



# The Energy Landscape: New Zealand and Beyond

EGEE 497 Final Presentation

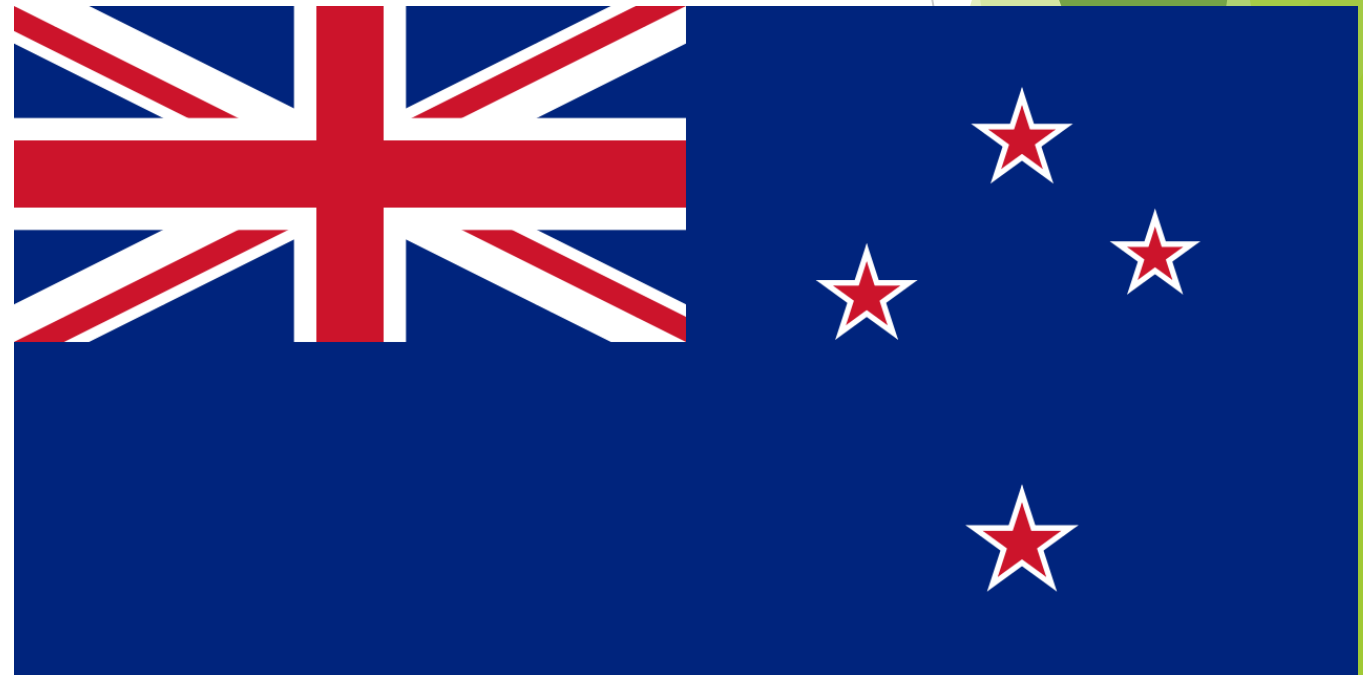
By Phil Badman

# Agenda:

- ▶ New Zealand background
- ▶ History of energy use in NZ
- ▶ Current situation
- ▶ Future prospects
- ▶ Popular opinion and political climate
- ▶ What about US?
- ▶ What can we learn?

# New Zealand: A Brief Introduction

- ▶ Population: ~4.5 million
- ▶ About 1/10<sup>th</sup> larger in land area than UK
- ▶ 9,000 kWh per capita 2014 electricity consumption (vs. 13,000 in US)
- ▶ Possesses significant resources for hydro, geothermal, and wind power
- ▶ Constitutional Monarchy with Parliamentary government
- ▶ Mixed Member Proportional (MMP) voting system
- ▶ Multi-party government; seven parties currently represented in Parliament

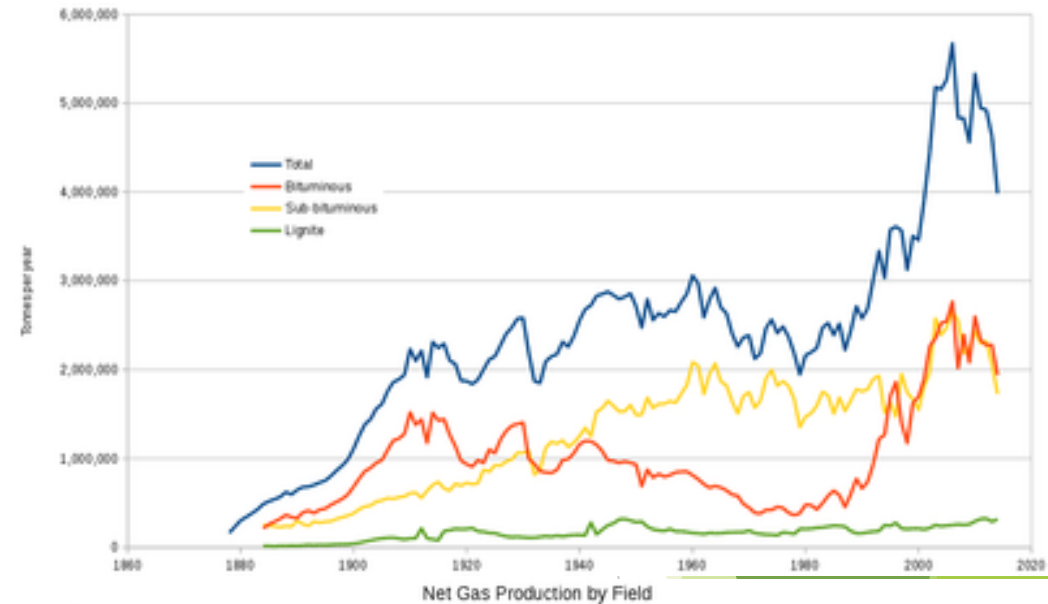


# Energy in New Zealand's Past

- ▶ Before electricity, residential and public gas lighting was prevalent, and was powered by gas generated from plentiful coal.
- ▶ Electricity took off with hydropower, coal
- ▶ Modern gas industry blossomed in 1970's with Kapuni and Maui fields
- ▶ Emerging markets for geothermal and wind power resources in more recent years.

