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 nation in the Pacific about 2000 km southeast of Australia. It consists of two main islands (the North Island and 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 is currently about 4.4 million. Although there is some light and heavy industry, foreign trade is heavily dependent on agriculture, tourism, forestry, and fishing. In 2010, New Zealand had a gross domestic product (GDP) of about US$68.3 billion, or about US$15,634 per capita. While the latter figure is lower than those of many OECD countries, New Zealand tends to be ranked high 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 electricity and natural gas, and is a net exporter of coal, but it meets most of its oil demand through imports. Energy reserves include around 15 million cubic metres (MCM) of oil and 52 billion cubic metres (BCM) of natural gas (each proven plus probable), as well as 8.6 billion tones of recoverable coal, 80 percent of which is lignite.

New Zealand's total primary energy demand was around 18.2 million tons of oil equivalent (Mtoe) in 2010. By fuel, oil represented the largest share at about 33 percent; gas and geothermal energy were second each with around 20 percent. New

Zealand obtains about 39.2 percent of its primary energy supply from renewable sources, including hydro, geothermal, woody biomass, and wind.

In 2010, electricity generation accounted for 38 percent of New Zealand's domestic coal use, with most of the remainder used for making steel or in other industrial processes. Electricity generation also accounted for 47 percent of gas use, and industry sector for 21 percent while commercial and residential use accounted for most of the remainder. Reticulated natural gas is only available on the North Island. Transport accounted for an estimated 76 percent of New Zealand's oil consumption. In the transportation sector, New Zealand heavily depends on private road vehicles and air transport, with oil providing 99 percent of New Zealand's transport energy.

New Zealand had 10 gigawatts (GW) of installed generating capacity which generated about 45 terawatt-hours (TWh) of electricity in 2010. The generation by energy type is broken down as: hydro at 55.1 percent, thermal (coal and gas) 26.6 percent, geothermal 13.1 percent, with wind and wood accounting for most of the remainder. 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 2.2 percent between 2010 and 2035. Population will increase by 22.7 percent to 5.4 million by 2035, relative to 4.4 million in 2010.

In the business as usual (BAU) scenario, an increasing amount of New Zealand's electricity supply is projected to be supplied by geothermal (Figure 13-1). Hydro will remain fairly steady as the best hydro sites have already been developed. Coal use in electricity generation will move away. Natural gas use will decrease at an average growth rate of 0.5 percent. Wind generation will continue to grow, but will still contribute only a small share on New Zealand's electricity by 2035.

Thermal efficiency for natural gas is assumed at the same level of 2010 as there will be no additional natural gas-fired power plants foreseen to be built until 2035.

Thermal efficiency for coal & oil will decline with the nations aging of power plants.

