# C.A.U.S.E 2013

ALEXANDER TANKOU
EMILY PHIPPS
ERIK BLEKHT
JOHN PAUL MILTON

# OUTLINE

Thesis

Overview of the consumer demand in both countries by source/sector

Energy by source and sector per capita

Carbon emissions and Emissions Trading Scheme

Conclusion

# QUESTION?

Do you guys think energy should be looked at as more of a privilege or a necessity?

- Is more really necessary?

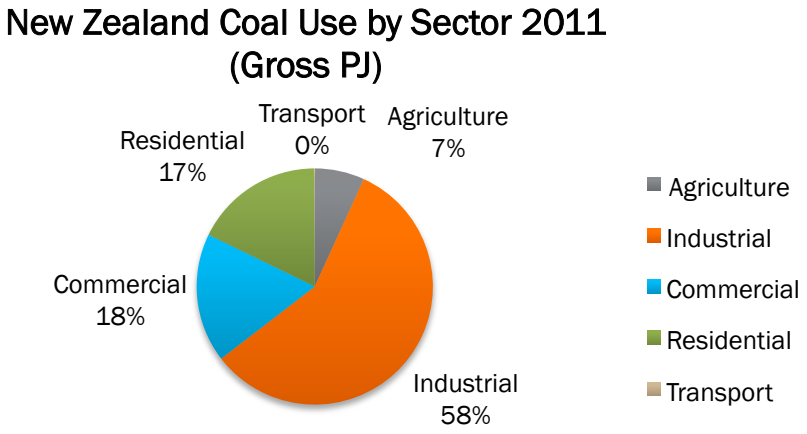
# THESIS

Sustainability is the main result of a different energy foundation between the U.S. and New Zealand, which could be attributed mainly to environmental awareness and economics.

# CONSUMER ENERGY DEMAND

- Source use by sector
- Use of source within the sectors
- Comparing the two

# COAL (NZ)




| Overall Energy Production | | | | | |
|---|---|---|---|---|---|
| Agriculture | Industrial | Commercial | Residential | Transport | Sum |
| 2.77 | 23.45 | 7.18 | 7.18 | 0.04 | 40.62 |
| | | | | | |
| | | | | | |
| Electricity Generation | | | | | |
| Agriculture | Industrial | Commercial | Residential | Transport | Sum |
| 0 | 4.26 | 5.9 | 6.43 | 0 | 16.59 |
| | | | | | |
| | | | | | |
| Total Supplied Energy | Consumed Energy | | | | |
| 59.68 | 40.62 | | Efficiency rate | 0.68063003 | |

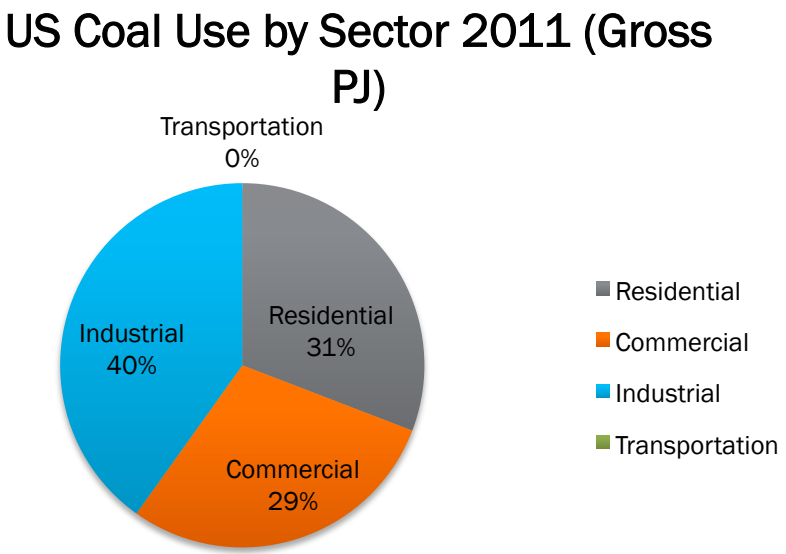
Primary use of coal in New Zealand among the sectors can be described as follows:

Industrial: cement, plaster, meat, dairy, other food processing, wool, timber, pulp, and paper products.

Commercial/Residential: heating accommodation and service buildings in central and local government, hospitals, rest homes, and educational institutions.

Agricultural: horticulture (plant cultivation)

# COAL (US)

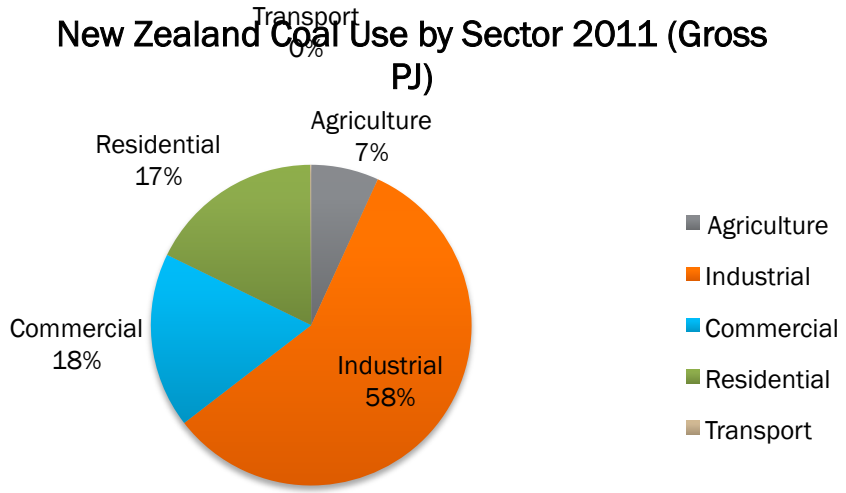


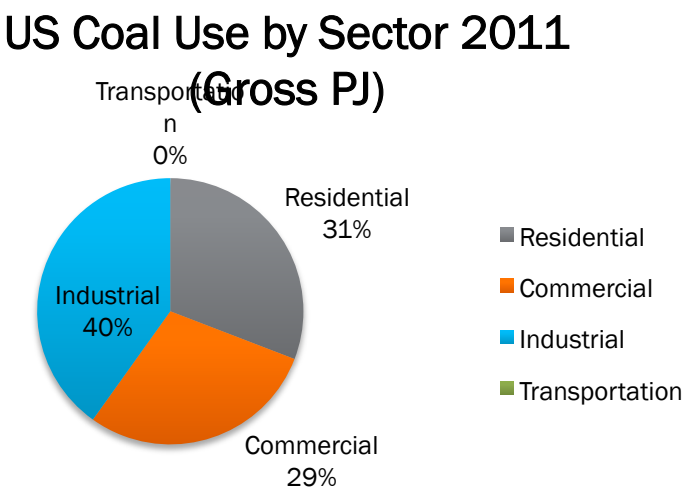

Primary use of coal in New Zealand among the sectors can be described as follows:

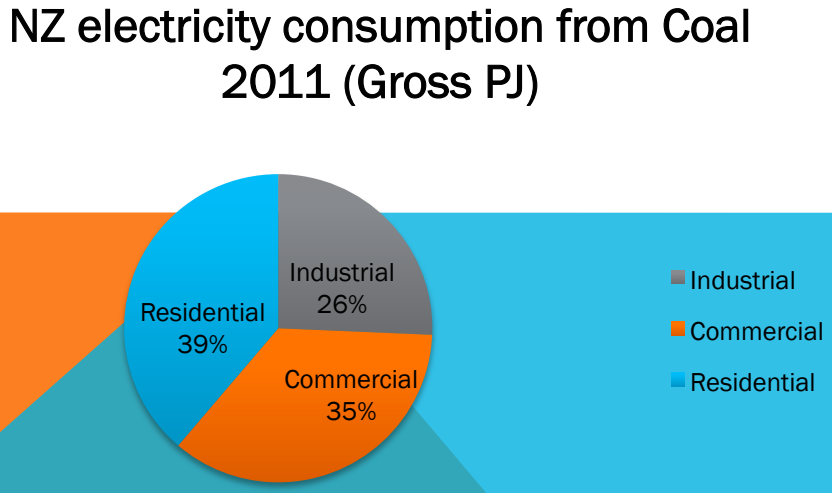
Industrial: plastics, tar, synthetic fibers, fertilizers, medicines, steel (bridges, buildings, automobiles), concrete, and paper.

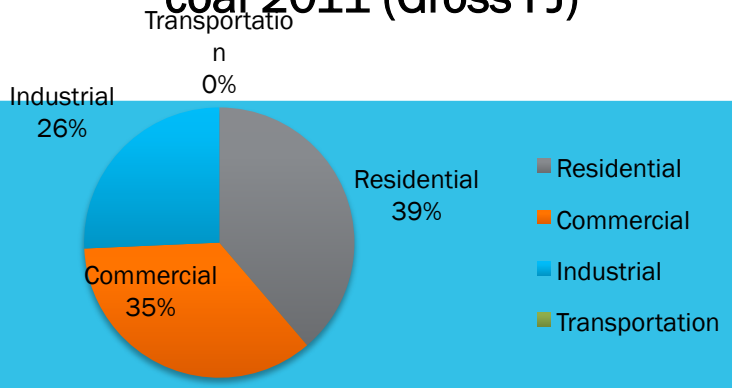
| Total Energy Production | | | | |
|---|---|---|---|---|
| Residential | Commercial | Industrial | Transportation | Sum |
| 2534.02 | 2385.14 | 3297 | 0 | 8216.16 |
| | | | | |
| | | | | |
| Electricity Generation | | | | |
| Residential | Commercial | Industrial | Transportation | Sum |
| 2526.83 | 2320.26 | 1676.54 | 0 | 6523.63 |
| | | | | |
| Total Supplied Energy | Consumed Energy | | | |
| 9390.296 | 8216.16 | | Efficiency rate | .875 |

# COAL (US VS. NZ)

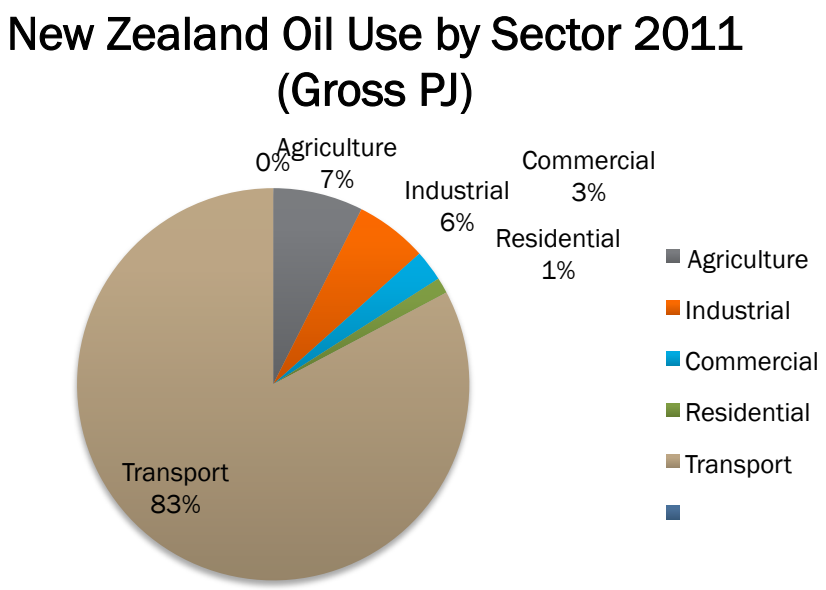

New Zealand Coal Use by Sector 2011 (Gross PJ)
Transport 0%
Agriculture 7%
Residential 17%
Commercial 18%
Industrial 58%
Agriculture
Industrial
Commercial
Residential
Transport