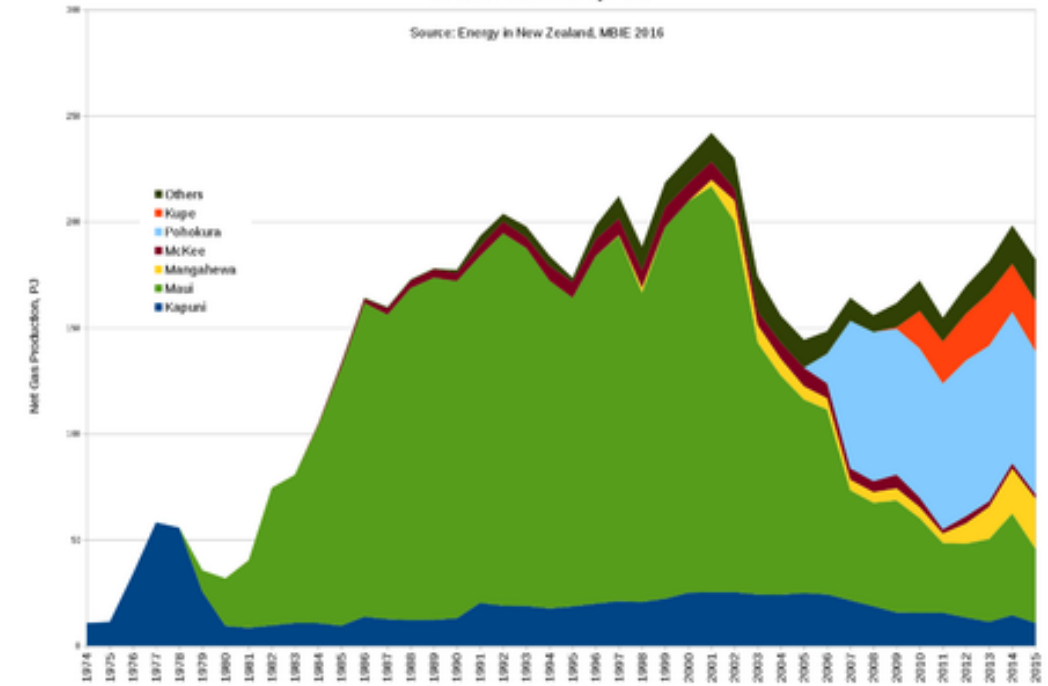
New Zealand Coal Production

Source: Energy in New Zealand, MBIE

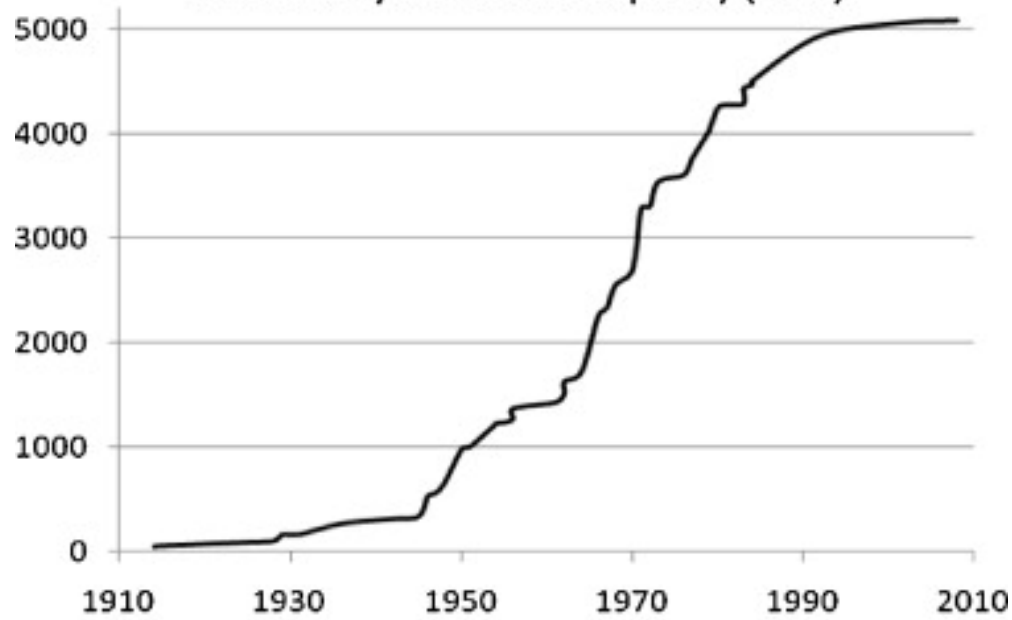


Net Gas Production by Field

Source: Energy in New Zealand, MBIE 2016

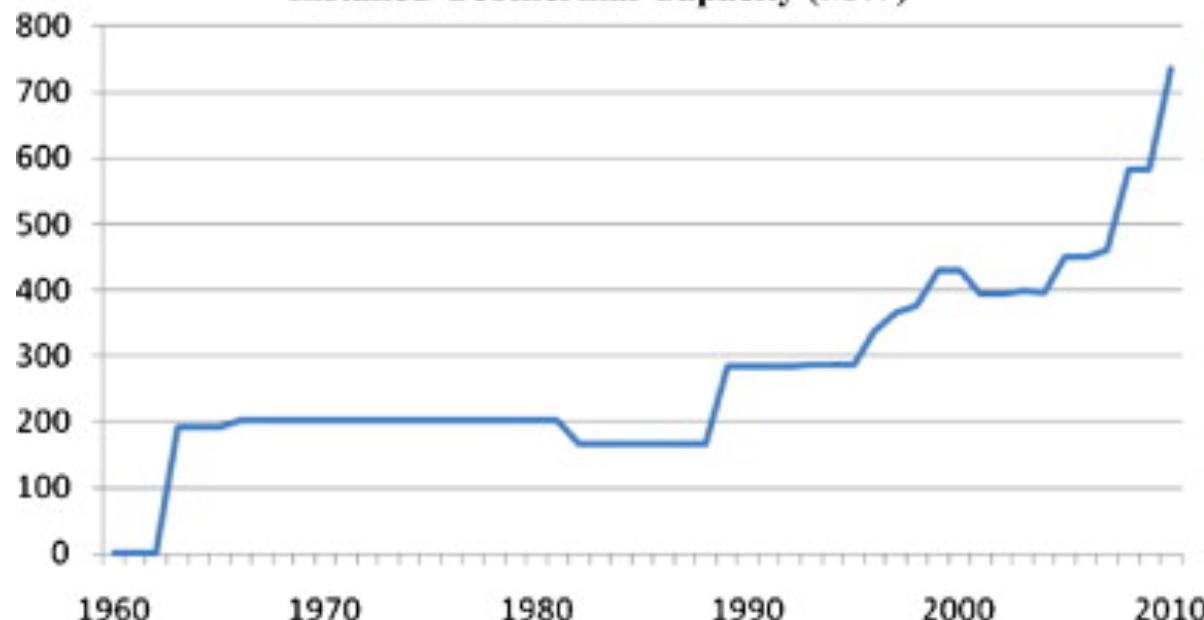


**Installed Hydroelectric Capacity (MW)**



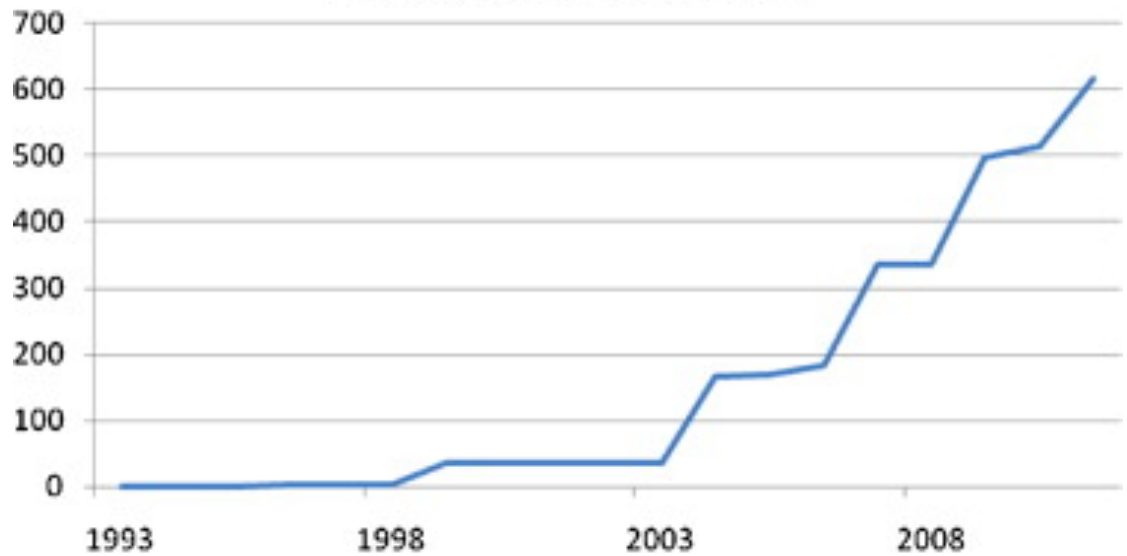
Source: MED, [69] and owners' data.

