



A. Energy Overview

New Zealand's total primary energy supply and total consumer energy for calendar year 2001 rose 0.2% to 760 PJ and 0.4% to 461 PJ respectively compared to 2000. New Zealand's total consumer energy was dominated by domestic transport, with 188 PJ or 41% of total consumer energy.

Statistics in this overview are in gross petajoules (PJ) and for the calendar year 2001 unless otherwise specified. For a full description of terms used, see the Glossary on page 150.

A.1 Energy Flows

Energy flows through the New Zealand economy from supply to end use, some energy being transformed from one type to another (such as from coal to electricity) in the process. These energy flows are displayed graphically on page 6 and tabulated as

an energy balance in Table A.1 below. Note that international transport and non-energy use are, for graphical simplicity, included on the demand side of the figure but by statistical convention on the supply side of the table.

Table A.1: Energy Supply and Demand Balance 2001

Gross Calorific Values in Petajoules		Fossil Fuels			Renewables			Electricity	TOTAL
		Coal	Oil	Gas	Hydro	Geothermal	Other		
SUPPLY	Indigenous production	103.4	81.8	247.5	77.0	83.9	51.5		645.1
	+ Imports less exports ¹	-55.6	209.7	-0.5					153.7
	- International transport		38.9						38.9
	TOTAL PRIMARY ENERGY	47.7	252.6	247.1	77.0	83.9	51.5		759.8
	Energy transformation	-17.5	-15.2	-122.0	-77.0	-70.8	-21.8	125.3	-198.9
Non-energy use		-10.8	-89.3					-100.1	
	CONSUMER ENERGY (calculated)	30.3	226.6	35.8		13.1	29.7	125.3	460.9
DEMAND	Agriculture	0.6	13.3					5.7	19.5
	Industrial	34.0	12.9	19.6		10.5	23.1	51.6	151.7
	Commercial	5.1	4.5	10.1			0.2	23.0	42.9
	Residential	0.7	1.8	6.0		2.6	6.5	41.3	59.0
	Domestic transport	0.1	185.5	0.1				1.8	187.5
	CONSUMER ENERGY (observed)	40.6	218.0	35.8		13.1	29.7	123.4	460.6
	Statistical differences	-10.3	8.6	0.0		0.0	0.0	1.9	0.2

This table summarises the detailed energy balance presented in Table B.2d on page 23.

Note: ¹This entry makes allowance for stock changes.

Total primary energy supply, energy transformation, and consumer energy demand are discussed and presented in detail in the remainder of this overview,

followed by sections on energy greenhouse gas emissions and the energy supply and demand outlook to 2020.

A.2 Primary Energy Supply (PJ)

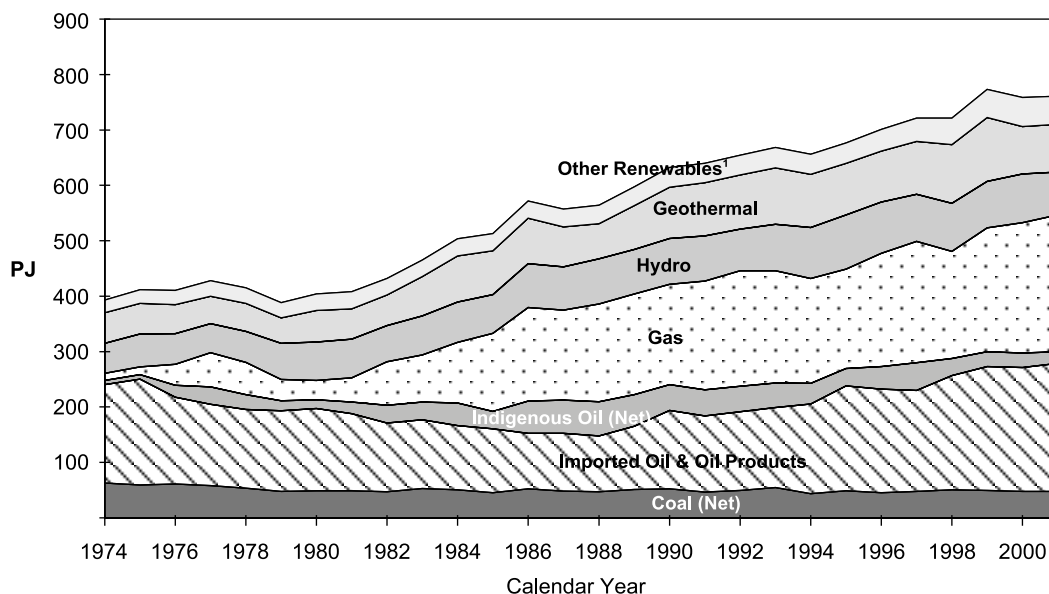
Total Primary Energy Supply (TPES) is the amount of energy available for use in New Zealand for energy transformation and end use. It includes energy as it is first obtained from natural sources, which means that coal is accounted for as it is mined, indigenous oil and natural gas as they are extracted from wells, imported oil and oil products as they are imported, and hydro as it is used for electricity generation (assuming efficiency of 100%). Geothermal is accounted for on

