Chapter 14

Philippines Country Report

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Chapter 14

Philippines Country Report

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1. Background

1.1. Socio-economic Situation

The Philippines, officially known as The Republic of the Philippines, with Manila as its capital city is an archipelago comprising of more than 7,000 islands that are categorised broadly under three main geographical divisions from north to south: Luzon, Visayas, and Mindanao. It is a sovereign island country in Southeast Asia situated in the western Pacific Ocean. The country is located in the midst of Southeast Asia's main water bodies – the South China Sea, Philippine Sea, Sulu Sea, and Celebes Sea.

In 2013, the Philippine economy posted a 7.2 percent growth rate, slightly higher than in 2012 when it was 6.8 percent. The growth of the economy was largely due to the vigorous economic activities in the industrial and services sectors in 2012 and 2013, when annual growth rates of 9.2 percent and 7.0 percent, respectively, were posted. The increase in the industrial sector was driven by growth in the manufacturing sector, which expanded by 10.3 percent during the period. Growth in the services sector is attributed to robust domestic trade and services and a boom in real estate business. Agriculture, hunting, forestry, and fishing posted a 1.1 percent increase during the period, a 1.7 percentage point decline from the 2012 level. Gross domestic product (GDP, valued at constant 2005 US$) per capita of the country was US$1,584.5 in 2013.

1.2. Policy Initiatives

Notwithstanding the fact that fossil fuels contribute significantly to the country's primary energy supply, the Department of Energy (DOE) of the Philippines is adopting the use of clean, green, and sustainable sources of energy for its long-term energy security strategy. The country's long-term national energy plan ensured that the immediate need for energy is met while ensuring it will not cause damage to the people and environment. The target of a 60 percent self-sufficiency level as part of the energy security goal of the country will ensure the development of indigenous energy such as renewable energy and hydrocarbon fuels (oil, gas, and coal). In particular, renewable energy sources like geothermal, wind, biomass, ocean, and alternative fuels like biofuels and compressed natural gas (CNG) are expected to meet the country's future energy requirements.

Another key component in the country's energy security strategy is the need to seize the opportunities presented by energy efficiency and conservation. The launching of the National Energy Efficiency and Conservation Program (NEECP) in August 2004 is evidence of the energy sector's commitment to continuously work on the development and promotion of new technologies and the practice of good energy habits in the household, business, and transport sectors. In line with the NEECP, the DOE has a goal of 10 percent energy savings from the total annual energy demand. The DOE has been making efforts to reduce demand for energy while ensuring energy requirements are met to support economic growth. It has taken the lead in trying to increase public interest in the use of energy-efficient technologies and conservation practices.

As the DOE walks the path towards energy development, it will continue to implement reforms in the power and downstream oil industries to address socially sensitive issues such as stability of supply and high cost of electricity and petroleum products.

Below are the highlights of the energy sector's plans and programmes:

Renewable Energy

The passage of Republic Act No. 9513 or Renewable Energy Act of 2008 legally supports the policy and programme framework to promote the utilisation of renewable energy resources and technologies. On 14 June 2011, the government unveiled the National Renewable Energy Program (NREP) or the 'Green Energy Roadmap' of the Philippines. The NREP is anchored on the DOE's Energy Reform Agenda, which aims to ensure greater energy supply security for the country. It has established the policy and programme framework for the promotion of renewable energy and a road map to guide efforts in realising the market penetration targets of each renewable energy resource in the country. The roadmap is targeting 15,304 MW installed renewable energy capacity by 2030. The NREP also provides for policy mechanisms to support the implementation of the Renewable Energy Act. These policy mechanisms include: Renewable Portfolio Standards (RPS), Feed-in Tariff (FiT), Green Energy Option Program, and Net-Metering for Renewable Energy.

The RPS sets the minimum percentage of generation from eligible renewable energy resources, provided by the generators, distribution utilities, and electric suppliers. Initially, an installation target of 760 megawatts (MW) from renewable energy is set for the first 3 years from 2013 to 2015, broken down as follows: biomass (250 MW), run-of-river hydro (250 MW), solar (50 MW), wind (200 MW), and ocean (10 MW).

On the other hand, the FiT provides guaranteed payments on a fixed rate per kWh for renewable energy generation, excluding generation for own use. On 27 July 2012, the Energy Regulatory Commission (ERC) approved the initial FiT rates, which will apply to generation from renewable energy sources, particularly, run-of-river hydro, biomass, wind, and solar. Approved FiT rates for biomass, hydropower, solar, and wind are 6.63 PhP[1], 5.90 PhP, 9.68PhP, and 8.53 PhP per kilowatt-hour (kWh), respectively. Currently, there is no FiT rate for ocean energy since the technology is still being studied and not yet available in the country.

[1] Philippine peso.

Alternative Fuels

Biofuels

The DOE is aggressively implementing Republic Act No. 9367 or the Biofuels Act of 2006. The law intends to tap the country's indigenous agricultural resources as potential feedstock for biofuels.

The mandatory 1.0 percent biodiesel blend in all diesel fuel sold in the country since May 2007 was increased to 2.0 percent in February 2009 on a voluntary basis. On the other hand, the country now enjoys an accelerated use of E10 (10%) bioethanol blend as supplied by most gasoline retailers in the Philippines.

To serve the technical requirements for the biofuels programme and ensure its continuous research and development, the DOE provided counterpart funding of P50 million for the establishment of a vehicle testing facility located at the Department of Mechanical Engineering Laboratory, University of the Philippines in Diliman, Quezon City. Roundtable discussions with stakeholders on technical verification and relevance of emerging biofuel technologies also form part of the DOE's initiatives on research and development.

As part of its continuing effort to diversify the country's energy mix, a biofuel project with the University of the Philippines – Visayas Foundation Inc. (UPVFI) titled 'Bioethanol Production from Macroalgae and Socio-ecological Implications' was launched in September 2013. Similarly, the 'B5 Testing on Public Utility Jeepneys' project between the Philippine Coconut Authority (PCA) and UP–National Center for Transportation Studies (UP–NCTS) was also launched in July 2013.

Compressed Natural Gas (CNG)

Currently, there are 61 compressed natural gas (CNG) buses in the Philippines, of which 41 are commercially run. The CNG buses are servicing the Manila–Batangas–Laguna routes. In addition, 20 CNG buses that had completed technical evaluation and testing. As of June 2012, seven bus operators had been accredited

for CNG bus operation. The CNG Mother-refuelling Station and the Daughter Station are operating in Batangas and Biñan, Laguna, respectively.

