Renewable vs Fossil Fuels

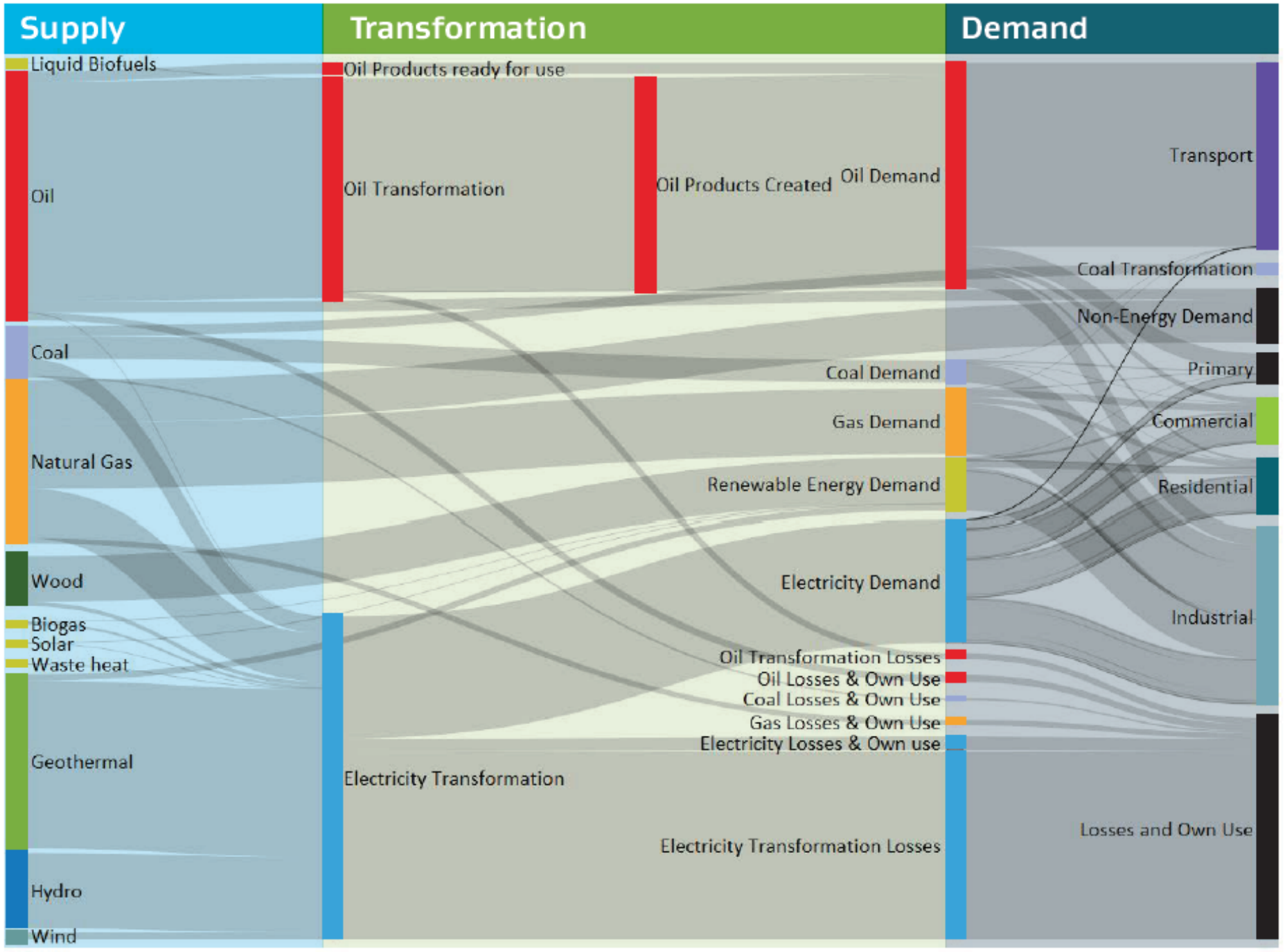
The Current Energy Outlook in New Zealand

A Quick Look on New Zealand

- Located in the southwestern Pacific Ocean, the country comprises of the North Island and the South Island
- It has a population of about 5 million
- Its capital city is Wellington, while its most populous city is Auckland
- Renewable sources and Fossil Fuels both contribute majorly to the its electricity demand

