Chapter 13

New Zealand Country Report

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CHAPTER 13

New Zealand Country Report

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1. Background

New Zealand is an island country in the south-western Pacific Ocean. It is located some 1,500 km east of Australia. It consists of two main islands (the North Island and the South Island), and a number of smaller, mostly uninhabited outer islands. The land area is approximately 269,000 square kilometres, making it smaller than Japan or Italy, but larger than the United Kingdom. Most of New Zealand is hilly or mountainous and has a mild temperate climate. The population was about 4.47 million at the end of 2013. Although there is some light and heavy industry, foreign trade is heavily dependent on agriculture, tourism, forestry, and fishing. In 2013, New Zealand had a nominal gross domestic product (GDP) of about US$171.0 billion, or about US$38,200 per capita. Whereas the latter figure is near the average of Organisation for Economic Co-operation and Development (OECD) countries, New Zealand tends to be ranked highly in international quality-of-life surveys.

New Zealand possesses significant indigenous energy resources, including hydro, geothermal, wind, natural gas, and coal. New Zealand is self-sufficient in natural gas and electricity, and is a net exporter of coal, but it meets most of its oil demand through imports. Energy remaining reserves include 116.6 million barrels of oil (P90) and 56.4 billion cubic metres (BCM) of natural gas (P90), as well as in-ground resources of over 15 billion tonnes of coal, 80 percent of which are South Island lignites.

In 2012, New Zealand's total primary energy demand was around 20.1 million tonnes of oil equivalent (Mtoe). By source, oil represented the largest share at about 33 percent. Natural gas and geothermal energy were second largest, contributing around 21 percent and 19 percent, respectively. The remainder of demand were hydro at 10 percent, coal at 8 percent, biomass with 8 percent, and a smaller percentage of other renewables such as wind and solar PV.

Final energy demand was about 13.9 Mtoe in 2012. By sector, the transport sector had the largest share at around 35 percent because New Zealand heavily depends on private road vehicles, road freight, and air transport. The share of the industrial sector was the second largest at about 33 percent, whereas the agricultural, residential, and commercial sectors had a joint share of 25 percent. The balance of 7 percent was consumed by the non-energy sector.

Total gross power generation output in 2012 was about 44.3 TWh. Hydro accounted for about 52 percent as the most utilised source, whereas natural gas represented the second most utilised source at over 20 percent. The third most utilised source was geothermal power at about 14 percent and the remainder were coal at 8

percent and other renewables at 6 percent. Oil is used in electricity generation only as a minor source peaking supply.