Auto–LPG

In terms of using LPG as an alternative fuel for transport, over 19,052 taxis nationwide are now running on LPG, which is complemented by 219 auto–LPG dispensing stations. To date, 31 auto–LPG conversion shops with Philippine National Standard (PNS) licenses are being monitored by the DOE to ensure safe operation and standards compliant conversion of gasoline-fed motor vehicles to auto–LPG.

In support of the Auto–LPG programme of the government, the Development Bank of the Philippines (DBP) has included auto–LPG initiative in its 'Clean Alternative Transport Fuel Financing Program,' which provides reasonable financing packages for auto–LPG related activities such as acquisition of auto–LPG vehicles. The LTFRB also extended the number of years of franchise for taxis that converted to auto–LPG by 2 years. These schemes promote large-scale conversion of taxi fleets and encourage new player participation in the programme. And to validate the technical viability on the use of alternative fuel for public transport, the UP–National Center for Transportation Studies (UP–NCTS) and the UP Vehicle Research and Testing Laboratory (UP–VRTL) were commissioned to conduct two performance tests for Alternative Fuel Vehicles, specifically Auto–LPG-fuelled Jeepney and Electric-Powered Jeepney that were completed in October 2013 (Department of Energy, 2013).

E-Vehicle

To date, 623 of various types of electric vehicles have been demonstrated in various cities and municipalities (Makati, Taguig, Mandaluyong, Quezon, Puerto Princesa, Davao, and Surigao del Norte) of the country. The E-vehicle programme is one of the government's initiatives towards a sustainable, energy efficient, and low-carbon transport future. In relation to the E-vehicle Program, the DOE launched in January 2012 its 'Bright Now! Do Right. Be Bright. Go E-trike!' design-an-electric-tricycle contest to encourage and promote the creativity and

innovativeness of young Filipinos in crafting the Philippine version of the so-called Green Vehicle.

Barangay Electrification

Rural electrification has been one of the government's priority thrusts. The goal is to achieve total barangay[2] electrification by the end of 2010. In August 2012, the country's total electrification level had reached 99.98 percent, with 41,965 barangays already with access to electricity out of the 41,974 (formerly 41,980) barangays. Given the importance of electricity in the economic development of the country, the electrification programme of the government is being extended to the household level. The government is targeting to achieve 90.0 percent household electrification by 2017.

On 30 December 2013, the household electrification level stood at 79.5 percent. This means that out of the 21.4 million households, 17.0 million are connected to electricity.[3]

1.3. Energy

The country's total primary energy supply (TPES) in 2013 reached 44.5 million tons of oil equivalent (Mtoe). Oil accounted for the biggest share of 31.6 percent in the total energy supply, followed by coal and geothermal with shares of 22.5 percent and 18.6 percent, respectively, in the mix. Total production reached 24.3 Mtoe, bringing the energy self-sufficiency level of the country to 54.6 percent in 2013.

Total electricity generation in the Philippines in 2013 reached 75.3 terawatt-hours (TWh). Coal-fired power plants remained the major source of power generation with total installed capacity of 5568 megawatt (MW) in 2013. Coal contributed 42.6 percent or 32.1 TWh in the total power generation mix of the country and

[2] Filipino term for a village, district, or ward, which is the smallest administrative division in the Philippines.
[3] Status of Household Electrification as of 31 December 2013.

natural gas-fired power plants accounted for 25.0 percent or 18.8 TWh in the power mix. Currently, the country has three natural gas power plants with a combined installed capacity of 2,861 MW. On the other hand, the combined share of renewable energy in the total power generation mix was 26.5 percent in 2013.

2. Modelling Assumptions

Five scenarios were developed to assess the energy savings potential of the country aside from the Business-as-Usual scenario (BAU). The BAU serves as the reference case in the projection of energy demand and carbon dioxide (CO_2) emission of the energy sector. The BAU incorporates the energy sector's existing energy policies, plans, and programmes that are being implemented and will be pursued within the forecast period.

The Alternative Policy Scenario (APS)1 assessed the impact of possible policy interventions in terms of utilisation of efficient and environment-friendly technologies for future energy use together with its corresponding CO_2 emission reduction. This is an assumption that the energy saving goals of 10 percent in 2025 and 20 percent in 2035 from annual final energy consumption of the country will be achieved through a range of measures including intensified energy utilisation management programmes in the commercial and industrial sectors, power plants, and distribution utilities as well as the continuous use of alternative fuels and technologies. The information and education campaign being conducted by the Department of Energy (DOE) and the 'Palit Ilaw[4] Program' also contribute to the energy saving goals of the country. In the residential and commercial sectors, the utilisation of more efficient electrical appliances is projected to induce savings. Energy labelling and ratings on major electrical appliances will help consumers to choose more efficient electrical products.

[4] Filipino term for 'change lamps' wherein the DOE distributes CFL lamps for free to consumers in exchange for their incandescent bulbs.

The APS2 assessed the effect of a more efficient thermal power generation, particularly due to future coal and natural gas power plant technology.

The APS3 measured the result of the combined contribution of renewable energy and alternative fuels to the total energy supply. As part of the government's initiatives to ensure security of energy supply and at the same time protect the environment and promote green technology, the targets set under the NREP were incorporated in the model to test its impact on the TPES. The NREP provides the foundation for developing the country's renewable energy resources, stimulating investments in the renewable energy sector, developing technologies, and providing the impetus for national and local renewable utilisation. It sets out indicative interim targets for the delivery of renewable energy within the timeframe of 2011 to 2030. Also covered by APS3 were the intensified development and utilisation of alternative fuels for transport such as compressed natural gas (CNG) and electric vehicle as a continuing strategy to reduce the country's dependence on imported oil.

Although the Philippines currently has no clear policy direction on the use of nuclear energy in its power generation, APS4 considered additional capacity from nuclear power to determine the impact of a possible long-term nuclear option. And lastly, the APS5 combined the effects of the four scenarios (APS1, APS2, APS3, and APS4).

In the model, GDP is assumed to grow at an average annual rate of around 6.0 percent (IMF, 2015) from 2016 to 2020 and the population is forecast to grow at a rate of 1.5 percent. Population growth is based on the adjusted 2000 census-based medium population projections using the results of the 2007 population census including the population level of 93.3 million for 2010.