US Coal Use by Sector 2011 (Gross PJ)
Transportation 0%
Residential 31%
Industrial 40%
Commercial 29%
Residential
Commercial
Industrial
Transportation


NZ electricity consumption from Coal 2011 (Gross PJ)
Industrial 26%
Residential 39%
Commercial 35%
Industrial
Commercial
Residential


US Electricity consumption from coal 2011 (Gross PJ)
Transportation 0%
Industrial 26%
Residential 39%
Commercial 35%
Residential
Commercial
Industrial
Transportation

# OIL (NZ)




Primary use of oil in New Zealand among the sectors can be described as follows:

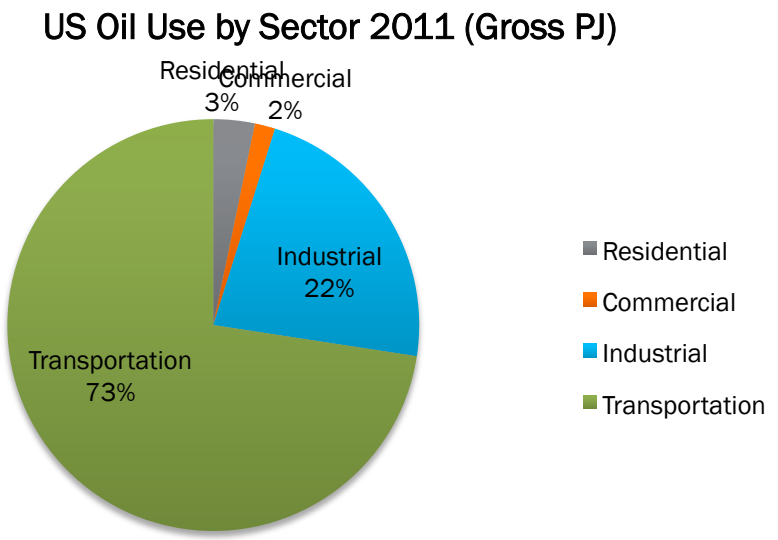
Transportation: automobiles, boats, planes

Agriculture: farm use

Industrial: power stations, construction sites.

| Agriculture | Industrial | Commercial | Residential | Transport | | Sum |
|---|---|---|---|---|---|---|
| 18.52 | 14.84 | 6.37 | 3.23 | 206.13 | | 249.09 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Total Supplied | Consumed | | | | | |
| Energy | Energy | | | | | |
| 276.21 | 249.09 | | Efficiency Rate | 0.90181384 | | |

# OIL (US)




| Overall production | | | | |
|---|---|---|---|---|
| Residential | Commercial | Industrial | Transportation | Sum |
| 1272.24 | 625.05 | 8832.48 | 28400.95 | 39130.72 |
| | | | | |
| Electricity Generation | | | | |
| Residential | Commercial | Industrial | Transportation | Sum |
| 50.2 | 46.1 | 33.31 | 0 | 129.61 |
| | | | | |
| | | | | |
| Total Supplied | Total consumed | | | |
| Energy | Energy | | | |
| 39613.15 | 39130.72 | | Efficiency rate | 0.98782147 |

The following products are produced from oil which are used in the transportation, industrial, residential, and commercial sectors:

Gasoline Fuel (43%): automobile and piston engine aircraft

Distillate Fuel Oil (24%): home heating oil & diesel fuel. Used for space heating, engine fuel, railroad engine fuel, agricultural machinery, electrical power gen.

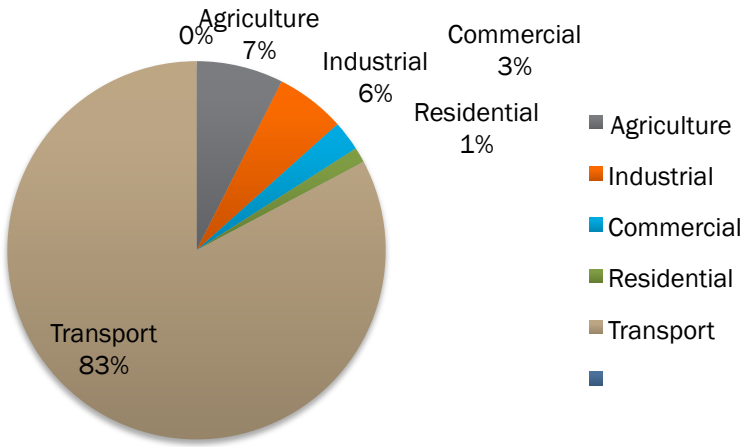
Petrochemicals (11%): used in plastics, rubber, and synthetic materials

Kerosene Jet fuel (9%): turbine powered aircraft

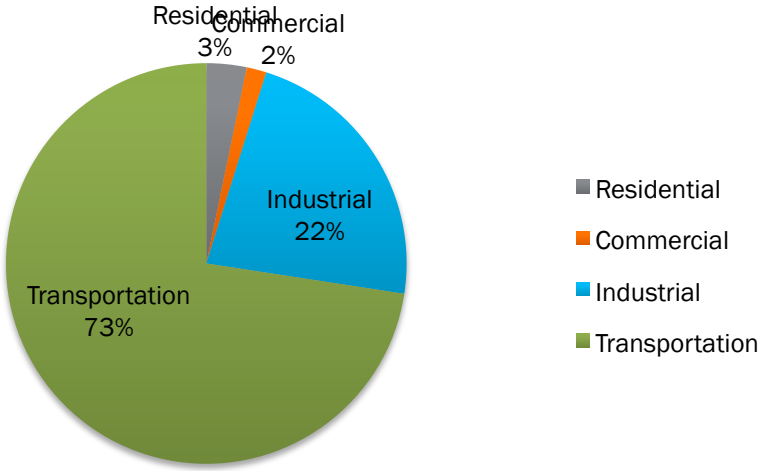
Petroleum coke (5%): used in electrode manufacturing, production of chemicals, and to heat steel industry ovens

# OIL (NZ VS. US)

New Zealand Oil Use by Sector 2011 (Gross PJ)



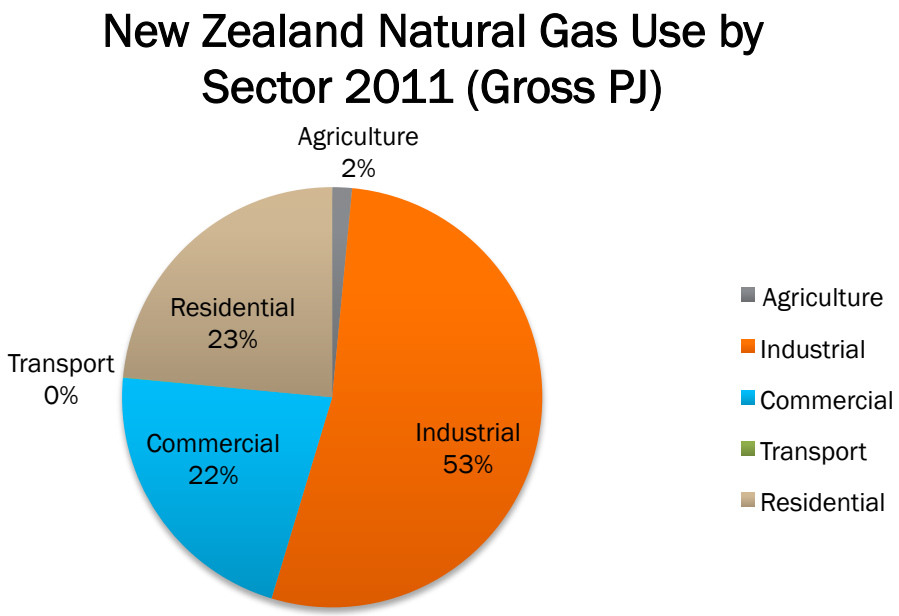

US Oil Use by Sector 2011 (Gross PJ)




FUN FACT!

Note that US electricity generation from oil (0.3% of oil US oil use) is about half of New Zealand's total oil consumption in PJs.

# NATURAL GAS (NZ)



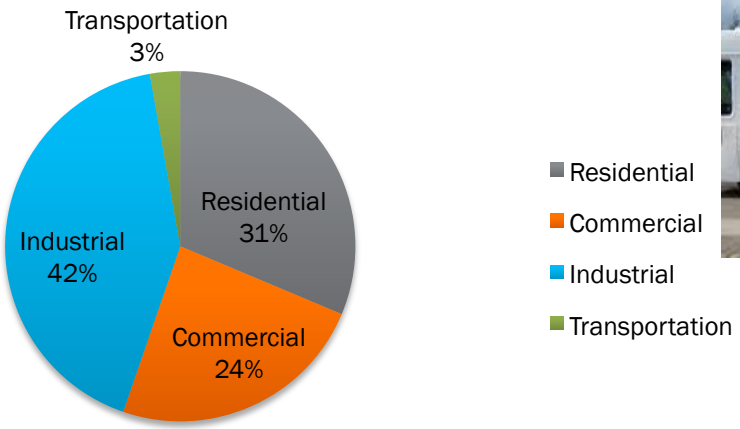

Gas Consumption from 2010 to 2011 was reduced by over 10 %. This was almost completely due to decreased use of gas for electricity generation among sectors.

Mostly used in the Industrial sector, gas was used in the following ways:
Petrochemical sector and oil refining. Growth in dairy and food processing sector should also be noted.

| Overall Energy Production | | | | | |
|---|---|---|---|---|---|
| Agriculture | Industrial | Commercial | Transport | Residential | Sum |
| 1.67 | 58.34 | 23.961 | 0.05 | 25.76 | 109.781 |
| | | | | | |
| Electricity Generation | | | | | |
| Agriculture | Industrial | Commercial | Transport | Residential | Sum |
| | 13.31 | 18.421 | | 20.06 | 51.791 |
| | | | | | |
| Total Supplied | Consumed | | | | |
| Energy | Energy | | Efficiency | | |
| 158.68 | 109.781 | | Rate | 0.69183892 | |

# NATURAL GAS (US)

## US Natural Gas Use by Sector 2011 (Gross PJ)





Natural gas use among the Industrial sector varies among the following processes: process heating for glass melting, food processing, metals preheating/drying, on-site electricity generation (fuelding boilers/turbines); and used as a feedstock to make chemical products, fertilizers, plastics, and other materials.