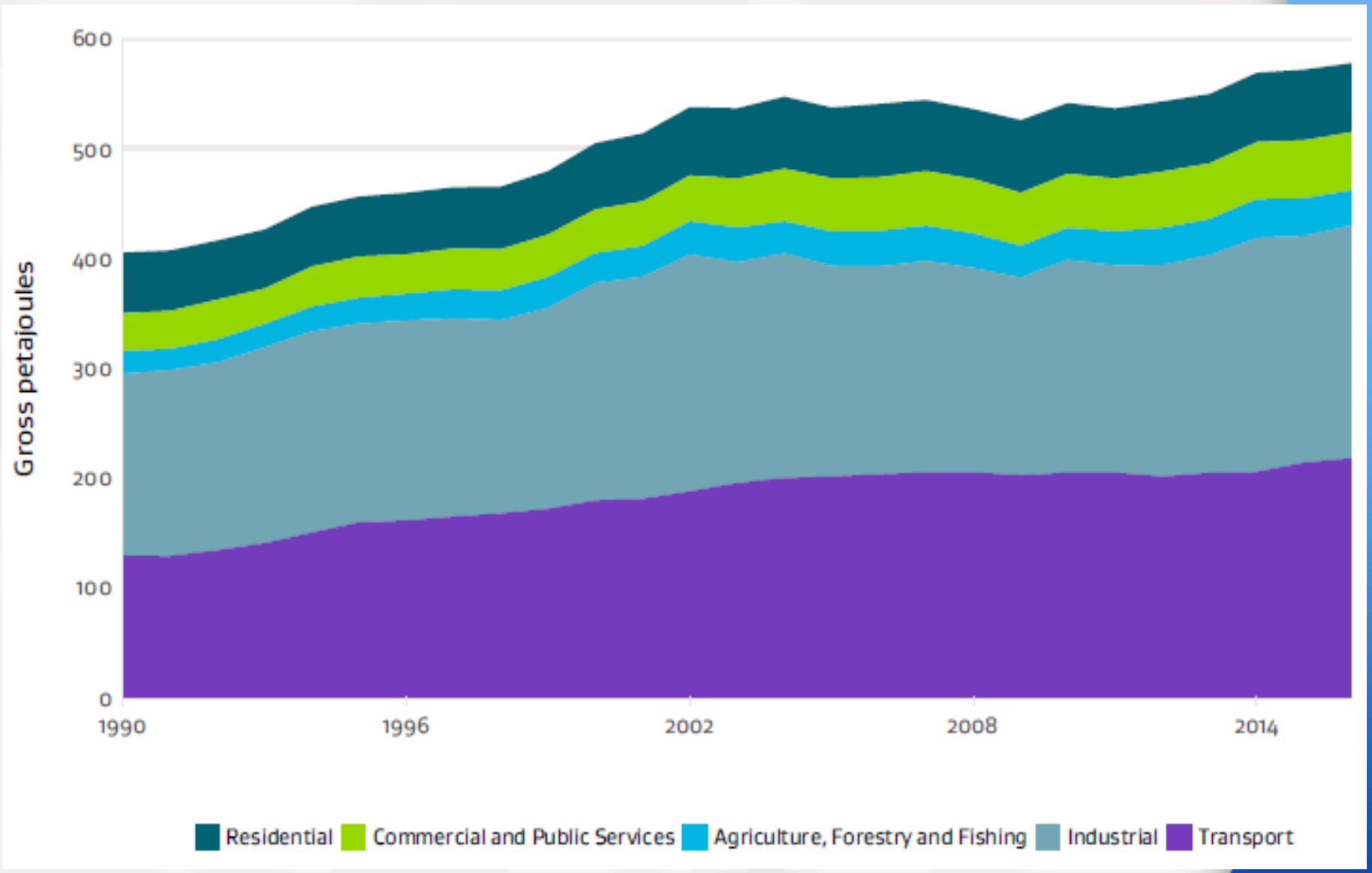
Snapshot of Energy in 2016

- Coal exports down to 12%, decreasing for 4th year in a row
- Oil exports down to 22%
- Energy production decreased to 2.4% from 2015 – Lower oil and coal production
- Electricity imports increased to 5.4% from 2015 – High levels of diesel entering the country
- NZ's energy self-sufficiency fell to 78%


Supply
Transformation
Demand
Liquid Biofuels
Oil
Coal
Natural Gas
Wood
Biogas
Solar
Waste heat
Geothermal
Hydro
Wind
Oil Products ready for use
Oil Transformation
Oil Products Created
Oil Demand
Coal Demand
Gas Demand
Renewable Energy Demand
Electricity Demand
Oil Transformation Losses
Oil Losses & Own Use
Coal Losses & Own Use
Gas Losses & Own Use
Electricity Losses & Own use
Electricity Transformation
Electricity Transformation Losses
Transport
Coal Transformation
Non-Energy Demand
Primary
Commercial
Residential
Industrial
Losses and Own Use

Energy Demand

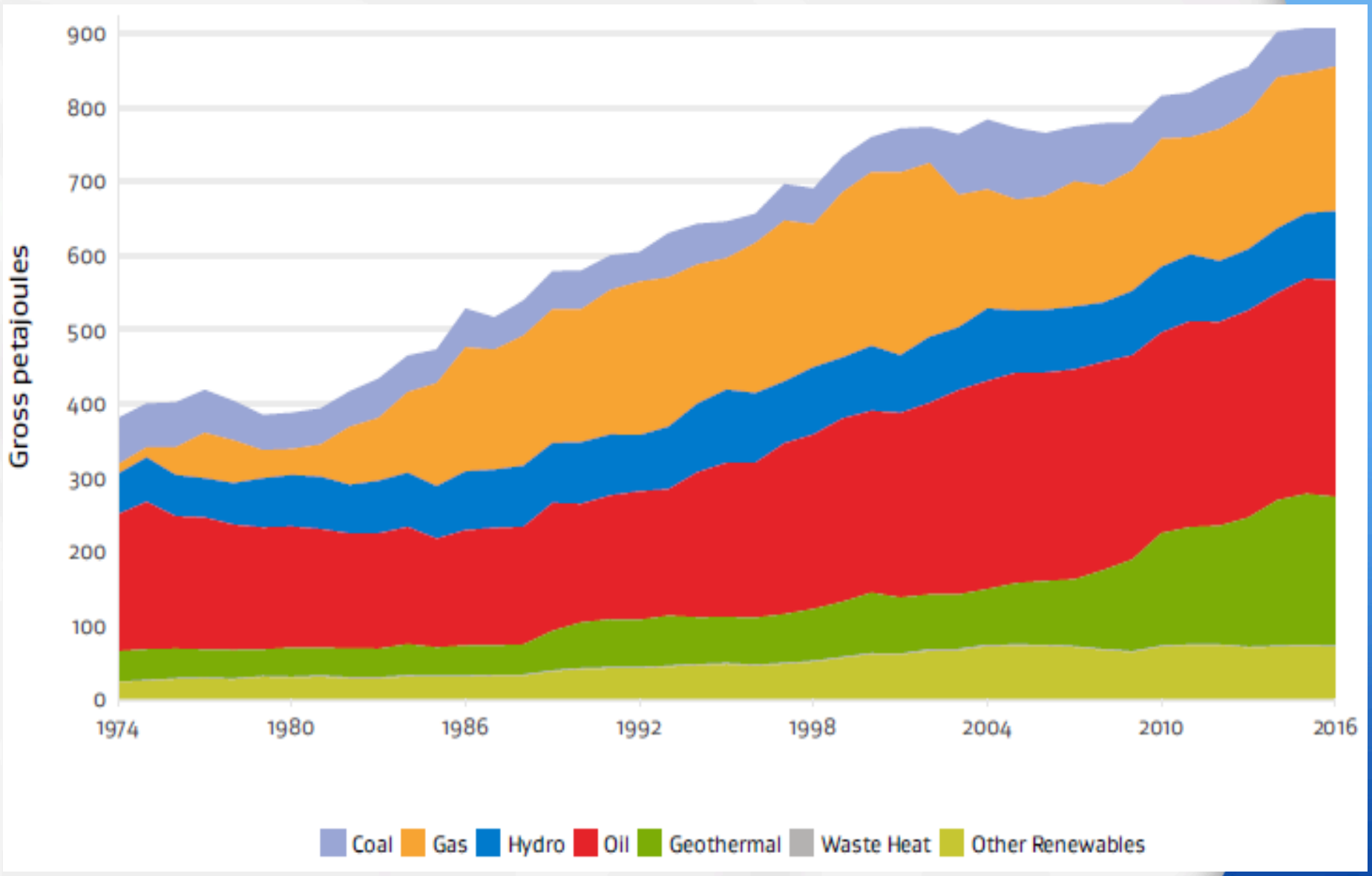
- Consumer energy demand continues to rise
- Industrial demand was a major contributor to growth – up by 2.7% in 2016
- Most of the increase came from higher demand in chemicals sector – Methanex returned to near full capacity
- Consumer energy demand up 1.0% from 2015 levels, led by higher Industrial and Transport demand
- Residential energy demand fell despite continued population growth


