New Zealand perspective: the role of electricity and likely demand; supply from alternative technologies: development and trends

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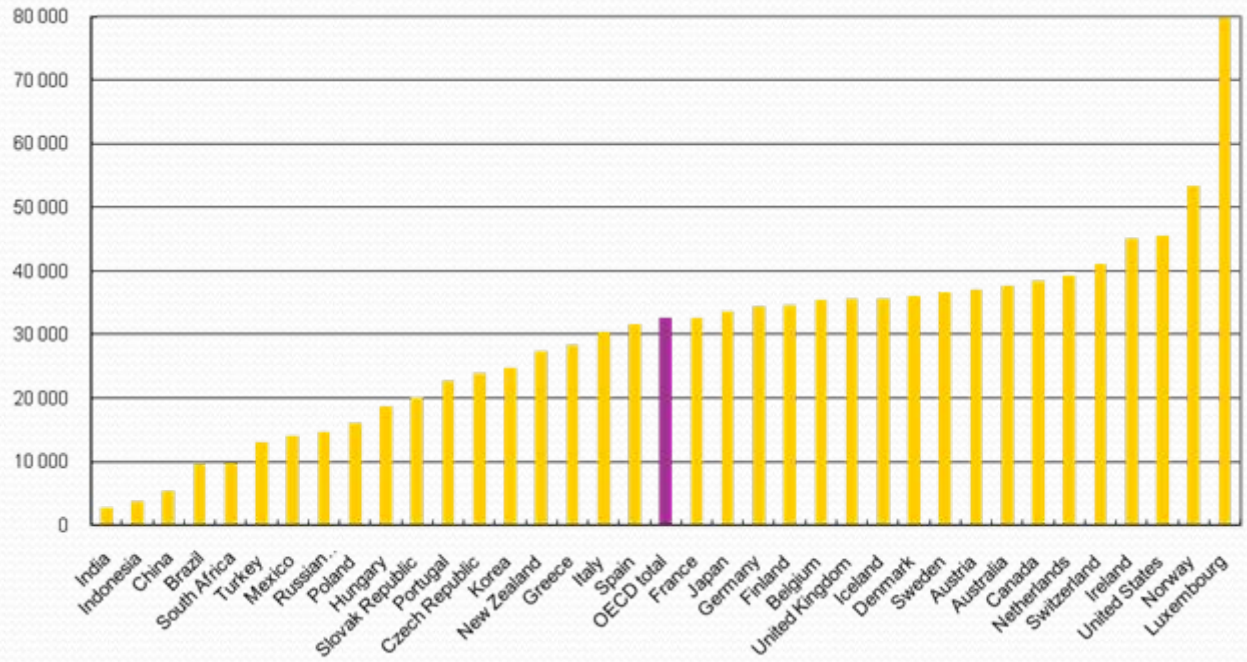
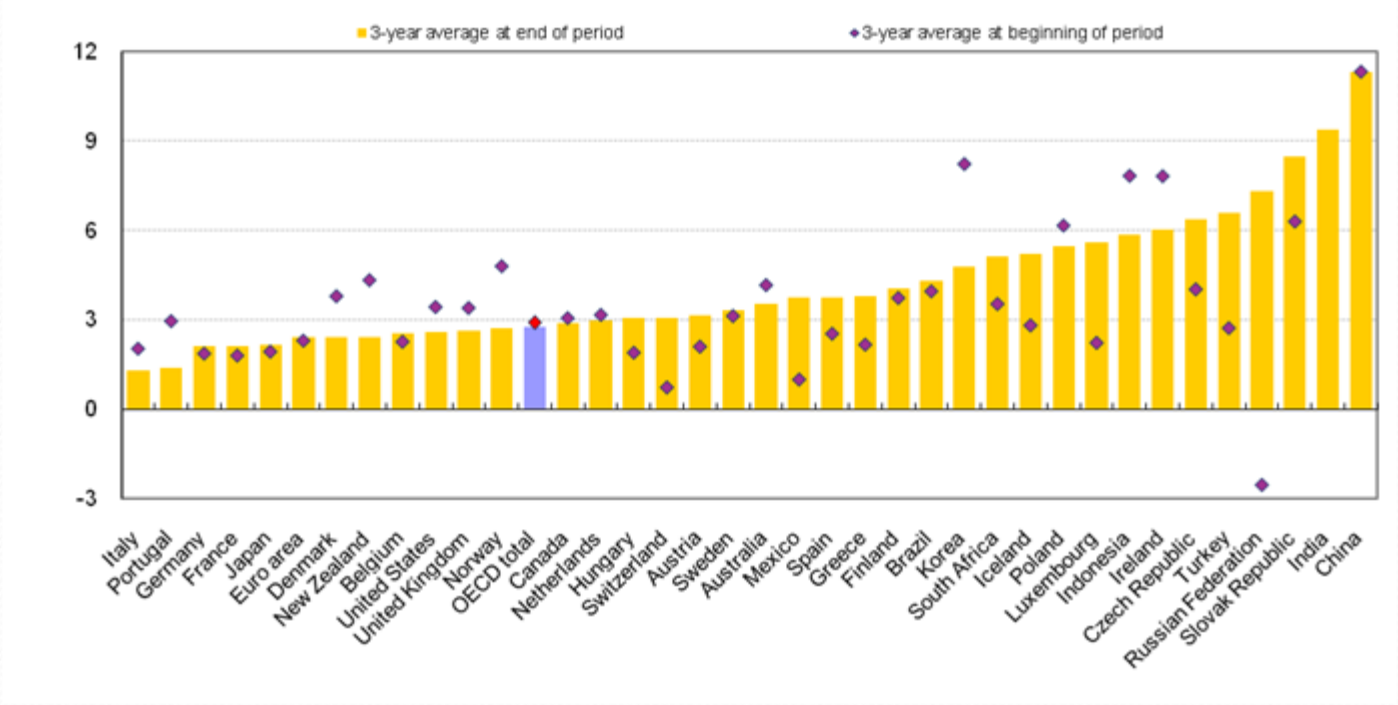
Overview

- The challenge
- Electricity & economic growth
- Public policy
- Renewable sources
- Concluding comments

