Chapter 11

Malaysia Country Report

Zaharin Zulkifli
Energy Commission of Malaysia

September 2015

This chapter should be cited as
Zulkifli, Z. (2015), 'Malaysia Country Report', in Kimura, S. and H. Phoumin (eds.), *Energy Outlook and Energy Saving Potential in East Asia*. ERIA Research Project Report 2014-33, Jakarta: ERIA, pp.160-177.

CHAPTER 11

Malaysia Country Report

ZAHARIN ZULKIFLI
Malaysia Energy Information Unit
Energy Commission of Malaysia

1. Background

Malaysia is located in Southeast Asia. Its 329,847 square kilometres of territory consist of Peninsular Malaysia and the Sabah and Sarawak States on the island of Borneo. Malaysia has a tropical, humid climate with temperatures averaging 30^{o}C. Malaysia's gross domestic product (GDP) grew steadily over the last 23 years, at an average of 5.8 percent per year from 1990 to 2012. However, growth was sluggish in 1998, due to the Asian Financial Crisis, and in 2001 due to slow growth of export demand for electronic products. Malaysia was also negatively affected by the world economic crisis in 2009.

Malaysia is well endowed with conventional energy resources such as oil, gas, and coal, as well as renewables such as hydro, biomass, and solar energy. As of January 2012, reserves included 6.0 billion barrels of crude oil and condensates, 92.1 trillion cubic feet of natural gas and 1483.1 million tonnes of coal. In terms of energy equivalent, Malaysia's gas reserves are four times as large as its crude oil reserves. Natural gas reserves off the east coast of Peninsular Malaysia are dedicated for domestic consumption and those in Sarawak are allocated for exports in the form of liquefied natural gas (LNG). Malaysia is a net energy exporter. Mineral fuels, lubricants, etc., contributed 20.4 percent of the economy's export earnings in 2012, or RM[1] 143,388 million.

The country's current energy policy was formulated in 1979. Since then, not only has the Malaysian economy undergone fundamental structural changes, but more importantly, the energy landscape, both domestic and international, has changed significantly. A review of the existing core policy has to be conducted and a more comprehensive energy policy and a master plan for the implementation of the energy policy have to be formulated.

During the last 10 years, some of the barriers to the uptake of energy efficiency and renewable energy have been removed. But there is room for further improvement and progress. The challenge would be to considerably increase renewable energy (RE) use in the next five years. Efforts to promote Energy Efficiency (EE) need to be intensified. Moreover, climate change, which is inextricably linked with energy use, has become increasingly important, as people begin to appreciate the implications of an increased risk of unpredictable, severe weather and rapid changes to the ecosystem. Thus, the need to work towards a truly sustainable energy future has become more urgent. A sustainable energy system is central to meeting the economic goals of Malaysia. Its levels of energy

[1] Malaysian ringgit.

use per unit of production (intensity) are high compared with other nations. A national strategy aimed at reducing energy intensity has to be drawn up. Energy planning has to recognise that the place to begin is not just supply, but also the management of demand for energy services, by increasing energy efficiency and the use of renewable energy sources to meet any remaining demand.

Throughout the years, the government of Malaysia has formulated some policies and programmes on energy to ensure the long term reliability and security of energy supply for sustainable social-economic development in the country. The major energy policies implemented in the country are as follows:

(a) Petroleum Development Act (1974)
(b) National Petroleum Policy (1975)
(c) National Energy Policy (1979)
(d) National Depletion Policy (1980)
(e) Four-Fuel Diversification Policy (1981)
(f) Fifth Fuel Policy (2000)
(g) Biofuel Policy (2006)
(h) National Green Technology Policy (2009)
(i) National Renewable Energy Policy and Action Plan (2010)
(j) New Energy Policy and 10th Malaysia Plan (2010)

2. Modelling Assumptions

In determining the forecast of final energy demand, an econometric approach was applied by using the historical correlation between energy demand as well as macroeconomic and activity indicators. Final energy demand equations were derived by using regression analysis.

Future energy demand for various energy sources were estimated using assumed values of the macroeconomic and activity indicators. Future values of these indicators were also derived using historical data depending on their sufficiency for 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, floor area of buildings, etc. 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 areas, private consumption, and other factors that encourage commercial activities. However, due to unavailability of information on the activity indicators, macroeconomic parameters, i.e. gross domestic product (GDP), were the best variables to use in establishing the relationship with the energy demand trend. These macroeconomic indicators were mainly used to generate the model equations. In some cases, where regression analysis was not applicable due to insufficiency of data, or failure to derive a statistically sound equation, other methods, such as share or percentage approaches, were used.

One of the main drivers of the modelling assumption is the GDP growth rate. The GDP growth rates assumption forecast was based on a study carried out by Economic Planning Unit (EPU) under the Prime Minister's Office. Most of the energy demand equations for Malaysia used GDP as the key factor to determine future projections, because of a high correlation between energy demand and GDP. The GDP growth assumptions are listed in Table 11-1.

Table 11-1. GDP Growth Assumptions by Sector to 2035

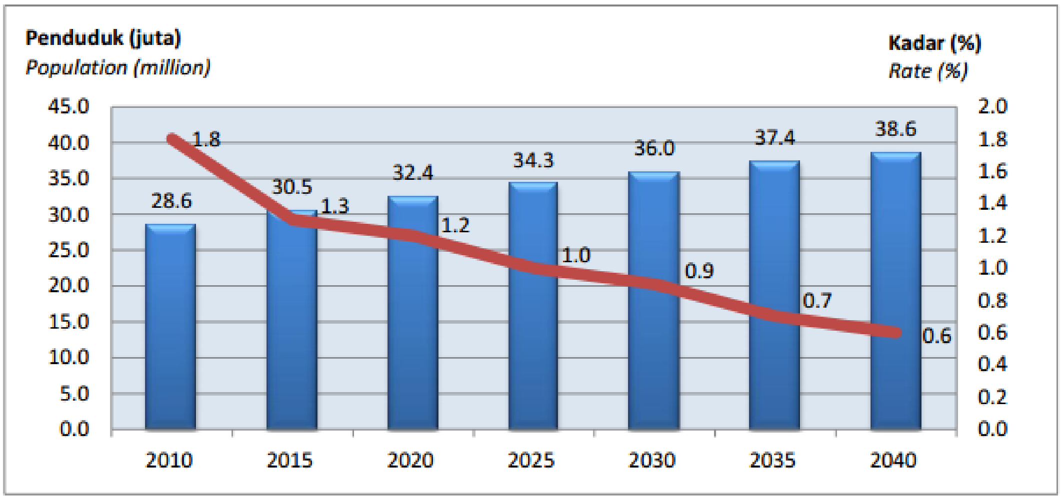
in % year-on-year

	Agriculture	Manufacturing	Services	Total GDP
2012–2013	2.06	4.78	5.88	4.74
2013–2014	2.55	6.19	6.35	6.02
2014–2015	0.30	4.90	5.60	5.00
2015–2020	1.44	2.95	4.13	3.30
2020–2025	1.37	2.95	3.72	3.02
2025–2030	1.37	2.95	3.88	3.02
2030–2035	1.37	2.95	3.67	3.02

GDP = gross domestic product.
Source: Economic Planning Unit, Prime Minister Department and ERIA.