the basis of its use as an input to electricity generation (assuming efficiency of 10% from years 1974 to 1999 and 15% from year 2000) including cogeneration, plus an estimate of losses, own use and geothermal used directly as a heat source. TPES includes imports but excludes exports, and makes allowance for any stock change. By convention, fuels used for international transport are excluded from TPES.

Table A.2: Total Primary Energy Supply 1974–2001

Calendar Year	Coal (Net)	Imported Oil and Oil Products	Indigenous Oil (Net)	Gas	Hydro	Geothermal	Other Renewables ¹	Total
PJ								
1974	62.80	177.37	7.98	12.92	54.13	55.07	22.64	392.92
1975	59.10	191.07	8.28	14.03	59.39	55.21	24.42	411.50
1976	60.90	156.66	21.96	37.54	55.24	52.74	25.34	410.38
1977	58.00	146.69	31.50	61.67	52.46	49.76	27.64	427.72
1978	53.50	142.16	26.81	57.92	55.81	50.65	27.94	414.79
1979	47.70	145.84	17.90	38.06	65.73	45.68	27.38	388.30
1980	49.06	148.02	15.71	35.31	69.02	57.06	30.12	404.30
1981	48.88	139.06	21.04	43.63	70.14	54.42	30.76	407.92
1982	47.27	123.61	32.13	78.56	65.24	55.19	29.81	431.80
1983	53.09	124.15	31.52	85.43	70.39	70.94	29.75	465.27
1984	50.68	116.05	40.80	109.23	72.62	83.05	31.41	503.84
1985	45.57	115.36	31.38	140.56	70.24	78.93	31.07	513.11
1986	52.37	99.99	58.56	168.90	78.76	82.26	30.83	571.67
1987	48.06	104.74	59.44	162.80	78.15	71.70	32.05	556.94
1988	47.42	100.33	61.72	176.33	81.84	63.06	33.35	564.05
1989	51.51	114.09	57.01	181.46	80.40	79.26	33.78	597.52
1990	52.55	141.13	46.92	180.93	82.63	92.65	35.23	632.04
1991	46.61	137.59	46.63	196.26	81.60	96.16	34.97	639.81
1992	49.37	141.89	46.39	208.20	75.17	97.70	35.78	654.51
1993	54.57	144.52	44.04	203.05	83.73	101.99	36.13	668.03
1994	43.84	161.74	37.21	188.90	92.08	96.05	36.06	655.89
1995	48.80	189.40	31.22	179.16	98.13	93.30	36.38	676.39
1996	45.41	186.77	40.99	204.17	92.57	91.87	38.94	700.72
1997	48.03	182.14	49.65	218.92	84.94	95.95	41.93	721.56
1998	50.48	206.53	30.73	193.06	86.99	105.49	48.25	721.55
1999	49.57	222.93	26.73	223.54	83.60	115.24	50.95	772.57
2000	47.49	223.78	26.41	235.19	87.79	85.97	51.89	758.52
2001	47.75	231.31	21.29	247.07	77.01	83.92	51.50	759.85

