



A. Energy Overview

New Zealand's total primary energy supply fell 3.6% to 750 PJ compared with the calendar year 2002 level of 778 PJ. This was due to a decrease in the primary energy supply of net indigenous oil (30%), gas (24%), hydro (6.1%) and geothermal (2.8%), while the primary energy supply of coal, imported oil and oil products and other renewables increased by 29%, 10% and 1.1% respectively. Annual per capita end

use of total energy was 123 GJ (about 20 barrels or 3,274 litres of oil). New Zealand's total consumer energy was dominated by domestic transport, with 208 PJ or 42% of total consumer energy.

Statistics in this overview are in gross petajoules (PJ) and relate to calendar year 2003 unless otherwise specified. For a full description of terms used, see the Glossary on page 156.

A.1 Energy Flows

Energy flows through the New Zealand economy from supply to end use, with 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 2003

| Gross Calorific Values in Petajoules | | Fossil Fuels | | | Renewables | | | Electricity | TOTAL |
|--------------------------------------|-------------------------------------|--------------|--------------|--------------|-------------|-------------|-------------|--------------|--------------|
| | | Coal | Oil | Gas | Hydro | Geothermal | Other | | |
| S U P P L Y | Indigenous production | 136.2 | 58.0 | 179.5 | 85.3 | 82.7 | 51.4 | | 593.0 |
| | + Imports less exports ¹ | -57.9 | 258.8 | -0.2 | | | | | 200.8 |
| | - International transport | | 44.1 | | | | | | 44.1 |
| | TOTAL PRIMARY ENERGY | 78.3 | 272.7 | 179.3 | 85.3 | 82.7 | 51.4 | | 749.6 |
| L Y | Energy transformation | -37.2 | -15.5 | -92.8 | -85.3 | -69.2 | -22.9 | 138.1 | -184.8 |
| | Non-energy use | | -12.0 | -45.5 | | | | | -57.5 |
| CONSUMER ENERGY (calculated) | | 41.1 | 245.2 | 41.0 | | 13.5 | 28.5 | 138.1 | 507.3 |
| D E M A N D | Agriculture | 0.6 | 16.6 | | | | | 5.1 | 22.3 |
| | Industrial | 40.6 | 14.4 | 21.2 | | 11.3 | 25.8 | 51.8 | 165.1 |
| | Commercial | 4.2 | 5.2 | 12.7 | | | 0.2 | 24.7 | 47.0 |
| | Residential | 0.8 | 1.9 | 6.9 | | 2.2 | 2.5 | 43.3 | 57.6 |
| | Domestic transport | 0.1 | 205.4 | 0.2 | | | | 1.9 | 207.6 |
| CONSUMER ENERGY (observed) | | 46.2 | 243.6 | 41.0 | | 13.5 | 28.5 | 126.8 | 499.5 |
| Statistical differences | | -5.2 | 1.6 | 0.0 | | 0.0 | 0.0 | 11.3 | 7.8 |

This table summarises the detailed energy balance presented in Table B.2h on page 27.

Note:

¹ This 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 2025.

A.2 Primary Energy Supply (PJ)

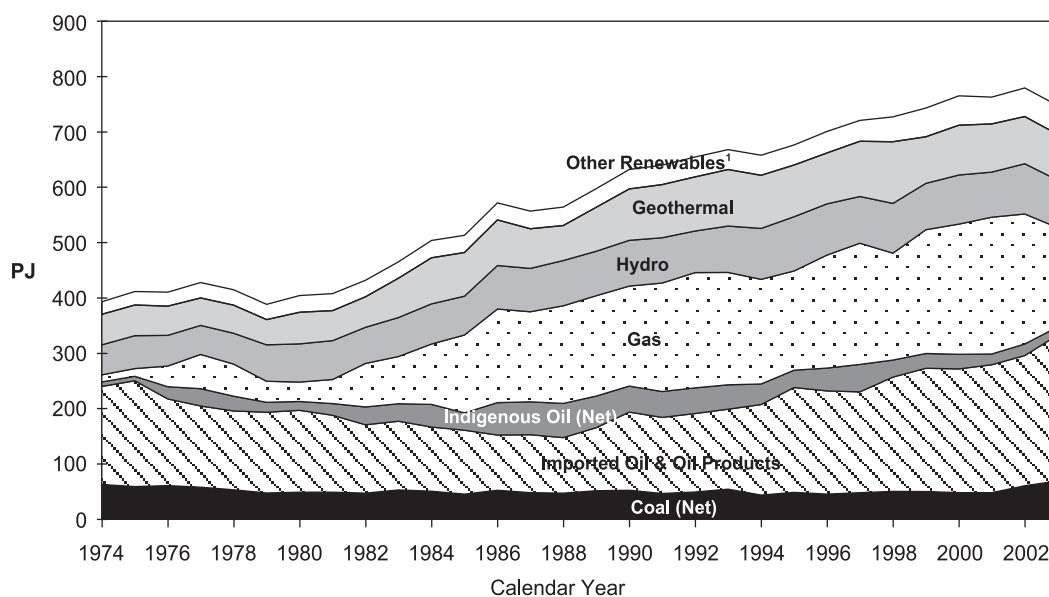
Total Primary Energy Supply (TPES) is the amount of energy available for use in New Zealand for energy transformation and end use. It includes energy as it is first obtained from natural sources, which means that coal is accounted for as it is mined, indigenous oil and natural gas as they are extracted 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 1974–2003

