



The New Zealand Society for Sustainability Engineering and Science

***The Sustainable Electricity Debate  
Enabling and disabling factors -  
What could upset the process?***

Gerry Te Kapa Coates



# Key drivers

- **Sustainability**
- **Climate change**
- **90% renewable electricity generation preference**



"I feel more confident than ever that the power to save the planet rests with the individual consumer."

- Denis Hayes, American Environmental Activist  
Coordinator of first April 22 Earth Day



Smil, V, Energy in Nature and Society: General Energetics of Complex Systems, MIT Press 2008

<b>Global Energy Fluxes</b>	<b>Total (TW)</b>	<b>Usable (GW)</b>	<b>Used 2005 (GW)</b>	<b>Comments</b>
<b>Solar radiation</b>	174,260		2	(excludes PV)
<b>Water</b>	11.7	1,700	750	(hydro)
<b>Wind</b>	2,000	6,000	60	(peak installed capacity)
<b>Ocean waves</b>	2		0	
<b>Ocean currents</b>	0.1	<5	0	
<b>Ocean thermal</b>	10	<0.1	0	
<b>Tides</b>	2.5	<10		
<b>Photosynthesis - biomass</b>	110	<3	1.5	(wood, charcoal, crop residues)
<b>Photosynthesis - land</b>	60	<5,000	<2,000	
<b>Photosynthesis - sea</b>	50	<1,000	0	
<b>Geothermal</b>	42	<3,000	15	
<b>Totals</b>		<b>&lt;16,718</b>	<b>&lt;2,828</b>	

**Total global anthropomorphic energy usage ~ 14TW.**

**Balance of 14 TW less 2.8 TW renewables (or 11.2 TW) presently comes from fossil fuels.**

The two most abundant forms of power on earth are solar and wind, and they're getting cheaper and cheaper...

- Ed Begley, Jr



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# Proposed exemptions from 90% renewables target

- for **non-baseload plant** .... for the purpose of **mitigating the effects of a present or future emergency**,
- for part of a **co-generation scheme** operating above prescribed energy efficiency levels,
- for a **combination of renewable energy sources and fossil fuels** where the fossil fuels will provide less than a prescribed proportion of the total fuel energy input in any 12-month period .....
- for **replacing an existing thermal electricity generation** plant which will be retired in whole or part and the new plant will reduce greenhouse gas emissions by at least 20% ..... whilst keeping security of supply above prescribed margins.

# New Zealand - a lucky country?



- **Renewable resources**
- **Fossil fuel reserves**
- **But no chance of interconnection**

“Australia’s the “lucky country”. New Zealand is the beautiful country, but unfortunately it’s full of Kiwis.

- Web Rugby League forum quote

# NZ oil and gas reserves

Source:

<http://www.crownminerals.govt.nz/cms/xls-library/petroleum-facts-figures/producing-oil-reserves.xls> etc



	Reserves - production fields (PJ)	Reserves – not yet producing fields (PJ)	Total reserves (PJ)	Annual usage 2007 (imported)	Years of reserve at current usage rate
Oil	565	562	1127	212 (imported)	5-6
Gas	1943	242	2175	168	41

"Energy Policy will be and should be driven by environmental policy in the future."

- Timothy Wirth, American Politician, Environmental Advocate  
President, Better World Campaign



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# Power planning?