Chart A.2a: Total Primary Energy Supply 1974–2001

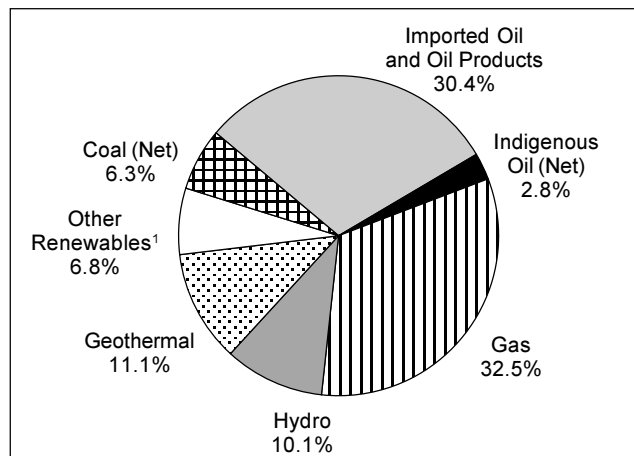


Note: ¹“Other Renewables” includes electricity generation from wind, biogas, industrial waste and wood.

New Zealand's TPES for calendar years 1974 to 2001 is presented in Table A.2 and Chart A.2a. TPES was 760 PJ in the calendar year 2001, up 93% on the 393 PJ supplied in the calendar year 1974. Other renewables, gas and net indigenous oil supply increased their shares of total primary energy from 5.8%, 3.3% and 2.0% in 1974 to 6.8%, 32.5% and

2.8% respectively in 2001. The shares of imported oil and oil products (for definition of terms used see Glossary, Section K, page 150), coal, geothermal and hydro declined from 45.1%, 16.0%, 14.0% and 13.8% in 1974 to 30.4%, 6.3%, 11.1% and 10.1% respectively in 2001.

Chart A.2b: Total Primary Energy Supply Shares 2001



Note: ¹Other Renewables includes electricity generation from wind, biogas, industrial waste and wood.

Chart A.2b shows New Zealand's TPES shares for calendar year 2001. TPES increased 0.2% to 760 PJ compared with 759 PJ in calendar year 2000. In 2001, oil provided 253 PJ (33%), gas 247 PJ (33%), geothermal 84 PJ (11%), hydro 77 PJ (10%), other renewables 51 PJ (7%) and coal 48 PJ (6%) of TPES. In total, fossil fuels contributed 547 PJ or 72% and renewables 213 PJ or 28%.

A.3 Energy Transformation

New Zealand's energy transformation industry includes petroleum refining, petrochemicals and electricity generation. New Zealand has one oil refinery: its main feedstocks are imported crude, blendstock and indigenous crude and condensate. In 2001, 92% of refinery input was from imported crude and refinery feedstocks, and the other 8% was from indigenous crude and condensate. In 2001, 36% of New Zealand's natural gas extracted was used for petrochemicals for the production of chemical methanol and ammonia/urea production. There has been no synthetic petrol production since February

1997, and in April 1999, Methanex New Zealand permanently closed the methanol to petrol unit at the Motunui plant. In 2001, 56% of input into electricity generation including cogeneration was from renewable resources, of which 47% was from hydro and 40% was from geothermal.

Overall, energy transformation in 2001 was around 12% higher than the 2000 level. This was mainly due to an increase in electricity generation from coal, gas and geothermal.

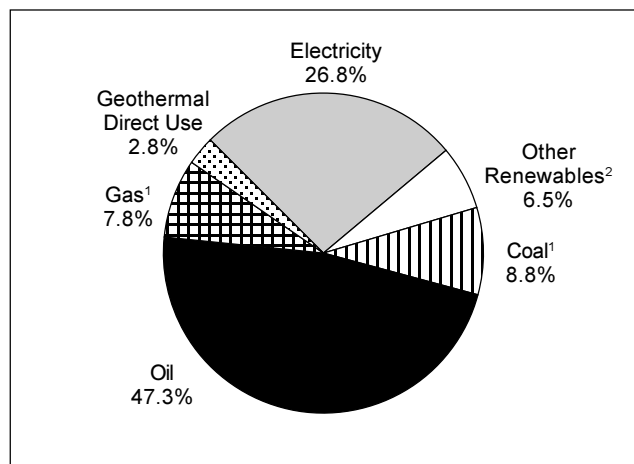
A.4 Consumer Energy Demand

Consumer energy is energy used by final consumers. It excludes energy used or lost in transformation and in bringing the energy to the final consumers. For example, natural gas is a source of primary energy,