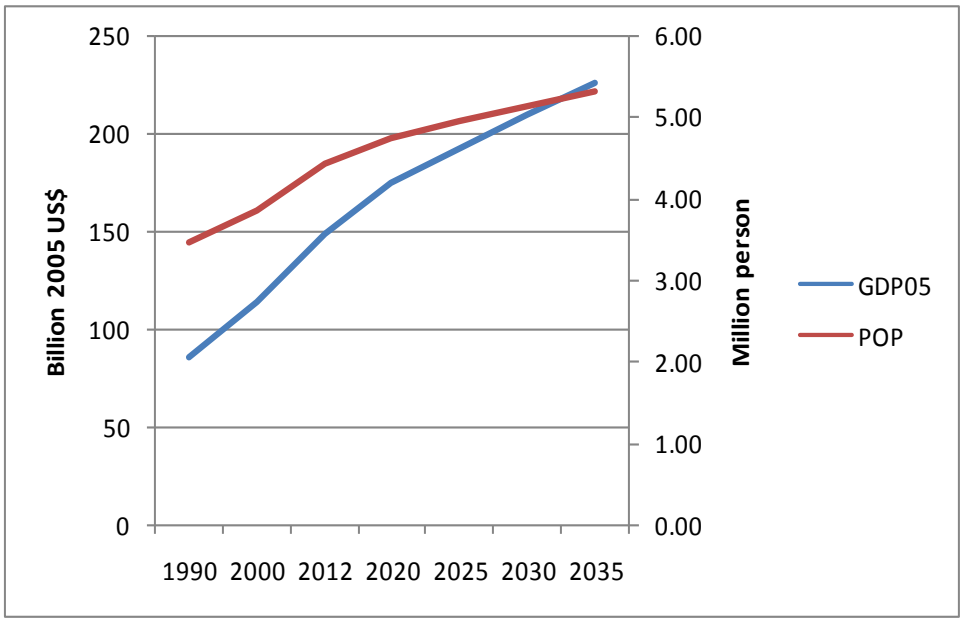
2. Modelling Assumptions

In this outlook, New Zealand's GDP is assumed to grow at an average annual rate of 1.8 percent between 2012 and 2035. The population is projected to increase by about 20 percent to 5.33 million by 2035, from 4.47 million in 2012. See Figure 13-1.

In the Business-as-Usual (BAU) scenario, hydro use in power generation will remain constant, although most hydro sites have already been developed. Generation from coal- and natural gas–based plants will decrease at an annual average rate of 2.1 percent and 0.2 percent, respectively. In contrast, geothermal power generation will increase at an annual average growth rate of 3.5 percent and wind generation will continue to grow, but it will still contribute only a small share on New Zealand's electricity by 2035 (Figure 13-2).

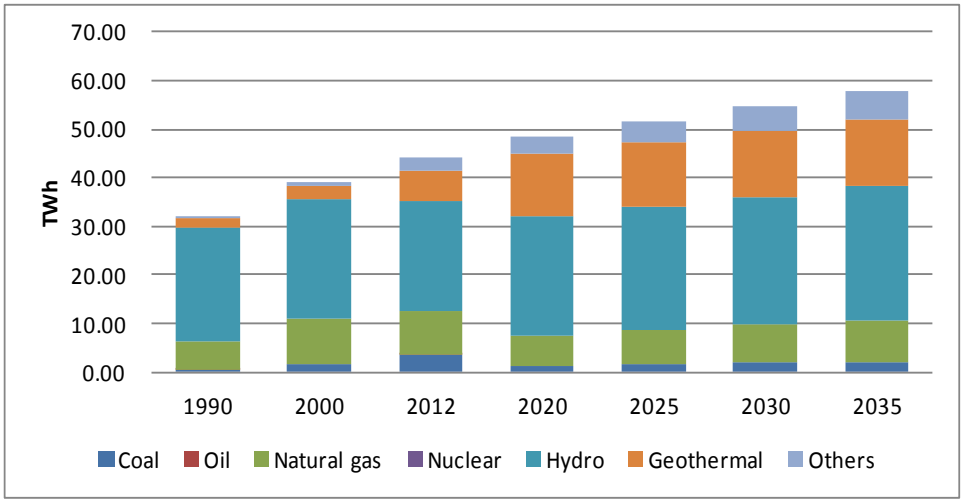
Thermal efficiency for coal-, gas-, and oil-fired power plants may not increase so much in the future, because new large fossil-fuelled plants are not planned.

Figure 13-1. GDP and Population



GDP = gross domestic product; POP = population.

Figure 13-2. Power Generation – BAU



BAU = Business-as-Usual.

In terms of energy demand, the overall energy intensity of the economy improved in real terms by an annual average rate of 0.8 percent from 1990 to 2012.

On the supply side, new gas discoveries are assumed at an average of 60 petajoules per year (PJ/year) – about 1.6 BCM – with production from new discoveries starting in 2012.

The New Zealand government implemented an emissions trading scheme in 2010 and has set a target for 90 percent of electricity to be generated from renewable sources by 2025. The government also maintains a range of programmes to promote energy efficiency at home, at work, and in transport, as well as for the development and deployment of sustainable energy technologies.

