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Policies to Facilitate the Evolution to a Sustainable Electricity Industry: *Reflections on the Australian Experience*

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Symposium on the Electrical Energy Evolution in China & Australia, Cairns, 30/7/08

www.ceem.unsw.edu.au

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Outline

- Global energy-related concerns
- Policy options to improve electricity industry sustainability:
  - Australian experience to date
  - Future directions – strengths & weaknesses
- Challenges in changing electricity industry technology to enhance sustainability
- Conclusions

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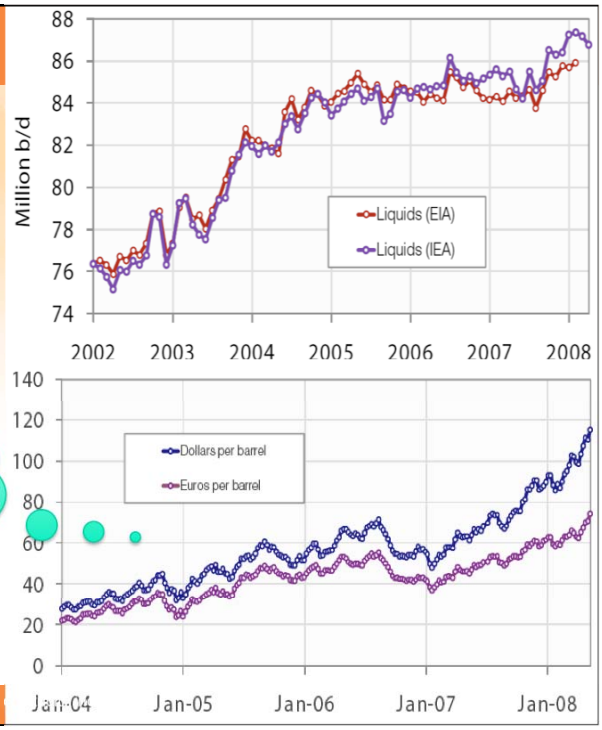
Oil production & price trends to April 2008

(Oilwatch Monthly May 08)
(www.theoildrum.com)

Growing demand & falling supply: Prices likely to rise further



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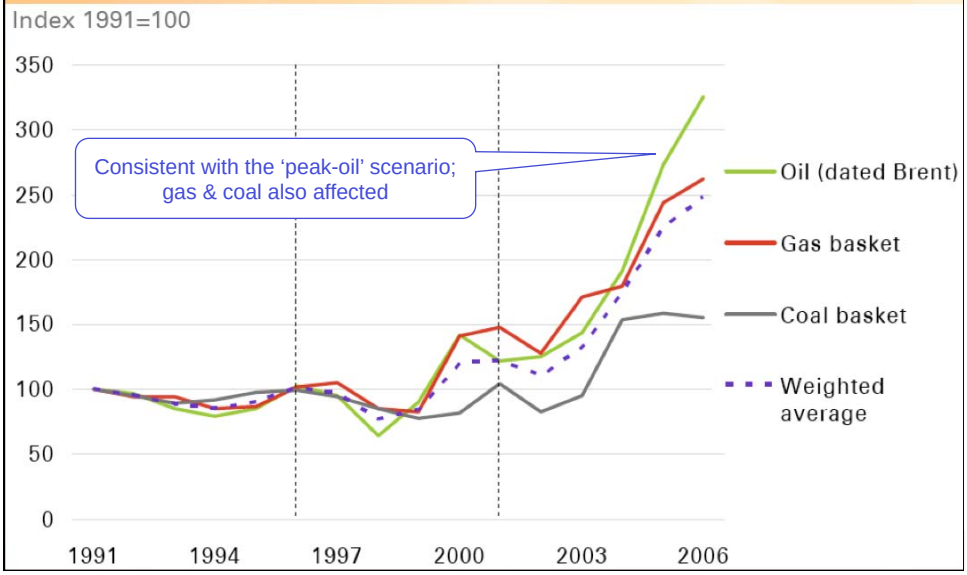
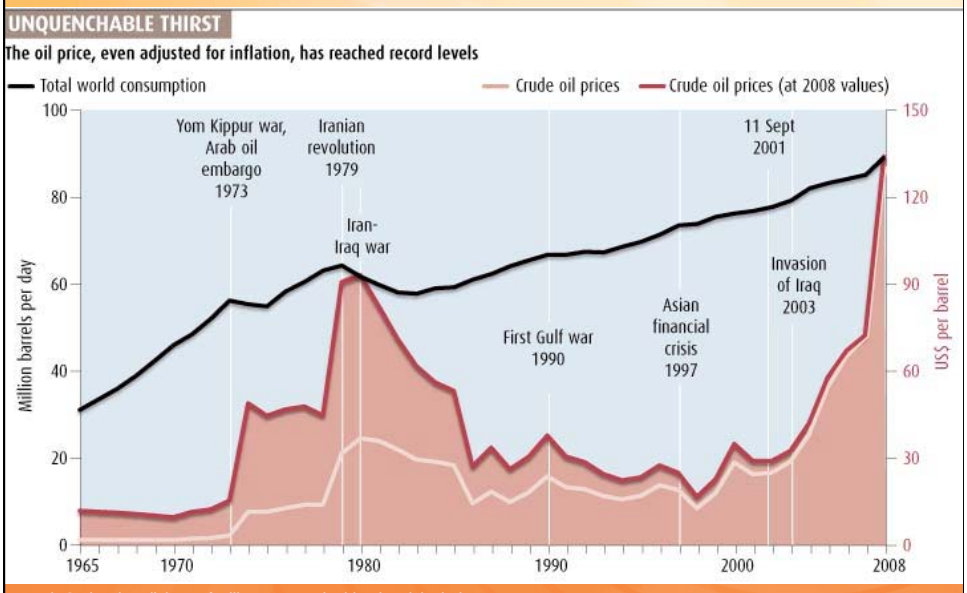
Prices for key energy commodities (BP Review 2007)