Gross petajoules
600
500
400
300
200
100
0
1990
1996
2002
2008
2014
Residential
Commercial and Public Services
Agriculture, Forestry and Fishing
Industrial
Transport

Energy Supply

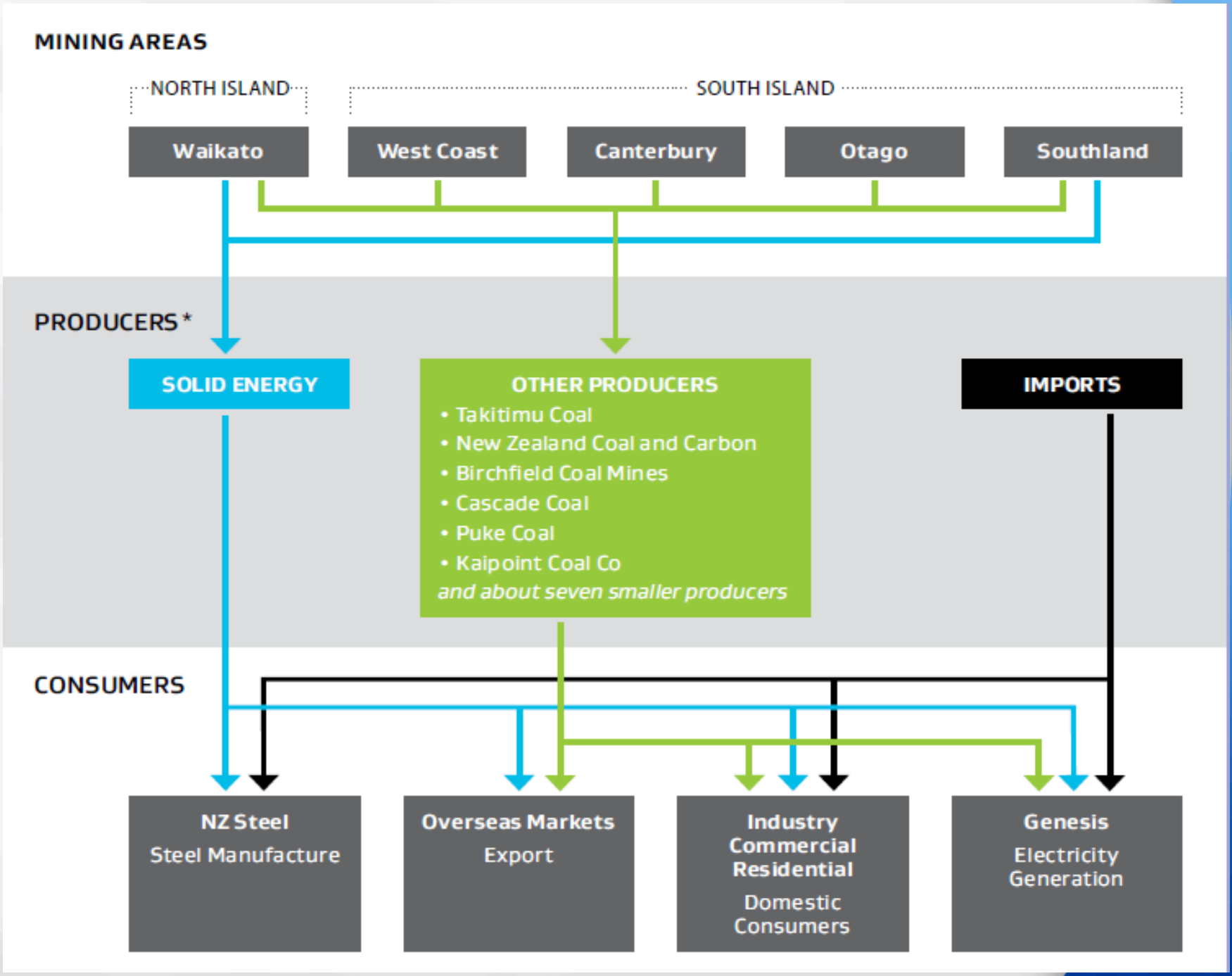
Supply = Production + Imports – Exports – Stock change

- Energy supply growth was flat as higher imports and lower exports were offset by a fall in energy production
- Exports fell 19% - lowest level since 2005
- New Zealand produced enough energy to meet 78% of its energy requirements
- About 3.2 million barrels of oil imports – highest level on record


Gross petajoules
900
800
700
600
500
400
300
200
100
0
1974
1980
1986
1992
1998
2004
2010
2016
Coal
Gas
Hydro
Oil
Geothermal
Waste Heat
Other Renewables

