MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

MODELLING AND SECTOR TRENDS

14

2013 CALENDAR YEAR EDITION

Comprehensive information on and analysis of New Zealand's energy supply, demand and prices

Energy in New Zealand

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Important

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Authorship

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Availability

A free electronic version of this publication can be downloaded from: http://www.med.govt.nz/sectors-industries/energy/energy-modelling/publications/energy-in-new-zealand.

Energy in New Zealand 2014 provides annual information on and analysis of New Zealand's energy sector and is part of the suite of publications produced by the Modelling and Sector Trends team of the Ministry of Business, Innovation & Employment (MBIE).

The 2014 edition includes information up to the end of the calendar year 2013.

Full data tables may be downloaded from the *Energy in New Zealand* webpage: http://www.med.govt.nz/sectors-industries/energy/energy-modelling/publications/energy-in-new-zealand-2014

CONTENTS

Facts

ELECTRICITY DEMAND **FELL**

0.6%

IN **2013**

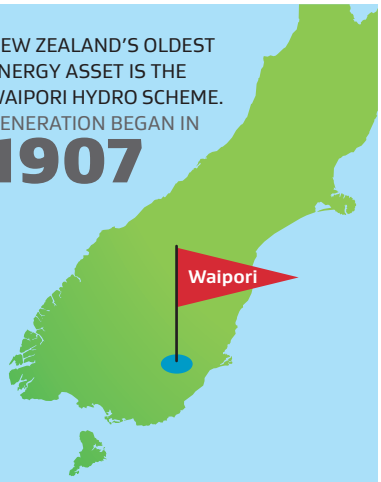
In 2013, renewable sources made up

75%

of electricity generation

NEW ZEALAND'S OLDEST ENERGY ASSET IS THE WAIPORI HYDRO SCHEME. GENERATION BEGAN IN

1907



Gas reserves increased

31%

Taxes on petrol are the

5th

lowest

in the OECD

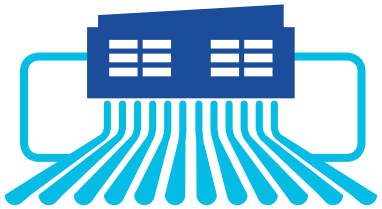
New Zealand produced

35,500

barrels of oil

per day

during 2013



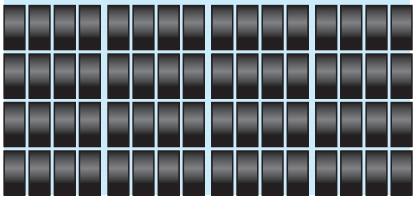
Geothermal electricity generation hit a record

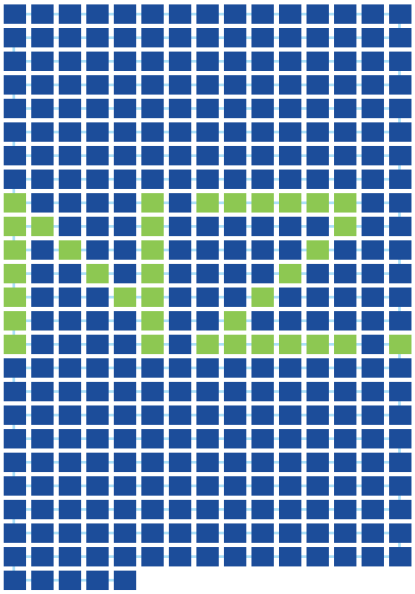
6,053 GWh

Solar PV generated

7

GWh





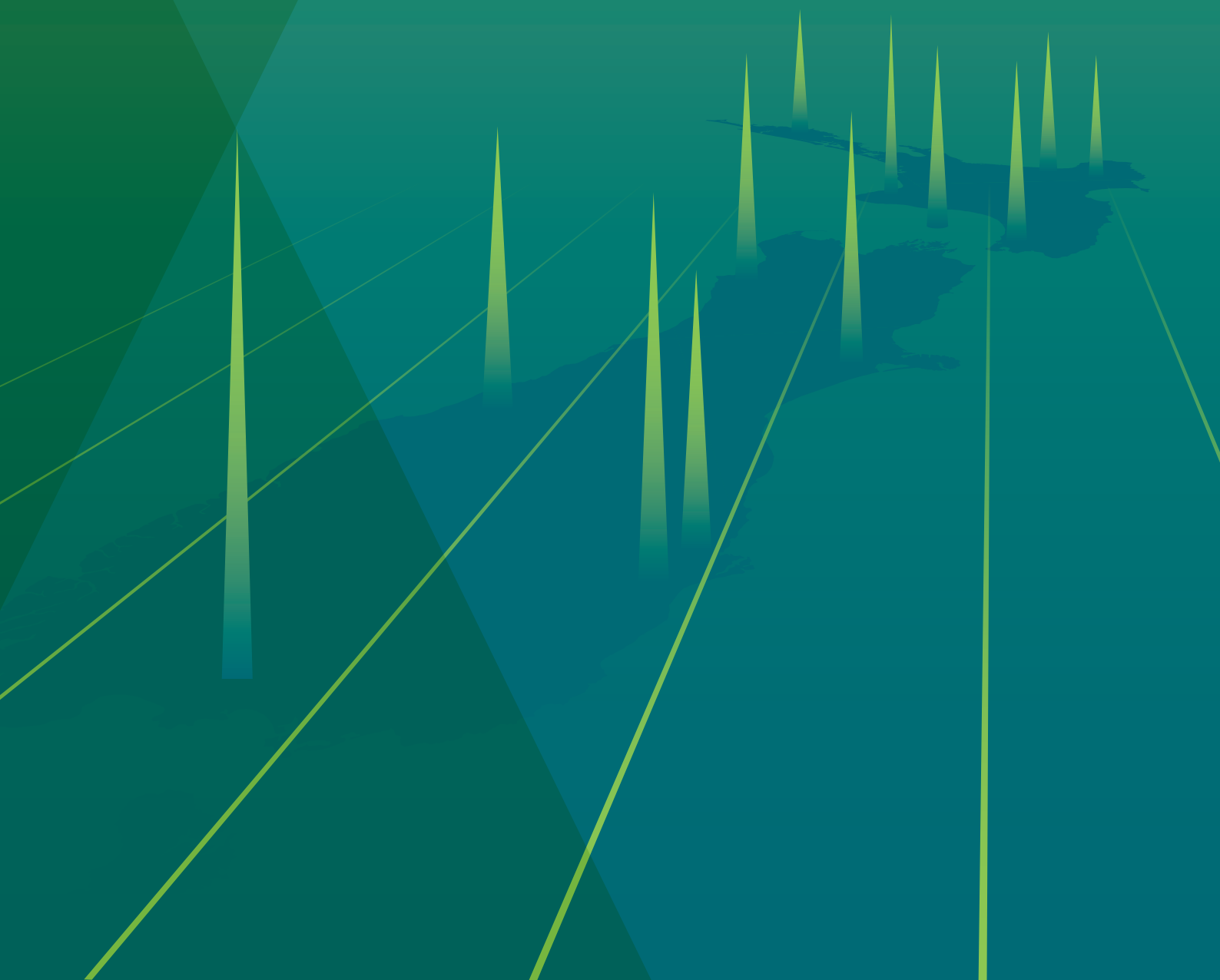
NEW ZEALAND CONSUMED 52,100 BARRELS OF DIESEL PER DAY

New Zealand's annual primary energy supply would supply the U.K. for over 36 days

A. ENERGY OVERVIEW

INTRODUCTION

This section presents an overview of New Zealand's key energy statistics, primary energy supply, energy transformation and energy consumption. It draws on information presented in the Energy Balances section and the other sections. In the second half of this section, we present energy sector performance indicators.



Energy overview

Primary Energy Supply

Total primary energy supply (TPES) is the total amount of energy supplied for use in New Zealand. This is calculated as domestic production plus imports, less exports and energy used for international transport. Figure A.1 shows New Zealand's TPES by fuel since 1974. In 2013, renewable energy made up 38.2% of New Zealand's TPES. This level of contribution from renewable energy was slightly up on last year's value of 37.5%. The latest international comparison shows that New Zealand has the third highest contribution of renewable energy to TPES in the Organisation for Economic Cooperation and Development (OECD) (behind Iceland and Norway).[1]

The rapid increase in renewable energy's share of TPES in the last few years has been driven by increased electricity generation from geothermal energy and reduced electricity generation from coal. As geothermal fluid is much lower in temperature than steam produced by a coal or gas boiler, the transformation efficiency of geothermal energy is significantly lower. The low transformation efficiency of geothermal energy (approximately 15%) contributes to New Zealand's relatively high renewable TPES compared with most other countries.

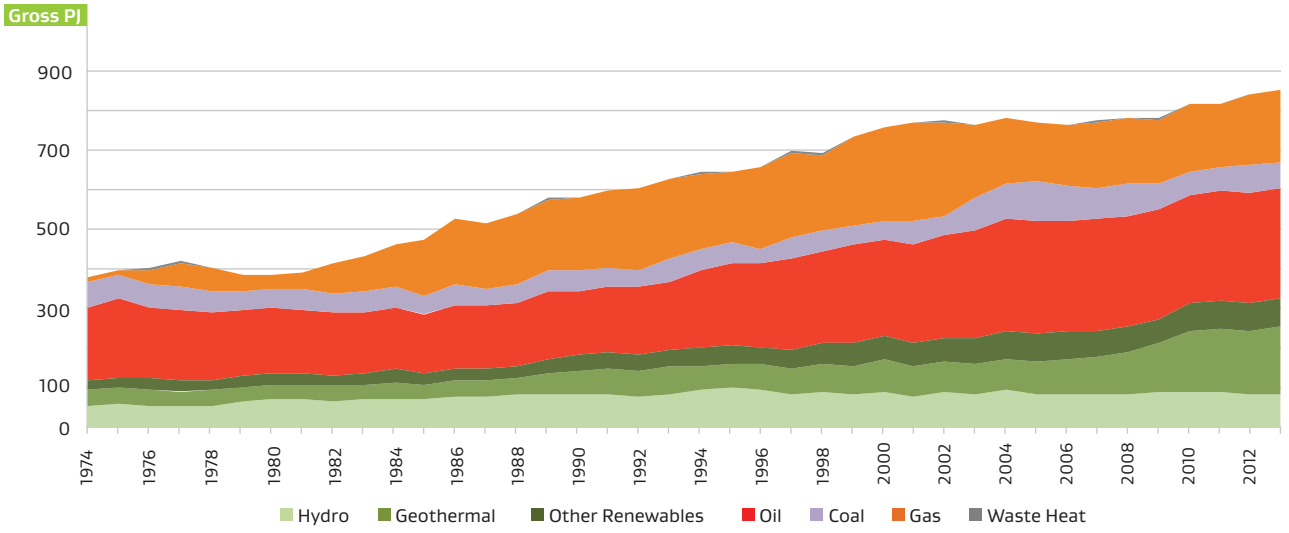
Although geothermal energy's share has increased rapidly over the last five years, oil continues to dominate New Zealand's TPES. In 2013, oil accounted for 33%, gas for 22% and geothermal energy for 20%. TPES was up by 1.4% in 2013 and has increased by an average of 1.8% per annum since 2008.

Energy Transformation

Energy transformation refers to the conversion of primary energy (see above) to more useful forms of energy. It includes activities such as electricity generation, oil refining and other transformation (including coal used for steel manufacturing) as well as losses. By convention, energy recorded as an input to energy transformation is recorded as negative; energy output from energy transformation is recorded as positive (e.g. gas used for generating electricity is negative; the electricity generated from gas is positive). For more analysis of oil refining and electricity generation, please read the oil and gas section and the electricity section.

Figure A.2 shows the total energy transformation by fuel from 1990 to 2013. This figure highlights the growth in renewables, mainly because of increased geothermal electricity generation over the last five years. Oil energy transformation is very small because very little oil is lost in the process of oil refining. Total energy transformation is a negative value, and has become more negative over the period shown, especially since the strong uptake of geothermal electricity generation since 2008. In 2013, total energy transformation was -250 PJ. Since 2008, total energy transformation has grown by an average of 3.2% per year.

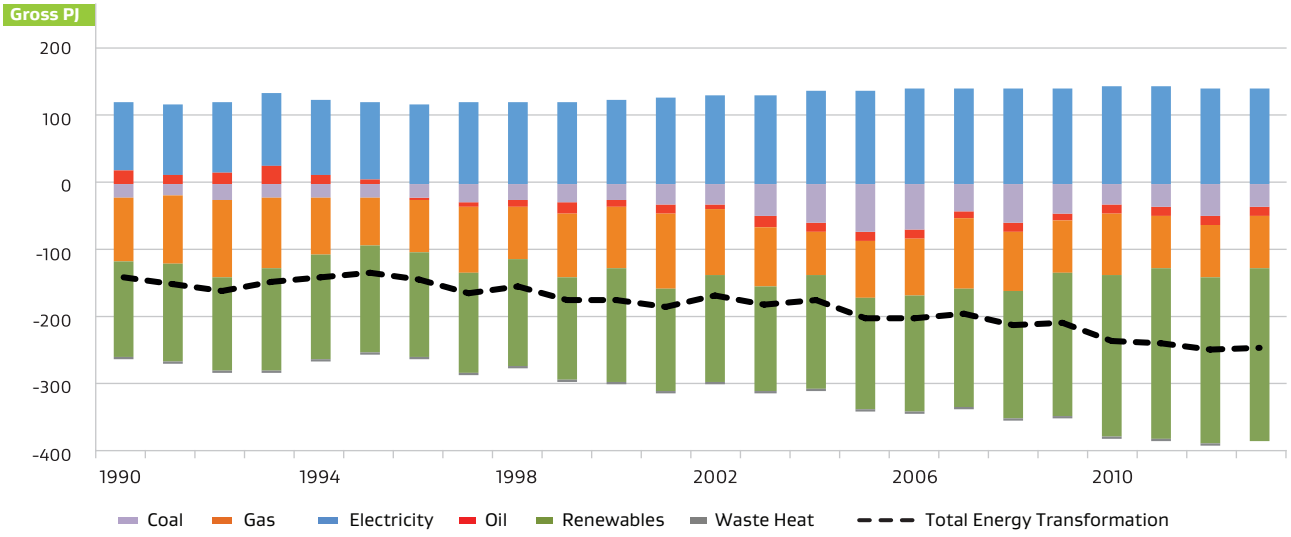
Figure A.1: Total Primary Energy Supply by Fuel



1. International Energy Agency, Renewables Information 2014. The most recent year for which data were available was 2012.

Energy overview

Figure A.2: Energy Transformation by Fuel



Energy Consumption

Consumer Energy Demand

Consumer energy demand (or total consumer energy) includes all energy used by final consumers. It does not include energy used for transformation, or non-energy use. Consumer energy demand in 2013 rose by 1.1% to 544 PJ. The following figures show the time series of consumer energy demand by fuel (Figure A.3a) and by sector (Figure A.3b). The rise in consumer energy demand in 2013 was a result of growth in the transport sector (up 0.2%) and the industrial sector (up 4.0%), balanced by drops in the agriculture, forestry and fishing sector (down 2.1%); the commercial and public services sector (unchanged) and the residential sector (down 2.2%).

Oil (46%) and electricity (25%) made up the bulk of consumer energy demand in 2013, with the other fuels making up the balance (see Figure A.3c). The transport (37%) and industrial (36%) sectors consumed the bulk of consumer energy in 2013 (see Figure A.3d). Neither the split by fuel nor the split by sector was significantly different to 2012.

Non-Energy Use

Non-energy use refers to use of fuels to produce non-energy products. Non-energy products are products where neither the raw energy source used to produce the product nor the product itself is combusted.

Non-energy use in New Zealand consists mostly of natural gas (conversion of natural gas to methanol or urea) with the remainder being oil (e.g. bitumen for roads) . In 2013, total non-energy use was 51.8 PJ, 12.1 PJ of which was from oil and 39.7 PJ was from natural gas. Figure A.3e shows a time series of non-energy

Figure A.3a: Consumer Energy Demand by Fuel

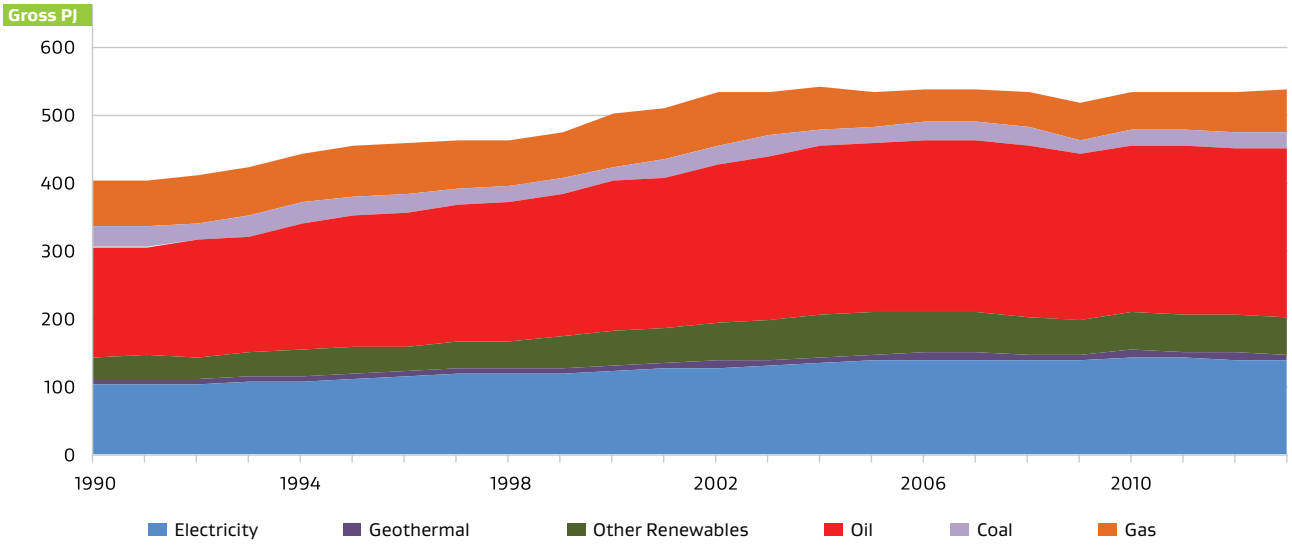
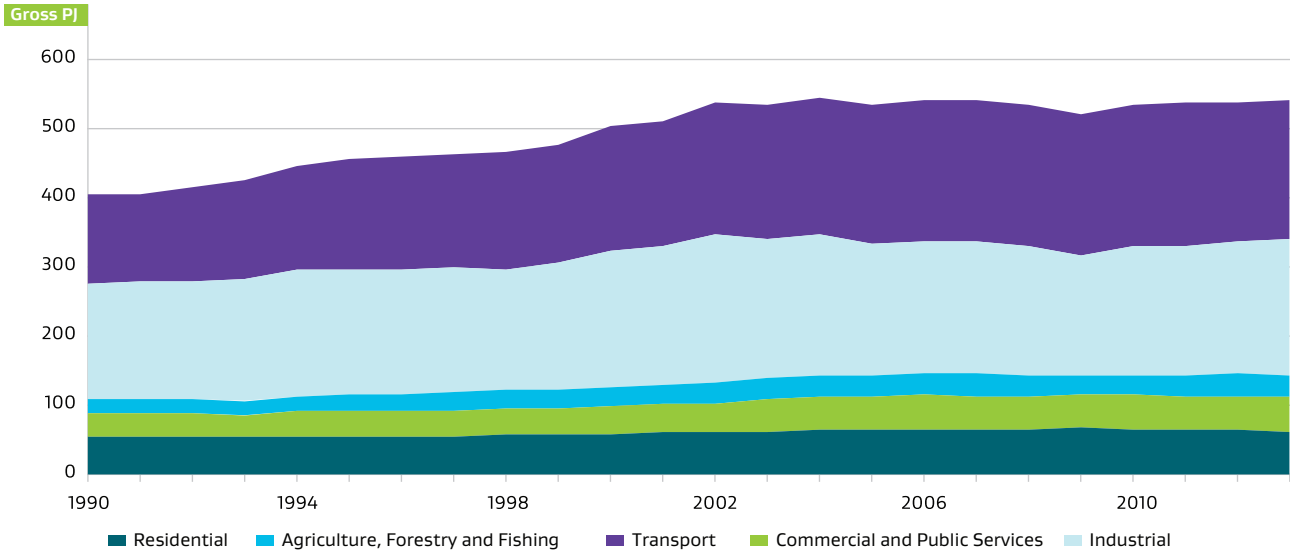


Figure A.3b: Consumer Energy Demand by Sector



use by fuel since 1990. Non-energy use of gas peaked in 2000 when the Maui gas field was producing strongly.

Non-energy use of natural gas was up by 25% in 2013, mostly due to an increase in methanol production, which uses natural gas as a feedstock. Methanex NZ's second methanol production train at Motunui was restarted in mid-2012 and their mothballed Waitara Valley plant was restarted in October 2013.

Although methanol can be combusted for energy purposes, the methanol produced in New Zealand is mainly exported for use as a chemical feedstock (e.g. to make plastic). Gas combusted during the production of petrochemicals such as methanol, urea and ammonia is included as industrial sector demand within total consumer energy. Only gas used as a feedstock (and therefore not combusted) in petrochemical production is classified as a non-energy use.

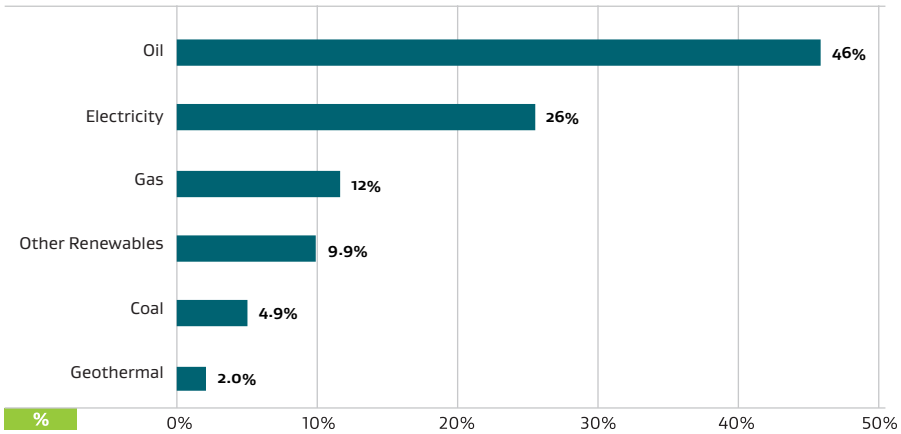
Energy Sector Performance Indicators

Energy sector performance indicators show how well New Zealand's energy sector is performing on a variety of aspects. These include energy intensity, emissions intensity, energy self-sufficiency and household energy affordability indicators.

Energy Intensity

Energy intensity is a measure of the energy used (in MJ) per unit of gross domestic product (GDP, in real 1995/96 New Zealand dollars). It is influenced by the composition of industry within the economy, improvements in energy efficiency and changes in behaviour. For a more detailed analysis of the drivers

Figure A.3c: Consumer Energy Demand Share by Fuel in 2013



Energy overview

Figure A.3d: Consumer Energy Demand Share by Sector in 2013

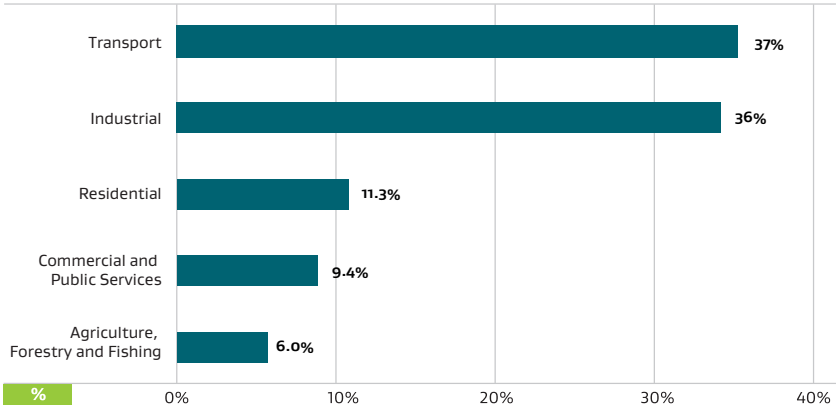
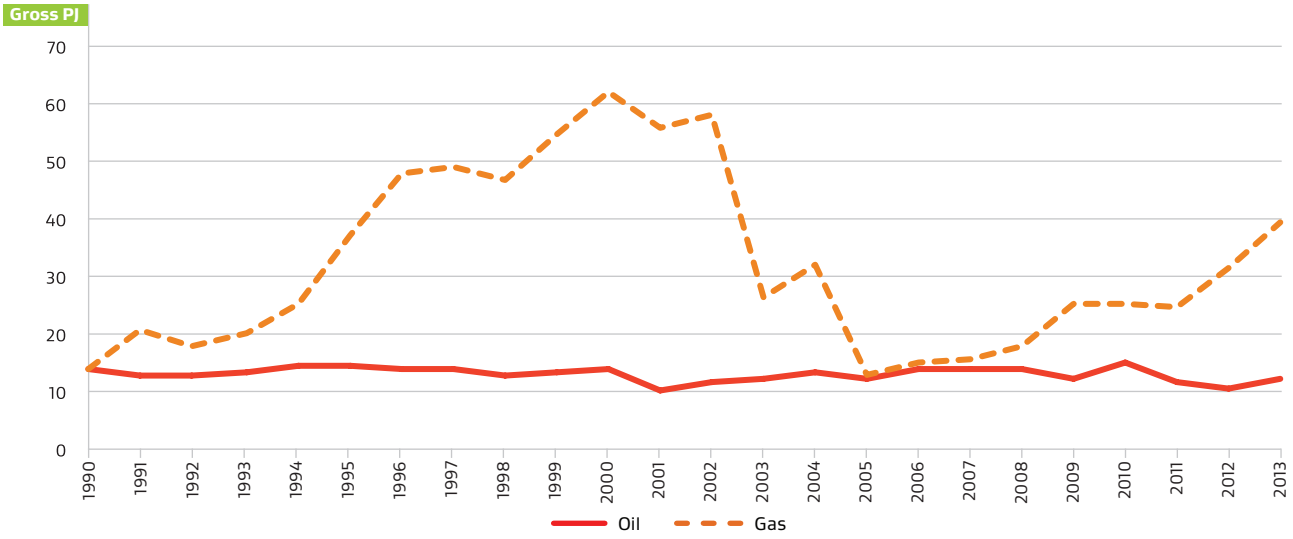


Figure A.3e: Non-Energy Use by Fuel



of energy use in New Zealand, readers are encouraged to read the report *Changes in Energy Use — New Zealand, 1990–2011.*[2]

Energy Intensity by Industry

The overall energy intensity of the economy improved by 1.8 percent from 2012 to 2013, to 3.6 MJ per (1995/96) dollar. Since 1990, the overall energy intensity of the economy has improved in real terms by an average rate of 1.4% per annum. The most significant factor in this almost 27% improvement in energy intensity has been the rapid growth of the commercial sector (low energy intensity) relative to the industrial sector (high energy intensity). Figure A.4a shows the real GDP by sector in 1990 and 2013, which shows that the commercial sector's GDP (excluding transport) has doubled since 1990.

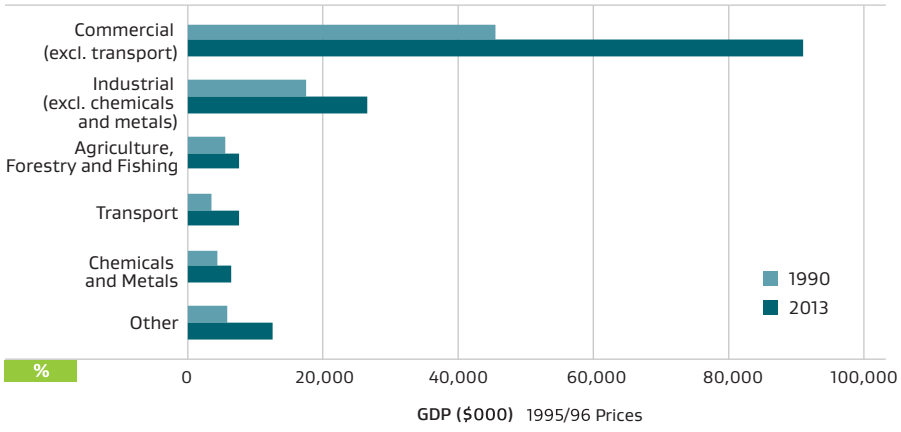
Figure A.4b shows a time series of the energy intensity of industries within the New Zealand economy. In this chart, the dashed lines refer to individual industries, whereas the solid blue line is the average energy intensity of New Zealand. The individual industries within the New Zealand economy all showed improvements in energy intensity since 1990. The agriculture, forestry and fishing sector's energy intensity has been relatively flat but has been quite variable since 1990. The variability of the energy intensity is largely seen in the GDP data, and is related to agricultural production volatility. The commercial sector is the least energy intensive sector at 0.6 MJ per dollar in 2013; this has improved steadily at a rate of 1.3% per annum since 1990. The energy intensity of the industrial sector (including chemical and metals manufacturing) has improved at an average rate of 1.0% per annum since 1990. It was relatively flat until 2002, when Methanex NZ's Waitara Valley methanol production facility was mothballed. Industrial energy intensity increased slightly from 2009 to 2011, but has since been declining. Factors affecting industrial energy use in 2013 included:

- Upward pressure from Methanex NZ restarting their methanol production train at Motunui and their Waitara Valley plant.
- Steady production at the Tiwai Point aluminium smelter.
- A drop in production in the wood, pulp and paper manufacturing sector.

Emissions Intensity

The production, supply and consumption of energy have a variety of impacts on the environment. In particular, the pressure on the global climate from the increasing concentration of greenhouse gases in the Earth's atmosphere is an important factor to monitor. This section compares how the New Zealand energy sector's greenhouse gas emissions compare

Figure A.4a: New Zealand GDP (Real 95/96 Prices) by Sector in 1990 and 2013*

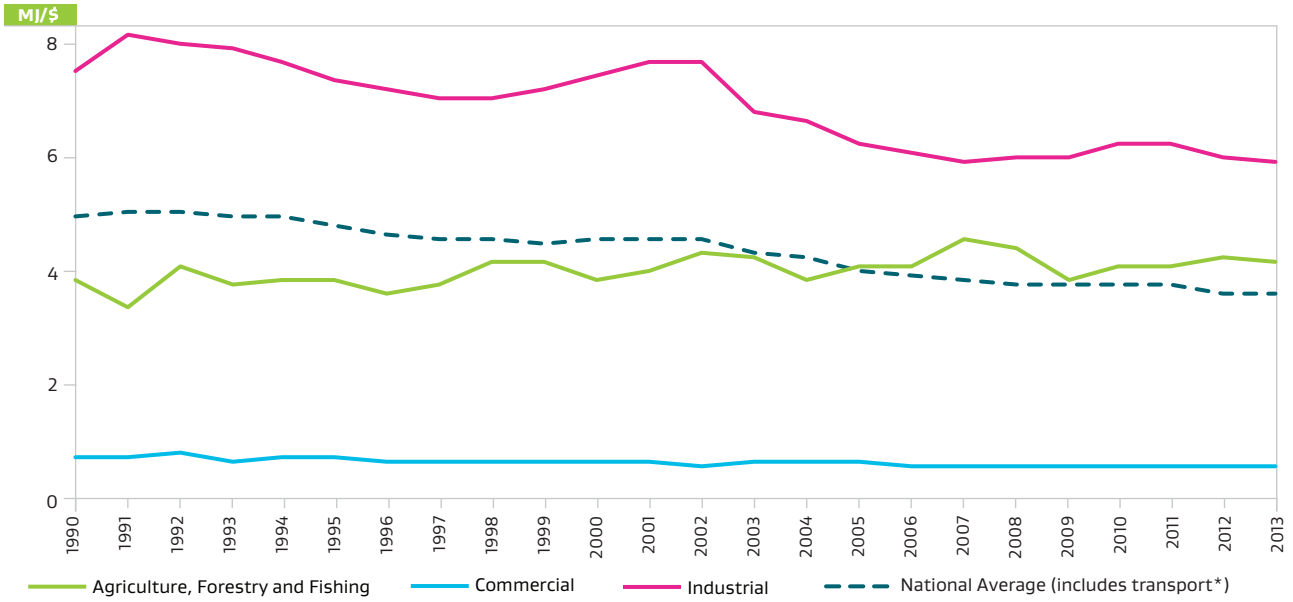


* Data from Statistics New Zealand. Table reference SND012AA.