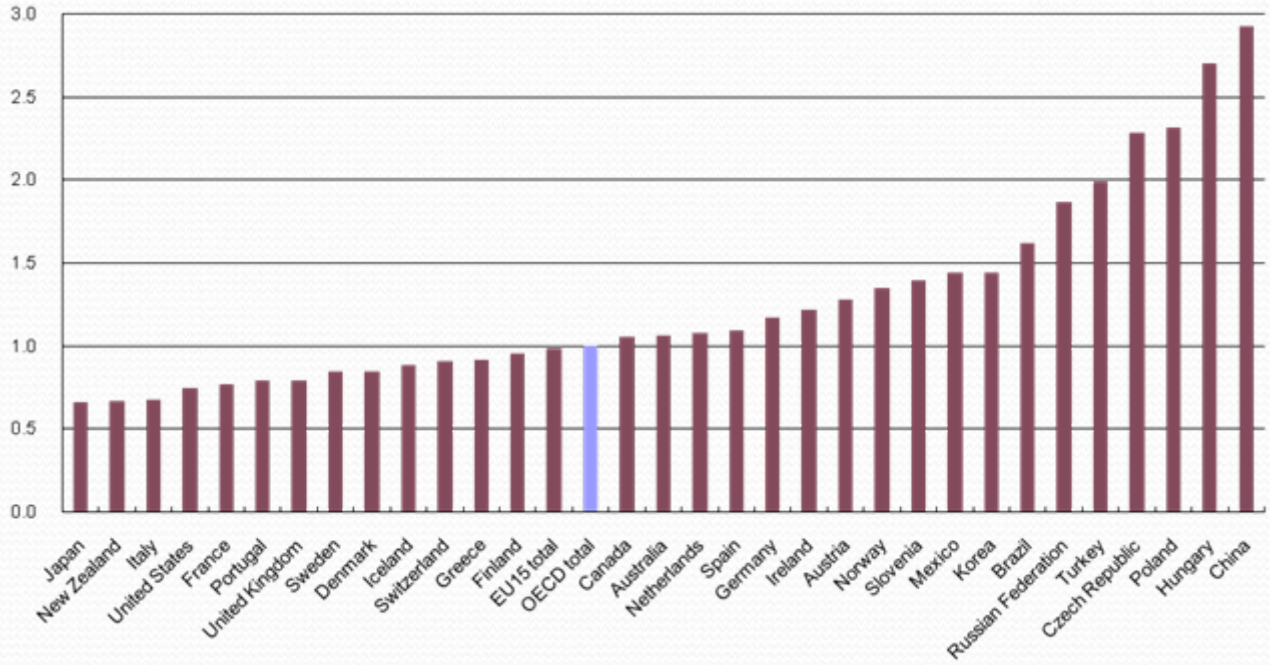
GDP/capita US$2007



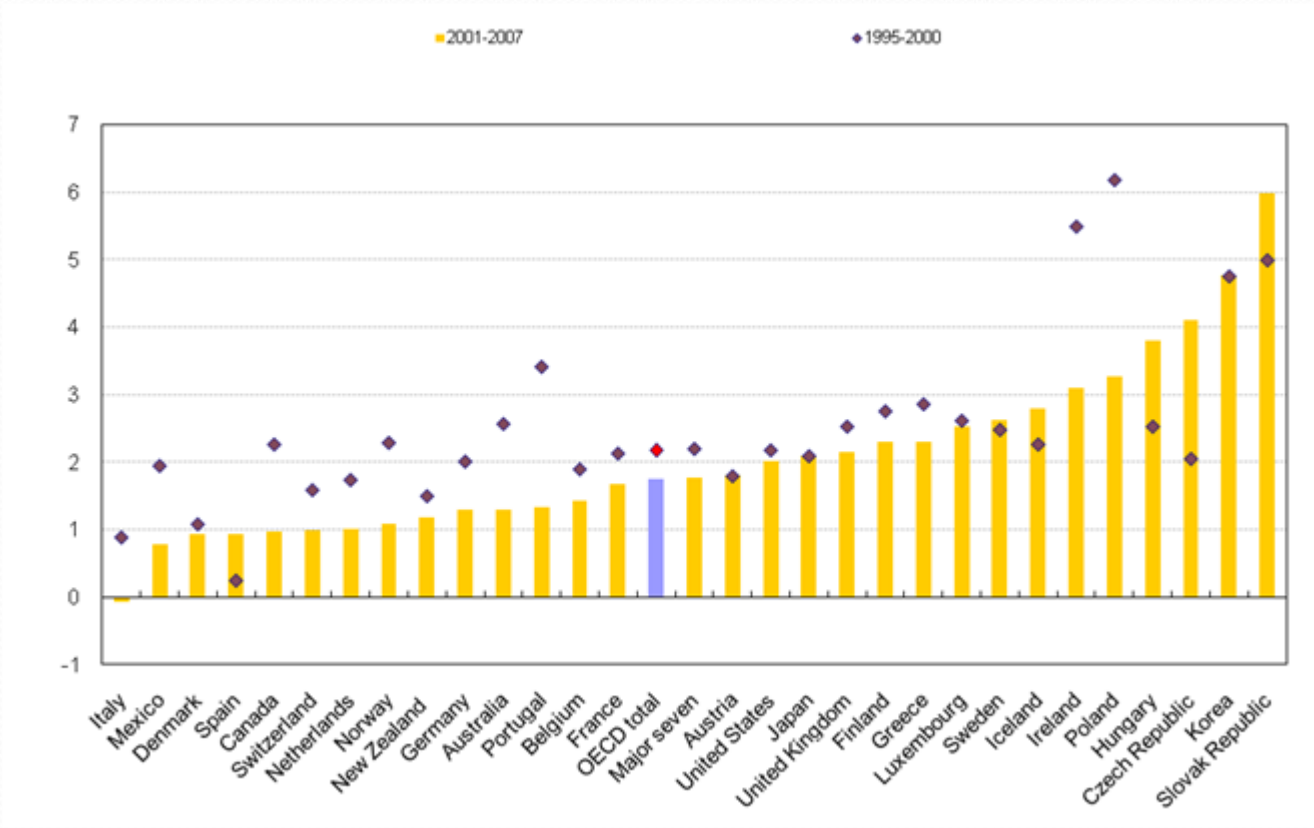
Real GDP Growth



Relative growth of exports OECD = 1 period 1996-2006



Growth in GDP per hour worked



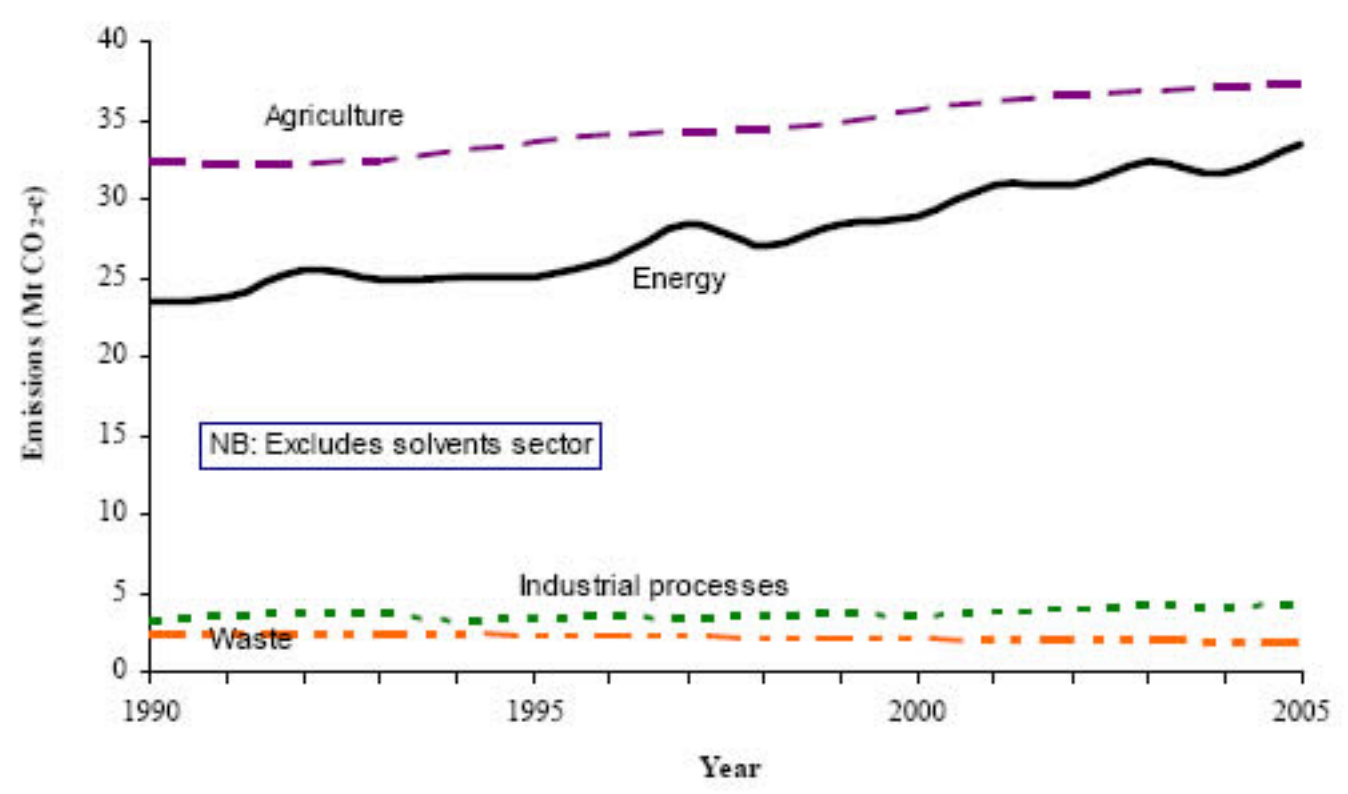
Observations

- Macroeconomic indicators
  - GDP below average for OECD
  - GDP growth also below average for OECD
  - Low growth GDP/hour worked
  - Underperforming in exports
  - Relatively low unemployment rate
- Let's now look at electricity

Policy: Climate Change

- ETS passed into law 2008 – reviewed & revised 2009
- Proposed change: delay entry of stationary energy sources to July 2010
- Transition phase:
  - Surrender 1 NZU for every 2 units CO_2-e or pay $25