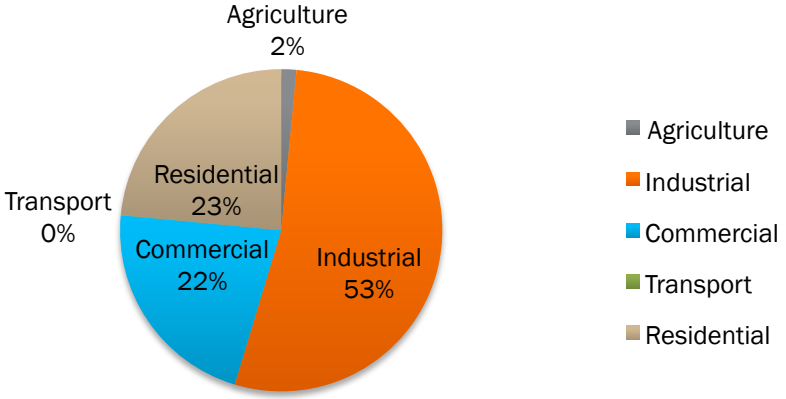
Residential/Commercial sectors use natural gas for heating/cooling and cooking.

| Overall energy production | | | | |
|---|---|---|---|---|
| Residential | Commercial | Industrial | Transportation | Sum |
| 8114.26 | 6200.45 | 10855.64 | 723.63 | 25893.98 |
| | | | | |
| Electricity Generation | | | | |
| Residential | Commercial | Industrial | Transportation | Sum |
| 2967.4 | 2724.83 | 1968.87 | 0 | 7628.31 |
| | | | | |
| | | | | |
| Total Supplied | Consumed | | | |
| Energy | Energy | | Efficiency | |
| 26001 | 25893.98 | | Rate | 0.995884 |

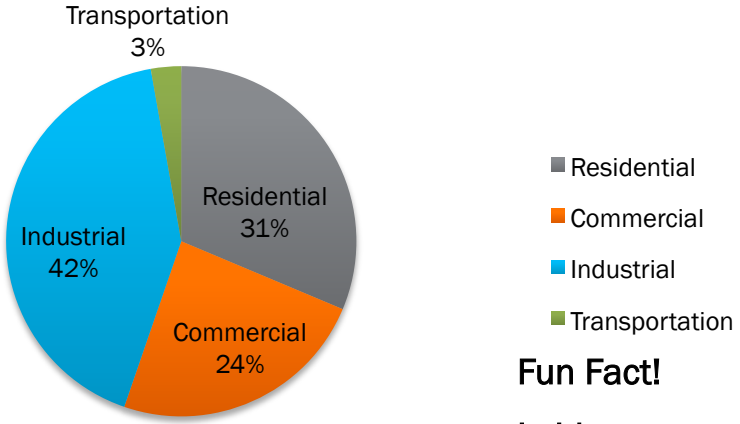
Public Transportation sector is starting to use natural gas as a source.

# NATURAL GAS (NZ VS. US)

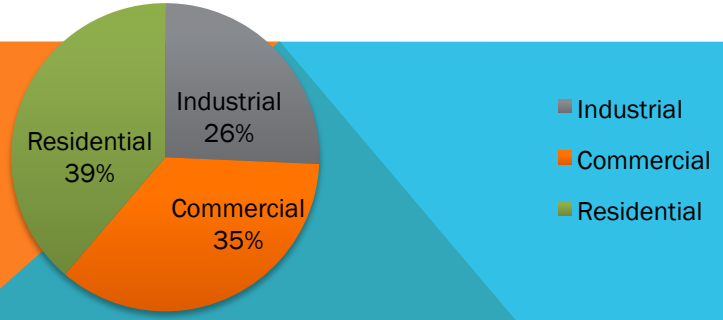
## New Zealand Natural Gas Use by Sector 2011 (Gross PJ)



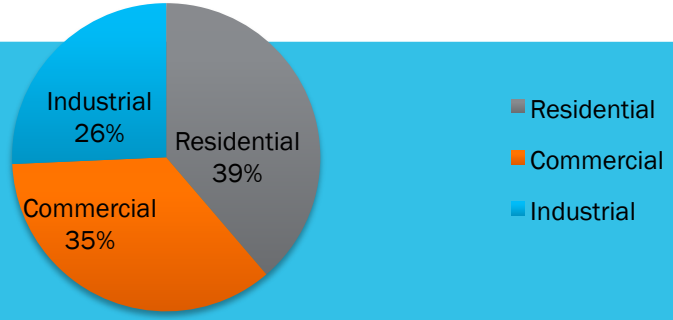

## US Natural Gas Use by Sector 2011 (Gross PJ)




## NZ electricity consumption from Natural Gas 2011 (Gross PJ)



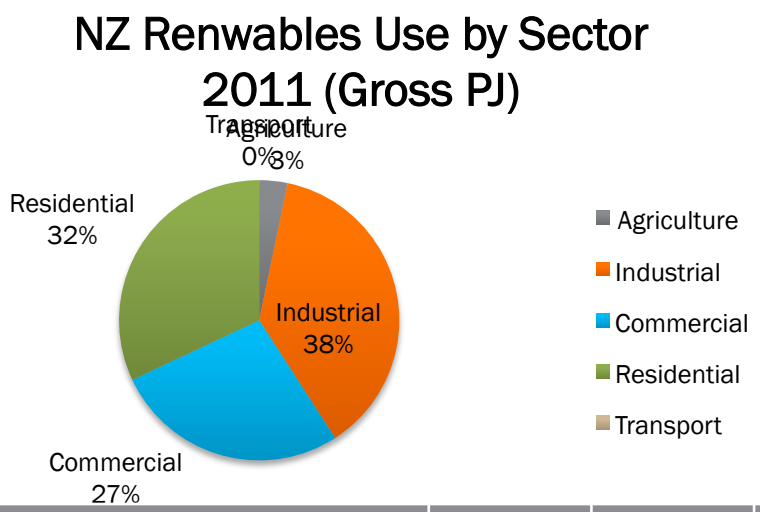

## US electricity consumption from Natural Gas 2011 (Gross PJ)




**Fun Fact!**

Leidy storage reservoir (stores gas for Western/ Northern New York and Western/ Central Pa) holds 12 times the amount of natural gas as New Zealand's largest storage reservoir. (420 mcm vs. 5 bbcm)

# RENEWABLE ENERGY (NZ)




| Overall Energy Production | | | | | |
|---|---|---|---|---|---|
| Agriculture | Industrial | Commercial | Residential | Transport | Sum |
| 10.2069 | 117.7928 | 84.947 | 100.17359 | 0 | 313.12029 |
| | | | | | |
| Electricity Generation | | | | | |
| Agriculture | Industrial | Commercial | Residential | Transport | Sum |
| 9.5269 | 63.5128 | 82.567 | 92.09359 | 0 | 247.70029 |
| | | | | | |
| | | | | | |
| Total Supplied Energy | Consumed Energy | | Efficiency Rate | | |
| 320.6 | 313.12 | | 0.97666875 | | |

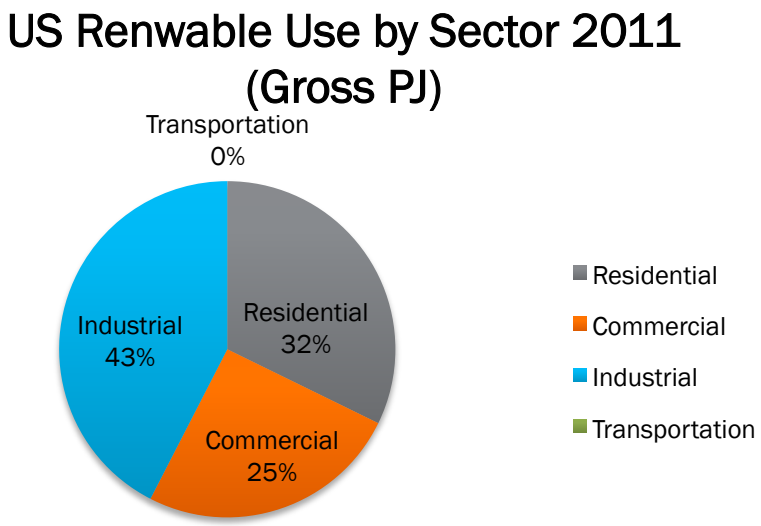
Biofuels production also constitute a portion of renewable energy consumption.

Over 78% of total electricity generation in New Zealand is used for electricity generation. Considered to be the highest renewables percentage since 1996 and third internationally.

Geothermal Electricity generation is increasing drastically as NZ is decreasing its focus on Hydro power electricity generation.

Remaining Renewable Energy goes into timber and tourism industries.

# RENEWABLE ENERGY (US)

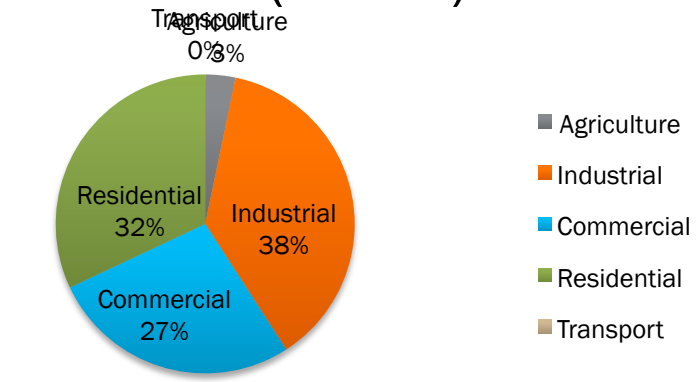



| Overall Energy Production | | | | |
|---|---|---|---|---|
| Residential | Commercial | Industrial | Transportation | Sum |
| 2164.3086 | 1698.5449 | 2848.78243 | 0 | 6711.63594 |
| | | | | |
| Electricity Generation | | | | |
| Residential | Commercial | Industrial | Transportation | Sum |
| 1722.2886 | 1581.4949 | 1142.73243 | 0 | 4427.47707 |
| | | | | |
| | | | | |
| Total Supplied | Consumed | | | |
| Energy | Energy | | effeciency | |
| 6711.63594 | 6711.63594 | | Rate | 1 |

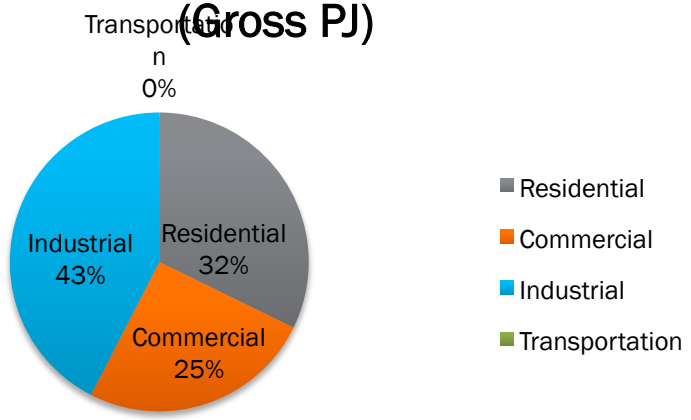
The US uses renewable energy for essentially the same processes, but on a much lower scale (in terms of per capita use).