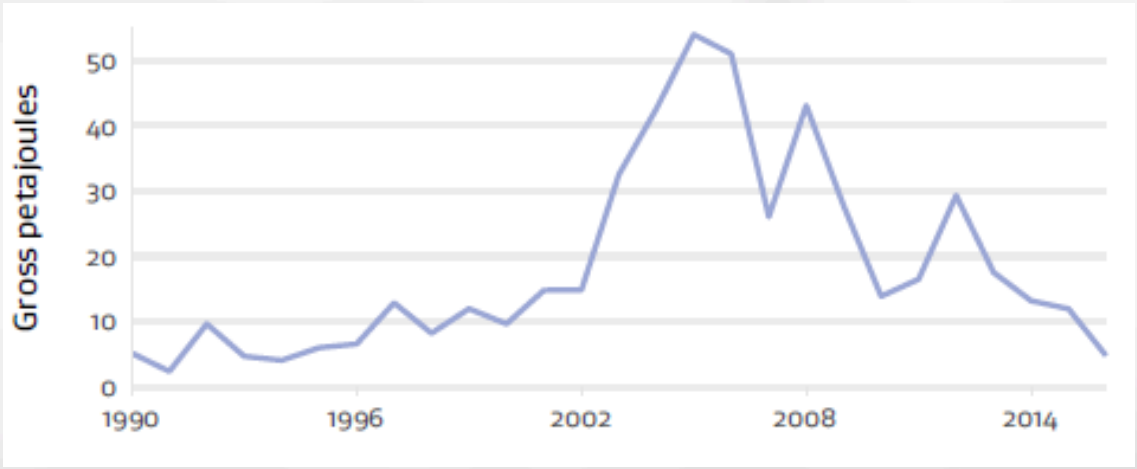
Coal

- Total coal supply fell 14% to 2.5 million tonnes
- This decrease was due to fall in production in the North Island and West Coast
- Coal production can be split into three geographic areas:
  - **North Island** – most of the coal produced here is used in North Island
  - **West Coast** – produced mainly for export to international markets. Production has been falling alongside falling international coal prices
  - **Rest of South Island** – production mainly for domestic use. Production actually rose 10% over the year


MINING AREAS
NORTH ISLAND
SOUTH ISLAND
Waikato
West Coast
Canterbury
Otago
Southland
PRODUCERS*
SOLID ENERGY
OTHER PRODUCERS
• Takitimu Coal
• New Zealand Coal and Carbon
• Birchfield Coal Mines
• Cascade Coal
• Puke Coal
• Kaipoint Coal Co
and about seven smaller producers
IMPORTS
CONSUMERS
NZ Steel
Steel Manufacture
Overseas Markets
Export
Industry
Commercial
Residential
Domestic
Consumers
Genesis
Electricity
Generation