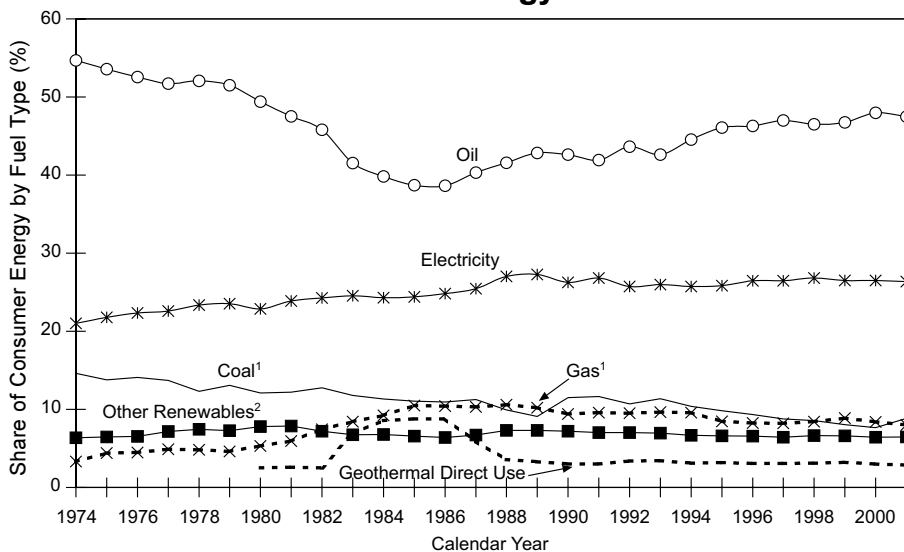
some of which is transformed into electricity, of which some is used or lost in transmission and distribution to consumers.

Table A.4a: Total Consumer Energy by Fuel

Calendar Year	Coal ¹	Oil	Gas ¹	Geothermal Direct Use	Electricity	Other Renewables ²	TOTAL ³
PJ							
1997	37.7	201.7	35.3	13.3	113.7	27.7	429.3
1998	37.6	204.1	36.9	13.6	117.7	29.1	439.0
1999	35.8	208.2	39.5	14.3	119.6	29.4	446.9
2000	35.1	220.0	38.6	13.8	121.8	29.6	458.9
2001	40.6	218.0	35.8	13.1	123.4	29.7	460.6
% of annual							
1997	8.8	47.0	8.2	3.1	26.5	6.4	100
1998	8.6	46.5	8.4	3.1	26.8	6.6	100
1999	8.0	46.6	8.8	3.2	26.8	6.6	100
2000	7.7	47.9	8.4	3.0	26.5	6.4	100
2001	8.8	47.3	7.8	2.8	26.8	6.5	100

Chart A.4a: Total Consumer Energy by Fuel 2001

The total consumer energy by fuel for calendar years 1997 to 2001 is presented in Table A.4a and illustrated in Chart A.4a for calendar year 2001. Total consumer energy (observed) in 2001 increased 0.4% to 460.6 PJ compared with 458.9 PJ in 2000. Oil consumption comprises around 218.0 PJ (47.3%), with electricity 123.4 PJ (26.8%), coal 40.6 PJ (8.8%), gas 35.8 PJ (7.8%) with other renewables such as biogas, wastes and wood making up 29.7 PJ (6.5%) and geothermal direct use 13.1 PJ (2.8%). Compared with the year before, the relative share of coal, electricity and other renewables increased by 15.4%, 1.3% and 0.6% respectively in 2001, while gas, geothermal direct use, and oil fell by 7.1%, 5.1% and 0.9% respectively between 2000 and 2001.

Chart A.4b: Total Consumer Energy Fuel Shares from Calendar Year 1974 to 2001**Notes:**

¹ Excludes cogeneration.

² "Other Renewables" includes direct use of biogas, industrial waste and wood.

