Ministry of Economic Development October 2003

NEW ZEALAND ENERGY OUTLOOK TO 2025

Ministry of Economic Development
Manatū Ōhanga

ACKNOWLEDGEMENTS

The authors are grateful to the individuals and organisations that provided information and gave generously of their time to assist with the work reported here. The responsibility for the presentation of the material in the final report, including any errors of fact, interpretation or analysis, however, remains with the authors.

AUTHORSHIP

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NEW ZEALAND ENERGY OUTLOOK TO 2025

Executive Summary

October 2003

A report prepared by the

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ISBN 0-478-26329-9

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NEW ZEALAND ENERGY OUTLOOK TO 2025

EXECUTIVE SUMMARY

New Zealand's energy sector faces new challenges over the period to 2025. These include meeting the growth in demand for energy at a time when gas availability from the Maui field is coming to an end and greenhouse gas emissions are an increasingly important consideration.

The focus of the Outlook is the Reference scenario. This scenario is designed to examine a projected future based on reasonably likely assumptions about factors such as international energy prices along with announced policy settings. The projections take a long-term perspective, which smoothes over short-term shortages or surpluses, and price fluctuations. The key assumptions of the Reference scenario, which covers the period 2000 to 2025, are[1]:

- 2.5% per annum (pa) GDP growth from 2007 (2002 Budget forecast prior to 2007);
- Oil prices rising from US$20/bbl in 2004 to US$25/bbl by 2020 and constant thereafter;
- Constant exchange rate of NZ$1.00 = US$0.50 out to 2025;
- Pohokura gas available from 2007[2] and Kupe from 2008;
- New gas available from discoveries averaging 35 PJ pa for 2011-2013 and 60 PJ pa from 2014 onwards;
- North Island delivered coal prices at $3.50/GJ in 2004 and at $4.00/GJ from 2013 onward, and South Island delivered coal prices about $3.00/GJ;
- As a result of the National Energy Efficiency and Conservation Strategy (NEECS), additional energy efficiency uptake above the normal rate, of 0.5% pa for 2002-2005, 1.0% pa for 2006-2015, and 0.5% pa again for 2016-2025;
- Carbon charges at $15/t$CO_2$ from 2008;
- Forest industry growth, with the harvest rate increasing from 19 Mm^3 in 2001 to 33 Mm^3 in 2025, and the total amount processed increasing from 13 Mm^3 in 2001 to 19 Mm^3 in 2025.

There is considerable uncertainty around some of these key assumptions. To allow for this, alternative scenarios with differing assumptions are also considered, such as higher GDP growth, no new gas discoveries, continued Methanex operation and lower energy efficiency uptake. These indicate a range of possible outcomes under the specified assumptions, none of which should be considered a prediction. Many developments are possible by 2025 that have not been allowed for in any of the scenarios. In particular, radical technological changes could alter cost relativities and hence the rate of uptake of different technologies. Also, policy adjustments are likely over this timeframe and these could have further effects on energy outcomes.

The Reference scenario projects that total consumer energy demand will grow at an average rate of 0.6% pa for the period 2000-2025 under the assumptions outlined above. This overall growth consists of 1.0% pa growth in residential energy demand, 1.3% pa growth in energy demand by the

[1] *Throughout the document: years are March Year Ending (MYE) unless otherwise specified; prices are in terms of MYE 2002 real dollars; and some totals may not appear to sum correctly due to rounding.*