# RENEWABLE ENERGY (NZ VS. US)

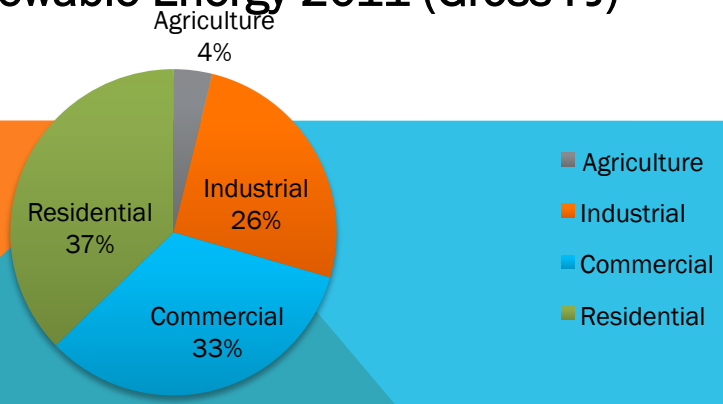
## NZ Renewables Use by Sector 2011 (Gross PJ)



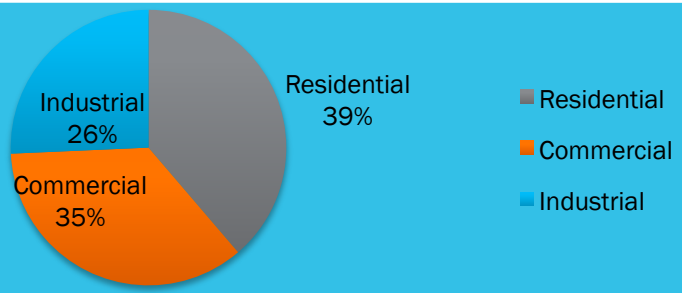

## US Renwable Use by Sector 2011 (Gross PJ)




## NZ electricity consumption from Renewable Energy 2011 (Gross PJ)

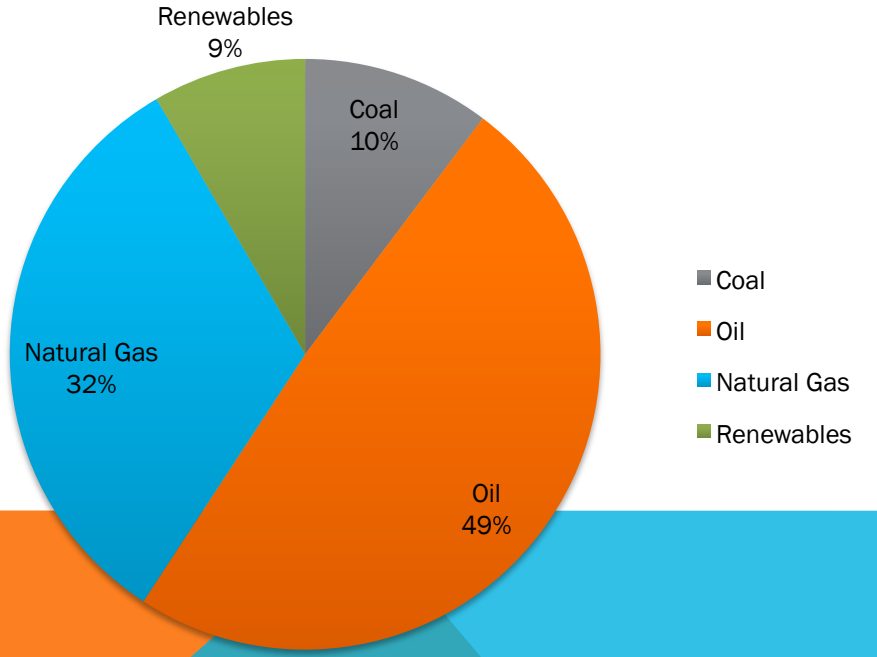



## US electricity consumption from Renewable Energy 2011 (Gross PJ)

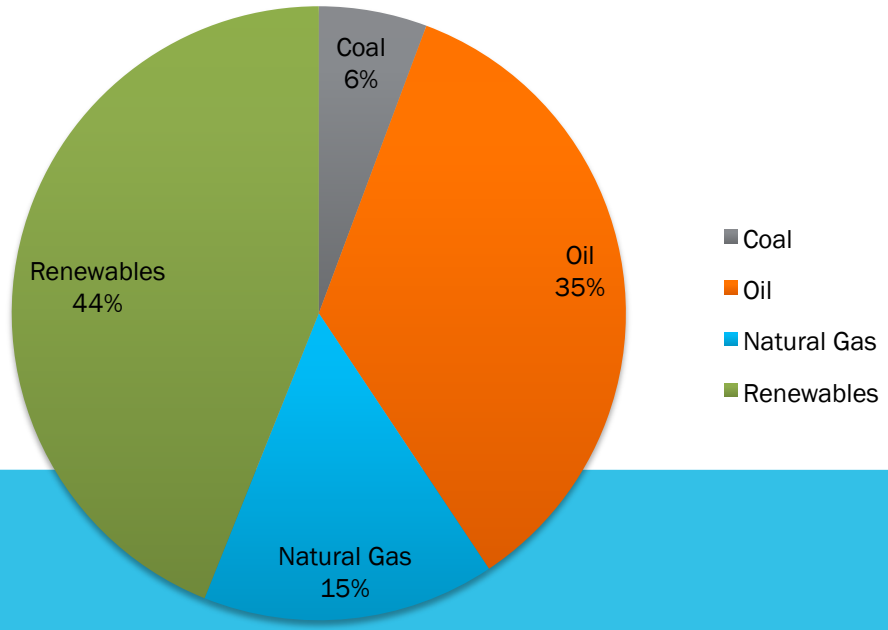


# NOW PUTTING IT ALL TOGETHER…

US Sources used in consumer energy profile 2011 USA (Gross PJ)



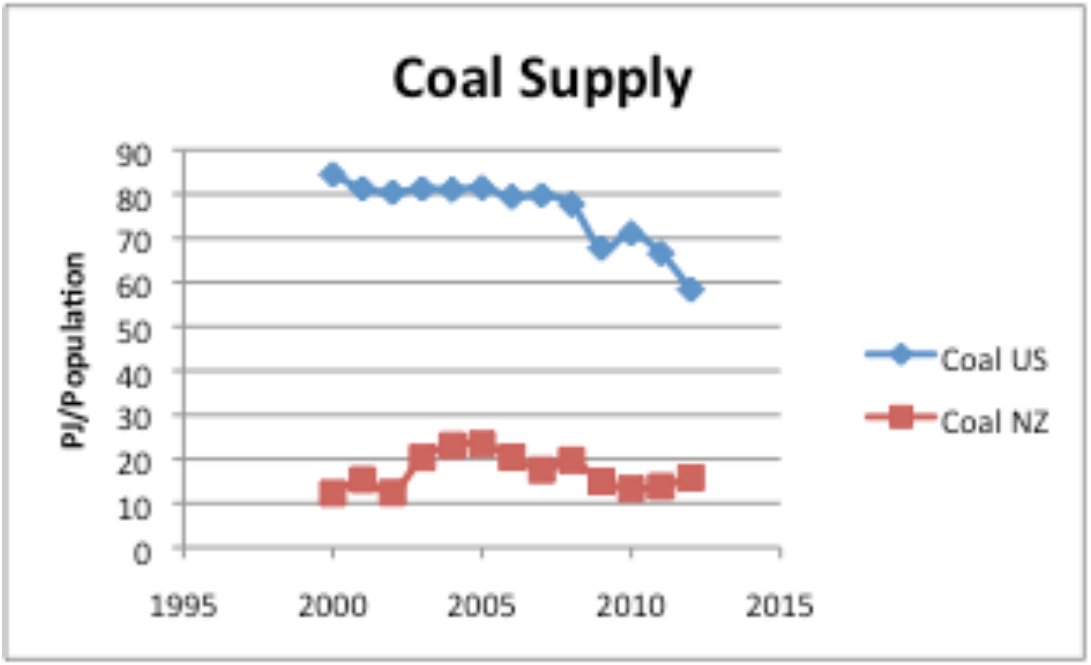

NZ Sources used in consumer energy profile 2011 (Gross PJ)