  - Can bank but can't export while price cap in place
- Great deal of uncertainty around Copenhagen

Emissions 1990-2005



Emissions by Gas

Country	CO_2	CH_4	N_2O
	% of Total Gross Emissions		
Argentina	46.8	31.6	21.7
Australia	68.6	23.8	6.8
Canada	79	12.9	7.3
European Union	82	8.5	7.9
Finland	84.8	6.2	8.3
Germany	85.4	8.2	5.5
Ireland	66.6	18.6	14.2
Japan	94.1	1.5	2.7
New Zealand	**46**	**34.5**	**17.9**
Russian Federation	80.4	15.5	1.9
United Kingdom	84.9	7	6.5
United States	83.6	8.6	6

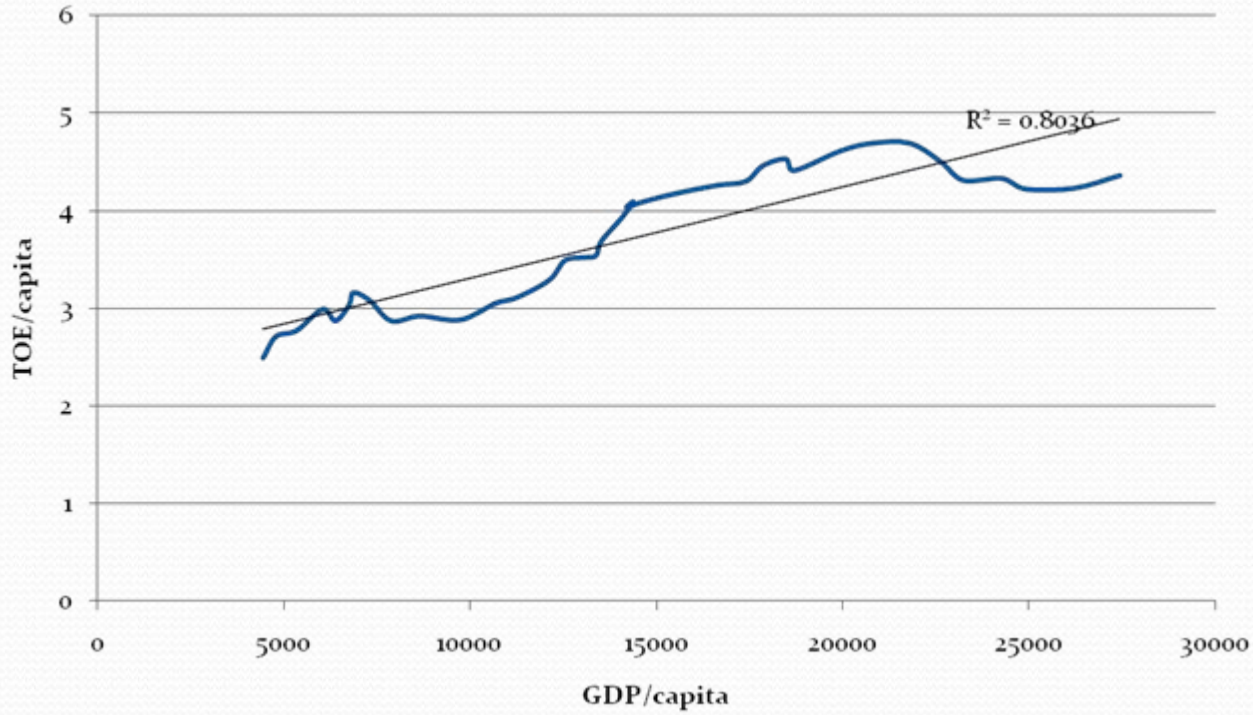
Sources: UNFCCC Greenhouse Inventory Database (see <www.wri.org>) and New Zealand's Greenhouse Gas Inventory 1990-2003. Data for Argentina is for 1997 and for New Zealand, 2003

