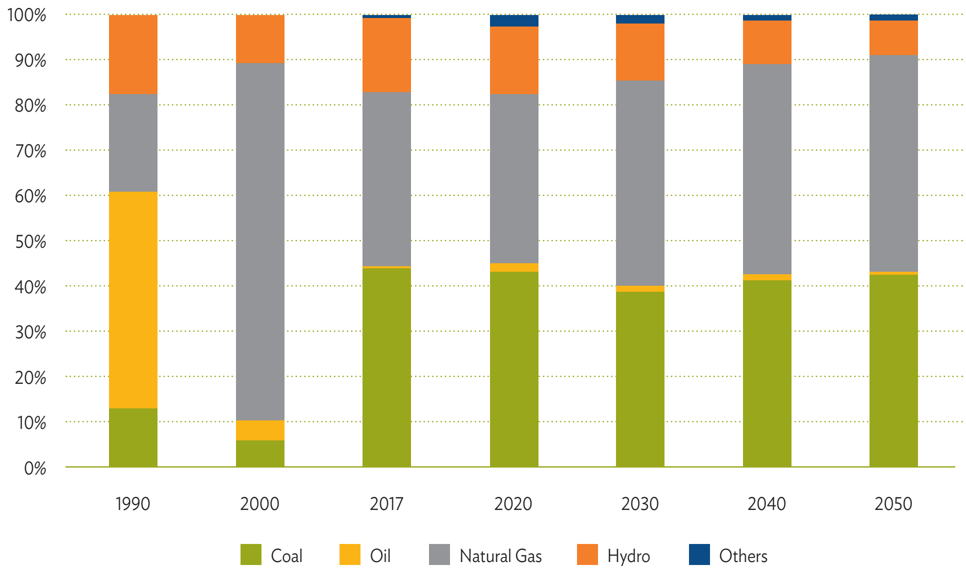


Hydro = hydropower, TWh = terawatt-hour.

Source: Author's calculation.

In 2050, the power generation mix will be dominated by natural gas, with a 48.0% share; and coal, with a 42.7% share. These will be followed by hydropower with a 7.5% share in 2050 compared to 16.2% in 2017. Other sources will account for 1.1% of the total power generation in 2050, and oil will account for 0.6%, compared to 0.9% in 2017 (Figure 11.9).

Figure 11.9. Share of Power Generation by Fuel Type, Business as Usual (1990–2050)

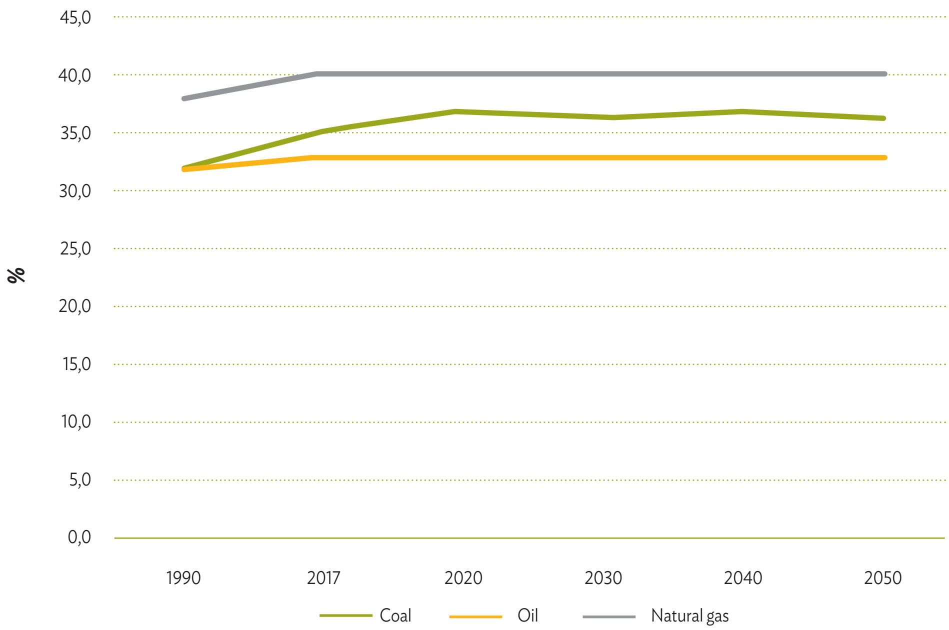


Hydro = hydropower.