Figure 13-1: Power Generation -BAU

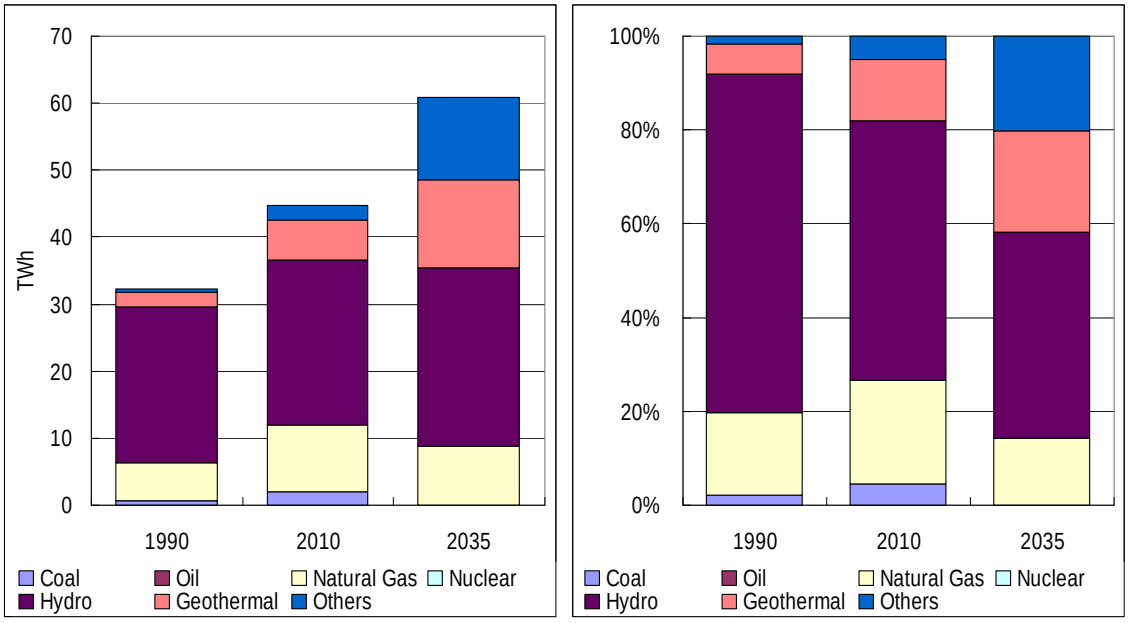
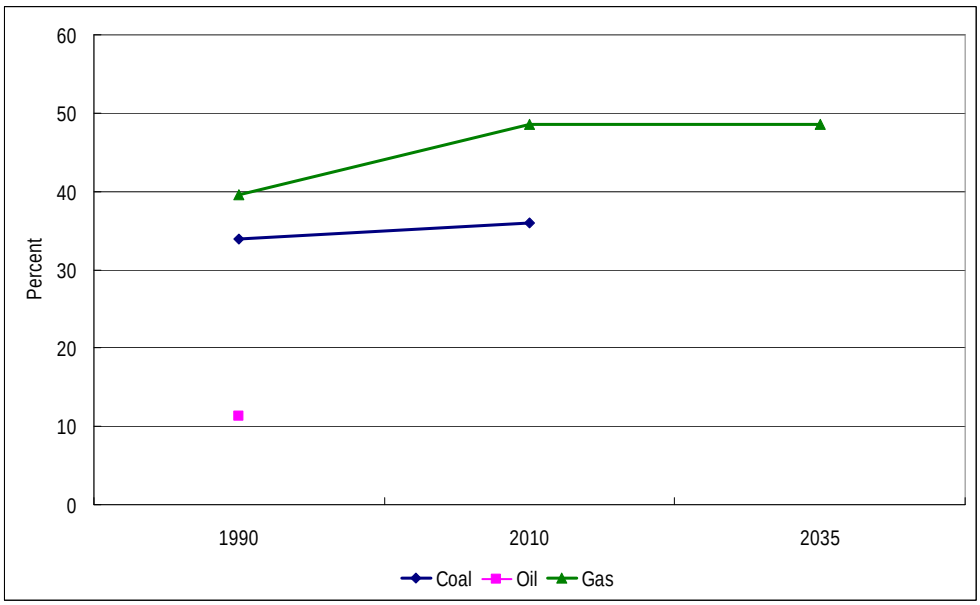


Figure 13-2: Thermal Efficiency - BAU



New Zealand's energy efficiency has improved at a rate of about 0.5-1.0 percent per year and this rate is assumed to be continued in the BAU scenario. 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 has agreed to implement an emissions trading scheme 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 and work, as well as the development and deployment of sustainable energy technologies.

3. Outlook Results

3.1. Total Final Energy Consumption

New Zealand's final energy consumption experienced a growth of 1.3 percent per year from 10.0 Mtoe in 1990 to 12.8 Mtoe in 2010. Oil was the most consumed energy source having a share of 40.4 percent in 1990 and increasing to 46.0 percent in 2010. Electricity was the second most consumed energy source during the same year with a share of 26.5 percent to the total.

Business as Usual Scenario

In the BAU scenario, final energy consumption from 2010 to 2035 is projected to grow at an average rate of 0.4 percent per year. The "Others" sector (primarily residential and commercial) will have the highest growth rate at 0.9 percent per year. The industry sector consumption is projected to increase at a slow pace of 0.4 percent.