3. Outlook Results

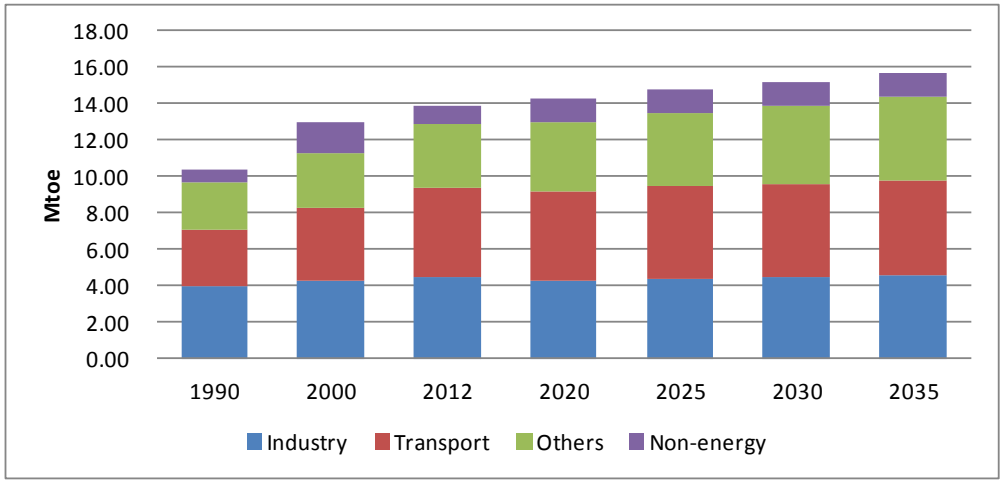
3.1. Total Final Energy Consumption

New Zealand's final energy consumption grew at an annual average rate of 1.3 percent per year from 10.4 Mtoe in 1990 to 13.9 Mtoe in 2012. Oil increased from 3.91 Mtoe to 5.87 Mtoe and electricity rose from 2.48 Mtoe to 3.37 Mtoe over the same period. But coal declined from 0.70 Mtoe to 0.59 Mtoe and natural gas decreased from 1.62 Mtoe to 1.45 Mtoe from 1990 to 2012.

3.1.1. Business-as-Usual (BAU) Scenario

In the BAU scenario, final energy consumption from 2012 to 2035 is projected to grow by 1.8 Mtoe at an average annual rate of 0.5 percent. The 'others' sector (agricultural, residential, and commercial) is projected to see the largest rise, of 1.0 Mtoe, between 2012 and 2035, at an average annual growth rate of 1.1 percent. Transport sector consumption is projected to increase by 0.4 Mtoe at an annual average rate of 0.4 percent and the industry sector is projected to increase slightly, by 0.1 Mtoe in 2035. Non-energy sector consumption will rise by 0.3 Mtoe, at an average annual rate of 1.1 percent (Figure 13-3).

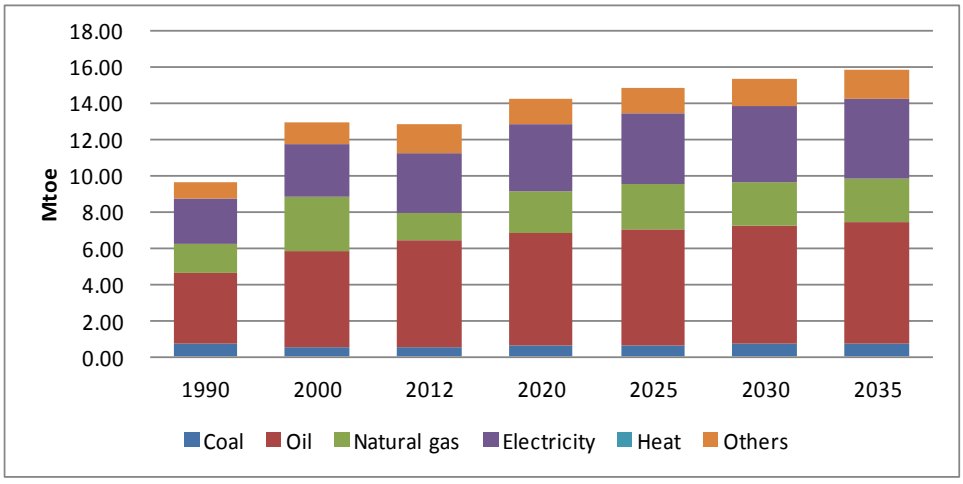
Figure 13-3: Final Energy Consumption by Sector – BAU