| 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 | 163.54 | 37.21 | 188.90 | 92.08 | 96.05 | 36.06 | 657.69 |
| 1995 | 48.80 | 189.40 | 31.22 | 179.16 | 98.13 | 93.30 | 36.38 | 676.39 |
| 1996 | 45.41 | 186.76 | 40.99 | 204.17 | 92.57 | 91.87 | 38.94 | 700.71 |
| 1997 | 48.03 | 182.20 | 49.65 | 218.92 | 84.44 | 99.85 | 37.57 | 720.66 |
| 1998 | 50.48 | 206.53 | 30.73 | 193.06 | 90.02 | 111.39 | 44.88 | 727.10 |
| 1999 | 50.05 | 222.93 | 26.73 | 223.53 | 83.73 | 84.31 | 51.92 | 743.19 |
| 2000 | 47.98 | 222.29 | 26.41 | 235.17 | 88.67 | 89.94 | 53.43 | 763.89 |
| 2001 | 48.11 | 232.89 | 19.46 | 247.07 | 81.41 | 87.24 | 47.69 | 763.87 |
| 2002 | 60.74 | 234.14 | 21.10 | 234.94 | 90.79 | 85.08 | 50.85 | 777.64 |
| 2003 ² | 78.30 | 257.80 | 14.87 | 179.27 | 85.28 | 82.67 | 51.40 | 749.59 |

Chart A.2a: Total Primary Energy Supply 1974–2003



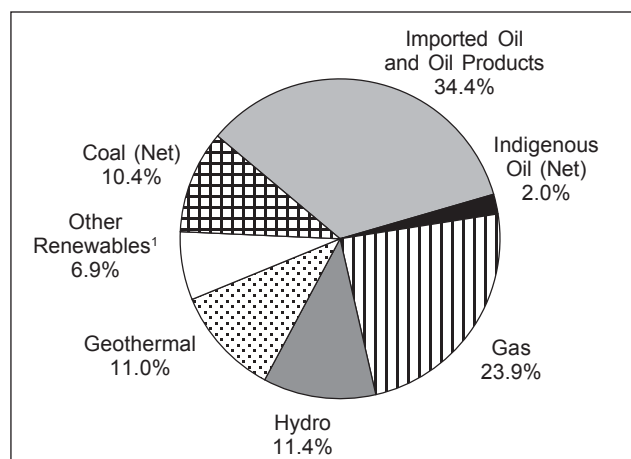
Notes: ¹ "Other Renewables" includes electricity generation from wind, biogas, industrial waste and wood.

² Provisional.

New Zealand's TPES for calendar years 1974 to 2003 is presented in Table A.2 and Chart A.2a. TPES was 750 PJ in calendar year 2003, up 91% on the 393 PJ supplied in calendar year 1974. Net indigenous oil supply and imported oil and oil products (for definition of terms used see Glossary, Section K) dominate TPES, accounting for 273 PJ of the total of 750 PJ supplied in calendar year 2003. Table A.2 shows that, in calendar year 2003, primary energy

supply of coal, imported oil and oil products and other renewables increased by 29% (from 61 PJ to 78 PJ), 10% (from 234 PJ to 258 PJ) and 1.1% (from 50.9 PJ to 51.4 PJ) respectively, compared with calendar year 2002. Primary energy supply of net indigenous oil, gas, hydro and geothermal fell by 30% (from 21 PJ to 15 PJ), 24% (from 235 PJ to 179 PJ), 6.1% (from 91 PJ to 85 PJ) and 2.8% (from 85 PJ to 83 PJ) respectively, between 2002 and 2003.