[2] *With a small amount available in 2006.*

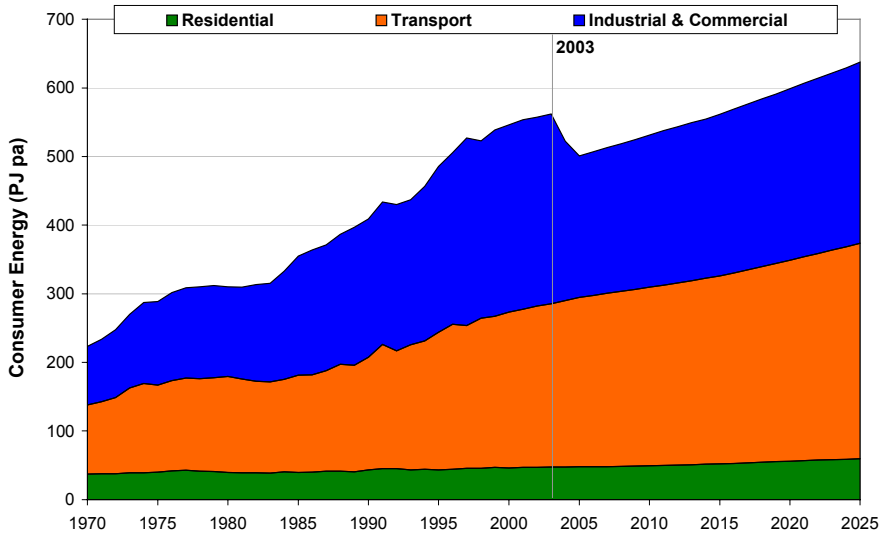


Figure 1: Total Consumer Energy by Sector 1970-2025 (Reference Scenario)

transport sector, and an average decline of 0.1% pa in the industrial and commercial sector[3]. The trends are illustrated in Figure 1.

The step down in industrial and commercial demand starting post-2003 is attributable to the wind-down of Methanex. It is assumed that in response to tightening gas supply and rising gas prices Methanex ceases use of gas in 2004. It is quite likely that Methanex will secure additional gas and maintain operations longer, and this would clearly impact on the gas market. Accordingly, in an alternative scenario it is assumed that Methanex takes 70 PJ more gas. Note that for the Reference scenario, if the effect of the Methanex closure is excluded, the growth in energy demand for the remainder of the industrial and commercial sector is 1.4% pa and total energy demand is 1.3% pa. While Methanex demand clearly puts pressure on the gas market, it can be argued that the existence of such a large single user provides a valuable incentive for exploration.

Energy intensity in New Zealand, as shown in Figure 2, grew from 3.9 PJ per $1000M of GDP in 1970 to 4.8 PJ per $1000M of GDP in 2002. It is projected to decline to 3.1 PJ per $1000M of GDP by 2025. This decline is consistent with projections in the last *Energy Outlook* published in 2000. There is an

[3] The industrial and commercial sector includes forestry, basic metals (including Comalco) and petrochemicals (including Methanex) use.

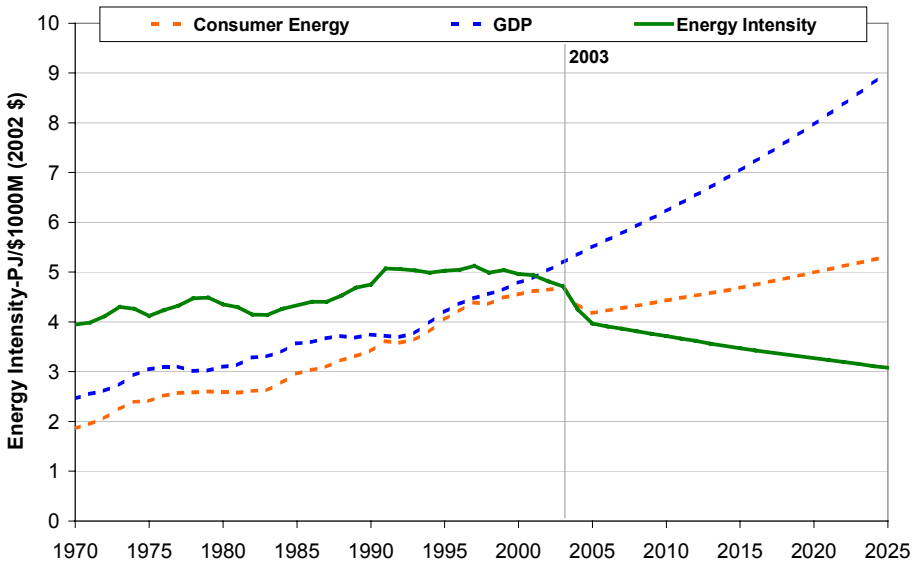


Figure 2: Energy Intensity 1970-2025 (Reference Scenario)