Oil price & production 1965-2008

(New Scientist, 25/6/08)



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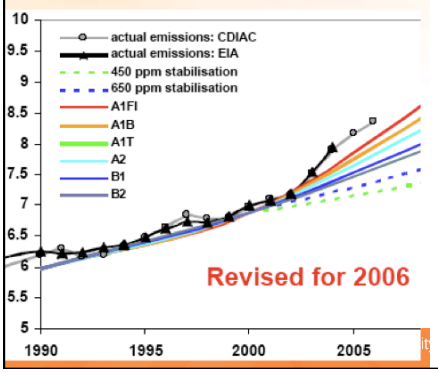
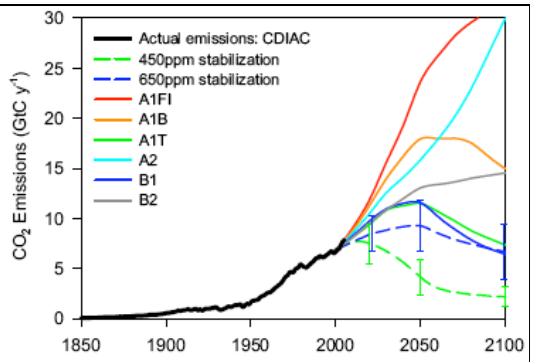
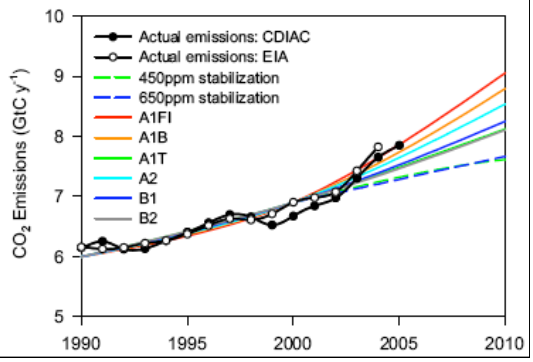
Actual emissions at or above "BAU"

(Raupach et al, PNAS, April 2007)