By fuel type, final consumption of electricity will increase at an average rate of 1.3 percent per year. Final consumption of oil and natural gas will decrease by 0.1 percent and 0.3 percent per year on average, respectively. Coal consumption will however increase at 0.7 percent per year.

Figure 13-3: Final Energy Consumption by Sector and Shares by Sector - BAU

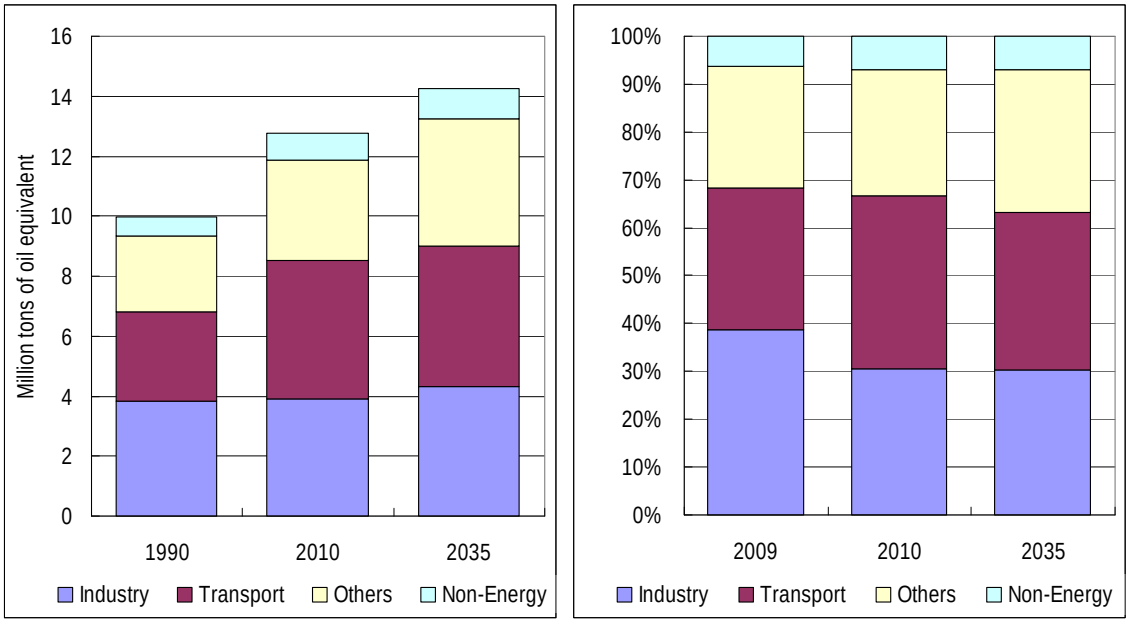
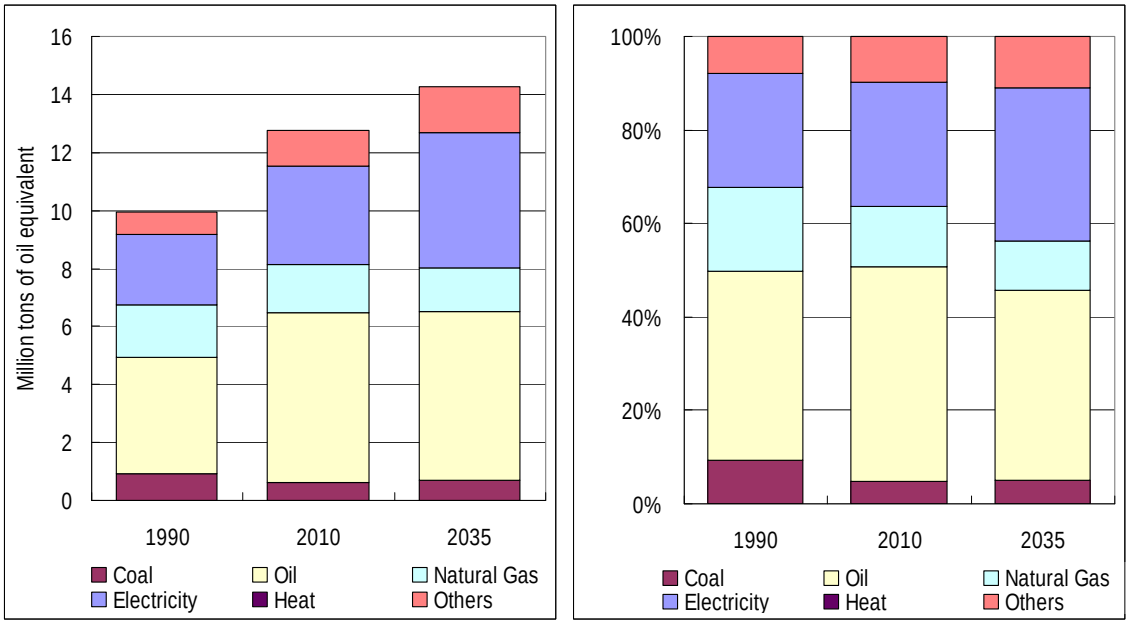