Another important parameter in projecting future energy demand is the population growth rate. Besides future GDP growth rates, annual average population growth was also considered as one of main key drivers for future energy growth. In 2012, Malaysia's population was 29.2 million and it is projected to increase by 8.7 million (29.9 percent) to 38.0 million in 2035. However, the annual population growth rate is projected to decrease from 1.4 per cent from 2012 to 2020, to 1.0 percent from 2020 to 2035. This is a reflection of a targeted decline in the fertility rate and international migration. The assumptions of future population growth rates were obtained from the Department of Statistics Malaysia (Figure 11-1).

Figure 11-1. Population Growth Assumption to 2035



Source: Department of Statistics Malaysia.

To accelerate its economic and social development, supported by its current position as a net energy exporter, Malaysia provides subsidises energy use for various users. Due to the volatility of global energy prices and growing demand for energy, the total amount of energy subsidies offered to various energy users in the country has been growing from year to year. It has reached very high levels, placing a strain on government expenditure and taking away funds from other developmental budgets. This has led the government to review its energy subsidy policies and take action to manage energy subsidies with proper mitigation actions. In this regard, energy efficiency offers a sound solution to mitigate the effects of the gradual removal of energy subsidies.

To promote energy efficiency, the Ministry of Energy, Green Technology and Water (MEGTW) enacted a number of legal instruments. The main legal instrument on energy efficiency promotion is the Electricity Supply Act (Amendment) 2001, also known as Act A1116. The act empowers the MEGTW, under Sections 23A, 23B, and 23C, to promote efficient use of electricity in the country. Based on this, MEGTW issued the Efficient Management of Electrical Energy Regulation 2008, under which all installations that consume or generate 3 million kWh or more of electricity over a period of six months will be required to engage an electrical energy manager who shall, amongst others, be responsible for analysing the total consumption of electrical energy, to advise on the development and implementation of measures to ensure efficient management of electrical energy, and to monitor the effectiveness of the measures taken. The Energy Commission (EC) is empowered to enforce the Energy Efficiency Regulations.

The latest regulatory instrument to promote energy efficiency improvement is the Electricity Regulations (Amendment) 2013. The regulation was amended to allow for the implementation of Minimum Energy Performance Standards (MEPS) regarding selected electrical appliances and lighting. Under the new regulation, refrigerators, air-conditioners, televisions, fans, and lamps (Fluorescent, Compact Fluorescent, Light Emitting Diode, and Incandescent) that enter the Malaysian market or are sold to consumers must meet the minimum energy performance standards as prescribed in the regulation. Furthermore, information related to MEPS of those products must be made available to consumers by labelling. Labelling of appliances covered by MEPS will became a mandatory requirement. The regulation will pave the way for the phasing-out of inefficient electrical appliances and lighting.

Malaysia has developed a reasonably well-designed renewable support mechanism that includes a set of legislation, published Feed-in-Tariff (FiT) with annual digression rates from 2013 onwards, developed a quota mechanism, and created a Renewable Energy Master Plan and an implementing agency (SEDA, the Sustainable Energy Development Authority). Malaysia has opted for FiT to drive the development of renewable capacity. FiT is guaranteed by the Renewable Energy Act 2011 and the levels are set by SEDA. The scheme is intended to provide a reasonable level of return for investors over a fixed period to provide a level of certainty. FiTs are available for biogas, biomass, solar PV, and small hydro. Support duration is16 years for biomass and biogas and 21 years for small hydropower and solar PV. A capacity quota system is in place to manage the new capacity added to the system. This mechanism enables Malaysia to shape the amount of new capacity to be added in the system from the different technologies and make it economically sustainable. Similar systems have been applied for example for solar PV in deregulated markets including Italy and Spain in response to a rush for new installations. Feed-in-Tariff (FiT) has been used to adjust to the cost of the technology. With the exception of small hydro, FiTs are revised every year according to different digression rates from 2013 onwards. This system is used in countries like Germany as a way to adjust the level of remuneration to technology cost evolutions. However, as these digression rates have to be correctly calculated to avoid a slowdown in capacity build out, such mechanisms have proven to work well only in relatively mature markets, with long track records and know-how.

The Malaysian government is seeking to promote the wider use of public transport through the development of mass transit systems. The current focus is on Kuala Lumpur and the Klang Valley, where around 7.6 million people live (about a third of the population). The existing light transit rail (LRT) system was developed in the late 1990s/early 2000s and consists of 124 km of track carrying 150 million passengers per year, around 1.2 billion passenger-km (0.5 percent of Peninsular Malaysia’s total transport demand in passenger-km). The current plans call for an expansion of the LRT system with an additional 150 km of track to be developed between 2016 and 2022. The new network will transport around 330 million passengers a year and account for around 1 percent of the Peninsula’s total transport passenger-km. In addition to the LRT, there are plans to develop the East Coast rail route. This would serve around 3.3 million people in Kelantan, Terengganu, Pahang, and Selangor via a 620 km line. It is also anticipated that it will carry 37 million tonnes of freight annually.

Under the Economic Transformation Programme (ETP), formulated as part of Malaysia's National Transformation Programme, the government is studying the possibility of deploying nuclear energy to meet future demand to further diversify the energy mix for Peninsular Malaysia. To spearhead the initiative, the Malaysia Nuclear Power Corporation (MNPC) has been formed to lead the planning based on the current development timeline of 11 to 12 years, from pre-project to commissioning.