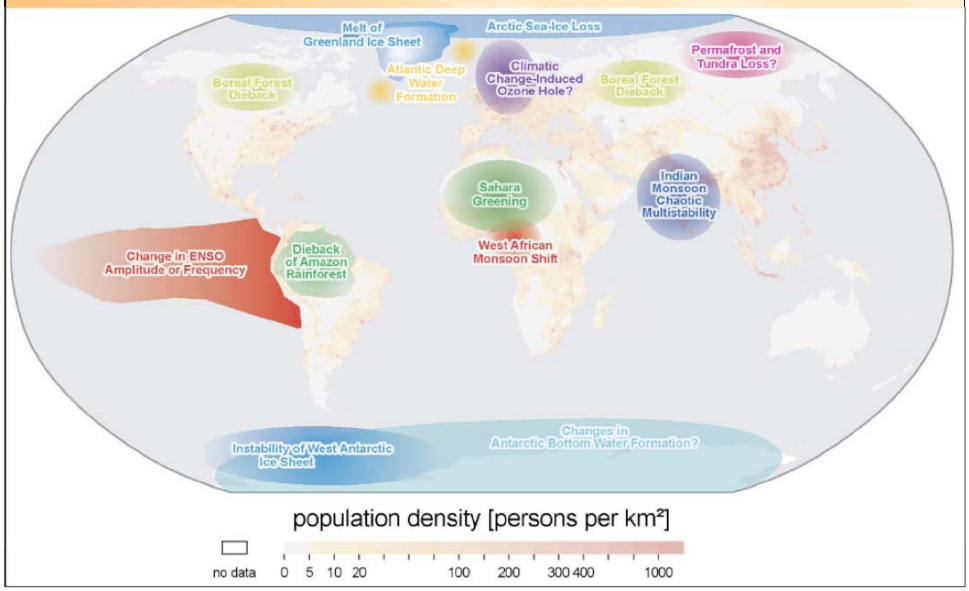
But need rapid decline

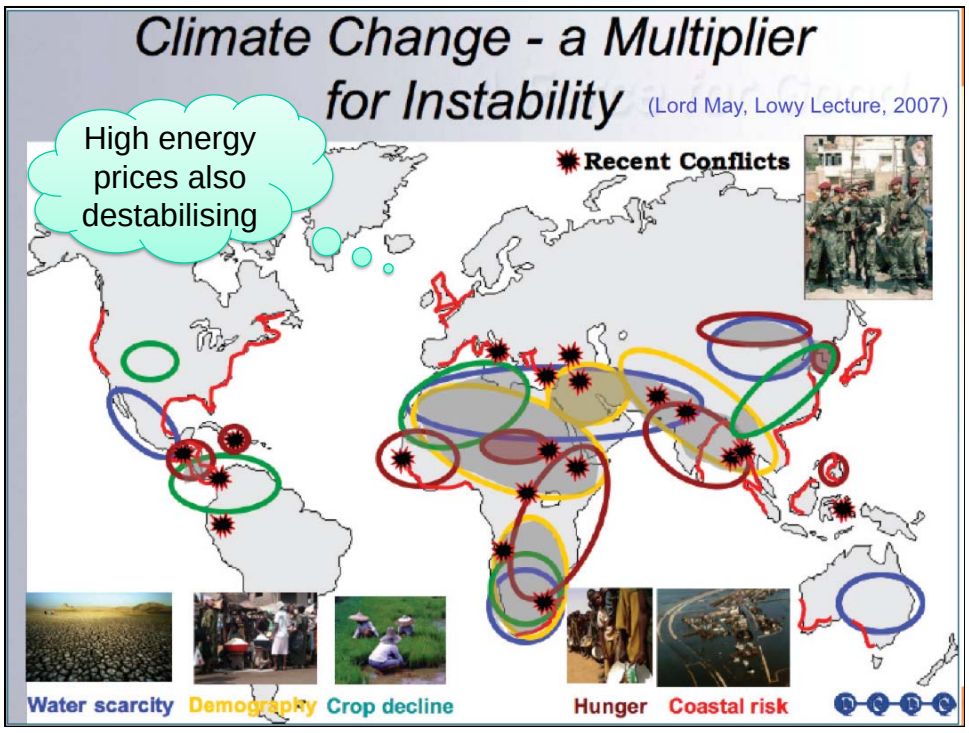


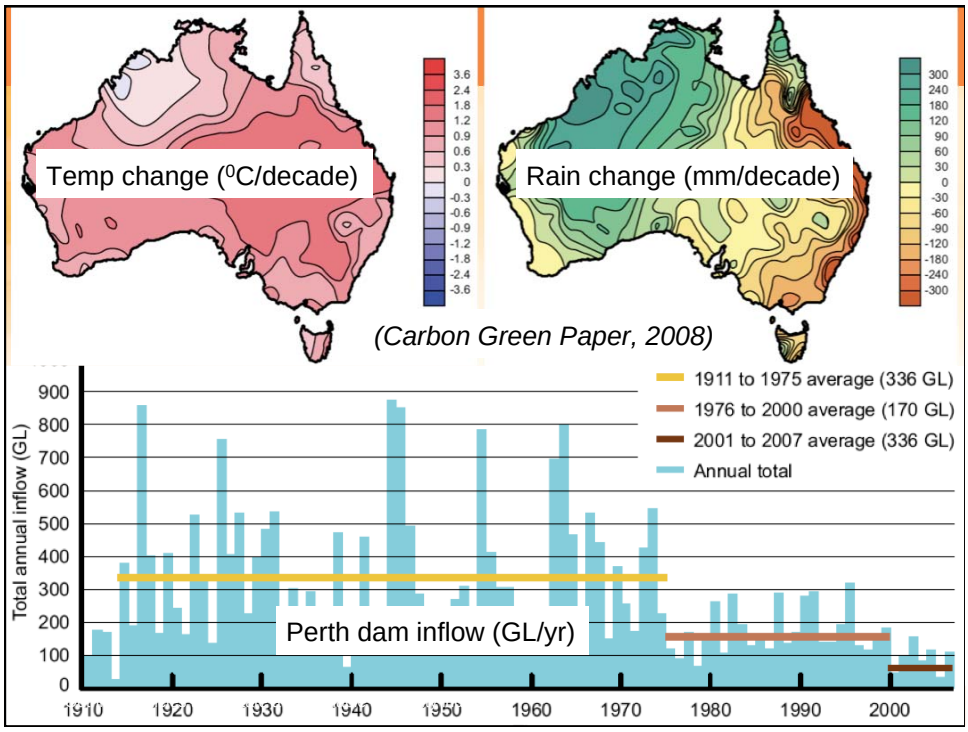