Chart A.2b: Total Primary Energy Supply Shares 2003



Note:

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

Chart A.2b shows New Zealand's TPES shares for calendar year 2003. TPES decreased 3.6% to 749.6 PJ compared with 777.6 PJ in calendar year 2002. In 2003, oil provided 272.7 PJ (36.4%), gas 179.2 PJ (23.9%), hydro 85.3 PJ (11.4%), geothermal 82.7 PJ (11.0%), coal 78.3 PJ (10.4%) and other renewables 51.4 PJ (6.9%) of TPES. In total, fossil fuels contributed 530.2 PJ or 71% and renewables 219.4 PJ or 29%.

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 2003, 98% of refinery input was from imported crude and refinery feedstocks, and the other 2% was from indigenous crude and condensate.

Total petrochemicals consumption in calendar year 2003 was 46 PJ, down 52% on the 96 PJ consumed in calendar year 2002. This was mainly due to a reduction in Methanex's entitlements for Maui gas. In 2003, 25% of New Zealand's natural gas extracted was used for petrochemicals for the production of chemical methanol and ammonia/urea production.

Major gas consumer Methanex Corporation's New Zealand plant was expected to produce between 0.5

million tonnes and 1 million tonnes of methanol from its plants in 2004. This estimate was based on contracted natural gas and additional natural gas Methanex believes it will contract.

In 2003, 59% of the total input into electricity generation, including cogeneration, was from renewable resources (hydro contributed 29%, geothermal contributed 22% and other renewables contributed 8%), 29% was from gas and 12% was from coal. Of the total renewable energy input, hydro contributed 50%, geothermal contributed 37% and other renewables such as wind, biogas, wastes and wood made up 13%. Overall, energy transformation in 2003 was around 9% higher than in 2002. This was mainly due to an increase in electricity generation from coal.

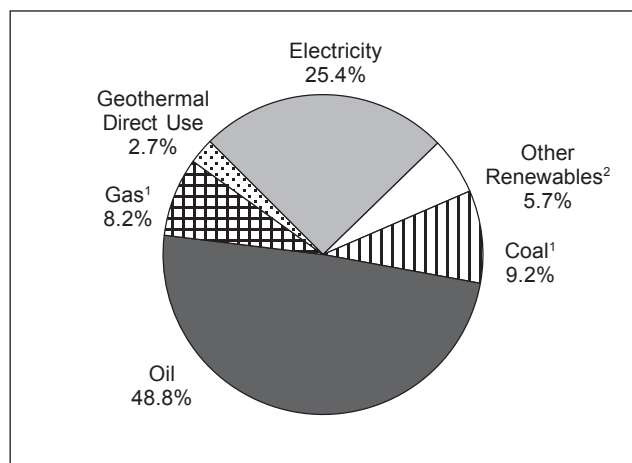
A.4 Consumer Energy Demand

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,

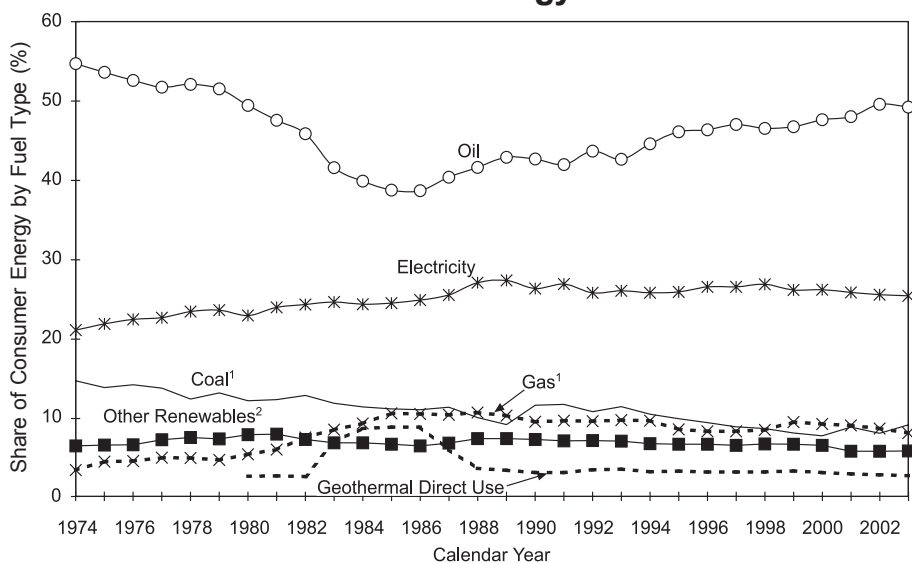
some of which is transformed into electricity, of which some is used or lost in transmission and distribution to consumers.