Energy and CO_2 Intensity of GDP

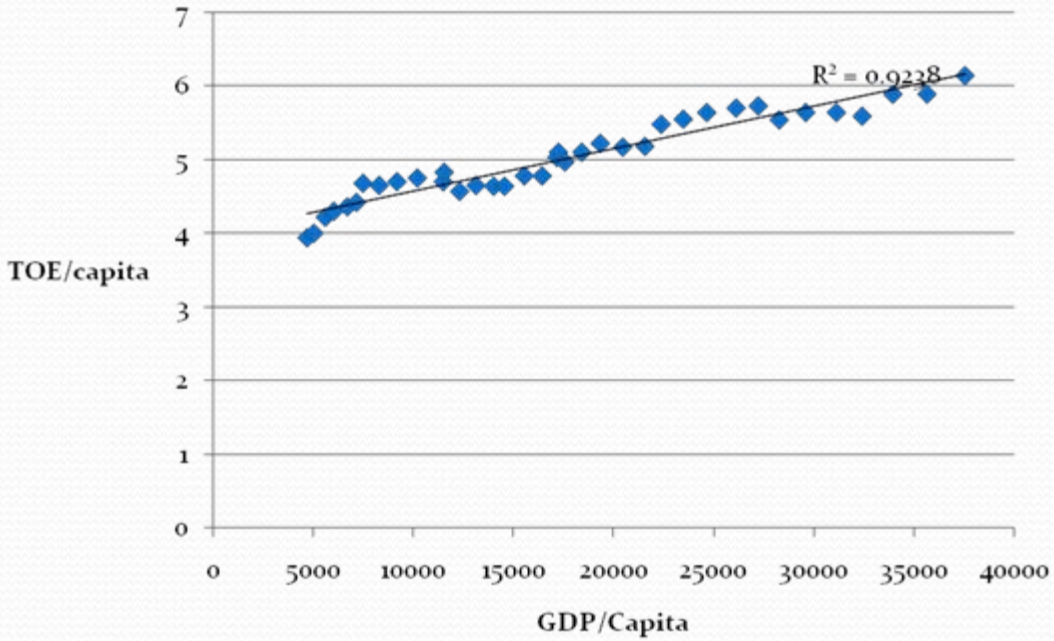
Country	BTU per 1995 US$	CO_2 per US$1000
Argentina	9,875	0.48
Australia	11,936	0.88
Canada	17,341	0.79
Chile	11,498	0.59
China	35,764	2.75
Denmark	3,920	0.26
France	5,998	0.22
Germany	5,269	0.31
Ireland	5,273	0.38
Italy	6,186	0.36
Japan	3,876	0.21
N.Z.	**11,871**	**0.51**
Norway	10,968	0.25
Poland	20,004	1.6
U.K.	7,039	0.41
U.S.	10,575	0.62