# COMPARISON AT THE PER CAPITA SCALE

## SOURCES AND SECTORS

# A LOOK AT THE ENERGY SUPPLY PER CAPITA- COAL



# NOTING THE DIFFERENCES

UNITED STATES

## $41 per ton

## Import

- 3.4 M short tons 2011
- 10.86 kg/person

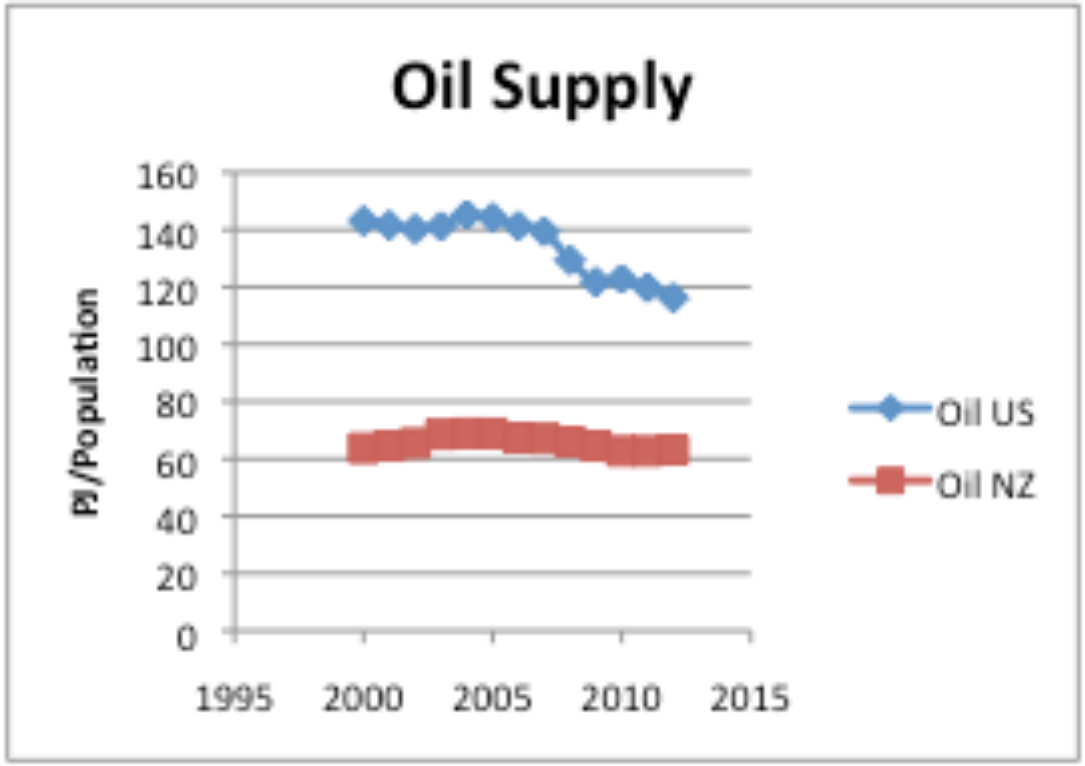
NEW ZEALAND

## $74 per ton

## Import

- 0.19 M short tons 2011
- 42.8 kg/person
- More imports= more tax

# A LOOK AT THE ENERGY SUPPLY PER CAPITA- OIL



# NOTING THE DIFFERENCES

UNITED STATES

Price of oil per barrel

- $112/Barrel

Outputting more than importing

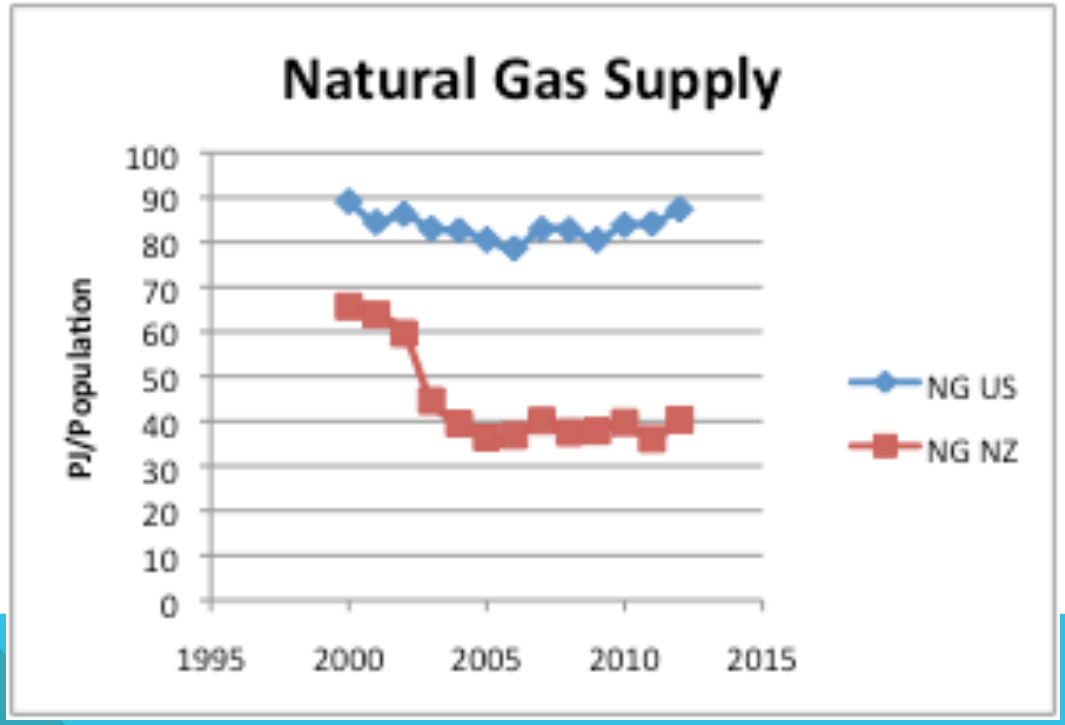
NEW ZEALAND

Price of oil per barrel

- $303/Barrel

Imports 57 mm bbl/ year

# A LOOK AT THE ENERGY SUPPLY PER CAPITA- NATURAL GAS



# NOTING THE DIFFERENCES

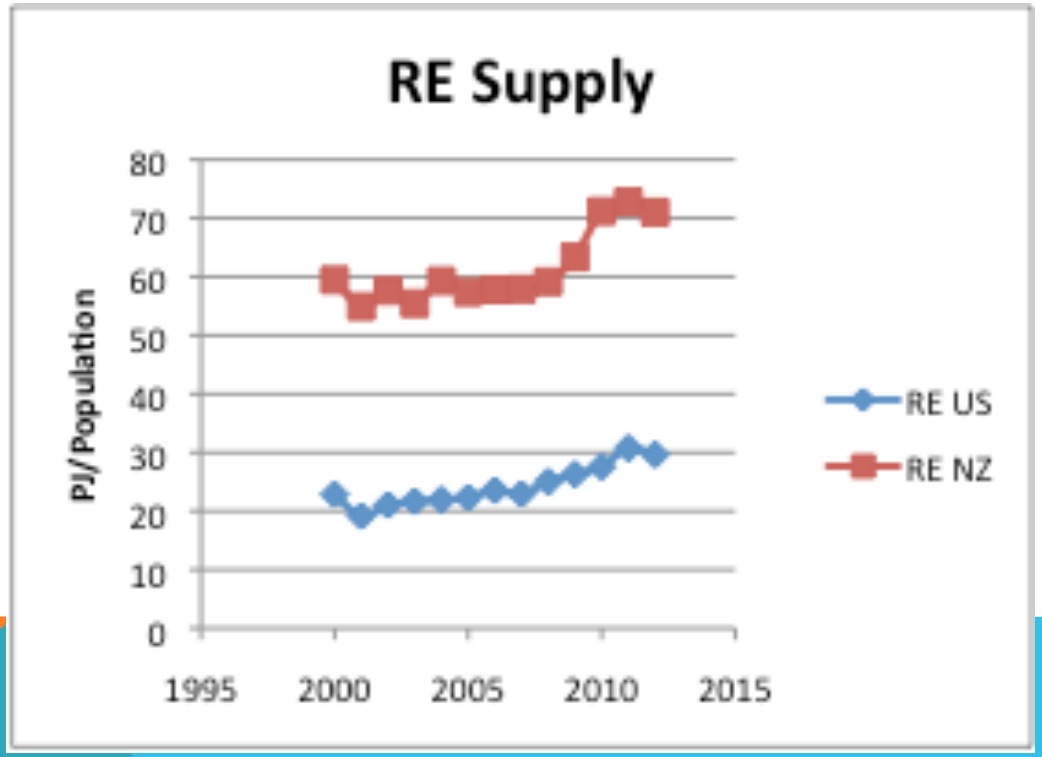
UNITED STATES

$4.24 per MM BTU

NEW ZEALAND

$4.37 per MM BTU

# A LOOK AT THE ENERGY SUPPLY PER CAPITA- RENEWABLE ENERGY



# NOTING THE DIFFERENCES

UNITED STATES

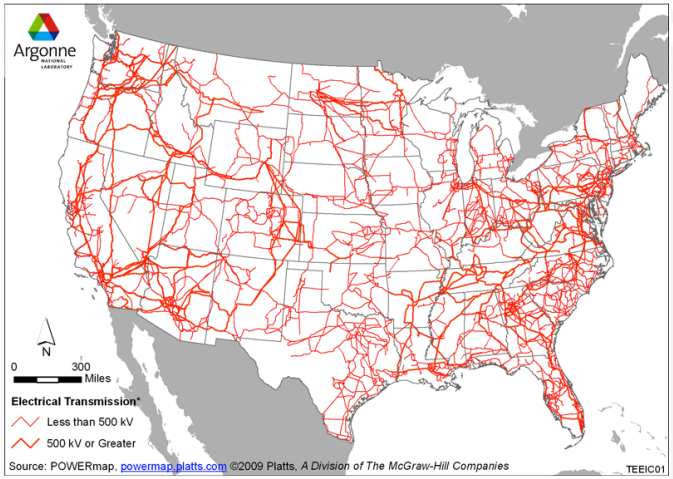
Coal + Natural Gas +Nuclear + Oil assure nearly 91% of the electricity production in the US, however American only pay an average of 12 cents per kwh

NEW ZEALAND

Hydropower+ wind+ Geothermal generate most of the electricity in New Zealand, 75%, however the average price of electricity paid is 20 cent.

