

## NEW ZEALAND

- *New Zealand's primary energy demand will grow annually at 1.8 percent from 18.8 Mtoe in 2002 to 30.6 Mtoe in 2030; buoyed mainly by high demand growth in coal and renewables.*
- *The economies high dependence on hydro for electricity generation and depleting natural gas reserves; thereby increasing the use of coal for electricity generation may raise concerns over the outlook period.*
- *CO<sub>2</sub> emissions from the energy sector are projected to reach 36.9 million tonnes of CO<sub>2</sub> in 2010 – about 75 percent higher than the 1990 level.*

### RECENT ENERGY TRENDS AND ENERGY POLICY

On the back of robust economic growth from 2000 to 2004, New Zealand's total primary energy consumption has increased by an average annual growth of 0.4 percent. Oil consumption in particular has increased substantially, accounting for 52 percent of the total incremental growth in energy consumption. This is primarily because of expanding trade/freight by road transport and the expansion of passenger vehicle use due to the lack of efficient public transport networks. Natural gas was mainly consumed in the industry and electricity sectors. With reduced natural gas production, the electricity sector has shifted from the utilisation of natural gas to coal and wind; substantially increasing coal consumption in the electricity sector from 0.23 Mtoe in 2000 to 1.02 Mtoe in 2004.

Historically, most of the economy's energy supply has been met through domestic production, except oil. However natural gas production has fallen in recent years from a peak of 6.3 Mtoe in 2001 to 4.1 Mtoe in 2004 – a drop of approximately 35 percent – as production from the Maui gas field draws to a close. The economy produces both steaming and coking coals, of which the majority of coking is exported while steaming coal is utilised domestically for electricity generation. Oil on the other hand is mostly imported and the economy's oil imports have increased from 5.3 Mtoe in 2000 to 6.2 Mtoe in 2004, representing an import dependency of 87 percent in 2004.

The decline in natural gas production from the Maui gas field has prompted New Zealand to: 1) intensify exploration of natural gas; as many areas of New Zealand remain relatively under-explored and the probability of finding hydrocarbon structures of the same size or greater than that of the Maui field still remains high, and 2) adopt an aggressive Petroleum Strategy to promote the development and security of natural gas supply through importation of LNG or CNG. Other countermeasures that have been undertaken to offset the reduction in domestic

production of natural gas include policies to increase investment in the upstream sector through the introduction of various incentives and tax breaks.

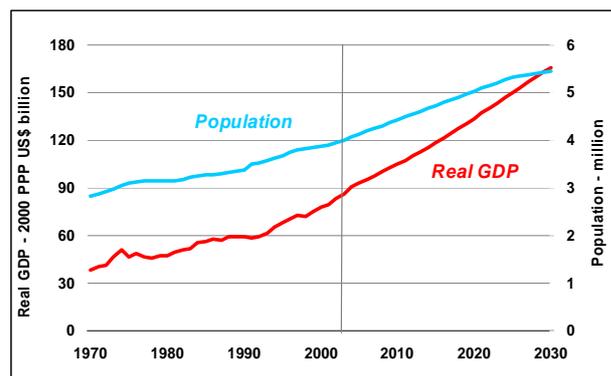
The government is currently in the process of developing a national energy strategy which will involve a broad re-examination of New Zealand's current energy policies with an emphasis on energy efficiency as a method to reduce growth in energy demand. This strategy will be based on the tenets of sustainable development through the Sustainable Development Programme of Action (SDPOA), which calls on government agencies to take a wider, more integrated approach to policy development with the three desired outcomes being: 1) energy use in New Zealand becomes more efficient and less wasteful, 2) renewable sources of energy are developed and maximised, and 3) New Zealand consumers have a secure supply of electricity. In addition, in 2002 New Zealand ratified the Kyoto Protocol under which the economy is obligated to reduce CO<sub>2</sub> emissions to that of the 1990 level. To this end, policies/strategies are currently being undertaken through which the mandated reduction target can be achieved.

### ENERGY DEMAND DRIVERS

The New Zealand economy is projected to grow annually at a modest rate of 2.5 percent over the outlook period, which will result in an approximate doubling of total GDP by 2030. While New Zealand is to all intents and purposes an agriculturally based economy, continued expansion of the services sector will contribute the most to economic growth, with the GDP in services sector making up approximately 80 percent of total GDP in 2030.