2. http://www.med.govt.nz/sectors-industries/energy/energy-modelling/publications/changes-in-energy-use

Energy overview

Figure A.4b: Energy Intensity of New Zealand Industries



* Transport is included in the national average because transport supports the entire economy.

with some other Annex 1 countries[3] in terms of emissions intensity (carbon dioxide equivalent (CO_2-e) emissions per capita). Greenhouse gas emissions data (and population) figures for this section were sourced from the United Nations Framework Convention on Climate Change.[4] European Union (15) population figures were sourced from Eurostat,[5] and Demographia.[6] The latest greenhouse gas data that were available were for the 2012 calendar year.

Overall Greenhouse Gas Emissions Intensity for the Energy Sector

Energy sector emissions in New Zealand generally account for almost half of New Zealand's total greenhouse gas emissions, with most of the remainder coming from the agricultural sector.

Figure A.5a shows the total greenhouse gas emissions per capita for the energy sector for a selection of Annex 1 countries. New Zealand sits at the bottom of this selection due to its low-carbon electricity system. In 2012, the New Zealand energy sector's greenhouse gas emissions per capita were 2.4% higher than in 1990. New Zealand's per capita emissions in 2000 and 2005 were higher due to strong growth in the transport sector, and electricity sector, driven by strong economic and population growth throughout the 2000s.

The United States of America (USA) has reduced per capita emissions by 16.7% since 1990, whereas per capita emissions in Australia have grown by 8.5% over the same period. The European Union (15) has per capita emissions 19% lower than in 1990. Japan's per capita emissions have grown by 9.5% from 1990 levels.

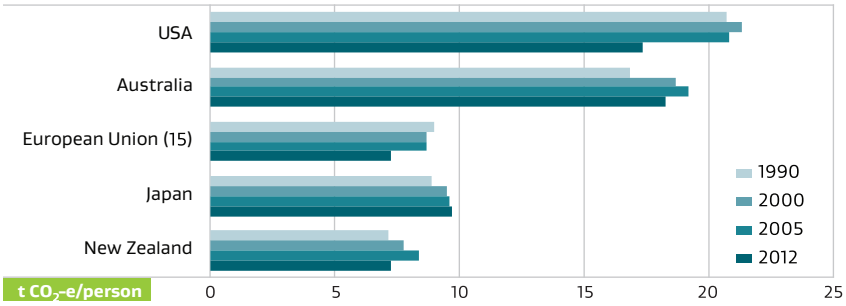
Figure A.5a: Energy Sector Greenhouse Gas Emissions per Capita for Selected Annex 1 Countries

Electricity Generation and Transport Emissions Intensity

The majority of energy sector greenhouse gas emissions for most countries are made up of electricity generation and transport emissions. This section compares a selection of countries from Figure A.5a for electricity generation emissions and transport emissions.

Figure A.5b shows the electricity generation emissions per capita of Annex 1 countries. New Zealand has very low electricity generation emissions per capita due to the high proportion of low carbon generation technologies (such as hydro, geothermal and wind generation). New Zealand's share of

Figure A.5a: Energy Sector Greenhouse Gas Emissions per Capita for Selected Annex 1 Countries



3. Annex 1 countries are developed nations that are Parties to the United Nations Framework Convention on Climate Change (UNFCCC). These countries generally have the highest quality greenhouse gas emissions statistics because of their reporting obligations as parties to the UNFCCC.

4. http://unfccc.int/di/FlexibleQueries/Event.do?event=selectPageItem

5. http://epp.eurostat.ec.europa.eu/portal/page/portal/population/data/main_tables

6. http://www.demographia.com/db-eu-pop.htm

electricity generation from renewable energy sources rates consistently in the top three nations in the OECD (behind Iceland and Norway).[7] This figure also highlights the difference between countries with fossil fuel-dominated electricity systems (such as the USA and Australia) and countries with a high proportion of nuclear energy in their electricity systems (such as the European Union (15) and Japan).

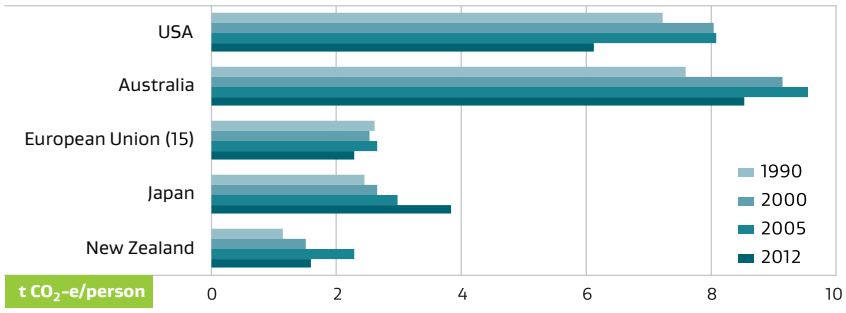
Figure A.5c shows the transport sector emissions per capita for Annex 1 countries. New Zealand sits about the middle of the pack for transport emissions per capita. New Zealand has the second highest private car ownership rate in the OECD at 604 cars per thousand people in 2013.[8] It is second only to the USA on this statistic. New Zealand also has a relatively old private vehicle fleet: the average age of the light vehicle fleet was 13.2 years in 2012, compared with 11.4 years for the USA and 10.0 years for Australia.[8] Additionally, freight transport in New Zealand has moved away from rail and coastal shipping, and is now predominantly moved by road truck,[9] which is a more energy (and emissions) intensive mode. The growth in New Zealand's transport emissions per capita since 1990 is related to changes in way freight is moved (as previously mentioned) and the influx of inexpensive Japanese SUVs into the New Zealand market in the mid-to late 1990s.

Energy Self-Sufficiency

Energy self-sufficiency is the ratio of indigenous production of energy to TPES. It is a measure of a country's ability to meet its own energy supply requirements (which includes non-energy uses such as natural gas used as a feedstock to manufacture methanol). A self-sufficiency value of 100% would indicate that New Zealand produces all the energy it needs, whereas values above or below 100% indicate that New Zealand is a net exporter or importer of energy (respectively). New Zealand meets all of its gas, renewables and waste heat supply needs by indigenous production.

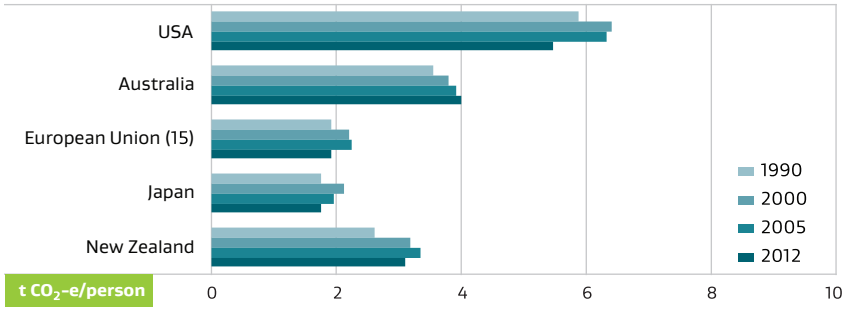
Figure A.6 shows a time series of New Zealand's energy self-sufficiency. Overall, New Zealand's total energy self-sufficiency was 83% in 2013. This series peaked in 2010 at 91% due to a combination of historically high oil, gas and coal production. The minimum self-sufficiency occurred in 2005 at 74%.

Figure A.5b: Electricity Generation Greenhouse Gas Emissions per Capita for Selected Annex 1 Countries*



* The UNFCCC carbon accounting rules do not count fugitive emissions from geothermal electricity generation in electricity emissions. However, for the purposes of this analysis, these are included in Figure A.5b for New Zealand due to its high proportion of geothermal electricity generation.

Figure A.5c: Transport Greenhouse Gas Emissions per Capita for Selected Annex 1 Countries



7. IEA Renewables Information 2012.

8. Ministry of Transport Vehicle Fleet Statistics, 2012 (http://www.transport.govt.nz/research/newzealandvehiclefleetstatistics/).

9. MBIE, *Changes in Energy Use – New Zealand, 1990–2011* (http://www.med.govt.nz/sectors-industries/energy/energy-modelling/publications/changes-in-energy-use).

Energy overview

New Zealand is a net exporter of coal. Premium quality coking coal is exported from the West Coast of the South Island and is mostly used for steel manufacturing in Asia. New Zealand is also a net exporter of liquid petroleum gas (LPG) (except during the period 2006–09). Self-sufficiency for LPG peaked in 1999 when the Maui field was producing strongly.

New Zealand is a net importer of oil, although this series should be interpreted with care because almost all domestically produced New Zealand oil is exported. This is because New Zealand crude oil is very high quality (low density and sulphur content) and fetches a premium price on the international market. Cheaper foreign oil is imported to refine at the Marsden Point refinery. Oil self-sufficiency peaked in 1997 at 53%. This was due to a peak in production at the Maui oil (and gas) field. Since then, self-sufficiency fell until 2007, when the Tui and Pohokura fields started producing.

Household Energy Affordability Indicator

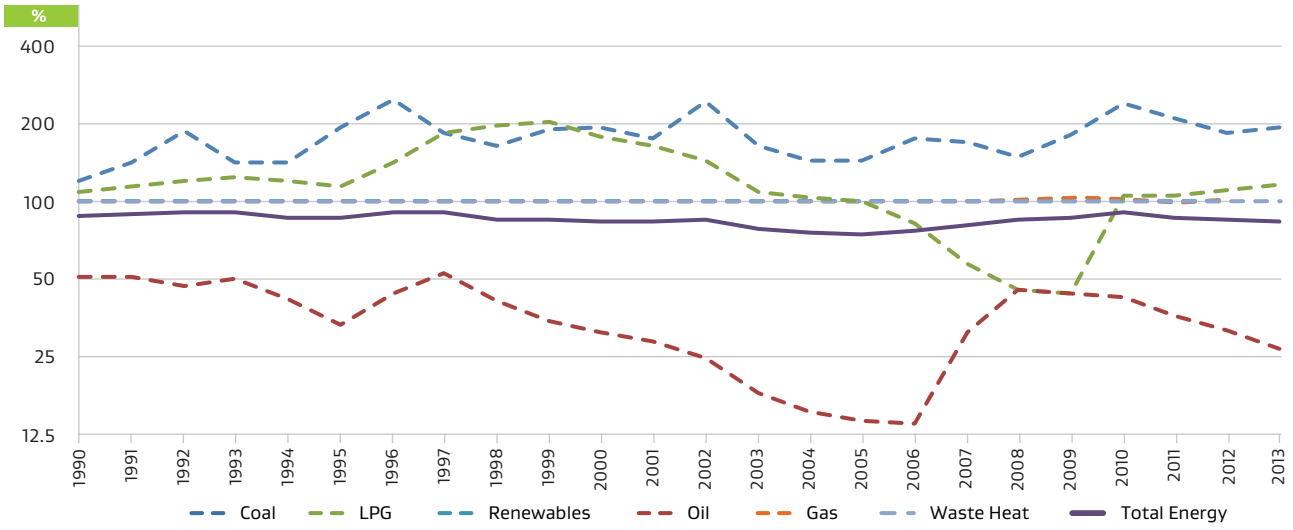
The household energy affordability indicator is an important indicator for interpreting whether or not energy has become more or less affordable over time. The household energy affordability indicator is calculated by multiplying the energy price by a representative quantity of energy, and dividing this by average income. A higher indicator implies worse affordability. Technical notes on the construction of this indicator are included at the end of this chapter. It should be noted that this indicator is not a direct measure of energy affordability because it ignores the movements in the relative prices of other goods and services that people may purchase.

Household Energy Affordability Indicator by Fuel

The household energy affordability indicators for regular petrol, diesel, natural gas and electricity are shown in Figure A.7a. This figure shows that energy prices have increased more than the national average income over the last 13 years.

The difference in level between regular petrol and diesel is almost solely due to the higher level of excise duty on petrol; this difference should be treated with care, because diesel vehicles are subject to road user charges (RUCs) in New Zealand. RUCs are charged on a per kilometre basis and if an estimate of these were included in the diesel price,

Figure A.6: Energy Self-sufficiency for New Zealand by Fuel



these two series would converge. Also of note is the high level of variability in the petrol and diesel series. This is due to the variability in the international oil price over the period shown. The household energy affordability indicators for petrol and diesel peaked in mid-2008, when the international price of oil peaked at almost US$150 per barrel.

The household natural gas and electricity affordability indicators are much smoother than the petrol and diesel indicators, with the electricity series being smoother than the gas series. The residential natural gas price peaked in 2008 after a strong period of growth (2003–2008) and has yet to reach that level again. The strong growth in the gas price was due to tightening of the supply–demand balance and the expiry of some historical gas contracts. In comparison, the electricity price grew fairly smoothly.

Technical Notes on the Household Energy Affordability Indicator

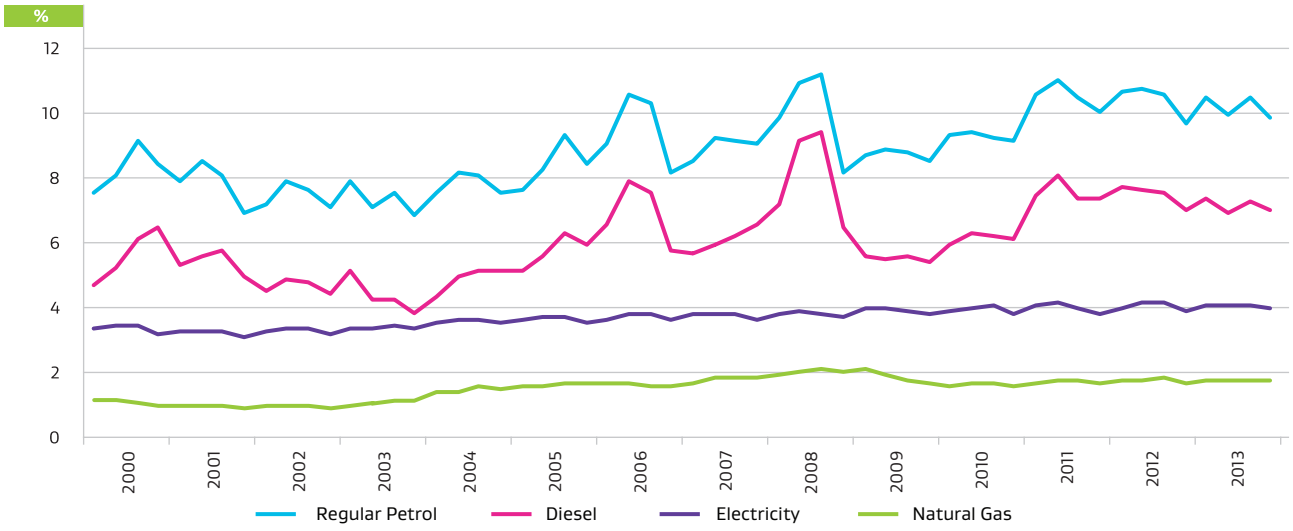
The weekly cost of purchasing energy depends on the price, and the quantity of the fuel purchased. This will vary greatly from region to region, and person to person, depending on their circumstances. Therefore, representative quantities of the fuels used in this analysis are shown in the table below:

Income data for these purposes are sourced from Statistics New Zealand's Linked Employer–Employee Dataset, which are released quarterly at a regional council level. Because the Linked Employer–Employee Dataset data are released about 18 months behind real time, the most recent four periods of data are estimated using a statistical error correction model. In this model, Statistics New Zealand's Quarterly Employment and Earnings Survey was used as an explanatory variable.

Table A.1: Assumptions Used in the Household Energy Affordability Indicator

Fuel Type	Assumed Weekly Quantity	Comment
Regular Petrol and Diesel	50 litres	Approximate capacity of the fuel tank of a medium-sized car
Natural Gas	134 kWh	Average annual gas consumption per installation control point (ICP) since 2007, divided by 52
Electricity	154 kWh	8,000 kWh divided by 52. The average household consumption of electricity in New Zealand has been about 8,000 kWh for many years.

Figure A.7: Household Energy Affordability Indicator by Fuel



B. ENERGY BALANCES

INTRODUCTION

This section presents annual energy supply and demand balance tables for New Zealand. Energy balances using gross caloric values (GCV) are presented in petajoules (PJ) for 2013 (Table B.2). The energy balances focus on commercial energy – energy forms that are typically produced and sold as a fuel. There are not enough reliable data to include other forms of energy, such as passive solar heating. The entry "0.00" in an energy balance table indicates that the figure is less than 0.005 PJ but greater than 0 PJ, with 0 PJ indicated by a blank entry (this includes cases where no reliable data are available).

Energy balances

Supply

Total primary energy is the amount of energy available for use in New Zealand. Much of it is converted into other forms of energy before it is used. By convention, fuel used for international transport is excluded from total primary energy. Indigenous gas production is given after any gas is flared or reinjected, and any LPG extracted. The primary energy figures presented are actual data, except for some that go into electricity generation as detailed under energy transformation.

Energy transformation includes generation of electricity (including cogeneration), oil production (including refinery operations and the manufacture of synthetic fuel from natural gas – Methanex ceased methanol to petrol production in April 1999) and other transformation, primarily steel production.

In the Energy Transformation section of the balance tables, "energy in" is shown as negative values and "energy out" as positive values in the appropriate fuel columns. Transformation of energy from one form to another always results in conversion losses, particularly in thermal electricity generation, as much energy is lost as heat.

Transformation losses in electricity generation are derived from the net electricity generated, with the actual fuel input being used where available and the conversion factors shown in Table B.1 used otherwise. Fuel input to biogas, hydro, wind and waste heat are fully estimated. Quarterly figures for electricity generation are made up of actual data from major generators and the Electricity Authority. Estimates are made where actual data are unavailable at the time of publishing.

Liquid biofuel production (bioethanol and biodiesel) appears as renewable energy supply in the energy balance tables. As bioethanol and biodiesel are generally blended with motor petrol and diesel before consumption,[1] liquid biofuel also appears in Energy Transformation under Oil Production.

Losses and own use in the energy balances include losses before and after transformation, losses and own use in production, transmission and distribution losses, electricity industry own use free of charge, and oil industry losses and own use (which includes distribution tankage losses, stocks, accounts adjustment and own consumption). Transformation losses are excluded.

Non-energy use is primary thermal energy used for purposes other than combustion, e.g. bitumen for roads, and natural gas used as feedstock for the production of methanol and ammonia/urea.

Demand

Consumer energy is the amount of energy consumed by final users. It excludes energy used or lost in the process of transforming energy into other forms and in bringing the energy to the final consumers. For example, natural gas is a primary energy source (see Total Primary Energy Supply), some of which is transformed into electricity, of which some is lost in transmission to consumers.

Consumer energy statistics can be either calculated from supply-side data or observed from usage data.

Consumer energy (calculated) forms the top half of the energy balance tables and is calculated as TPES less energy transformation less non-energy use.

Consumer energy (observed) forms the bottom half of the energy balance tables and it represents reported demand in the agriculture, forestry and fishing; industrial; commercial; transport and residential sectors. With the exception of domestic/national use of energy for on-road, rail, sea and air transport in the transport sector, these sectors follow the Australia New Zealand Standard Industrial Classification 2006 definitions.

Annual figures presented for consumer energy (observed) are actual data except for thermal fuels used for cogeneration in the industrial and commercial sectors and biogas, wastes and wood. Estimates of on-site cogeneration demand are included in electricity end use.

Where the energy use is not available or confidential, the "unallocated" category is used.

International transport includes international sea and air transport. It excludes coastal shipping, national air transport and all land transport.

Statistical differences shows the difference between "consumer energy (calculated)" and "consumer energy (observed)". This difference is shown at the bottom of the energy balance tables.

Table B.1: Default Electrical Transformation Factors*

Fuel	Default Efficiency
Biogas	30%
Coal	30%
Gas (Single Cycle)†	30%
Geothermal#	15%
Hydro	100%
Oil	30%
Waste Heat	15%
Wind	100%
Wood	25%

* Default efficiencies are only used where real data is unavailable.

† For combined cycle plants, the assumed efficiency is 55%. Currently, however, actual fuel input data are collected for all combined cycle plants.

Geothermal is predominantly based on real plant steam data and uses a 15% efficiency where these are unavailable.

1. A very small amount of liquid biofuel is consumed unblended. However, insufficient data are available on the use of unblended liquid biofuel to include in this publication.

Energy balances

Table B.2: Energy Supply and Demand Balance, Calendar Year 2013

	Converted into PJ using Gross Calorific Values	COAL			OIL							
		Bituminous & Sub-bituminous	Lignite	Total	Crudes/ Feedstocks/ Natural Gas Liquids	LPG	Petrol	Diesel	Fuel Oil	Aviation Fuel/ Kerosene	Others	Total
SUPPLY	Indigenous Production	114.72	4.44	119.16	75.06	8.72						83.78
	+ Imports	11.72	0.00	11.72	243.04	0.09	52.59	29.39	–	3.79	7.17	336.07
	- Exports	66.23	–	66.23	66.81	1.41	–	–	9.72	–	–	77.94
	- Stock Change	3.23	-0.07	3.16	7.57	-0.12	6.36	-1.53	-0.35	-0.67	-0.41	10.85
	- International Transport						0.03	1.66	11.47	37.76	–	50.92
	TOTAL PRIMARY ENERGY	**56.97**	**4.51**	**61.48**	**243.73**	**7.52**	**46.19**	**29.26**	**-20.85**	**-33.29**	**7.58**	**280.14**
	ENERGY TRANSFORMATION	**-37.11**	**-0.23**	**-37.34**	**-241.79**	**0.01**	**62.67**	**88.10**	**29.14**	**45.10**	**4.57**	**-12.20**
	Electricity Generation	-17.56	–	-17.56				-0.03	–			-0.03
	Cogeneration	-7.77	-0.23	-8.00								
	Oil Production				-241.68		62.96	88.42	27.96	44.97	11.49	-5.87
	Other Transformation	-11.55	–	-11.55								
	Losses and Own Use	-0.23	–	-0.23	-0.11	0.01	-0.29	-0.28	1.18	0.12	-6.92	-6.29
Non-energy Use											**-12.15**	**-12.15**
CONSUMER ENERGY (calculated)		**19.87**	**4.28**	**24.15**	**1.94**	**7.53**	**108.86**	**117.36**	**8.29**	**11.81**	**–**	**255.79**
DEMAND	**Agriculture, Forestry and Fishing**	**3.55**	**0.02**	**3.57**		**0.06**	**1.52**	**15.38**	**1.99**	**–**		**18.95**
	Agriculture	3.55	0.02	3.57		0.06	1.38	10.97	–	–		12.42
	Forestry and Logging	–	–	–			0.00	2.77	–	–		2.77
	Fishing	–	–	–			0.13	1.64	1.99	–		3.76
	Industrial	**17.65**	**3.76**	**21.42**		**3.03**	**0.11**	**14.79**	**1.59**	**–**		**19.52**
	Mining	–	–	–			0.01	5.02	0.01	–		5.04
	Food Processing	9.00	3.74	12.74			–	–	–	–		–
	Textiles	0.09	0.00	0.09								
	Wood, Pulp, Paper and Printing	0.48	0.01	0.49								
	Chemicals	–	–	–								
	Non-metallic Minerals	5.54	0.01	5.55								
	Basic Metals	0.02	–	0.02			–	–	–	–		–
	Mechanical/Electrical Equipment	0.45	0.00	0.45								
	Building and Construction	–	0.00	0.00			0.01	3.74	0.02	–		3.76
	Unallocated	2.05	–	2.05		3.03	0.10	6.02	1.56	–		10.72
	Commercial	**1.10**	**0.36**	**1.46**		**1.22**	**0.22**	**3.72**	**0.02**	**–**		**5.18**
	Transport	**–**	**–**	**–**		**0.32**	**104.21**	**81.81**	**4.55**	**11.23**		**202.12**
	Residential	**0.19**	**0.14**	**0.33**		**2.90**	**–**	**0.45**	**–**	**–**		**3.35**
CONSUMER ENERGY (observed)		**22.49**	**4.28**	**26.77**	**–**	**7.53**	**106.06**	**116.14**	**8.15**	**11.23**	**–**	**249.12**
Statistical Differences		**-2.63**	**0.00**	**-2.63**	**1.94**	**–**	**2.80**	**1.22**	**0.14**	**0.58**	**–**	**6.68**

Energy balances

NATURAL GAS	RENEWABLES								ELECTRICITY	WASTE HEAT	
Total	Hydro	Geothermal	Solar	Wind	Liquid Biofuels	Biogas	Wood	Total	Total	Total	TOTAL
187.17	82.96	174.78	0.39	7.19	0.16	3.38	57.83	326.68		0.85	717.63
											347.79
											144.17
2.04											16.05
											50.92
185.13	**82.96**	**174.78**	**0.39**	**7.19**	**0.16**	**3.38**	**57.83**	**326.68**		**0.85**	**854.28**
-77.54	**-82.96**	**-163.98**		**-7.19**	**-0.16**	**-3.05**	**-4.87**	**-262.19**	**140.31**	**-0.85**	**-249.82**
-54.13	-82.96	-162.61		-7.19		-2.30		-255.05	146.27		-180.51
-16.54		-1.37				-0.74	-4.87	-6.98	9.45	-0.85	-22.92
–					-0.16			-0.16			-6.03
											-11.55
-6.86									-15.42		-28.81
-39.67											**-51.82**
67.92		**10.80**	**0.39**	**–**	**–**	**0.33**	**52.96**	**64.48**	**140.31**	**–**	**552.64**
1.48		**0.64**						**0.64**	**8.00**		**32.64**
1.48		0.64						0.64	7.14		25.24
0.01									0.35		3.13
–									0.52		4.28
48.59		**7.51**					**45.56**	**53.07**	**53.67**		**196.26**
0.02									1.96		7.03
10.21									7.86		30.81
0.42									0.35		0.86
5.05									11.15		16.70
27.17									2.65		29.82
0.70									1.25		7.51
3.03									23.72		26.78
1.66									0.53		2.65
0.25									1.03		5.04
0.06		7.51					45.56	53.07	3.16		69.06
7.67		**2.37**				**0.28**		**2.65**	**34.19**		**51.15**
0.03						**–**		**–**	**0.22**		**202.37**
5.66		**0.29**	**0.36**				**7.40**	**8.05**	**44.30**		**61.70**
63.44	**–**	**10.80**	**0.36**	**–**		**0.28**	**52.96**	**64.41**	**140.39**	**–**	**544.13**
4.48		**-0.00**	**0.03**	**–**		**0.05**	**–**	**0.08**	**-0.09**	**–**	**8.52**

C. COAL

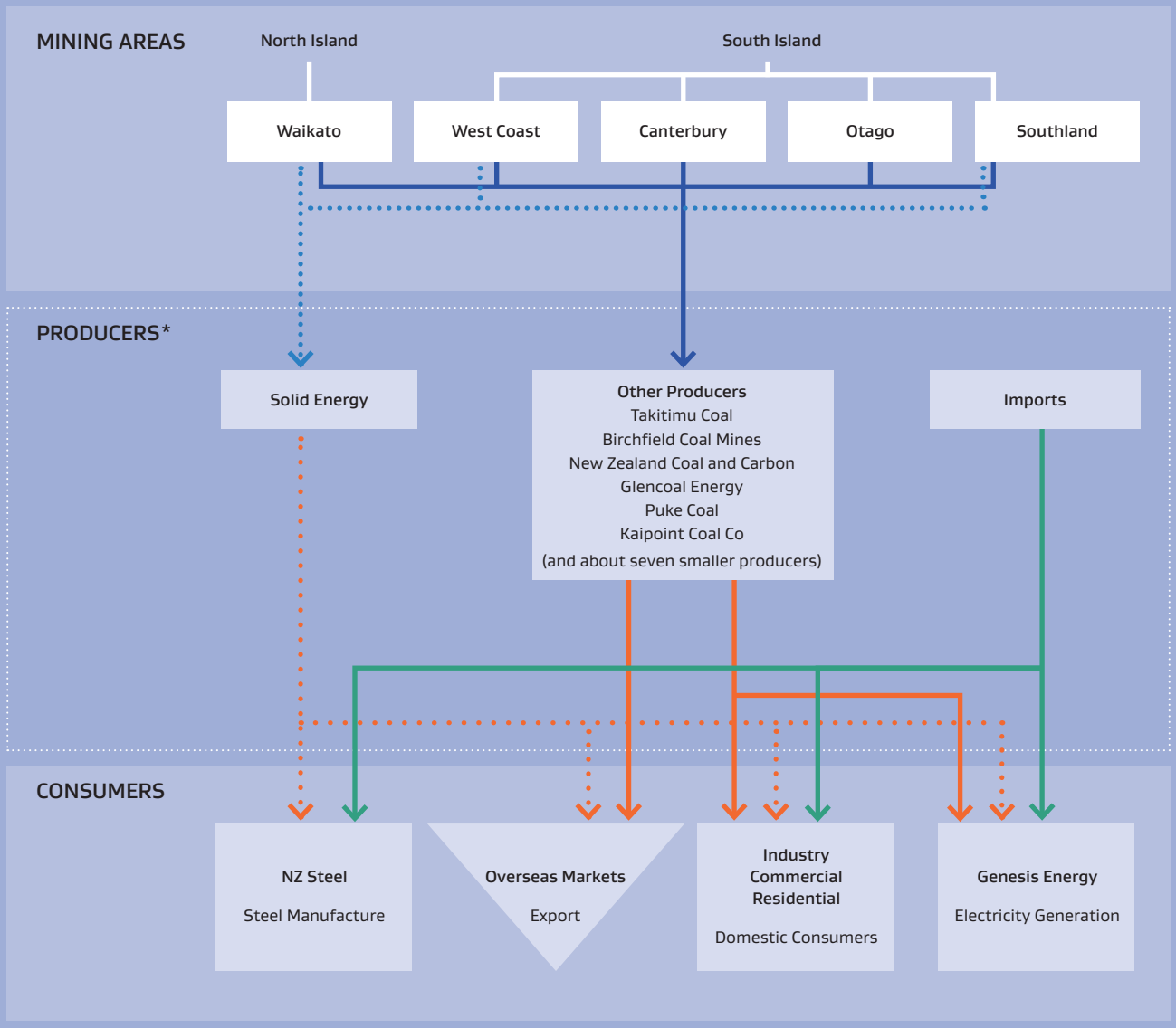
INTRODUCTION

This chapter contains information about coal production (supply) and sales to consumers (demand). Information on coal is presented for the 2013 calendar year. Background information on New Zealand's coal industry can be found on the New Zealand Petroleum and Minerals website:

http://www.nzpam.govt.nz/cms/coal.

Coal

Figure C.1: Coal Industry Summary for 2013



*Company names are listed without the suffixes "Limited" and "New Zealand Limited" where applicable.

Coal

Overview of New Zealand's Coal Industry

Introduction

The 2013 year saw coal production decline by a further 6%. The drop was mainly due to Solid Energy reducing production at the Waikato-based Huntly East and Rotowaro mines.

In 2013, New Zealand produced 4.6 million tonnes of coal, 2.1 million tonnes of which were exported. The corresponding figures for 2012 were 4.9 and 2.2 million tonnes.

The total amount of coal used in 2013 was 2.9 million tonnes, a decrease of 10% over the year. One factor was a 40% reduction in coal use at the Huntly Power Station from the 2012 year, when low hydro storage levels saw increased coal-fired electricity generation.

North Island markets underwent substantial adjustment in 2013. While NZ Steel and Genesis Energy remain the main consumers, Genesis announced that it would decommission one of its four old coal/gas generation units at Huntly and mothball a second to allow it to be used again if required. Both Genesis Energy and NZ Steel also adjusted supply agreements with Solid Energy during the year.

Resources

New Zealand has extensive coal resources, mainly in the Waikato and Taranaki regions of the North Island, and the West Coast, Otago and Southland regions of the South Island. It has been estimated that national in-ground resources of all coal are over 15 billion tonnes, 80% of which are South Island lignites.

Lignite is New Zealand's largest fossil fuel energy resource. The main deposits are well known, with technically and economically recoverable quantities in the 10 largest deposits established at over 6 billion tonnes.

Sub-bituminous and bituminous in-ground resources are around 3.5 billion tonnes, but recoverable quantities of these coals are uncertain.

Recoverable coal estimates are dependent on assessment of a complex mix of factors including:

- resource size and location;
- geological conditions;
- technical constraints to mining;
- mining economics;
- access to resources;
- project consents;
- market size and certainty;
- market price, which is itself partly set by the import substitute price for some markets; and
- distribution costs and infrastructure.

Recoverable coal quantities are thus not simple to assess and will change depending on market conditions, and as a result of ongoing exploration and feasibility studies to convert resources to reserves.