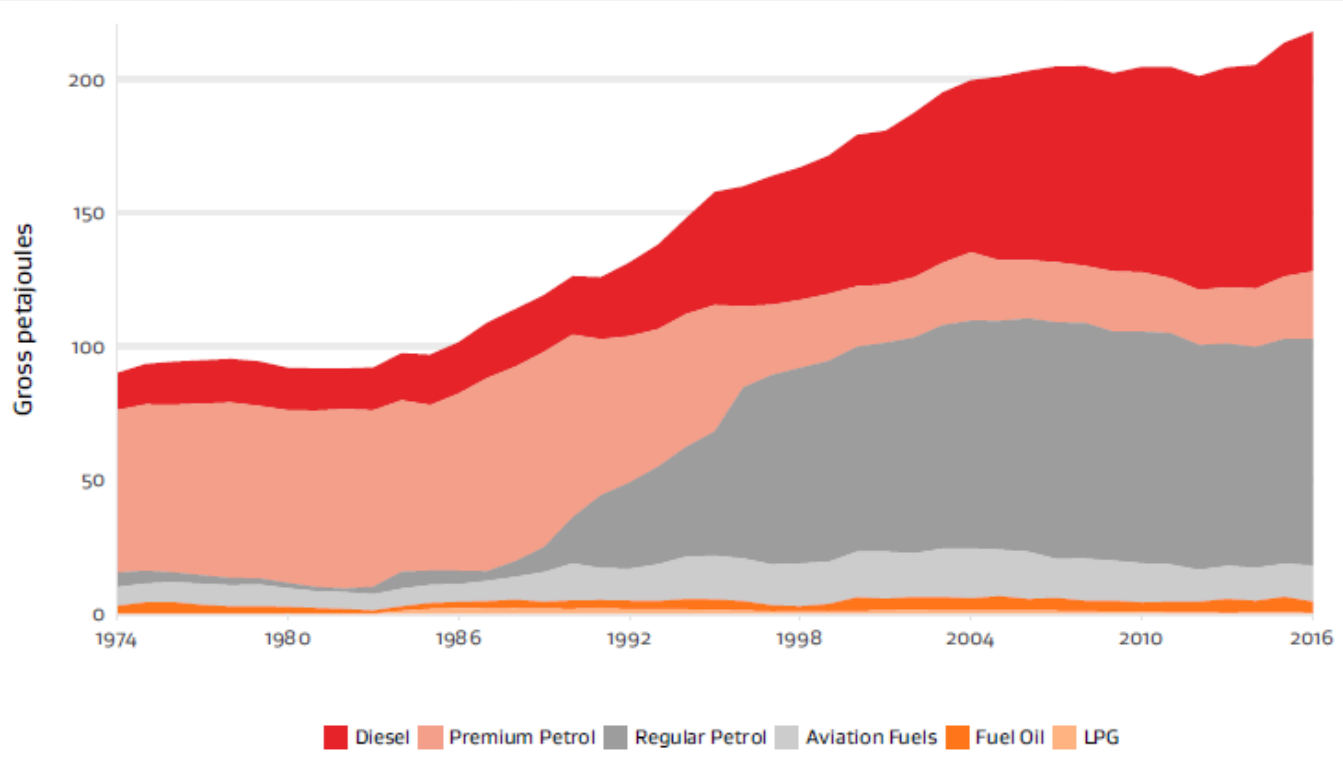
Coal Use

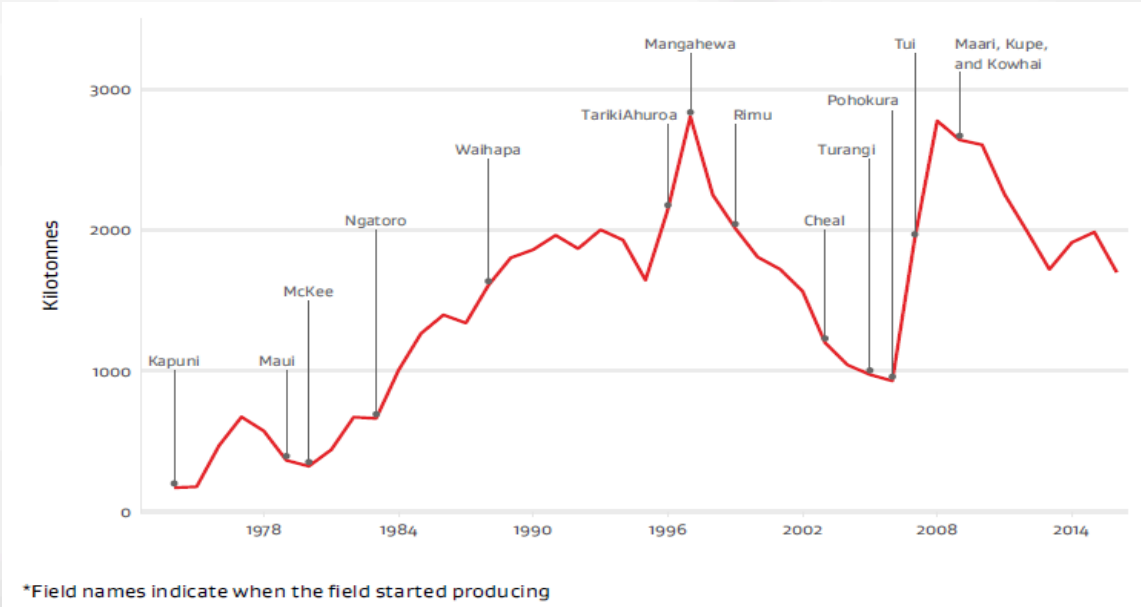
- Coal used in electricity generation fell 60% because of wetter weather
- Factors for continued fall in coal:
  - There has been strong supply of renewables for electricity generation
  - Genesis Energy's closure of two of its 4 coal/gas Huntly Rankine units in recent years



Oil

- Production of crude oil fell 15.1% because of diminishing production from existing fields
- Oil production at its lowest level in a decade
- Oil imports up 5% because of higher demand for diesel
- Oil consumption grew 2.2% because of higher domestic transportation