Source: Author's calculation.

Under BAU, the thermal efficiency of coal power plants is expected to improve from 35.0% in 2017 to 36.4% in 2050. Over the same period, the thermal efficiency of oil power plants is projected to remain at 33.0%, and that of natural gas power plants will also remain at 40.0% (Figure 11.10).

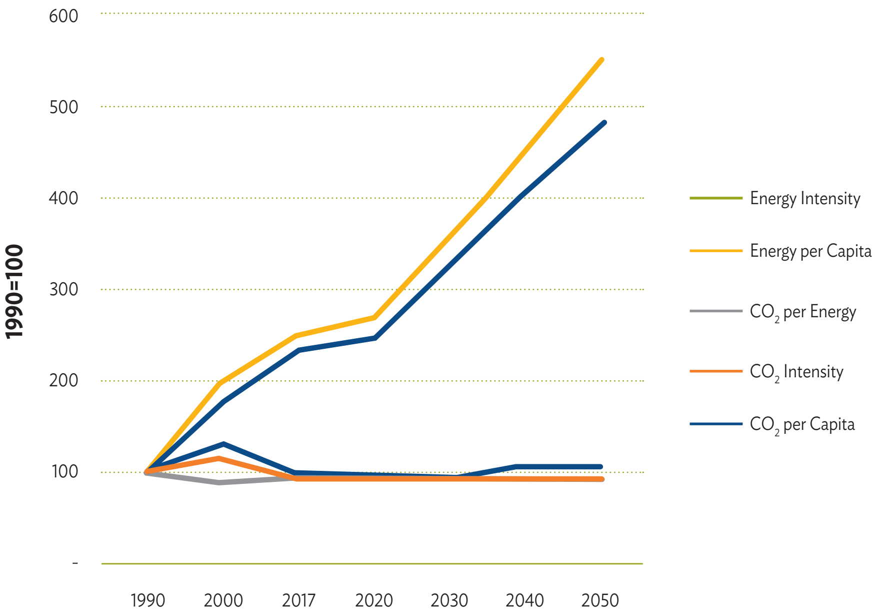
Figure 11.10. Thermal Efficiency by Fuel Type, Business as Usual (1990–2050)



Source: Author's calculation.

From 2017 to 2050, Malaysia's primary energy intensity is expected to increase from 224 tonnes of oil equivalent per million dollars (toe/$ million) to 236 toe/$ million, final energy intensity is expected to increase from 164 toe/$ million to 177 toe/$ million, and primary energy supply per capita is projected to increase from 2.62 toe/person to 5.73 toe/person (Figure 11.11).

Figure 11.11. Energy Indicators, Business as Usual (1990–2050)



CO_2 = carbon dioxide.

Source: Author's calculation.

From 2017 to 2050, it is expected that CO2 intensity will decrease from 151 tonnes of carbon per million dollars (t-C/$ million) to 150 t-C/$ million, and CO2 per primary energy will decrease slightly from 0.67 t-C/toe to 0.64 t-C/toe.

3.2 Alternative Policy Scenario

In the alternative policy scenario (APS), growth in final energy consumption will be at 3.1% per year from 2017 to 2050, slightly lower than BAU at 3.3% per year. The slower projected rate of increase in the APS would result from improvements in manufacturing technologies, as well as efforts to improve energy efficiency, particularly in the industry and 'others' sectors. Thus, savings of 16% in the industry sector could be expected in 2050. In the 'others' sector, the annual growth rate of energy consumption is projected to be 2.9%, slower than BAU at 3.4% in BAU. Potential savings of 16% in 2050 can be achieved through the implementation of energy efficiency measures (Figure 11.12).