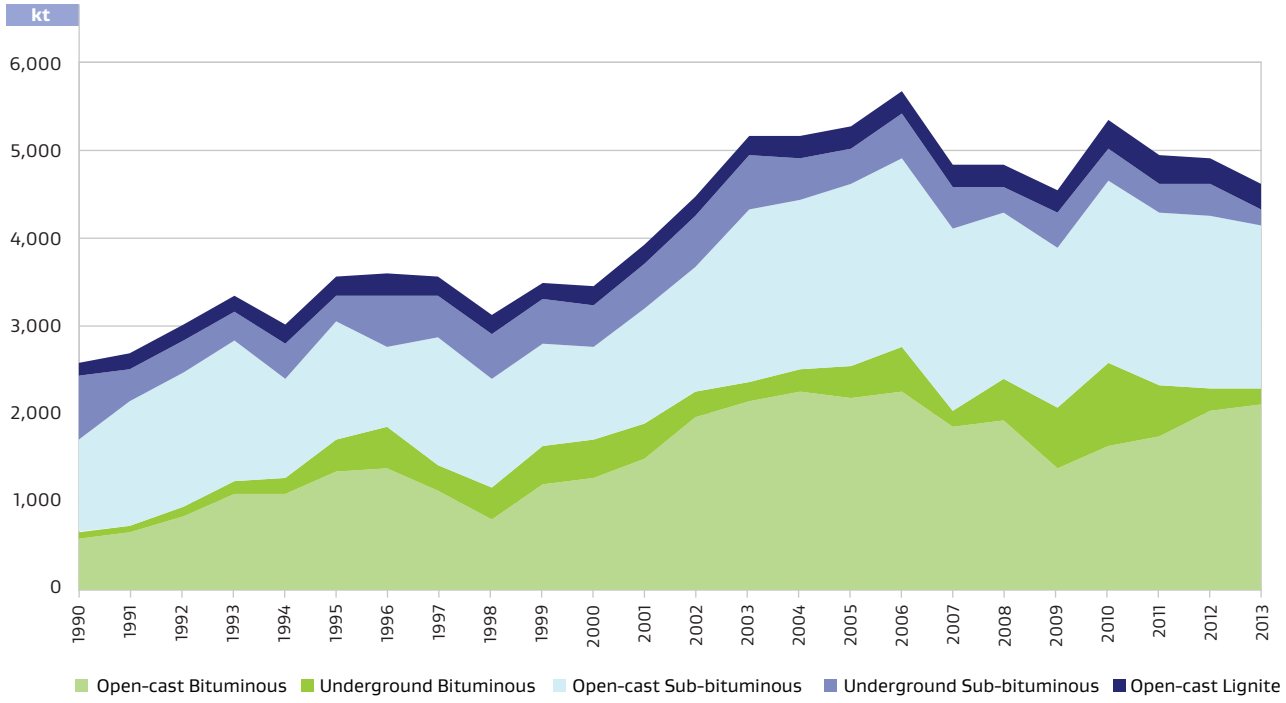
Production

New Zealand coal production in 2013 was 4.6 million tonnes (119 PJ), down from 4.9 million tonnes (127 PJ) in 2012. The drop was mainly due to combined production at the Waikato-based Huntly East and Rotowaro mines reducing by over 0.3 million tonnes.

About 94% of all production is of bituminous and sub-bituminous coals. Even though lignite makes up 80% of national coal resources, it represented only 6% of total indigenous production in 2013, mostly as a consequence of its low energy content and distance from the main centres of energy demand.

Production is centred in the Waikato (1.5 million tonnes, mainly for several major industrial users and the Huntly power station), on the West Coast (2.5 million tonnes, mainly for export) and in

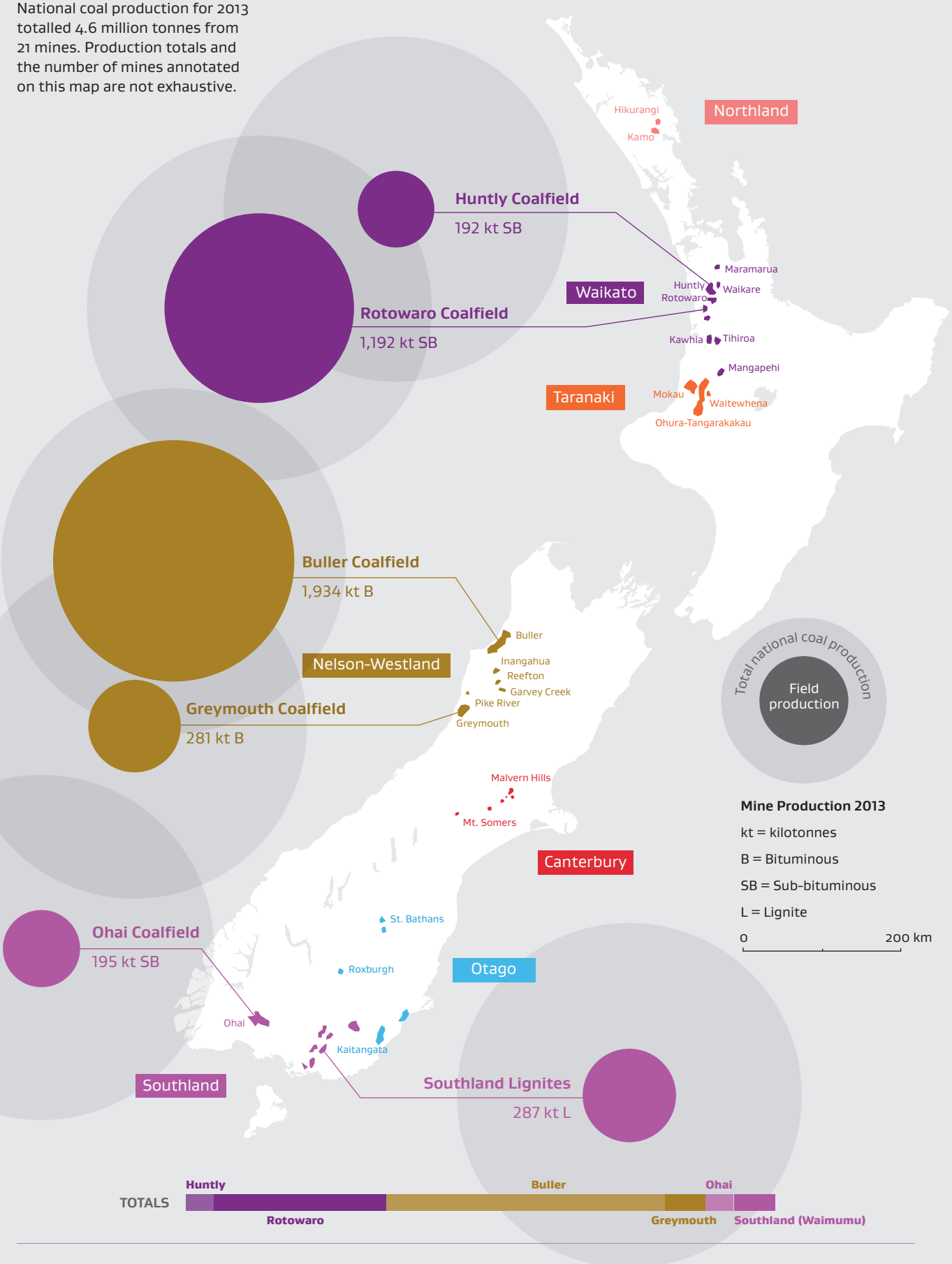
Figure C.2: Annual Coal Production by Rank and Mining Method



Coal

Figure C.3: Location of New Zealand Coal Resources and 2013 Coal Production

National coal production for 2013 totalled 4.6 million tonnes from 21 mines. Production totals and the number of mines annotated on this map are not exhaustive.



Coal

Southland (0.5 million tonnes, mainly for local industrial markets). The remaining production is from Otago and Canterbury. All lignite is produced in the lower South Island and all bituminous coal is from the West Coast. The North Island only produces sub-bituminous coal.

There were three underground and 18 open-cast mines operating in 2013. The two large open-cast operations, at Stockton and Rotowaro, contributed to 64% of national production. State-owned Solid Energy was responsible for about 80% of national production. A number of smaller private coal mining companies produced the remainder.

There are currently 43 permits and 20 licences granted by New Zealand Petroleum and Minerals to mine coal, some of which cover small mines that are not producing. In addition, there are 50 granted coal exploration permits. The Crown owns only about half of New Zealand's coal resources. Mining of privately owned coal is not subject to the Crown Minerals Act 1991, although preceding legislation covers mining of some privately owned coal.

Exports and Imports

Exports of bituminous coal, produced entirely from the West Coast, were 2.1 million tonnes (66 PJ) for 2013, down by 5% from 2012 levels.

Most of New Zealand's premium bituminous coal production is exported. These coals are valued internationally for their low ash and sulphur contents, and other characteristics such as high swelling, fluidity and reactivity, which allow them to be blended with other coals for use in the steel industry.[1] New Zealand coal is exported mainly to India and Japan, with smaller quantities going to China and South Africa. Most exports are of coking coal, with smaller amounts of thermal and specialist coals.

Coal imports were estimated at 0.5 million tonnes in 2013.[2] Substantial market adjustment occurred during the year. Genesis ended a contract to import coal and extended its supply agreement with Solid Energy to June 2017. Also in 2013, Solid Energy entered into a new supply contract with NZ Steel.

Consumption

Coal accounted for approximately 5% of New Zealand's total consumer energy supply. Total coal supplied was 2.9 million tonnes (61 PJ) in 2013, a decrease of 10% from the previous year.

New Zealand's biggest users of coal are the Huntly power station and the Glenbrook steel mill. In 2013, Huntly power station consumed around 0.8 million tonnes, down from a four-year high of 1.3 million tonnes in 2012. The Glenbrook steel mill consumed over 0.8 million tonnes.

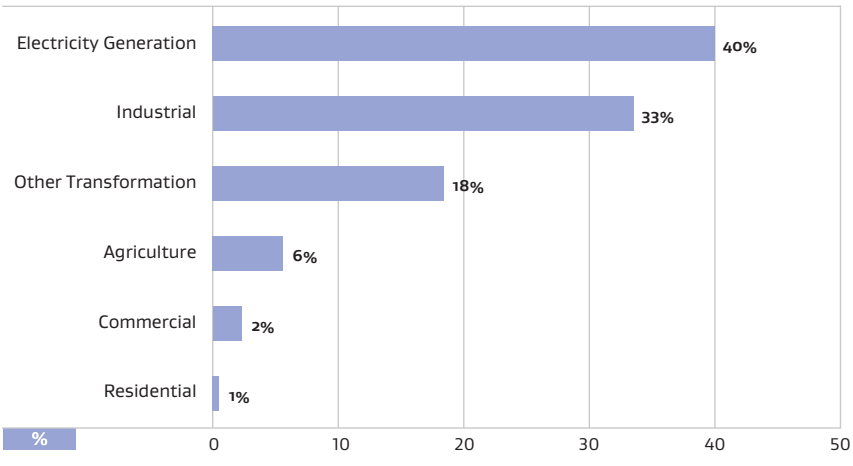
Figure C.5 shows coal consumption by sector. In 2013, electricity generation (including cogeneration) accounted for 40% of domestic coal use, followed by industrial sector use at 33%. Industrial coal use is primarily for meat, dairy, and cement, lime and plaster manufacturing.

A large portion of New Zealand's coal production for domestic use in 2013 was from the Waikato, underlining the regional interdependence of coal supply, industry and electricity supply. Waikato coal resources are becoming increasingly difficult and expensive to access, and remaining resources for open-cast mining are limited.

More information on the New Zealand coal industry is available on the New Zealand Petroleum and Minerals website: www.nzpam.govt.nz/cms/coal/.

Figure C.4: Coal Imports and Exports

Figure C.5: Coal Consumption by Sector for 2013

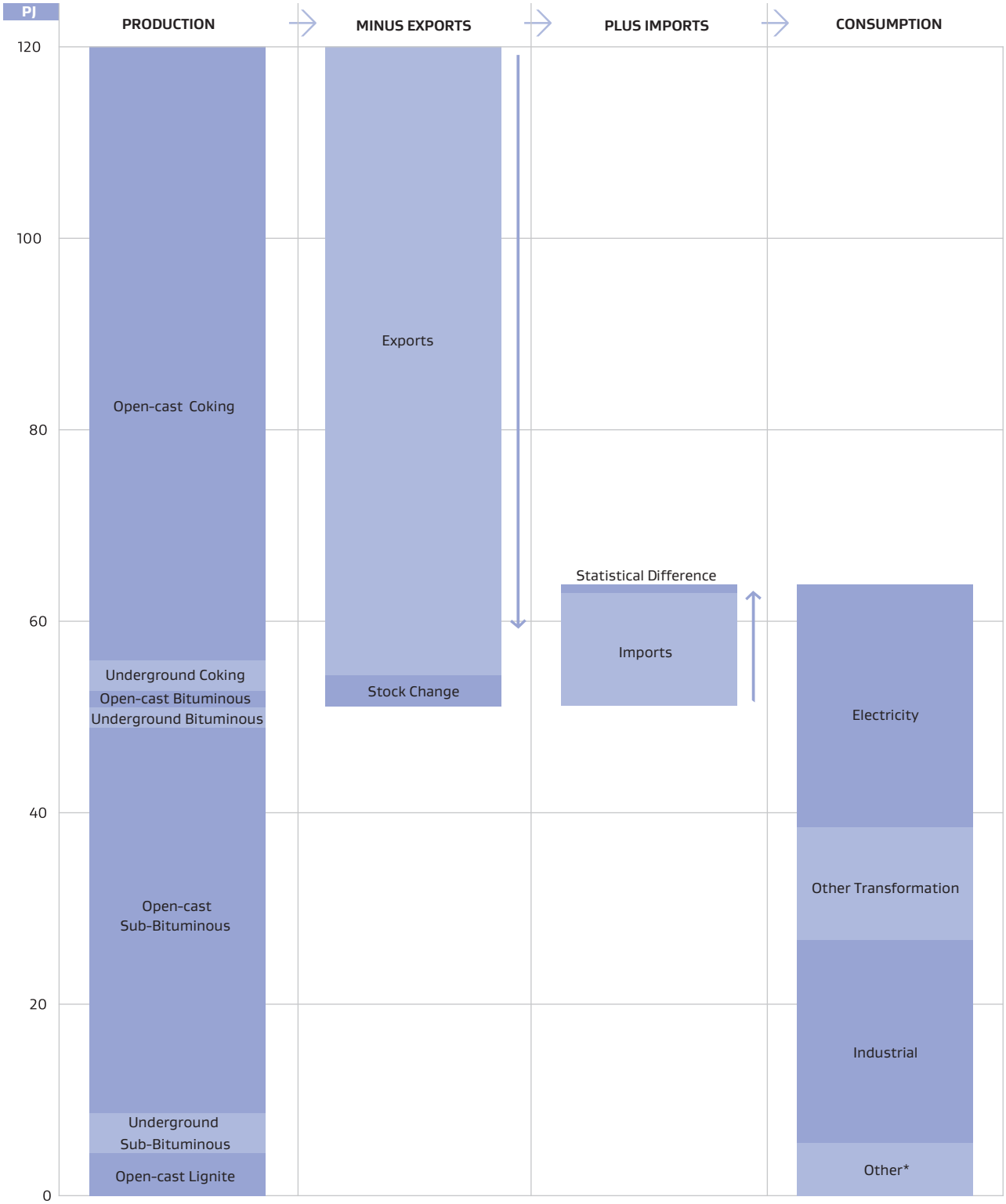


1. West Coast bituminous coals are not suitable for use at the New Zealand Steel plant in Glenbrook, Auckland.

2. Complete import data were not available from Statistics New Zealand.

Coal

Figure C.6: Coal Energy Flow Diagram for 2013

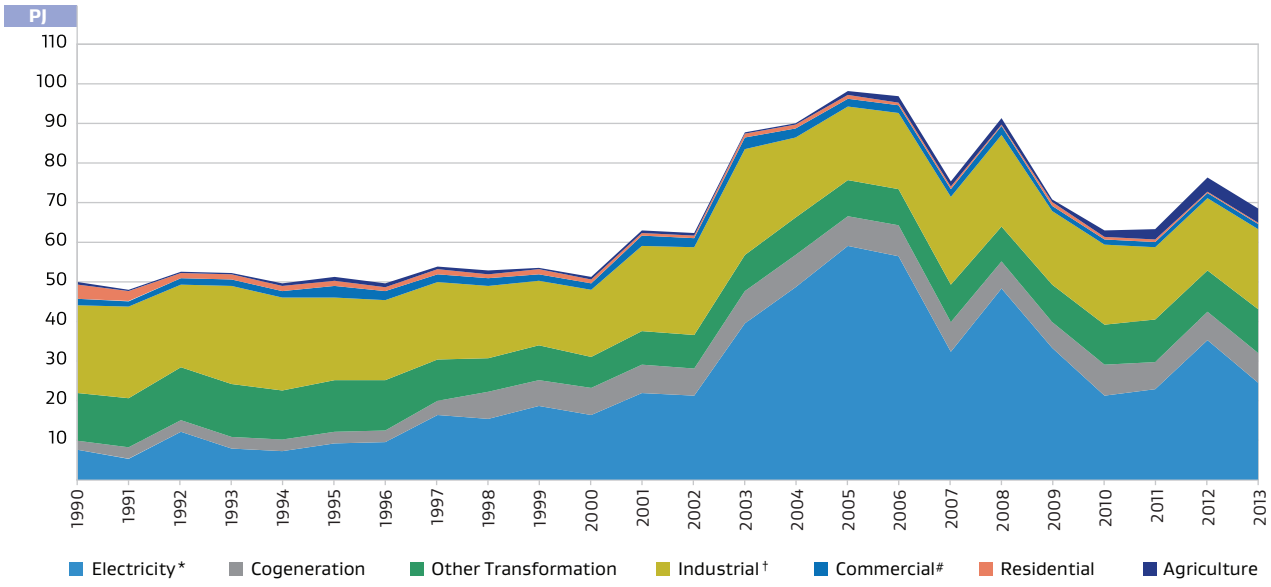


* Includes commercial, residential, agriculture and transport.

Some totals may not add up due to rounding.

Coal

Figure C.7: Summary of Observed Coal Consumption by Sector (PJ)



* Includes losses and own use.

† Excludes cogeneration.

Includes transport.

D. OIL AND GAS

INTRODUCTION

This section of Energy in New Zealand covers all aspects of oil and natural gas. Oil is New Zealand's largest source of energy and it has a strong influence on the economy. Natural gas is currently produced and consumed only in the North Island.

The beginning of this section covers oil and gas reserves. This is followed by oil (production, trade, stocks and consumption) then gas (production, stocks and consumption).

EXPLORATION AND DEVELOPMENT

- Overall, expenditure increased to 1.577 billion dollars, up 7% from 2012.
- Production permit expenditure fell very slightly, to $1.265 billion dollars. Approximately $659 million was spent on well drilling activities and $70 million on seismic projects.
- Exploration permit expenditure jumped 48% to 313 million dollars. This is on par with the highest recorded value in 2008 of 314 million dollars and is the third consecutive year of growth.
- While there was one less well drilled in 2013 (32, down from 33), drilled metreage rose 30% to 93,428 metres in 2013 for a cost of 659 million dollars. Four offshore wells were drilled, two more than in 2012, with all but two wells (on the East Coast) drilled in the Taranaki Basin.
- 3D seismic acquisition of 6,825 km^2 returned to near the record high in 2011 of 6,864 km^2. Other years have usually been less than 1,000 km^2. There was also a fall in 3D reprocessing to 1,113 km^2, after an anomalously high figure in 2012 of 9,484 km^2.
- Acquisition and reprocessing of 2D seismic were similar to 2012, following a significant drop from 2011.

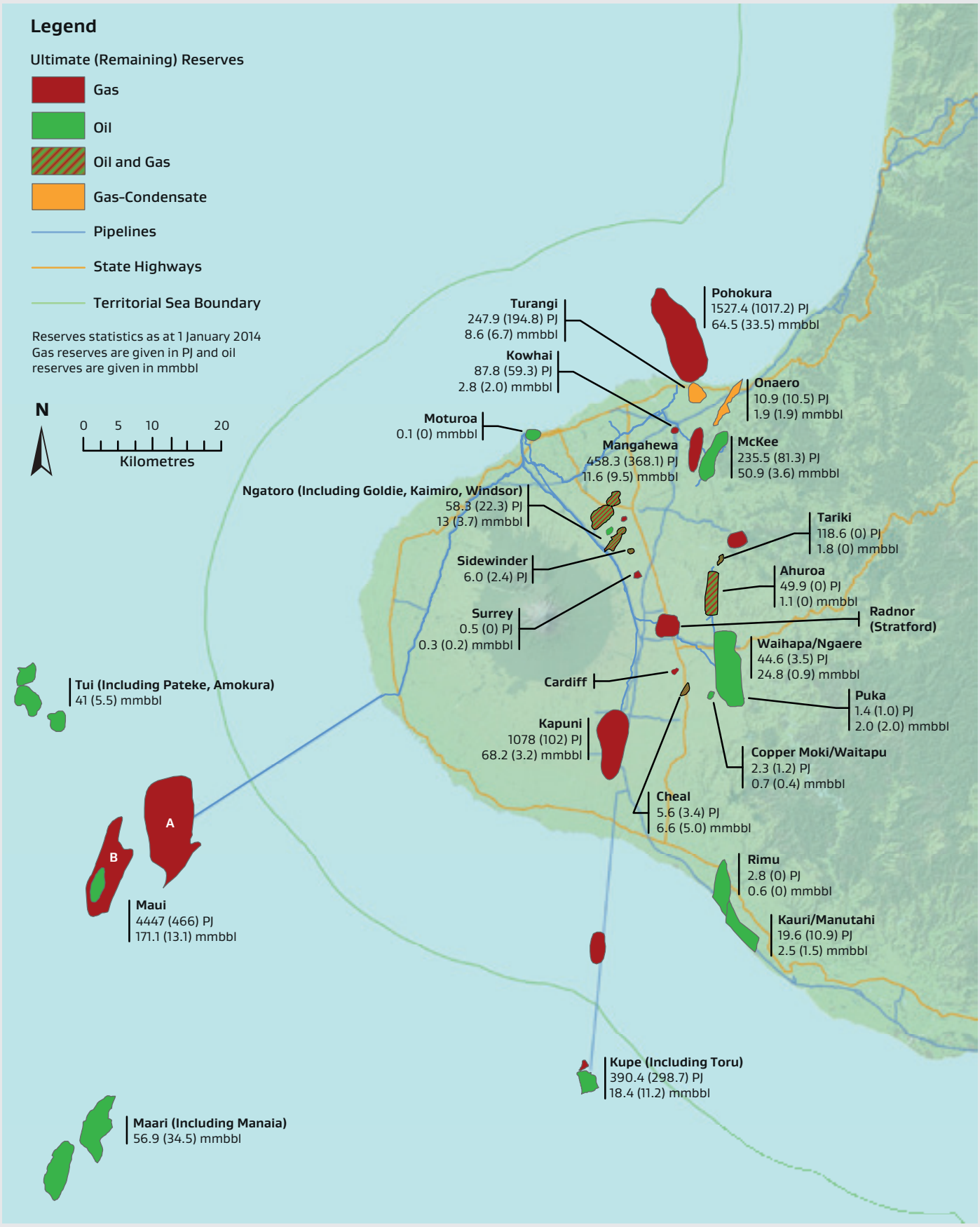
PERMITS

- Eleven exploration permits were granted, ten under Block Offer 2013 and one under the previous first-in, first-served "priority in time" method. These permits were in the Taranaki, Northland and East Coast Basins. No Petroleum Prospecting Permits ('PPPs') or Petroleum Mining Permits ('PMPs') were granted in 2013.[1]
- The increase in exploration activity did not correlate with changes in active permits. The number of PMPs and Petroleum Mining Licences (PMLs) remained at 24 and PPPs and Petroleum Exploration Permits (PEPs) dropped by four to 52.
- Most of the mining permits and licences for the large fields are jointly held, with the bulk of investment coming from foreign companies. There were changes to the ownership of the Tariki, Waihapa and Ngaere (TWN) fields, and changes within the ownership of the Tui field.

1. Further information on gas exploration is available on the New Zealand Petroleum and Minerals website www.nzpam.govt.nz

Oil and Gas

Figure D.1: Taranaki Oil and Gas Fields



Oil and Gas

Table D.1: National Summary of Activity and Expenditure (All Petroleum Exploration and Mining Permits/Licenses)

National Totals – Activity Statistics Combined for PPPs, PEPs, PMPs and PMLs	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Exploration Wells												18
Appraisal Wells												5
Development Wells												9
Total Wells Drilled	**21**	**16**	**33**	**34**	**30**	**43**	**34**	**37**	**45**	**52**	**33**	**32**
Exploration Well Metres Made												43104
Appraisal Wells Metres Made												17482
Development Wells Metres Made												32842
Total Metres Made	**36,958**	**35,201**	**78,237**	**87,533**	**112,369**	**99,854**	**51,037**	**64,596**	**76,026**	**63,669**	**72,177**	**93,428**
Exploration Well Expenditure ($NZDm)												$206.78
Appraisal Well Expenditure ($NZDm)												$93.82
Development Well Expenditure ($NZDm)												$358.15
Total Well Expenditure ($NZDm)												**$658.76**
2-D Seismic Acquired (km)	141	2,455	5,466	3,764	13,240	14,424	25,749	12,058	9,751	8,353	220	315
2-D Seismic Reprocessed (km)	9,927	10,829	23,808	14,707	30,627	20,019	11,411	6,989	21,512	7,911	6,387	5,917
3-D Seismic Acquired (km^2)	483	444	39	3,120	2,360	935	991	1,151	204	6,864	164	6,825
3-D Seismic Reprocessed (km^2)	566	961	410	247	2,147	407	432	457	1,244	1,214	9,484	1,113
Acquisition Expenditure												$66.12
Reprocessing Expenditure												$3.95
Total Seismic Expenditure ($NZDm)												**$70.07**
PEP & PPP National Expenditure ($NZDm)	$186	$159	$280	$186	$133	$200	$314	$191	$246	$159	$212	$313
PMP/PML National Expenditure ($NZDm)	$218	$195	$182	$553	$574	$1,359	$963	$1,202	$1,095	$1,084	$1,267	$1,265
Expenditure, All Permits – National Total ($NZDm)	**$404**	**$354**	**$462**	**$739**	**$707**	**$1,559**	**$1,277**	**$1,393**	**$1,341**	**$1,243**	**$1,479**	**$1,577**
PPPs Granted											1	0
PEPs Granted	29	18	29	5	16	19	15	9	10	3	16	11
PMPs Granted	1	0	2	5	2	2	0	2	1	0	1	0
Total Permits Granted	**30**	**18**	**31**	**10**	**18**	**21**	**15**	**11**	**11**	**3**	**18**	**11**
Permits Surrenderred	14	10	6	14	25	20	13	21	11	14	13	12
Permits Expired												3
Permits Revoked												15
Number of PEPs & PPPs at Granted Status	82	86	105	104	79	76	89	71	70	73	56	52
Number of PMPs and PMLs at Granted Status	12	12	14	19	21	23	23	24	23	23	24	24

PEPs = Petroleum Exploration Permits

PPPs = Petroleum Prospecting Permits

PMPs = Petroleum Mining Permits (production permits)

PMLs = Petroleum Mining Licences (production permits)

Oil and Gas

Reserves

› Reserves are the estimated total amounts of oil and gas that are able to be recovered from a known petroleum reservoir. Ultimate recoverable reserves are the total reserves before any oil or gas is produced. Remaining reserves are ultimate recoverable reserves, less production to date.

› Oil and condensate ultimate recoverable reserves (P50) increased slightly from 2013, from 548 mmbbl to 549 mmbbl. Various fields showed reserve increases due to sustained drilling programmes (such as the Mangahewa Development) while others diminished following revised interpretations.

› Remaining recoverable reserves (P50) decreased 6% from 148 to 138 mmbbl. Remaining oil reserves at Kupe decreased from 26 to 11 mmbbl.

› Ultimate recoverable gas reserves (P50) increased 11% from 2013, with Pohokura, Maui and Mangahewa providing most of this increase. Remaining recoverable gas reserves (P50) increased 31% from 2021 PJ to 2642 PJ.

› Further data are also available on P10 reserves, LPG reserves, contingent resources, oil and gas initially in place and system deliverability at: http://www.med.govt.nz/sectors-industries/energy/energy-modelling/publications/energy-in-new-zealand-2014.

Table D.2: Oil and Condensate Reserves

		Oil and Condensate Ultimate Recoverable Reserves (P90)			Oil and Condensate Ultimate Recoverable Reserves (P50)			Oil and Condensate Remaining Reserves (P90)			Oil and Condensate Remaining Reserves (P50)		
Field	**Type**	**Mm^3**	**mmbbl**	**PJ**	**Mm^3**	**mmbbl**	**PJ**	**Mm^3**	**mmbbl**	**PJ**	**Mm^3**	**mmbbl**	**PJ**
Maari	Crude oil	5.41	34.00	218.39	9.05	56.90	365.48	1.84	11.60	74.51	5.49	34.50	221.60
Pohokura	Condensate	9.45	59.43	341.76	10.25	64.48	370.80	4.53	28.48	163.78	5.33	33.53	192.82
Maui	Condensate	25.70	161.62	894.73	27.20	171.06	946.99	0.58	3.63	20.07	2.08	13.07	72.35
Kupe	Condensate	2.36	14.88	83.32	2.92	18.36	102.84	1.23	7.71	43.19	1.78	11.20	62.73
Mangahewa	Condensate	0.92	5.80	37.03	1.84	11.60	74.07	0.59	3.70	23.62	1.51	9.50	60.66
Turangi*	Condensate	0.68	4.30	24.04	1.37	8.60	48.07	0.36	2.27	12.67	1.06	6.67	39.07
Tui	Crude oil	5.98	37.60	231.35	6.52	41.00	252.27	0.33	2.10	12.92	0.87	5.50	33.84
Cheal*	Crude oil	0.59	3.70	20.68	1.05	6.60	36.89	0.33	2.11	11.78	0.80	5.01	27.99
Ngatoro*	Crude oil	1.59	10.00	50.30	2.07	13.00	65.39	0.10	0.66	3.32	0.58	3.66	18.41
McKee	Crude oil	7.63	48.00	290.99	8.09	50.90	308.57	0.11	0.70	4.24	0.57	3.60	21.82
Kapuni	Condensate	10.55	66.36	377.79	10.85	68.22	388.42	0.21	1.30	7.38	0.50	3.16	18.01
Puka	Crude oil	0.10	0.65	4.27	0.32	2.04	13.40	0.10	0.61	4.03	0.32	2.00	13.16
Kowhai*	Condensate	0.16	1.00	6.19	0.45	2.80	17.33	0.03	0.16	1.00	0.31	1.96	12.14
Onaero*	Condensate	0.11	0.72	4.71	0.31	1.92	12.64	0.11	0.72	4.71	0.31	1.92	12.64
Kauri/Manutahi	Crude oil	0.24	1.50	8.78	0.40	2.50	14.64	0.09	0.54	3.18	0.24	1.53	8.98
Waihapa/Ngaere	Crude Oil	3.9	24.5	154.7	3.9	24.8	156.7	0.1	0.6	3.9	0.1	0.9	5.8
Copper Moki	Crude oil	0.08	0.51	3.03	0.10	0.66	3.92	0.04	0.24	1.43	0.06	0.39	2.32
Surrey*	Crude oil	0.03	0.20	1.08	0.05	0.30	1.63	0.02	0.10	0.52	0.03	0.20	1.06
Rimu	Crude oil	0.10	0.60	3.51	0.10	0.60	3.51	0.00	0.00	0.00	0.00	0.02	0.10
Moturoa*	Crude oil	0.02	0.10	0.56	0.02	0.10	0.56	0.00	0.00	0.00	0.00	0.00	0.00
Ahuroa	Crude oil	0.17	1.10	6.45	0.17	1.10	6.45	0.00	0.00	0.00	0.00	0.00	0.00
Tariki	Crude oil	0.29	1.80	10.54	0.29	1.80	10.54	0.00	0.00	0.00	0.00	0.00	0.00
All Fields†		**82.7**	**519.8**	**3,062.8**	**87.3**	**549.4**	**3,201.1**	**18.6**	**116.6**	**687.3**	**22.0**	**138.3**	**825.6**

* Not reported. Calculated by MBIE on a reserve depletion basis using last year's estimates.