- **Central or market-based?**
- **Incentives?**
- **Demand growth rate**

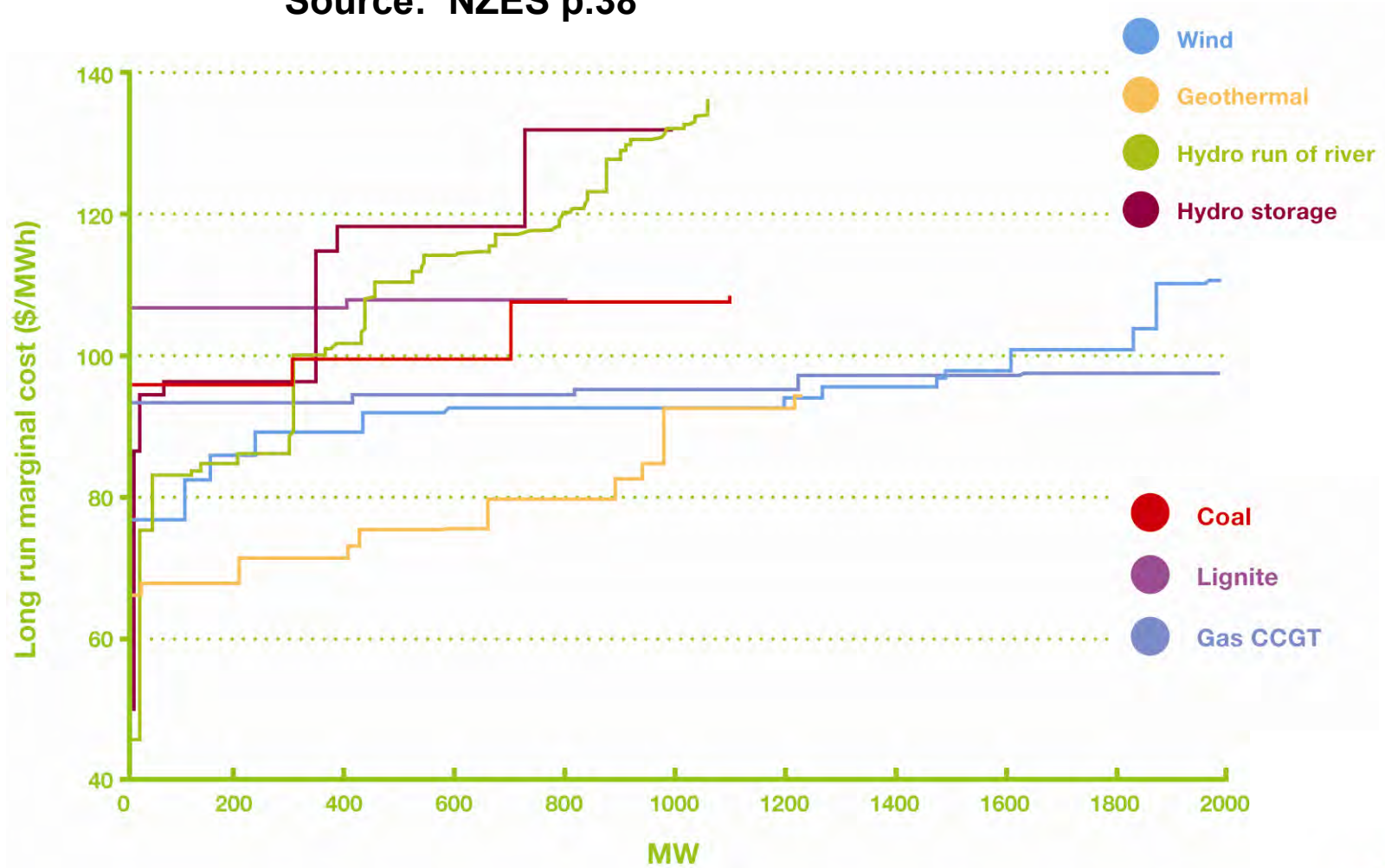
Under the rule of the "free market" ideology, we have gone through two decades of an energy crisis without an effective energy policy. Because of an easy and thoughtless reliance on imported oil, we have no adequate policy for the conservation of gasoline and other petroleum products. We have no adequate policy for the development or use of other, less harmful forms of energy. We have no adequate system of public transportation.