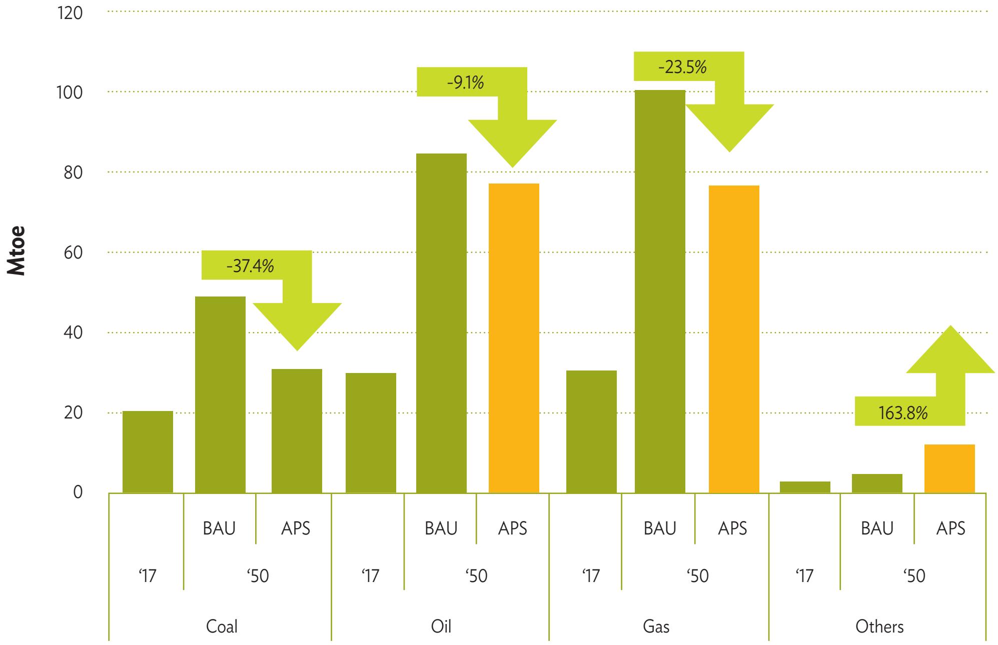
Figure 11.12. Final Energy Consumption by Sector, Business as Usual and the Alternative Policy Scenario (2017 and 2050)

APS = alternative policy scenario, BAU = business as usual, Mtoe = million tonnes of oil equivalent.

Source: Author's calculation.

The TPES is projected to increase at a slower rate in the APS than in BAU, from 81.57 Mtoe in 2017 to 195.49 Mtoe in 2050, a 2.7% AAGR (Figure 11.13). Other sources (biomass, solar, and biofuels) will grow the fastest at an average rate of 11.2% per year. This is because the implementation of FiT, NEM, and LSS in power generation will significantly impact the primary energy supply by 2050, as more renewable energy for power generation is expected to be commissioned. Higher biodiesel blending rates will also contribute to this growth. Consequently, the renewable energy supply ('others') in the APS will be 163.8% higher than BAU by 2050. On the other hand, by 2050 coal in the APS will be 37.4% lower than under BAU due to the implementation of higher efficiency coal power plants. Coal is expected to increase at a rate of 1.4% per year in the APS, compared to 2.8% per year under BAU. Natural gas will grow at 2.8% per year in the APS, compared to 3.7% under BAU. As a result, by 2050, the primary natural gas supply will be 23.5% lower in the APS compared with BAU. Oil in the APS is expected to increase at 3.0% per year, compared to 3.3% per year under BAU. In 2050, the primary oil supply will decrease by 9.1% in the APS compared to BAU.

Figure 11.13. **Primary Energy Supply by Fuel Type, Business as Usual and the Alternative Policy Scenario (2017 and 2050)**