**Installed Geothermal Capacity (MW)**



Source: NZ Geothermal Association [40]

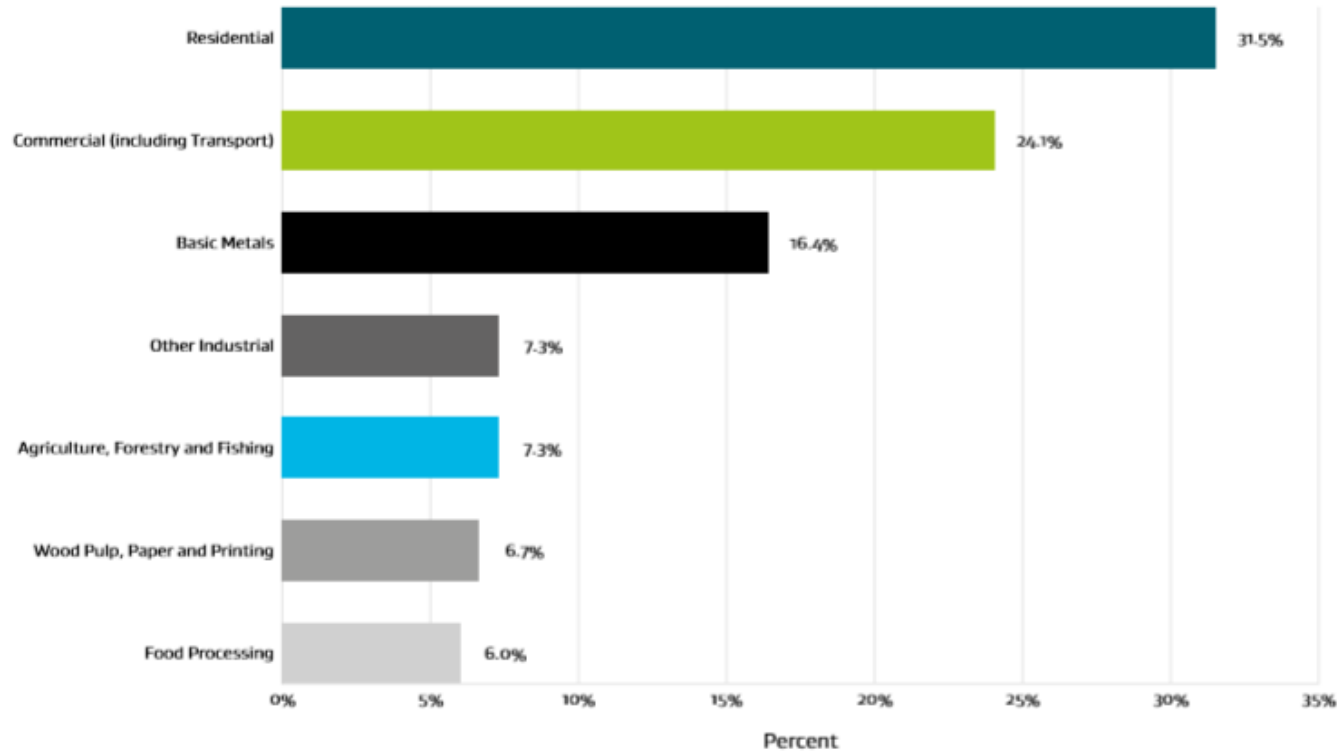
**Installed Wind Power (MW)**



Source: NZ Wind Energy Association [79]

# What's Happening Now?

Figure F.6: Electricity Consumption by Sector for the 2015 Year\*



\* Consumption excludes calculated onsite consumption and unallocated demand.