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 | | | | | | | |
| 1995 | 39.7 | 195.5 | 35.9 | 13.5 | 109.6 | 28.0 | 422.2 |
| 1996 | 39.7 | 197.4 | 35.1 | 13.2 | 112.8 | 28.1 | 426.2 |
| 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 | 41.8 | 14.3 | 116.2 | 29.4 | 445.7 |
| 2000 | 35.1 | 218.0 | 41.9 | 13.8 | 119.6 | 29.6 | 458.0 |
| 2001 | 40.5 | 222.7 | 41.6 | 13.1 | 119.7 | 25.8 | 463.3 |
| 2002 | 38.8 | 232.1 | 41.9 | 13.3 | 124.2 | 27.1 | 477.3 |
| 2003 | 46.2 | 243.6 | 41.0 | 13.5 | 126.8 | 28.5 | 499.6 |
| % of annual | | | | | | | |
| 1995 | 9.4 | 46.3 | 8.5 | 3.2 | 26.0 | 6.6 | 100 |
| 1996 | 9.3 | 46.3 | 8.2 | 3.1 | 26.5 | 6.6 | 100 |
| 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 | 46.7 | 9.4 | 3.2 | 26.1 | 6.6 | 100 |
| 2000 | 7.7 | 47.6 | 9.2 | 3.0 | 26.1 | 6.5 | 100 |
| 2001 | 8.7 | 48.1 | 9.0 | 2.8 | 25.8 | 5.6 | 100 |
| 2002 | 8.1 | 48.6 | 8.8 | 2.8 | 26.0 | 5.7 | 100 |
| 2003 | 9.2 | 48.8 | 8.2 | 2.7 | 25.4 | 5.7 | 100 |

Chart A.4a: Total Consumer Energy by Fuel 2003

The total consumer energy by fuel for calendar years 1995 to 2003 is presented in Table A.4a and illustrated in Chart A.4a for calendar year 2003. Total consumer energy (observed) increased by 4.7% to 499.6 PJ in 2003 compared with 477.3 PJ in 2002. Oil consumption comprises around 243.6 PJ (48.8%), electricity 126.8 PJ (25.4%), coal 46.2 PJ (9.2%), gas 41.0 PJ (8.2%), while other renewables such as biogas, wastes and wood made up 28.5 PJ (5.7%) with geothermal direct use of 13.5 PJ (2.7%). Compared with the year before, the relative share of coal, other renewables, electricity, oil and geothermal direct use increased by 19%, 5.4%, 2.1%, 5.0% and 1.3% respectively in 2003, while gas fell by 2.2% between 2002 and 2003.

Chart A.4b: Total Consumer Energy Fuel Shares from Calendar Years 1974 to 2003

The shares of consumer energy by fuel from calendar years 1974 to 2003 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 25% and 8.2% respectively in 2003. Geo-thermal direct use increased its share slightly from 2.5% in 1980 to 2.7% in 2003. The shares of oil, coal and other renewables declined from 55%, 15% and 6.4% in 1974 to 49%, 9.3% and 5.7% respectively in 2002.

Notes:

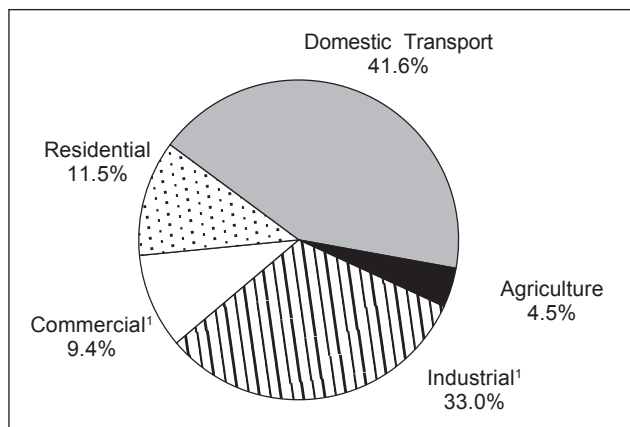
¹ Excludes cogeneration.² "Other Renewables" includes direct use of biogas, industrial waste and wood.³ Totals may not add up due to rounding.