- Wendell Berry, American Writer, Farmer \_



# Typical costs for new generation (Aug 2007)

Source: NZES p.38



# Power planning?



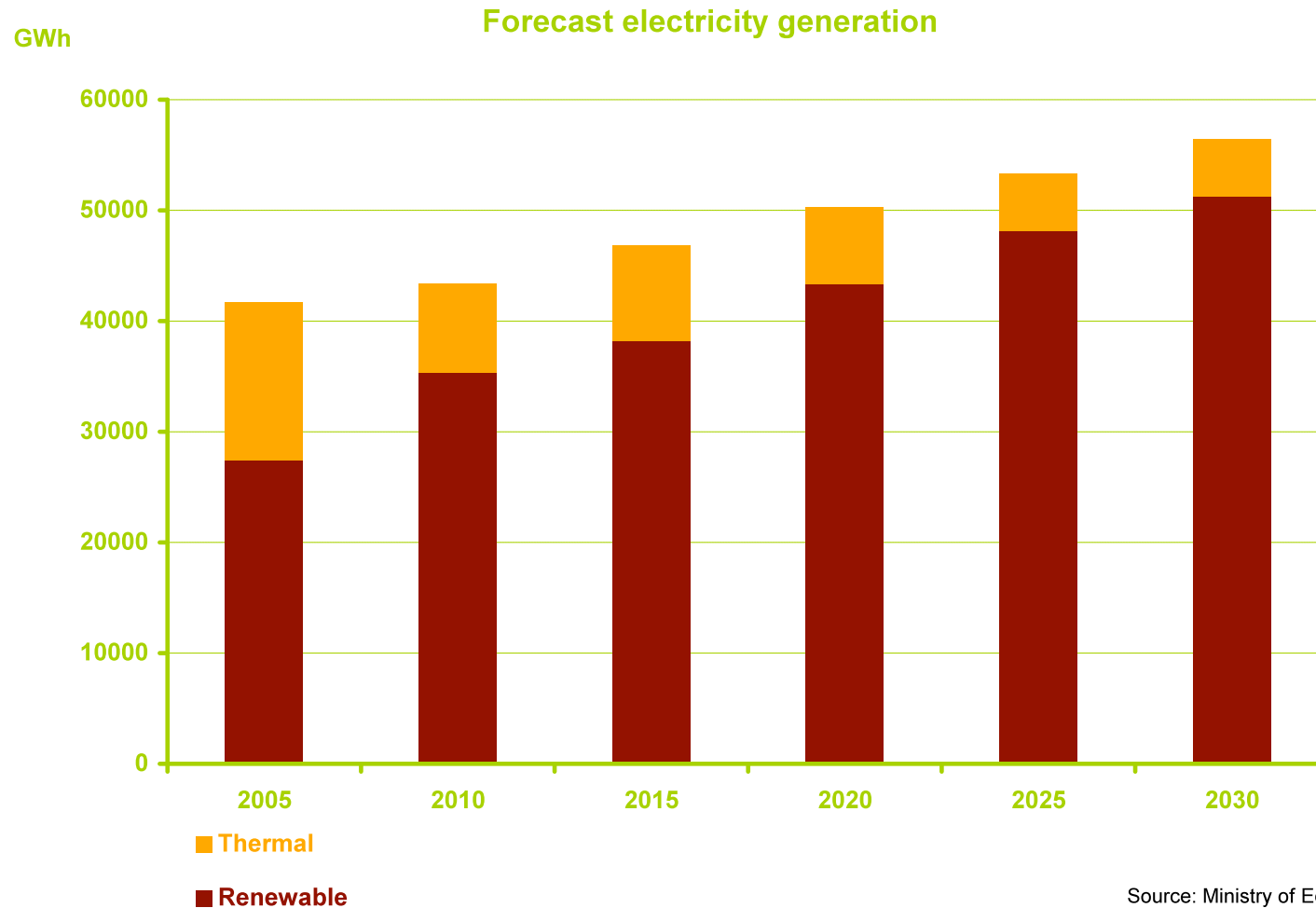
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# Forecast demand to 2030

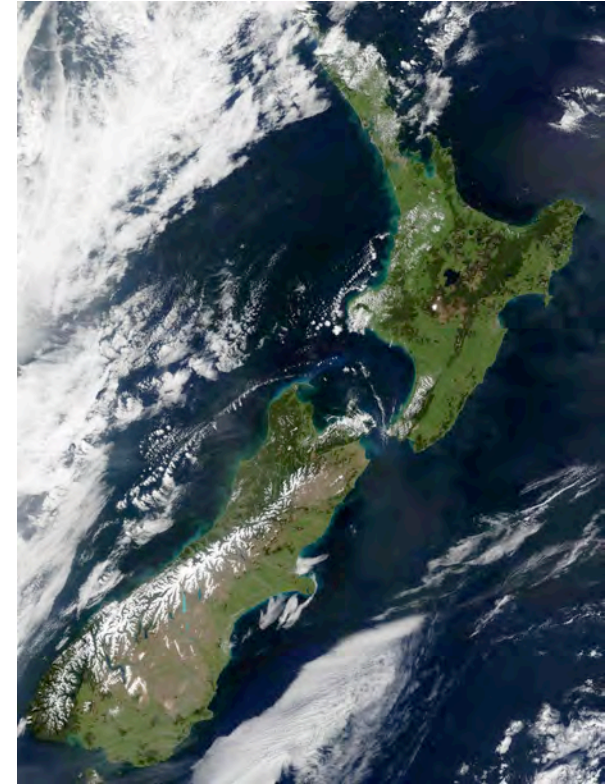


Source: Ministry of Economic Development



# Incentives to achieving the 90% target

- Emissions Trading Scheme
- Specific price incentives
- Rapid electrical vehicle uptake