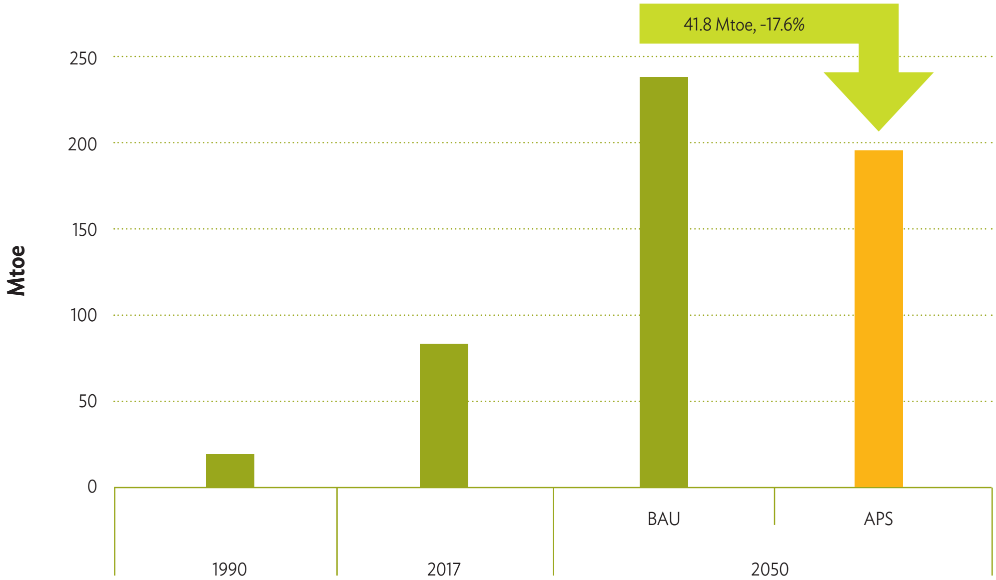
APS = alternative policy scenario, BAU = business as usual, Mtoe = million tonnes of oil equivalent.

Source: Author's calculation.

3.3 Projected Energy Savings

The potential energy savings can be obtained from the difference in total primary energy supply between BAU and the APS. These energy savings can be achieved by energy efficiency efforts in the industry and 'others' sectors, as well as through a more efficient thermal power supply. Potential energy savings of 41.8 Mtoe (17.6%) in 2050 can be achieved as indicated from the difference in TPES between BAU and the APS in 2050 (Figure 11.14).

Figure 11.14. Total Primary Energy Supply, Business as Usual and the Alternative Policy Scenario (2017 and 2050)



APS = alternative policy scenario, BAU = business as usual, Mtoe = million tonnes of oil equivalent.

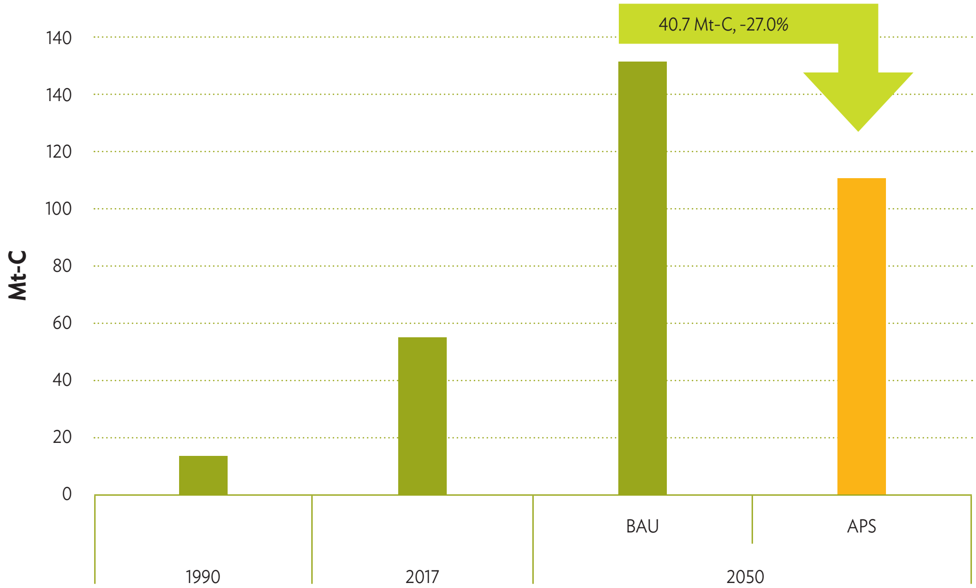
Source: Author's calculation.

Major savings can be achieved by switching from coal or natural gas to renewable energy such as biomass or solar, and total savings of 11.32 Mtoe in final energy consumption – comprising savings of 7.19 Mtoe in the industry sector and 4.12 Mtoe in the 'others' sector – can potentially be achieved in 2050.