In setting up the scenarios for this project, several assumptions or scenarios have been identified:

1) APS1 Improved efficiency of final energy demand
2) APS2 Higher efficiency of thermal electricity generation
3) APS3 Higher contribution of NRE (here NRE for electricity generation and biofuels for the transport sector are assumed)
4) APS4 Introduction of nuclear energy
5) APS5 Combined impact of scenarios APS1 to APS4

The details of future assumptions based on their respective scenarios are mentioned in Table 11-2:

Table 11-2. Energy Efficiency Assumptions

Scenarios	Assumptions
APS1	1. Electricity Demand in Industrial Sector (INEL)
	Potential reduction of electricity demand in industrial sector from the year 2015 until 2035 by 1.6 percent per year
	2. Total Energy Demand in Industrial Sector (INTT)
	Potential reduction of total energy demand (electricity + petroleum products + coal + natural gas) in industrial sector by 1 percent per year from 2015 until 2035
	3. Total Energy Demand in Commercial Sector
	Potential reduction of total energy demand in commercial sector by 1 percent per year from 2015 until 2035

APS = Alternative Policy Scenario.

Table 11-3. Higher Efficiency of Thermal Electricity Generation

Scenarios	Assumptions
APS2	1.Higher efficiency of coal power plant by 40 percent in 2035
	2. Higher efficiency of natural gas power plant by 45.9 percent in 2035

Table 11-4. Renewable Energy Assumptions

<table>
<tr><th>Scenarios</th><th colspan="7">Assumptions</th></tr>
<tr><td rowspan="8">APS2</td><td colspan="7">1. By 2030, Malaysia will be expected to have the following renewable energy (RE) capacities in power generation. The breakdown of the capacity based on type of fuels type are showed below:</td></tr>
<tr><td colspan="7">Cumulative Capacity (MW)</td></tr>
<tr><td>Year</td><td>Biomass</td><td>Biogas</td><td>Mini-Hydro</td><td>Solar PV</td><td>Solid Waste</td><td>Total</td></tr>
<tr><td>2015</td><td>330</td><td>100</td><td>290</td><td>55</td><td>200</td><td>975</td></tr>
<tr><td>2020</td><td>800</td><td>240</td><td>490</td><td>175</td><td>360</td><td>2,065</td></tr>
<tr><td>2025</td><td>1,190</td><td>350</td><td>490</td><td>399</td><td>380</td><td>2,809</td></tr>
<tr><td>2030</td><td>1,340</td><td>410</td><td>490</td><td>854</td><td>390</td><td>3,484</td></tr>
<tr><td colspan="7">2. In 2020, 7 percent of Malaysia’s share of diesel consumption in transport sector will come from biodiesel.</td></tr>
</table>

APS = Alternative Policy Scenario.

Table 11-5. Nuclear Energy Assumptions

Scenarios	Assumptions
APS4	1. By 2025, a 2000 MW nuclear plant is expected to have been commissioned.

APS = Alternative Policy Scenario(s).

Table 11-6. APS Assumptions

Scenarios	Assumptions
APS5	APS1 + APS2 + APS3 + APS4

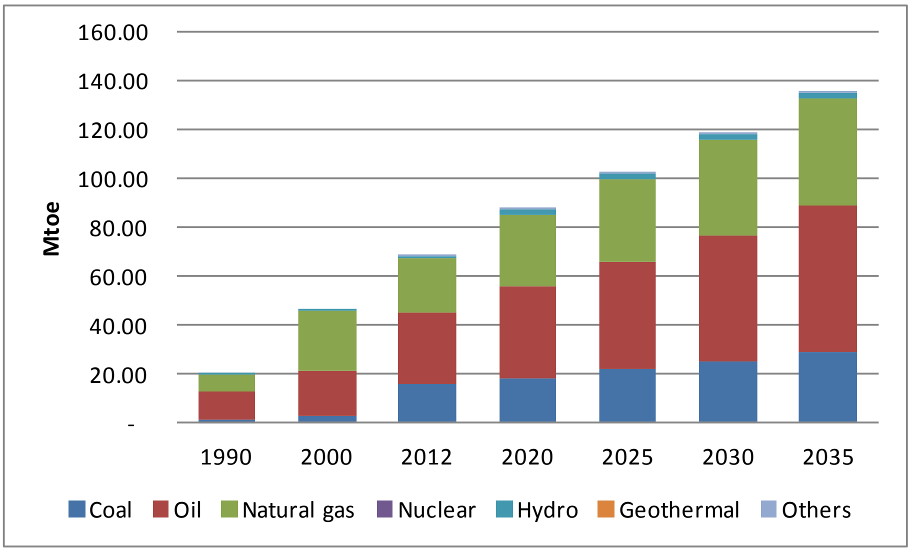
APS = Alternative Policy Scenario.

3. Outlook Results

3.1. Business-as-Usual (BAU) Scenario

Total primary energy consumption under the BAU scenario registered average annual growth of 5.8 percent from 1990 to 2012 and is projected to increase by 2.9 percent per year from 2012 to 2035. Hydro is expected to increase from 0.78 Mtoe in 2012 to 2.75 Mtoe in 2035, at an average annual growth rate of 5.6 percent, oil supply by 3.1 percent, and supply of coal mainly consumed by the power sector by 0.8 percent. Natural gas is projected to increase from 22.48 Mtoe in 2012 to 52.74 Mtoe in 2035, or grow at an average annual rate of 3.8 percent, biomass for power generation at 7.4 percent, and biofuel use for land transportation at 1.2 percent.

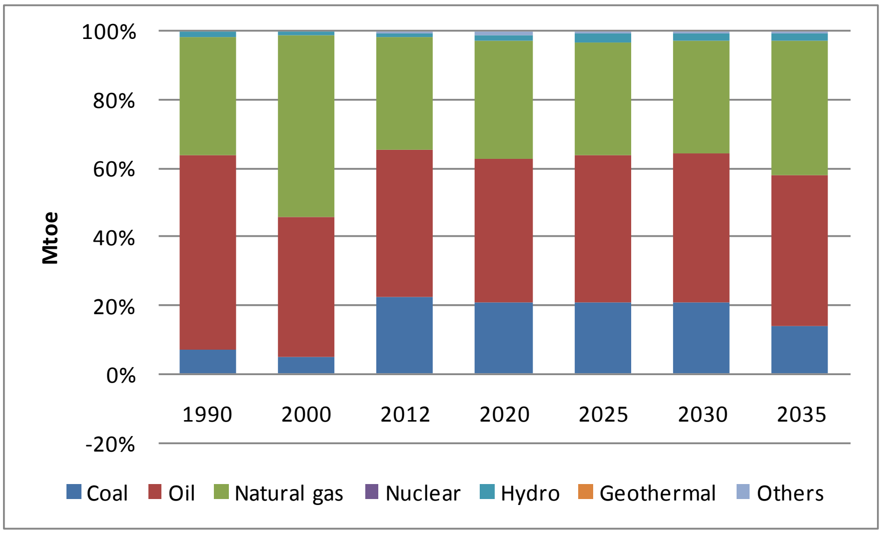
Figure 11-2. Primary Energy Consumption by Fuel, BAU



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

In terms of shares by fuel type, the share of oil is projected to increase from 43.2 percent in 2012 to 44.4 percent in 2035 and the share of natural gas will increase from 32.6 percent in 2012 to 39.3 percent in 2035. The share of coal is expected to decrease over the projection period, from 22.4 percent in 2012 to 13.9 percent in 2035, and the share of hydro will increase from 1.1 percent in 2012 to 2.0 percent in 2035.