Source: Energy Information Administration 2004,

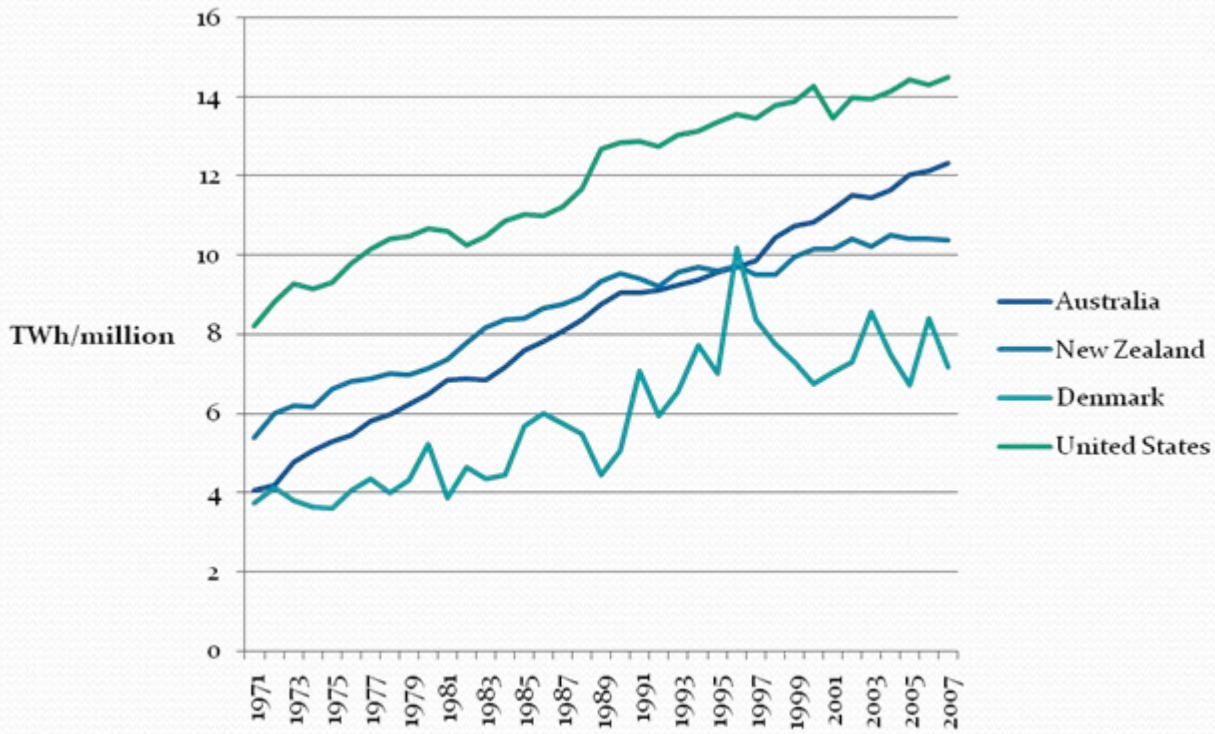
Energy & Economic Growth: NZ



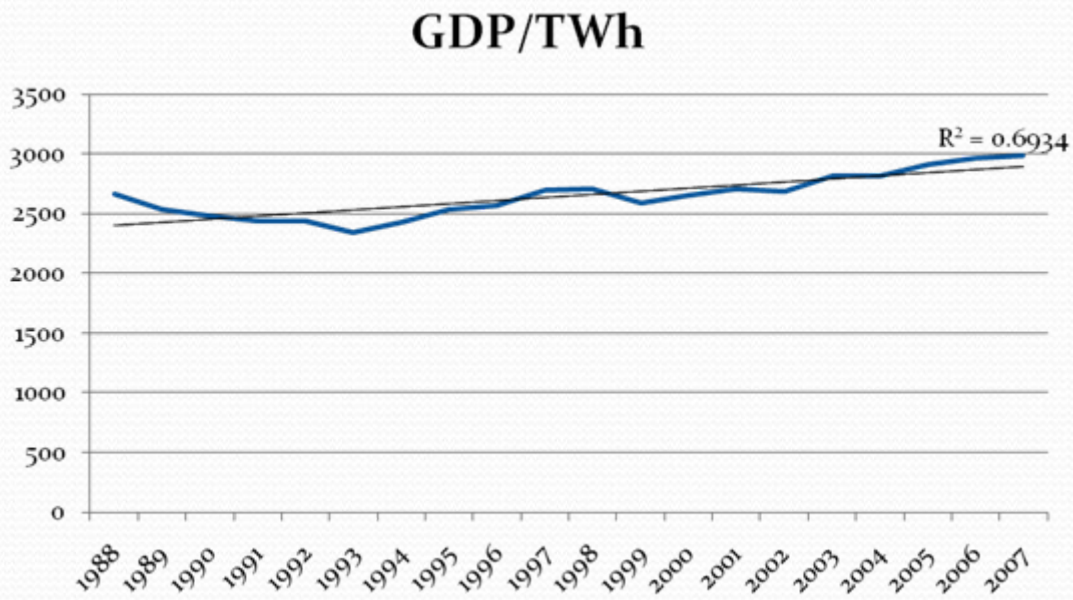
Energy & Economic Growth: Australia



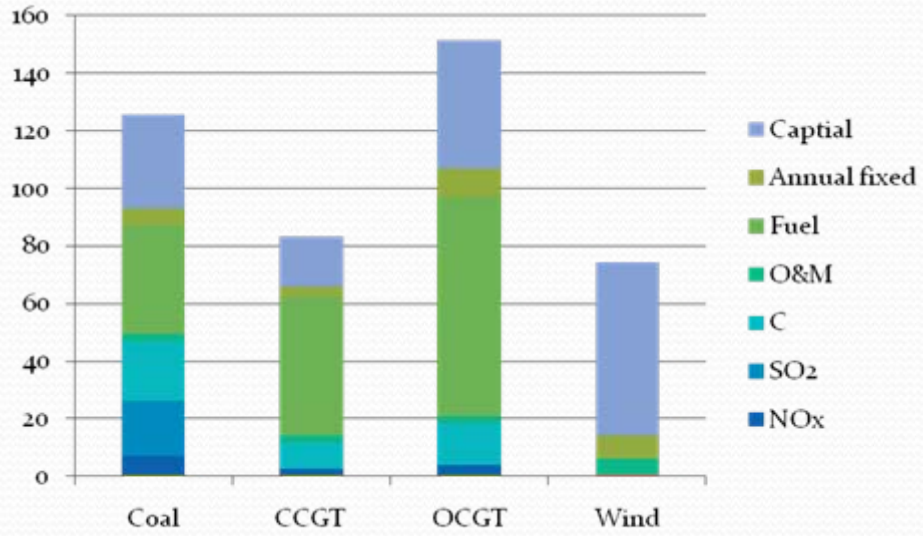
Electricity Generation/capita



GDP per unit electricity



Full Cost of Electricity Generation



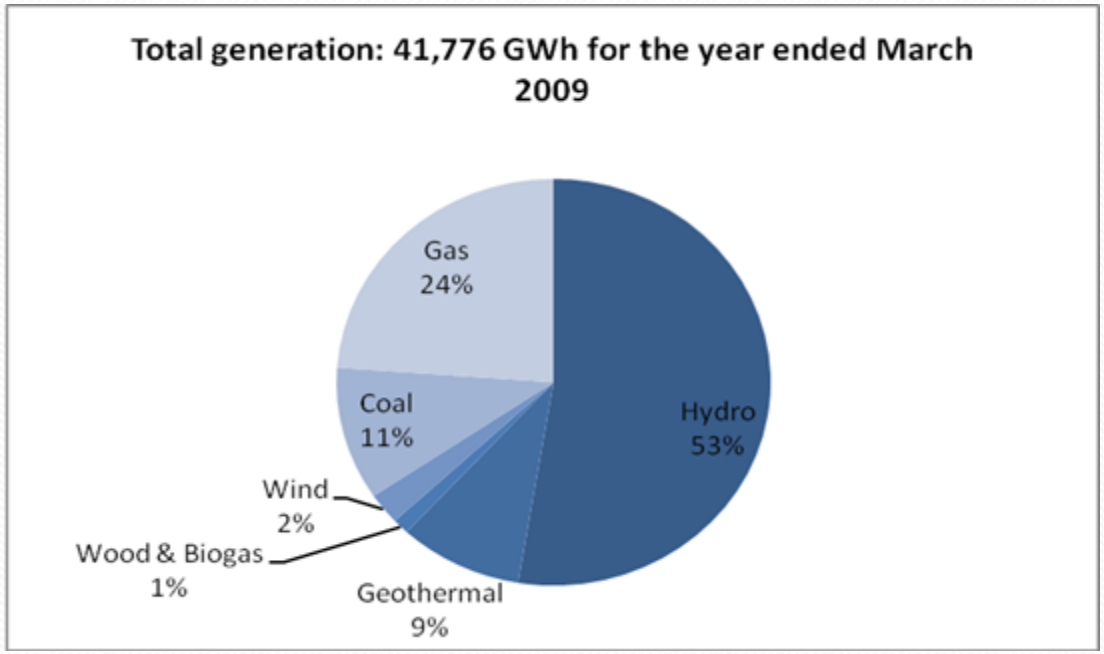
New Plant High-Cost; source: COVEC (2006)

Price elasticity: electricity

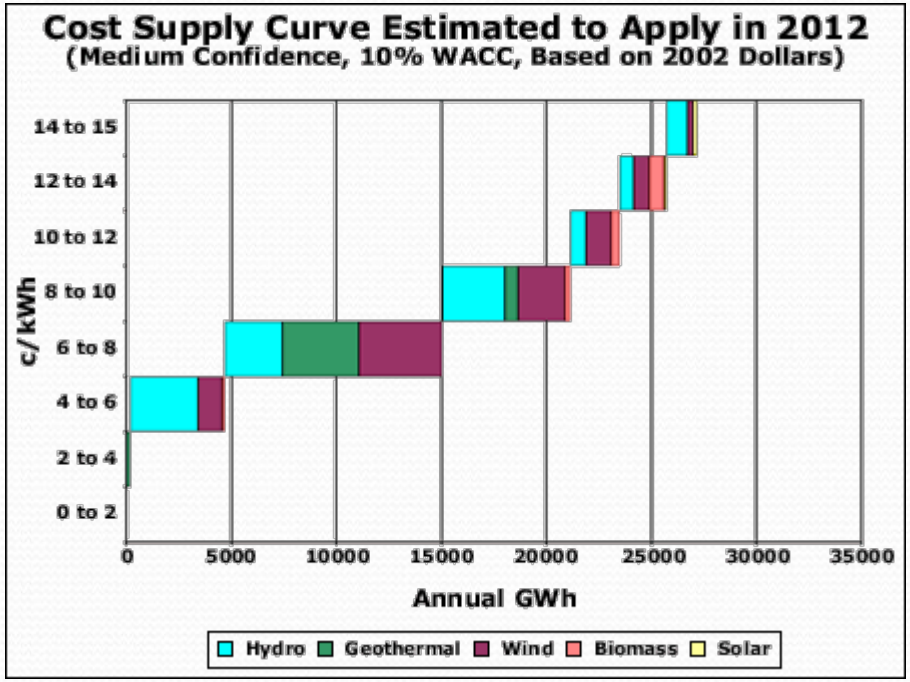
	Proportion	Short-run	Long-run
Industrial	45%	-0.06	-0.28
Commercial	22%	-0.06	-0.28
Residential	33%	-0.08	-0.21
Weighted Av.		-0.07	-0.26