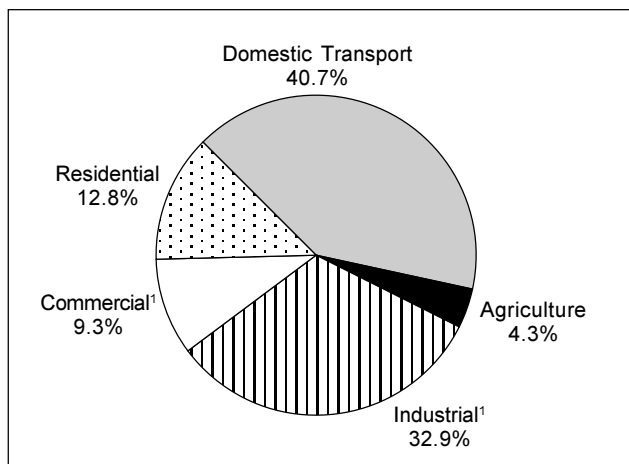
³ Totals may not add up due to rounding.

The shares of consumer energy by fuel from calendar year 1974 to 2001 are illustrated in Chart A.4b. Compared with 1974, electricity and gas increased their share of total consumer energy from 21% and 3.3% respectively to 27% and 7.8% respectively in

2001. Geothermal direct use increased its share slightly from 2.5% in 1980 to 2.8% in 2001, while other renewables were steady during the same period. The shares of oil and coal declined from 55% and 15% in 1974 to 47% and 8.8% respectively in 2001.

Table A.4b: Total Consumer Energy by Sector

Calendar Year	Agriculture	Industrial ¹	Commercial ¹	Residential	Domestic Transport	TOTAL ²
PJ						
1997	19.4	145.8	37.1	57.1	169.9	429.3
1998	20.3	149.4	38.3	58.3	172.8	439.0
1999	20.7	151.8	39.8	57.3	177.2	446.9
2000	19.1	152.0	41.1	58.3	188.4	458.9
2001	19.5	151.7	42.9	59.0	187.5	460.6
% of annual						
1997	4.5	34.0	8.6	13.3	39.6	100
1998	4.6	34.0	8.7	13.3	39.4	100
1999	4.6	34.0	8.9	12.8	39.7	100
2000	4.2	33.1	9.0	12.7	41.1	100
2001	4.3	32.9	9.3	12.8	40.7	100

Notes: ¹ Excludes cogeneration.² Totals may not add up due to rounding.**Chart A.4c: Total Consumer Energy by Sector 2001**Note: ¹ Excludes cogeneration.

Total consumer energy by sector from 1997 to 2001 is presented in Table A.4b, and the shares in 2001 are illustrated in Chart A.4c. Out of all the sectors, domestic transport (excluding international transport) consumption accounts for the largest share, 40.7% of total consumer energy. Compared with the year before, the commercial, agriculture and residential sectors increased their share of total consumer energy by 4.3%, 2.3% and 1.2% respectively, while the shares domestic transport and industrial sectors fell by 0.5% and 0.2% respectively from 2000 to 2001.

Table A.4c: Total Renewable Consumer Energy

Calendar Year	Total Electricity	Renewable Electricity	Other Renewables ³	Geothermal Direct Use	TOTAL RENEWABLE ENERGY
PJ					
1997	113.7	84.1	27.7	13.3	125.0
1998	117.7	88.4	29.1	13.6	131.1
1999	119.6	88.5	29.4	14.3	132.3
2000	121.8	90.4	29.6	13.8	133.8
2001	123.4	81.6	29.7	13.1	124.4
% of annual					
1997		67.3	22.1	10.6	100
1998		67.4	22.2	10.4	100
1999		66.9	22.3	10.8	100
2000		67.6	22.1	10.3	100
2001		65.6	23.9	10.5	100