3. Outlook Results

3.1. Business-as-Usual Scenario (BAU)

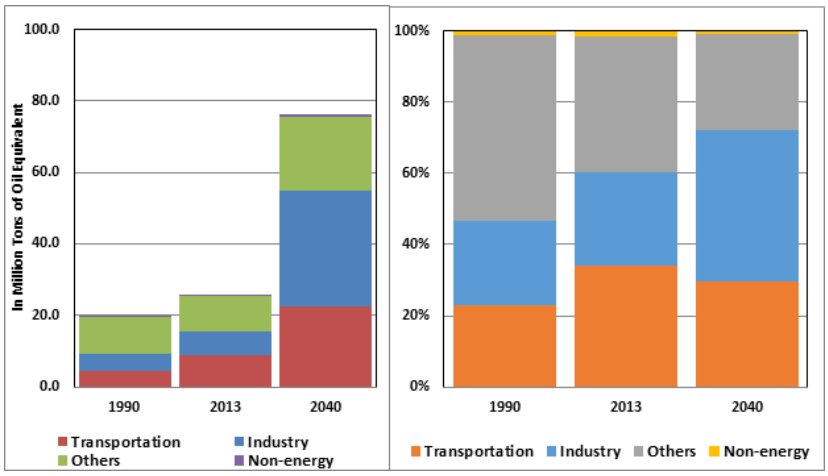
3.1.1. Final energy consumption

Final energy consumption by sector

The Philippines' final energy consumption grew from 19.7 Mtoe in 1990 to 25.9 Mtoe in 2013 at an average annual growth rate of about 1.2 percent. From 1990 to 2013, energy demand in the transport sector grew fastest, at an average annual rate of 2.9 percent, followed by the industrial sector with 1.7 percent growth.

Final energy consumption is expected to grow at an annual average rate of 4.1 percent in the BAU from 2013 to 2040. The transport sector is forecast to grow at an average annual rate of 3.5 percent and the industrial and other sectors are expected to grow at average annual rates of 6.0 percent and 2.8 percent, respectively (Figure 14-1).

Figure 14-1. Final Energy Consumption by Sector, BAU



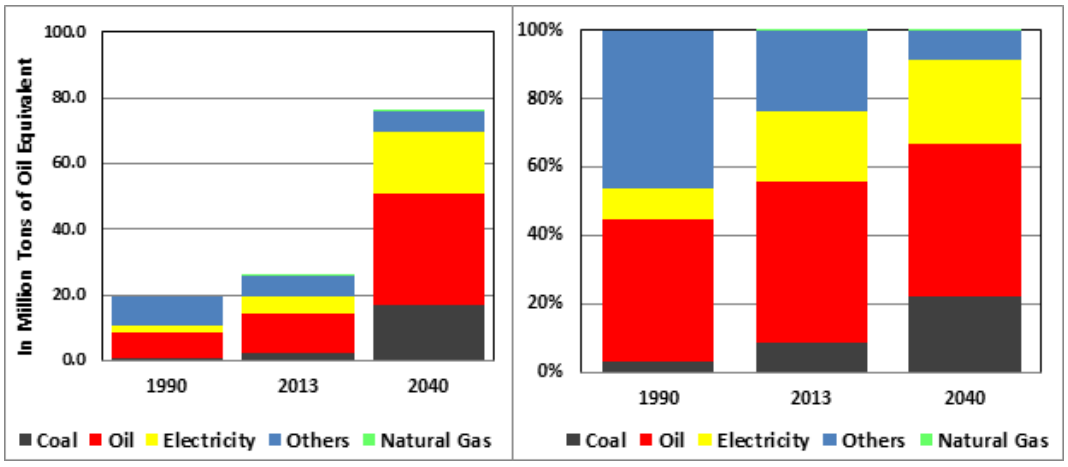
BAU = Business-as-Usual scenario.
Source: Author's calculation.

The aggregate energy demand of other sectors such as residential, commercial, and agriculture comprised the biggest share in the total demand mix from 1990 to 2013, although their share fell from 52.2 percent to 38.0 percent. Over the same period, the shares of the industry and transport sectors in the demand mix rose from 23.7 percent to 26.4 percent and from 23.0 percent to 33.9 percent, respectively. From 2015 to 2025, the share of the transport sector is expected to dominate the demand mix. The share of industry sector demand in the mix will overtake that of the transport sector as the most energy intensive sector from 2025 to 2040. At the end of the projection period, the industry sector will account for a 42.7 percent share in the demand mix and the transport sector will account for 29.5 percent. The share of 'other' sectors in the demand mix will continue to decline over the forecast period to reach 26.9 percent in 2040.

Final energy consumption by fuel

By fuel, demand for natural gas is projected to grow at an average annual rate of 3.8 percent over the forecast period and oil demand is expected to grow by 3.9 percent, to be used mainly for the transport sector. The fastest growth is expected to be demand for coal for non-power application, which will increase at an annual average rate of 7.8 percent over the planning period, with the bulk of its end-use demand expected to come from the cement industry. Electricity is expected to see the second-fastest growth of 4.8 percent (Figure 14-2).

Figure 14-2. Final Energy Consumption by Fuel, BAU



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

Oil will remain the most consumed fuel throughout the planning period, with a projected share of 44.8 percent in the demand mix by 2040, which is lower than its 47.3 percent share in 2013.

Electricity will contribute a share of 24.4 percent at the end of the planning period, making it the second-most consumed energy source after oil. Demand for other fuels such as biomass and other RE, although projected to be on a downward trend, will account for 8.7 percent of the demand mix in 2040. The continuing importance of coal in the industry sector is evident from its projected share of 21.9 percent of energy demand in 2040.

Primary energy supply by fuel

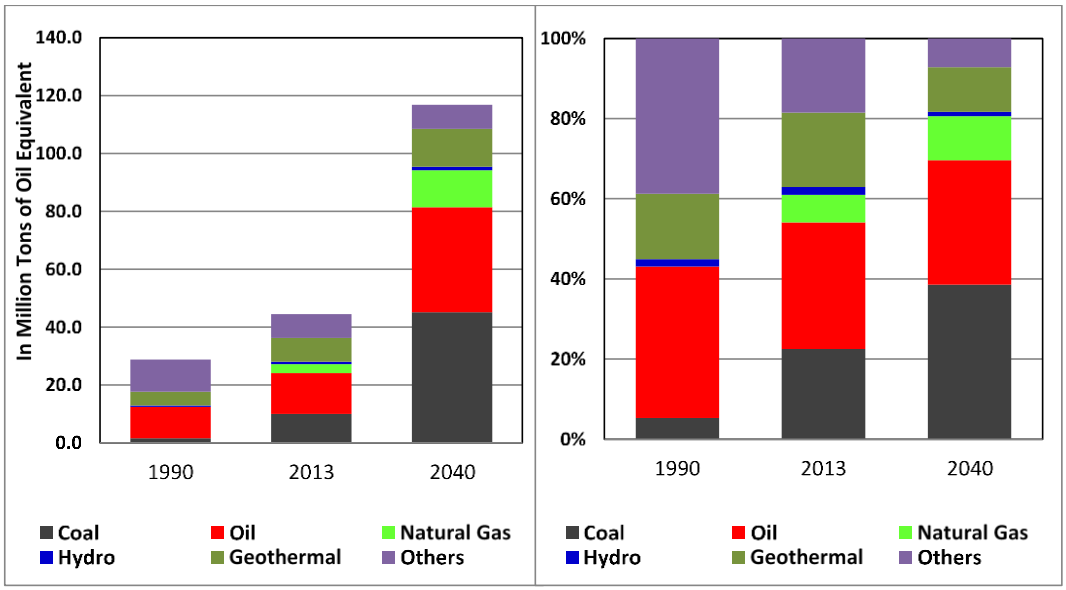
Primary energy supply in the Philippines grew at an annual average rate of 1.9 percent, from 28.7 Mtoe in 1990 to 44.5 Mtoe in 2013. Among the major energy sources, consumption of coal grew the fastest at 8.5 percent per year followed by geothermal and hydro, with 2.5 percent and 2.2 percent, respectively. Oil grew at a very low rate of 1.1 percent per year from 1990 to 2013 and primary energy supply of other fuels declined by an annual average 1.3 percent.