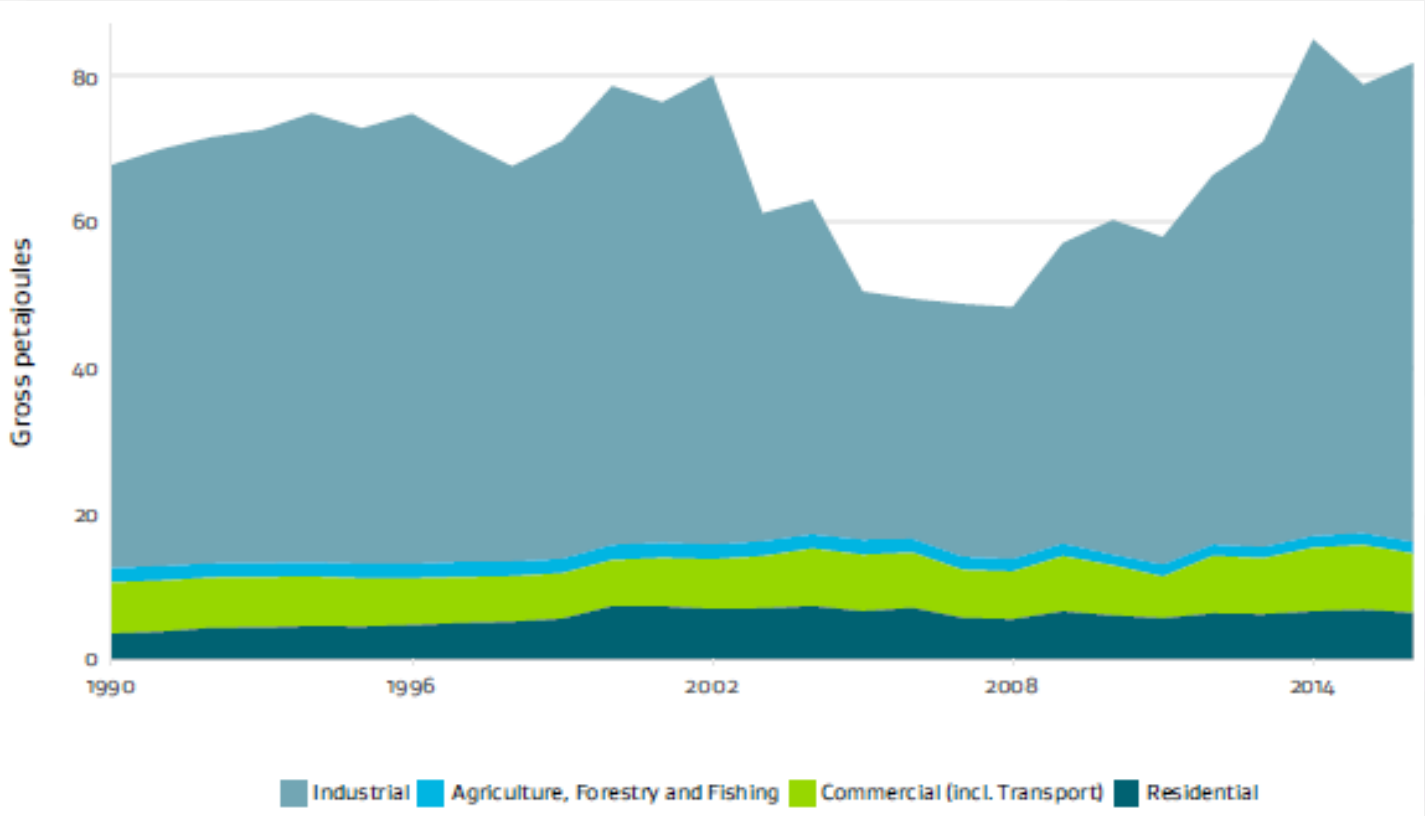


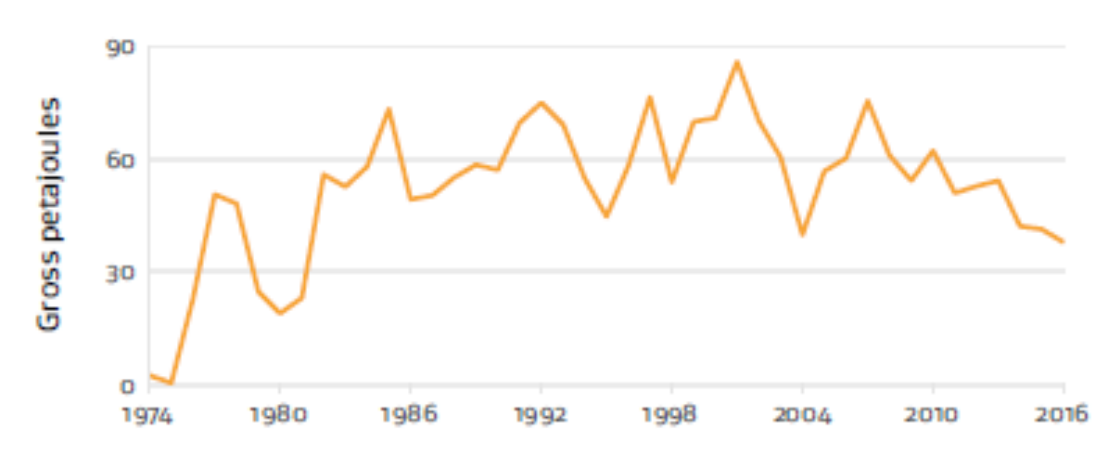


*Field names indicate when the field started producing

Gas

- Gas consumption in 2016 rose 3.8% because of increased demand from the Chemical Manufacturing sector
- The non-energy use of gas rose 16% after Methanex returned to normal production levels
- Gas used to fuel electricity plants fell to a 25 year low because of wetter weather – greater volume of hydro available
- Natural gas production rose 5.2% mostly due to higher production at Mangahewa
- In NZ, all natural gas is produced in the North Island – 86% of it comes from just 4 fields: Pohokura, Maui, Mangahewa and Kupe


Gross petajoules
80
60
40
20
0
1990
1996
2002
2008
2014
Industrial
Agriculture, Forestry and Fishing
Commercial (incl. Transport)
Residential