† The All Fields P90 values were estimated based on probabilistic summation using a Monte Carlo simulation.
Arithmetic summation of P90 values will return a number with a much lower probability of occurring (0.1^{n}).
P50 values may be totalled safely using arithmetic summation since they are the mid-point of the probability distribution.

Table D.3: Natural Gas and LPG Ultimate Recoverable Reserves

	Natural Gas and LPG Ultimate Recoverable Reserves (P90)			Natural Gas and LPG Ultimate Recoverable Reserves (P50)			Natural Gas and LPG Remaining Reserves (P90)			Natural Gas and LPG Remaining Reserves (P50)		
Field	**Mm³**	**Bcf**	**PJ**	**Mm³**	**Bcf**	**PJ**	**Mm³**	**Bcf**	**PJ**	**Mm³**	**Bcf**	**PJ**
Pohokura	35,108	1,239.84	1,453.41	36,896	1,302.98	1,527.38	22,797	805.08	943.25	24,585	868.22	1,017.23
Maui*	104,145	3,680.00	4,114.00	112,587	3,978.00	4,447.00	3,355	118.54	132.51	11,797	416.86	465.97
Mangahewa*	6,321	223.23	251.43	11,537	407.44	458.26	4,068	143.67	161.33	9,282	327.78	368.06
Kupe*	7,525	265.76	299.80	9,801	346.13	390.35	5,227	184.61	208.13	7,503	264.98	298.69
Turangi*	3,024	106.80	121.45	6,173	218.00	247.91	1,780	62.87	71.49	4,850	171.29	194.79
Kapuni*	37,491	1,324.00	1,015.00	39,870	1,408.00	1,078.00	1,501	53.00	39.00	3,908	138.00	102.00
McKee	4,600	162.46	191.60	5,654	199.68	235.50	898	31.71	37.40	1,952	68.93	81.30
Kowhai†	807	28.50	32.65	2,169	76.60	87.76	231	8.15	9.33	1,466	51.79	59.33
Ngatoro†	1,048	37.00	41.43	1,475	52.10	58.33	183	6.48	7.25	563	19.88	22.25
Kauri*	193	6.80	7.97	488	17.22	19.62	0	0.00	0.00	277	9.78	10.90
Onaero†	101	3.56	4.89	224	7.93	10.89	93	3.28	4.50	216	7.64	10.50
Waihapa/Ngaere*	1,110.5	39.2	43.5	1,147.3	40.5	44.6	77.4	2.7	2.3	114.1	4.0	3.5
Cheal†	71	2.50	3.40	116	4.10	5.57	22	0.78	1.06	70	2.47	3.36
Sidewinder	133	4.70	5.21	153	5.40	5.99	41	1.43	1.59	60	2.13	2.36
Copper Moki*	35	1.25	1.78	46	1.63	2.30	14	0.50	0.66	25	0.88	1.18
Puka	9	0.32	0.44	28	1.00	1.37	1	0.03	0.05	20	0.72	0.98
Rimu	68	2.40	2.81	68	2.40	2.81	0	0.00	0.00	0	0.01	0.01
Tariki	2,809	99.20	118.57	2,809	99.20	118.57	0	0.00	0.00	0	0.00	0.00
Moturoa†	0	0.01	0.01	0	0.01	0.01	0	0.00	0.00	0	0.00	0.00
Surrey†	11	0.40	0.44	14	0.50	0.55	0	0.00	0.00	0	0.00	0.00
Ahuroa	1,297	45.80	49.92	1,297	45.80	49.92	0	0.00	0.00	0	0.00	0.00
All Fields#	**209,367.9**	**7,394.2**	**8,418.1**	**232,554.0**	**8,214.6**	**8,792.7**	**56,402.0**	**1,991.9**	**2,267.8**	**66,689.7**	**2,355.4**	**2,642.4**

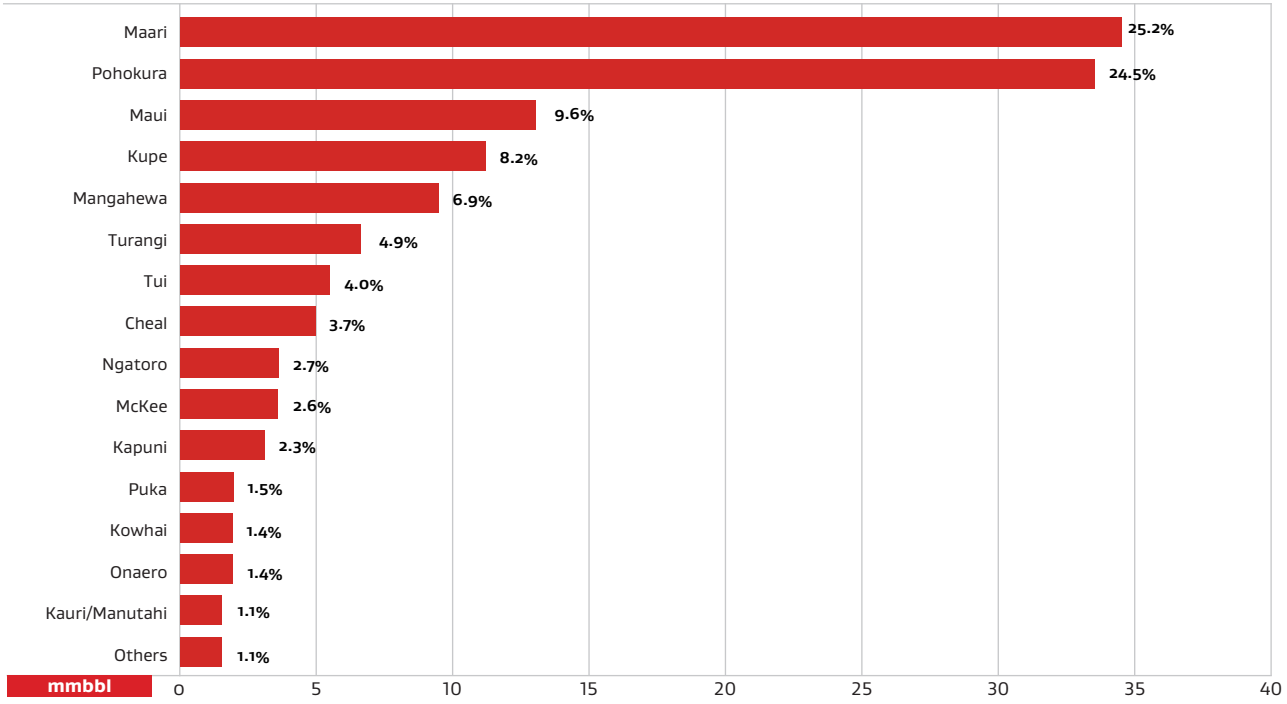
* Includes LPG.

† Not reported. Calculated by MBIE on a reserve depletion basis using last year's estimates.

The All Fields P90 values were estimated based on probabilistic summation using a Monte Carlo simulation. Arithmetic summation of P90 values will return a number with a much lower probability of occurring (0.1^n). P50 values may be totalled safely using arithmetic summation since they are the mid-point of the probability distribution.

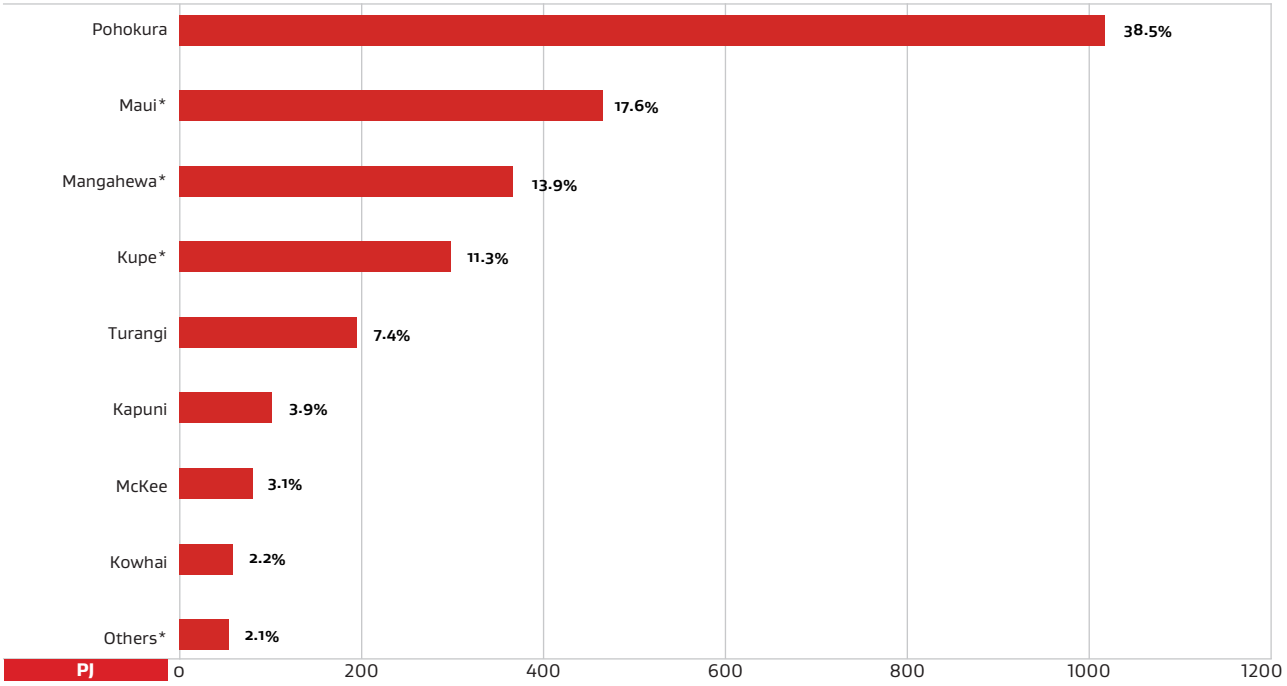
Oil and Gas

Figure D.2a: Oil and Condensate Remaining Reserves (P50)



Figures not reported for Turangi, Ngatoro, Kowhai, Onaero and some fields within Others.
Calculated by MBIE staff on a reserve depletion basis.

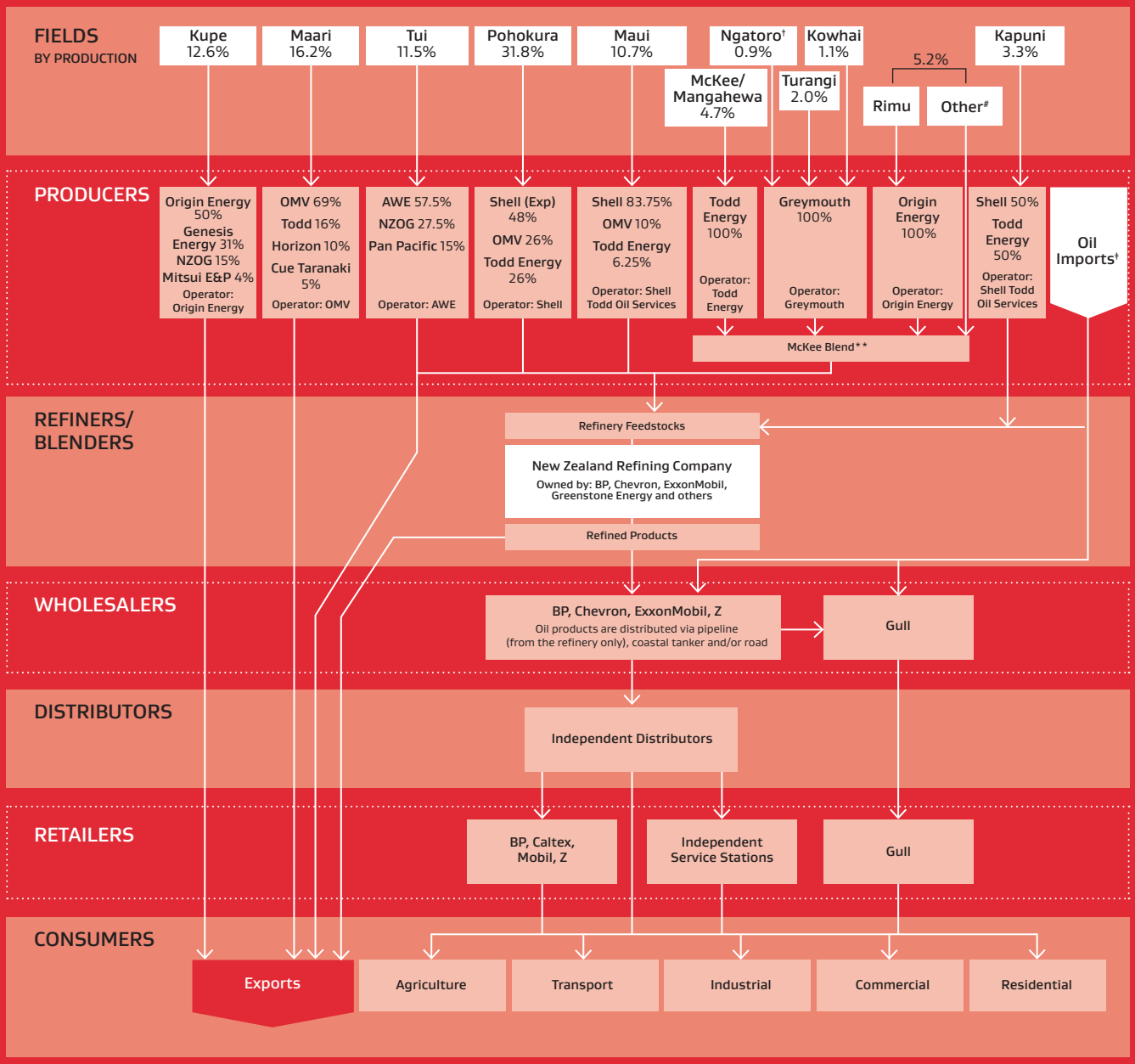
Figure D.2b: Natural Gas and LPG Remaining Reserves (P50)



*Includes LPG
Figures are not reported for Turangi, Kowhai and some fields within Others.
Calculated by MBIE staff on a reserve depletion basis.

Oil and Gas

Figure D.3: Oil Flows for the 2013 Calendar Year*



Company names are listed without the suffixes "Limited" and "New Zealand Limited" where applicable and subsidiaries are listed as the parent company. The companies are: *AWE* is Australian Worldwide Exploration Limited, *Chevron* is Chevron NZ (includes Caltex New Zealand Limited), *Greymouth* is Greymouth Petroleum Holdings Limited, *Mitsui E&P* is Mitsui E&P Australia Pty, *ExxonMobil* is ExxonMobil New Zealand Holdings (includes Mobil Oil New Zealand Limited), *NZOG* is New Zealand Oil and Gas, *OMV* is OMV New Zealand Limited (Österr Mineralöl Verwaltung), *Origin Energy* is Origin Energy New Zealand Ltd and Contact Energy (51% owned by Origin), *Shell* is Shell NZ Limited (includes Shell Exploration NZ Limited, Shell (Petroleum Mining) Energy Petroleum Holdings Limited, Energy Petroleum Investments Ltd, Energy Petroleum Taranaki Ltd and Taranaki Offshore Petroleum Company), and *TWN* comprises the Tariki, Waihapa and Ngaere fields.

* Ownership as at 31 December 2013.

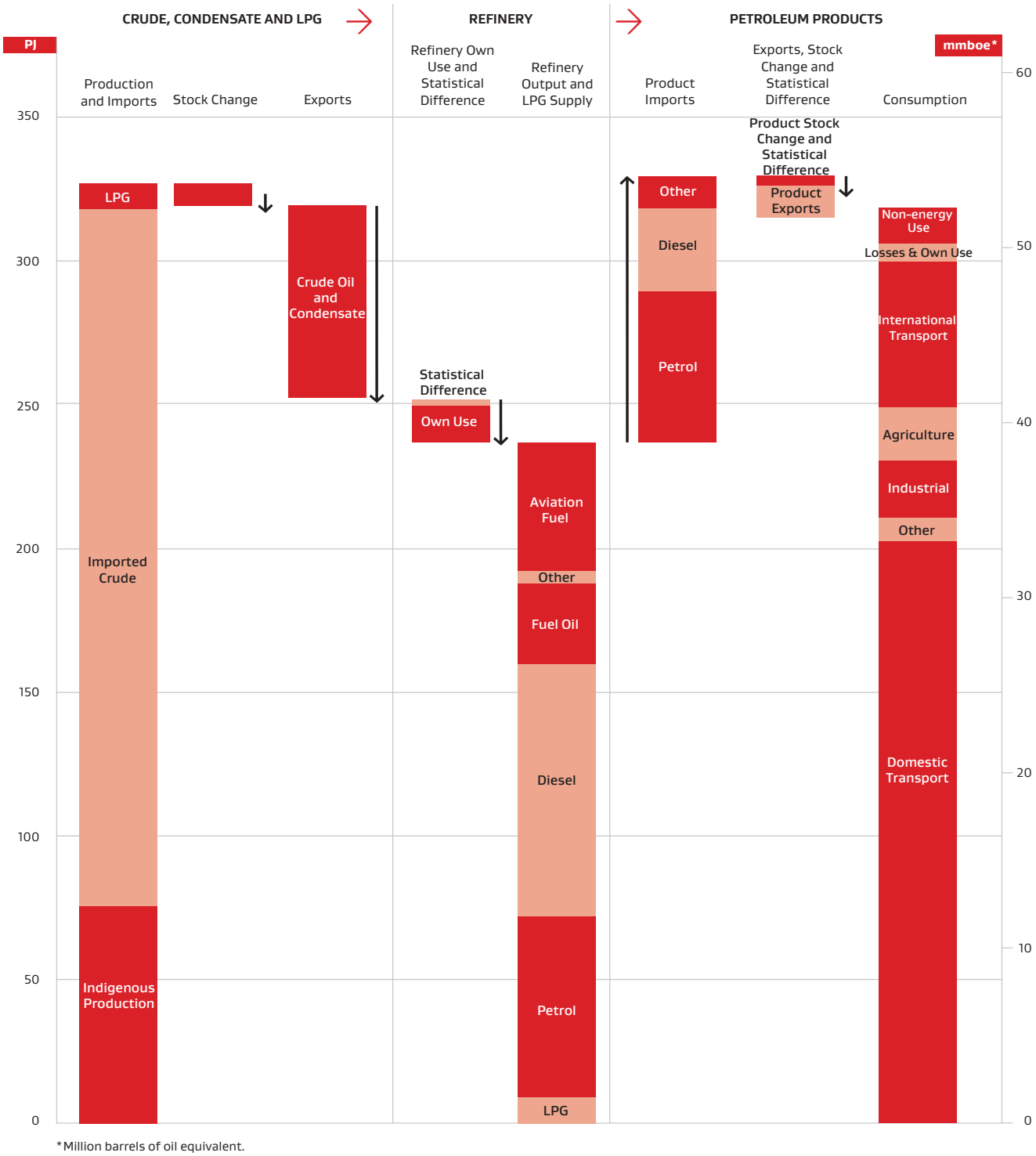
† The Kaimiro, Ngatoro and Windsor fields were combined as a single permit area in 2010. All these fields are included here, as is Moturoa.

Includes the Cheal, Sidewinder, Copper Moki, TWN and Surrey fields, and the Radnor well . Cheal and Sidewinder are owned by Tag Oil Limited. Surrey is owned and operated by Greymouth Petroleum. Copper Moki is owned by New Zealand Energy Corp. TWN is jointly owned by New Zealand Energy Corp and L&M Energy, and operated by New Zealand Energy Corp.

‡ Crude and refined product are imported by the four large oil companies. Refined product is imported by Gull Petroleum.

** Source: Shell NZ Limited.

Figure D.4: Oil Energy Flow Summary for 2013



*Million barrels of oil equivalent.

OIL

Overview

Units of volume (usually million barrels[2], mmbbl) are used for the discussion of oil production statistics alongside the energy units (petajoules).

Percentage changes between annual statistics are calculated based on energy units because this allows comparisons among the different oil product types (a litre of petrol and a litre of diesel have different energy contents).

The data used to compile this section are available online.[3]

Indigenous crude production declines

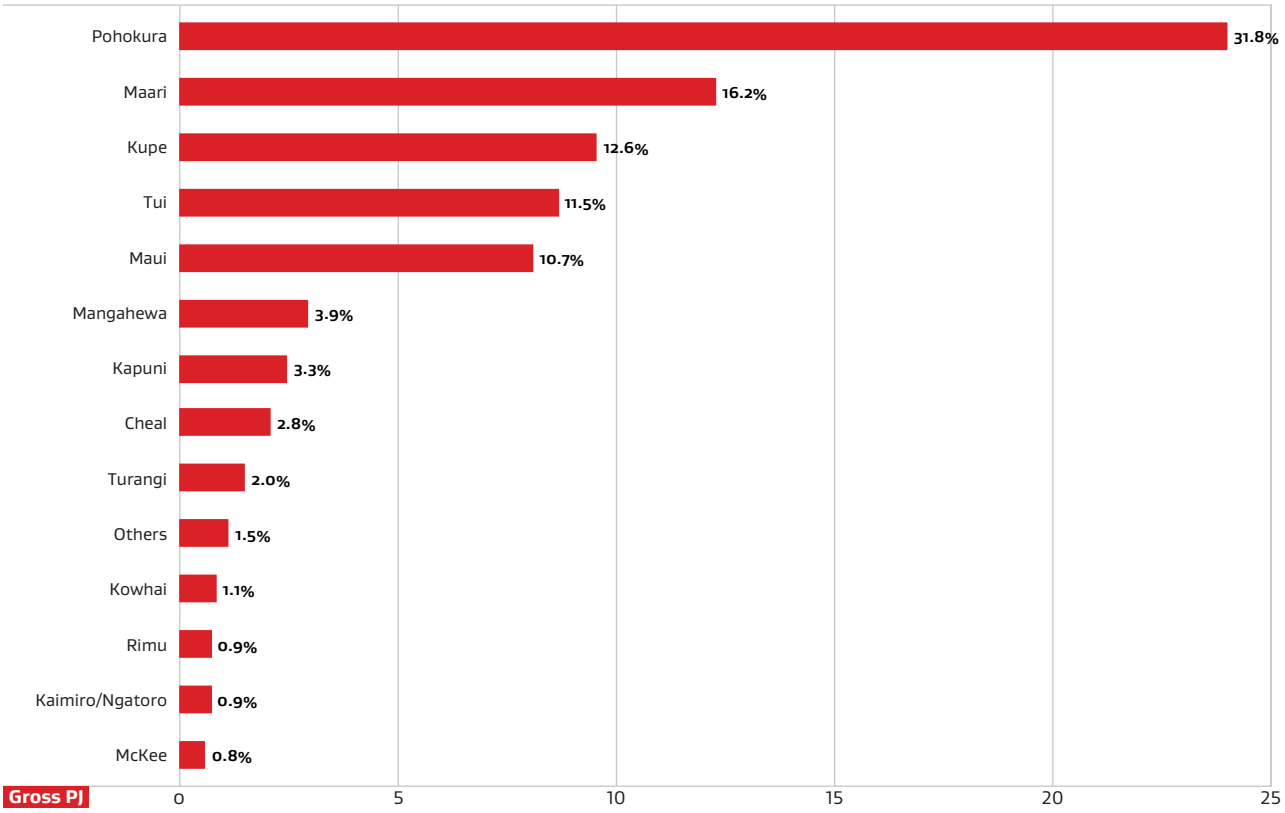
Indigenous production of crude oil, condensate, naphtha and natural gas liquids declined 14% to 35,500 bbl/day (74 PJ), largely the effect of a 4½ month shutdown at the Maari field. The shutdown began in late July 2013 for maintenance and upgrade work to be carried out on the Floating Production, Storage, and Offtake (FPSO) vessel. The Maari field has been the largest or second-largest indigenous crude producer since production began there in 2009. Even with the shutdown, the Maari field was still the second-biggest oil-producing field in 2013, with 5,300 bbl/day.

Looking only at the first six months of 2013 (that is, outside the Maari shutdown), there was a decrease of 7% in total indigenous production to 39,300 bbl/day from the first half of 2012 (42,200 bbl/day). A comparison of the second halves of 2013 and 2012 shows a larger decrease of 19% (to 31,700 bbl/day from 39,000 bbl/day).

Pohokura was the largest oil-producing field (11,600 bbl/day) in 2013 by a large margin and was up 3%. Kupe was up 3% to 4,600 bbl/day and Maui was up 13% to 4,000 bbl/day. Tui fell to 3,900 bbl/day (from 5,300 bbl/day).

The decrease in total production continues the downward trend seen

Figure D.5a: Oil Production by Field in 2013



2. A barrel is 159 litres.

3. Available at http://www.med.govt.nz/sectors-industries/energy/energy-modelling/data/oil

Oil and Gas

each year since 2008, which was the largest year of production on record at 58,600 bbl/day (128 PJ), of which the Tui field provided 36,800 bbl/day (83 PJ) or 63%.

Exports of New Zealand's crude oil dropped 19% in 2013 to 11 mmbbls (67 PJ). New Zealand's locally produced crude oil is generally exported (only 3% of it was sent to the Marsden Point refinery for processing in 2013) because of its high quality and consequent higher value on the international market. Australia purchases the majority of this oil.

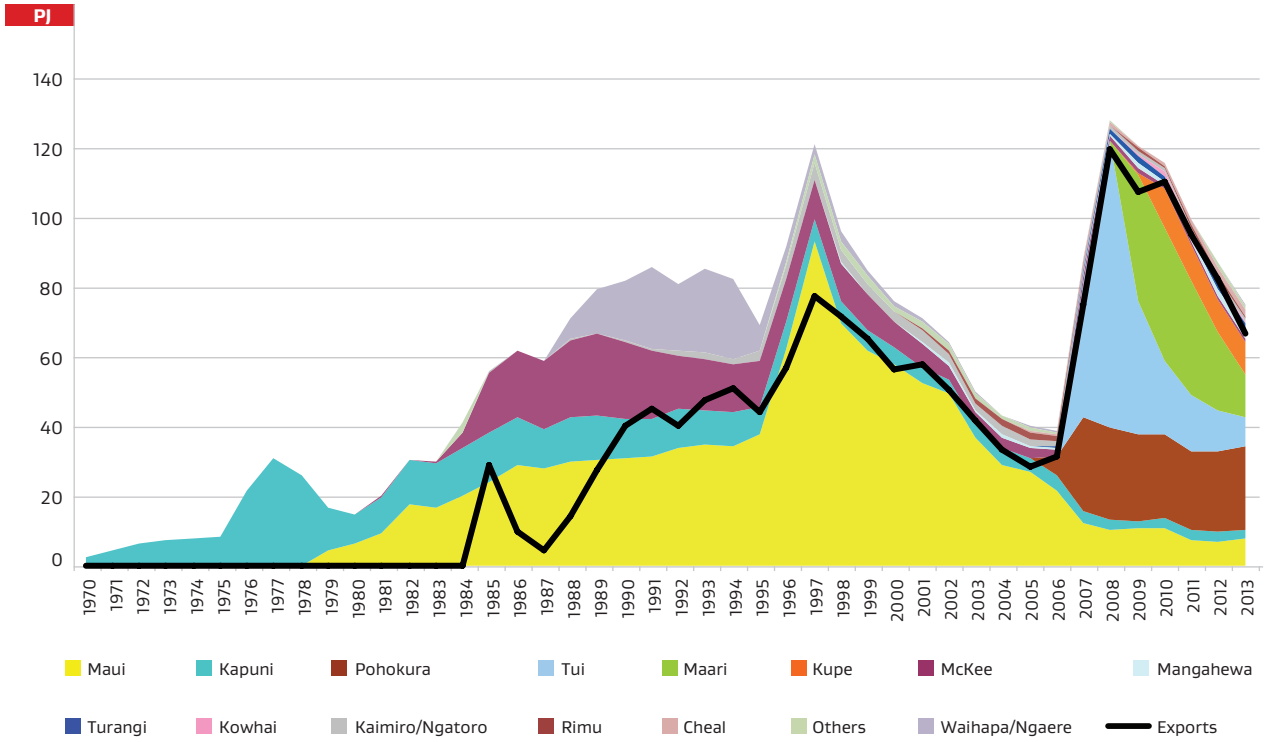
Consumption of Oil Products Up

Observed domestic consumption of all refined oil products rose 2% in 2013 to 123,000 bbl/day (261 PJ). Fuel consumed for international transport (such as shipping or aviation) rose 4% to 23,000 bbl/day (51 PJ). While fuel consumed domestically did not change much (and is in line with the average of the last five years of 261 PJ), petrol consumption continued to slowly fall while diesel continued to rise.

Consumption of petrol recorded almost no change at 52,200 bbl/day (106 PJ). Diesel surpassed the 50,000 bbl/day mark in 2013, rising 4% to reach its highest consumption on record of 52,200 bbl/day (116 PJ). In previous years, only petrol consumption had been higher than 50,000 bbl/day (from 1999 onwards). Diesel's share of oil products consumption is now at 44%. Diesel with petrol make up 85% of oil products demand in New Zealand.

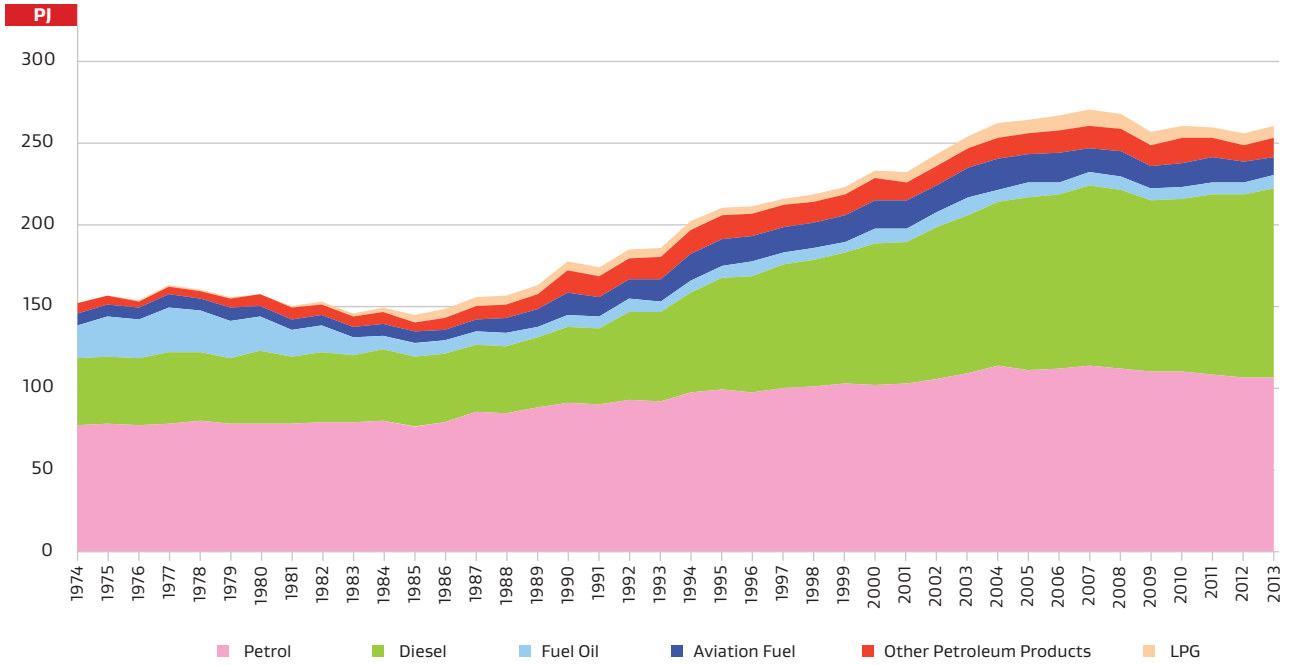
Diesel is the primary fuel for commercial land transport and tends to be strongly linked to economic performance. Petrol, meanwhile, tends to be for private consumption. Figures D.7A and D.7B

Figure D.5b: Annual Crude, Condensate, Naphtha and Natural Gas Liquids Production by Field



Oil and Gas

Figure D.6: Observed Oil Products Consumption



show the respective breakdowns of petrol and diesel use by vehicle type.

Refined Imports Up

Imports of refined petroleum products rose 15% to 43,800 bbl/day (93 PJ). At the same time, imports of crude oil and feedstocks fell 2% to 109,100 bbl/day (243 PJ) and refinery production of petroleum products fell 5% to 104,700 bbl/day (229 PJ). There were two planned maintenance shutdowns (in February and October) at the refinery in 2013, which meant less processing time than in 2012.

About three-quarters of New Zealand's oil product imports came from Singapore and South Korea in 2013.