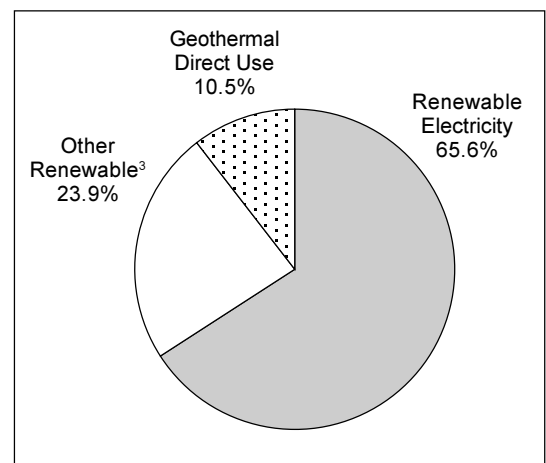
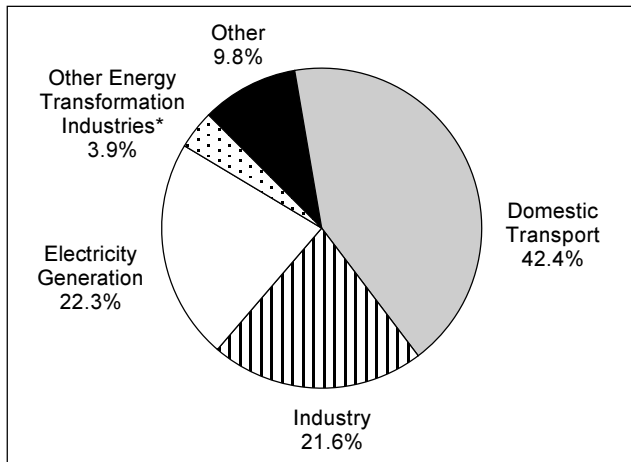
Note: ³ "Other Renewables" includes direct use of biogas, industrial waste and wood.**Chart A.4d: Total Renewable Consumer Energy 2001**

Table A.4c shows total renewable consumer energy for calendar years 1997 to 2001. Total renewable consumer energy was 124 PJ for the calendar year

2001, a decrease of 0.5% over four years. During calendar year 2001, renewable electricity contributed 82 PJ or about 66% of total electricity consumption.

A.5 Energy Greenhouse Gas Emissions²

Chart A.5: Energy CO₂ Emissions Sectoral Share



* Petroleum refining, synthetic petrol production, and oil and gas extraction and processing.

Carbon dioxide (CO₂) emissions from fuel combustion in the energy sector were about 29 million tonnes in 2001. The energy sector contributes around 91% of New Zealand's national gross human-made CO₂ emissions with the remainder from industrial processes. Chart A.5 shows New Zealand energy CO₂ emissions by source, excluding international transport, in 2001.

New Zealand's overall per capita CO₂ emissions have been estimated by the IEA to be 8.1 tonnes of CO₂, using 1999 data. This compares favourably with those of many other developed countries.

Other greenhouse gases emitted from energy sources include nitrous oxide (N₂O) and methane (CH₄). The amount of these gases emitted is small compared with CO₂, and agriculture rather than the energy sector is the main contributor of both these gases.

A.6 Energy Outlook

The Ministry of Economic Development's Energy Modelling and Statistics Unit publishes an occasional *Energy Outlook* (see page 164 for details). A comprehensive set of new projections was published in February 2000. A revised energy outlook report is being prepared and will be published shortly.

The February 2000 *Outlook* presents energy supply and demand scenarios for New Zealand to 2020. The scenarios are developed and analysed using the Ministry's SADEM long-range energy model, which estimates the market clearing pattern of energy supply and demand.

The February 2000 *Outlook* presents a baseline scenario that assumes 3% per annum (pa) GDP growth from 2003 on, new gas discoveries averaging 80 PJ pa, oil prices dipping in the short term before rising to a plateau of US\$22/bbl in 2015, coal prices rising from around NZ\$2.66/GJ in 1998 to NZ\$3/GJ in 2010 before stabilising, and current policy settings.

This scenario projects consumer energy demand to

grow by 1.1% pa between 1998 and 2020 or 1.8% pa excluding the gas used at the petrochemicals plants. The former includes 2.0% pa growth in the transport sector, 2.1% pa growth in the residential sector, and a 0.3% pa decline in the industrial and commercial sector (due to the closure of the petrochemicals plants). Oil and electricity are projected to increase their consumer energy fuel shares with a slight decline in the fuel share for coal. A significant decline for gas's share is projected if the methanol plants close around 2005, as assumed.

Some 2200 MW of electricity generation capacity is projected to be economic by 2020. This is a relatively modest amount in comparison to the 1100 MW of capacity that was added in the three years to 2000. The current "supply bubble" of new generation capacity is expected to mute new generation developments to around 2005, and together with recent industry reforms, will result in lower wholesale electricity prices in the short to medium term.

² For more information see *Energy Greenhouse Gas Emissions 1990–2001*, details on page 164.