BAU = Business-as-Usual.
Note: 'Others' sector includes the agricultural, residential, and commercial sectors.
Source: Author's calculation.

By source, final consumption of electricity will steadily increase, by 1.0 Mtoe between 2012 and 2035, at an average rate of 1.1 percent per year. Final consumption of oil will also rise, by 0.8 Mtoe, at an average rate of 0.6 percent. Natural gas and coal will increase by 1.0 Mtoe and 0.2 Mtoe at 2.3 percent and 1.2 percent, respectively, whereas other renewables such as wind and biomass will decrease slightly from 2102 to 2035 (Figure 13-4).

Figure 13-4. Final Energy Consumption by Source – BAU

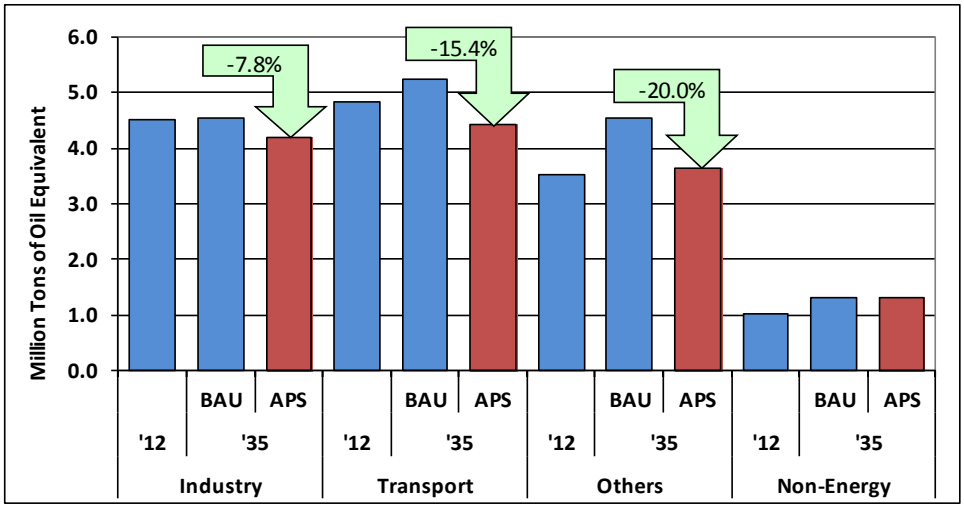


BAU = Business-as-Usual.
Source: Author's calculation.

3.1.2. Alternative Policy Scenario (APS)

In the Alternative Policy Scenario (APS), final energy consumption will decrease slightly in 2035. The projected decrease in final energy consumption will be 0.3 Mtoe between 2012 and 2035. Energy use in the 'others' sector will increase at an average rate of 0.1 percent per year, reflecting increased use of efficient appliances in the residential and commercial sectors. Energy use in the industrial sector will decrease at an annual average rate of 0.3 percent. Furthermore, energy use in the transport sector will decline at an average of 0.4 percent, reflecting a shift to more energy efficient vehicles, particularly electric vehicles. Sectoral final energy consumption in 2012 and 2035 in the BAU scenario and the APS is shown in Figure 13-5.