Source: Ministry for Economic Development

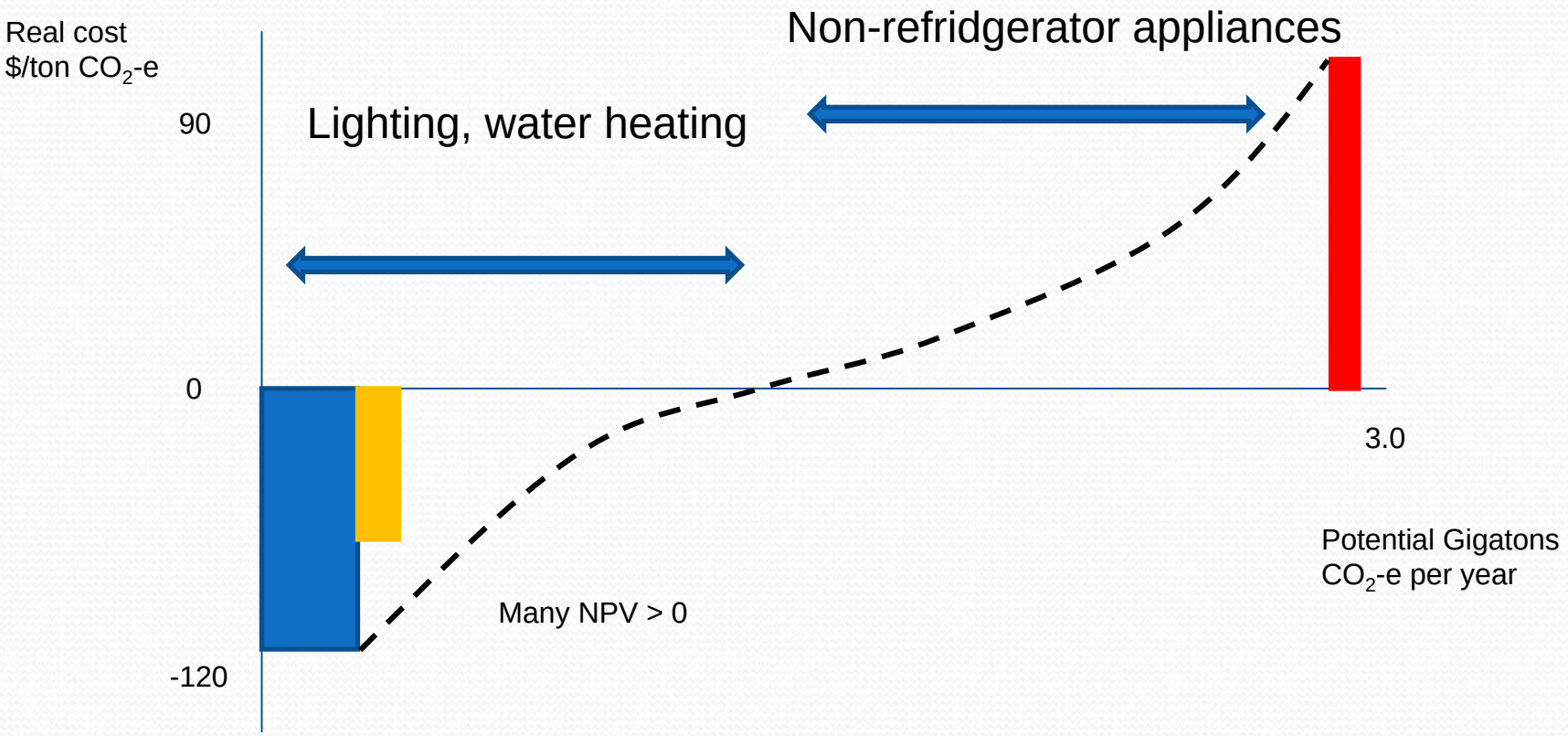
Status Quo


Total generation: 41,776 GWh for the year ended March 2009
Gas 24%
Coal 11%
Wind 2%
Wood & Biogas 1%
Geothermal 9%
Hydro 53%

Supply curve for electricity



Efficiency opportunities – stationary uses of electricity

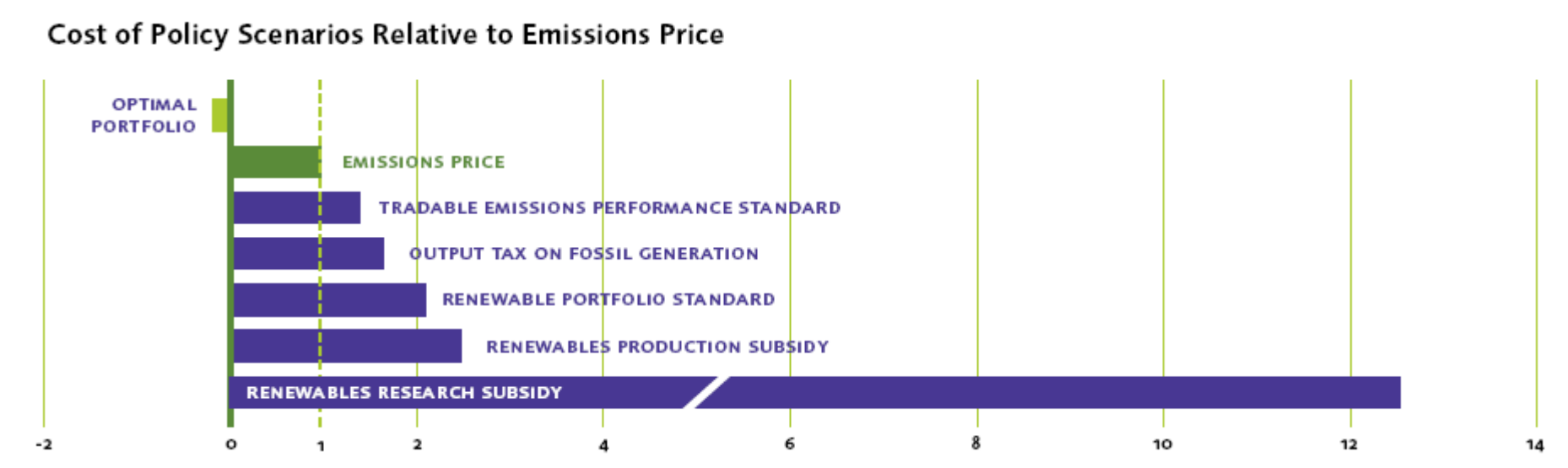


Source: based on McKinsey Report (2007)