Figure F.2: Electricity Flow Diagram for the 2015 Year

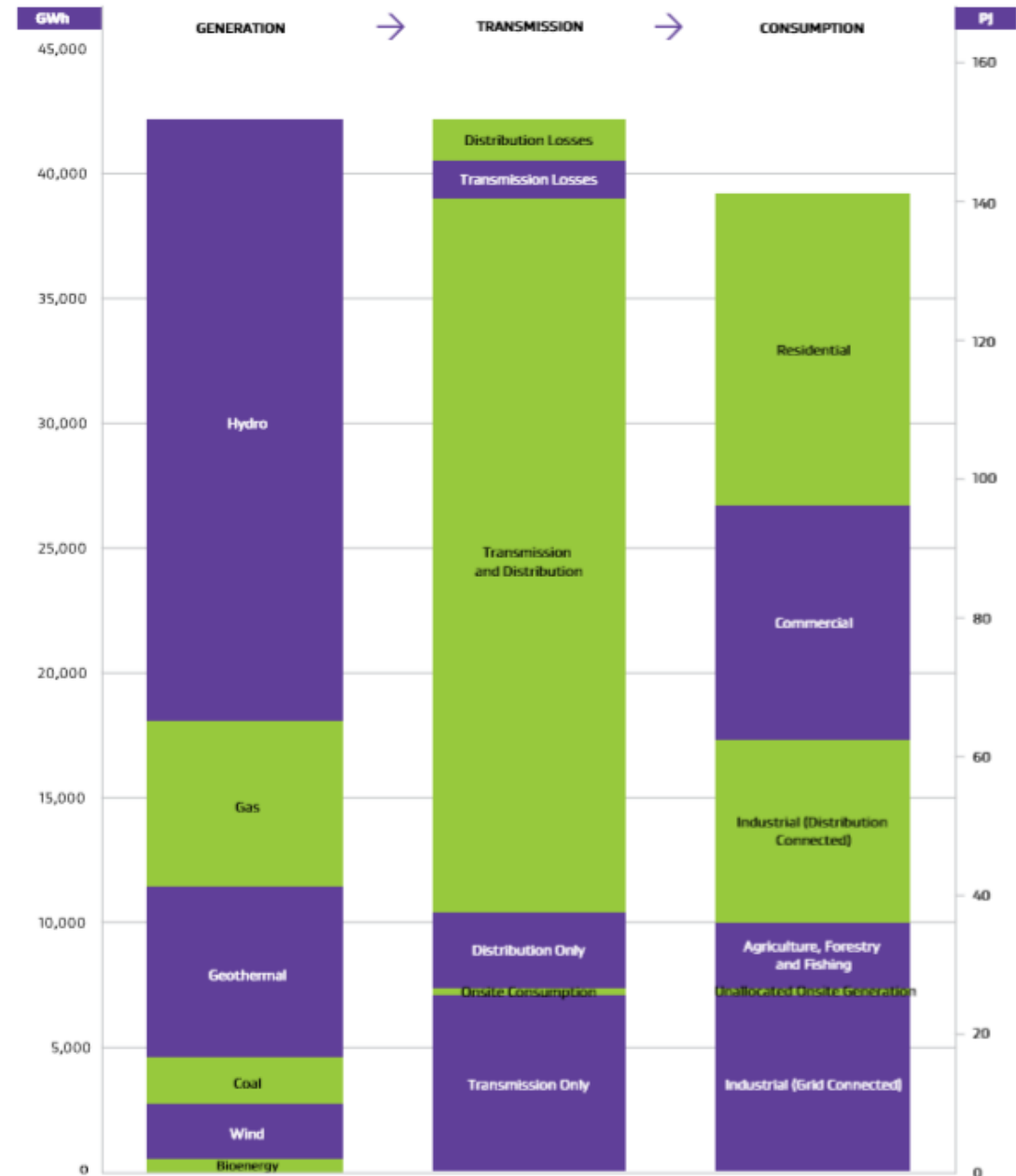
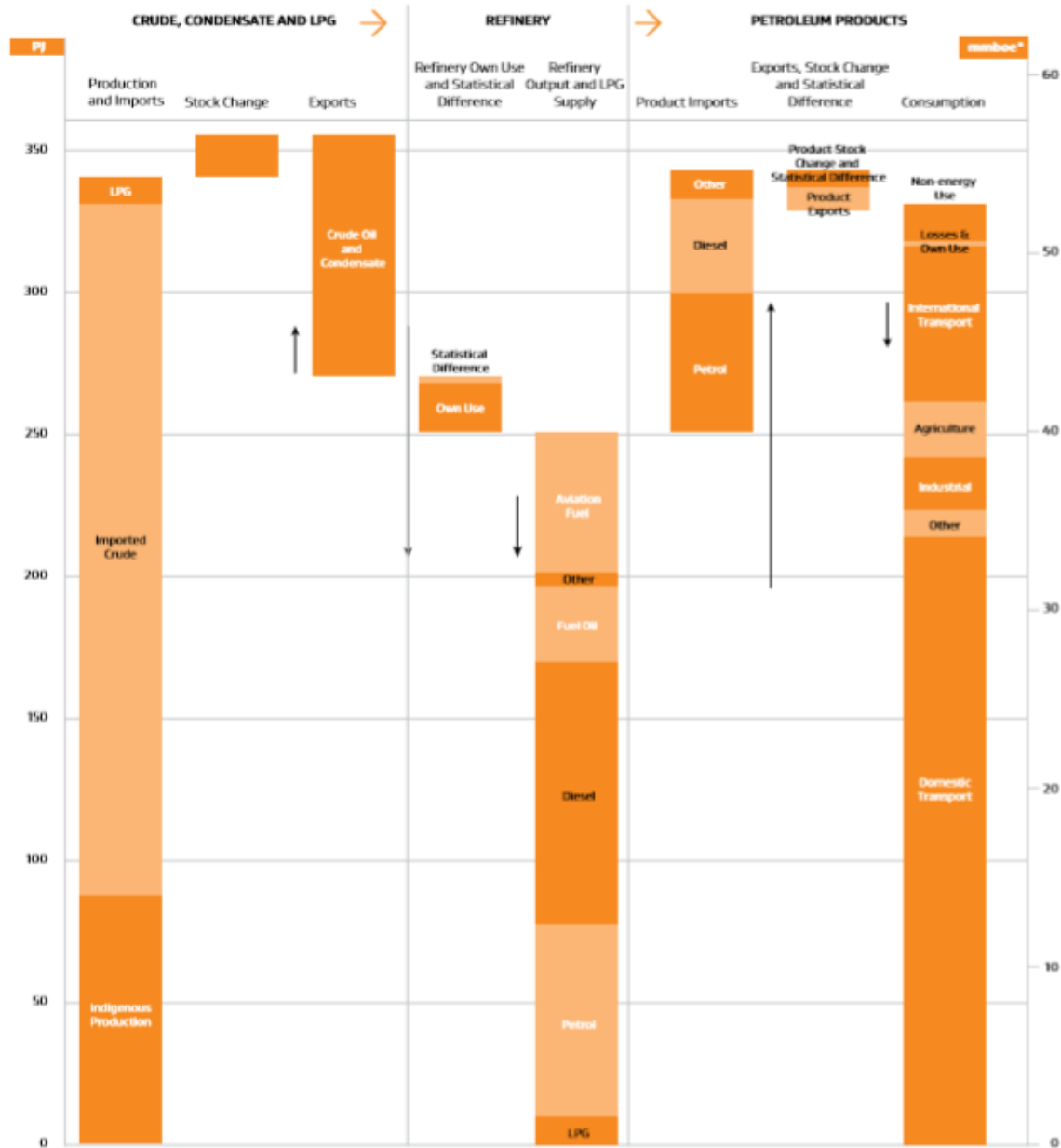
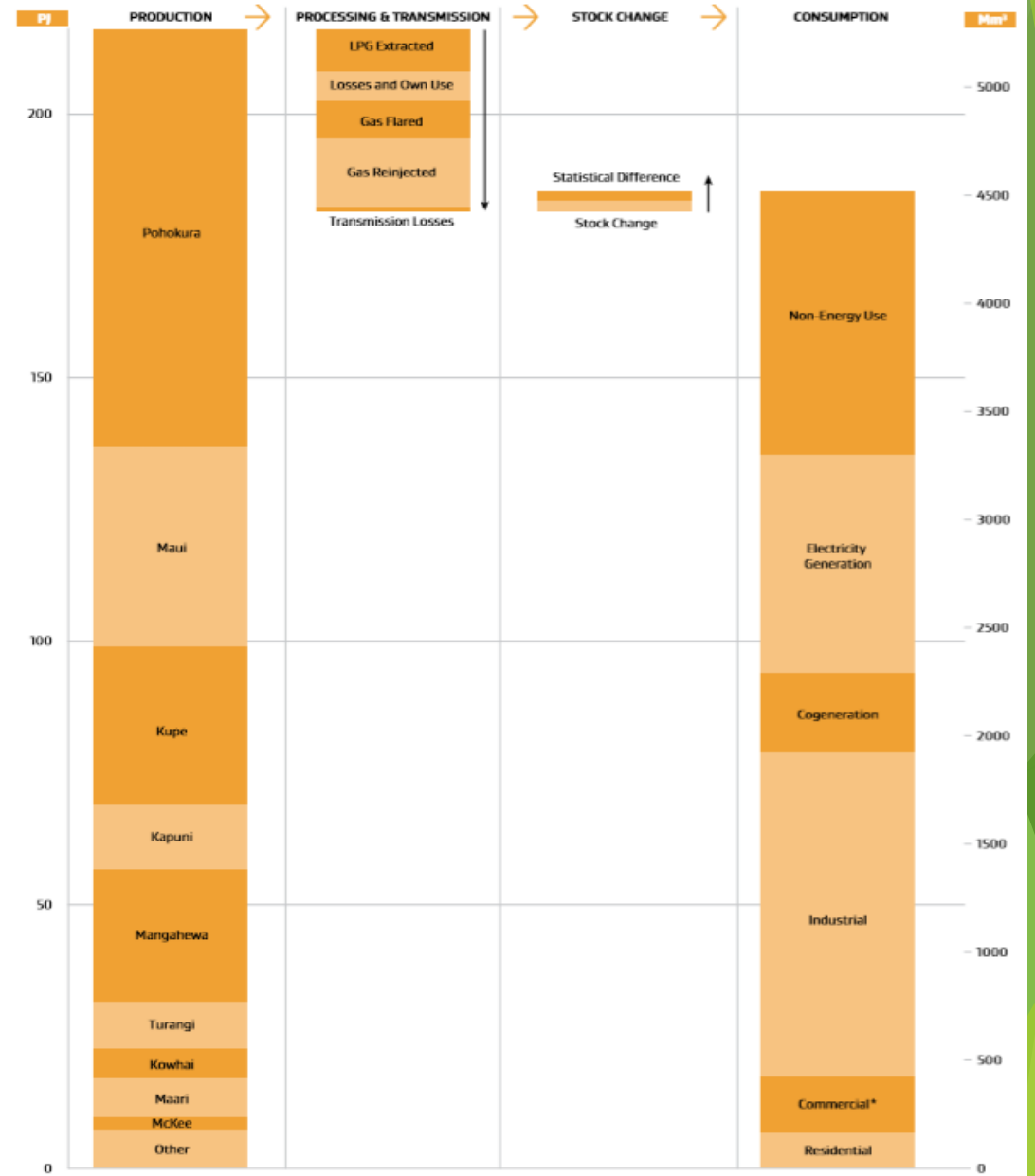