Figure 13-5. Final Energy Consumption by Sector, BAU and APS



BAU = Business-as-Usual; APS = Alternative Policy Scenario.
Source: Alternative Policy Scenario of the Institute of Energy Economics, Japan (IEEJ).

3.2. Primary Energy Demand

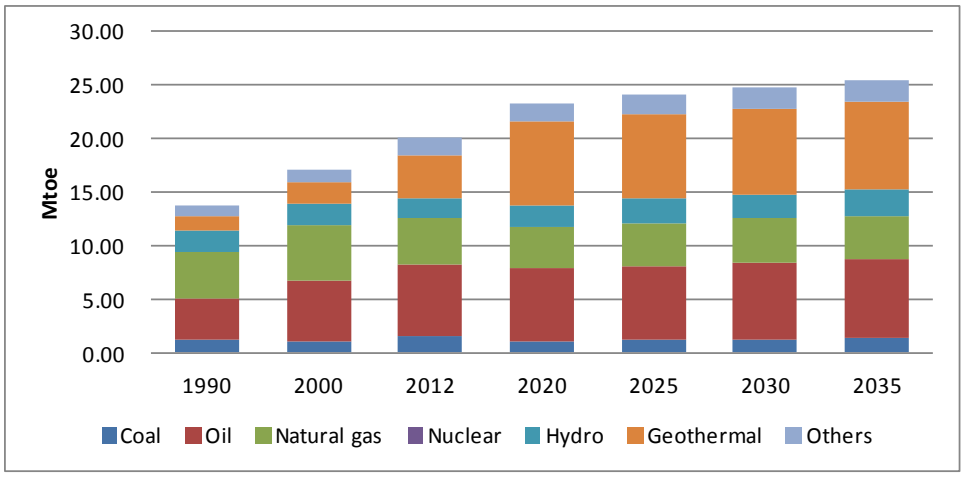
Primary energy demand in New Zealand grew at a rate of 1.7 percent per year from 13.8 Mtoe in 1990 to 20.1 Mtoe in 2012. The fastest growing primary fuel in absolute terms was oil, rising from 3.8 Mtoe in 1990 to 6.6 Mtoe in 2012. The increase in oil demand is due to rapid growth in transport energy demand. Coal demand also increased, at an annual average growth rate of 1.3 percent, whereas natural gas demand was almost unchanged from 1990 to 2012, reflecting a decrease in gas production from the Maui gas field. Geothermal energy use grew from 1.5 Mtoe in 1990 to 3.9 Mtoe in 2012, at an average annual rate of 4.5 percent for electricity generation, whereas hydro demand for electricity production decreased slightly, at an average rate of 0.1 percent per year. 'Others' energy sources, which include biomass, solar, and wind, increased at 2.6 percent per year.

3.2.1. Business-as-Usual (BAU) Scenario

In the BAU scenario, New Zealand's primary energy demand is projected to grow at an average annual rate of 1.0 percent per year, to 25.5 Mtoe in 2035 from 20.1 Mtoe in 2012. To the incremental growth of primary energy demand between 2012 and 2035, geothermal energy contributes the most, and is estimated to account for 32.5 percent of total primary energy demand in 2035. 'Others' primary energy will grow by 0.6 percent

per year on average, mainly reflecting an expected growth in wind power, so it will account for 7.8 percent of the total. Primary fossil fuel will slightly increase, at an average annual rate of 0.1 percent, and its share of the total will account for 50.4 percent in 2035, down from a 62.4 percent share in 2012. The remaining 9.3 percent of the total share in 2035 will be hydro for electricity generation, increasing at annual average growth rate of 0.8 percent over the projection period (Figure 13-6).