Population is projected to grow robustly at 1.2 percent per year over the outlook period, compared with the previous three decades of 1.0 percent. The projected growth will result in a 20 percent increase over the 2002 level reaching 5.44 million in 2030.

Figure 68 GDP and Population



Source: Global Insights (2005)

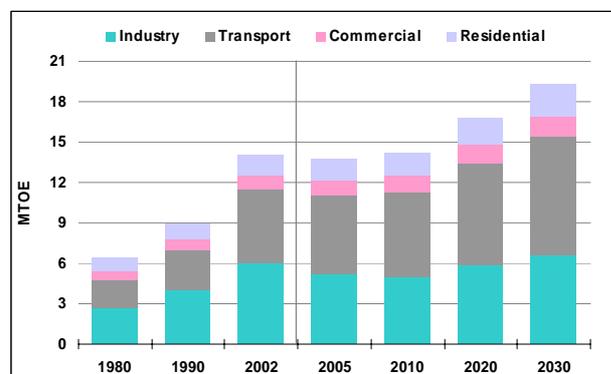
New Zealand is by world standards a fairly urbanized economy with the urban population expected to reach 89 percent in 2030 from 86 percent in 2002. What is peculiar to New Zealand however is that this urbanisation is very unbalanced with the majority of people concentrated in, Auckland City – New Zealand's largest urban region – which continues to grow dramatically. In 2005, more than 25 percent of the economy's population live in this region and the trend is expected to continue with the projected population to reach one third of total population by 2030.

## OUTLOOK

### FINAL ENERGY DEMAND

Final energy demand is expected to grow at 1.2 percent per year over the outlook period, slower than the annual growth of 3.6 percent in the previous two decades. The transport sector is projected to account for the largest share at 46 percent, followed by industrial (34 percent), residential (12 percent), and commercial (8 percent).

Figure 69 Final Energy Demand



Source: APERC Analysis (2006)

### Industry

Energy demand in the industrial sector is projected to grow at an average annual rate of 0.4

percent until 2030, much lower than the average annual growth of 3.7 percent over the past two decades. The low projected increase in industrial energy demand is attributed to the large decrease in natural gas utilisation resulting from the closure of Methanex's gas-to-methanol plants.<sup>77</sup> These plants were partly responsible for the historical growth in natural gas consumption which grew at an average of 10.8 percent over the period 1980 to 2002. As a result of these closures, the share of industrial energy demand to total final energy demand is expected to fall from 43 percent in 2002 to 34 percent in 2030. Energy intensity<sup>78</sup> in the industrial sector is also expected to decline at an average annual rate of 2.3 percent, improving from 310 toe per US\$ million in 2002 to 161 toe per US\$ million in 2030.

The individual shares of energy sources to total industrial energy demand is projected to change significantly over the outlook period. The share of natural gas is projected to decrease from 42 percent in 2002 to 14 percent in 2030 while the share of oil and coal will increase respectively at 1.5 percent and 0.8 percent per year. Renewables, the second fastest-growing energy source, is projected to grow at an average annual rate of 1.6 percent, accounting for 20 percent of total industrial energy demand in 2030. Among the renewable energy sources, biomass is expected to lead the growth which is largely utilised in cogeneration, particularly by the forestry industry.<sup>79</sup>

Electricity is projected to increase from 1.3 Mtoe in 2002 to 2.6 Mtoe in 2030, accounting for the fastest growth in industrial energy demand at an average annual rate of 2.5 percent. Electricity demand will surpass that of natural gas as the leading energy source, accounting for 39 percent of industrial energy demand in 2030, as more new and efficient electrical equipment is utilised within the manufacturing sector.

<sup>77</sup> Methanex is the largest petrochemical producer in New Zealand operating two plants with a combined capacity of 2.4 million tonnes of methanol per annum; however, due to the shortage of gas on the New Zealand market the 1.87 million tonne Motunui plant ceased operations in November 2004. The smaller 530,000 tonne per annum Waitara Valley plant was idled in the fourth quarter of 2005, but has managed to secure sufficient gas to continue operations up until the end of the second quarter of 2006.