From 2013 to 2040, the country's primary energy supply is expected to increase by 3.6 percent per year from its 2013 level of 44.5 Mtoe to 116.8 Mtoe in 2040. Consumption for all major energy sources is projected to increase during this period, with coal growing the fastest at 5.7 percent per year. Natural gas is expected to expand at a similar rate of 5.4 percent and oil is projected to grow by 3.6 percent. Major renewable energy consumption from geothermal and hydro is expected to see average annual growth of 1.7 percent and 1.5 percent, respectively, and other fuels' aggregated consumption is forecast to grow at just 0.1 percent per year on average over the forecast period.

Coal will account for the largest share in the total energy supply of the Philippines from 2030 up until the end of the planning period, reaching a 38.6 percent share in 2040. Oil and natural gas, part of the country's major energy sources, are projected to account for 31.1 percent and 11.0 percent, respectively, at the end of the planning period. Geothermal and hydro, which are mainly used for power

generation, will have shares of 11.1 percent and 1.1 percent, respectively, and 'other' fuels will account for 7.2 percent in the supply mix in 2040 (Figure 14-3).

Figure 14-3. Primary Energy Supply by Sector, BAU

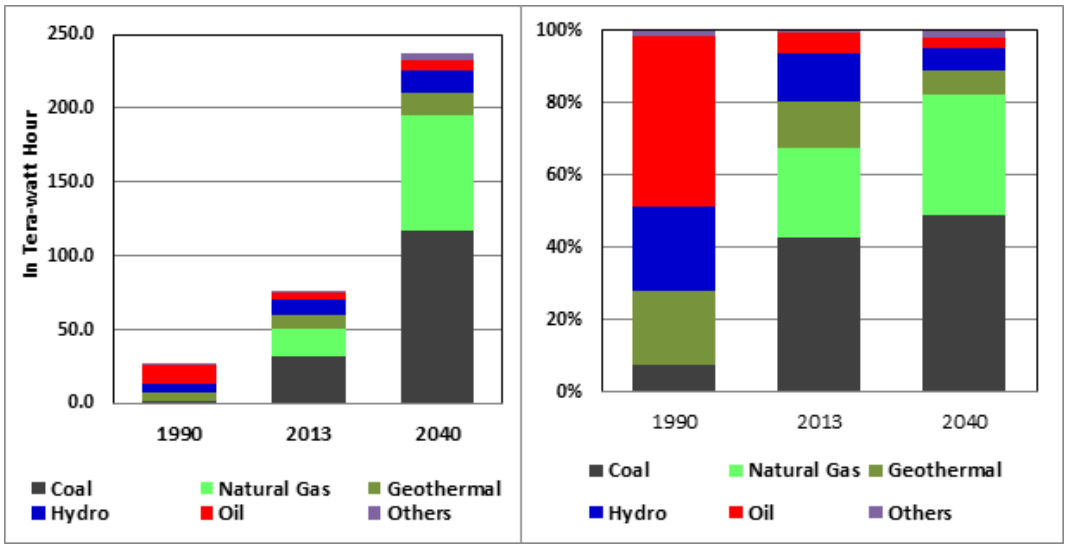


BAU = Business-as-Usual scenario.
Source: Author's calculation.

Power generation

Total power generation in the Philippines in 2013 reached 75.3 terawatt-hours (TWh), almost triple the country's level in 1990. Power generation is expected to increase by an annual average 4.3 percent over the planning period. Coal remained the major source in power generation, accounting for a share of 42.6 percent in 2013. At the end of the planning period, the share of coal is expected to be 49.1 percent, as it is expected to increase at an annual average rate of 4.9 percent – from 32.1 TWh in 2013 to 116.5 TWh in 2040. Natural gas follows, with growth in output from 18.8 TWh in 2013 to 79.3 TWh in 2040, increasing at an average rate of 5.5 percent per year. Oil's share in the generation mix, by contrast, will continue to decline, reaching a share of just 2.8 percent in 2040. Power generation from hydro and geothermal are expected to grow at steady rates of 1.4 percent and 1.7 percent per year, respectively. Other sources of power generation, aggregate output from solar, wind, and biomass, is expected to increase at an annual average rate of 11.1 percent (Figure 14-4).

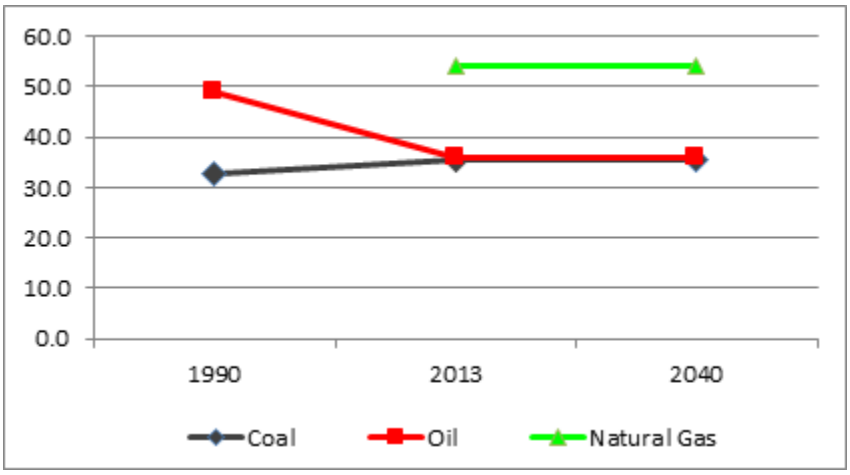
Figure 14-4. Power Generation by Fuel, BAU



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

The thermal efficiencies of coal, oil, and natural gas under the BAU are projected to remain constant for the entire planning period. Coal thermal efficiency is set at 35.3 percent, and oil and natural gas power plant efficiencies are set at 35.9 percent and 54.0 percent, respectively.