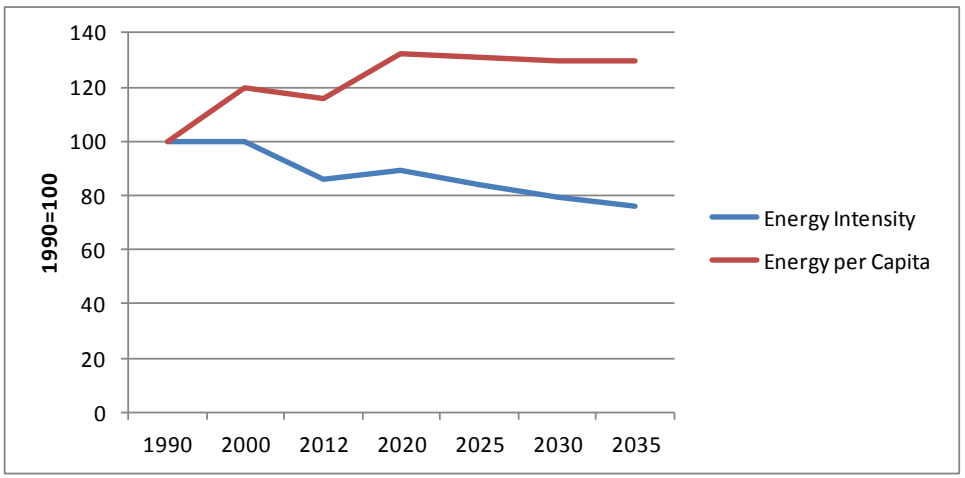
Figure 13-6. Total Primary Energy Demand and its Composition – BAU



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

The lower projected growth of primary energy demand relative to GDP growth will result in lower energy intensity in the future. From 136 toe/million US$ in 2012, energy intensity will improve to 113 toe/million US$ in 2035. Primary energy demand per capita, however, is expected to increase from 4.54 toe per person in 2012 to 4.78 toe per person in 2035. Figure 13-7 shows primary energy intensity and energy per capita as indicators.

Figure 13-7. Primary Energy Intensity & Energy per Capita Indicators – BAU

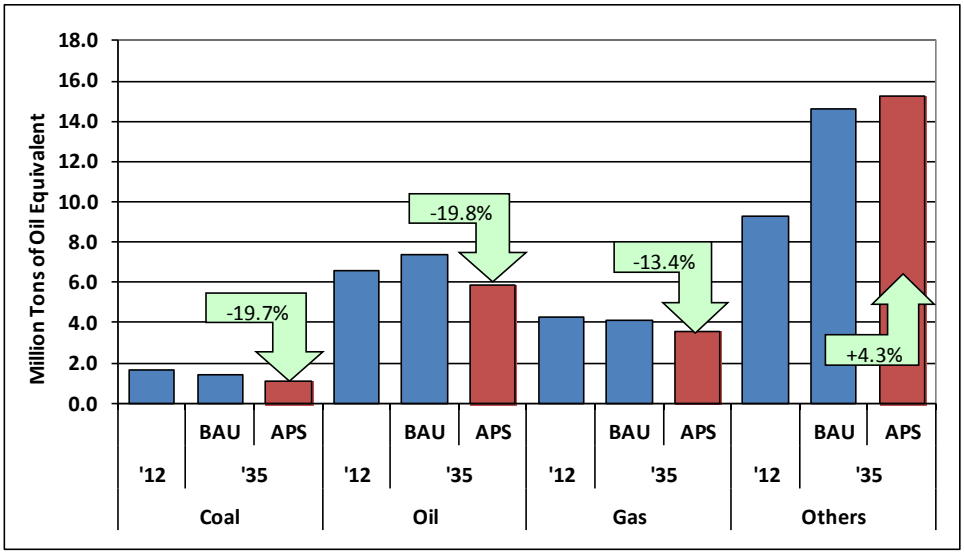


BAU = Business-as-Usual.