Note: The Y-axis units apply only to energy intensity. The GDP and consumer energy series have been scaled for presentation purposes. The step fall in intensity after 2003 is attributable to the Methanex wind-down.

initial drop around 2003-2005 attributable to the expected closure of the Methanex plant followed by a steady decline.

Under the Reference scenario electricity demand is projected to grow at 1.2% pa over 2000-2025. This is relatively lower than the historical trend, mainly because of the assumptions regarding enhanced energy efficiency uptake and the effect of the carbon charge. In round terms, this results in new electricity generation capacity of 3355 MW being required over the period as demand growth outstrips available capacity. The modelling suggests that this new capacity will comprise around 890 MW of hydro, 630 MW of geothermal, 635 MW of wind, 350 MW of cogeneration, 800 MW of gas combined cycle (GCC), and 50 MW of distillate. Projected new generation is illustrated in Figure 3.

Although no new coal plant is projected under the Reference scenario, it includes a considerable increase in the amount of coal used to generate electricity at Huntly[4].

The 50 MW of new distillate capacity is for normal peak generation. An additional 155 MW of distillate plant, announced by the Government as reserve for dry year security of supply, has not been included as this is to be ring-fenced from the normal provision of generation. By 2010, the 400 MW New Plymouth plant is expected to be withdrawn from normal generation but some or all of it could be retained as additional reserve. Part of the new capacity projected for 2005-2010 is to replace this plant.

Electricity generation by fuel type for the Reference scenario is shown in Figure 4. Over the Outlook period the rundown/depletion of the large gas fields (e.g. Maui, Pohokura, Kapuni, and Kupe) is expected to reduce the proportion of gas-fired generation from 21% in 2000 to 14% by 2010 and to 7% in 2025. As gas supplies tighten, an initial increase in the use of coal-fired generation from 4% in 2000 to 9% in 2005 is projected. From 2010 to 2020, it is expected to drop back to around 3-4%, followed by a significant increase to 11% in 2025. Hydro generation falls from 65% in 2000 to 56% in 2025. Geothermal is projected to undergo significant expansion over the Outlook period, as it increases from 7% to 15%. Also wind is projected to increase from near zero to 5%. Oil use for electricity generation is projected to remain near zero.

New Zealand's total annual primary energy supply for the Reference scenario (see Figure 5) is projected to grow at 1.1% pa between 2000 and 2025, from around 753 PJ pa to 1002 PJ pa. This growth is dominated by the growth in geothermal energy of 3.5% pa, increasing from 111 PJ in 2000 to 261 PJ in 2025. Much of the growth in geothermal use is,

[4] *Beyond 2015 Huntly will be an old plant, and will likely be refurbished, or replaced, with new coal technology. Alternative scenarios with greater electricity demand growth are considered which require further additional generation capacity including other new coal-fired plant.*