Figure 14-5. Thermal Efficiency by Fuel, BAU



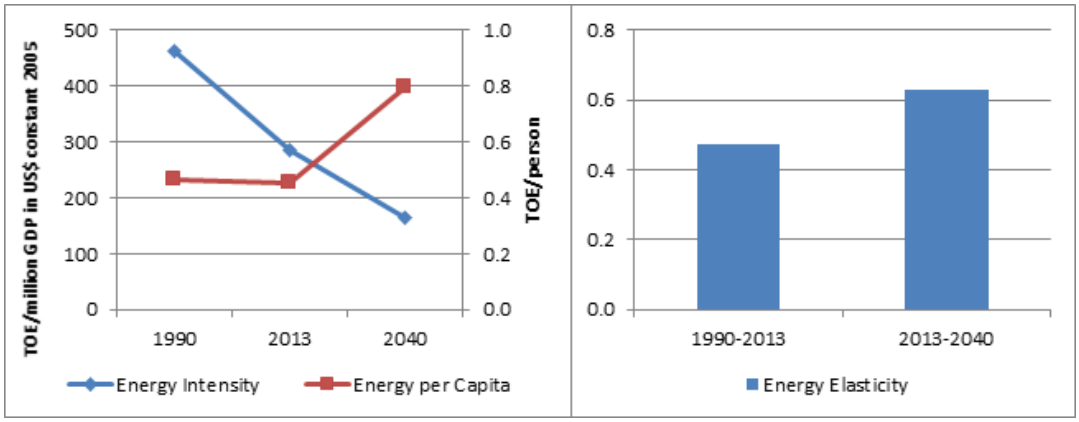
BAU = Business-as-Usual scenario.
Source: Author's calculation.

Energy indicators

Under the BAU, energy intensity of the Philippines is projected to decrease at an average annual rate of 2.0 percent from 2013 to 2040. Energy intensity is the ratio of total primary energy over GDP. The significant reduction of energy intensity is attributable to the government's efforts in promoting energy conservation and efficiency in the different sectors of the economy. The level of energy per capita is projected to increase from 0.45 toe/person in 2013 to 0.80 toe/person in 2040, indicating the steady improvement in energy accessibility and services in the country.

Energy elasticity is the relationship between changes in the primary energy supply and the changes in GDP. It is expected to be approximately 0.6 from 2013 to 2040, an indication that energy demand will rise less than proportionately in relation to income.

Figure 14-6. Energy Intensity, Energy Per Capita, and Energy Elasticity

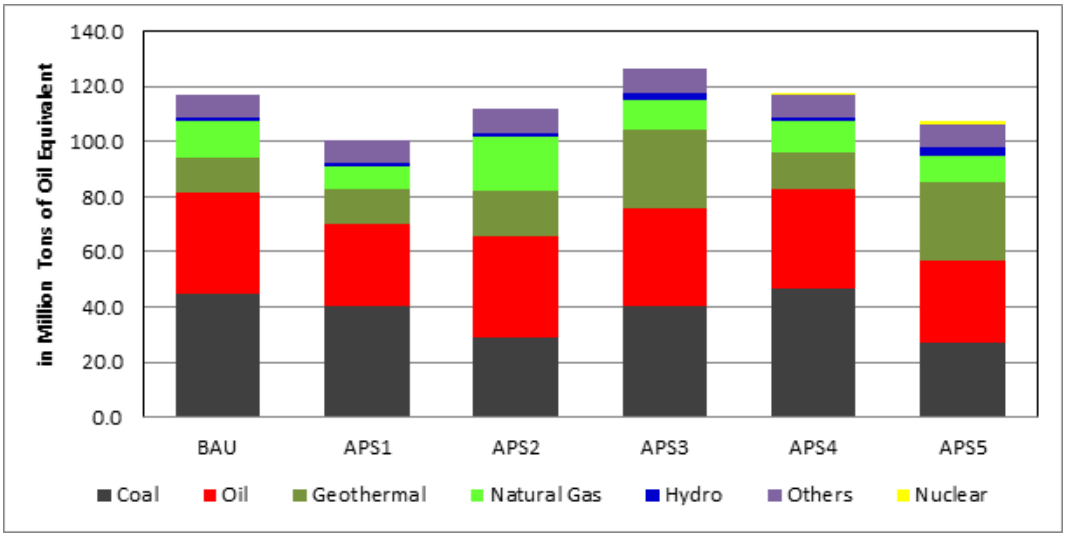


TOE = tons of oil equivalent; GDP = gross domestic product.
Source: Author's calculation.

3.2. Alternative Policy Scenario (APS)

The assumptions in the APS were analysed separately to determine the individual impacts of each assumption in APS1, APS2, APS3, APS4, and the combination of all these assumptions (APS5 or APS). Figure 14-7 shows the changes in total primary energy supply in all the scenarios.

Figure 14-7. Comparison of Scenarios to Primary Energy Supply in 2040



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

Figure 14-7 shows that APS1 has the lowest level of total primary energy supply due to the energy efficiency assumptions on the demand side. Under this scenario, the country's total primary energy supply (TPES) will grow at an annual average rate of 3.1 percent to reach 100.5 Mtoe in 2040, which is 14.0 percent lower than for the BAU. This is attributable to the effectiveness of energy efficiency measures implemented in the various sectors of the economy under APS1.

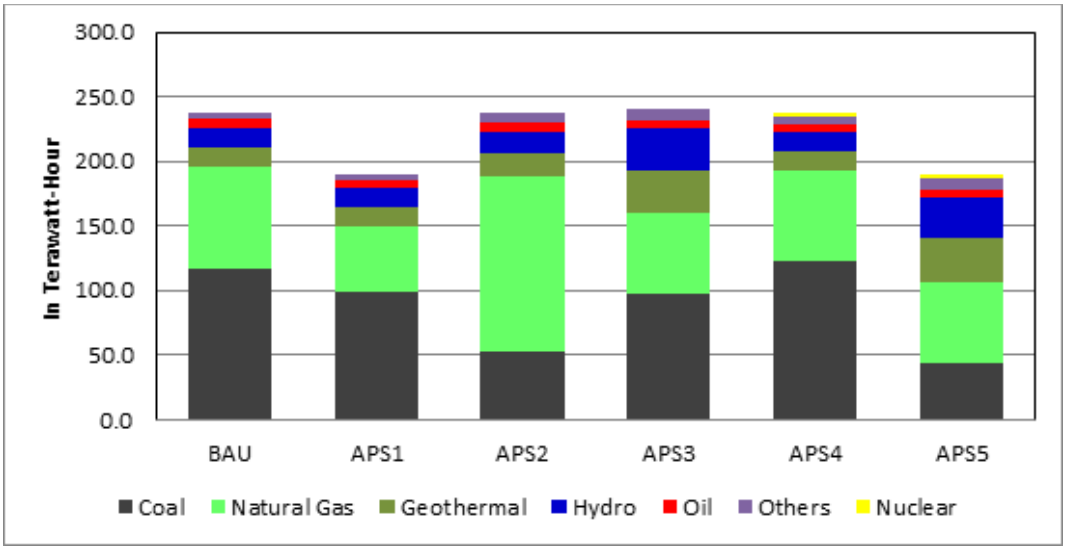
APS2, which assumes higher efficiency in thermal electricity generation, will have a total primary energy supply of 111.9 Mtoe in 2040, or 4.2 percent lower than the BAU. Under APS2, the country's TPES is expected to increase by 3.5 percent per year over the planning period. The bulk of the reduction in TPES in this scenario vis-à-vis the BAU would be from coal and natural gas as more efficient power plants are assumed to be used to generate power in this scenario.