Table A.4b: Total Consumer Energy by Sector

| Calendar Year | Agriculture | Industrial ¹ | Commercial ¹ | Residential | Domestic Transport | TOTAL ² |
|--------------------|-------------|-------------------------|-------------------------|-------------|--------------------|--------------------|
| PJ | | | | | | |
| 1995 | 17.3 | 149.7 | 38.4 | 54.8 | 162.0 | 422.2 |
| 1996 | 17.9 | 150.7 | 36.7 | 56.5 | 164.5 | 426.2 |
| 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 | 20.5 | 151.7 | 39.9 | 56.6 | 177.0 | 445.7 |
| 2000 | 19.0 | 154.7 | 43.7 | 55.2 | 185.3 | 458.0 |
| 2001 | 19.6 | 149.7 | 46.5 | 56.8 | 190.7 | 463.3 |
| 2002 | 20.5 | 153.6 | 47.6 | 56.4 | 199.2 | 477.3 |
| 2003 | 22.3 | 165.1 | 47.0 | 57.6 | 207.6 | 499.5 |
| % of annual | | | | | | |
| 1995 | 4.1 | 35.5 | 9.1 | 13.0 | 38.4 | 100 |
| 1996 | 4.2 | 35.3 | 8.6 | 13.2 | 38.6 | 100 |
| 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 | 12.7 | 39.7 | 100 |
| 2000 | 4.2 | 33.8 | 9.5 | 12.1 | 40.5 | 100 |
| 2001 | 4.2 | 32.3 | 10.0 | 12.3 | 41.2 | 100 |
| 2002 | 4.3 | 32.2 | 10.0 | 11.8 | 41.7 | 100 |
| 2003 | 4.5 | 33.0 | 9.4 | 11.5 | 41.6 | 100 |

Notes: ¹ Excludes cogeneration. ² Totals may not add up due to rounding.

Chart A.4c: Total Consumer Energy by Sector 2003



Note: ¹ Excludes cogeneration.

Total consumer energy by sector from 1995 to 2003 is presented in Table A.4b, and the shares in 2003 are illustrated in Chart A.4c. Out of all the sectors, domestic transport consumption (excluding international transport) accounts for the largest share, 41.6% of total consumer energy. Compared with calendar year 2002, total consumer energy use by the agriculture, industrial, domestic transport and residential sectors increased by 8.8% (from 20.5 PJ to 22.3 PJ), 7.5% (from 153.6 PJ to 165.1 PJ), 4.2% (from 199.2 PJ to 207.6 PJ) and 2.2% (from 56.4 PJ to 57.6 PJ) respectively. Total consumer energy use by the commercial sector fell by 1.3% from 47.6 PJ to 47.0 PJ between 2002 and 2003.

Table A.4c: Total Renewable Consumer Energy

| Calendar Year | Total Electricity | Renewable Electricity | Other Renewables ³ | Geothermal Direct Use | TOTAL RENEWABLE ENERGY |
|--------------------|-------------------|-----------------------|-------------------------------|-----------------------|------------------------|
| PJ | | | | | |
| 1995 | 109.6 | 93.2 | 28.0 | 13.5 | 134.6 |
| 1996 | 112.8 | 90.1 | 28.1 | 13.2 | 131.3 |
| 1997 | 113.7 | 84.1 | 27.7 | 13.3 | 125.0 |
| 1998 | 117.7 | 88.4 | 29.1 | 13.6 | 131.1 |
| 1999 | 116.2 | 86.1 | 29.4 | 14.3 | 129.8 |
| 2000 | 119.6 | 88.7 | 29.6 | 13.8 | 132.1 |
| 2001 | 119.7 | 81.8 | 25.8 | 13.1 | 120.7 |
| 2002 | 124.2 | 90.3 | 27.1 | 13.3 | 130.7 |
| 2003 | 126.8 | 86.4 | 28.5 | 13.5 | 128.4 |
| % of annual | | | | | |
| 1995 | | 69.2 | 20.8 | 10.0 | 100 |
| 1996 | | 68.6 | 21.4 | 10.0 | 100 |
| 1997 | | 67.3 | 22.1 | 10.6 | 100 |
| 1998 | | 67.4 | 22.2 | 10.4 | 100 |
| 1999 | | 66.3 | 22.7 | 11.0 | 100 |
| 2000 | | 67.2 | 22.4 | 10.5 | 100 |
| 2001 | | 67.8 | 21.3 | 10.9 | 100 |
| 2002 | | 69.1 | 20.7 | 10.2 | 100 |
| 2003 | | 67.3 | 22.2 | 10.5 | 100 |

Note: ³ "Other Renewables" includes direct use of biogas, industrial waste and wood.