Figure D.4: Oil Energy Flow Summary for 2015



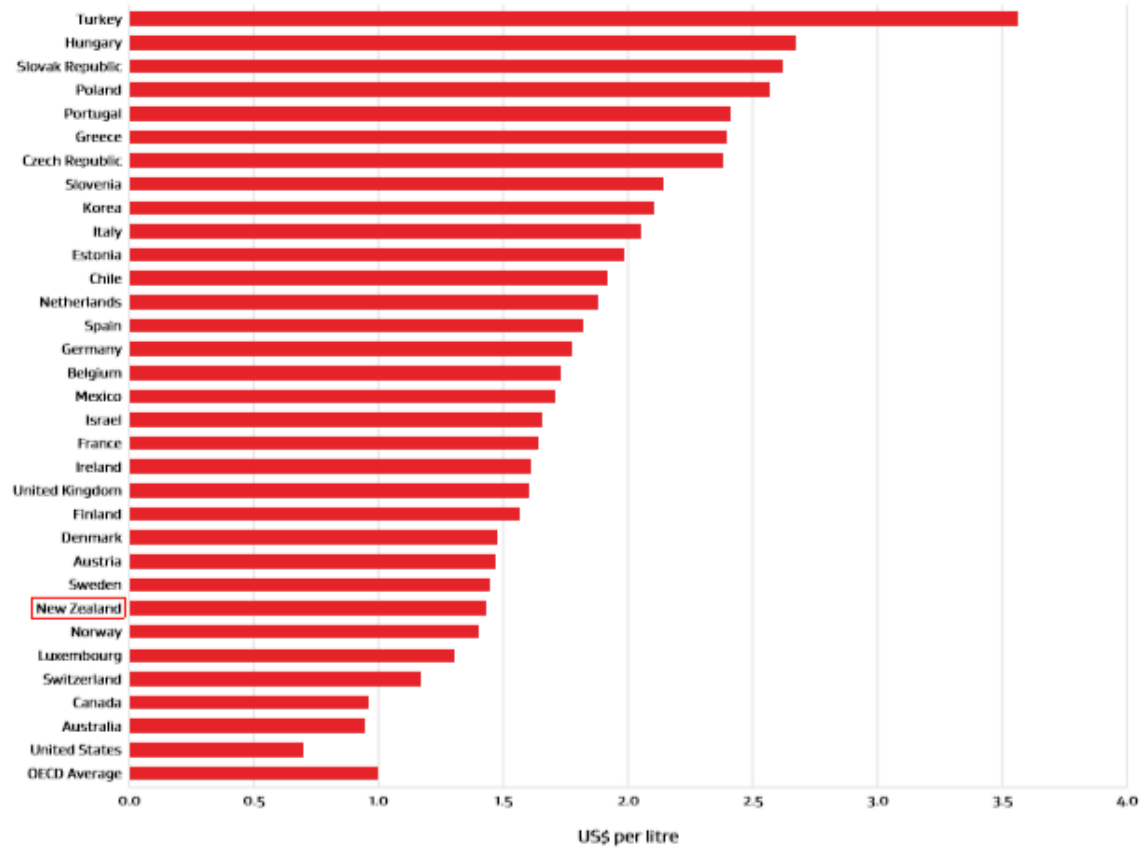
\*Million barrels of oil equivalent.