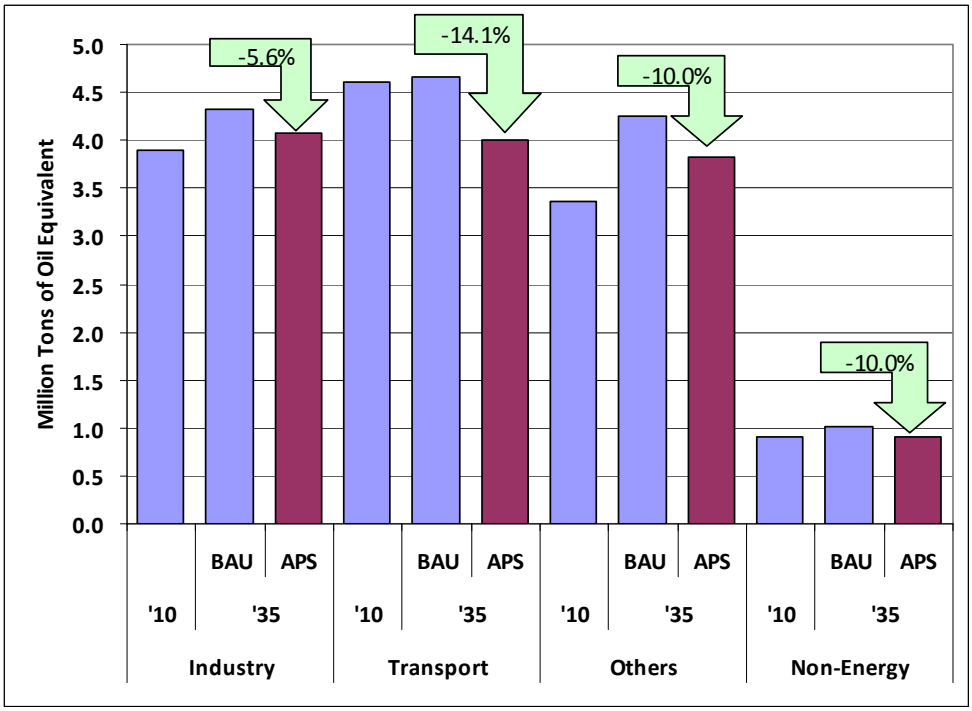
Figure 13-4: Final Energy Consumption by Source and Shares by Source - BAU



Alternative Policy Scenario

In the APS, final energy consumption will keep same level of energy consumption in 2010. Energy use in the other sector will increase at an average of 0.5 percent per year, reflecting increased use of efficient appliances at the residential and commercial sectors. Energy use in the transport sector will decline at an average of 0.6 percent, reflecting a shift to more energy efficient vehicle, particularly electric vehicles. The sectoral final energy consumption in New Zealand in 2010 and 2035 in the BAU and APS is shown in Figure 13-5.