Chart A.4d: Total Renewable Consumer Energy 2003

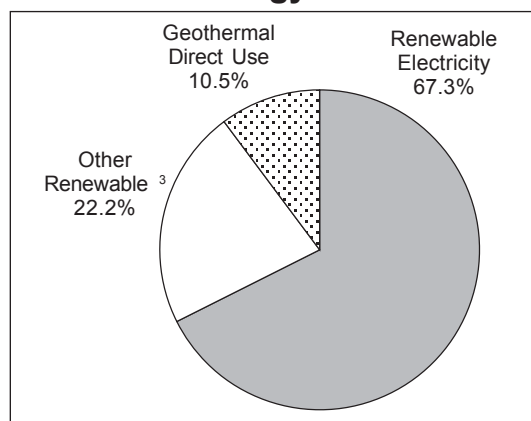
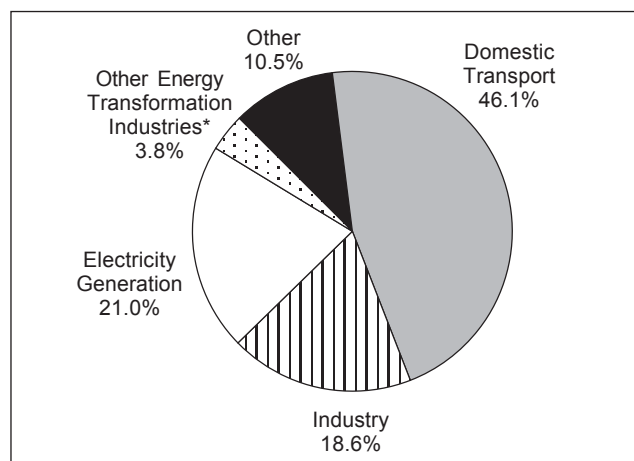


Table A.4c shows total renewable consumer energy for calendar years 1995 to 2003. Total renewable consumer energy was 128 PJ for the calendar year 2003, a decrease of 4.7% over eight years. During calendar year 2003, renewable electricity contributed 86 PJ or about 68% of total electricity consumption.

A.5 Energy Greenhouse Gas Emissions¹

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 32 million tonnes in 2003. 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 2003. In calendar year 2003, emissions from the domestic transport sector accounted for 14,663 kt (46.1%), the industry sector 5,910 kt (18.6%), thermal electricity generation 6,687 kt (21.0%), the other sectors 3,355 kt (10.5%) and the other energy transformation industries 1,215 kt (3.8%).

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 170 for details). A comprehensive set of new projections was published in October 2003.

The October 2003 *Outlook* presents energy supply and demand scenarios for New Zealand to 2025. 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 *Energy Outlook* presents a Reference scenario that assumes 2.5% GDP growth per annum from 2007, new gas discoveries averaging 35 PJ pa for 2011 to 2013 and 60 PJ pa for 2014 to 2025, oil prices rising to US\$25/bbl from 2020, and coal prices rising to NZ\$4/GJ from 2013. A carbon charge is assumed at \$15/t of CO₂ from 2008 and it is also assumed that the NEECS energy efficiency uptake of 20% by 2012 is achieved.

The Reference scenario projects consumer energy demand to grow an average 0.6% pa between 2000 and 2025. The former includes 1.3% pa growth in the transport sector, 1.0% pa growth in the residential sector, and a 0.1% pa decline in the industrial and commercial sector (due to the closure of the methanol plants). Oil, coal and electricity are projected to increase their consumer energy fuel shares while the share of gas is projected to decline if the methanol plants close around 2005 as assumed.

Some 3,357 MW of new electricity generation capacity is projected to be economic by 2025, with geothermal energy and wind power both projected to become increasingly more significant generation sources. Wholesale electricity prices will rise to reflect the cost of power, at the margin, from these renewable sources.

Note:

¹ For more information see *Energy Greenhouse Gas Emissions 1990–2003*, details on page 170.