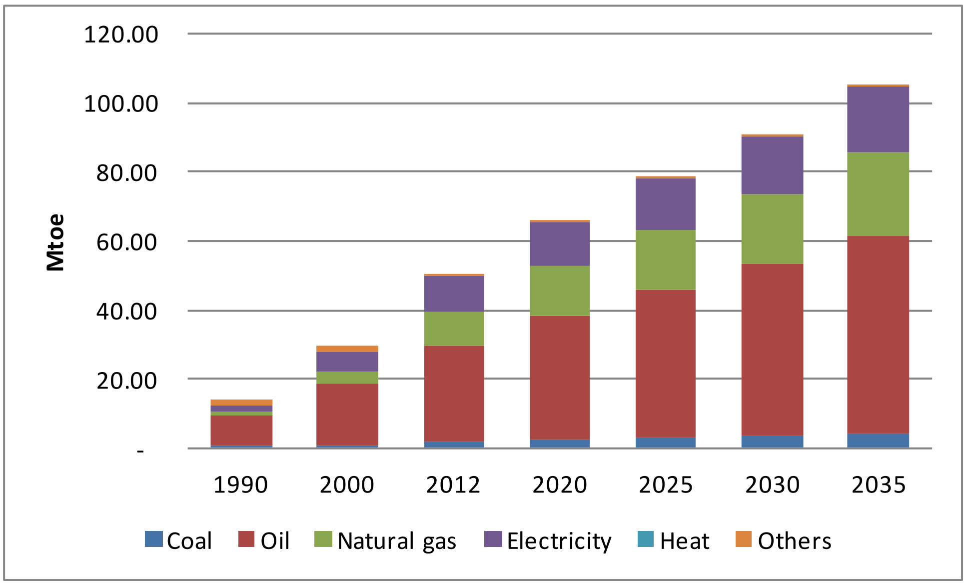
Figure 11-3. Share of Primary Energy Consumption by Fuel, BAU



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

Total final energy demand in the BAU scenario is projected to increase from 50.2 Mtoe in 2012 to 104.7 Mtoe in 2035, or at an average annual growth rate of 3.2 percent per year. Final demand of coal and natural gas are expected to see the highest average annual growth rates, of 3.8 percent and 4.2 percent, respectively from 2012 level to 2035. Oil demand will grow from 27.7 Mtoe in 2012 to 57.6 Mtoe in 2035, or at 3.2 percent per year. Electricity demand will increase by 2.6 percent per year from 2012 to 2035 and other fuels will grow from 0.11 Mtoe in 2012 to 0.15 Mtoe in 2035, or by 1.2 percent per year.

Figure 11-4. Final Energy Demand by Fuel, BAU

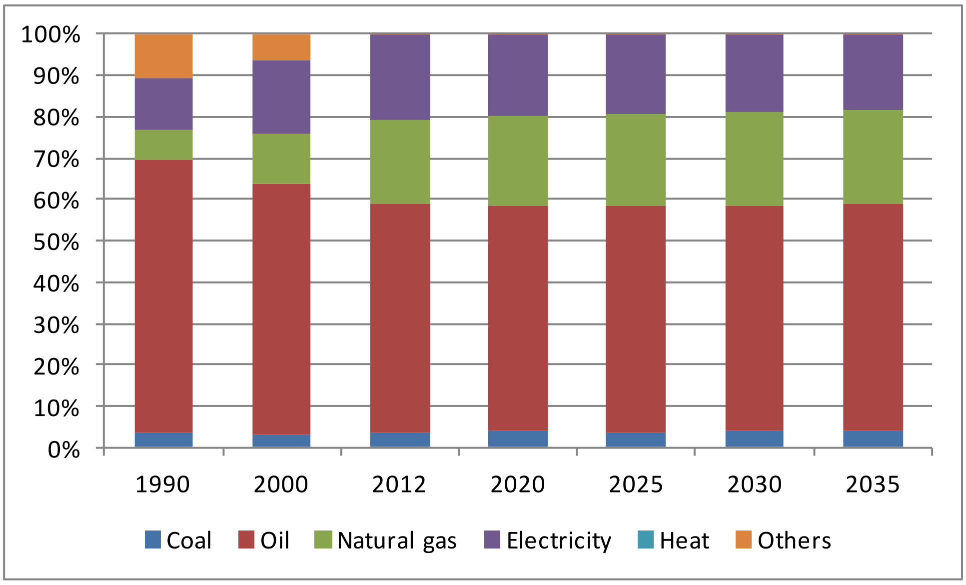


BAU = Business-as-Usual.
Source: Author’s calculation.

Analysis by fuel type shows that the share of oil will remain the largest, at 55.1 percent, in 2035, nearly the same as in 2012 (55.3 percent), followed by natural gas with 23.9 percent in 2035. The share of electricity is projected to fall to 18.1 percent from 20.7 percent in 2012, whereas the share of coal is expected to increase slightly, from 3.5 percent in 2012 to 3.9 percent in 2035.