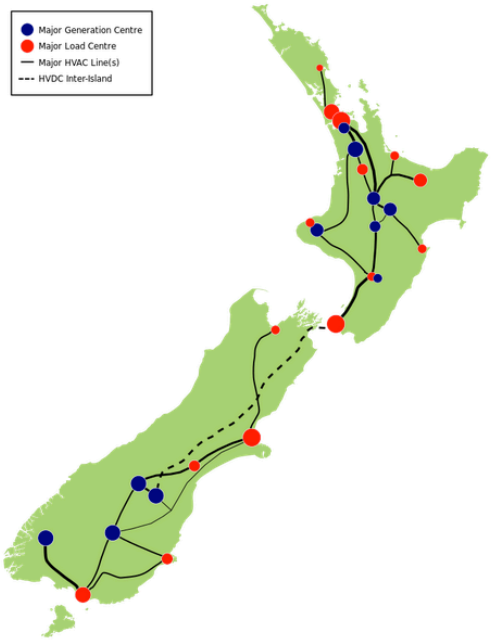
# NOTING THE DIFFERENCES

USA




U.S. Electrical Transmission Lines
Source: Argonne

NEW ZEALAND



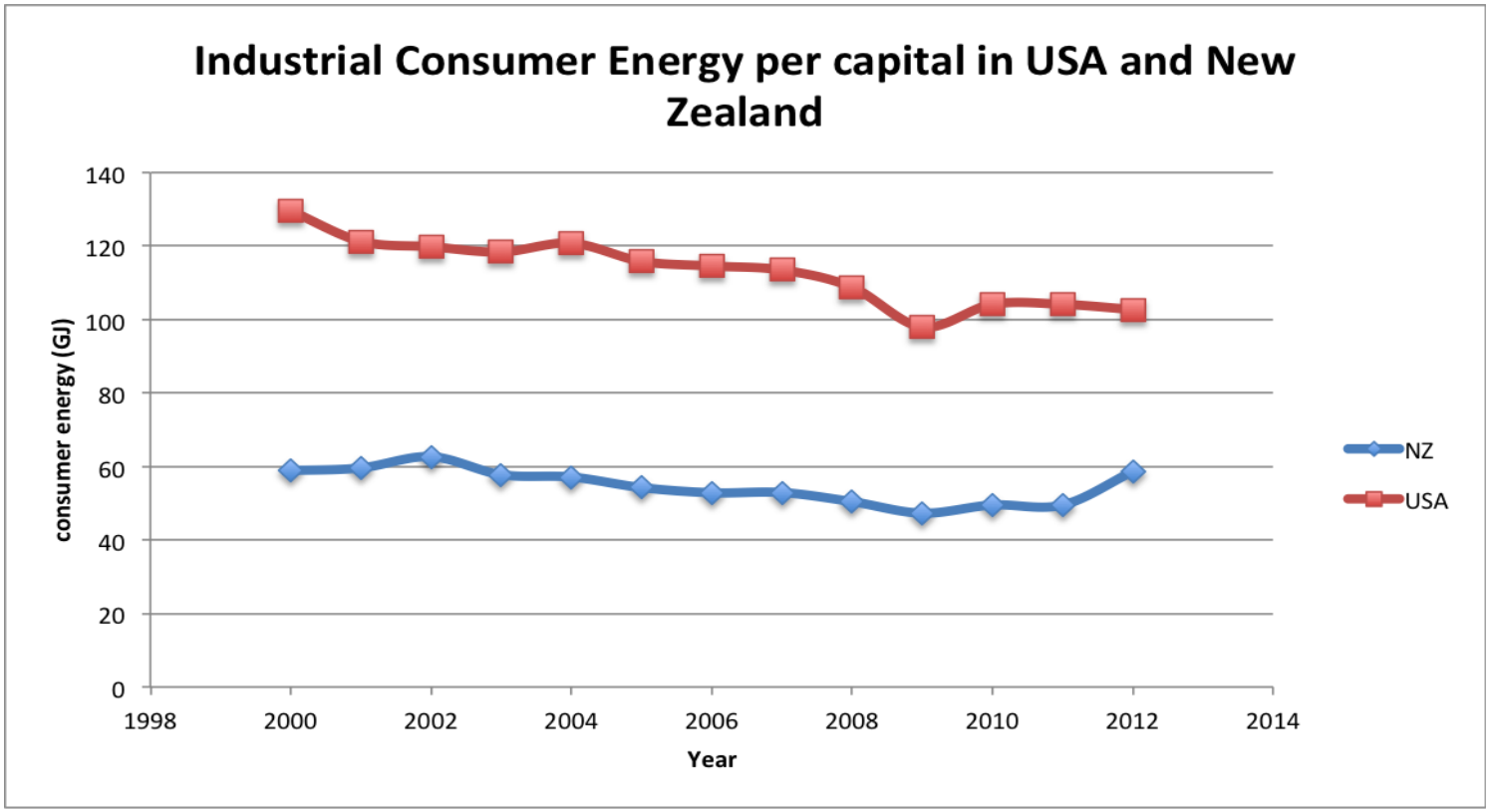
# BRINGING THE DIFFERENCES TOGETHER

Overall United States are supplied more fossil based sources as they are relatively cheap and yet widely available.

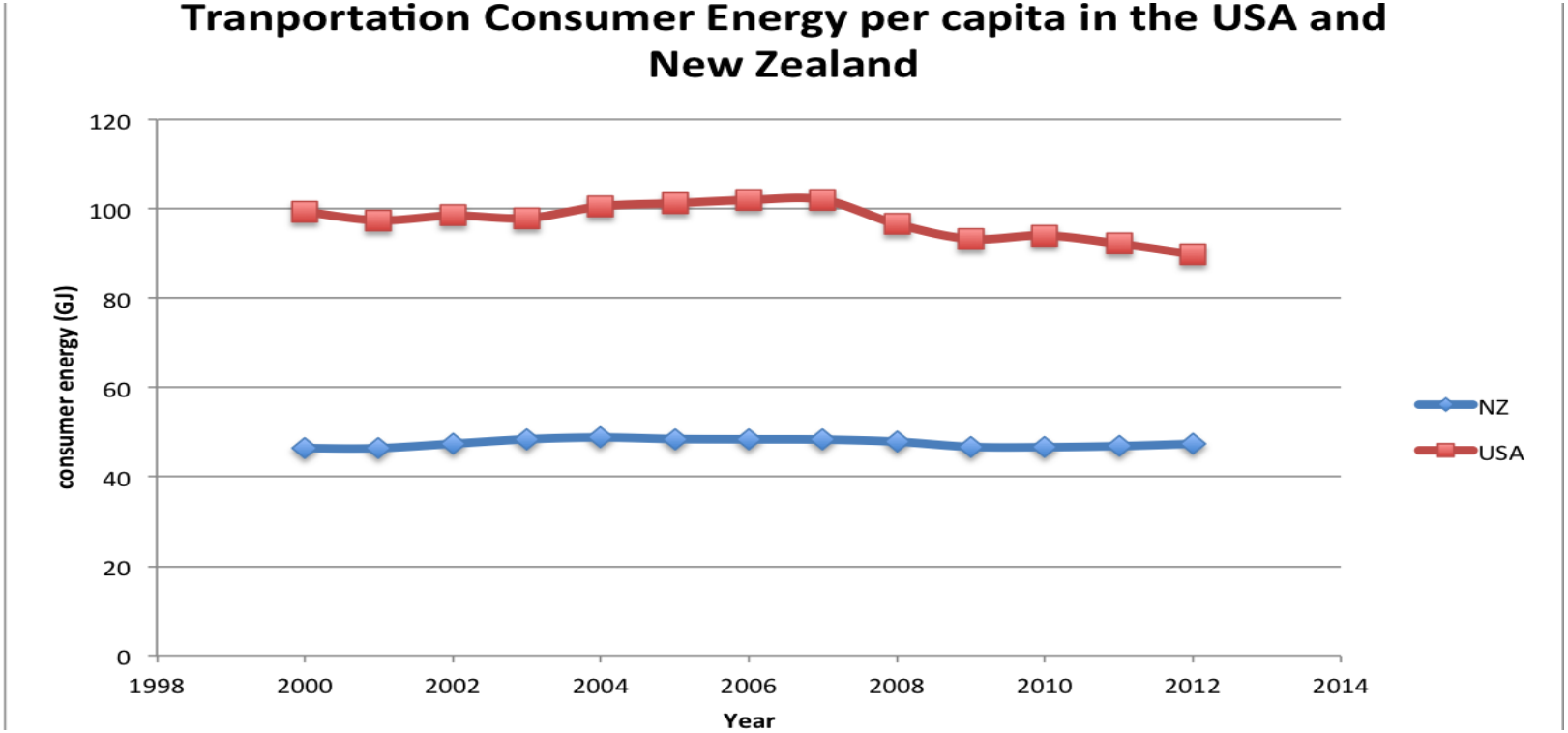
New Zealand uses more renewables because their best option in a country where the electricity transmission systems are not as prominent

-“island in the middle of the ocean”