Figure D.13: Natural Gas Flow Summary for 2015

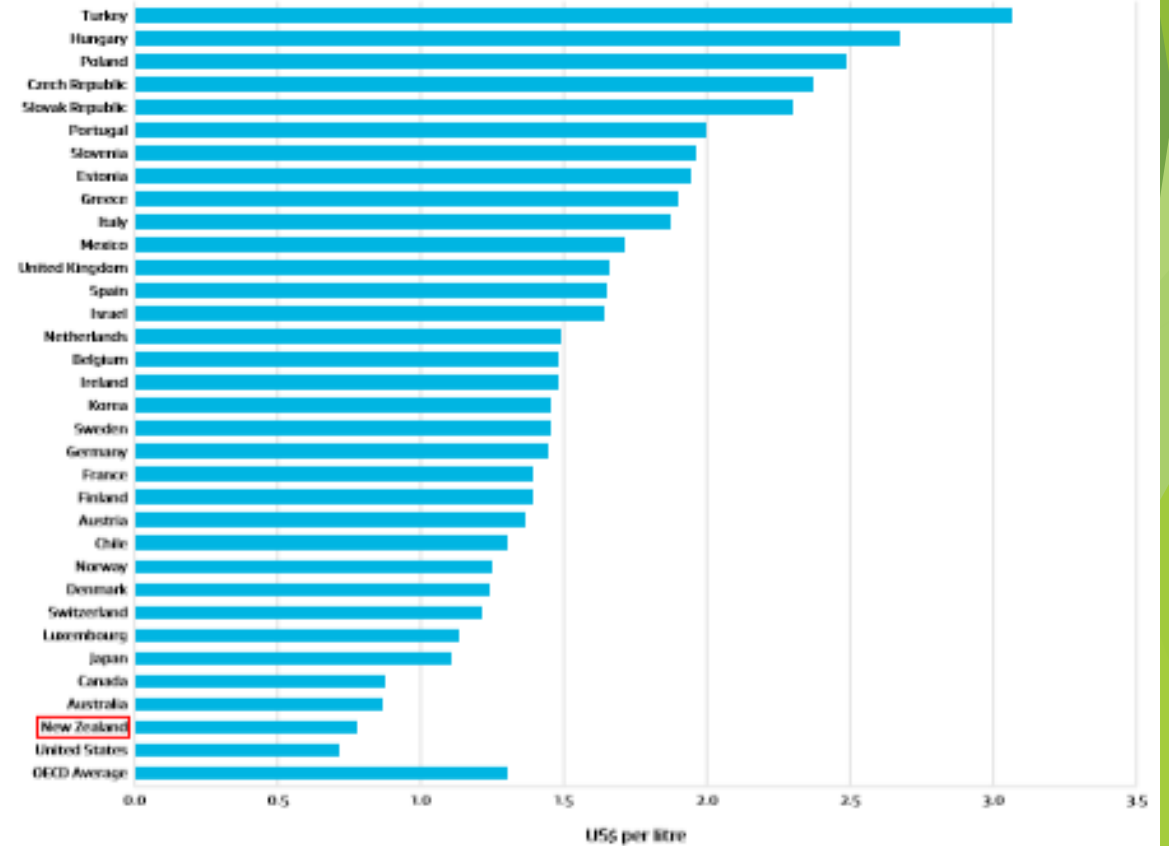


\* Includes transport, agriculture, forestry and fishing.