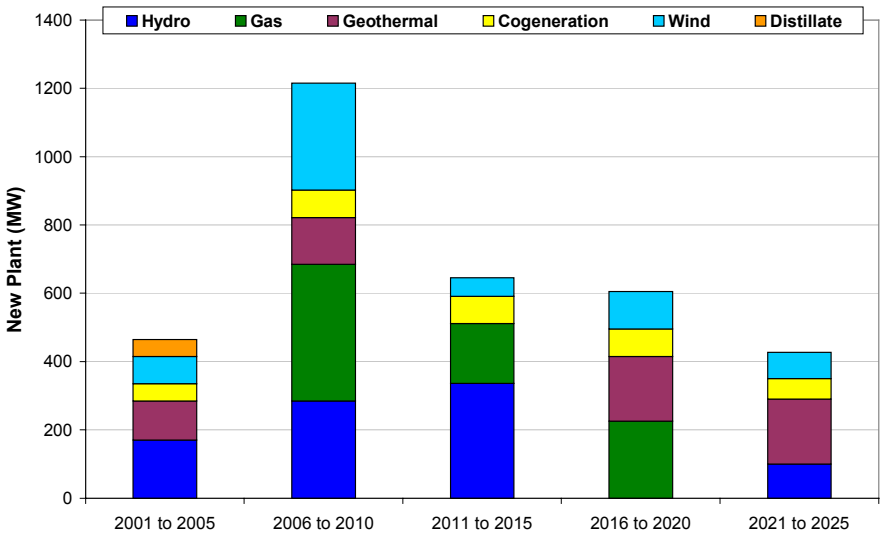


Figure 3: Projected Economic New Power Station Sequence 2005-2025 (Reference Scenario)

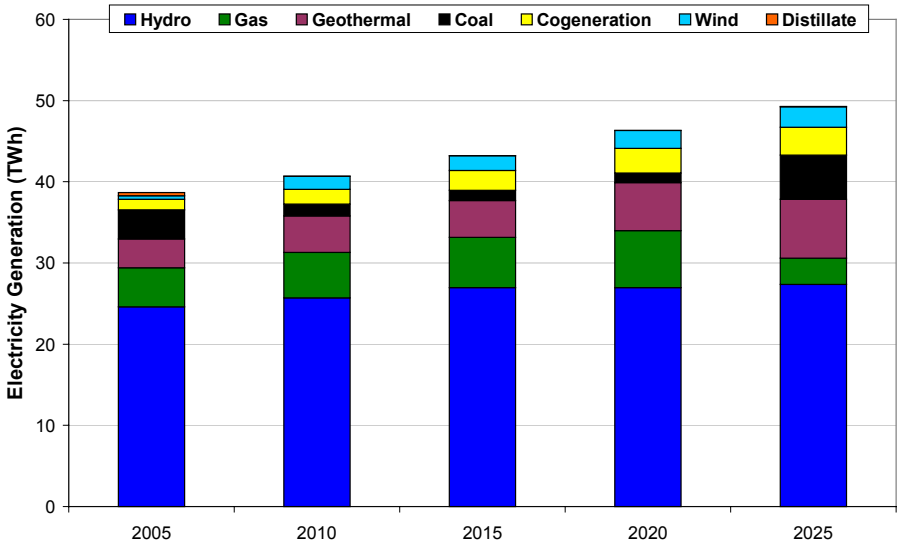


Figure 4: Projected Electricity Generation by Fuel Type 2005-2025 (Reference Scenario)

however, for electricity generation, and in this use it is assumed to have only 10% efficiency. Another key feature is the 17% pa growth in wind, from 0.2 PJ in 2000 to 9.1 PJ in 2025. Oil use, mostly for transport, grows steadily at 1.2% annually. Coal increases by 2.6% pa and gas declines by 1.8% pa on average. The growth in coal occurs in periods when gas supply is relatively constrained. Biomass is also projected to steadily increase at 1.9% annually.

The projected new generation capacity to become available after 2006 (see Figure 3), together with the projected demand, leads to the wholesale electricity price path shown in Figure 6. It climbs from 6.3 c/kWh in 2005 to 7.2 c/kWh in 2020, and then to 8.4 c/kWh in 2025. The main driver of this over the period is the constrained availability of gas. The annual average growth rate in wholesale electricity prices for the period 2005-2025 is 1.4%.