Figure D.8a shows imports of crude oil by country of origin for the 2013 calendar year. Over half (59%) of all imported oil to New Zealand in 2013 was produced in the Middle East. Crude from Asia was 27%, while imports from Russia approximately doubled from last year to be 10%. Nigeria and Australia made up the rest.

Refining NZ produces a full range of petroleum products and satisfied approximately 64% of domestic consumption of petroleum products in 2013.[4] It processed an average of 108,700 bbl/day (242 PJ). It is currently undergoing major expansion work, with a $365 million project expected to be complete by the end of 2015.[5]

Stock Requirements

New Zealand has officially been a member of the International Energy Agency (IEA) since 1977. The IEA was set up in 1974 in response to major oil market disruptions in 1973/74. Member countries must demonstrate they have access to reserves of crude oil and/or oil

4. Percentage is calculated as:

$$\frac{\text{(refinery output – product exports – international transport)}}{\text{domestic oil product consumption}}$$

5. See the CCR Project page, available at http://www.refiningnz.com/our-investors/growth/ccr-project.aspx

6. Net oil imports = imports - exports - stock change.

Figure D.7a: Transport Petrol by Mode in 2013*

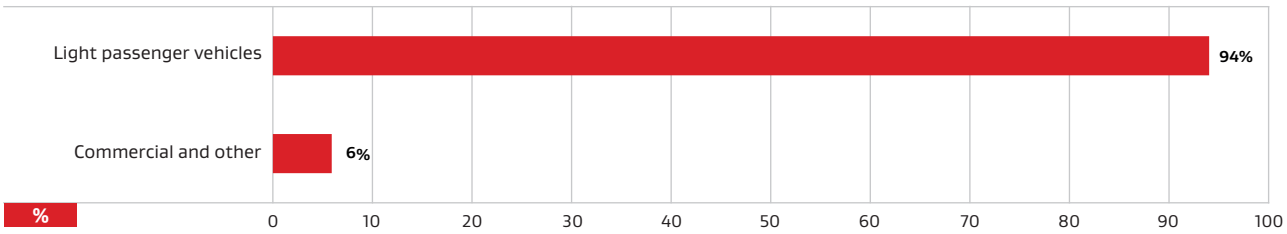
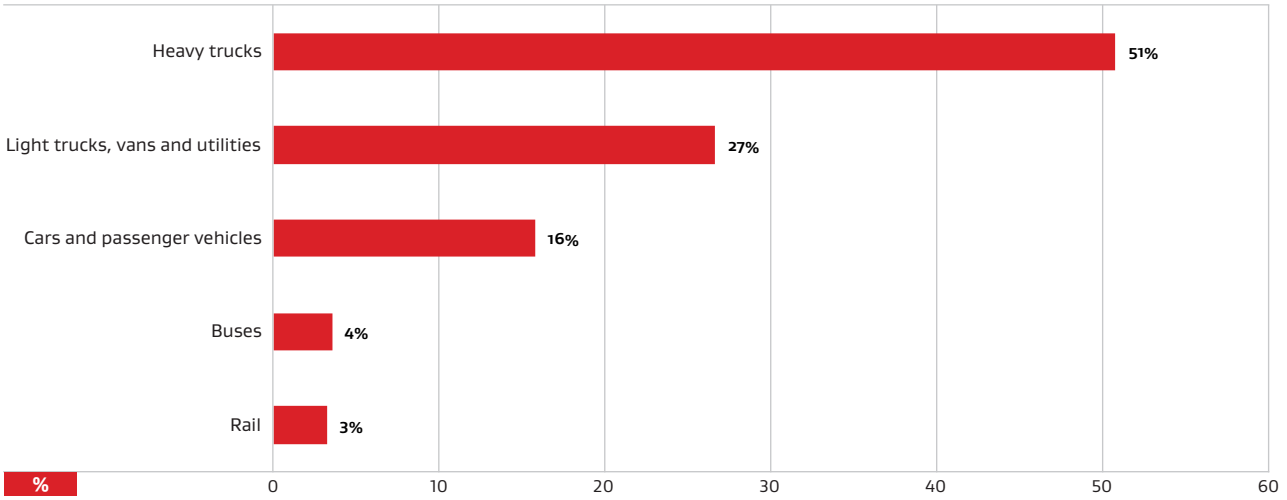


Figure D.7b: Transport Diesel by Mode in 2013*



*This data was estimated by disaggregating transport fuel use using data from the Ministry of Transport's Vehicle Fleet Model.

products equivalent to not less than 90 days of their prior year's average net oil imports.[6] To help meet this requirement, governments can purchase stock tickets which allow access to oil stocks held overseas, should the need arise.

On average for the year, there were 100 days of oil stock. The main stock-holders in the country include the main oil companies, the Marsden Point refinery, and some large companies which hold large stocks of oil products for their own use. Lower month-end stock levels (for example, in November) can occur, for example, in the event of a delayed arrival of a ship bringing oil into New Zealand.

Port Offtakes

Figure D.10 is a chart of port offtakes of petrol, diesel and jet fuel in mmbbl during 2013. While ports have been grouped by regions, it should be noted that some regions, such as Whangarei and Auckland, include multiple port terminals.

While port offtakes of petrol, diesel and jet fuel can be thought of as a rough measure of regional demand for these fuels, it is important to note that the oil network in New Zealand often involves deliveries between regions. For example, New Plymouth is often served by Wellington (Seaview), whereas Mount Maunganui supplies throughout the North Island. Figures should therefore be interpreted with care.

Auckland, with about a third of the national population and a major airport (a pipeline connects the airport to a terminal in Wiri), had 18 mmbbl of diesel, petrol and jet fuel offtakes in 2013. Lyttleton (Christchurch) was next with 6 mmbbl.

Oil Prices

Quarterly and annual retail prices for petrol and diesel are collected from Statistics New Zealand. Wholesale diesel data are produced using data collected each quarter from New Zealand's four largest oil companies (BP, Z, Chevron and ExxonMobil).

Retail Prices Relatively Stable

In 2013, retail petrol and diesel prices remained relatively stable. Petrol prices stayed between 205 and 227 cents per litre, while diesel prices have fluctuated around 150 cents per litre. This continues a period of relative stability since early 2011. Since then, petrol prices have mostly ranged between 200 and 225 cents per litre, and diesel prices have ranged between 140 to 170 cents per litre.

Figure D.11 shows petrol and diesel prices since 1974 in real 2013 terms. Prices have been trending upwards since 1998, but are still below the highs seen prior to deregulation in the 1980s. Petrol prices (regular and premium) remained flat for the 2013 year, while diesel prices (retail and wholesale) dropped slightly (real 2013 prices). The volatility seen in prices during 2008

Oil and Gas

Figure D.8a: 2013 Oil Product Imports by Country of Origin

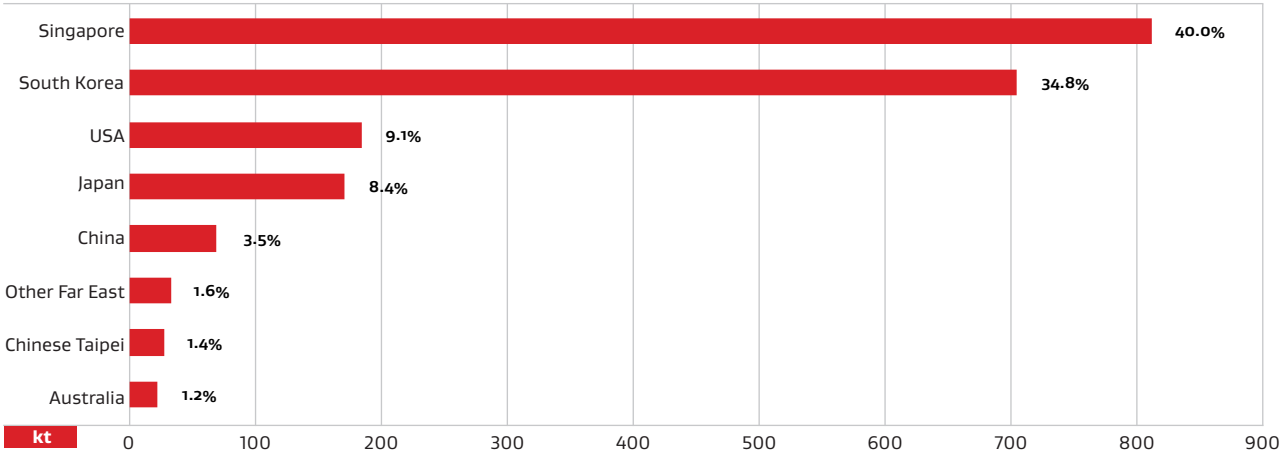


Figure D.8b: 2013 Crude Oil Imports by Country of Origin

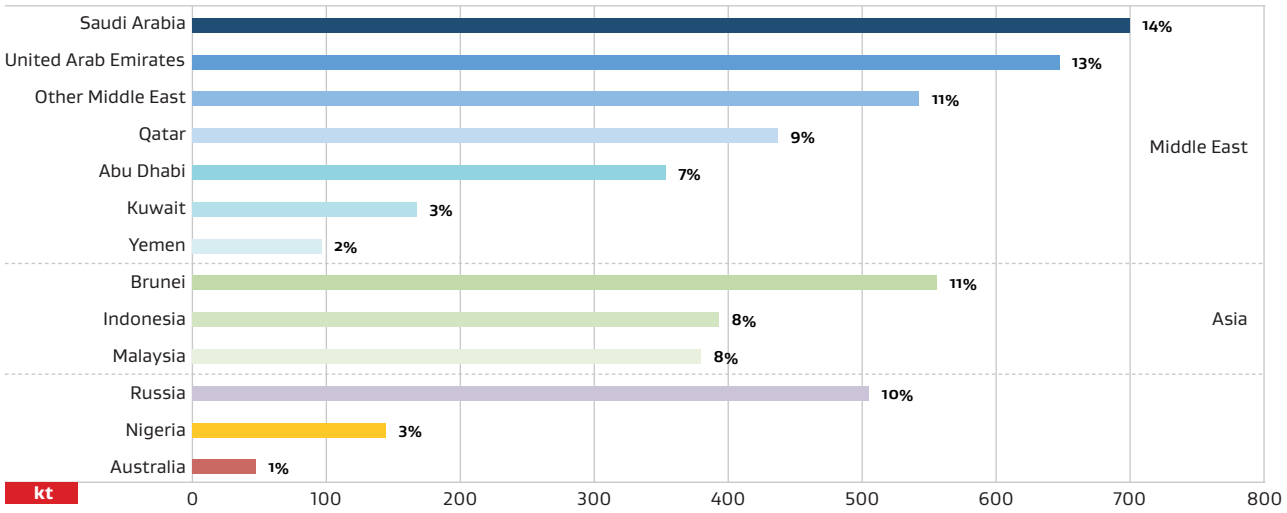


Figure D.9: Oil Stocks for 2013

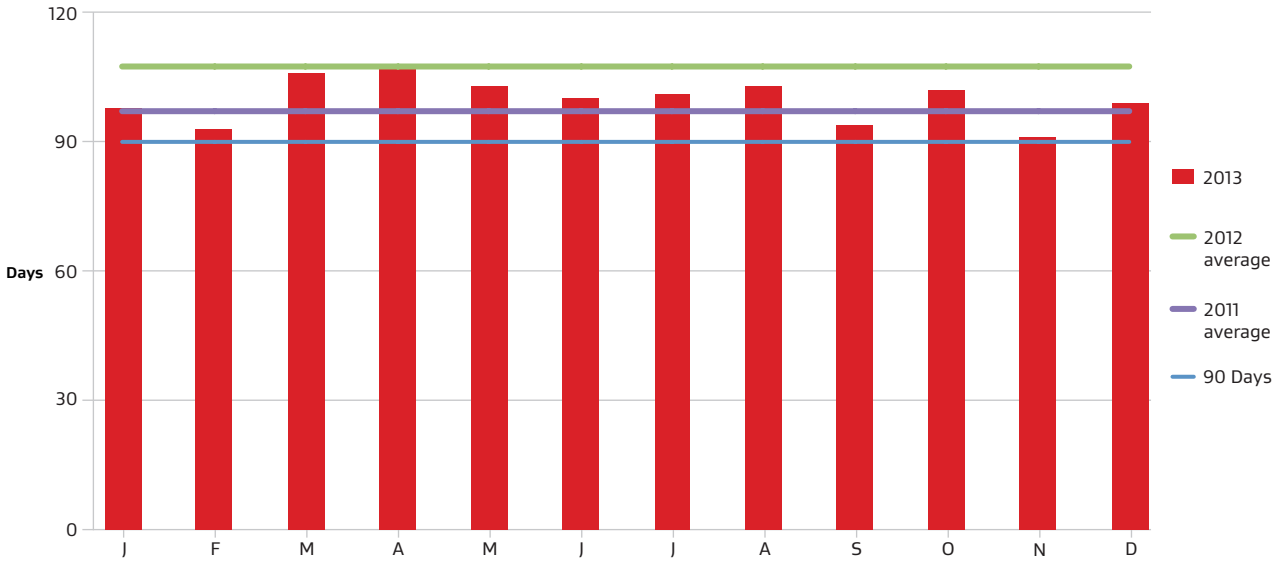
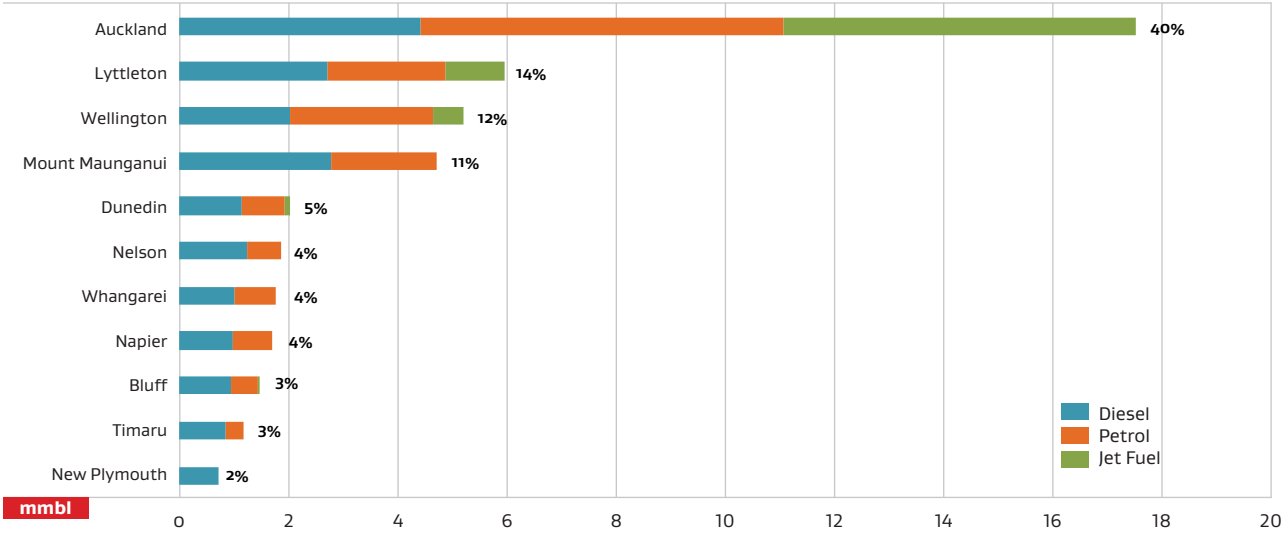


Figure D.10: Diesel, Petrol and Jet Fuel Offtakes by Port in 2013*



*Data sourced from Coastal Oil Logistics Ltd, which is jointly owned by BP, Z, Exxon Mobil and Chevron (Caltex).

and 2009 was due to volatility in the international crude oil price.

The key drivers of changes in the retail price are:

- The importer cost, largely driven by movements in the international crude oil price and USD to NZD exchange rate.
- Changes in excise duty (for petrol) and the cost of greenhouse gas emissions.
- Changes in importer margins (the amount available to retailers to cover domestic transportation, distribution and retailing costs, and profit margins).

Between early 2009 and early 2011, importer costs increased in response to movements in the crude oil price and exchange rate. Since 2011, the importer cost has declined slightly and the cost of greenhouse gas emissions has fallen sharply. Importer costs have fallen slightly, while importer margins have continued to trend upwards.

Premium and regular petrol are subject to petrol excise duty. Excise duty on petrol increased by 3 cents a litre from the 1st of July 2013. Diesel is subject to RUCs which are vehicle dependent and charged on a per-kilometre basis. RUCs, designed to increase at an equivalent rate to petrol excise duty, increased by an average of 5.9%.

Importers' Cost and Margin

The Ministry publishes a weekly report on liquid fuel prices. The weekly fuel price report breaks down the retail price of petrol and diesel into its components in order to monitor liquid fuel importer margins.

Importer margins are calculated from retail prices less taxes, levies and import costs. New Zealand import costs are calculated using the Singapore spot market price plus allowances for international freight, wharfage fees and insurance costs. Further details on the calculation of importer margins can be found in the tables released online with this publication.

Figure D.11B shows that importer margins have decreased significantly since petrol prices were deregulated during the mid-1980s. Margins decreased further after the entry of Gull and Challenge to the market in the late-1990s.

However, since 2009, both petrol and diesel importer margins have been trending upwards, although, in real terms, they are still around half the level seen in the 1980s prior to market deregulation. In 2013, average real importer margins were up 11% for regular petrol and 7% for diesel compared with 2012. The average import cost of fuel, made up mainly by the Singapore spot price, reduced slightly over the year.

Oil and Gas

Figure D.11a: Petrol and Diesel Prices (Real 2013 Prices)

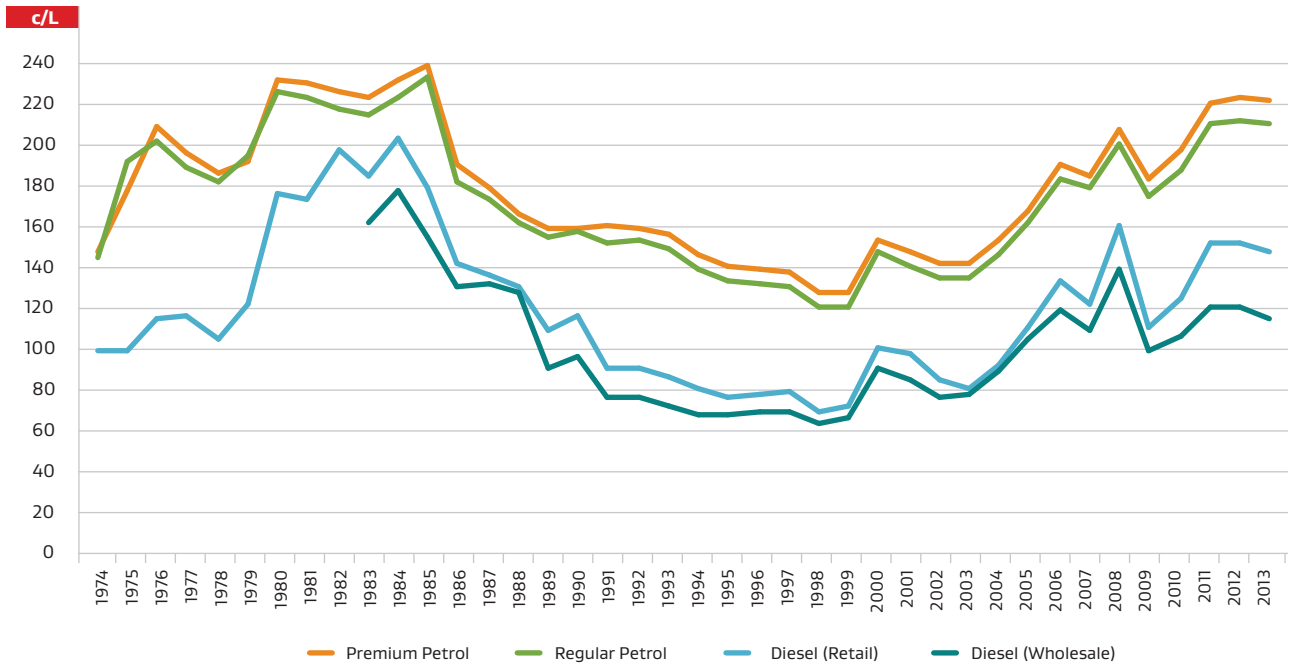
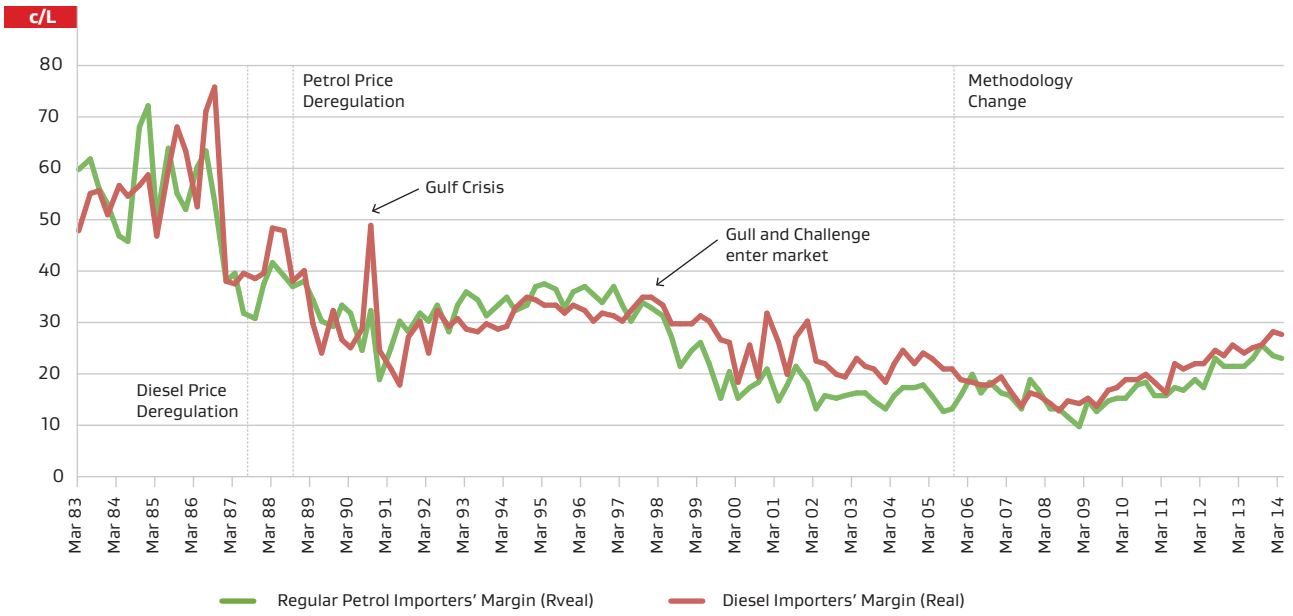


Figure D.11b: Importers' Margin (Real 2013 Prices)



GAS

Overview

This section contains information about the production, transmission, distribution and sales to end consumers of natural gas.[7]

All statistics apply to the 2013 calendar year. Comparisons are made with the 2012 calendar year, unless otherwise specified. Percentage changes are calculated from energy units (PJ) rather than volume (Mm^3, or million cubic metres), due to the different energy properties of gas from different fields.

Gas is produced entirely in the Taranaki region and reticulated gas is only available in the North Island. Figure D.13 summarises the New Zealand gas industry in 2013, showing current fields and their percentage of total gas produced. Consumption by major user/supplier categories is also shown in this figure. Companies involved in the production of gas are also shown.

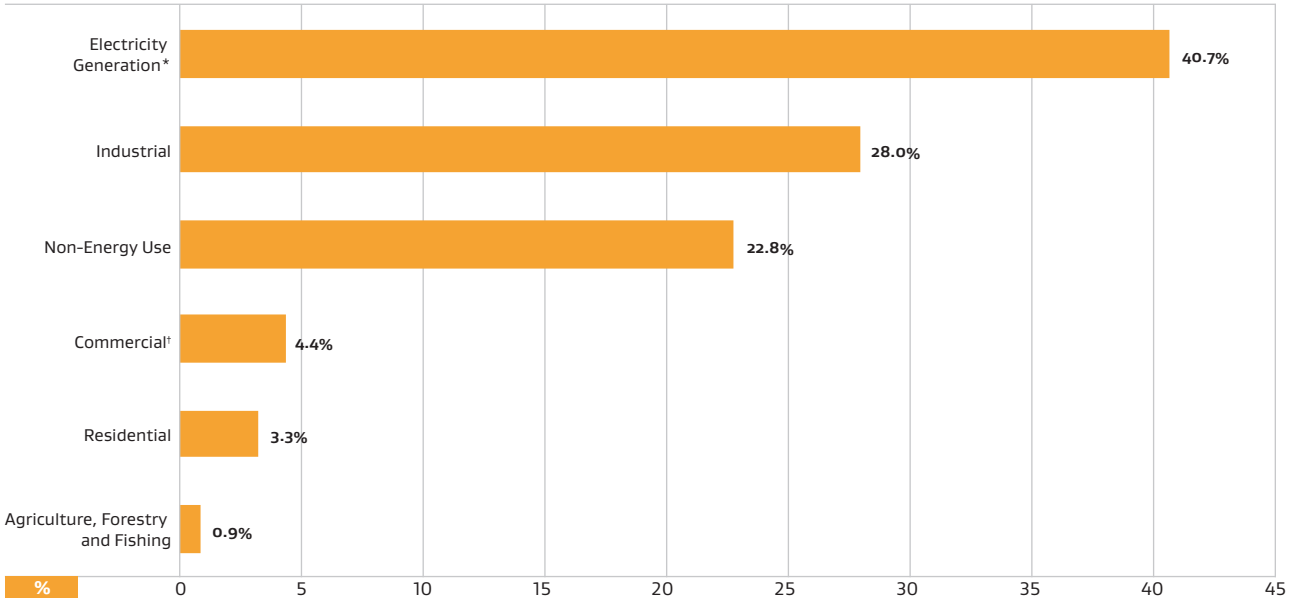
Gas Consumption

Total observed gas consumption (including electricity generation, cogeneration, total losses, own use and non-energy use) increased 6% in 2013 to 181 PJ. Most gas is still consumed for electricity generation with a 40.7% share, followed by the industrial sector on 28.0% then non-energy use with 22.8%. In recent years, the share of gas for non-energy use has increased while the share consumed for electricity generation has fallen. In 2011, the share for electricity generation was about triple that of non-energy use, while in 2013 it was less than double.

Much of the increased consumption in 2013 was due to Methanex, which consumed about a third of the domestic gas supply. Methanex produces crude methanol using natural gas. In 2013, Methanex upgraded the Motunui-1 train and restarted the Waitara Valley train. With its second train at Motunui, Methanex is now operating at full capacity in New Zealandfor the first time since 2004. Methanex New Zealand produced about 1419 kilotonnes of methanol during 2013, up 28% from 1108kt in 2012.[8]

The Motunui-1 train was shut in December 2004 due to gas supply constraints in New Zealand. Domestic gas supply had fallen 24% from 2002 (230 PJ) to 2003 (174 PJ). Maui had fallen 32% over this time, from 175 PJ to 119 PJ (see figure D.8). Pohokura, the largest

Figure D.12: Natural Gas Consumption by Sector for 2013



*Includes cogeneration.

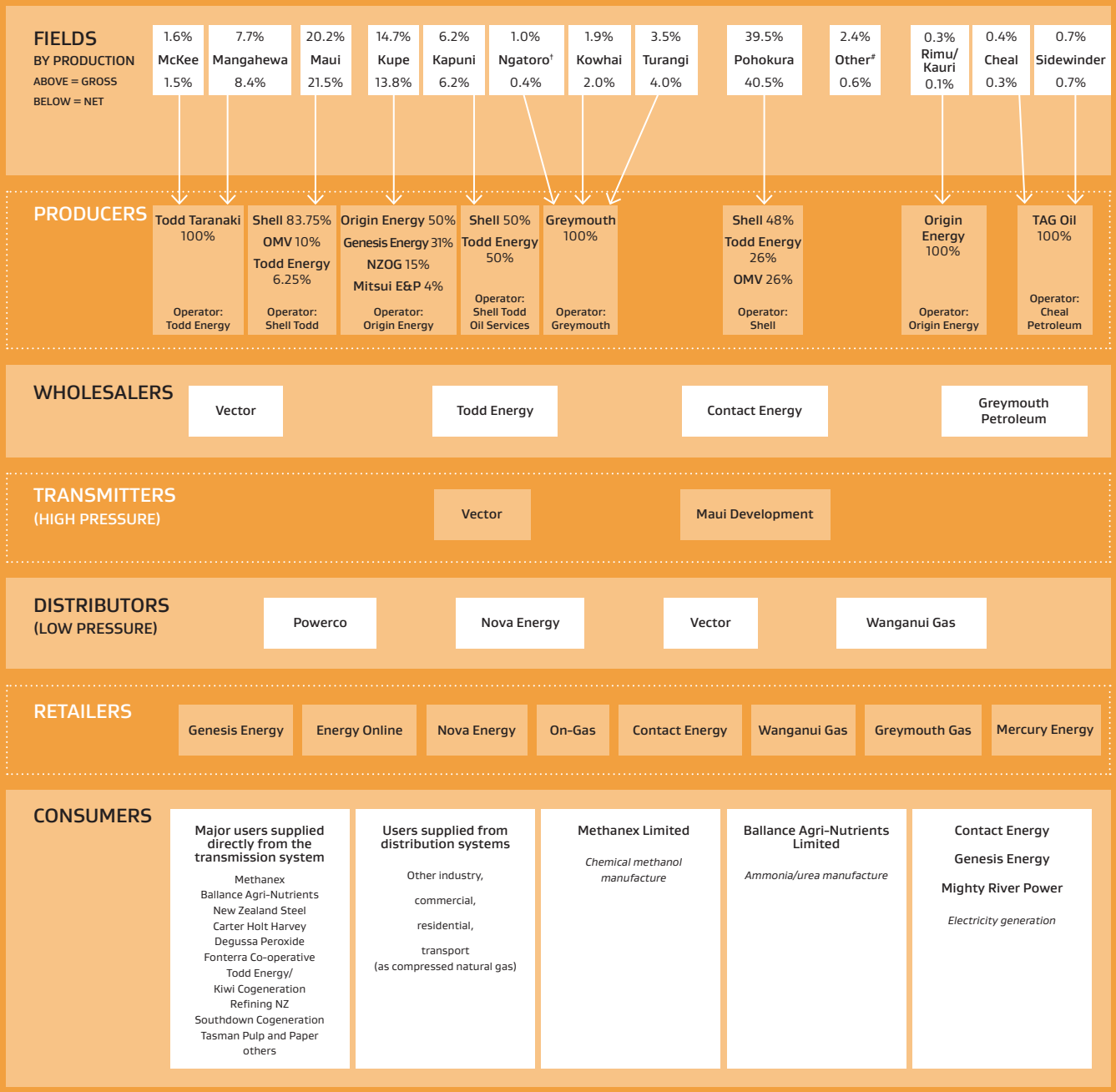
† Includes transport.

7. LPG statistics are not presented here but are presented in the oil section.

8. See 2013 annual report, available at: http://www.methanex.com/investor/documents/667945_AR_000.pdf

Oil and Gas

Figure D.13: Natural Gas Industry Summary for 2013*



Company names are listed without the suffixes "Limited" and "New Zealand Limited" where applicable. AWE is Australian Worldwide Exploration Limited; Greymouth is Greymouth Petroleum Limited; Mitsui E&P is Mitsui E&P New Zealand Limited; NZOG is New Zealand Oil & Gas Limited; OMV is OMV New Zealand Limited; Contact Energy is Contact Energy Limited; Origin Energy is Origin Energy New Zealand Ltd and Contact Energy (51% owned by Origin); Pan Pacific is Pan Pacific Petroleum; Shell is Shell NZ Limited (includes Shell Exploration NZ Limited; Shell (Petroleum Mining) Co Limited; Energy Petroleum Holdings Limited; Energy Petroleum Investments Ltd; Energy Petroleum Taranaki Ltd; Energy Finance New Zealand Limited and Taranaki Offshore Petroleum Company); TWN comprises the Tariki; Waihapa and Ngaere fields; Todd Energy is Todd Energy Limited and includes Nova Gas; Vector is Vector Limited and includes OnGas; Wanganui Gas is Wanganui Gas Company Limited and Nova Energy is Nova Energy Limited.