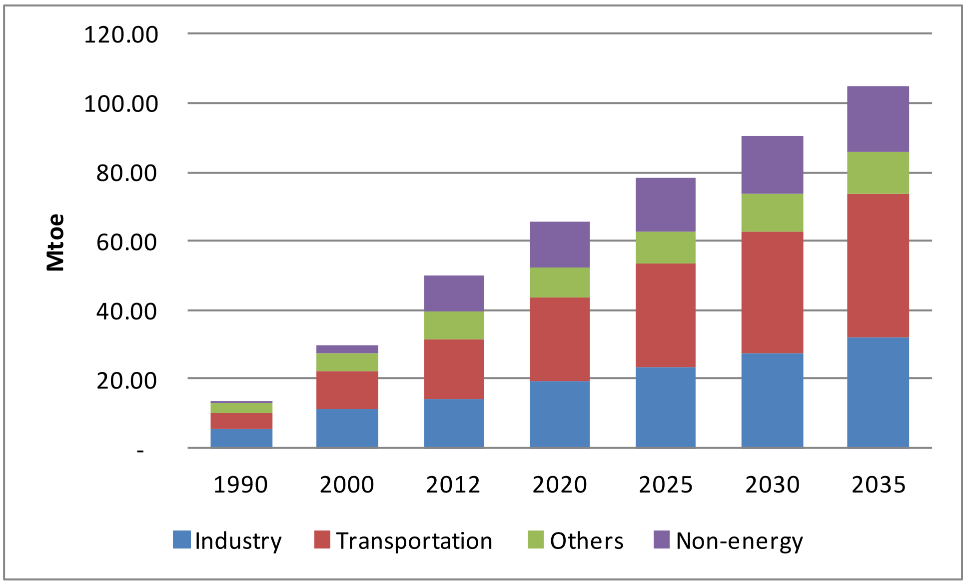
Final energy demand by sector shows that the transportation sector will see the highest growth, at 3.9 percent per year, from 2012 until 2035, followed by industrial sector which is projected to grow from 14.3 Mtoe in 2012 to 32.2 Mtoe in 2035, or at 3.6 percent per year. The ‘Others’ sector is expected to see an annual average increase of 1.7 percent from 2012 until 2035. The non-energy use is expected to increase from 10.7 Mtoe in 2012 to 19.1 Mtoe in 2035, or at an average annual growth rate of 2.6 percent.

Figure 11-5. Share of Final Energy Demand by Fuel, BAU



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

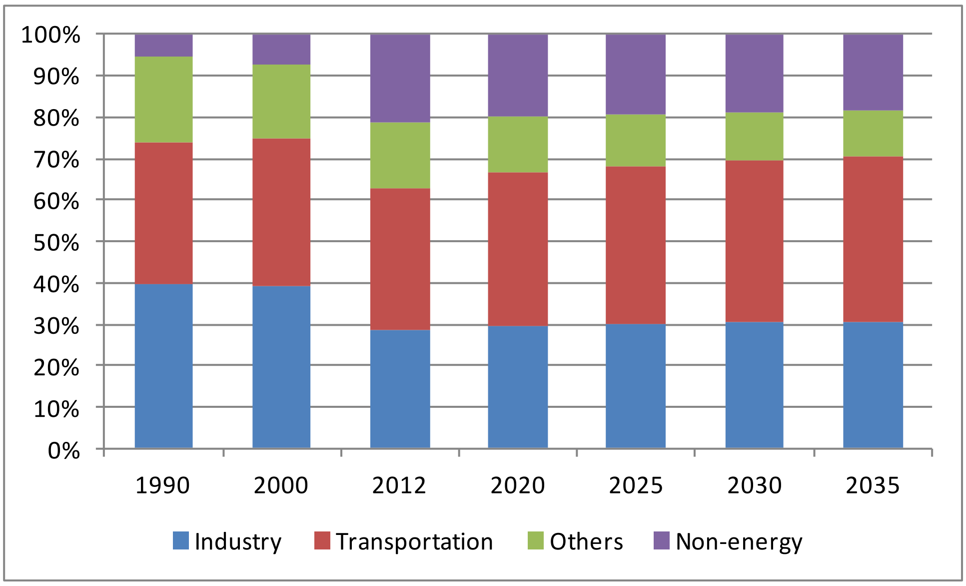
Figure 11-6. Final Energy Demand by Sector, BAU



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

The transport sector is projected to maintain its highest share of energy usage in 2035, at 39.8 percent, compared with 34.2 percent in 2012, followed by the industry sector at 30.8 percent share in 2035, compared with 28.5 percent in 2012. The share of non-energy use is expected to be 18.2 percent of total final energy demand in 2035, a decrease from 21.3 percent share in 2012. The share of the 'others' sector is expected to be 11.2 percent in 2035.

Figure 11-7. Share of Final Energy Demand by Sector, BAU



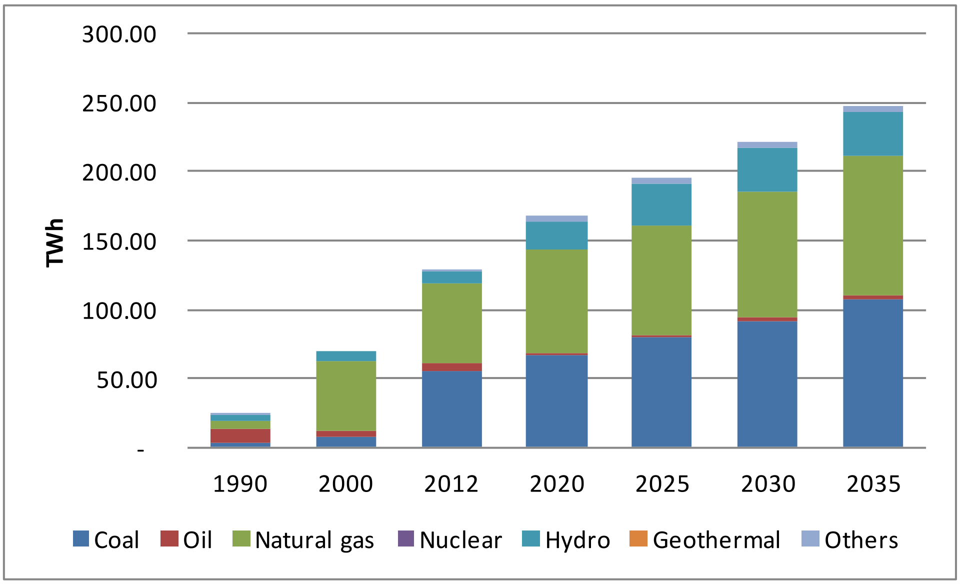
BAU = Business-as-Usual.
Source: Author's calculation.

In the BAU scenario, total power generation is expected to grow at around 2.9 percent per year on average from 2012 to 2035, reaching 248.3 TWh. Power generation from others is expected to see the fastest growth, at 7.1 percent per year from 2012 until 2035. This is followed by power generation from hydro, which is projected to increase to almost 32 TWh in 2035, compared with 9.1 TWh in 2012. Power generation from coal is projected to grow at an annual average rate of only 0.5 percent from 2012 to 2035, from 55.8 TWh in 2012 to 62.4 TWh in 2035. Power generation from oil is expected to decline by an average 3.5 percent per year, to 2.6 TWh in 2035 compared with 5.9 TWh in 2012.