The word "energy" incidentally equates with the Greek word for "challenge." I think there is much to learn in thinking of our federal energy problem in that light. Further, it is important for us to think of energy in terms of a gift of life.

- Thomas Carr, Testimony to US Senate,



# Possible barriers to achieving the 90% target – extraneous events



- A large natural gas discovery
- Consenting process delays
- Equipment supply constraints and price rises

“We simply must balance our demand for energy with our rapidly shrinking resources. By acting now we can control our future instead of letting the future control us.”

- Jimmy Carter, former President of the US

# Possible barriers (2) - the grid



- **Grid not robust enough to accept renewables**
- **HVDC connection charge and capacity problems**
- **Another “power crisis”**

"I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait 'til oil and coal run out before we tackle that."

- Thomas Edison (1847-1931)



# Possible barriers (3) - systemic

- Penetration rates for renewables
- System limits for a particular renewable
- Lignite or LNG use decision

Economic policies absorb almost the entire attention of government, and at the same time become ever more impotent. The simplest things, which only fifty years ago one could do without difficulty, cannot get done any more. The richer a society, the more impossible it become to do worthwhile things without immediate payoff.

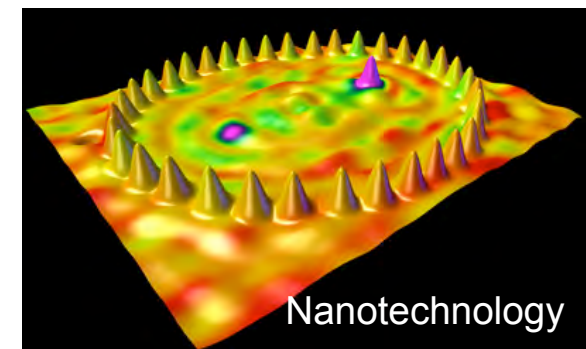
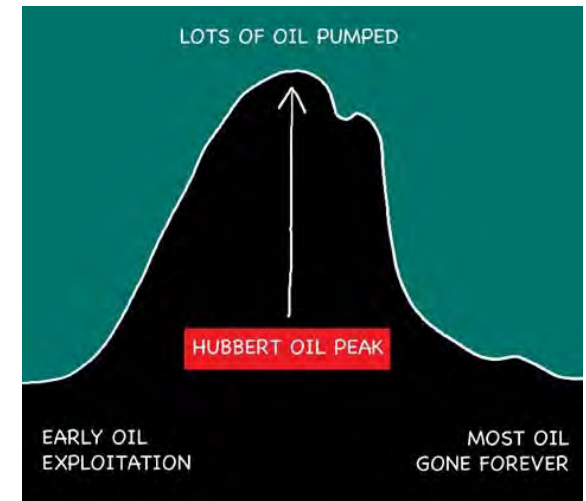
- E F Schumacher author "Small is Beautiful"



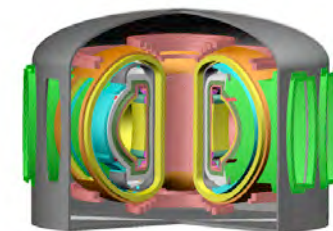


# Possible barriers (4) – wild cards

- Severe economic recession due to “peak oil”
- A technological “silver bullet”



Fusion power



"Rely on renewable energy flows that are always there whether we use them or not, such as, sun, wind and vegetation: on energy income, not depletable energy capital."

- Amory Lovins, Rocky Mountain Institute

# Summary

- **NZ is “lucky” in its resources**
- **300 MW a year of renewables is easily doable**
- **There are no intrinsic reasons why 90% can’t be met**
- **External factors may force a change of plan**
- **We have to become sustainable no matter what**