**Figure G.4: Premium Petrol Retail Prices (using Purchasing Power Parity) in OECD Countries for 2015\***

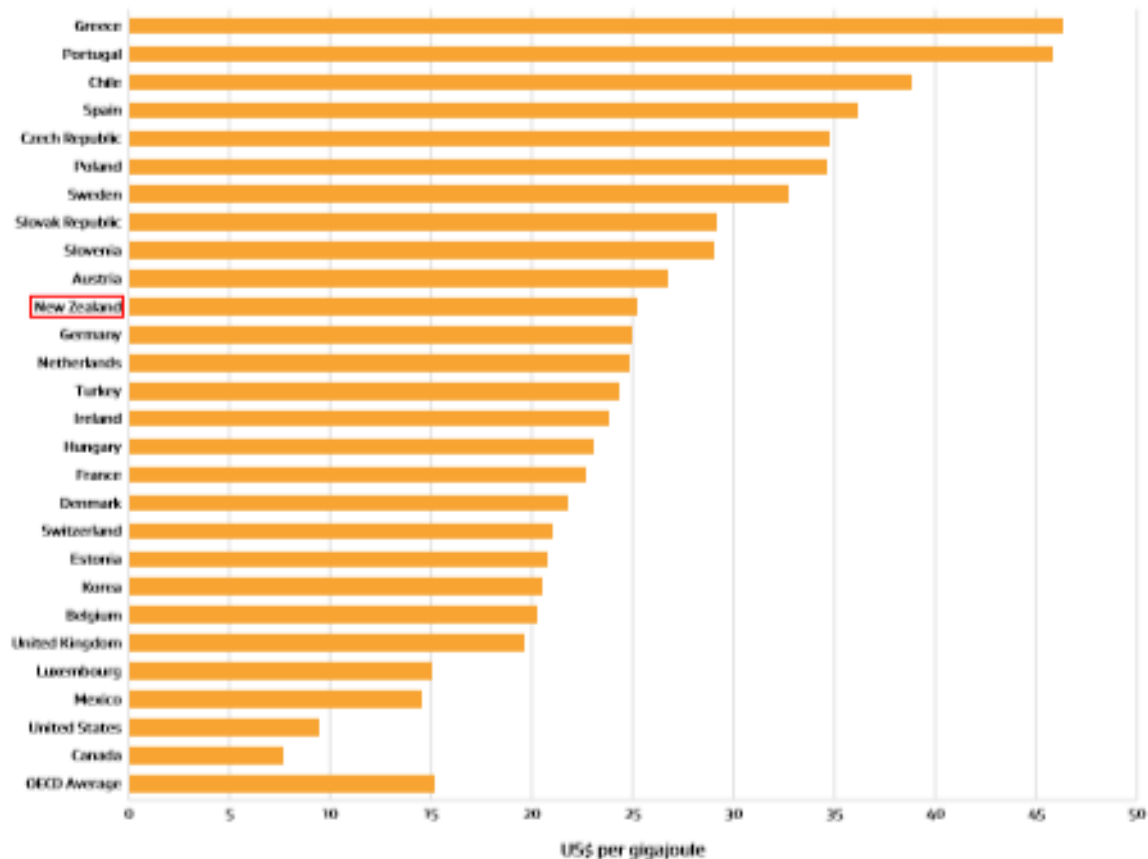


**Figure G.5: Automotive Diesel Retail Prices (using Purchasing Power Parity) in OECD Countries for 2015\***

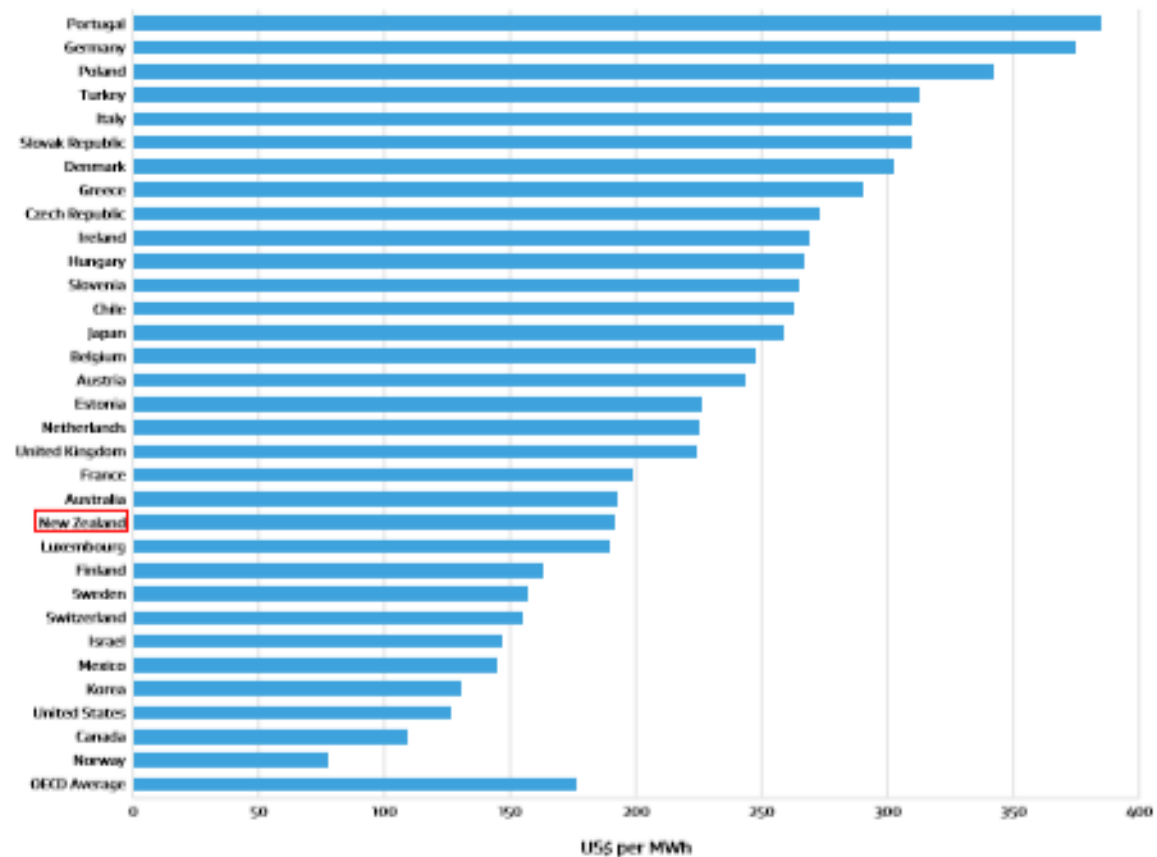




**Figure G.6: Residential Natural Gas Prices (using Purchasing Power Parity) in OECD Countries for 2015**

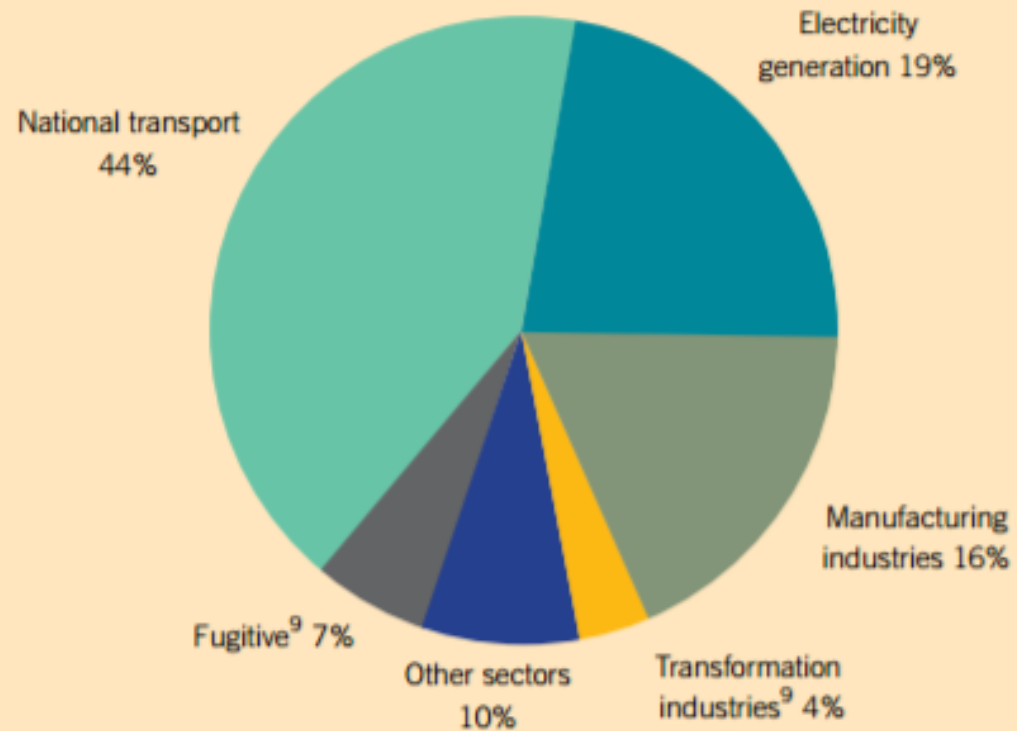


**Figure G.7: Residential Electricity Costs (using Purchasing Power Parity) in OECD Countries for 2015\***

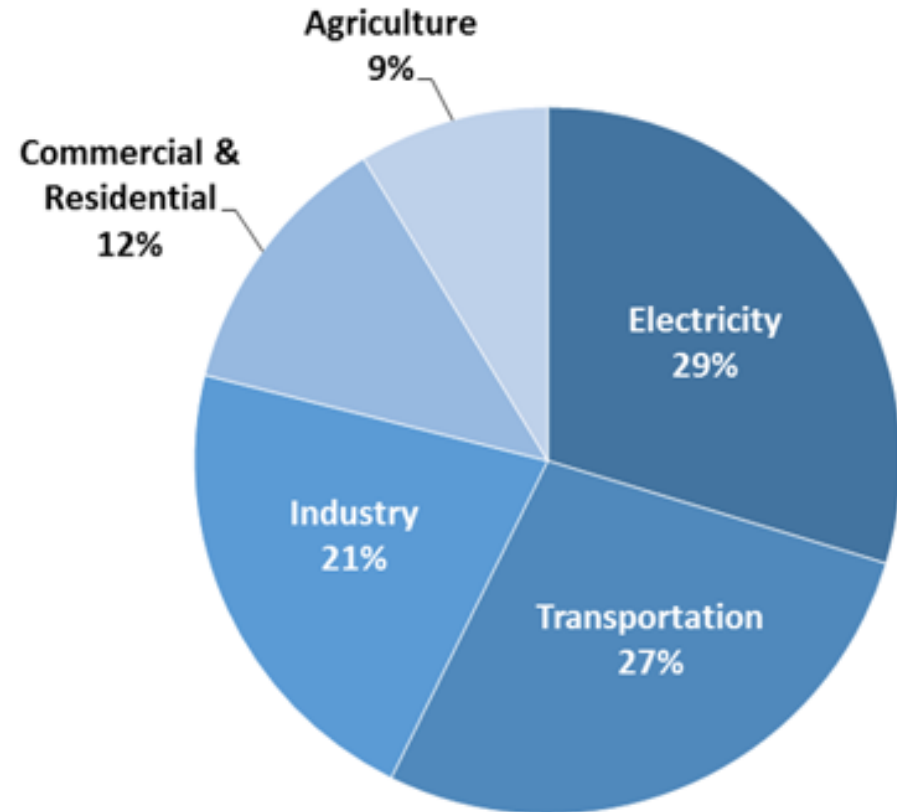


## NZ Energy-Related Greenhouse Emissions

Energy emissions by sector in 2009<sup>8</sup>



## Total U.S. Greenhouse Gas Emissions by Economic Sector in 2015



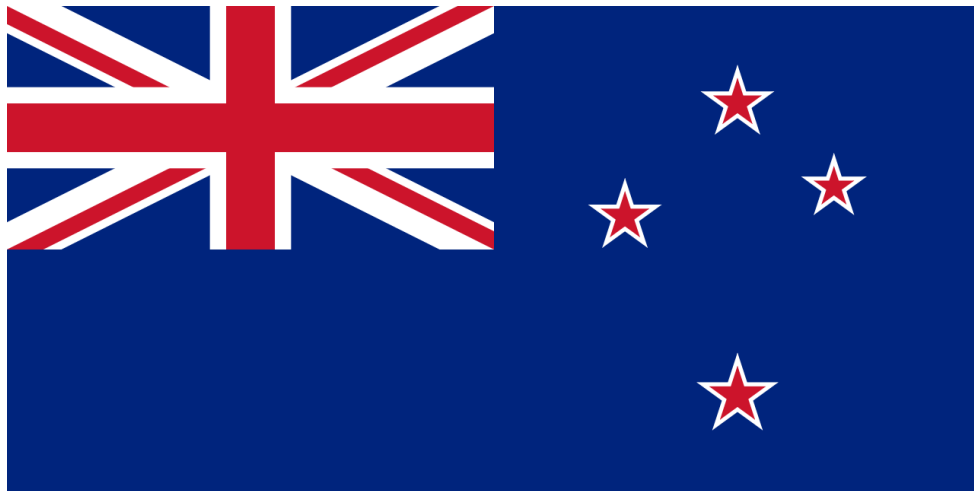
# What's Next?

- ▶ New Zealand is well on track to meeting its stated goal of 90% renewably generated electricity by 2025.
  - ▶ Continued growth of wind and geothermal expected
  - ▶ Emergence of solar in the market as prices continue to drop?
- ▶ How to get there?
  - ▶ Projects to Reduce Emissions Programme (PRE)
    - ▶ Launched in 2003 in fulfillment of commitments under Kyoto Protocol 2008-2012
  - ▶ Negotiated Greenhouse Agreements (NGAs)
    - ▶ Introduced in 2007 as a way to negotiate with firms to remain competitive in the face of proposed carbon dioxide taxes of \$15/tonne.
  - ▶ New Zealand Emissions Trading Scheme (NZ ETS)
    - ▶ Cap and Trade type program first legislated in 2008.
- ▶ Popular opinion in regards to climate change and government intervention in the energy industry seem much more favorable in NZ.
  - ▶ However, controversy still exists.

# What's all this mean to us?

New Zealand is not the United States—it's very different in almost every way.

- ▶ Population: size, location, urbanization
- ▶ Geography and available resources
  - ▶ Geothermal, wind, fossil resources
  - ▶ Hydropower
- ▶ Political Climate and type of government