The power generation mix will in 2035 will be dominated by natural gas and coal, with shares of 59.3 percent and 25.1 percent, respectively. Hydro follows with a share of 12.9 percent in 2035 compared with 7.0 percent in 2012. The share of others will be 1.7 percent of total power generation in 2035 and that of oil share 1.0 percent in 2035, compared with 4.6 percent in 2012.

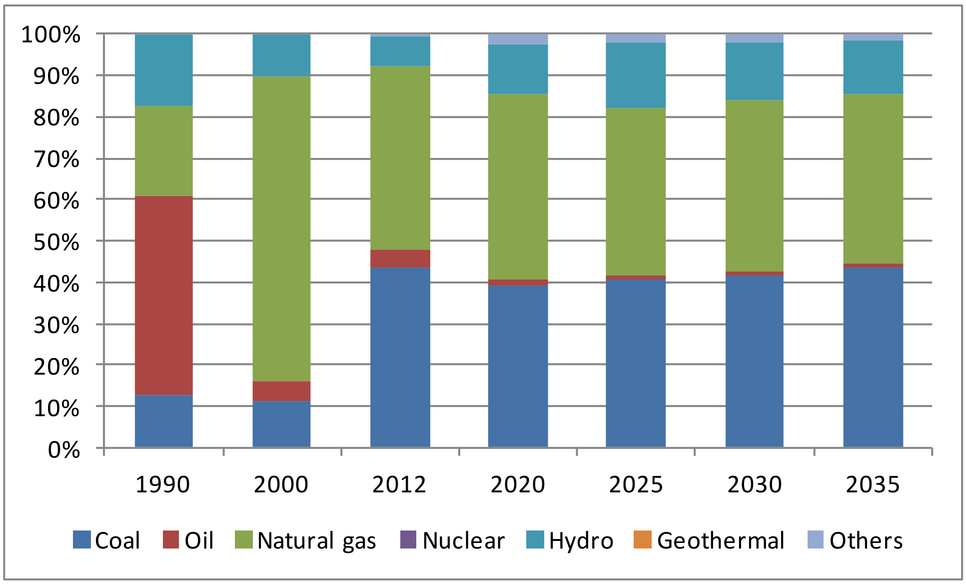
In the BAU scenario, thermal efficiency of coal power plants is expected to improve to 37.0 percent in 2035 from 35.0 percent in 2012, and that of oil power plants is projected to remain more or less the same over the projection period at around 33.0 percent. Thermal efficiency of natural gas power plants will further improve, to almost 44 percent by 2035, from 40 percent in 2012.

Figure 11-8. Power Generation by Fuel, BAU



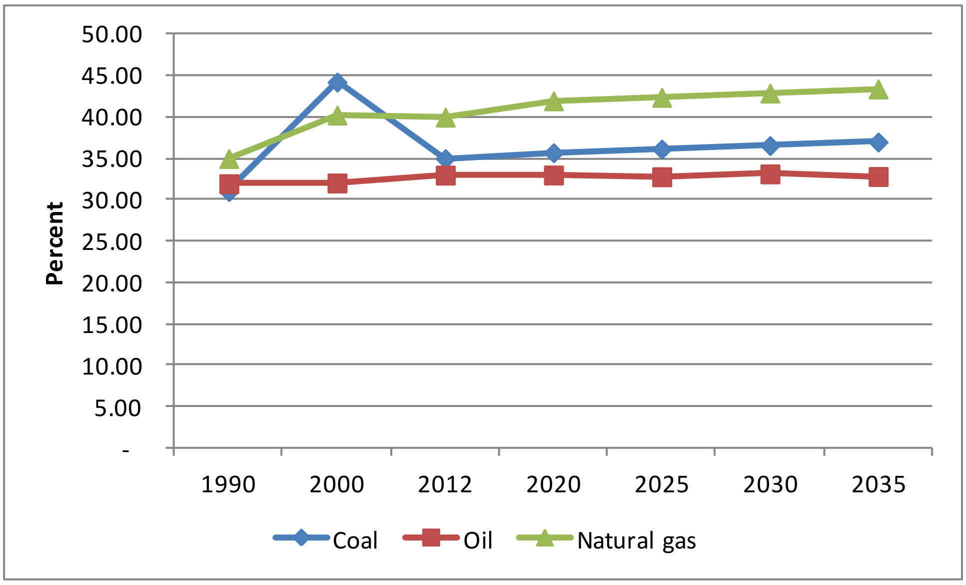
BAU = Business-as-Usual.
Source: Author's calculation.

Figure 11-9. Share of Power Generation by Fuel, BAU



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

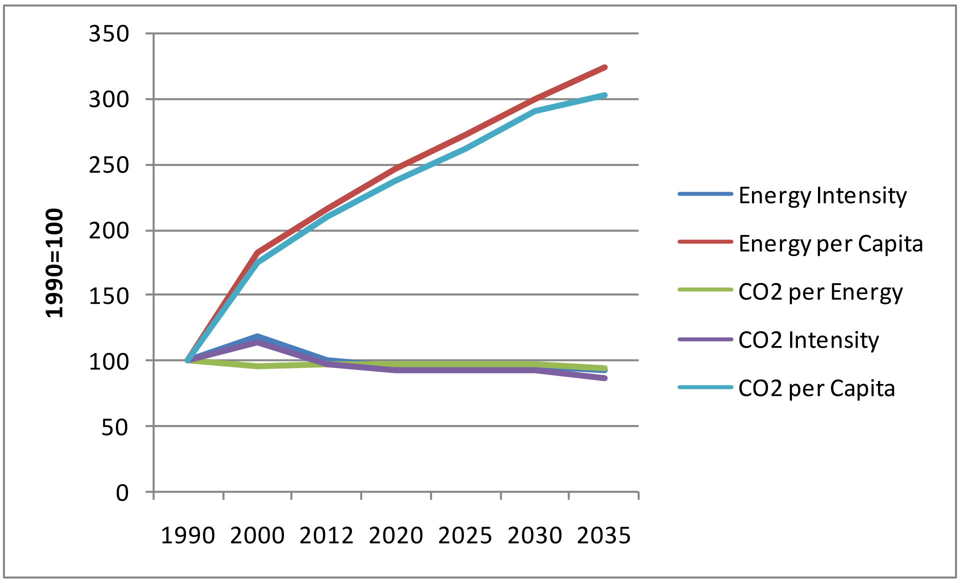
Figure 11-10. Thermal Efficiency by Fuel, BAU



Source: Author's calculation.