Implications of McKinsey Report

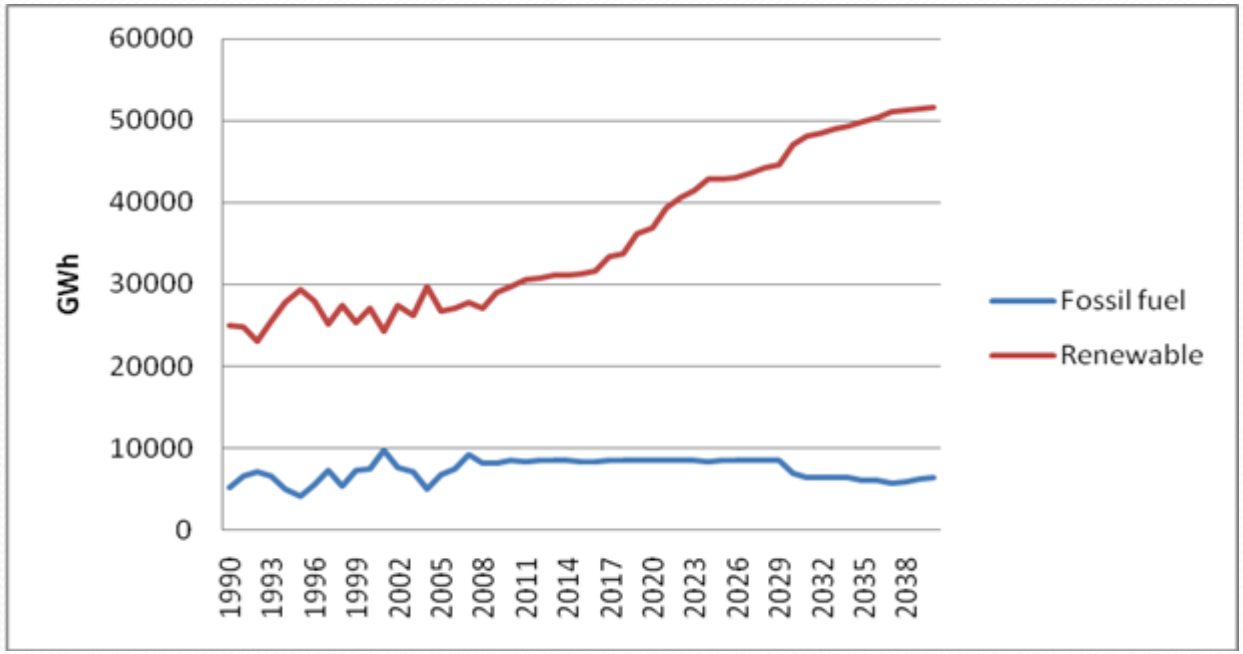
- Negative abatement comes from energy efficiency opportunities that save more than they cost.
- Why haven't they been used?
  - Possibly because of consistently low energy prices
- But lack of action doesn't necessarily imply market failure.
- Identifying true market failures is prerequisite to determining the need for a pricing (such as carbon) policy

Cost of policy Scenarios relative to emissions price

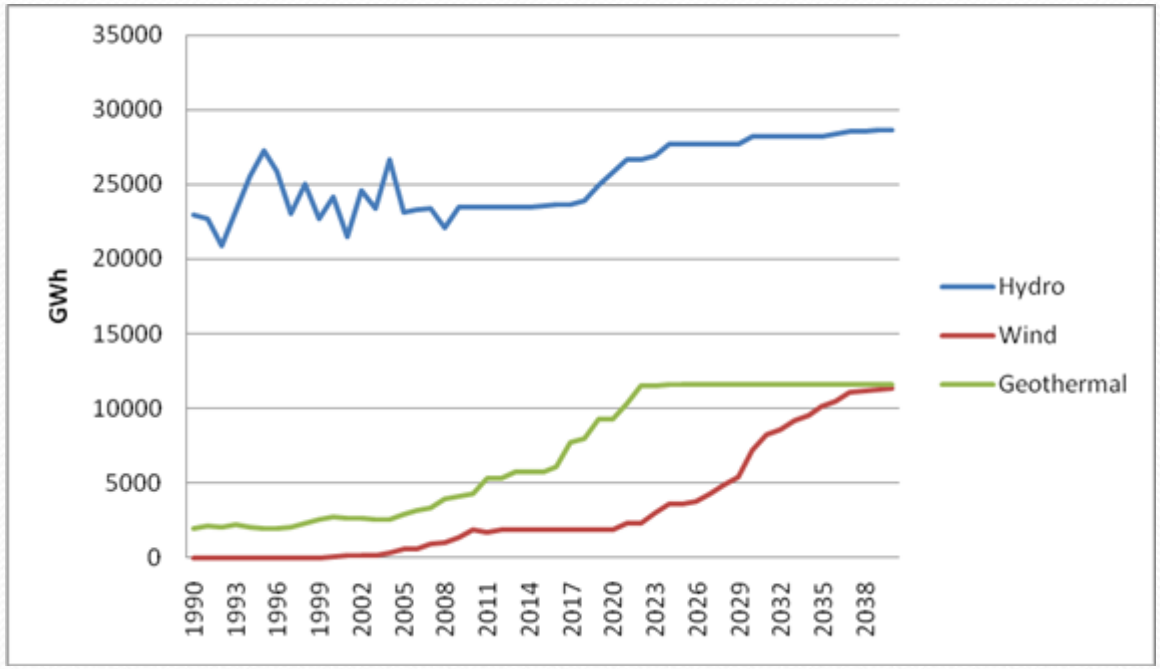


Source: Resources for the Future, Summer 2008, Number 169

Policy: 90% Renewables



Policy: Projected Renewables



Property Rights: Resource Management Act

- Renewable resources recognised in law
- Local government not to consider effects of climate change but are to have regard to benefits derived from use & development of renewables
- Local governments can set rules limiting GHG emissions

Property Rights: Geothermal

- Discretionary activity within Development Geothermal Systems
- First-in-time basis
  - Rewards first-movers & innovators
  - Race to the pump house?
  - Efficient use?
- One system multiple operators (Environment Court)
  - Unitisation (single tapper) v. multiple tappers?
  - Incumbent consent holder: access, possible holdout?
  - Multiple operator agreements

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Property Rights: Wind

- Typically in more remote areas
  - Exposed sites
  - Transport
  - Connection to grid
- Generator negotiates right of access with landowner
  - First in time basis
  - Structure of agreement
- External impacts
  - Aesthetics, noise

Economics

- Secure & durable rights essential for investment
- Demand
  - Growth
  - Characteristics
- Supply into market
  - Timing of development
  - Scale
  - Siting of development
- Balancing supply and demand

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Demand

- Drivers: economic growth, population, efficiency of use – generally slower than economic growth
- Expectations: around 1.5-2.5% per year
- Characteristics:
  - Location: population, climate
  - Peaks mornings & evenings
  - Seasonal demand
- Average around 8 MWh/household/year

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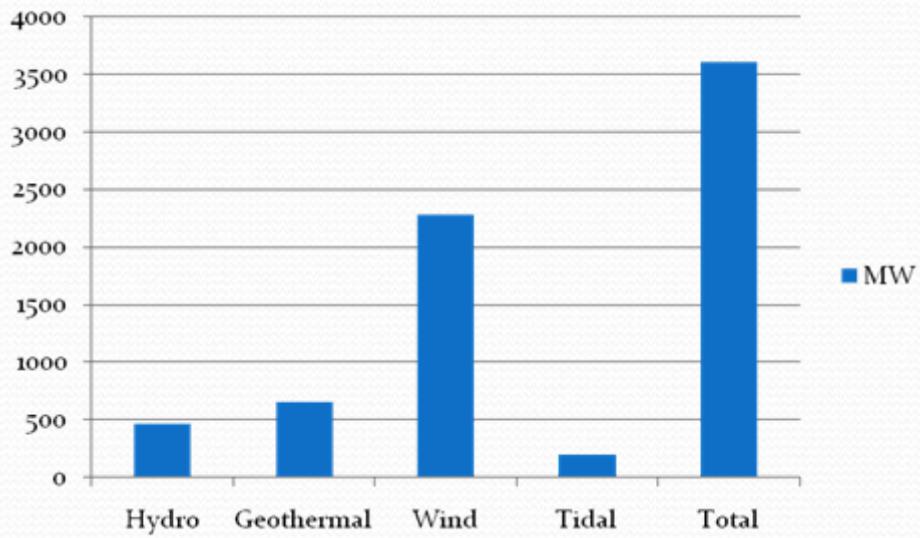
Recently installed, committed, under consideration