<sup>78</sup> The amount of energy needed to produce a dollar's worth of industrial sector's value added

<sup>79</sup> Ministry of Economic Development (2003) assumes robust forest industry growth, with the harvest rate increasing from 19 million m<sup>3</sup> in 2001 to 33 million m<sup>3</sup> in 2025, and the total amount processed increasing from 13 million m<sup>3</sup> in 2001 to 19 million m<sup>3</sup> in 2025.

## Transport

Transportation energy consumption in New Zealand is dominated by road transport sub-sector, accounting for about 84 percent in 2002. Given the low population density, sprawling sub-urban areas, and an insufficient mass transit system that connects city centre and residential suburbs, commuters have to rely on gasoline powered passenger vehicles. Inter-city transport for both the passenger and freight sub-sectors depend mainly on road transport as cities in the economy are connected by toll-free highway systems. To support the mobility of passengers, New Zealand's vehicle ownership per 1,000 population is relatively high, at 541 per 1000 population – the third highest in the APEC region after the US and Canada.

Over the outlook period, the transportation energy demand of New Zealand is projected to grow at an annual rate of 1.7 percent. The major growth is expected to come from road transport sub-sector accounting for about 78 percent, with the remainder from air transport sub-sector at 22 percent. With the steady growth in the road and air sub-sectors, per capita energy demand in the transport sector is projected to reach 1.6 toe in 2030 – the fourth largest after the US, Canada and Australia.

By fuel type, jet kerosene demand for international air transport is projected to grow at the fastest rate of 2.6 percent per year. The projected growth will be mainly due to New Zealand's reaching bilateral and multilateral agreements with neighbouring economies such as Australia and Singapore, boosting international air travel.

Diesel demand for freight trucks is expected to grow at 1.8 percent per year. Since the deregulation of the freight transport sub-sector in the 1990s, diesel consumption has experienced robust growth of 10.8 percent over the last decade. However, over the outlook period, the growth rate in diesel demand is expected to stabilise at 1.8 percent. On the other hand, gasoline demand for passenger vehicles is projected to grow at an annual rate of 1.4 percent – a slower rate than the past three decades at 1.9 percent per year, as a result of the saturation in vehicle ownership.

## Residential and Commercial

Energy demand in the residential sector is expected to grow at 1.8 percent per year over the outlook period. With urban migration to Auckland, electricity demand will grow the fastest at an annual rate of 2.0 percent, with the share of electricity to total residential energy demand increasing from 69 percent in 2002 to 74 percent 2030. Natural gas is projected to maintain the second largest share to total

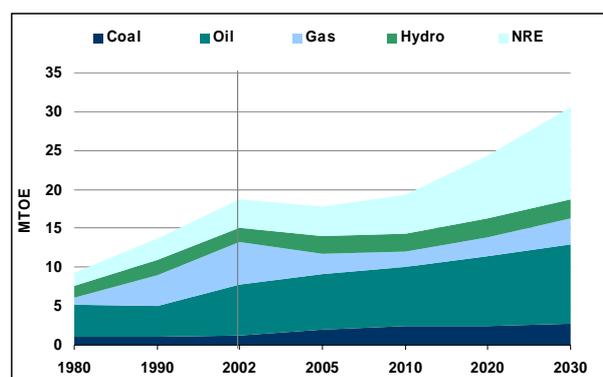
residential energy demand accounting for 12 percent in 2030, growing at 1.9 percent annually, slower than the previous two decades, due to the lower growth in the number of households connecting to the gas pipeline system. Demand for renewables and waste is also expected to grow at 0.6 percent per year, with the share to total residential energy demand accounting for 11 percent in 2030.

Although the value added for services sector will continue to grow robustly at 2.9 percent per year during the outlook period, energy demand in the commercial sector is projected to grow moderately at an annual rate of 1.2 percent, influenced by initiatives to increase the energy efficiency of the sector. Electricity is expected to maintain the largest share of total commercial energy demand, accounting for 59 percent in 2030, and grow at 1.3 percent per year. Likewise, natural gas demand is expected to grow at 1.8 percent per year until 2030, with the share of natural gas increasing from 26 percent in 2002 to 30 percent in 2030. By contrast, the share of coal is expected to decrease from 10 percent in 2002 to 5 percent in 2030, declining at a rate of 1.2 percent per year.