# FOR THE INDUSTRIAL SECTOR



# FOR THE TRANSPORTATION SECTOR



# TRANSPORTATION

UNITED STATES

Ford-F Series

Average miles driven is 13, 476 miles

797 vehicles per 1000 people

2.6 vehicles per household

NEW ZEALAND

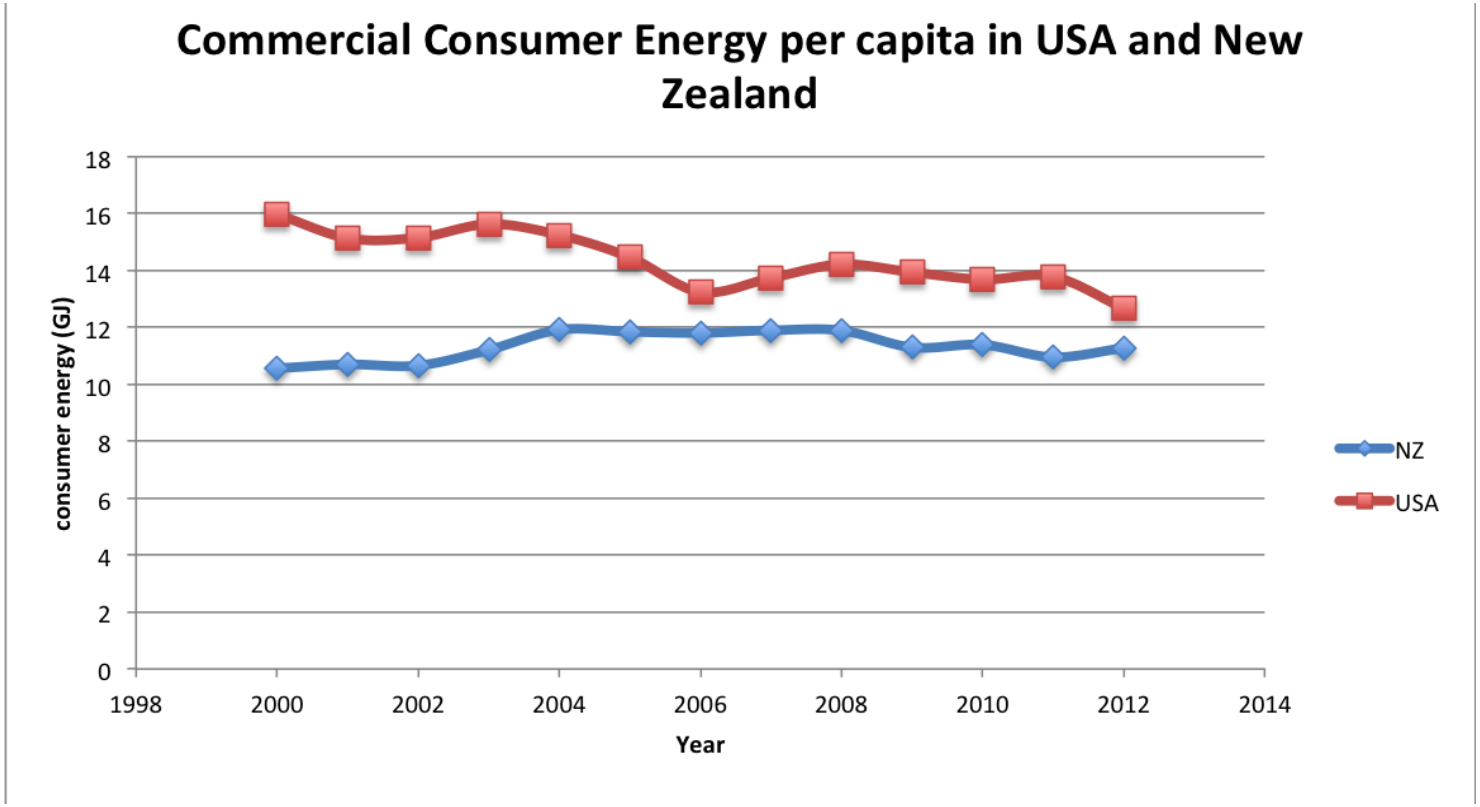
Toyota Corolla

Average miles driven is 6,350 miles

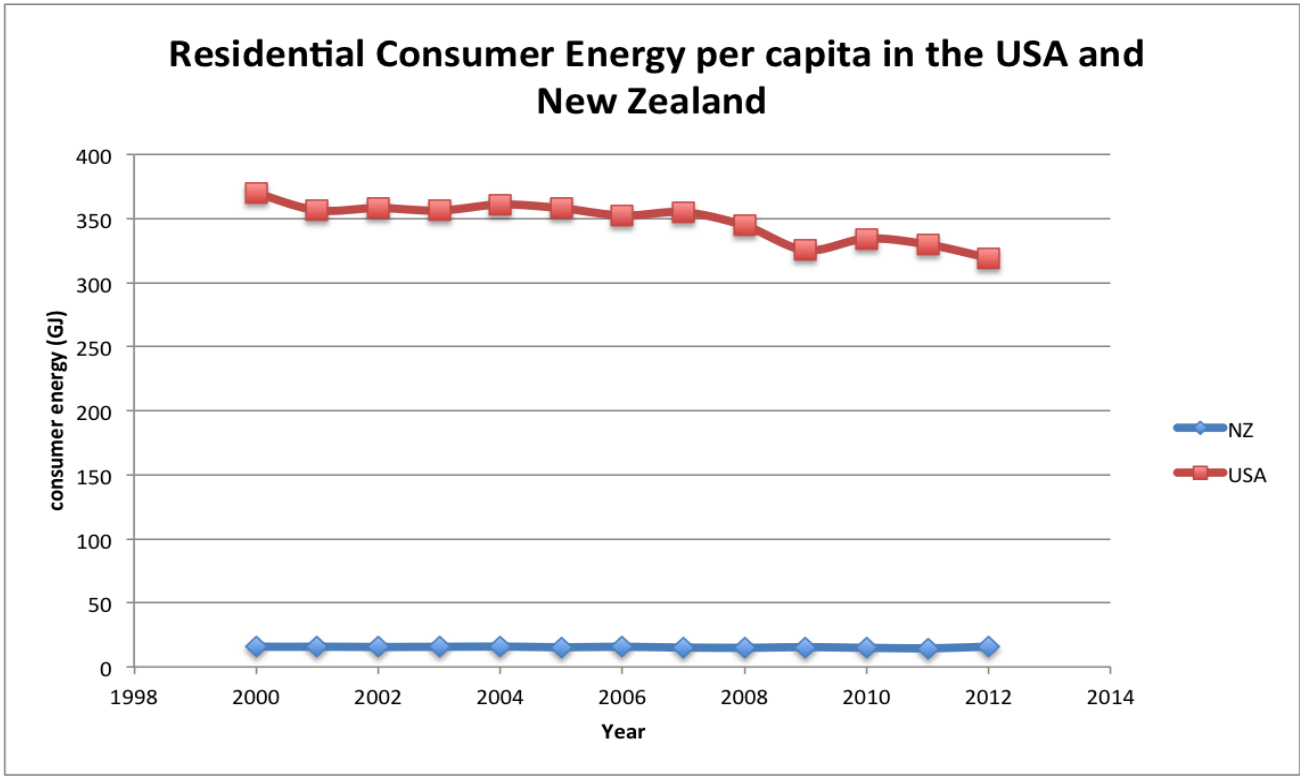
712 vehicles per 1000 people

1.6 vehicles per household

# FOR THE COMMERCIAL SECTOR



# FOR THE RESIDENTIAL SECTOR



# RESIDENTIAL

UNITED STATES

222.22 $m^2$

2.55 people/household

2.5 TVs per household

Average annual electricity Consumption per household in 2011

- 11,280 KW

NEW ZEALAND

149 $m^2$

2.6 people/household

2.1 TVs per household

Average annual electricity consumption per household in 2011

- 8,000 KW

# CYCLISTS

Approximately 57 million people, 27.3% of the population age 16 or older, rode a bicycle at least once during 2002.

The Ministry of Transport Household Travel Survey (2006) shows there are 1.274 million people who cycle in New Zealand, or about a third (31%) of New Zealanders.

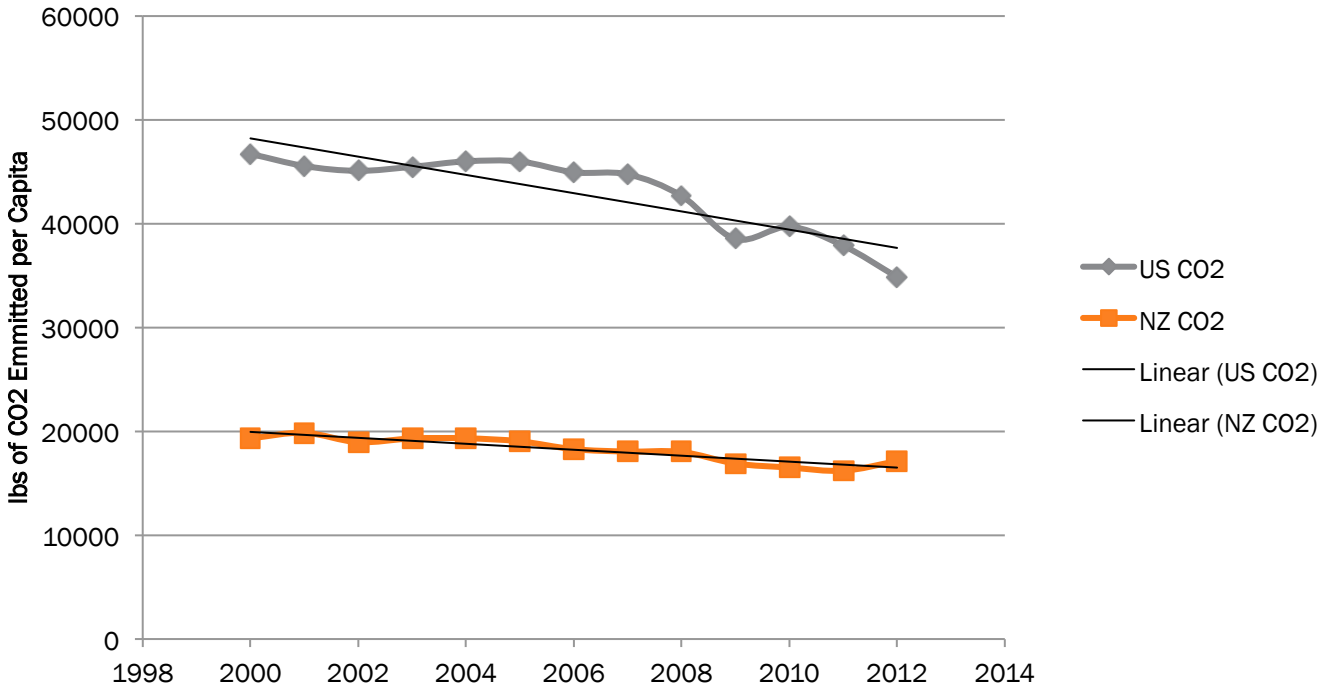
# NOTING THE DIFFERENCES

In all of the sectors the United States  consumed more energy than New Zealand

New Zealand is more sustainable in their decisions about energy consumption

- Smaller houses
- Less number of cars
- Less electronic gadgets

# CO2 EMISSIONS PER CAPITA ON A YEARLY BASIS



# UNITED STATES

Overall decrease in $CO_2$ emissions

- Fluctuating trend

More emissions that New Zealand per capita

Previous source and sector graphs also demonstrate this conclusion

# New Zealand

Overall decrease in $CO_2$ emissions

Steady decrease with not much fluctuation

Emissions trading scheme helps to regulate the decrease in emissions

# NEW ZEALAND EMISSIONS TRADING SCHEME

Initiated under:

*The Kyoto Protocol* (1997)

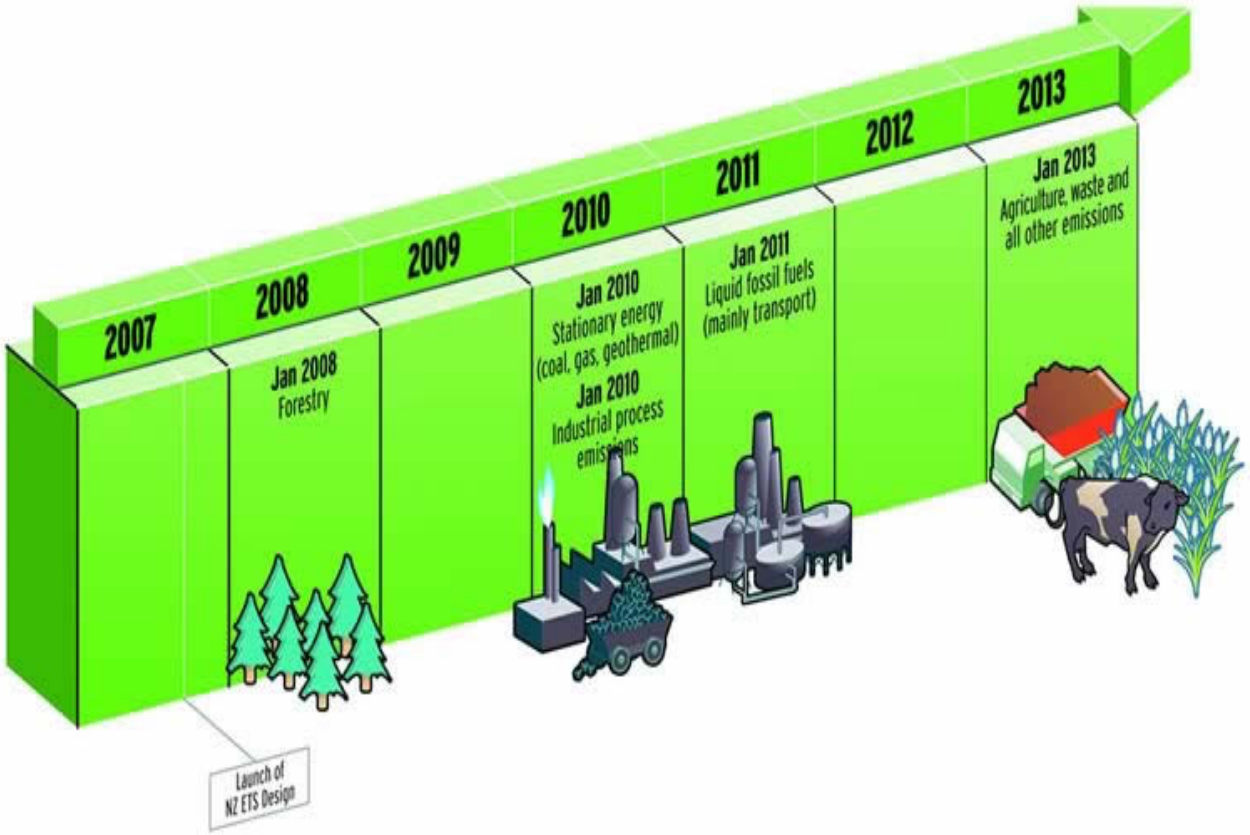
And

*the UN Framework Convention on Climate Change*

**TO REDUCE GLOBAL GHG EMISSIONS**

**By Increasing The Price**

# NZ ETS TIMELINE



# OTHER EXAMPLES OF ETS

European Union Emissions Trading Scheme (2005)