3.2.2. Alternative Policy Scenario (APS)

In the APS, primary energy demand is projected to grow at a lower rate of 0.8 percent per year to 24.0 Mtoe in 2035. Coal, oil, and gas are expected to show significant declines, of 1.7 percent, 0.5 percent, and 0.8 percent per year, respectively. Whereas geothermal primary energy is expected to grow by 3.9 percent per year (like in the BAU), 'Others' primary energy, which includes wind and biomass, is expected to grow by only 0.3 percent per year (Figure 13-8).

Figure 13-8. Primary Energy Demand by Source, BAU and APS



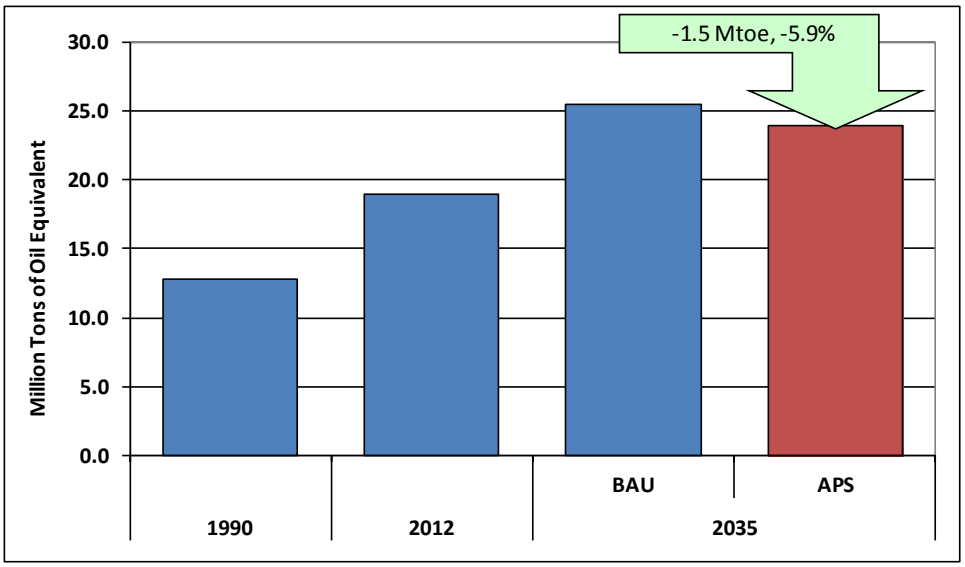
BAU = Business-as-Usual; APS = Alternative Policy Scenario.
Note: 'Others' source includes hydro and geothermal.
Source: Alternative Policy Scenario of the Institute of Energy Economics, Japan (IEEJ).

3.3. Projected Energy Savings

Under the APS, energy savings could amount to 1.5 Mtoe in 2035, the difference between primary energy demand under the BAU scenario and the APS, which is 5.9 percent less under the APS in 2035 (Figure 13-9).

The savings in primary energy are mainly due to a switch in automobiles to more efficient vehicles, particularly electric vehicles, in the transport sector, along with improved insulation and more efficient appliances in the residential and commercial sectors.