## PRIMARY ENERGY DEMAND

New Zealand's primary energy demand is projected to grow at an annual rate of 1.8 percent – a slower rate than the previous two decades at 3.3 percent per year.<sup>80</sup>

Figure 70 Primary Energy Demand



Source: APERC Analysis (2006)

Among the fossil fuels, coal will grow at the fastest rate of 2.9 percent per year, followed by oil at 1.6 percent, while gas is projected to decrease at 1.8 percent over the outlook period. However, the highest growth will be in renewables, growing at 4.3

<sup>80</sup> Note that the growth rate for primary energy demand is much higher than that of final energy demand primarily as a result of geothermal generation. With low efficiency (10-15 percent) the amount of energy from geothermal supplied as electricity (final energy) is low compared with amount used in the process (primary energy).

percent per year to reach 39 percent of total primary energy demand in 2030.

Coal demand will be largely driven by the electricity sector, accounting for approximately 14 percent of the total incremental growth of input fuel to electricity. The capacity of coal-fired electricity generation is projected to triple over the outlook period.

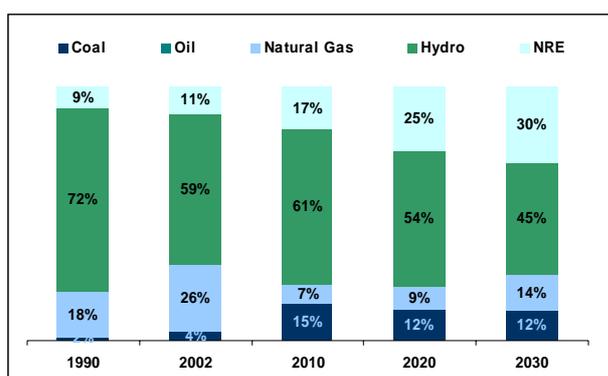
The transportation sector will be the largest single contributor to incremental oil demand growth accounting for 92 percent of the total. Since New Zealand has only very limited domestic oil resources and production is declining, the majority of oil supply will continue to be imported. In addition there is only one domestic refinery in New Zealand, which can only produce enough petroleum products to meet 70 percent of the economy's domestic demand, therefore net oil import dependency is projected to increase from 80 percent in 2002 to 90 percent in 2030.

The direct use of renewable resources which include biogas, industrial waste, wood, solar, and geothermal will continue to play an important role in New Zealand's primary energy mix over the outlook period and reach 11.8 Mtoe in 2030.

**ELECTRICITY**

Over the outlook period, the electricity demand of New Zealand is projected to grow at 2.1 percent per year.

*Figure 71 Electricity Generation Mix*



Source: APERC Analysis (2006)

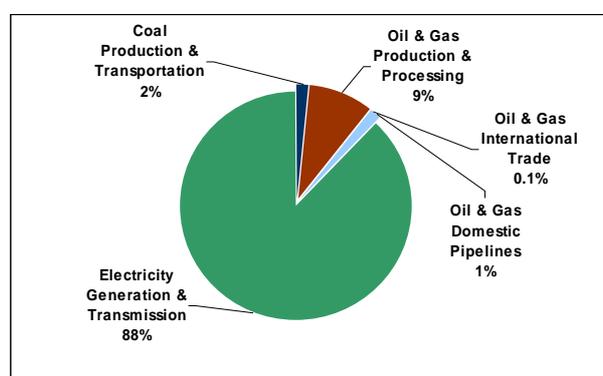
Hydro will maintain the dominant share of 45 percent in the electricity generation mix; however, this is much lower than the 2002 level of 59 percent. Diversification away from hydro will be achieved through increasing the share of other renewables, such as wind and geothermal which will increase their share to 12 and 11 percent respectively by 2030. Overall electricity from renewable sources is projected to account for 75 percent of the electricity generation mix in 2030.

For electricity generation from fossil fuels, natural gas will be a major fuel at 14 percent in 2030. However, the role of coal will become more important as domestic natural gas resources are depleted and emphasis is placed on the use of domestically produced coal.

**INVESTMENT REQUIREMENTS**

The total investment necessary to support New Zealand's energy infrastructure requirements will reach a total of between US\$15-18 billion by 2030. A large part of the investment will be needed for the construction of new and additional electricity generation and transmission facilities reaching about US\$13-16 billion by 2030.