Notes:

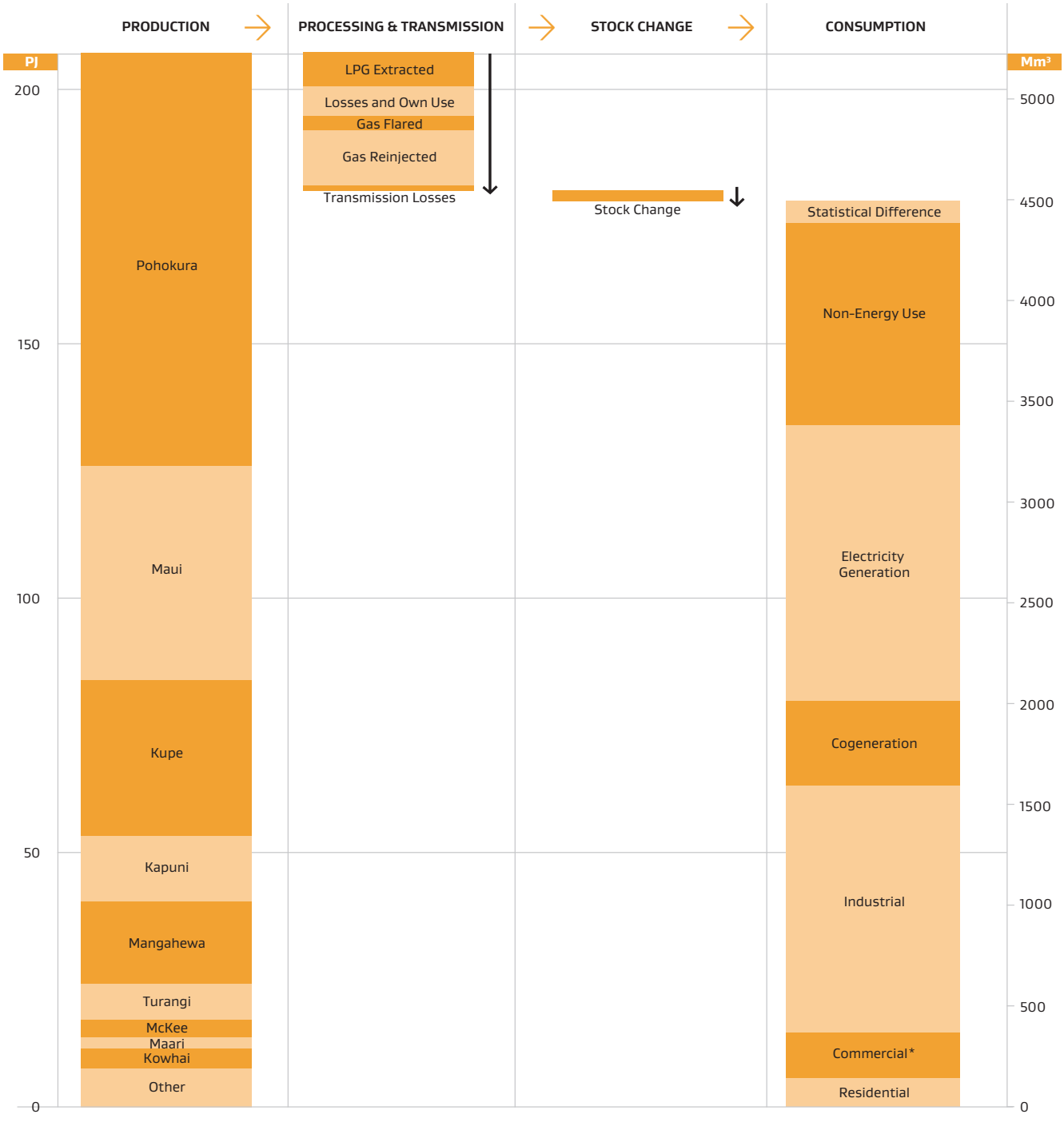
* Gas ownership as at year end 2013; excludes LPG.

† Includes Kaimiro, Windsor and Goldie wells.

Includes Maari, Tui, TWN, Copper Moki and Surrey fields. Maari is owned by OMV, Todd, Horizon and Cue Taranaki and is operated by OMV. Tui is owned by AWE, NZOG and Mitsui E & P, and is operated by AWE. TWN is owned by New Zealand Energy Corp and L & M Energy, and is operated by New Zealand Energy Corp. Copper Moki is owned by New Zealand Energy Corp. Surrey is owned and operated by Greymouth.

Oil and Gas

Figure D.14: Natural Gas Flow Summary for 2013



* Includes transport, agriculture, forestry and fishing.

Oil and Gas

gas-producing field in New Zealand from 2007 onwards, has reduced supply constraints. It began production in the latter half of 2006 with 14 PJ, and has annually produced around 70 PJ from then on.

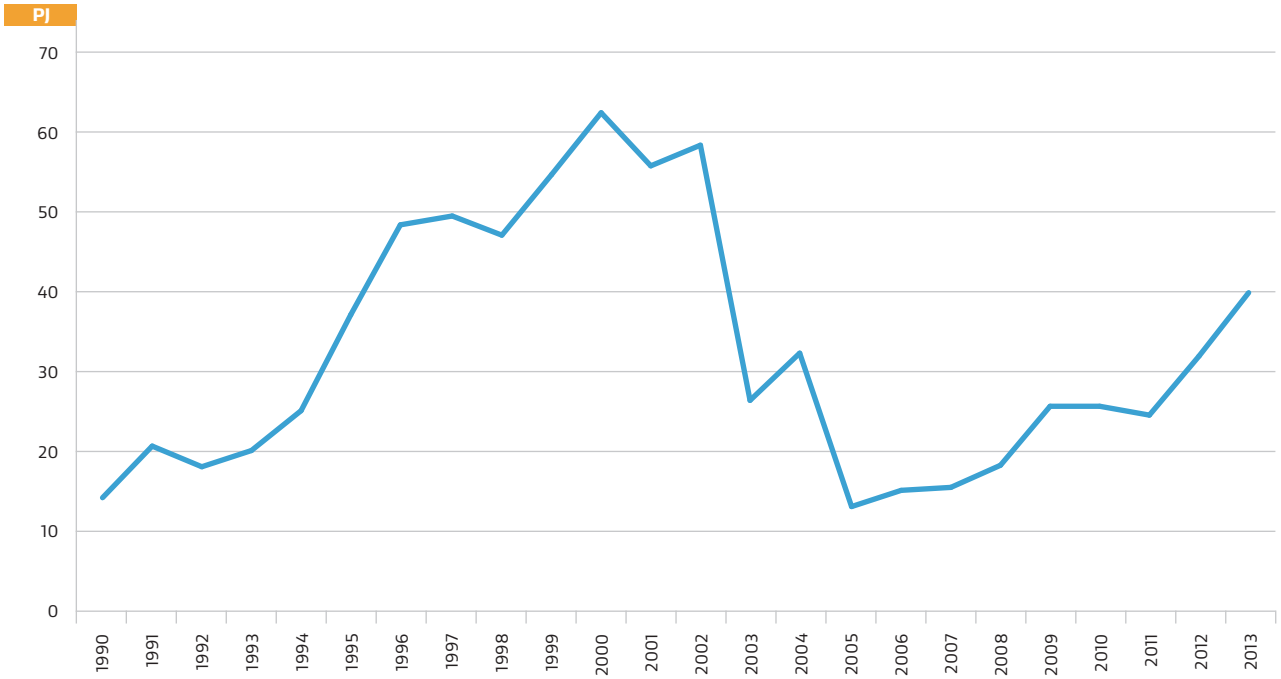
In January 2012, it was announced that Methanex had a 10-year sales agreement with Todd Energy, which owns and operates the Mangahewa and McKee fields. As a result of the agreement, Todd Energy is undertaking an 800 million dollar expansion project over five years to increase its production and processing supply at its Mangahewa and McKee fields.

Gas used as a feedstock (that is, non-energy use of gas) in the petrochemicals sector represented around 23% (40 PJ) of New Zealand's natural gas consumption in 2013 (up from 19% or 32 PJ).

Ballance Agri-Nutrients (Kapuni) Limited (previously Petrochem Limited) manufactures ammonia/urea from natural gas. Gas consumption as a feedstock for ammonia/urea production is up on 2012.

The industrial sector accounted for 28% of total gas consumption (up from 26%). This was mainly due to an increase in gas for energy consumption at the Methanex facilities. Methanex consumes some gas to run its facilities (categorised under Industrial consumption) and also transforms feedstock gas (categorised under non-energy use) into crude methanol, which has a variety of uses such as fuel feedstock, adhesives or production of chemicals. About a third of total domestic gas consumption in 2013 came from Methanex.

Figure D.15: Non-Energy Use Gas Consumption



Oil and Gas

Forty-one percent of New Zealand's natural gas consumption during 2013 was for electricity generation (including cogeneration). In 2013, gas consumption for electricity generation increased from 53 to 54 PJ, while cogeneration decreased from 18 to 17 PJ.

Genesis Energy Limited (Huntly – including the unit 5 combined cycle plant) and Contact Energy Limited (Otahuhu B, Taranaki Combined Cycle and Stratford) are the main electricity generators in New Zealand using natural gas.

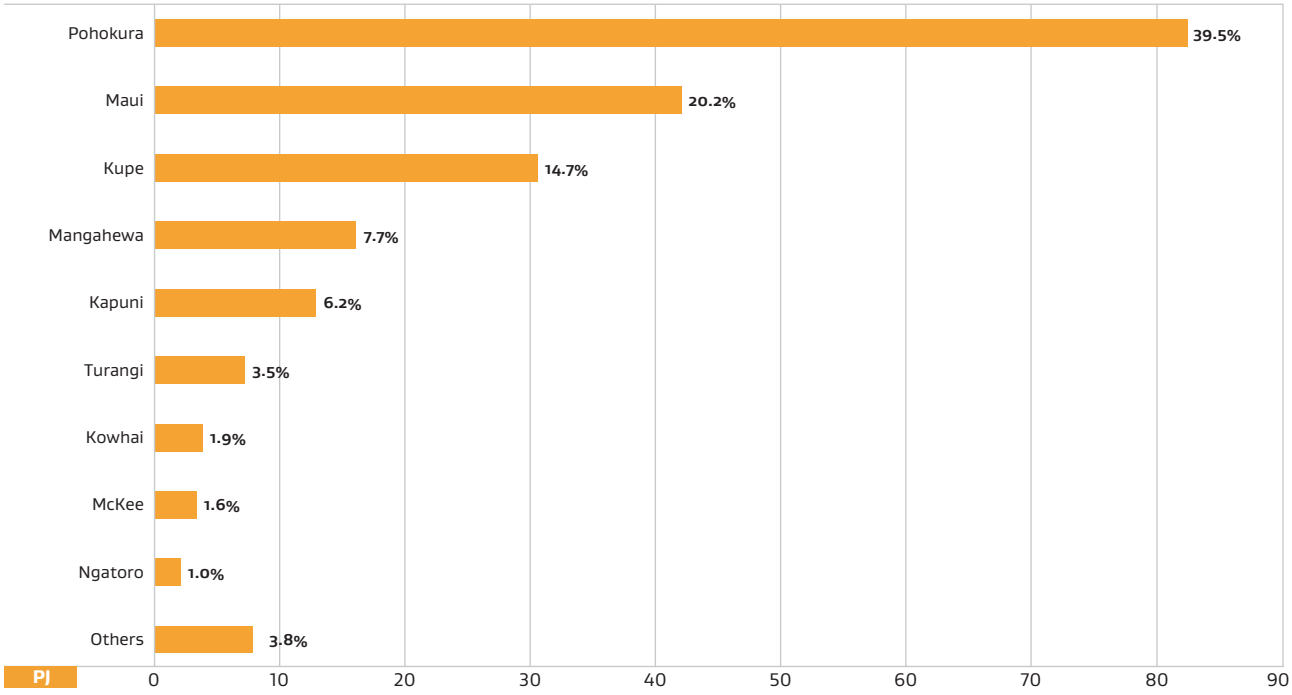
Around 4% of gas consumption came from the commercial sector in 2013, which had about 14,000 consumers. The residential sector, with about 248,000 consumers in 2013, accounted for around 3% of total gas consumption. Industrial consumers numbered around 1,500 and consumed 28% of natural gas.

Production Up

Maui contributed some of the increase in supply, up from 37 PJ to 42 PJ. Production at Mangahewa, which is owned by Todd Energy and supplies Methanex's three methanol production trains, increased 52% to 16 PJ in 2013. This is the highest annual production at Mangahewa on record and follows on from a major expansion project at the Todd Energy-owned Mangahewa and McKee fields. In May 2014, Todd Energy officially opened a new expansion train which will increase natural gas processing capacity from 20 PJ to 45 PJ.

Despite the increase in production at Mangahewa, total production continues to be dominated by Pohokura (responsible for 40%) and Maui (20%), as shown in Figure D16.

Figure D.16: Total Natural Gas Production by Field for 2013

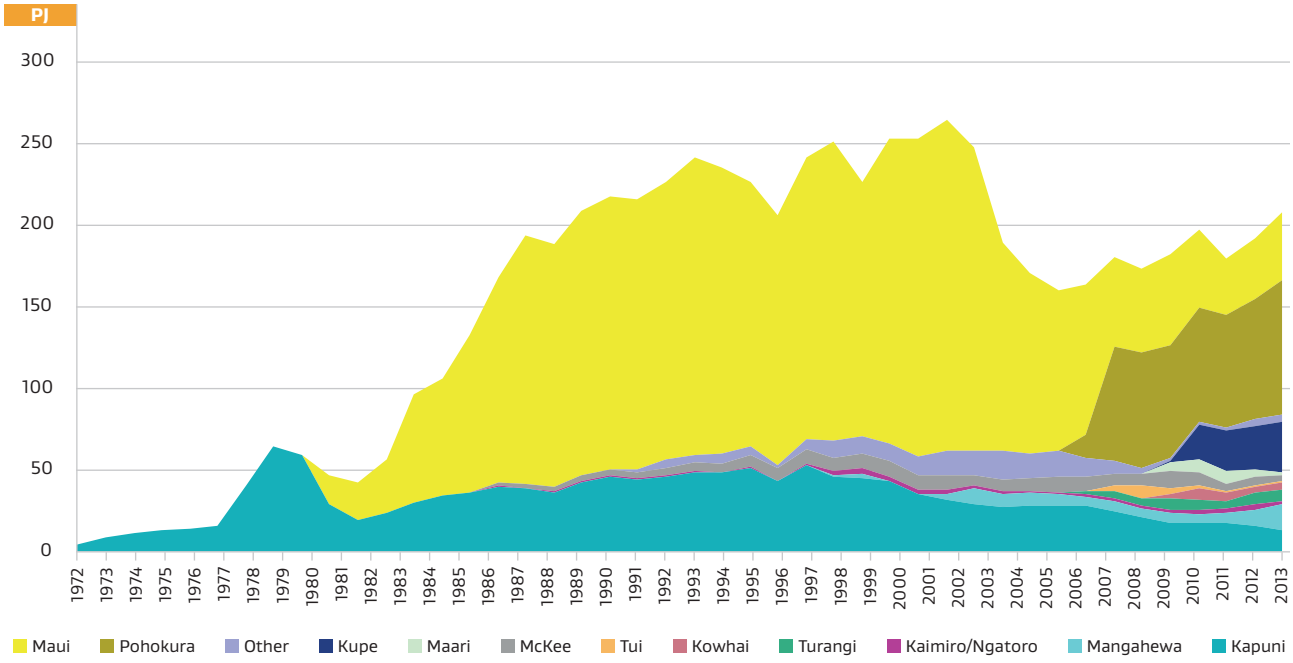


Oil and Gas

Total net gas production[9] grew 7% to 181 PJ (from 170 PJ). This is the highest net gas production since 2002 (230 PJ), when the Maui field itself had a net production of 175 PJ, which subsequently fell below 100 PJ in 2005.

Total gross gas production grew 8% to 208 PJ (from 192 PJ). One reason why gross gas production grew more (in absolute terms) than net production is that reinjection grew from 4 PJ to 11 PJ. Pohokura is the main field reinjecting, which is done to maintain pressure underground which aids the extraction of liquids. Net production of gas at Pohokura did not show an overall change in 2013, even though its gross gas production grew 12% to 82 PJ.

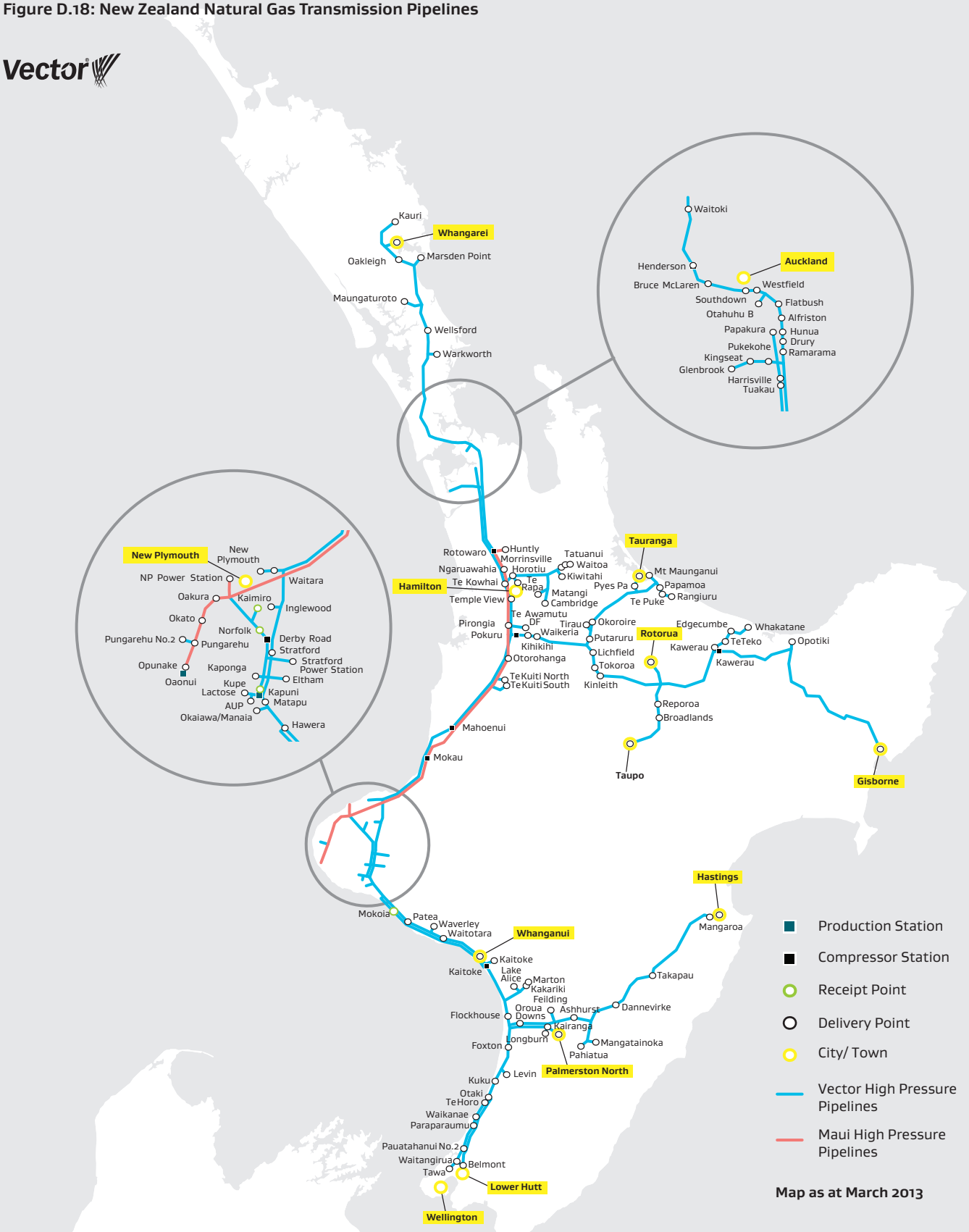
Figure D.17: Total Natural Gas Production by Field



9. Net gas production is gas injected into the transmission network after field flaring, LPG extraction, reinjection, losses and own use.

Oil and Gas

Figure D.18: New Zealand Natural Gas Transmission Pipelines

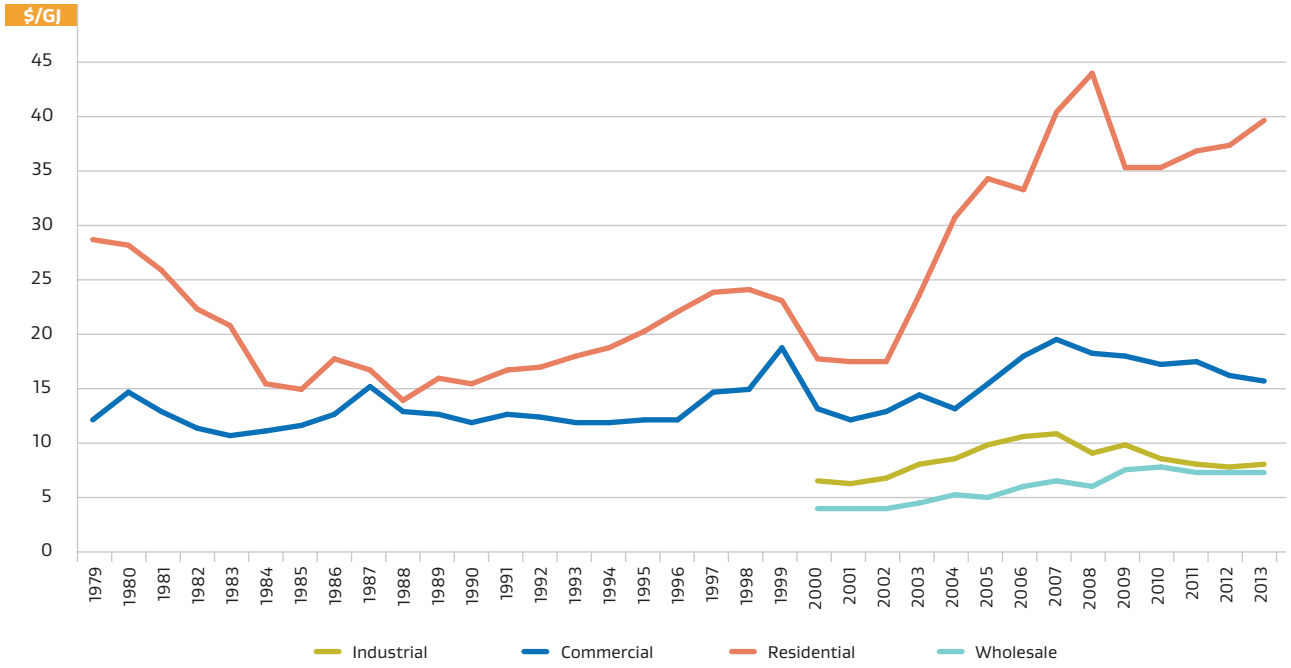


Natural Gas Prices

Natural gas prices are calculated by dividing income data by consumption data for each of the commercial, industrial and residential sectors. These data are collected quarterly from gas retailers. Gas sold for electricity generation has been excluded from the industrial sector, as the actual price paid by the generators is reflected in the wholesale price. Quarterly residential gas prices are calculated as a rolling average over the last year to smooth out seasonal variations as a result of fixed charges.

Figure D.19 shows real natural gas prices ($/GJ) by sector (2013 basis). The running down of the large Maui gas field was a major factor in the price increases from 2001 onwards. Residential prices show similar volatility to fuel prices in 2008 and 2009. In 2013, the residential sector showed the largest change, with a 6% increase in price from 2012. Wholesale and retail prices showed slight increases over the year, while commercial prices decreased slightly.

Figure D.19: Natural Gas Prices (Real)



Oil and Gas

E. RENEWABLES

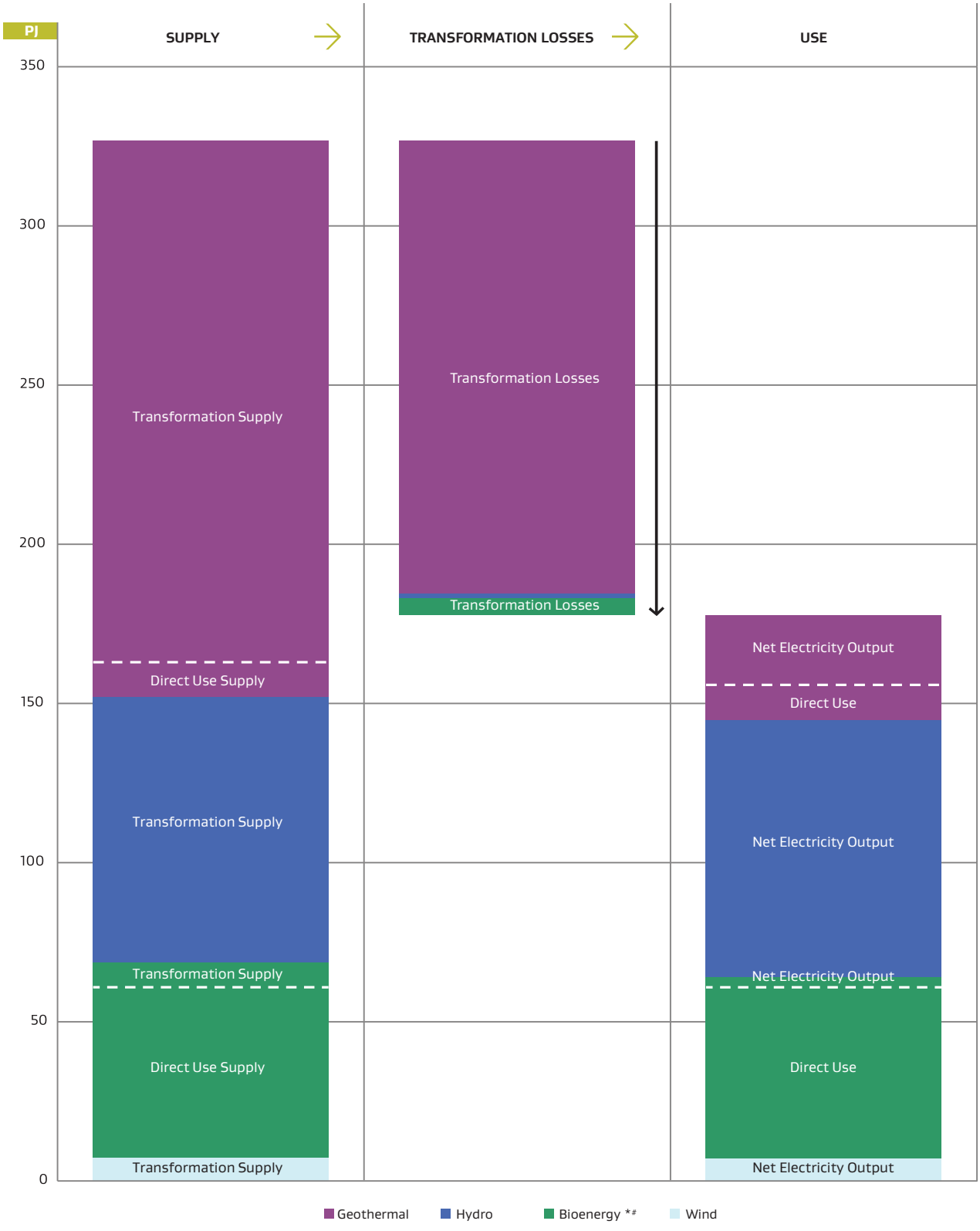
INTRODUCTION

Renewable energy sources discussed in this section include hydro, wind, geothermal, solar, woody biomass, biogas and liquid biofuels. Information on renewable energy is presented for the 2013 calendar year.

Detailed information is available on the renewable energy used by large electricity generators. However, information on the direct use of renewable energy and use for distributed generation is more difficult to obtain, given that the input energy source (e.g. geothermal or the sun) is often used without being purchased and hence it is not well recorded. Where actual information on the direct use of renewable energy is not available, estimates have been made based on research and the knowledge of experts in this field.

Renewables

Figure E.1: Renewable Energy Flow Summary for 2013



* Bioenergy in this instance refers to biogas, woody biomass and liquid biofuel.

A very small amount of liquid biofuel is produced in New Zealand and sent to the transformation sector under oil production. This is included in bioenergy but is too small to distinguish on this figure.

OVERVIEW OF RENEWABLES IN NEW ZEALAND

Supply

The proportion of New Zealand's primary energy supply that came from renewable resources was 38.2% in 2013. New Zealand had the third highest renewable primary energy supply in the OECD after Norway and Iceland in 2013, according to preliminary data from the IEA. This is due to the high levels of hydro and geothermal energy used for electricity generation. Figure E.2 gives a breakdown of renewable primary energy supply for 2013. Bioenergy includes energy from woody biomass and biogas.

The contribution of renewable sources to the primary energy supply increased in 2013, from 37.5% in 2012 to 38.2% (shown in Figure E.3). This was due to increased geothermal generation, with new plants increasing the geothermal contribution to 54% of total renewable primary energy (Figure E.2).

Electricity Generation

Most of New Zealand's production of renewable energy is used for electricity generation. In 2013, a total of 75.1% of electricity generation came from renewable resources, increasing from 72.8% in 2012. New Zealand's renewable percentage in 2013 was the fourth highest in the OECD. Figure F.4 shows how the percentage of electricity generation from renewables has changed over time.

Direct Use of Renewable Energy

In 2013, an estimated 64 PJ of renewable energy was used for direct-use heat applications around New Zealand. This is mostly in the form of woody biomass and geothermal for heating in commercial and industrial applications.

Geothermal energy is used directly as a heat source in small quantities in the central North Island in the timber and tourism industries. It is also used in small quantities for domestic heating.

Woody biomass direct use is mainly in the timber industry, which burns residue wood to provide heat energy. Wood is also burned to heat many private homes in New Zealand, with the 2013 Census reporting that over 36% of New Zealand households use wood to heat their homes.

Liquid Biofuels

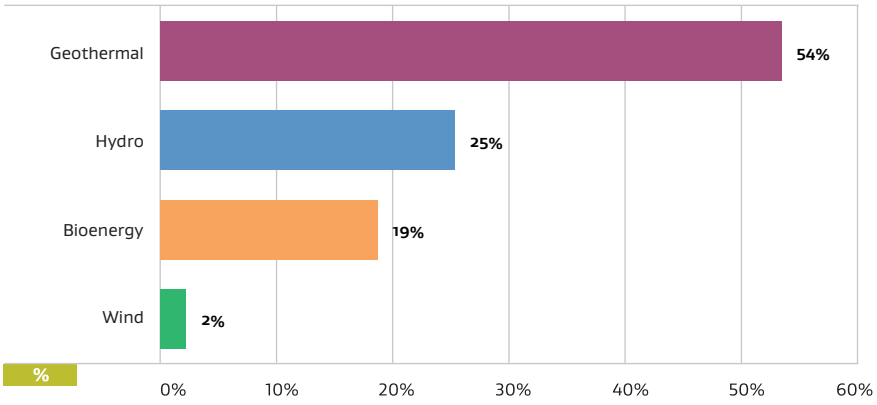
Estimated production of liquid biofuels was 5.2 million litres in 2013, a 26% decrease from 2012. Biodiesel production fell to its lowest level since data was first recorded in 2007, after the Bio-diesel grant scheme was not renewed in 2012. As a result, bio-ethanol production (5.0 million litres) now makes up over 95% of New Zealand's liquid biofuels production. The total consumption of biofuels was 6.5 million litres, with imports of 1.3 million litres, in 2013.[1]

In New Zealand, bio-ethanol is produced and imported from sustainable sources. Bio-ethanol is produced by fermenting whey, a cheese by-product, with some of the resulting ethanol purchased by fuel companies. This, along with imported ethanol, produced from sustainable sugarcane, is mixed with regular petrol. A typical blend is 10% ethanol, which results in a 5–6.5% reduction in greenhouse gas emissions per litre compared with those from regular petrol.[2]

Solar Use

The use of solar photovoltaic (PV) panels to generate electricity is a small but growing proportion of total renewable primary energy. The total generation capacity of small solar PV panels in 2013 was estimated at 7 GWh (26 TJ), an increase of almost 50% compared with 2012.[3] This was calculated using total numbers of solar connections, less than 10 kWh, and does not include unregistered solar or off the grid generation. Total solar generation remains a small proportion of renewable energy at 0.1%.

Figure E.2: Renewable Primary Energy for 2013*



*Energy from liquid biofuels and solar is less than 0.2%.

1. Liquid biofuels are included under oil in the balance tables.
2. ECCA biofuels information.
3. Electricity Authority data.