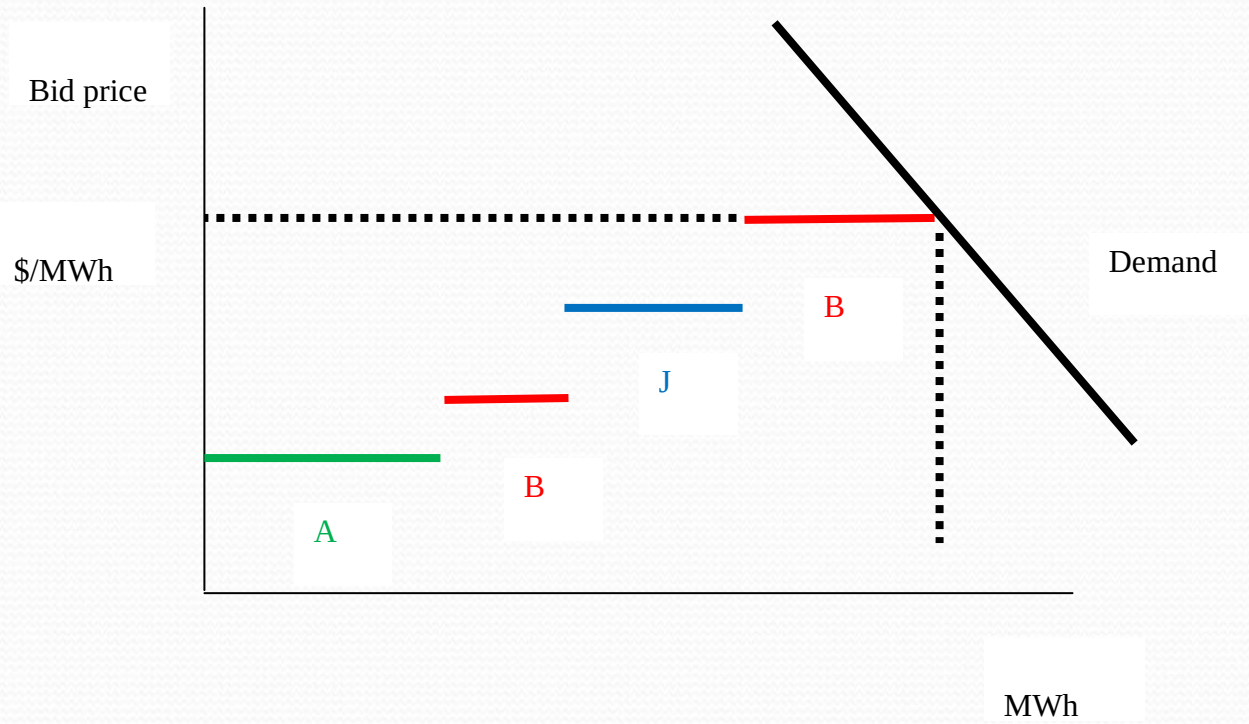


Plant costs

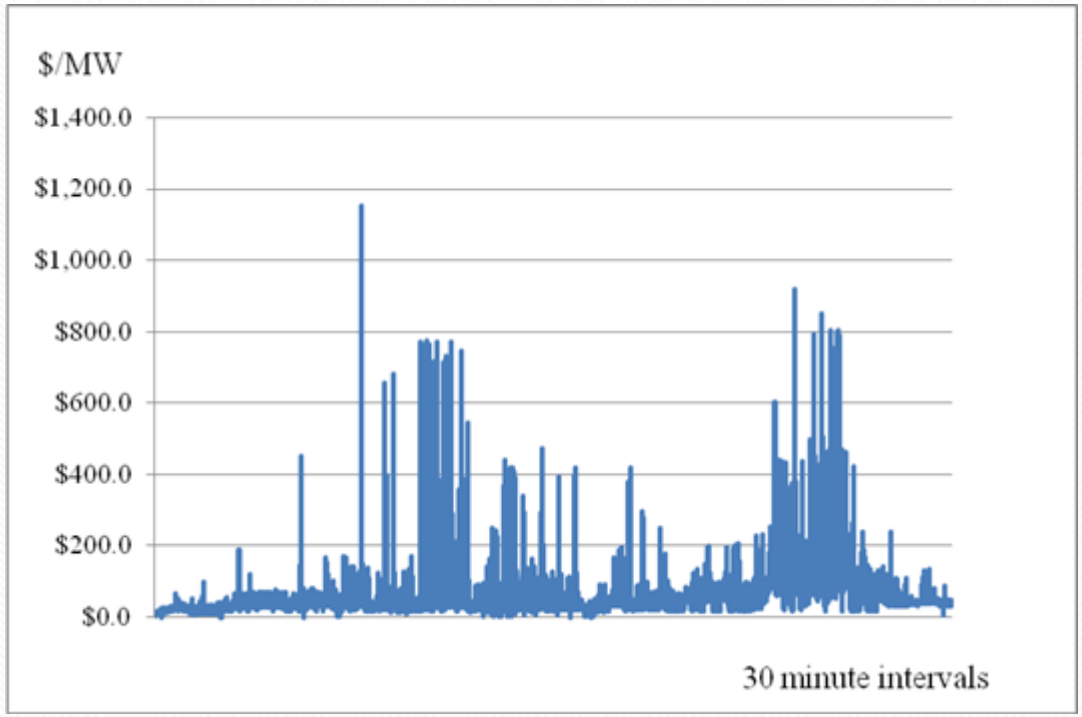
	Plant size	
Geothermal plant	**20 MW**	**50 MW**
Single pressure condensing	$2,200/kW	$1,900/kW
Double pressure condensing	$2,450/kW	$2,100/kW
Organic Rankine Cycle	$2,700/kW	$2,700/kW
Hybrid steam & Organic Rankine Binary	$2,600/kW	$2,200/kW
Wind		
Approximately NZ$2m/MW	$2,000/kW	

Source: SKM (2009)
Note: Costs are in 2007 NZ dollars

Balancing supply and demand



Prices: Wairakei Plant 2000 – April 2009



Regional economics

- Regional & local impacts
  - Capturing benefits:
    - Local infrastructure and business
    - Depends on scale, source of materials
    - Agreements with land owners
- Employment opportunities
  - Typically use multipliers to capture expected employment during construction & operation
- Income
  - Multipliers
- Agreements with local community to derive employment, income, education, …, benefits

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Concluding Comments

- Policy
  - Geothermal, wind, tidal, solar & biomass renewable:
    - Integration into supply
    - Challenges: access; intermittent supply; externalities; obtaining consent (Lamermoor decision)
  - Climate change: investment option
  - Resource Management Act
    - Quality of consents
    - Managing externalities
- Development
  - Demand growth ~ 1-2% per year
  - Is scale and timing efficient?

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Concluding comments

- Achieving gains in energy efficiency -
  - Prices matter
  - Gains to be had through technology
    - Only 4% of energy used to power incandescent light bulb produces the light, rest is wasted.
- Carbon pricing
  - Will definitely facilitate change, if it comes about
- Should government's pick winners?
  - No, but at least agree that we should not pick losers to be winners.