Note that the price path represents the trend over the period, which smoothes over the shorter-term variations. It relates to average prices assuming steady demand growth, mean hydro inflows, no major plant failures, and new plant being commissioned "on time". Furthermore, the path relates to prices for new contracts at the times shown and not prices as influenced by historical contracts. Bands are shown on either side of the price path in Figure 6 to emphasise the likely variability over the short term[5].

[5] *The underlying price path is likely to be smooth. The chart shows a discontinuity at 2020 simply because the electricity sub-sectoral model moves forward in five-yearly steps.*

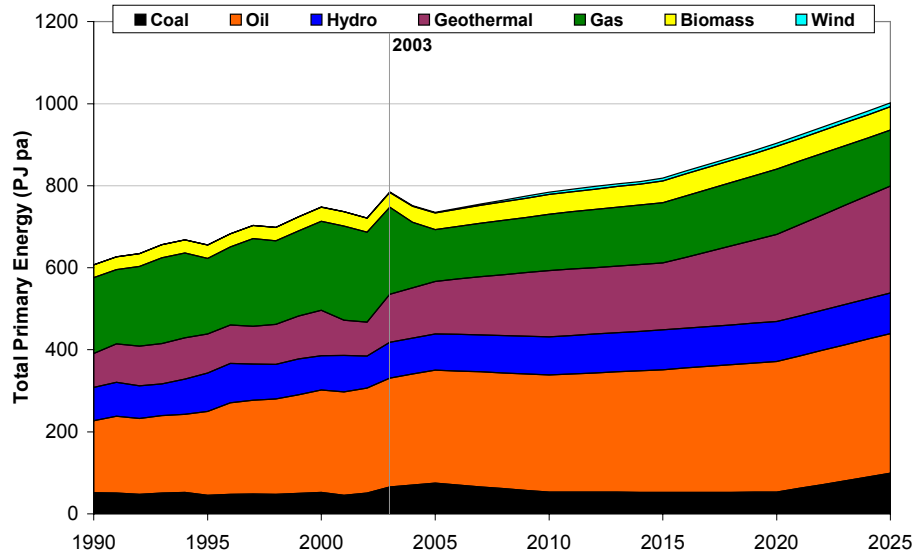
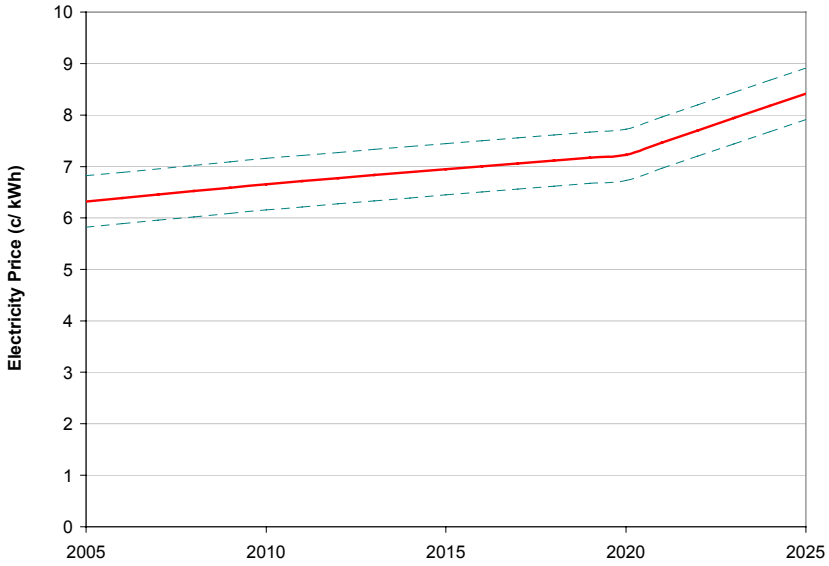


Figure 5: Total Primary Energy Supply 1990-2025 (Reference Scenario)

Figure 6: Wholesale Electricity Prices 2005-2025 (Reference Scenario)

Note: As the price path (solid red line) shows the long term trend and smoothes over shorter-term variations, price bands (dotted lines) are shown to emphasise the likely price variability.