Renewables

Figure E.3: Renewable Percentage of New Zealand Total Primary Energy Supply by Fuel Type

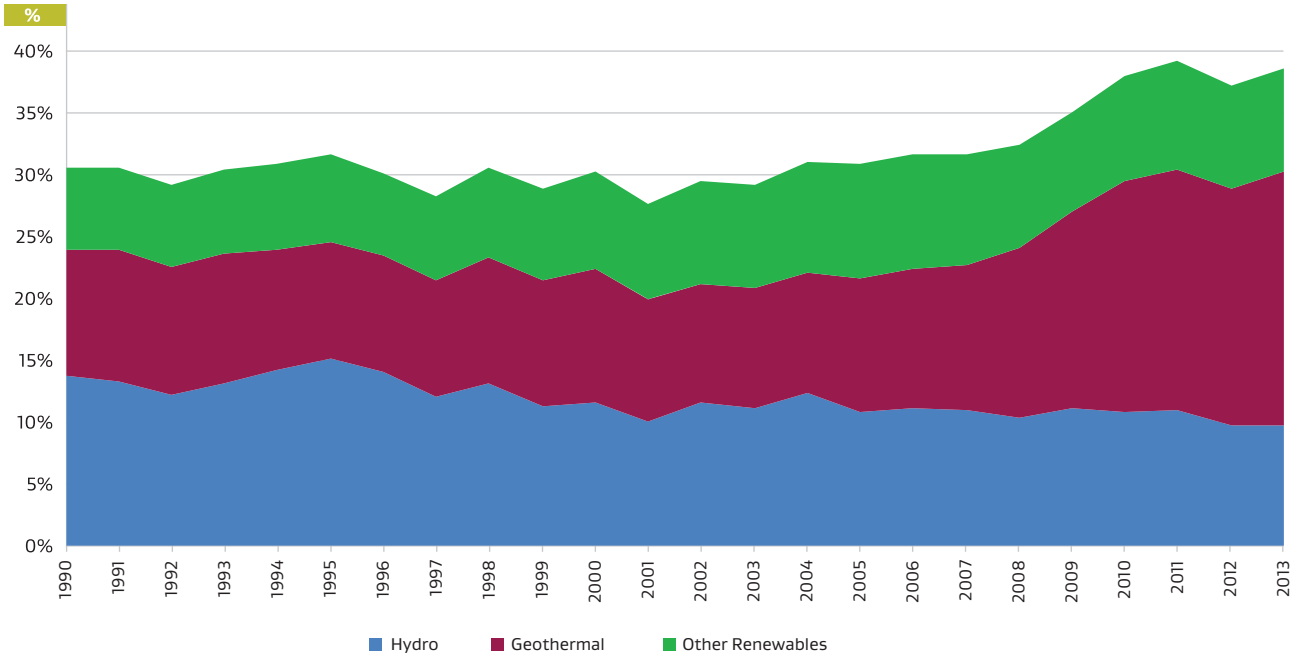
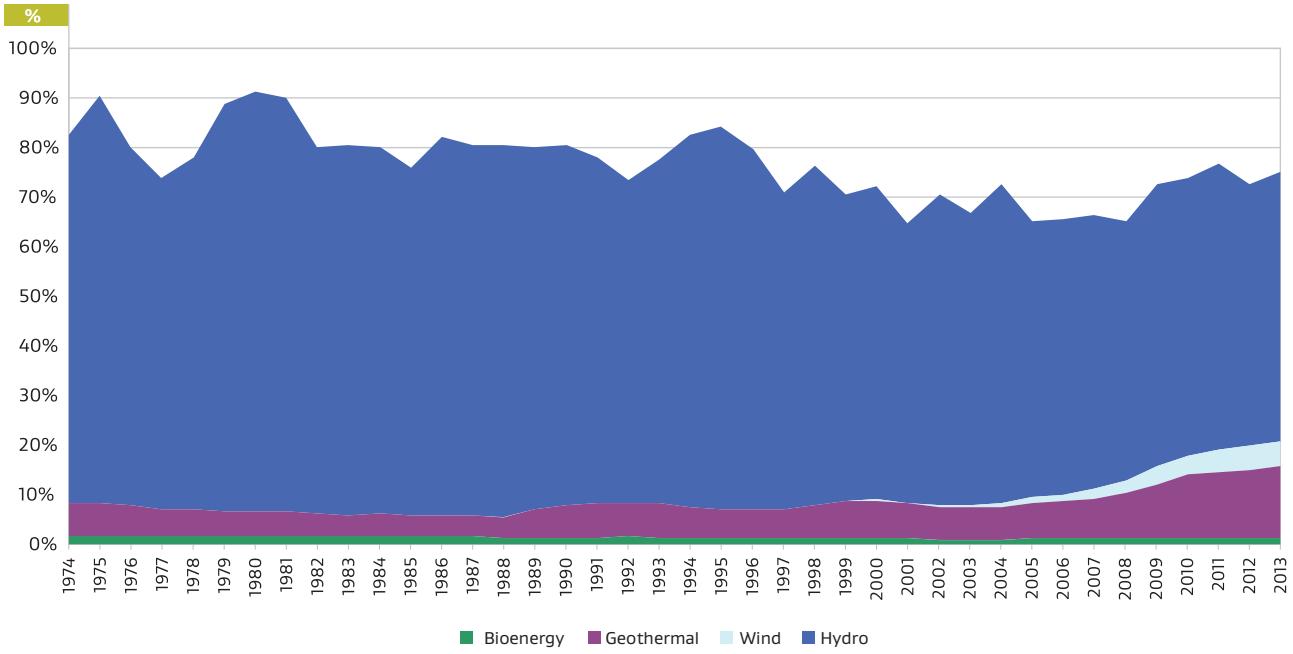


Figure E.4: Percentage of New Zealand Electricity Generation from Renewable Sources



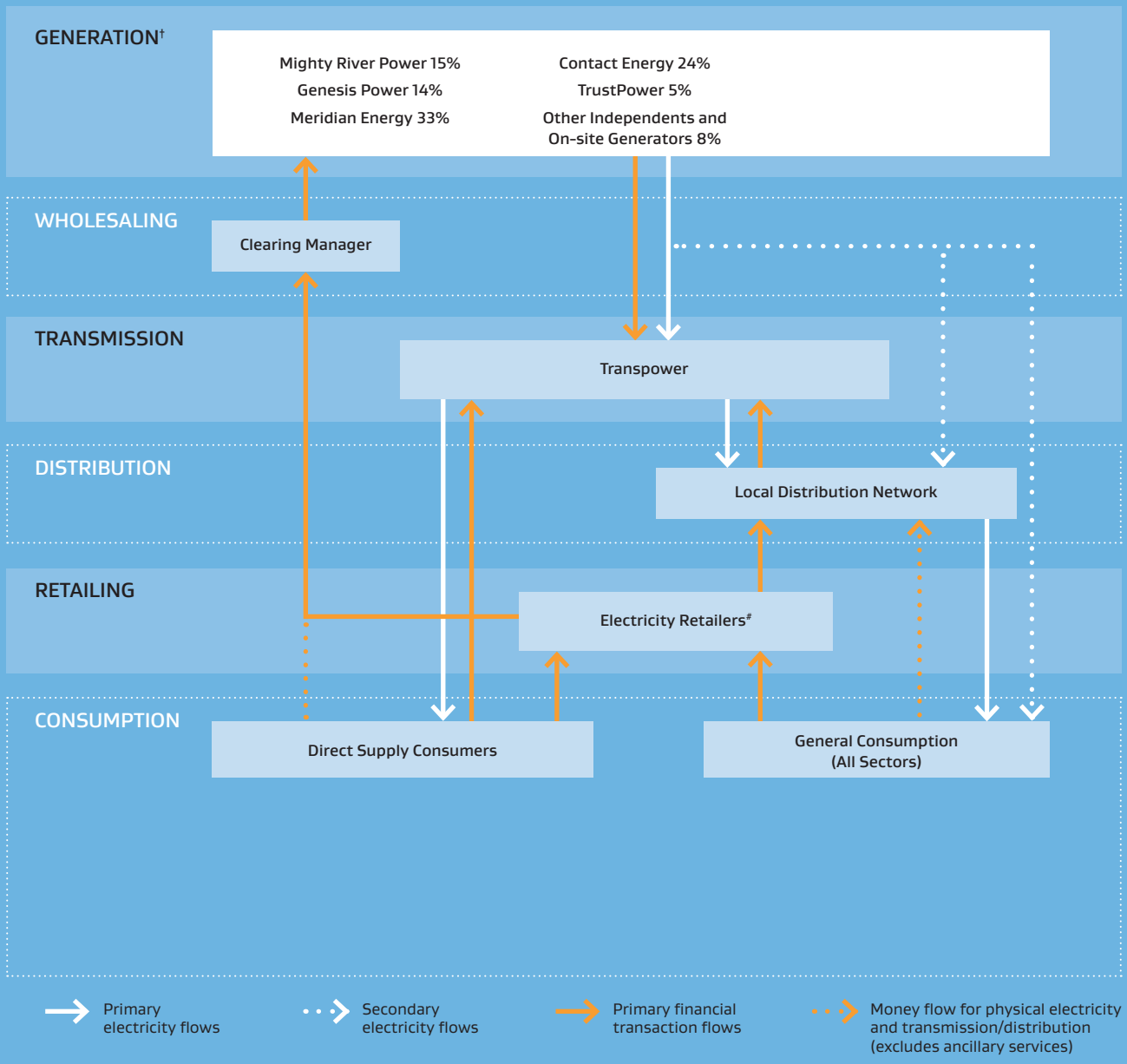
F. ELECTRICITY

INTRODUCTION

This section contains information about electricity generation/supply, transmission and distribution, and demand. Annual figures are for the calendar year, with the exception of electricity prices, which are presented on a March year basis.

Electricity

Figure F.1: Electricity Industry Summary for 2013*



* Primary refers to the most common or typical way that electricity or money flows through the Electricity Industry. Secondary refers to flows of money or electricity which do occur, but are not typical of most participants in the industry. As an example, all customers in the "The Lines Company" distribution network area pay distribution charges directly to the local distribution network as shown by the orange dotted line between the "General Consumption" box and "Local Distribution Network" box. This is not typical nationwide as most consumers pay their lines charges through their retailer as shown by the dense orange line between "General Consumption" and "Electricity Retailers" which partly continues onto the "Local Distribution Network".

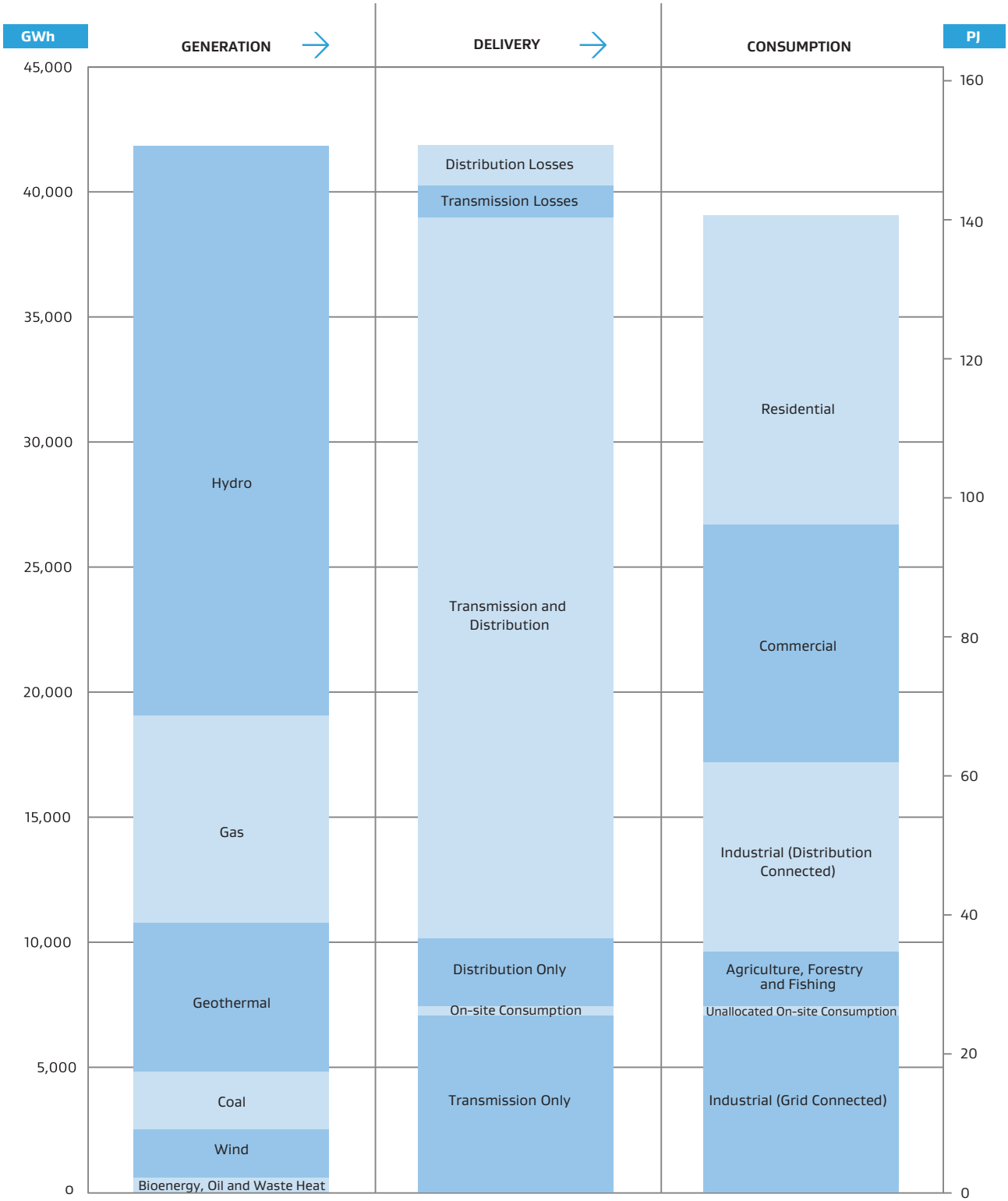
Both the Commerce Commission and Electricity Authority have key roles in the electricity market. The Commerce Commission has regulatory oversight of distribution and transmission pricing while the Electricity Authority has regulatory oversight of the retail and wholesale markets, and transmission contracts. The Electricity Authority also has contracts with service providers for market operation services such as that of the Clearing Manager.

† Embedded (distributed) generators can choose to sell their electricity directly to retailers trading on the same grid exit point.

Electricity retailers include Contact Energy, Genesis Energy (and subsidiary Energy Online), Meridian Energy (and subsidiary Powershop), Mighty River Power (through its brands and subsidiaries Mercury Energy, Bosco Connect, Tiny Mighty Power, Globug and Budgie Power), TrustPower, Pulse Energy, Opunake Hydro and Nova Energy.

Electricity

Figure F.2: Electricity Flow Diagram for the 2013 Year



Electricity

Overview

The share of electricity generated from renewable energy sources increased from 72.8% in 2012 to 75.1% in 2013. This was due to increased hydro and geothermal generation, and lower coal generation. New geothermal power stations near Taupo boosted geothermal generation during 2013.

Electricity demand in New Zealand fell 0.6% between 2012 and 2013 (see Table 1). This was driven by a decrease in the level of residential demand for the third year in a row, combined with flat total industrial demand.

Retail market trends showed that switching trends increased over the last year and the combined market share of the five largest companies decreased.

Generation

In 2013, 41,876 GWh of electricity was generated in New Zealand. Electricity generation decreased 2.2% from the previous year.

The share of electricity generated from renewable energy sources increased from 72.8% in 2012 to 75.1% in 2013. Higher hydro and geothermal generation and lower demand reduced the need for electricity generation from coal.

Figure F.3 is a time series of generation by fuel type and shows continued growth in geothermal generation. There was an increase in geothermal generation, from 5,843 GWh in 2012 to 6,053 GWh in 2013. In the 2013 calendar year, geothermal generation was boosted by the new geothermal power stations coming online near Taupo. The Ngatamariki power plant was fully commissioned in 2013 and late in the year, the Te Mihi power station generated electricity while in its testing phase. The Te Mihi geothermal power station will be commissioned in late 2014, and will increase geothermal capacity by a net 114 MW. The increase in geothermal baseload generation reduces the extent that fossil fuels are required in peak demand periods.

Other renewable sources for electricity generation include bioenergy, solar energy and marine energy. Of these, bioenergy is the largest contributor to electricity generation in New Zealand. Bioenergy is predominantly from woody biomass consumed at a number of cogeneration plants located at wood processing factories and also from biogas created from digesting waste at wastewater treatment plants and landfills.

Table 1: Electricity Supply and Demand Energy Balance (GWh)

		2009	2010	2011	2012	2013	Δ2009/ 2013 p.a.	Δ2012/ 2013
SUPPLY	**Total Gross Generation**	**43,444**	**44,828**	**44,397**	**44,261**	**43,258**	-0.1%	-2.3%
	Own Use – Parasitic Load*	-1,373	-1,417	-1,347	-1,454	-1,382	0.2%	-5.0%
	Total Net Generation	**42,071**	**43,411**	**43,050**	**42,806**	**41,876**	-0.1%	-2.2%
	Electricity Only Plant	39,683	40,827	40,639	40,223	39,421	-0.2%	-2.0%
	Combined Heat and Power Plant	2,388	2,584	2,411	2,583	2,455	0.7%	-5.0%
	Total Lines Losses†	**-2,992**	**-3,109**	**-3,008**	**-3,010**	**-2,902**	-0.8%	-3.6%
	Losses – Transmission	-1,350	-1,359	-1,310	-1,387	-1,303	-0.9%	-6.1%
	Losses – Distribution	-1,642	-1,750	-1,699	-1,623	-1,600	-0.6%	-1.4%
Total Electricity Demand (Calculated)		**39,079**	**40,302**	**40,041**	**39,796**	**38,974**	-0.1%	-2.1%
Statistical Difference#		0.3%	0.5%	1.7%	1.4%	-0.1%		
DEMAND	**Total Electricity Demand (Observed)**	**38,967**	**40,104**	**39,356**	**39,245**	**38,998**	0.0%	-0.6%
	Agricuture Forestry and Fishing	2,021	2,133	2,084	2,224	2,223	2.4%	0.0%
	Industrial	14,066	15,211	15,240	14,632	14,647	1.0%	0.1%
	Commercial (including Transport)‡	9,047	9,108	8,984	9,466	9,561	1.4%	1.0%
	Residential	13,170	13,178	12,779	12,525	12,307	-1.7%	-1.7%
	Calculated Onsite Consumption§	663	473	269	397	260	-20.8%	-34.5%
Electricity entering system**		41,408	42,938	42,781	42,409	41,616		
National loss ratio††		7.2%	7.2%	7.0%	7.1%	7.0%		

* Electricity used by the generator for auxilliary services (e.g. lighting, coal grinders) and internal losses.

† Loss information is obtained from Commerce Commission electricity disclosures by Transpower and the distribution companies.

Statistical differences exist between supply and demand figures as the information comes from different sources.

‡ Transport is included with commercial as the Ministry of Business, Innovationa and Employment (MBIE) does not have a reliable time series of electricity used for transport (e.g. electric trains and trolley busses). For the balance tables presented at the front of the Energy in New Zealand, approximately 0.36 PJ or 100 GWh has been used for all years (subtracted from commercial demand) until which time MBIE can provide improved estimates. Sales to different parts of the commercial transport sector does not provide an accurate enough reflection of demand for transport as it includes some electricity used for airports, train stations and bus terminals, which should be excluded from the transport sector under IEA definitions.

§ Calculated estimate based on the difference between net production and electricity entering the system. This includes on-site generation not exported into the network. In the balance tables in section B, this figure is added to the Industrial Unallocated sector.

** Total amount of electricity entering the local and national transmission and distribution networks. Includes embedded generation.

†† Loss ratio calculated as the transmission and distribution losses divided by the total electricity entering the system.

Electricity

Figure F.4 compares the electricity generation breakdown by fuel type for the 2012 and 2013 years.

The five major generating companies provided 91.9% of New Zealand's electricity generation in the 2013 year. These companies are Meridian Energy (32.7%), Contact Energy (24.3%), Genesis Energy (14.5%), Mighty River Power (15.1%) and Trustpower (5.2%).

Consumption

Electricity consumption decreased by 0.6% to 38,998 GWh in 2013 from 39,245 GWh in 2012. Residential consumption decreased by 1.7% to 12,307 GWh. This is the third year in a row residential demand has fallen, as shown in Figure F.5. As New Zealand's population has continued to grow over the last three years, New Zealand's residential electricity use per capita has fallen. Technological energy efficiency improvements and changes in household behaviour could be behind this fall.

Figure F.3: Annual Electricity Generation by Fuel Type

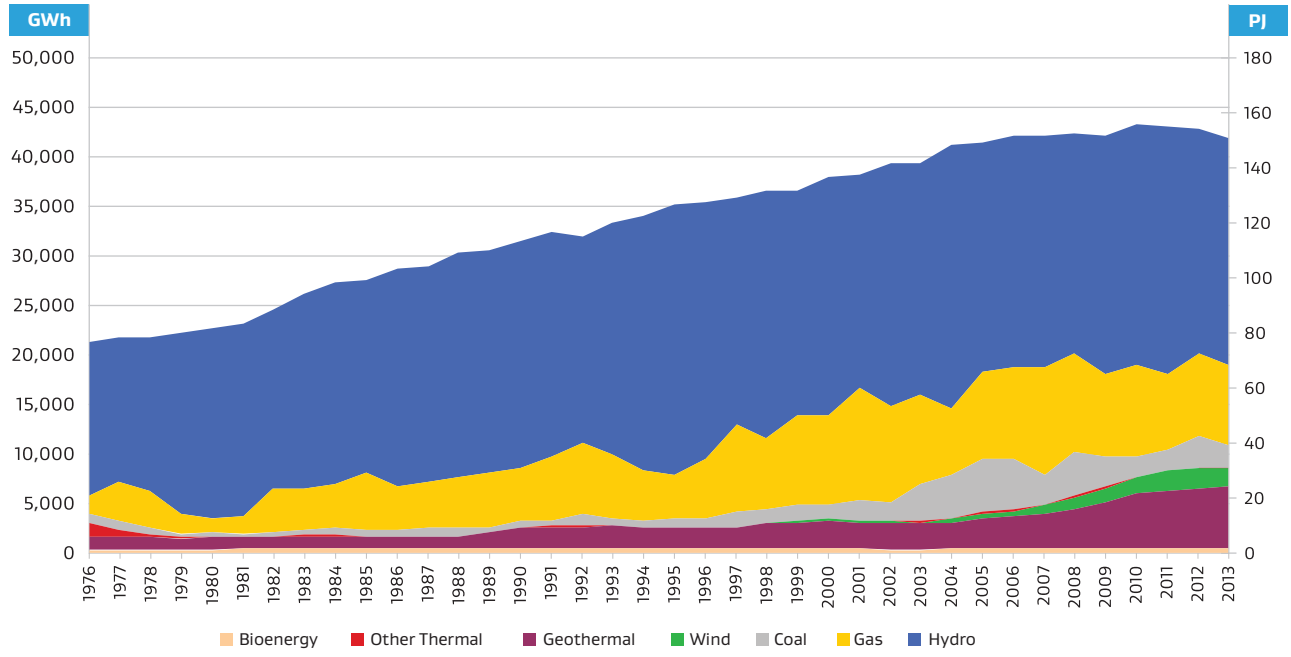
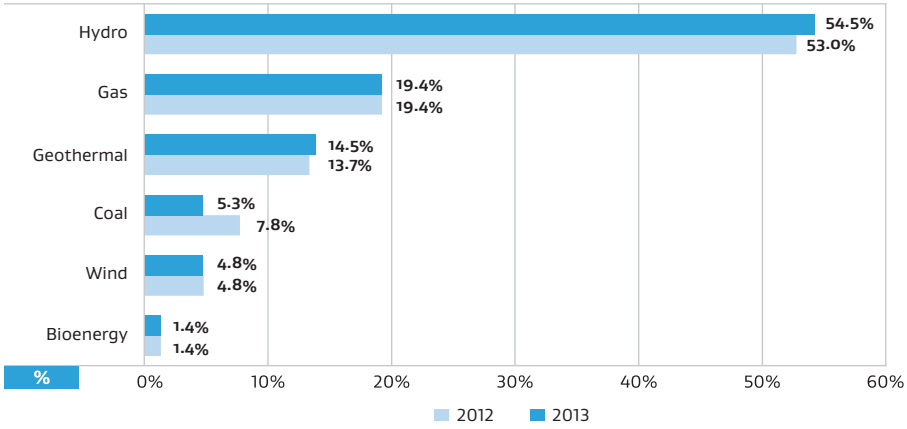


Figure F.4: Electricity Generation by Fuel Type, 2012 and 2013 Years



Electricity

Industrial consumption remained at a similar level in the 2013 year when compared to the previous year, up 0.1% to 14,647 GWh. Electricity demand from the wood, pulp, paper, and printing sector continued to decline, falling 8.1% over the last year. Falling demand for newsprint led to Norske Skog halving production at one of its paper mills at the end of 2012. It subsequently closed that mill at the beginning of 2013.

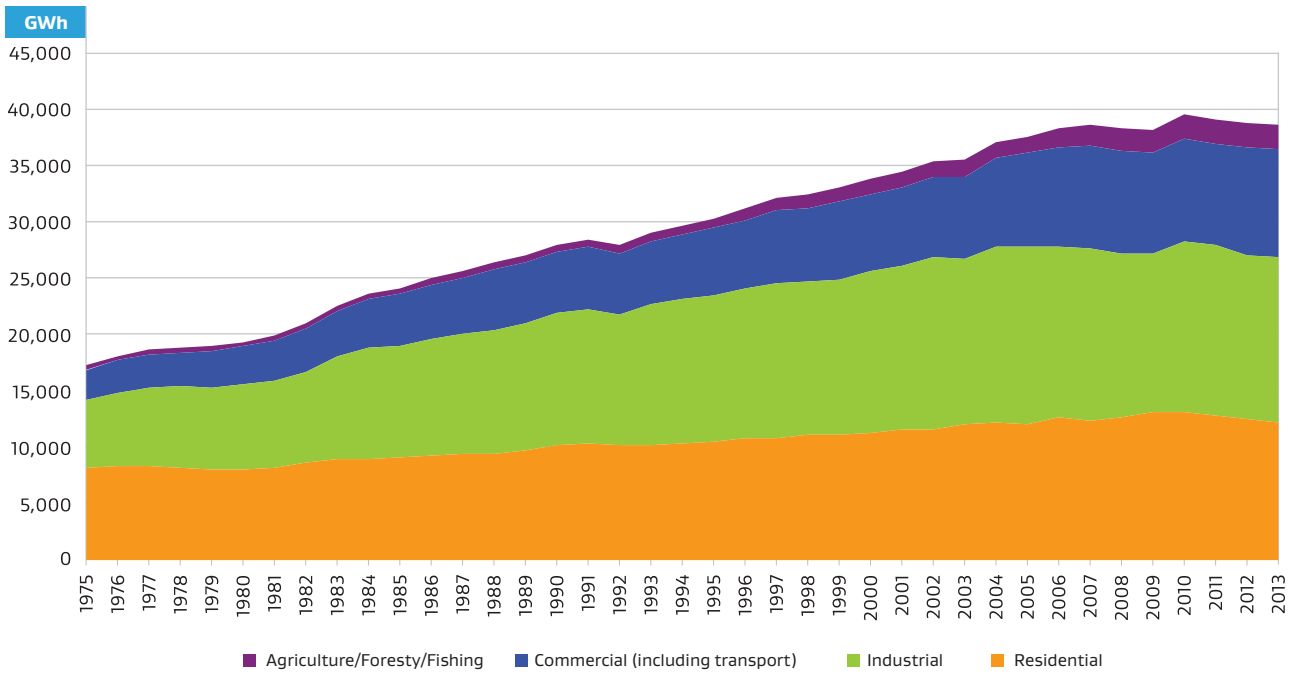
However, this fall in demand from the wood, pulp, and paper sector was offset by increased demand from the basic metals sector (up 1.5%) and other minor industrial sectors (up 8.5%). Demand from the New Zealand Aluminium Smelter, part of the basic metals sector, was largely unchanged from 2012. It was not behind the increase in demand from basic metals.

In other sectors, commercial demand increased by 1.0%, while agricultural demand was unchanged.

Figure F.6 shows demand by sector.

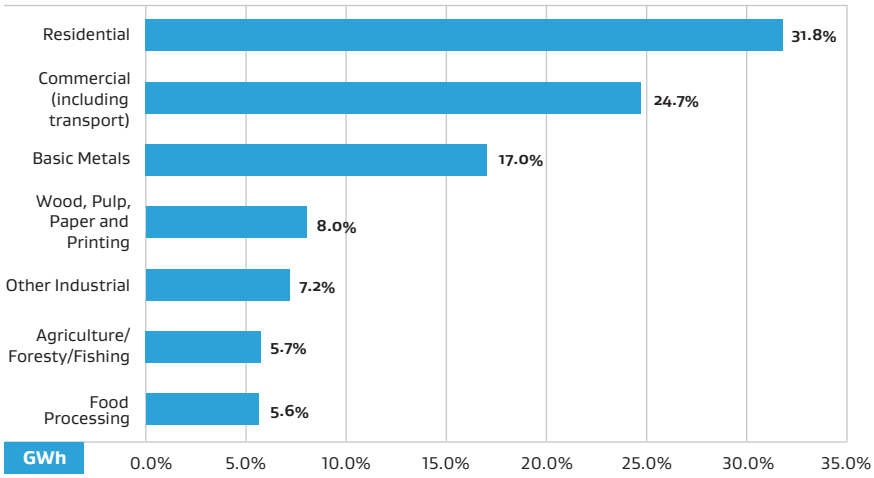
Figure F.7 shows demand by region. Otago/Southland has the largest demand because it includes demand from the New Zealand Aluminium Smelter. However without it, Otago/Southland demand was around 8%.

Figure F.5: Electricity Consumption by Sector*



*Electricity consumption in this figure excludes calculated onsite consumption.

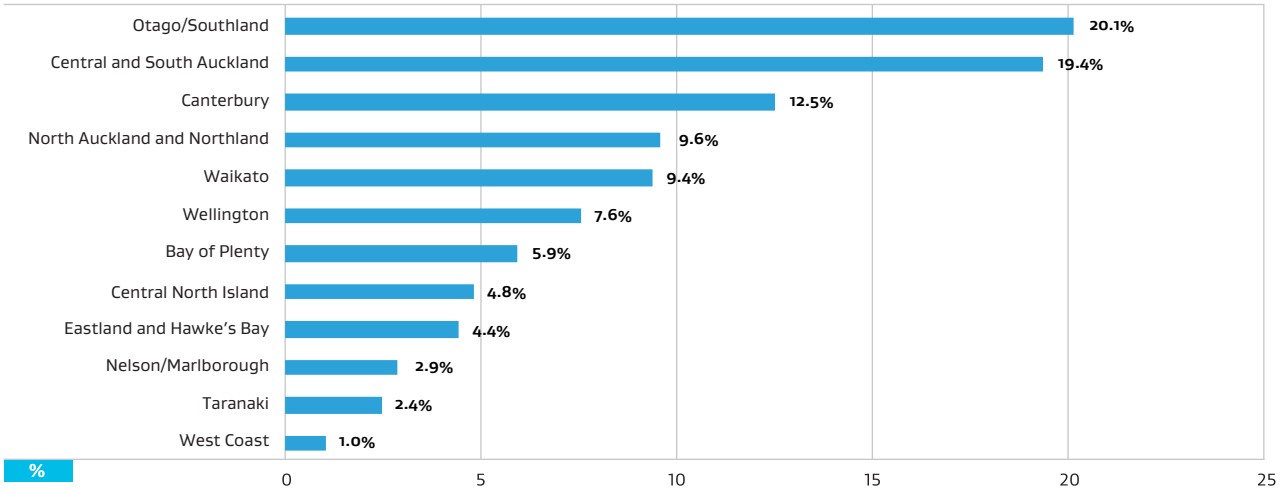
Figure F.6: Electricity Consumption by Sector for the 2013 Year*



*Electricity consumption in this figure excludes calculated onsite consumption.

Electricity

Figure F.7: Approximate Share of National Demand by Region for the 2013 Year*



*Source: Electricity Authority, http://www.emi.ea.govt.nz/

Retail Electricity market

Figure F.8 shows the market share of retailers (parent companies) based on monthly numbers of customers since the beginning of 2004. As at 31 December 2013, the market shares of significant retailers were:

- Genesis Energy (including Energy Online): 26.9%,
- Contact Energy: 22.4%,
- Might River Power (including Bosco Connect, Globug, and Budgie Power): 19.4%,
- Meridian (including Powershop): 14.0%,
- Trustpower (including Energy Direct New Zealand): 11.0%,
- Todd Energy (Nova Energy): 3.2%,
- Pulse (including Just Energy): 2.1%,
- King Country Energy: 0.9%.