*Figure 72 Investment Requirements*

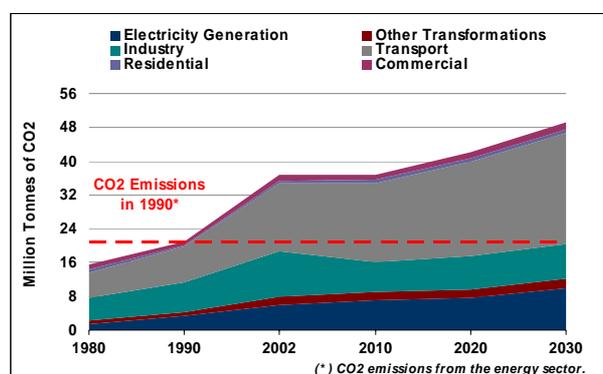


Source: APERC Analysis (2006)

**CO<sub>2</sub> EMISSIONS**

Over the outlook period New Zealand's total CO<sub>2</sub> emissions from the energy sector are projected to reach 49 million tonnes of CO<sub>2</sub>, which is 2.3 times higher than the 1990 level, which will make reductions under the Kyoto Protocol difficult for New Zealand to achieve.

*Figure 73 CO<sub>2</sub> Emissions by Sector*



Source: APERC Analysis (2006)

By sector, the transportation sector is expected to account for the largest share at 53 percent of total CO<sub>2</sub> emissions or 26 million tonnes of CO<sub>2</sub>, followed

by the electricity sector at 20 percent emitting 10 million tonnes of CO<sub>2</sub>.

## MAJOR ISSUES

### SECURITY OF ELECTRICITY SUPPLY

New Zealand is highly dependent on hydro for electricity generation. In 2004, 65 percent of the total electricity generated was supplied from hydro compared with the APEC average at 14 percent in 2002. The heavy reliance on hydro has led to problems in recent years when the storage capacity of hydro reservoirs reached critically low levels. The lack of incentives in the previous market for electricity generators to invest in new generation capacity, which would provide sufficient supply security in very dry years, has prompted government to establish the Electricity Commission in 2003. The Commission is responsible for managing the electricity sector so that electricity demand can be met in a 1-in-60 dry year<sup>81</sup>, without the need for emergency conservation campaigns like the voluntary “electricity savings” campaign “Target 10%”<sup>82</sup> that was run in 2001 and 2003.

The economy is also faced with the expected high growth in electricity demand in the Greater Auckland region, which requires added generating and transmission capacity. The electricity demand of the Greater Auckland region is projected to grow by an average 3.8 percent per year to reach an equivalent electricity generation capacity of 3,356 MW in 2025<sup>83</sup>, compared with the economy average annual rate of 2.2 percent. The main reason for Auckland’s faster growth compared with the economy average is growth in population due to internal migration and immigration.<sup>84</sup> In addition, much of the infrastructure serving this region was built in the 1950’s and 60’s and is in need of upgrading with the main transmission lines fast approaching capacity loading.<sup>85</sup>

### MEETING THE KYOTO PROTOCOL TARGETS

In December 2002 the New Zealand government ratified the Kyoto Protocol, under which the

economy was obligated to reduce its CO<sub>2</sub> emissions to the 1990 levels over the period 2008-2012. However, as a result of very robust economic growth over the past five years, greenhouse gas emissions have increased markedly. Although New Zealand’s greenhouse gas emissions are only growing at around half the rate of GDP growth, the increase is still significant.

In the latest Greenhouse Gas Inventory for the year 2003, New Zealand’s CO<sub>2</sub> emissions came from the following sources: Agriculture 49 percent<sup>86</sup>, energy 43 percent and other (industrial processes etc) 5 percent. Within the energy sector, transportation is the largest contributor at 45 percent with emissions having increased by 65 percent over 1990 levels. Carbon intensity improvement in the transport sector is thus seen as the best way for New Zealand to meet its Kyoto Protocol target, but given the lack of public transportation options and the current high energy intensity of this sector, reduction could be difficult to achieve.

The next largest contributor is thermal electricity generation at 25 percent, with emissions having increased by 60 percent over 1990 levels. However, with the depletion of the Maui gas field the mix between coal-fired and gas-fired generation is shifting. For the 2005 March year end, coal provided 38 percent of thermal generation compared with 25 percent in 2004, therefore it is expected that emissions from this sector will increase over the coming years. To reduce emissions from electricity generation the government is promoting the installation/expansion of renewable sources; however, there are more thermal than renewable options to meet increasing demand for electricity under current economic/technological conditions.