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



3.2. Primary Energy Demand

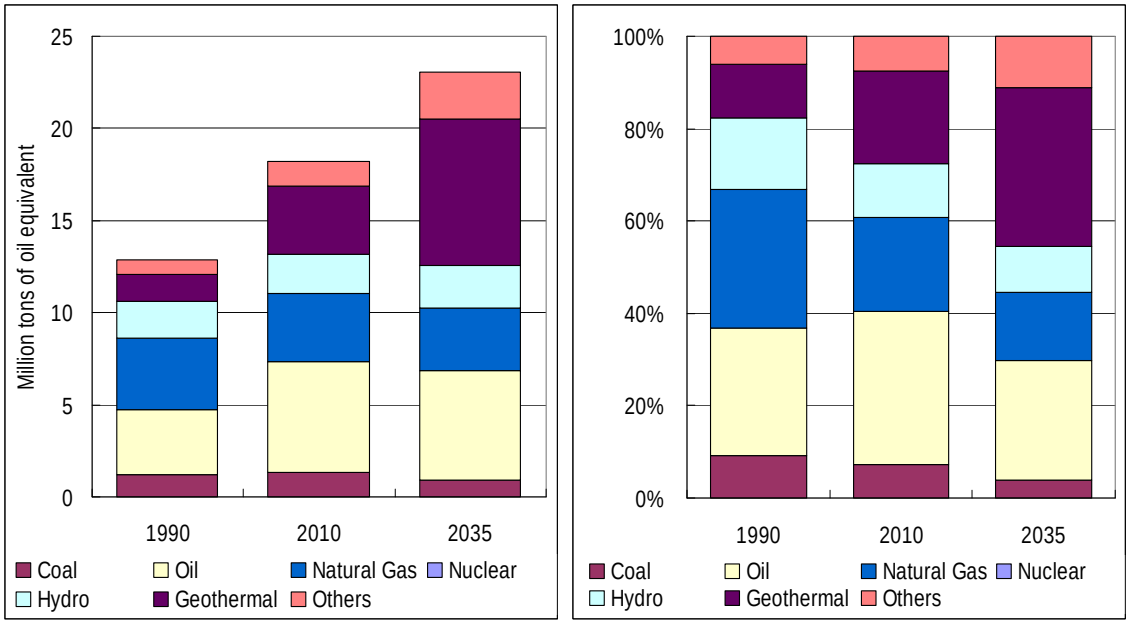
Primary energy demand in New Zealand grew at a rate of 1.7 percent per year from 12.9 Mtoe in 1990 to 18.2 Mtoe in 2010. The fastest growing primary fuel in absolute terms was oil from 3.6 Mtoe in 1990 to 6.0 Mtoe in 2010. The increase in oil demand is due to the rapid growth in transport energy demand. Natural gas declined at an average annual rate of 0.2 percent, reflecting the decrease in gas production from the Maui gas field. Geothermal energy use grew from 1.5 Mtoe in 1990 to 3.6 Mtoe in 2010 at an annual rate of 4.6 percent for electricity generation. Hydroelectricity production increased at a slower pace at 0.3 percent per year. Other

energy sources which include biomass, solar and wind increased at 2.7 percent per year.