Figure 13-9. Total Primary Energy, BAU and APS



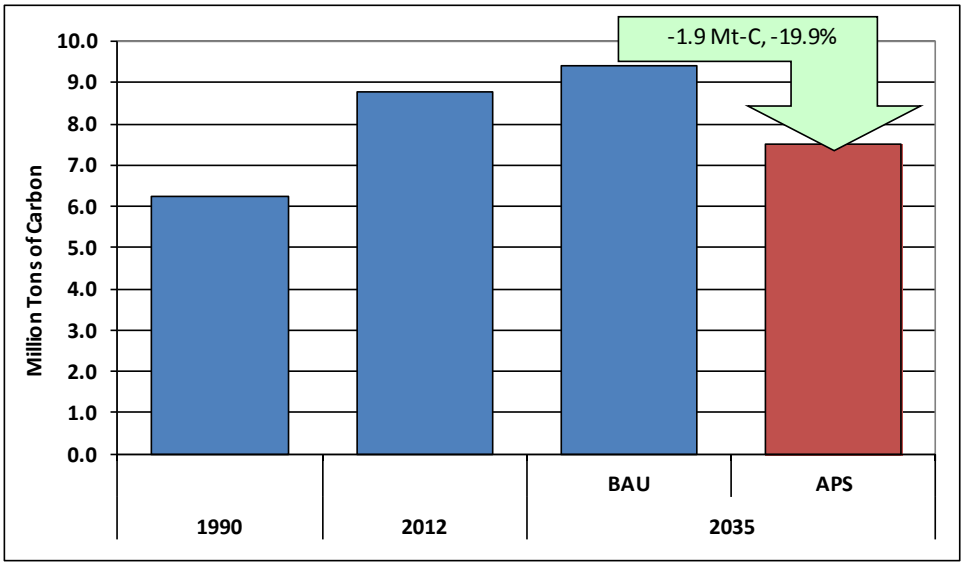
BAU = Business-as-Usual; APS = Alternative Policy Scenario.
Source: Alternative Policy Scenario of the Institute of Energy Economics, Japan (IEEJ).

3.4. CO_2 Emissions

Carbon dioxide (CO_2) emissions in the BAU scenario will increase by 0.3 percent on average per year, from 8.8 million tonnes of carbon (Mt-C) in 2012 to 9.4 Mt-C in 2035.

In the APS, CO_2 emissions will decrease from 2012 to 2035, or by 0.7 percent per year. Since primary energy demand, excluding geothermal, is expected to be more or less stable over this period, the decrease reflects a switch to renewable energy in electricity generation, and the switch in automobiles to electric vehicles in the transport sector. Figure 13-10 shows the difference in CO_2 emissions from energy consumption between the BAU scenario and the APS in 2035 compared with 1990 and 2012.

Figure 13-10. CO_2 Emissions as Carbon from Energy Consumption, BAU and APS



BAU = Business-as-Usual; APS = Alternative Policy Scenario.
Source: Alternative Policy Scenario of the Institute of Energy Economics, Japan (IEEJ).

4. Implications and Policy Recommendations

Although New Zealand's primary energy intensity (energy per dollar of GDP) has been declining since 1990, energy use has still grown steadily, reflecting economic growth, population growth, and increasing numbers of private road vehicles.

New Zealand generates a high proportion of its electricity from renewable sources, particularly hydro, although CO_2 emissions from this sector have grown with large investment in fossil-fuelled generation. Their trading will incentivise investment in new renewable generation technologies, with geothermal and wind particularly as prospective options, provided CO_2 trading prices rise above current levels. As the Acting Minister of Energy and Resources released on the 30th of August in 2011, New Zealand's ambitious goal of achieving its target of 90 percent of electricity generation from renewable sources by 2025 would be achieved if the power generation companies and operators stop using fossil fuels and replace them with renewables. New Zealand's large base of renewable generation, however, limits the room for CO_2 emissions reduction in the electricity generation sector.

New Zealand has some other opportunities to improve energy efficiency, for example, through upgrading inefficient vehicles, reducing the amount of poorly-insulated buildings, and extending biomass use in industry. Actually, there are significant potential energy savings in the transport sector. Growth in energy consumption in the transport sector slowed in recent years, mainly because of high fuel prices and a shift to smaller vehicles. Furthermore, reductions in emissions from the transport sector are possible through a switch to electric vehicles and increased use of biofuels. Electric vehicles are a good match for New Zealand given the high proportion of electricity generated from renewables, and relatively short average trips. Also charging infrastructure already exists in most residential dwellings. Stronger regulation of new buildings in the residential and commercial sectors, to enhance their energy efficiency, should also be considered. Some of the regulations might also be applied to existing buildings along with some remedies to reduce CO_2 emissions, such as subsidies for installing wind or solar PV, where the economics make good fiscal sense.