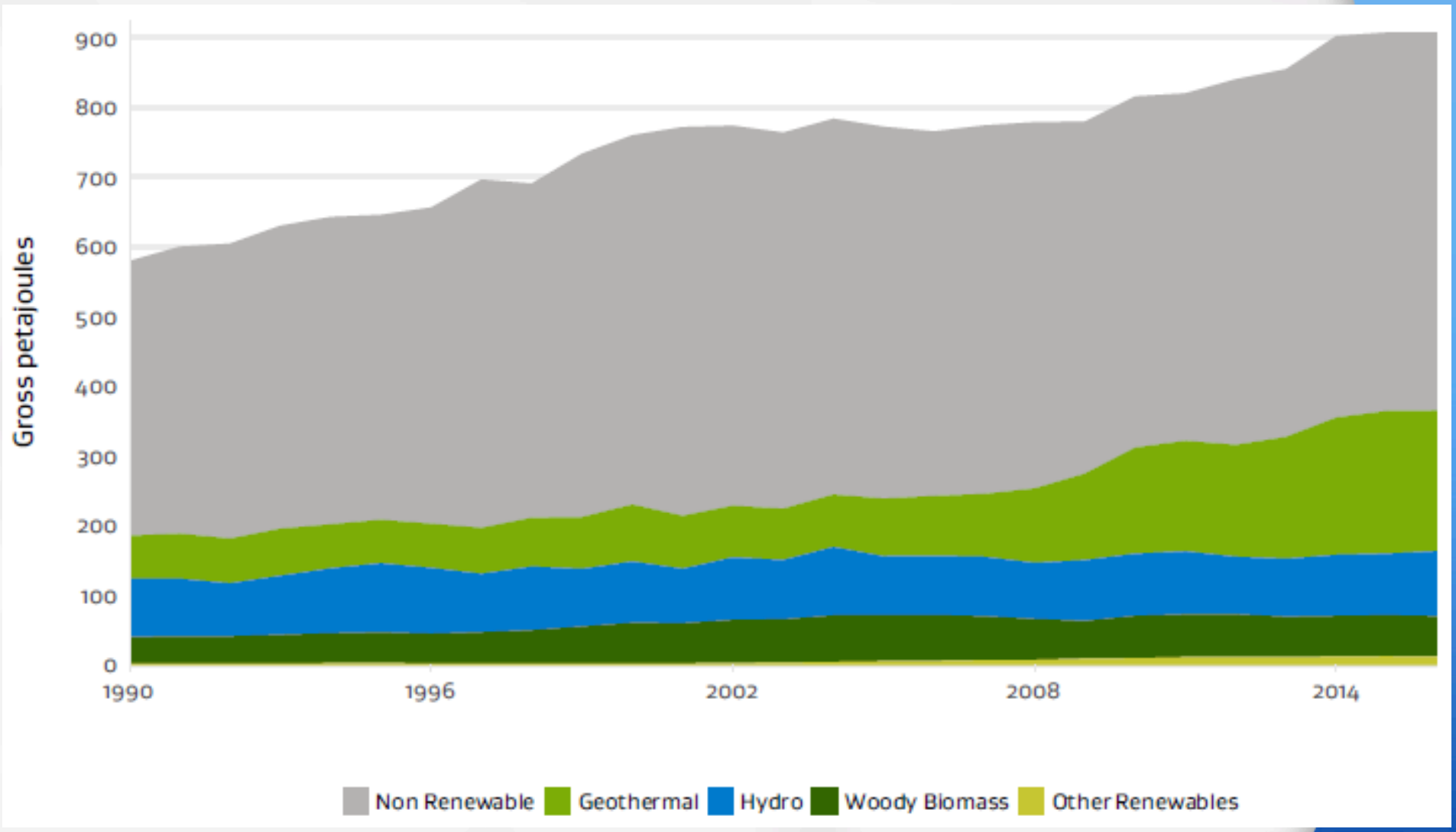

Gross petajoules
90
60
30
0
1974
1980
1986
1992
1998
2004
2010
2016

Oil and Gas Reserves

- At the current levels of gas use, remaining natural gas reserves would be exhausted in 11 years
- NZ's oil and gas exploration expenditure fell 62% alongside low crude oil prices
- Lower price of crude oil reduced the appetite for further investment resulting in reductions in exploration investment
- Deferral of drilling makes economic sense as most companies believe there will be a return to higher prices as global supplies fall

Renewables

- Renewable energy supply rose to 40.2% because of higher electricity generation from hydro
- Hydro and geothermal energy were the largest contributors to renewable energy supply
- NZ had the 4th highest renewable primary energy supply in the OECD (Organisation for Economic Co-operation and Development)


Gross petajoules
900
800
700
600
500
400
300
200
100
0
1990
1996
2002
2008
2014
Non Renewable
Geothermal
Hydro
Woody Biomass
Other Renewables

Renewable Use

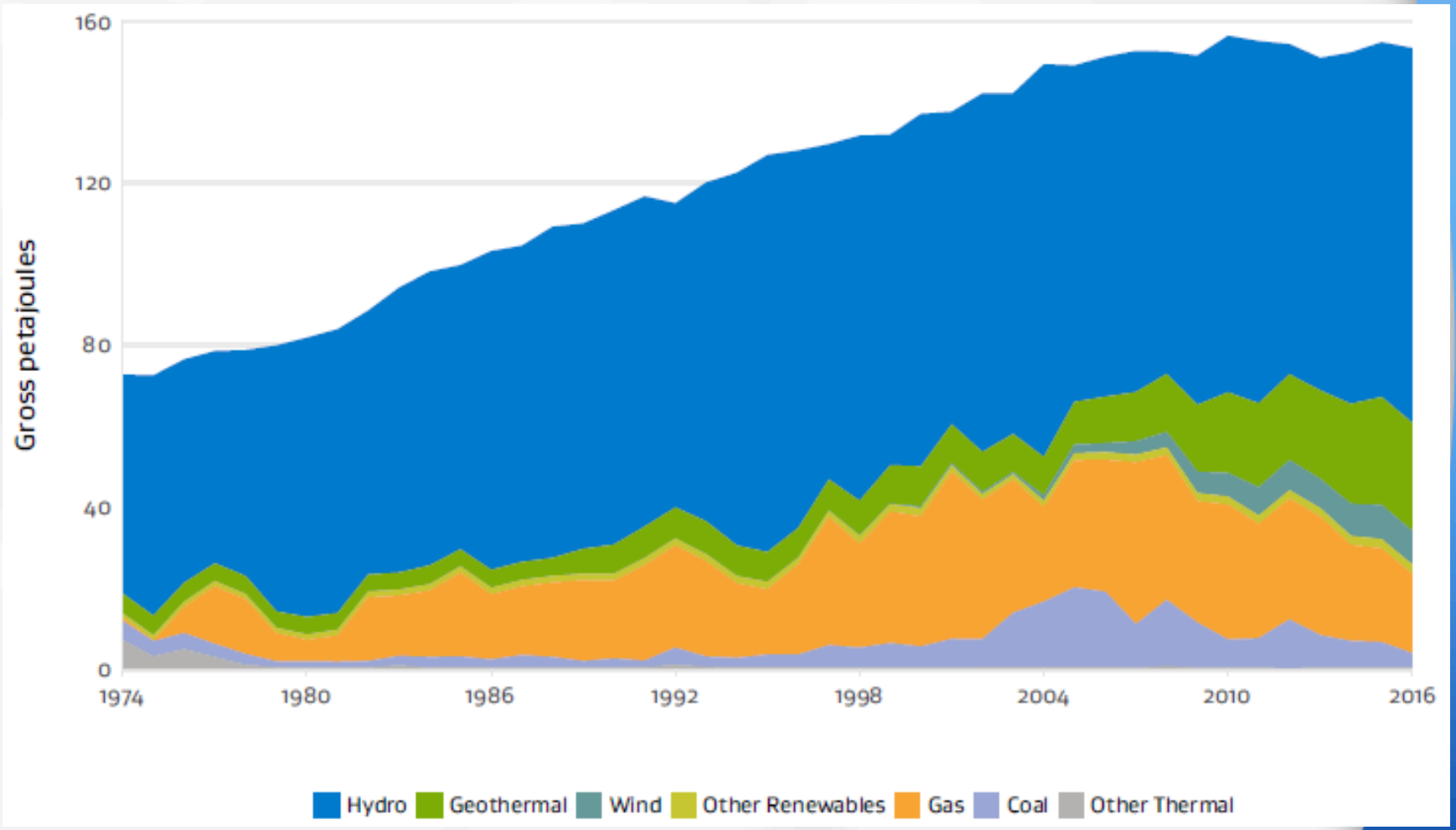
- Renewable electricity generation rose to a 35 year high
- In 2016, a total of 84.8% of electricity generation came from renewable resources
- The number of wind and geothermal developments started to increase rapidly from mid-2000 onwards due to:
  - The continual development of electricity market
  - The downgrading Maui natural gas reserves which lead to a sharp drop in production in 2003
  - Declining costs of renewable technologies along with much lower operating costs compared to fossil fuel generation
- Solar PV generation continues to grow quickly
- Total solar generation, including both PV and thermal, remains a small proportion of total primary renewable energy at 0.2%