3.4 Carbon Dioxide Emissions from Energy Consumption

Under BAU, total CO2 emissions from energy consumption are projected to increase by 3.1% per year from 2017 to 2050. In 2017, the CO2 level was at 55.0 million tonnes of carbon (Mt-C) and was expected to increase to 150.9 Mt-C by 2050 under BAU. In the APS, the annual increase in CO2 emissions from 2017 to 2050 will be lower than BAU at 2.1% per year, consistent with the growth in the primary energy supply. This reduction of CO2 emissions in the APS of 40.7 Mt-C (27.0%) relative to BAU is also due to a significant decrease in coal consumption for power generation in the APS, given the improved efficiency of the power plants. Further, coal consumption is being replaced by natural gas and renewable energy such as biomass, biogas, solar, and municipal solid waste. Lower energy usage in the industry and 'others' sectors has also contributed to this reduction. This indicates that Malaysia's energy-saving efforts and renewable energy action plan will be effective in reducing CO2 emissions. Use of biodiesel in the transport sector will also help slow the growth of total CO2 emissions (Figure 11.15).

Figure 11.15. Carbon Dioxide Emissions from Energy Combustion, Business as Usual and the Alternative Policy Scenario (2017 and 2050)



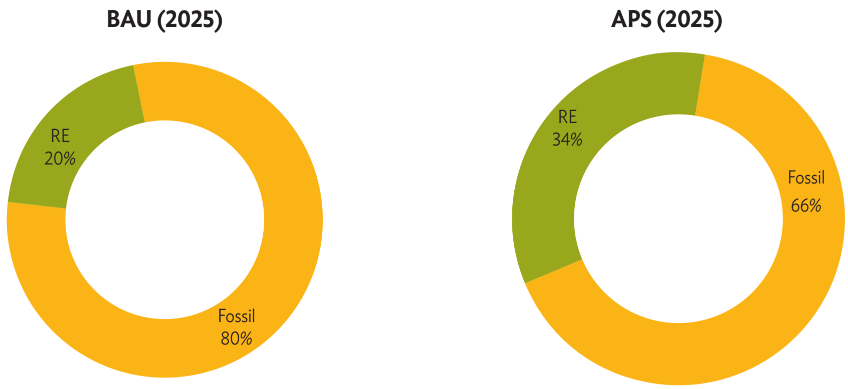
APS = alternative policy scenario, BAU = business as usual, Mt-C = million tonnes of carbon.

Source: Author's calculation.

3.5 Policy Implications

The government target for renewable energy capacity (20% of total capacity) can be achieved under BAU. Based on the current development of renewable energy, this target will be met in 2025. However, the renewable energy capacity mix will be much higher under the APS at 34%

Figure 11.16. Generation Capacity Mix of Fossil Fuels versus Renewable Energy for Business as Usual and the Alternative Policy Scenario in 2025



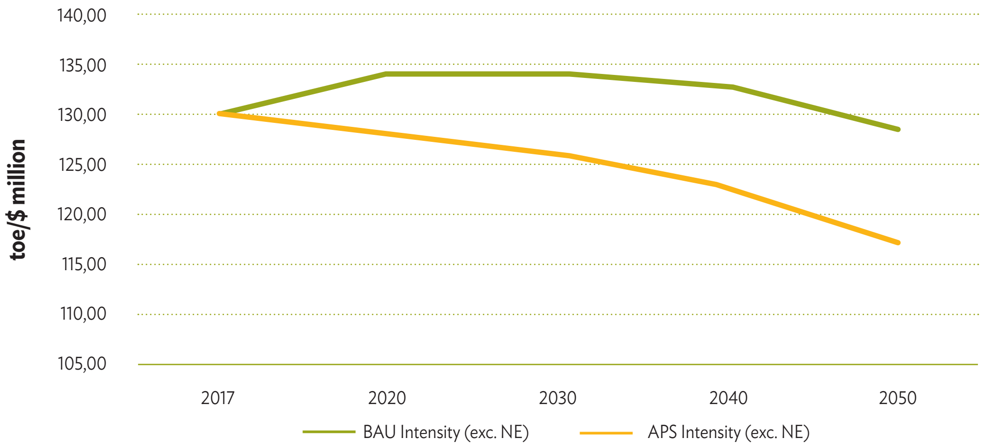
APS = alternative policy scenario, BAU = business as usual, RE = renewable energy.

Source: Author's calculation.

(Figure 11.16). This finding shows that Malaysia can achieve higher targets with respect to renewable energy capacity in long-term projections.