Business as Usual Scenario

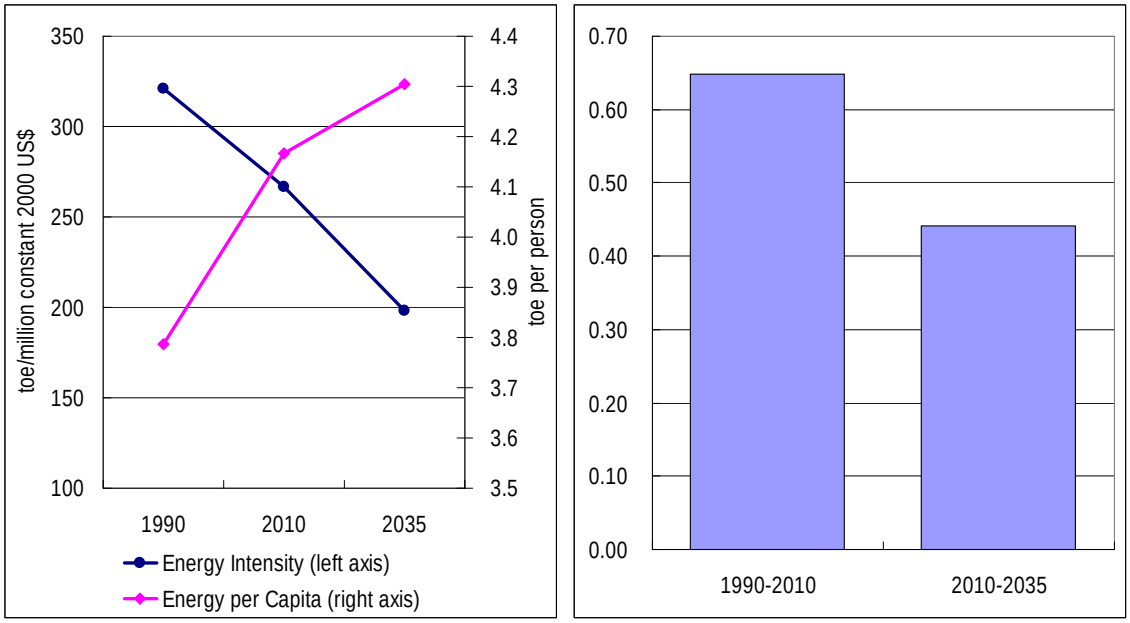
In the BAU scenario, New Zealand's primary energy demand will grow at an annual rate of 1.0 percent per year to 23.1 Mtoe in 2035. To the incremental growth of primary energy demand between 2010 and 2035, geothermal energy contributes the most, and will account 34.5 percent of the total primary energy demand in 2035. "Others" primary energy will grow by 2.5 percent per year reflecting mainly the expected growth in wind power. Meanwhile, primary fossil fuel will decrease at an average rate of 0.3 percent.

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



The lower growth of primary energy demand relative to the GDP growth will result in lower energy intensity in the future. From 266 toe/million USD in 2010, energy intensity will decline to 165 toe/million USD in 2035. This decline is further illustrated by the lower energy elasticity in the period 2010-2035 of 0.44 from 0.65 in the period 1990-2010. Primary energy demand per capita will however increase from 4.17 toe/person in 2010 to 4.30 toe per person in 2035 (Figure 13-7).

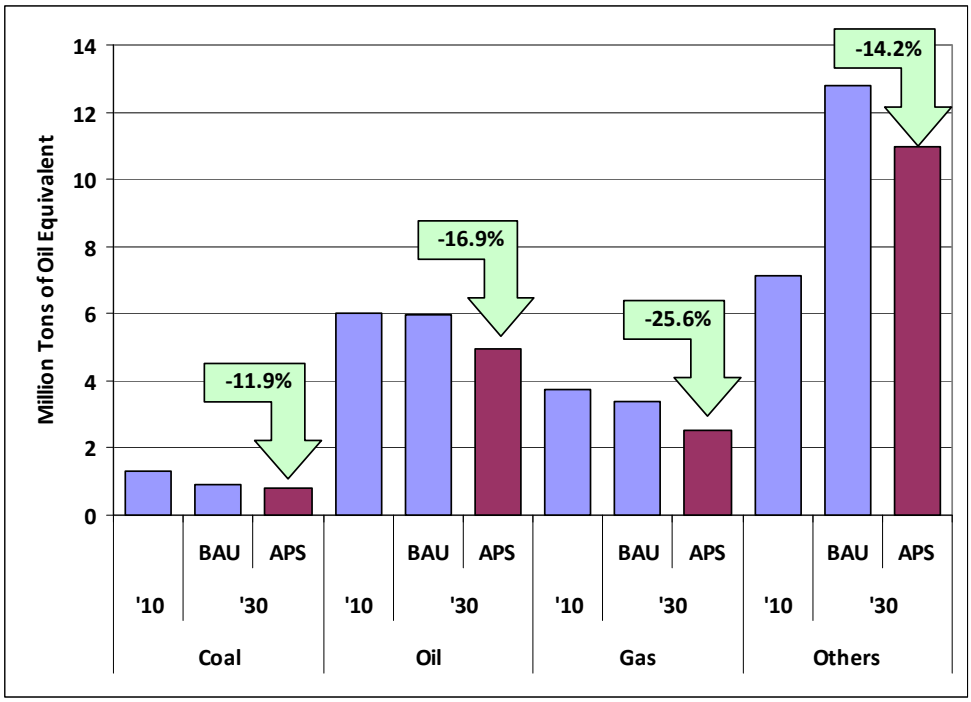
Figure 13-7: Primary Energy Intensity and Elasticity -BAU