## IMPLICATIONS

The economy’s energy supply and demand structure is likely to change over the outlook period from one where the majority of energy resources are domestically produced to another where a greater proportion of energy resources are imported from international markets. This coupled with New Zealand’s commitment to reduce CO<sub>2</sub> emissions under the Kyoto Protocol will have profound implications for the development of the electricity sector in particular.

<sup>81</sup> The amount of hydro storage required to sustain a 1 in 60 year low inflow sequence with all non-hydro electricity supply fully committed.

<sup>82</sup> The aim of the campaign was to reduce electricity consumption by 10 percent.

<sup>83</sup> Transpower (2005)

<sup>84</sup> In 2002 roughly 25 percent of New Zealand’s population lived in the greater Auckland region with this share expected to increase to more than one third by 2030.

<sup>85</sup> In 1998 a power failure in Auckland greater reduced electricity supply in the central business district for a number of weeks.

<sup>86</sup> Agriculture is the principal industry of New Zealand and 31.3 percent of New Zealand’s total CO<sub>2</sub>-eq emissions come from methane produced as a by-product of enteric fermentation of domestic farm animals (cattle, sheep etc), which are not easy to reduce.

A balanced approach to the development of the electricity sector will have to be taken into consideration where all available resources are considered, including domestically produced coal. Government incentives and promotion of clean coal technologies, further research and development of CO<sub>2</sub> capture and sequestration technologies in addition to informed debate on the merits as well as demerits of each energy resource will become more necessary. Failure to look at all possible options – including coal and LNG – could lead to an unbalanced electricity system, which could impact on the economic health of New Zealand.

The introduction and promotion of biofuels in New Zealand would contribute substantially to the reduction of carbon intensity in the transport sector; however, a truly integrated and efficient mass transit rail system within the Auckland region would also contribute significantly to the reduction of carbon emissions in addition to lower point source air pollution, therefore, development and promotion of mass transit systems is one method in which energy efficiency could be greatly enhanced over the outlook period.

## REFERENCES

- Anthony Bellve (2005). *“Change to turn the tide of power supply.”* New Zealand Herald. 10 May 2005.
- Contact Energy (2004). *“Press release – Liquefied Natural Gas Established as Viable Option for New Zealand: Update on Contact Energy and Genesis Energy Joint Feasibility Study.”* Website: [www.mycontact.co.nz](http://www.mycontact.co.nz).
- Crown Minerals (2003). *“Latest News - Maui Gas Buyers to Work out Revised Gas Allocations.”* Website: [www.crownminerals.govt.nz](http://www.crownminerals.govt.nz).
- Energy Efficiency and Conservation Authority (2005). *EECA Transport Fuels Program.* Website: [www.eeca.govt.nz/renewable-energy/biofuels](http://www.eeca.govt.nz/renewable-energy/biofuels).
- Ministry of Economic Development (2003). *New Zealand Energy Outlook to 2025.*
- Ministry of Economic Development (2004a). *Gas Exploration Incentives.*
- Ministry of Economic Development (2004b). *Sustainable Energy, Creating a Sustainable Energy System.*
- Ministry of Economic Development (2006). *New Zealand Energy in Brief.* Website: [www.med.govt.nz](http://www.med.govt.nz).
- Motor Industry Association of New Zealand (2006). *“What’s New - Imported Used Vehicles Keep Getting Older.”* Website: [www.mia.org.nz](http://www.mia.org.nz).
- New Zealand Business Council for Sustainable Development (2005). *Incentivising Greener Fleet*

*Vehicles – A report to Government.* Website: [www.nxbcsd.org.nz](http://www.nxbcsd.org.nz).

New Zealand Standards Authority (2005). *“Keep your motor running.”*

Statistics New Zealand (2006). *“Subnational Demographic Projections.”* Demographic Trends 2005. Website: [www.stats.govt.nz/analytical-reports/dem-trends-05/default.htm](http://www.stats.govt.nz/analytical-reports/dem-trends-05/default.htm).

Transpower (2005). *Security of Supply into Auckland, Review of System Capacity Limitations.*