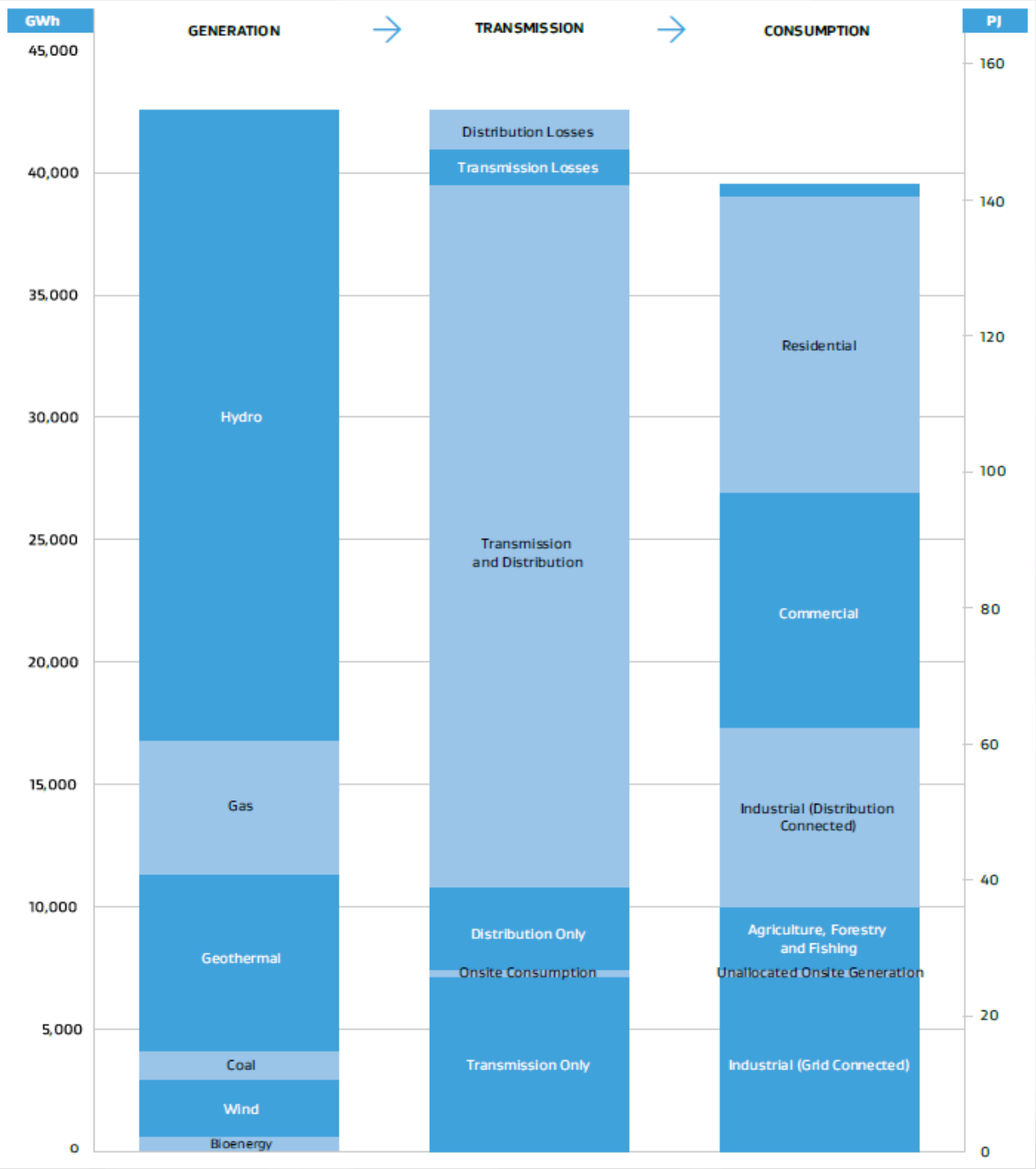
Renewable Use

- However, the use of solar photovoltaic (PV) panels to generate electricity is growing rapidly
- Total generation from small solar PV panels in 2016 was about 21.7 GWh – up 52% over the year
- Most consumption of renewable energy is from wood biomass
- Woody biomass makes up 86% of renewable energy used for direct-use heat application in 2016
- Woody biomass is used mainly in the timber industry – burns residue wood to provide process heat
- Wood is also burned to heat many private homes in NZ, with 2013 census reporting that 36% of NZ households use wood to heat their homes

Electricity Supply

- Electricity generation decreased 0.9% alongside lower electricity demand
- Renewable electricity generation rose to 85% - a 35 year high
- High hydro generation saw coal- and gas-fired generation fall to record lows
- Geothermal generation rose by 0.2% from 2015 levels, however wind generation fell 1.6% over the same period


Gross petajoules
160
120
80
40
0
1974
1980
1986
1992
1998
2004
2010
2016
Hydro
Geothermal
Wind
Other Renewables
Gas
Coal
Other Thermal


GWh
GENERATION
TRANSMISSION
CONSUMPTION
PJ
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
160
140
120
100
80
60
40
20
0
Hydro
Gas
Geothermal
Coal
Wind
Bioenergy
Distribution Losses
Transmission Losses
Transmission and Distribution
Distribution Only
Onsite Consumption
Transmission Only
Residential
Commercial
Industrial (Distribution Connected)
Agriculture, Forestry and Fishing
Unallocated Onsite Generation
Industrial (Grid Connected)

Conclusion

- Renewable energy is a growing trend in NZ
- Fossil fuels will continue to display a downward trend in the future
- However, fossil fuel demand will increase in the near future due to low global supply
- During the transition to renewable energy, NZ will need to rely on fossil fuel production and imports
- Renewable energy is the definite future of New Zealand’s energy demand

Citations

- Energy in New Zealand 2017. (n.d.). Retrieved from http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/publications/energy-in-new-zealand
- New Zealand Commits to 90% Renewable Electricity by 2025. (2007, September 26). Retrieved from https://www.renewableenergyworld.com/articles/2007/09/new-zealand-commits-to-90-renewable-electricity-by-2025-50075.html