Alternative Policy Scenario

In the APS, primary energy demand is projected to grow at a lower rate of 0.2 percent per year to 19.3 Mtoe in 2035. Geothermal primary energy is expected to grow by 1.7 percent per year, while 'others' primary energy, which includes wind and biomass, is expected to grow by 3.4 percent per year (note that the 'Others' shown in Figure 13-9 also includes hydro and geothermal). Oil and gas are expected to show significant declines of 1.5 percent and 1.9 percent per year, respectively.

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

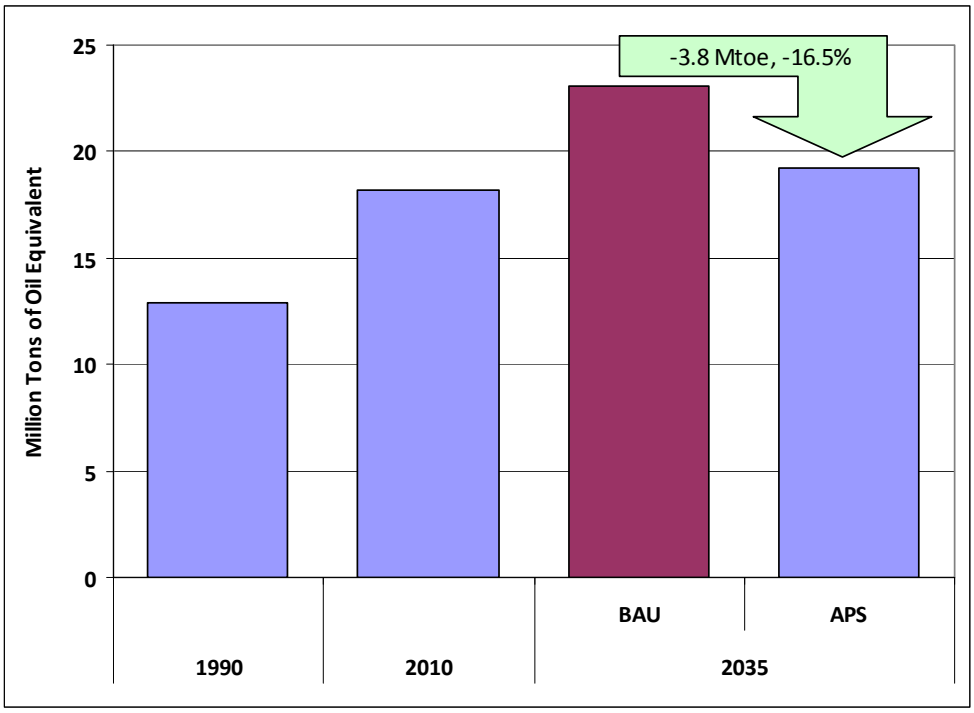


3.3. Projected Energy Savings

Under the APS, energy savings could amount to 3.8 Mtoe in 2035, the difference between the primary energy demands in the BAU scenario and the APS – 16.5 percent less than the BAU's in 2035 (Figure 13-9).