Total carbon dioxide emissions in the Reference scenario are projected to increase by 0.8% pa on average over the Outlook period, with most of the increase coming from oil use in transport and from coal use for electricity generation.

Under the Kyoto Protocol, New Zealand is committed to returning the rate of net greenhouse gas emissions for the period 2008-2012 back to the 1990 rate. The projections indicate that in 2010, which may be taken as representative of the commitment period, gross carbon dioxide emissions will be 16% above the 1990 level. After allowing for absorption of carbon dioxide through new forest plantations, however, the net carbon dioxide emissions are still expected to be below the 1990 level[6].

The additional uptake of renewable consumer energy by 2012 relative to 2000 is about 40 PJ pa in the Reference scenario compared with the target of 30 PJ pa. This is derived from geothermal, hydro, wind and biomass sources, with increased use of biomass in the forestry industry contributing 13-14 PJ of the 40 PJ.

There are some significant differences from the Ministry's 2000 *Energy Outlook*. Notably, projected total consumer energy demand for 2020 is now 11% lower. This stems primarily from the new assumptions regarding enhanced energy efficiency uptake associated with the NEECS and the introduction of a carbon charge. New power plant capacity to the year 2020, however, is projected to be 33% higher. This is associated with assumptions of less gas availability and the carbon charge, which lead to greater reliance on renewable forms of energy for electricity generation - wind, hydro and geothermal. Wind and hydro plants have lower load factors, so more capacity is needed.

[6] *Also other greenhouse gases, such as methane, have to be accounted for in New Zealand's overall emissions inventory.*

Energy Publications

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ENERGY DATA FILE

The New Zealand *Energy Data File* provides comprehensive statistics and supporting information on New Zealand's energy supply, demand and prices, mostly as national aggregates. It includes annual data from 1974, with monthly or quarterly data and energy balances for the more recent years. Oil and gas reserves information is also included.

It is published twice yearly (ISSN 0111-6592): in January, including data up to the preceding September (with detailed electricity statistics for the year ending the preceding March), and in July, including data up to the preceding March (with the detailed electricity statistics of the preceding January edition duplicated). It is also available on-line (single-user licence) including the publication's main tables in Microsoft Excel™ format. The paper version and the online copy are separately available at a price of $50 excluding GST each. Summary information and a list of contents are available free on the website.

For those without Internet access, the paper *Energy Data File* is available with data disks containing the publication's main tables in Microsoft Excel™ format, for a total price of $150 excluding GST.

ENERGY OUTLOOK

The New Zealand *Energy Outlook* publication presents and analyses supply and demand scenarios for New Zealand's energy sector to 2025. A range of scenarios considers the effects of different GDP growth rates and other assumptions related to gas discovery rates, oil prices etc on possible energy outcomes.

Energy Outlooks are published periodically. This latest edition (ISBN 0-478-26329-9) was published in October 2003. It is available in a paper version and in an on-line (single-user licence) version. Each is separately available at a price of $60 excluding GST. Summary information and a list of contents are available free on the website.

ENERGY EMISSIONS

The New Zealand *Energy Greenhouse Gas Emissions* publication provides detailed inventory information on emissions of carbon dioxide, methane, oxides of nitrogen and carbon monoxide from New Zealand's energy sources. Also included are estimates of carbon dioxide emissions from chemical processes used in industry, to provide a full estimate of total national gross emissions of carbon dioxide.

Published annually (ISSN 1173-6771), with a base year of 1990, the latest edition covers the calendar years 1990 to 2002. It is available in a paper version and in an on-line (single-user licence) version. Each is separately available at a price of $50 excluding GST. Summary information and a list of contents are available free on the website.

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