TPES under APS3 is 8.2 percent higher at 126.4 Mtoe in 2040 than in the BAU. This is mainly due to the projeced increase in the use of geothermal energy in power generation. The efficiency of geothermal plants is usually lower than that of fossil-fueled power plants. Hence, more fuel input will be required to generate the same amount of electricity.

In APS4, TPES in 2040 will be just 0.7 percent higher than in the BAU, reaching 117.6 Mtoe at the end of the forecast period. This is due to the assumption that nuclear power plants are only 33 percent efficient, lower than natural gas and coal power plants, which have efficiencies of 35.3 percent and 54.0 percent, respectively.

Lastly, APS5 (representing the combined effects and/or assumptions of APS1, APS2, APS3, and APS4) will result in a TPES of 107.2 Mtoe in 2040, which is 8.3 percent lower than the BAU level.

Figure 14-8. Comparison of Scenarios to Electricity Generation in 2040



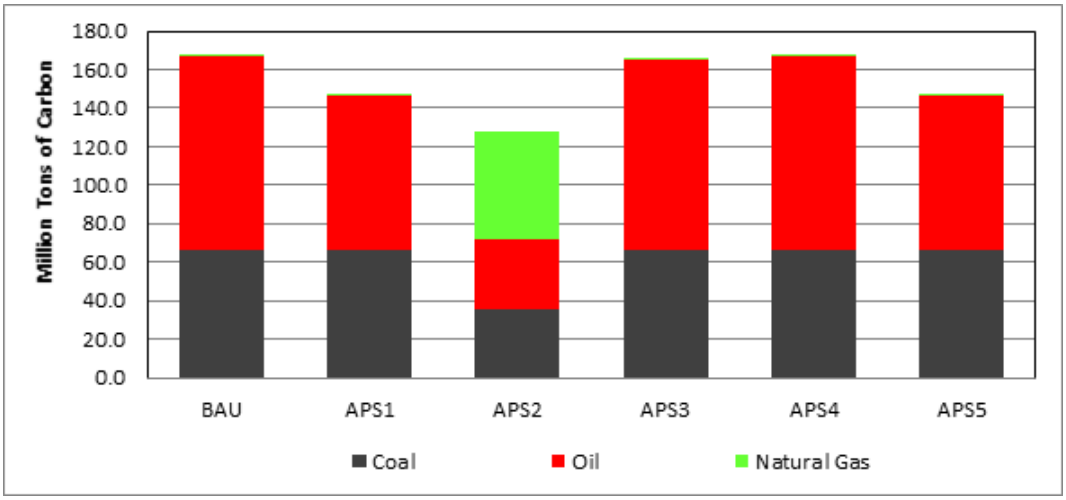
BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario.
Source: Author's calculation.

Figure 14-8 shows the total electricity generation in 2040 for all scenarios. In APS1, the total generation output is 20.0 percent less than the BAU due to its lower electricity demand. The share of fossil fuels under APS1 will be 82.3 percent, versus 85.2 percent in the BAU, while the share of renewable energy will be 17.7 percent higher vis-à-vis 14.8 percent in the BAU.

The shares of fossil and renewable energy fuels under APS2 are similar to those of APS1, and total generation output is equal to the BAU level at 237.6 TWh. In APS3, due to the assumption of more renewable energy, the share of fossil fuel-

fired power generation will only be 69.1 percent, which is significantly lower than under the BAU with an 85.2 percent share. In APS4, fossil fuel-fired power generation will account for 83.9 percent of the total power generation mix, indicating that nuclear power displaced 1.3 percent of fossil fuel power output. In APS5, the share of fossil fuel-fired power generation will be further reduced, to 59.3 percent, as renewable energy will contribute its maximum possible share in the generation mix at 39.3 percent, while nuclear accounts for 1.4 percent in the mix.

Figure 14-9. Comparison of Scenarios to CO_2 Emission in 2040



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

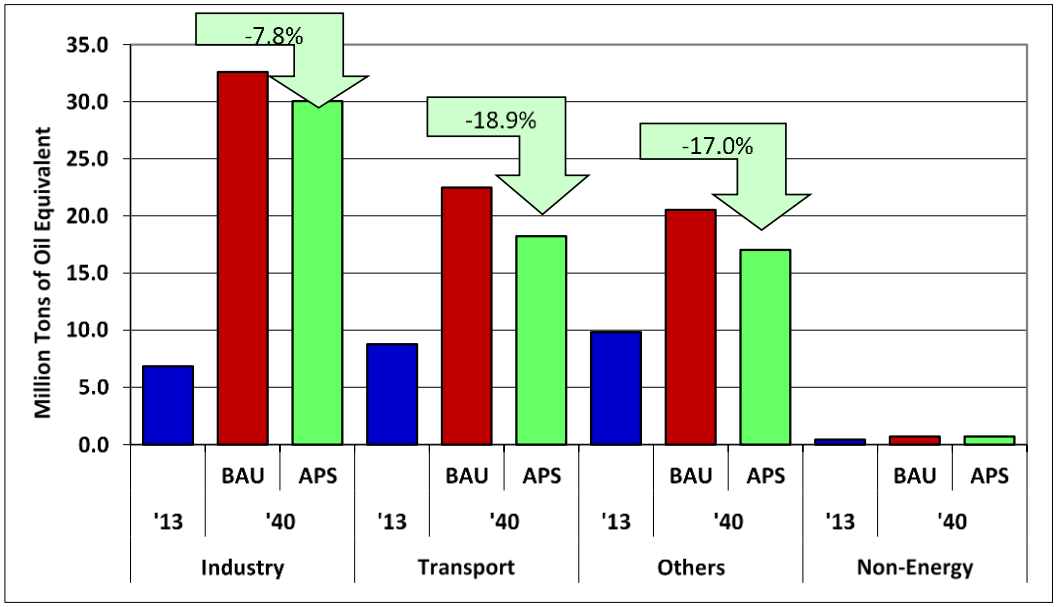
In terms of CO_2 emission reduction, the energy efficiency assumption in APS1 is expected to reduce emissions by around 20.2 million metric ton of carbon (Mt-C), which is 12.1 percent lower than the BAU. The decrease in CO_2 indicates that the energy saving goals, action plans, and policies to promote energy efficiency and conservation programmes will be effective in reducing CO_2 emissions.