The above savings in primary energy are mainly due to a switch of 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 Demand, BAU and APS

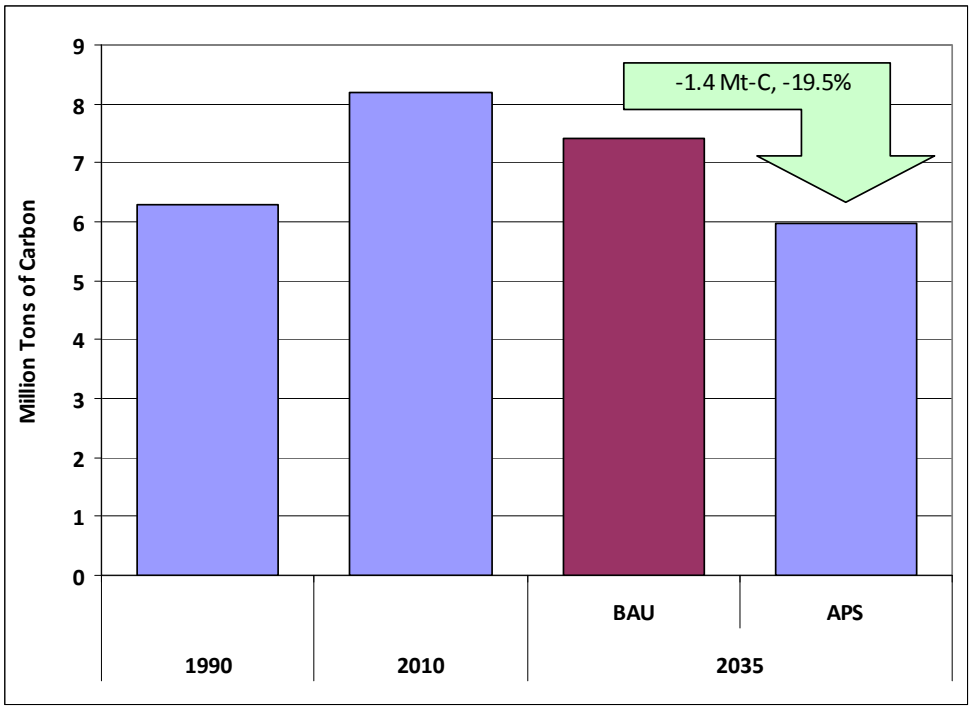


3.4. CO_2 Emissions

The carbon dioxide (CO_2) emissions in the BAU scenario will decrease by 0.4 percent per year from 8.2 million tons of carbon (Mt-C) in 2010 to 7.4 Mt-C in 2035. This decrease is roughly in line with decrease in coal primary energy demand.

In the APS, CO_2 emissions will decrease from 2010 to 2035 by 1.3 percent per year. Since primary energy demand, excluding geothermal is more or less stable over this period. The decrease reflects the switch to renewable energy in electricity generation, and the switch automobiles to electric vehicles in the transport sector. Figure 13-10 shows the CO_2 emissions from energy consumption in New Zealand from 2010 to 2035.

Figure 13-10: CO_2 Emissions from Energy Combustion, BAU and APS



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 and increasing numbers of private road vehicles.

New Zealand generates a high proportion of its electricity from renewable sources, particularly hydro, although emissions from this sector have been growing with large investment in fossil-fuelled generation. Emissions trading will incentivise investment in new renewable generation technologies, with geothermal and wind particularly as prospective options for New Zealand. 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 many opportunities to improve energy efficiency, for example, through upgrading the poorly-insulated building stock and the inefficient vehicle fleet.

There are potential energy savings in the transportation sector in New Zealand. Growth in energy consumption in the transport sector has been slowed in recent

years, mainly because of high fuel prices and a shift to smaller vehicles. Furthermore, reduction in emissions from the transport sector is possible through increased use of biofuels, and a switch to electric vehicles. Electric vehicles are a good match for New Zealand given the high proportion of electricity generated from renewables, and relatively short average trips.