Malaysia primary energy intensity is expected to decline to 321 toe/million US$ in 2035 from 348 toe/million US$ in 2012, and final energy intensity is projected to decline to 250 toe/million US$ in 2035 compare with 253 toe/million US$ in 2012. However, primary energy per capita is projected to increase to 3.53 toe/person in 2035 compared with 2.36 toe/person in 2012.

Figure 11-11. Energy Indicators, BAU



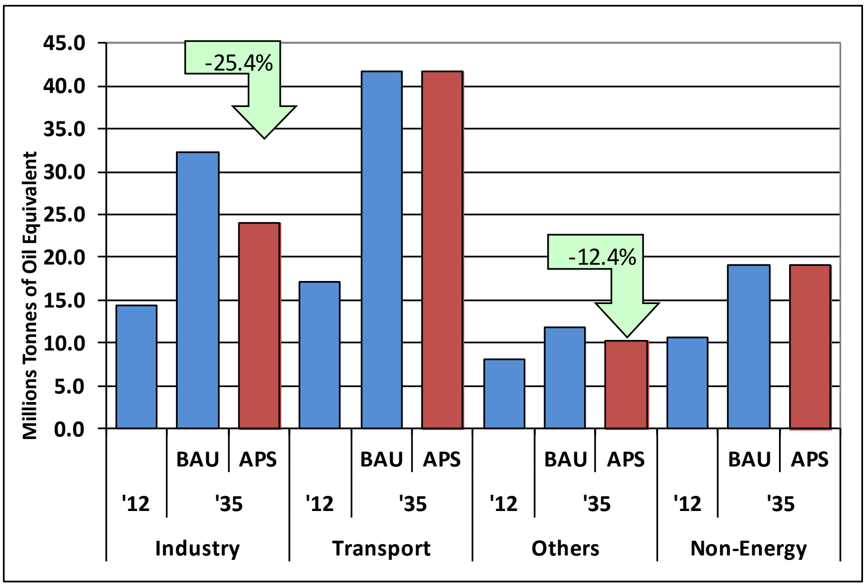
BAU = Business-as-Usual.
Source: Author's calculation.

CO_2 intensity is expected to decrease to 205 t-C/million US$ in 2035 from 231 t-C/million US$ in 2012. CO_2 per primary energy is projected to decrease slightly, from 0.66 t-C/toe in 2012 to 0.64 t-C/toe in 2035.

3.2. Alternative Policy Scenario (APS)

In the APS, growth in final energy demand will be 2.8 percent from 2012 to 2035, slightly lower than under the BAU scenario. The slower rate of growth in the APS is projected to be the result of improvements in manufacturing technologies as well as efforts to improve energy efficiency, particularly in the industrial and commercial sectors. As a result, savings of 25.4 percent in the industry sector can be expected by 2035. In the 'others' sector, the growth rate of energy consumption is projected to be slower than under the BAU scenario, growing at an average rate of 1.1 percent per year compared with 1.7 percent per year in the BAU scenario. The potential saving of 12.4 percent in 2035 can be achieved through the implementation of energy efficiency measures (Figure 11-12).

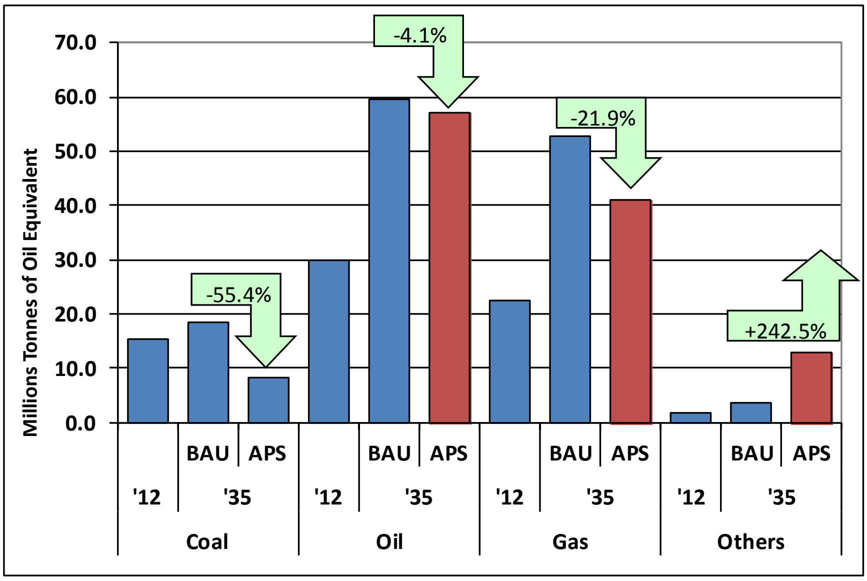
Figure 11-12. Final Energy Demand by Sector, BAU and APS



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

In the APS, primary energy consumption is projected to increase at a slower rate than in the BAU scenario, at 2.3 percent per year, from 69.0 Mtoe in 2012 to 115.8 Mtoe in 2035. Biomass and biofuels will be growing fastest, at annual average rates of 13.1 percent and 10.4 percent, respectively. This is due to the implementation of FiT in power generation, which is expected to have a big impact on primary energy consumption in 2035, as more renewable energy for power generation is expected to be commissioned. Hydro will also increase steadily, but at a slower rate of 5.9 percent per year from 2012 to 2035. Oil is expected to grow at 2.9 percent per year from 2012 until 2035 and natural gas at 2.7 percent. Coal is projected to decrease by an annual average 2.7 percent from 2012 to 2035 (Figure 11-13), mainly as a result of energy efficiency and conservation measures on the demand side as well as a reduced dependency on fossil fuels. Nuclear power will be introduced as another energy option after 2025.