Malaysia has great energy saving potential under its energy efficiency measures. Based on the outlook results, under BAU, final energy intensity (excluding non-energy) will decrease by 0.94% from 2017 to 2050. Efforts such as the implementation of the newly proposed EECA can further reduce the final energy intensity. Under the APS, the final energy intensity (excluding non-energy) is projected to decrease by 9.6% from 2017 to 2050 (Figure 11.17).

Figure 11.17. Final Energy Intensity (Excluding Non-Energy) for Business as Usual and the Alternative Policy Scenario

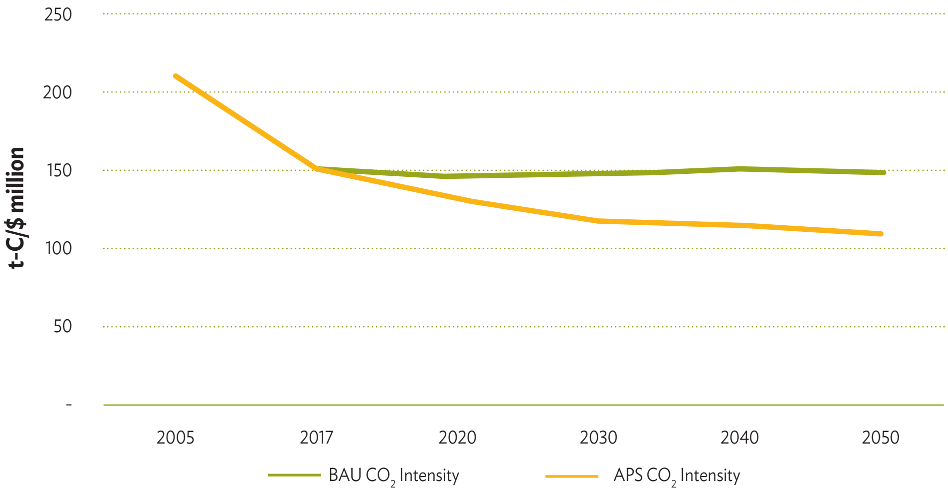


APS = alternative policy scenario, BAU = business as usual, toe = tonnes of oil equivalent, NE = non-energy.

Source: Author's calculation.

As pledged in its nationally determined contribution, Malaysia intends to reduce the greenhouse gas emissions intensity of GDP by 45% from 2005 to 2030. Of this 45%, 35% is unconditional, and the remaining 10% is conditional upon receipt of climate finance, technology transfer, and capacity building from developed countries. At the 21st Conference of Parties to the UNFCCC, Malaysia reiterated its commitment to maintain at least 50% of the country under forest cover. Based on the outlook results, under BAU, Malaysia's CO2 intensity will decline by 28.4% from 2005 to 2030. However, in the APS CO2 intensity is expected to decline by 43.0% from 2005 to 2030 (Figure 11.18). This indicates that Malaysia will easily achieve its nationally determined contribution unconditional target under the APS.

Figure 11.18. **Carbon Dioxide Intensity for Business as Usual and the Alternative Policy Scenario**



APS = alternative policy scenario, BAU = business as usual, CO2 = carbon dioxide, t-c = tonnes of carbon.

Source: Author's calculation.

4. Conclusions

Under BAU, Malaysia's final energy intensity will continue to rise. Greater efforts to ensure energy efficiency are needed. If the current trend continues, Malaysia will spend more than necessary just to sustain the economy. Bold actions need to be taken to tackle issues of energy efficiency without sacrificing public welfare. Promising action plans and effective regulation can be good tools to address this issue.

This study sees no potential savings in the transport sector due to unclear targets for potential savings. The electric vehicles target is still very low and will not directly impact overall energy consumption in the transport sector. Moreover, the incremental consumption of electricity will increase electricity generation, with the supply possibly coming from coal. This will drive up CO2 emissions. At present, old and inefficient vehicles can still use Malaysia's roads without restriction, and Malaysia continues to allow used internal combustion engine vehicles from abroad to enter its market.

A clear and effective roadmap as well as energy action plans must be developed to reduce energy and carbon intensity. A successful energy action plan will require complete and detailed information, as well as smart strategies to enable all parties to contribute.

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