CO_2 emission under APS2 and APS4 will be the same as that of the BAU at 167.4 Mt-C. In APS3, the reduction could be 1.4 Mt-C, which is 0.9 percent lower than the BAU. Combining all the assumptions in APS1, APS2, APS3, and APS4 into APS5 can reduce BAU CO_2 emissions by 19.6 Mt-C or 11.7 percent.

Final energy consumption

In the APS (APS5), final energy consumption is projected to increase at a slower rate of 3.5 percent per year compared with the BAU, from 25.9 Mtoe in 2013 to 66.0 Mtoe in 2040. Slower growth under the APS, relative to the BAU, is projected across all sectors as a result of the government programme of promoting energy efficiency and conservation. The industry sector will experience the fastest growth, at 5.6 percent per year, followed by the transport sector at 2.7 percent per year. Figure 14-10 shows the final energy consumption by sector in 2013 and 2040 in both the BAU and the APS. The total reduction in final energy consumption will be 13.5 percent in 2040, as all sectors are expected to see lower demand levels in APS5, with the exception of the non-energy sector.

Figure 14-10. Final Energy Consumption by Sector, BAU and APS



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

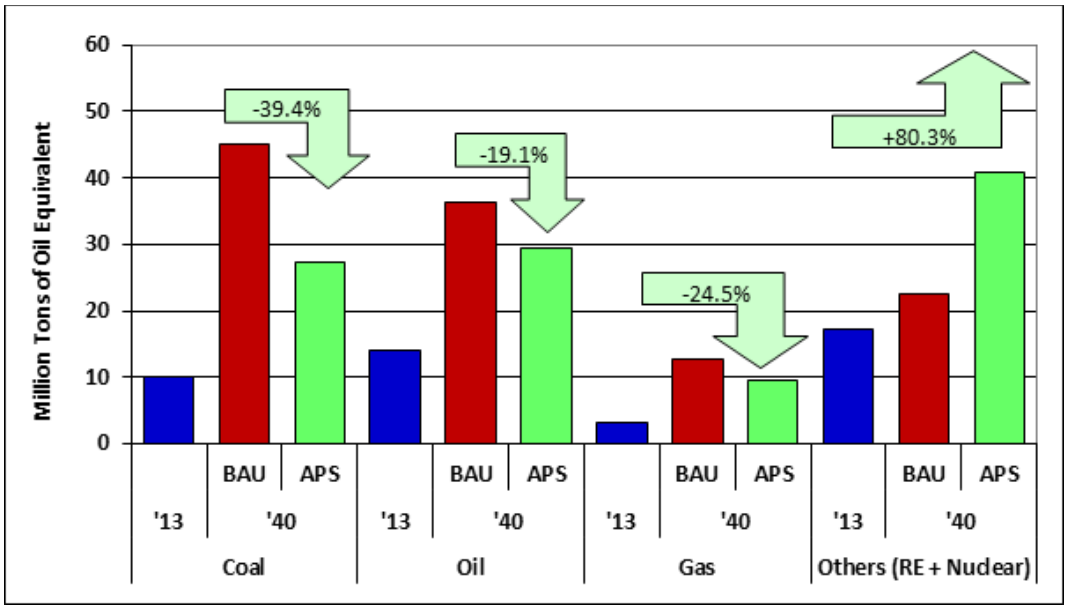
Primary energy consumption

Over the projection period, the relative share of each form of energy is expected to change significantly in response to a different economic structure and policy environment. The country's primary energy supply under the APS will grow at an average annual rate of 3.3 percent, increasing from 44.5 Mtoe in 2013 to 107.2 Mtoe in 2040. In comparison with the BAU, the APS will register a level of energy

that is 8.3 percent lower in 2040 due to the projected reduction in fossil fuel supply (Figure 14-11).

RE sources are expected to feature significantly in the TPES under the APS. Geothermal and hydro are projected to see the fastest growth rates over the projection period, increasing by 4.7 percent and 4.3 percent per year, respectively. Other RE, such as solar, wind, and biofuels, are also expected to contribute considerably to TPES under the APS. Energy supply from fossil fuels such as coal, oil, and natural gas, is projected to increase by 3.8 percent, 2.8 percent, and 4.3 percent per year, respectively, for this scenario.

Figure 14-11. Total Primary Energy Supply by Fuel, BAU and APS

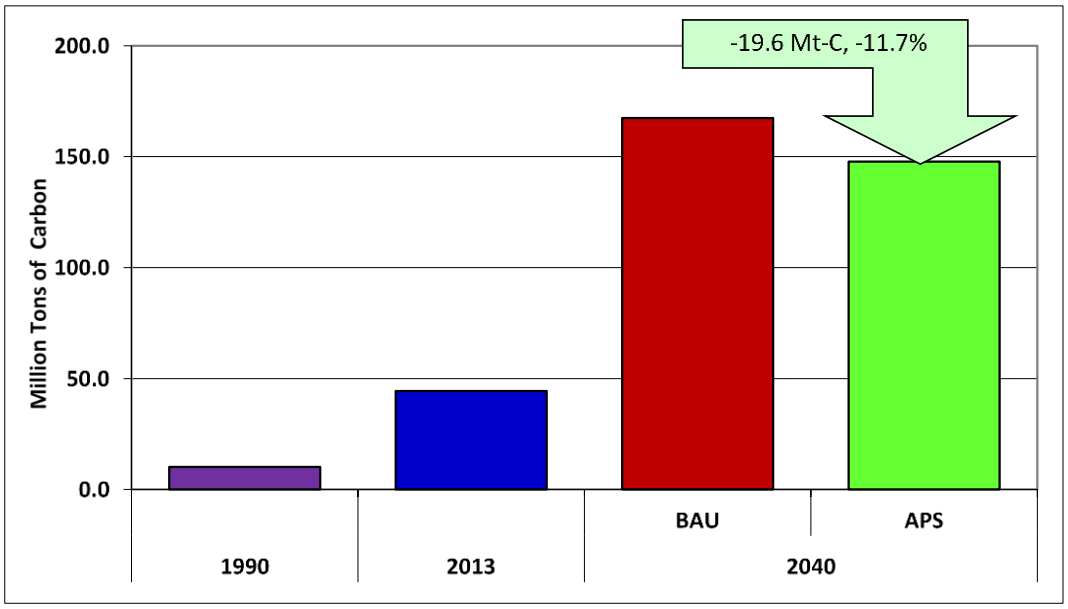


BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario; RE = renewable energy.
Source: Author's calculation.