If one compares December 2013 with the same month in the previous year, combined market share of the five largest companies decreased from 94.5% to 93.6%. The market share of the three largest companies, Genesis Energy, Contact Energy and Mighty River Power, decreased. Mighty River Power had the largest fall in customer numbers, losing around 9,000 over the period. Smaller companies, Todd Energy and Pulse increased their market share over the same period. Meridian Energy's fall in market share in February 2012 was due to Energy Direct New Zealand becoming its own electricity retailer. In July 2013, Trustpower purchased Energy Direct New Zealand, and this can be seen in Figure F.8.

Figure F.9 shows switches in a year as a percentage of total consumers (all types) on a rolling annual basis. Retail switching as a percentage of total customer numbers increased in 2013, from 17.9% in 2012 to 19.7% in 2013. Over the year, switching increased in both the North and South Islands. Switching in the South Island has not yet fully recovered from a large decrease in 2012, when switching in Christchurch slowed.

Figure F.10 compares sales-based residential prices in real and nominal terms. The sales-based residential electricity price increased 2.3% between March year 2013 and March year 2014 in nominal terms. After adjusting for inflation, the increase is 0.8%. Growth in residential electricity prices has slowed over the last two years.

Transmission & Distribution

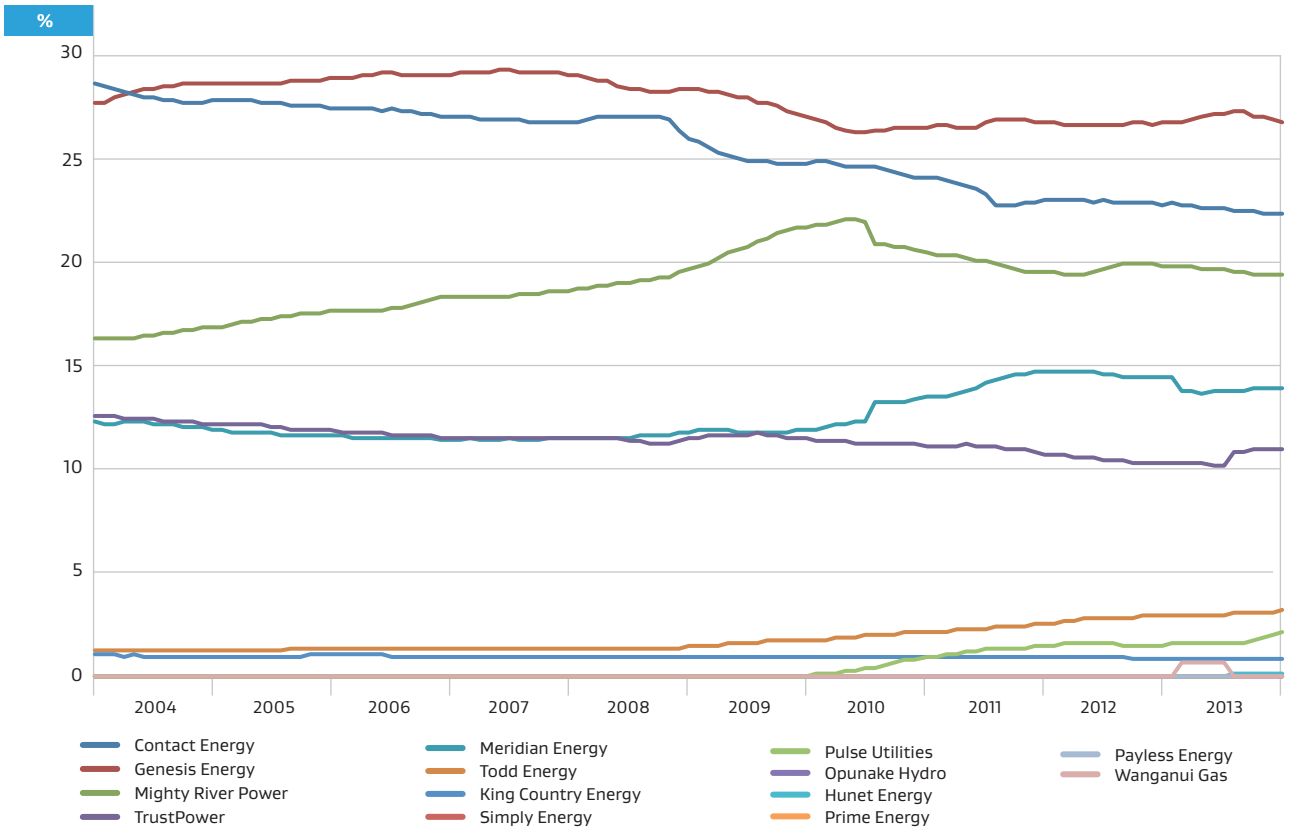
Transpower operates the national transmission grid, which conveys electricity from most of the major power stations around the country to local distribution lines. It also conveys electricity directly to major users such as the New Zealand Aluminium Smelter.

Transpower commissioned the Pole 3 upgrade of the High Voltage Direct Current link between the North and South Islands during 2013, now with a capacity of 1200 MW. Up to 1000 MW of surplus power generated in the South Island can be transmitted to the North Island.

There are 29 lines companies in New Zealand, with a variety of ownership forms from publicly listed companies to local community-owned trusts. Lines companies convey electricity to users within their network areas.

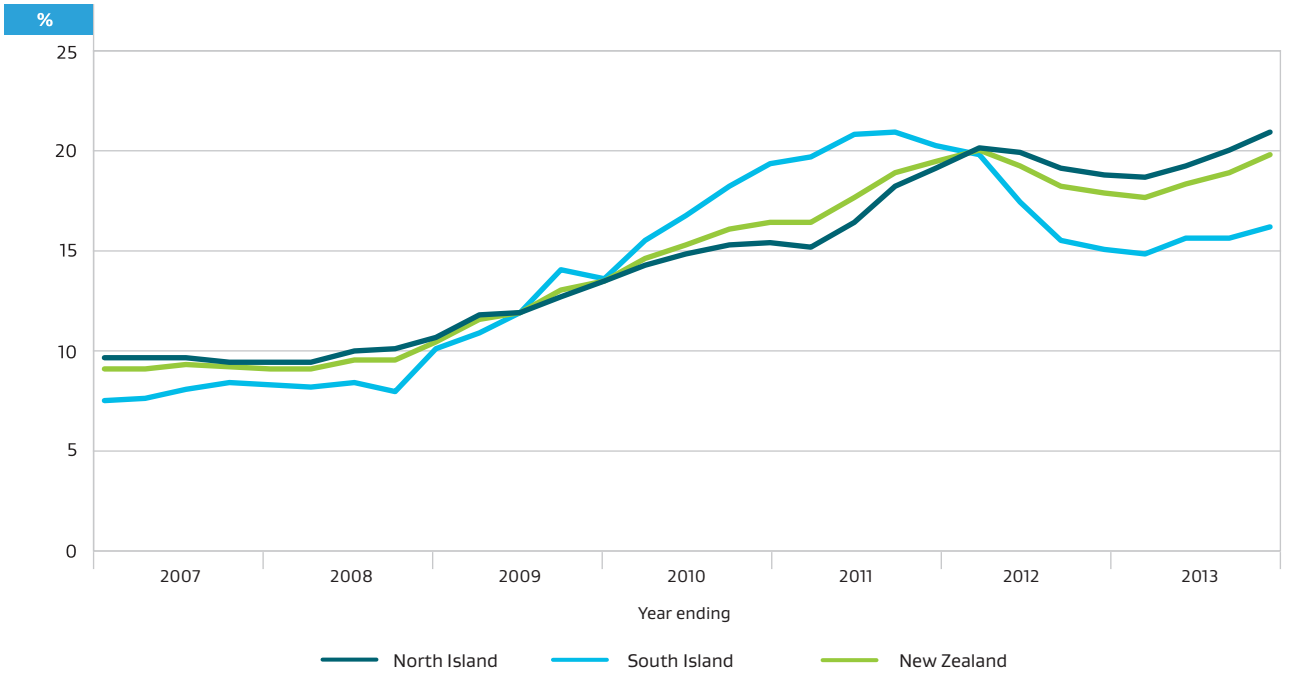
Electricity

Figure F.8: Monthly Retail Market Share by Parent Company*



*Source: Electricity Authority, http://www.emi.ea.govt.nz/

Figure F.9: Percentage of Customers Switching for Year to Date*



*Source: Electricity Authority, http://www.emi.ea.govt.nz/

Electricity

Figure F.10: Real and Nominal Sales-based Residential Electricity Prices for March Years 1974–2014*

*Sales based residential electricity prices have been revised back to the year ending 31 March 2002. For more information please visit: http://www.med.govt.nz/sectors-industries/energy/energy-modelling/data/prices/electricity-prices

Electricity

G. INTERNATIONAL ENERGY COMPARISONS

INTRODUCTION

This section compares New Zealand's energy situation with that of its major OECD trading partners, for which information is available.

Care is needed in interpreting the data, as product specifications, statistical methodology and information available can differ considerably among countries.

Taxation forms a large component of some energy prices, notably for petrol (around 50% or more for most countries, except for the North American countries, for which the share is closer to 30%).

International Energy Comparisons

Prices

Figures G.1a to G.1c show international energy prices for 2013. These figures are based on data using US dollars per unit using purchasing power parity. The figures are also ranked in descending order in relation to residential prices and use the 2013 annual data.

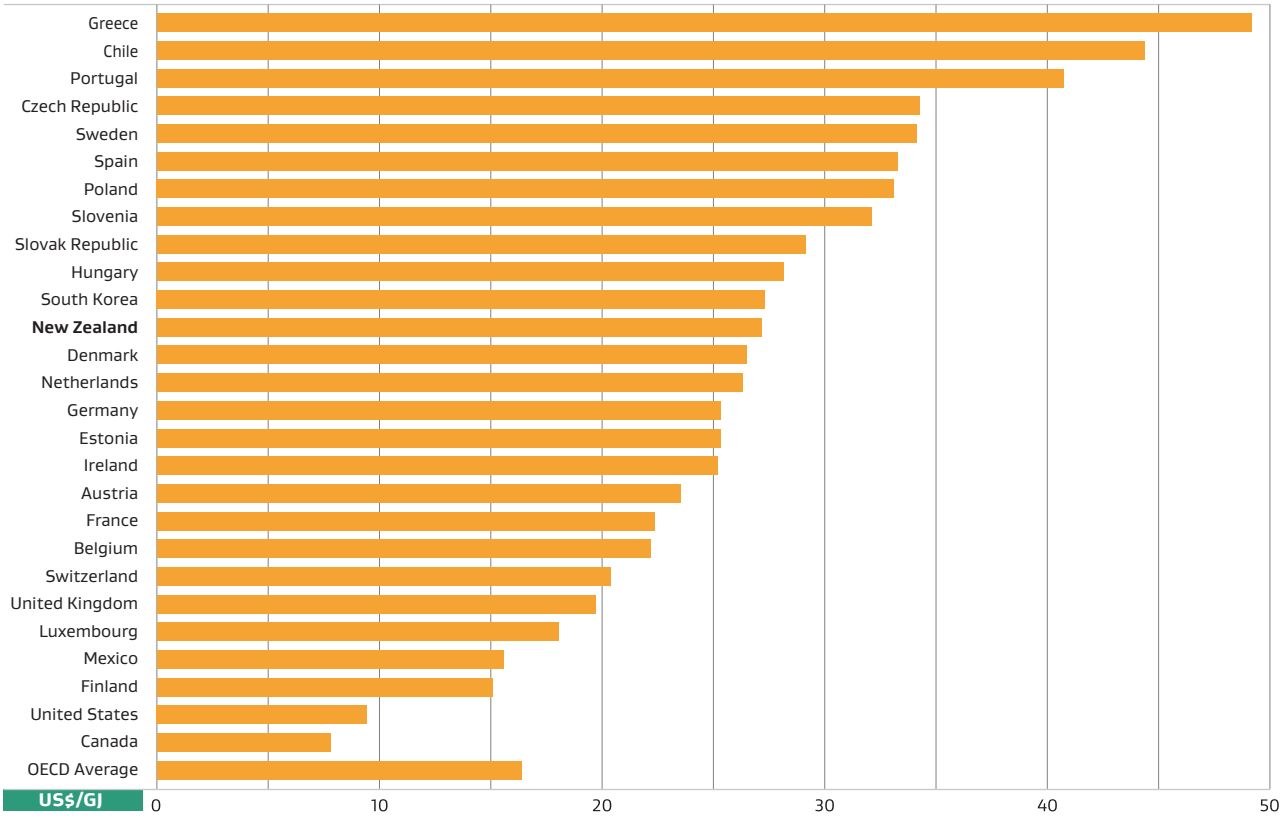
International electricity price comparisons are currently not available, as the methodology used to measure the New Zealand average electricity price has changed (see Section F, Electricity) and the data need to be resubmitted to the IEA. A separate international electricity price comparison will be released once this process is complete.

New Zealand's natural gas prices in 2013 for residential consumption are at the middle of the range compared to other OECD countries. Residential (or retail) energy prices are subject to value-added taxes such as New Zealand's Goods and Services Tax of 15%.

Figure G.1b presents the international petrol price comparisons across OECD countries. New Zealand's premium petrol prices in 2013 were among the lowest. Regular petrol is not a feature in most of the OECD countries, so the price comparison for that fuel is not presented here.

Diesel price comparisons may be misleading because only taxes paid at the pump are included. For New Zealand, this means that Road User Charges (RUCs), which are charged per kilometre, are not included in these data. Most other OECD countries have taxes and levies paid at the pump. New Zealand's retail diesel prices were the lowest in the OECD in 2013, as shown in Figure G.1c.

Figure G.1a: Natural Gas Prices (Using Purchasing Power Parity) in OECD Countries for 2013



International Energy Comparisons

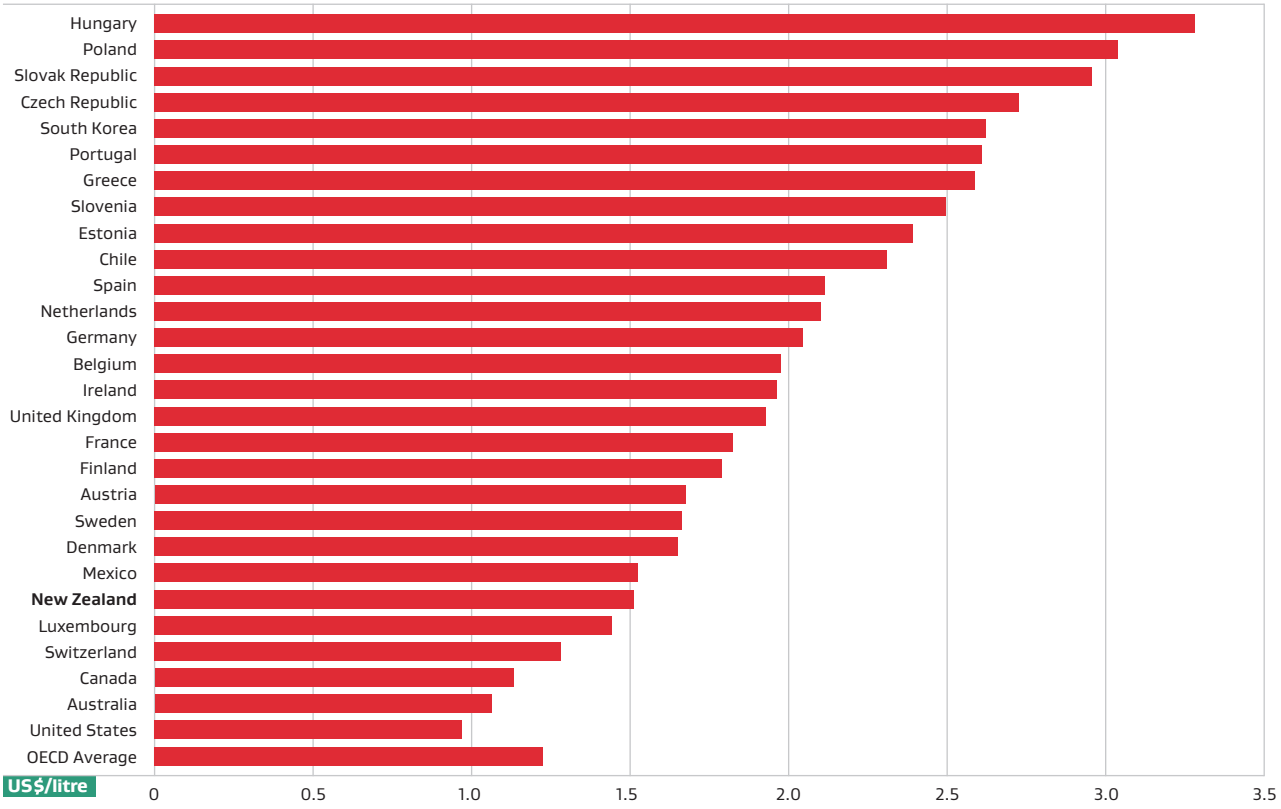
Consumption

Figures G.2d to G.2c show the comparative energy consumption on a per capita basis relative to OECD countries for 2013. New Zealand's oil product consumption per capita in 2013 was relatively high in the OECD range.

New Zealand has a similar per capita consumption rate to countries like Sweden and Ireland.

In 2013, gas and electricity consumption per capita in New Zealand remained in the middle of the OECD range.

Figure G.1b: Premium Petrol Prices (Using Purchasing Power Parity) in OECD Countries for 2013



International Energy Comparisons

Figure G.1c: Automotive Diesel Prices (Using Purchasing Power Parity) in OECD Countries for 2013

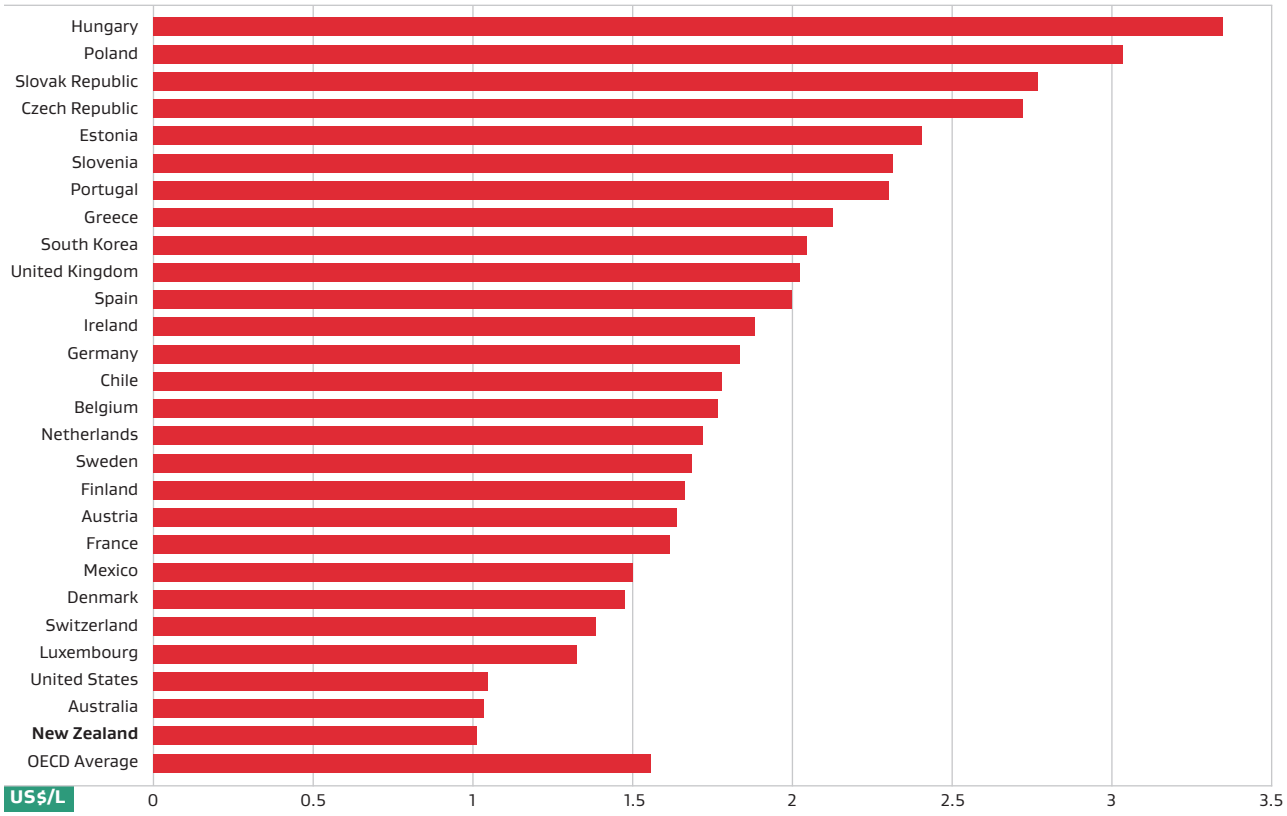
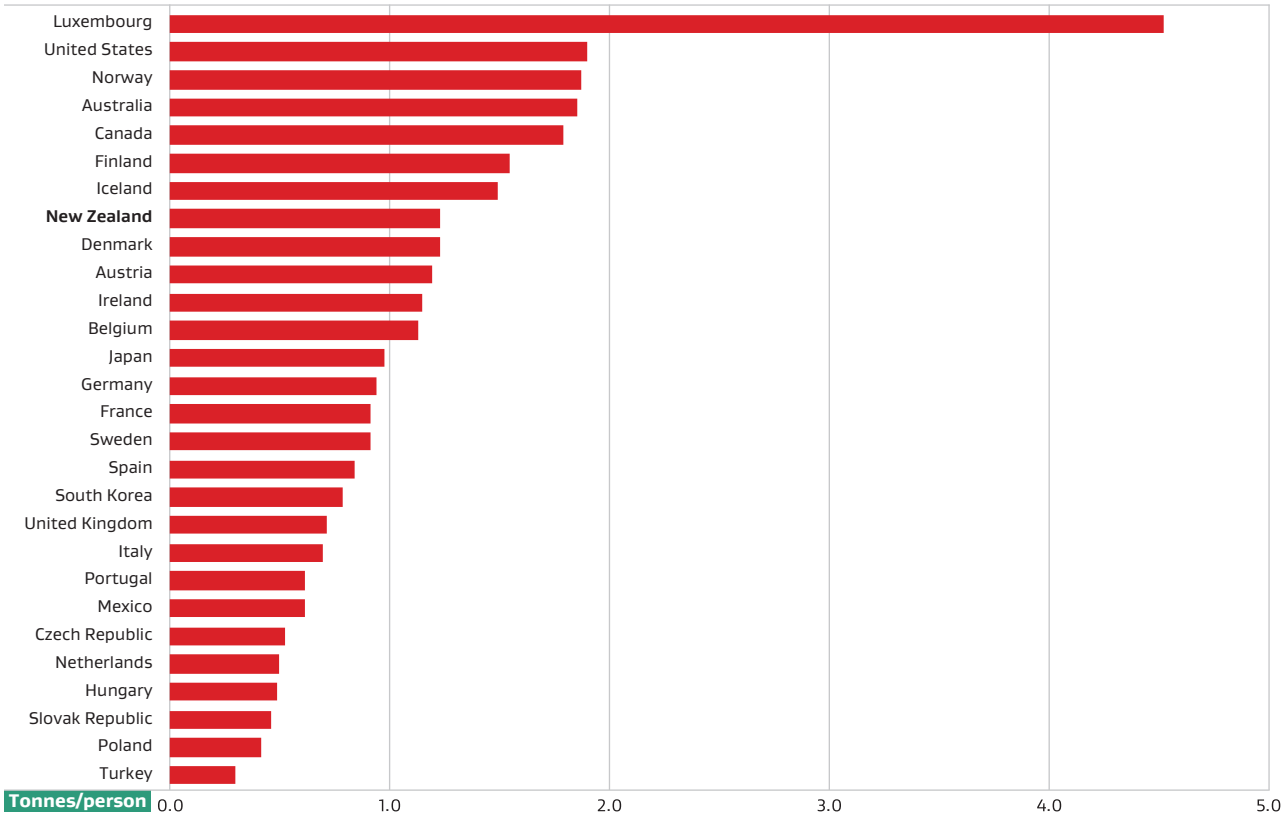


Figure G.2a: Oil Product Consumption per person for 2013



International Energy Comparisons

Figure G.2b Gas Consumption per person for 2013

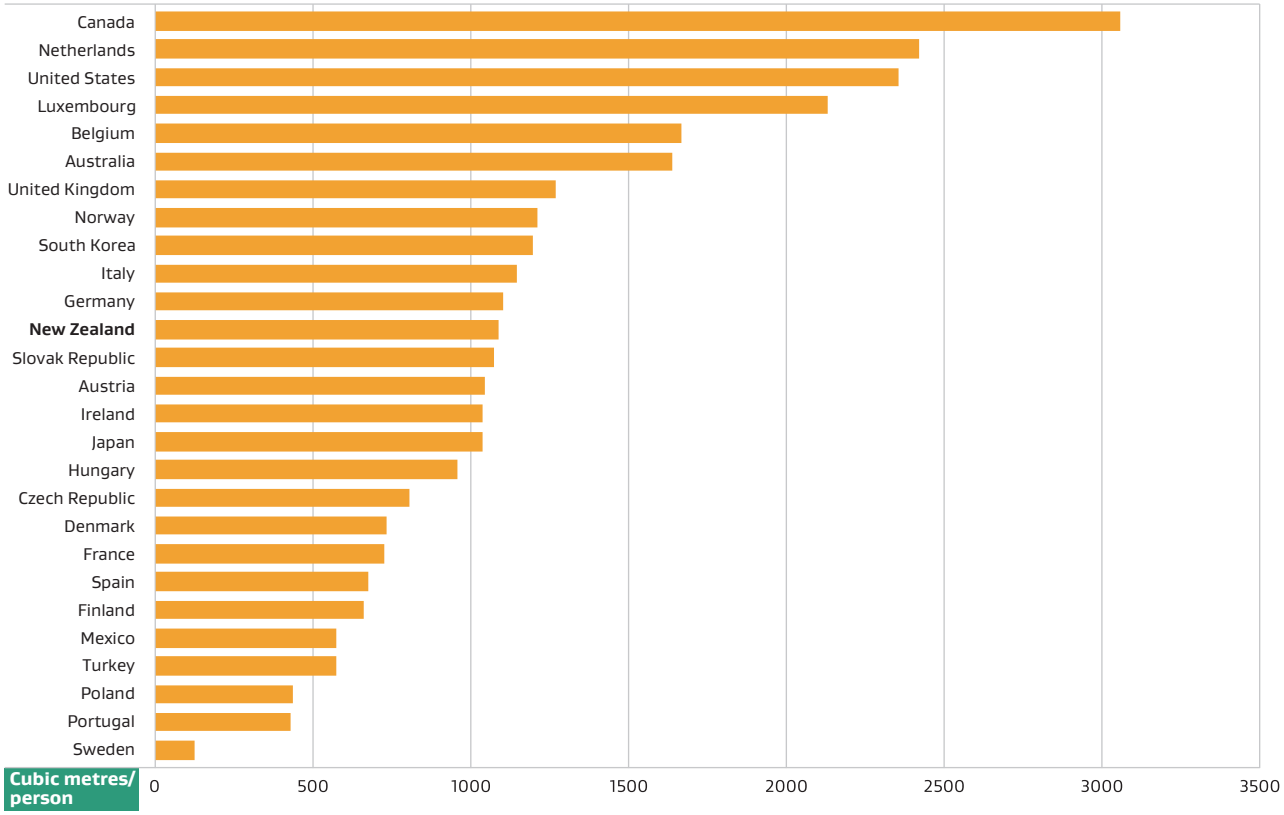
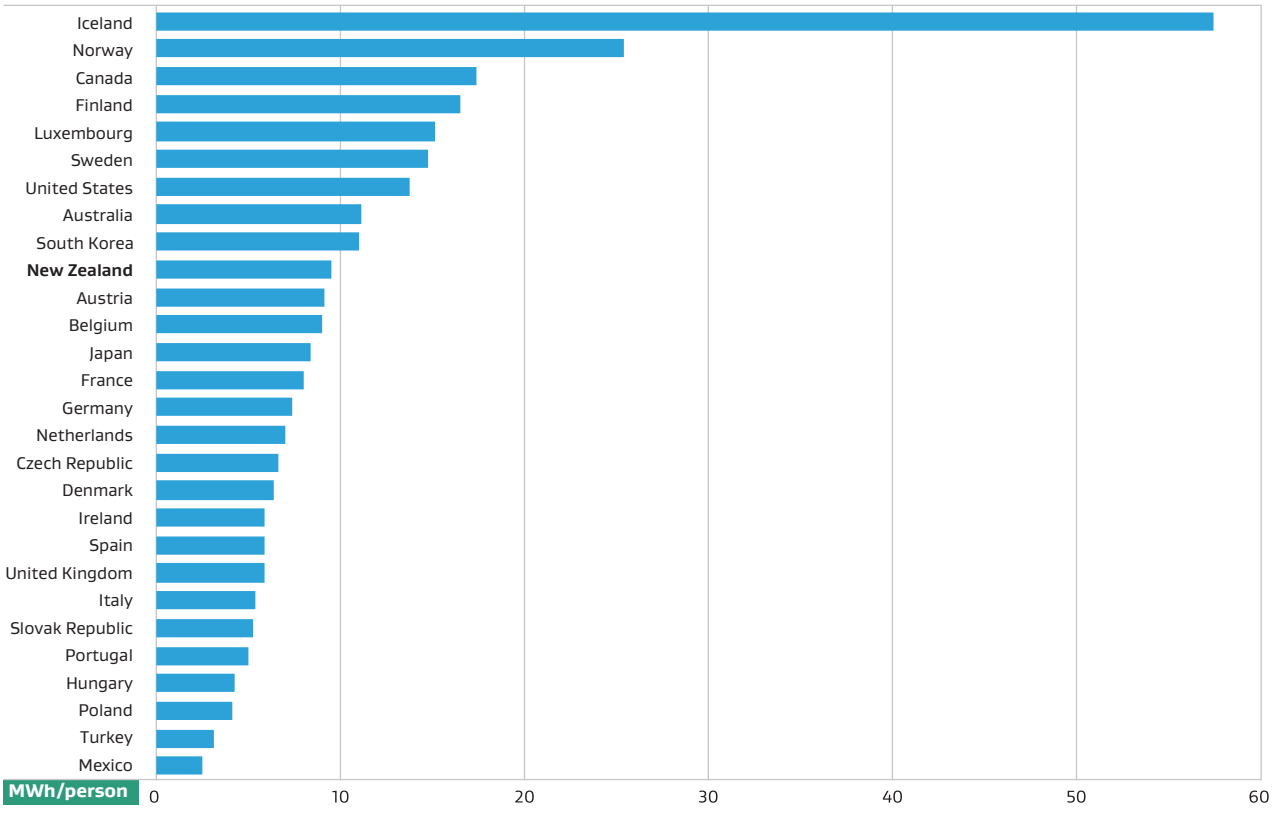


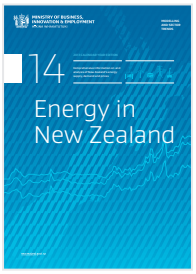
Figure G.2c: Electricity Consumption per person for 2013



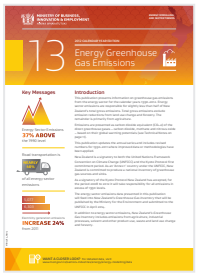
FURTHER READING

http://www.med.govt.nz/sectors-industries/energy/energy-modelling

Modelling and Sector Trends Energy Publications



Energy in New Zealand provides comprehensive information and analysis on New Zealand's energy supply, demand, reserves and prices, mostly as national aggregates.



New Zealand Energy Greenhouse Gas Emissions provides detailed inventory information on carbon dioxide equivalent emissions from New Zealand's energy sector and industrial processes for the calendar years 1990–2012.

New Zealand's Energy Outlook explores the long-term future for energy supply, demand, prices and energy sector greenhouse gas emissions in New Zealand.

New Zealand Energy Snapshot provides a handy pocket-sized overview and insight into New Zealand's energy sector. The *New Zealand Energy Snapshot* replaced *New Zealand Energy in Brief.*

New Zealand Energy Quarterly provides quarterly energy statistics and trend data on the supply of major fuel types, electricity generation and the associated greenhouse gas emissions, and fuel prices.

Changes in Energy Use provides annual trend data and analysis of changes in the way energy is used.

newzealand.govt.nz