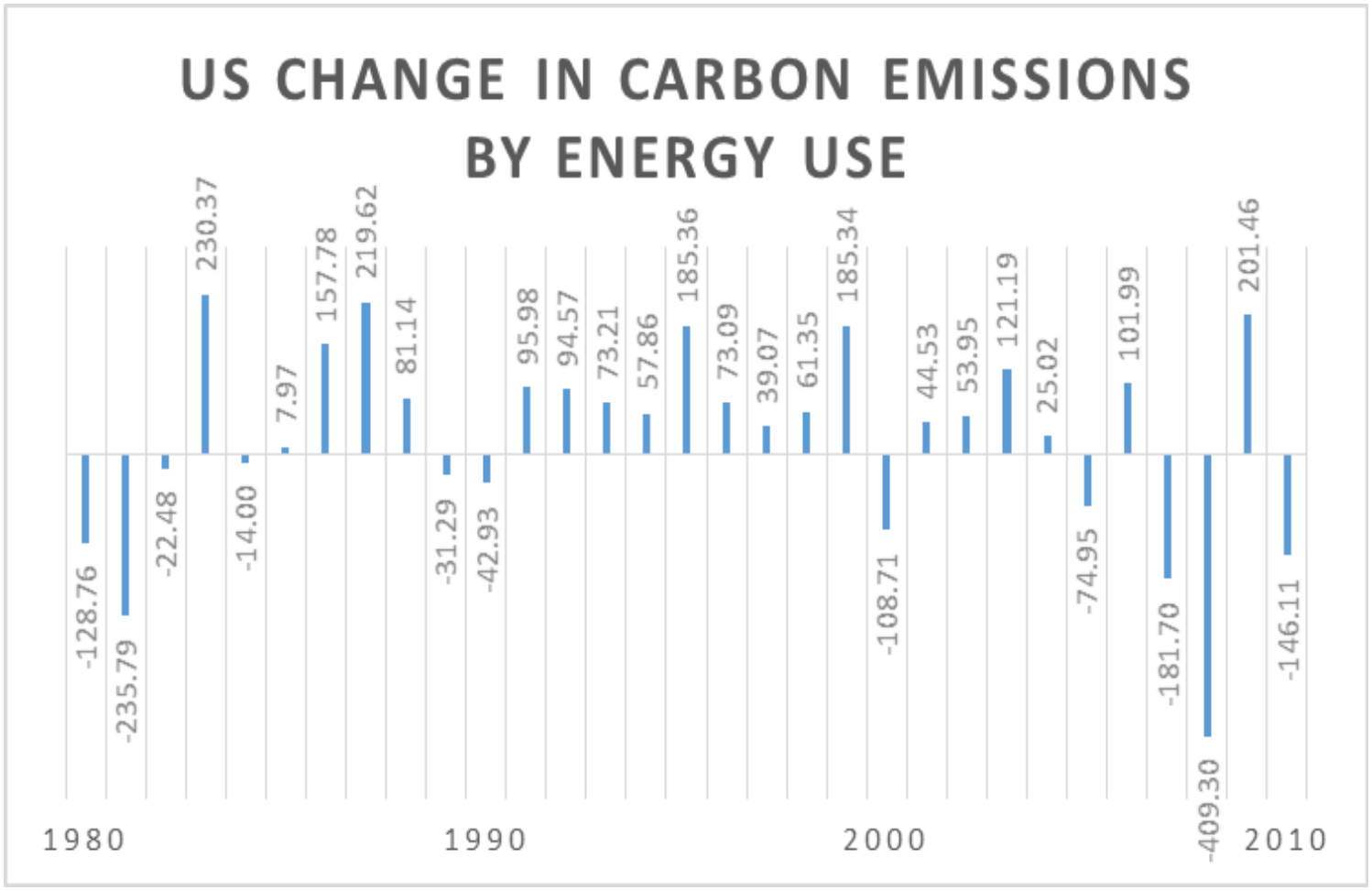
- Largest mandatory cap and trade scheme

Regional Greenhouse Gas Initiative (2008)

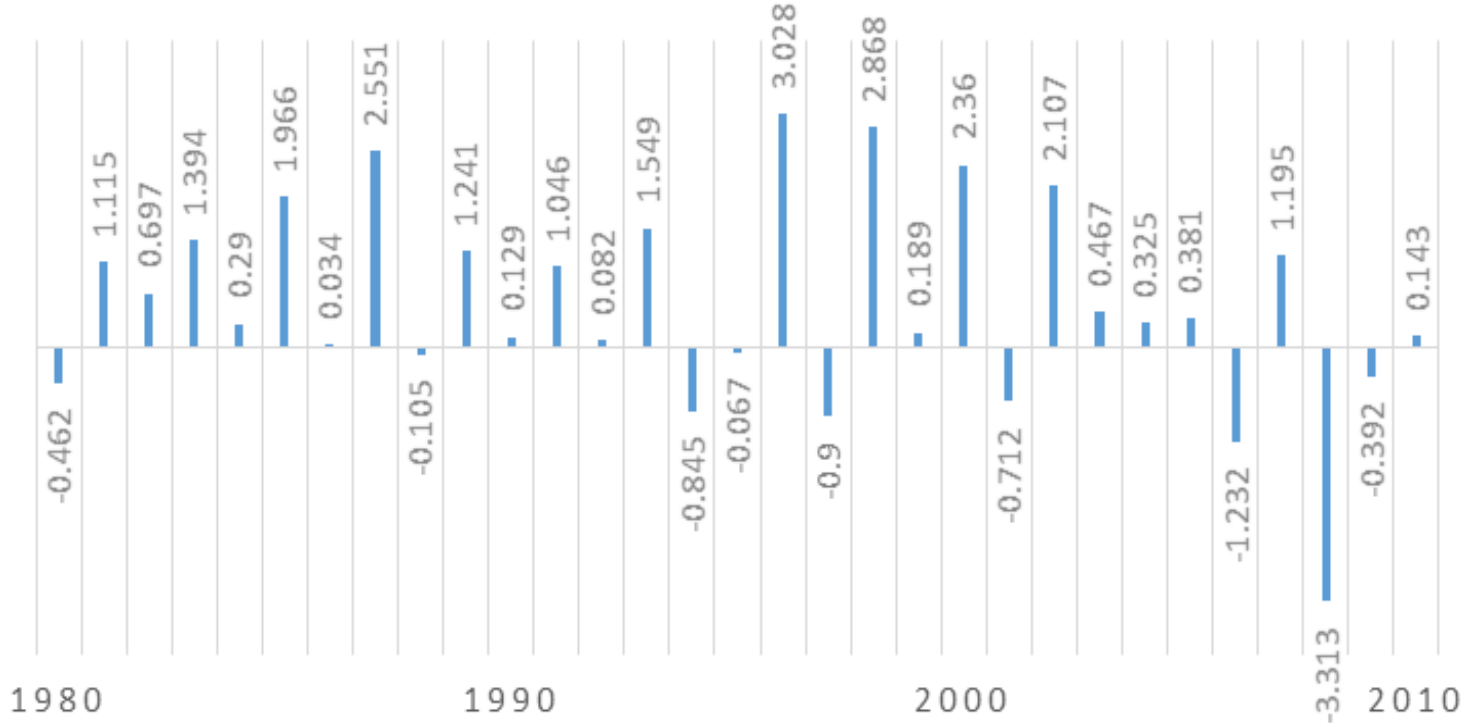
- 209 fossil fuel electricity generators in northeastern US

Shenzhen Emissions Trading Scheme (June 2013)

- China's Pilot ETS
- 2015 target: 21% ***carbon intensity*** reduction


US CHANGE IN CARBON EMISSIONS BY ENERGY USE
-128.76
-235.79
-22.48
230.37
-14.00
7.97
157.78
219.62
81.14
-31.29
-42.93
95.98
94.57
73.21
57.86
185.36
73.09
39.07
61.35
185.34
-108.71
44.53
53.95
121.19
25.02
-74.95
101.99
-181.70
-409.30
201.46
-146.11
1980
1990
2000
2010

# NZ CHANGE IN CARBON EMISSIONS BY ENERGY USE



The New York Times

Business Day

Energy & Environment

# Large Companies Prepared to Pay Price on Carbon

# CONCLUSION

Thesis: Sustainability is the main result of a different energy foundation between the U.S. and New Zealand, which could be attributed mainly to environmental awareness and economics.

http://www.youtube.com/watch?v=JGS90HEbP5U

# QUESTION?

Do you guys think energy should be looked at as more of a privilege or a necessity?

- Is more really necessary?

# SOURCES


http://www.eia.gov/coal/production/quarterly/

http://www.indexmundi.com/energy.aspx?country=nz&product=coal&graph=imports

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

http://www.qv.co.nz/resources/news/article?blogId=61

http://www.mfe.govt.nz/publications/waste/eee-survey-report-jan06/html/page3.html

http://www.census.gov/const/C25Ann/sftotalmedavgsqft.pdf

http://www.marketingcharts.com/wp/topics/demographics/american-households-are-getting-smaller-and-headed-by-older-adults-24981/

http://www.stats.govt.nz/browse_for_stats/population/estimates_and_projections/demographic-trends-2011/subnational%20demographic%20projections.aspx

# SOURCES


http://www.epa.gov/statelocalclimate/state/topics/renewable.htmlhttp://www.nasdaq.com/markets/natural-gas.aspx

http://www.eia.gov/naturalgas/

http://www.transport.govt.nz/assets/Import/Documents/_versions/3989/NZ-Household-travel-survey-driver-travel-April-2013.1.pdf

http://en.wikipedia.org/wiki/List_of_countries_by_vehicles_per_capita

http://www.mfe.govt.nz/publications/ser/enz07-dec07/html/chapter4-transport/page4.html

https://www1.eere.energy.gov/vehiclesandfuels/facts/2010_fotw618.html

http://www.climatechange.govt.nz/emissions-trading-scheme/about/international-examples.html