CO_2 reduction potential

The total CO_2 emissions from energy consumption will reach a level of 147.8 Mt-C under the APS, indicating a 19.6 Mt-C reduction, which is 11.7 percent lower than the BAU level. The decrease in CO_2 indicates that applying all the assumptions for energy saving goals to increase renewable energy and alternative fuels in the total supply and improve thermal efficiency in power generation will meet the target of reducing the CO_2 emissions from related energy sectors' activities (Figure 14-12).

Figure 14-12. CO_2 Savings Potential, BAU and APS5



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

4. Implications and Policy Recommendations

The Philippine energy sector's Energy Reform has comprised three pillars – ensure energy security, achieve optimal energy pricing, and develop a sustainable energy system. Key to successful implementation of the three pillars is good governance, particularly transparency, which is comprised of initiatives, implementation, and information regarding the development of the three pillars. In the BAU model, self-sufficiency decreased by 15 percent from 2013 to 2040, i.e. from 55.0 percent to 40.0 percent. In the APS, however, the level of self-sufficiency will be maintained at around 60 percent up to 2040. This indicates that the government needs to strictly implement the identified targets for the different energy sub-sectors. It should also find a way to encourage the stakeholders to invest in and support the government's thrusts on good governance and initiatives to further enhance operational efficiency and data transparency and exchanges among stakeholders.

Under the BAU for the supply side, the primary energy supply of coal will see the fastest growth rate at 5.7 percent throughout the planning period. This is due to

the significant contribution of this fuel in power generation, which corresponds to the increasing demand for electricity at a 4.8 percent annual average rate. It was projected that towards the end of the planning period, coal supply levels will even surpass the country's requirement for oil resources, which is mainly utilised in the transport sector. The aggregated share of renewable energy at 19.4 percent is less than half of the projected contribution of coal in the supply mix. Thus, it is imperative for the government to temper the utilisation of this fuel through the strict implementation of energy security policy in adopting the use of clean, green, and sustainable sources of energy, particularly in the power sector. However, there is an issue in implementing the policy considering the current condition of the power sector as a deregulated industry.

The government under these circumstances has only limited control over what type of power plants to put up since the power industry has already been established as private driven investment. To some extent this issue can be addressed by formulating fuel mix policy for power generation to guide and inform investors and other key players of the industry on the preferred power mix for the Philippines for the benefit of the long-term sustainability of the country's power sector. The proposed fuel mix policy for power generation directed the power generation capacity shares of cleaner sources of power generation such as renewable energy and natural gas in the country's total power generation capacity for at least 30 percent by 2030. The recently issued department circular to maintain renewable energy capacity for at least 30 percent of the total power capacity is achievable based on the APS scenario; however, the 30 percent share of natural gas may not be possible based on the APS scenario, which only accounted for 18 percent of the total power generation capacity by 2030.

On the demand side, oil will register the biggest share in the final energy consumption by around 45.0 percent towards the end of the planning period for BAU and 42 percent for APS. This is despite of the current effort of the government to implement the promotion of energy efficiency and conservation programme and alternative fuel and technology development. The results of the model indicated that the share of oil in the total demand is the biggest across different scenarios. This is because oil is the major fuel of the transport sector, which has an annual average share of 95.0 percent in the demand mix of the

sector across the planning period. As indicated by the outlook model results, transport sector will be the biggest user of energy until 2023, while industry sector will be the most energy intensive sector after the specified period. Coal as the most dominant fuel of industry sector with an average share of 40 percent across the planning period will become one of the major fuels for non-power application energy consumption. In this regard, the government should have to push the programme on sustainable fuels and expand the use of natural gas not only for transport sector but also for industry sector as well. It would be appropriate for the government to focus on the promotion of alternative fuels in the transport and industry sectors to substitute partly and directly the use of oil and coal in the sectors with the extended implementation of alternative fuels promotional programme.

Moreover, the use of alternative technologies and fuels such as electric vehicle, CNG, autogas (LPG for transportation), and biofuels for transport will temper the utilisation of oil in the country in the future, thus, reducing the negative impacts of oil prices volatility in the world market. The government's efforts in the promotion of alternative fuels in the transport and industry sectors will help not only in reducing energy requirement but also lessen GHG emission coming from the energy intensive sectors.

On the other hand, under the APS, energy intensity and CO_2 intensity will continue to decline from 2013 to 2040, although CO_2 emission per energy consumption will increase corresponds to the increase share of fossil fuels. In this regard, the government should implement strictly the energy plans and programmes for energy efficiency and conservation to address; responses to volatile oil prices and their inflationary effects on the prices of basic commodities; and changing economic structure of the country to rely more on its service sector rather more than on energy intensive industries. This is also consistent with the Asia-Pacific Economic Cooperation's (APEC) target to reduce APEC's aggregate energy intensity (energy demand per unit of GDP) by 45 percent by 2035 with 2005 as the base year. Improvement in the energy intensity of the Philippines is expected to be driven in part by the country's changing economic structure to rely more on its service sector rather than on energy intensive industries.

In response to the result of the study, the government should pursue its programmes and projects that will further increase and enhance the utilisation of indigenous, clean and efficient alternative fuels. The full implementation of the Renewable Energy Act of 2008 to expand the utilisation and development of indigenous energy such as geothermal, hydro solar, wind and other clean energy will not only promote the use of sustainable energy but will also lessen the country's need for energy imports. The FiT, RPS and other policy mechanism provided under the law will boost the utilisation of RE.

Special attention should also be given to the industrial sector since it is growing most likely more than the increasing trend of the transport sector and could have high potential energy savings.

Currently, the Philippines have a specific quantitative energy saving requirement as provided under Administrative Order (AO) No. 110, 'Directing the Institutionalization of a Government Energy Management Program'. The AO requires the reduction of at least 10 percent in the cost of the consumption of fuel and electricity among others in the government. This can be duplicated or expanded to other sectors if there is an existing energy conservation law which will require strict regulation and implementation.

There is a need to pass the Energy Conservation Law to realise the targets set by the government. The Law will institutionalise energy conservation and enhance the efficient use of energy in the country.

Moreover, looking at the integration of all the scenarios, the result is effective in reducing the carbonisation ratio. This indicates that the government should set the necessary environment to ensure that the policies through energy programmes and projects will be strictly implemented.

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