vs.



# Takeaways

- ▶ The biggest obstacle to rapid change is government inaction.
  - ▶ NZ: multiparty system successful in addressing issues head on, achieving compromise
  - ▶ Countries like Germany have had great success with government initiatives.
- ▶ The US is not realizing its potential:
  - ▶ Solar in the Sunshine State??  
Not in the Top 10
  - ▶ Wind?
- ▶ Growth rate vs. country/economy size?

## Top 10 States in the US for Solar Energy



Cumulative Solar Electricity Capacity per Capita

State	Cumulative Solar Electricity Capacity per Capita 2013 (Watts/person)	Rank
Arizona	275	1
Hawaii	243	2
Nevada	161	3
California	148	4
New Jersey	136	5
New Mexico	113	6
Delaware	82	7
Massachusetts	66	8
Colorado	63	9
North Carolina	57	10

# Sources:

- ▶ <https://www.govt.nz/browse/engaging-with-government/government-in-new-zealand/>
- ▶ <http://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?contextual=default&locations=NZ-US>
- ▶ Geoff Kelly, History and potential of renewable energy development in New Zealand, Renewable and Sustainable Energy Reviews, Volume 15, Issue 5, June 2011, Pages 2501-2509, ISSN 1364-0321, <http://doi.org/10.1016/j.rser.2011.01.021>.
- ▶ <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>
- ▶ New Zealand Ministry of Business, Innovation & Employment  
(<http://www.mbie.govt.nz/info-services/sectors-industries/energy>)
  - ▶ <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/publications/energy-in-new-zealand>
  - ▶ <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-strategies>
- ▶ New Zealand Ministry for the Environment  
(<http://www.mfe.govt.nz/climate-change/>)
  - ▶ <http://www.mfe.govt.nz/climate-change/reducing-greenhouse-gas-emissions/about-nz-emissions-trading-scheme>
  - ▶ <http://www.mfe.govt.nz/climate-change/reducing-greenhouse-gas-emissions/former-government-initiatives>
- ▶ <https://cleantechnica.com/2014/09/03/top-10-solar-energy-states-per-capita-us/>