Figure 11-13. Primary Energy Consumption by Source, BAU and APS5

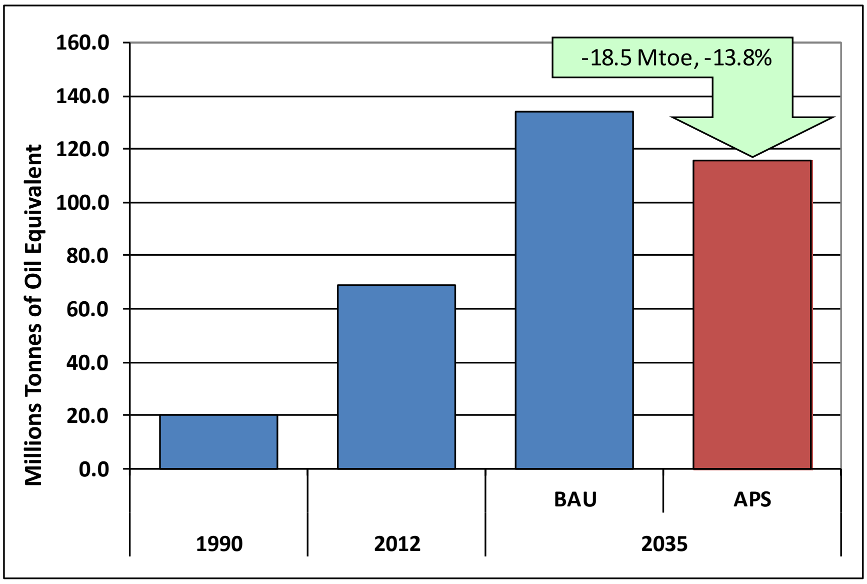


BAU = Business-as-Usual; APS = Alternative Policy Scenario.
Source: Author's calculation.

3.3. Projected Energy Savings

The energy savings that could be achieved under the APS, relative to the BAU scenario, are a result of energy efficiency efforts in the industrial and commercial sectors, a more efficient thermal power supply, and a higher contribution from renewable energy, and are estimated at about 18.5 Mtoe in 2035 (Figure).

Figure 11-14. Total Primary Energy Consumption, BAU and APS



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

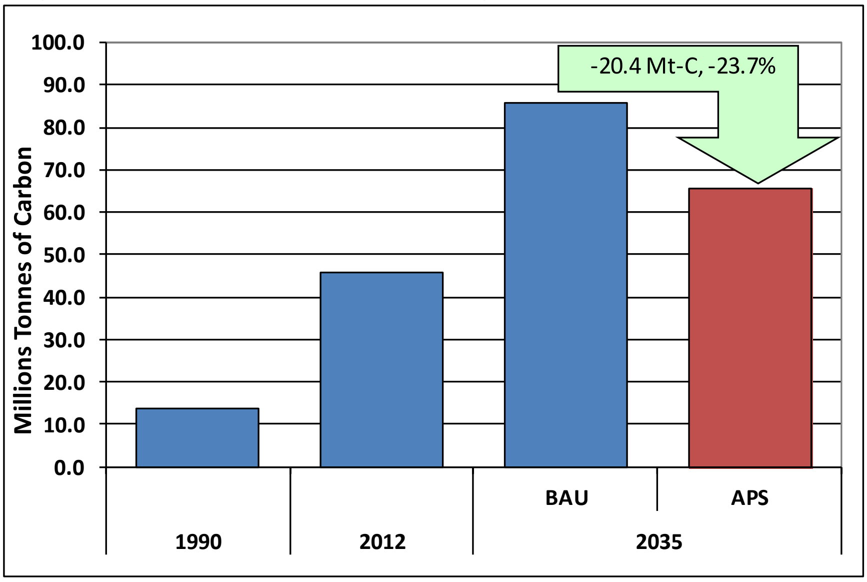
Most of the savings can be achieved by switching from coal to renewable energy and nuclear power. In terms of final energy demand, the saving of 9.6 Mtoe that can be achieved in 2035 consist of savings of 8.2 Mtoe in the industrial sector and savings of 1.5 Mtoe in the commercial sector.

3.4. CO_2 Emissions from Energy Consumption

In the BAU scenario, total carbon dioxide (CO_2) emissions from energy consumption are projected to increase by 2.8 percent per year from 2012 to 2035. In 2012, the CO_2 level was at 45.8 million tonnes of carbon (Mt-C) and this is expected to increase to 86.0 Mt-C in 2035 under the BAU scenario.

In the APS, the annual increase in CO_2 emissions from 2012 to 2035 will be lower than in the BAU scenario, at 1.6 percent per year, which is fairly consistent with the projected growth in primary energy consumption. The reduction in CO_2 emissions in the APS of 20.4 Mt-C or 23.7 percent relative to the BAU scenario is also due to a significant decrease in coal consumption for power generation in the APS, relative to the BAU scenario, as coal consumption is being replaced by natural gas and other clean energy sources such as nuclear and renewable energy. Furthermore, the lower energy usage in the industrial sector and the commercial sector and fuel switching in the transport sector have also contributed to the reduction. This indicates that Malaysia's energy saving effort and renewable energy action plan would be effective in reducing CO_2 emissions.

Figure 11-15. CO_2 Emissions from Energy Combustion, BAU and APS5



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

4. Conclusions

Malaysia's primary energy intensity in the APS is projected to be 13.8 percent lower in 2035 than under the BAU scenario. The reduction of primary energy intensity will be due to Malaysia's energy saving measures, promoting energy efficiency and renewable energy. A contribution is expected to be made by programmes and activities under the Economic Transformation Programme (ETP) to increase diversification of the energy industry, step up exploration for new oil and gas resources, enhance production from known reserves, and encourage the use of alternative energy sources such as solar, hydro-electric, and nuclear.

Malaysia faces several energy issues and challenges, which can be addressed in holistic manner. The entire need of reformulation of the sustainable energy plan can help to achieve future economic targets. Some major challenges are the depletion of fossil fuel, global warming, and the volatility of energy prices. Successfully tackling the increase in energy demand depends on many issues. These issues can be addressed by utilising a large proportion of renewable sources, even though these sources are costlier than fossil fuels. However, hastening technology learning and subsidies can help improve technology competitiveness. Renewable subsidies should be well targeted and not burdensome to consumers.

For its Economic Transformation Programme (ETP), Malaysia needs more energy and continuous economic growth. Faced with rising demand for electricity, Malaysia is also exploring the nuclear energy option to meet future demand. The increase in energy consumption has also resulted in high levels of greenhouse gas (GHG) emissions. Alternative energy sources like nuclear and solar are needed to reduce GHG emissions.

Malaysia should continue with and enhance energy efficiency programmes and activities, as the results so far have been a large reduction in total final energy consumption compared with the BAU scenario. There is potential for savings in the industry, commercial, and residential sectors. Besides the industry sector, the transportation sector is expected to become one of the largest energy consumers in 2035. Programmes or activities to reduce energy demand – such as enhancing the public transportation network, introducing hybrid and Electric Vehicle (EV), and substituting private vehicles with Natural Gas Vehicle (NGV) – should be implemented and organised. To mitigate CO_2 emission in the power sector, cleaner, better, and more efficient thermal technologies should be used for electricity generation in the country. The FiT programme should also be continued to promote the utilisation of RE to minimise CO_2 emissions.