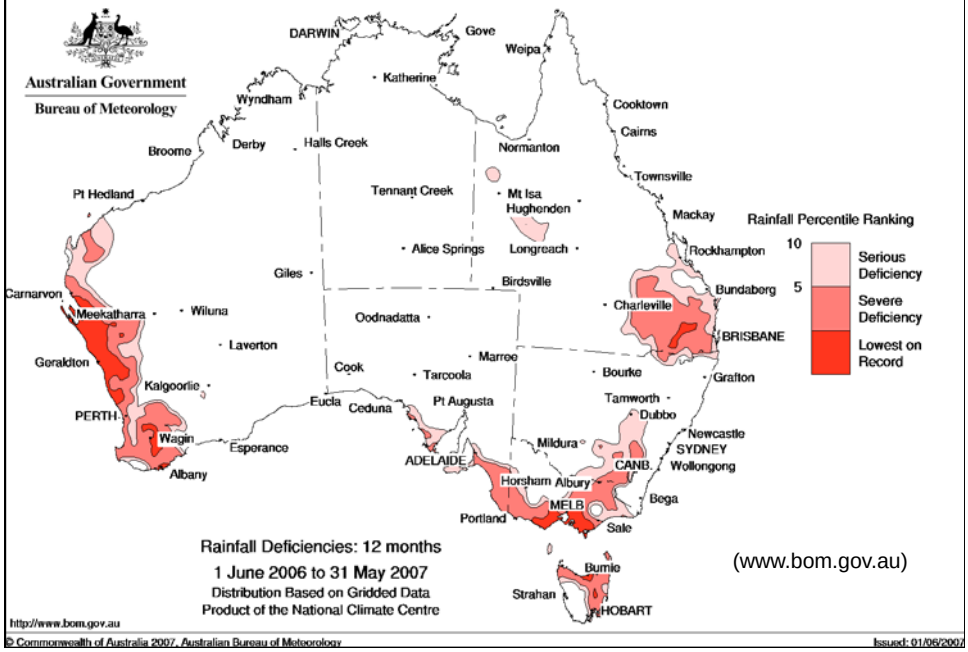
Potential climate change tipping points
(Lenton et al ,2008)







Drought & electricity gen'n (coal & hydro)



(www.bom.gov.au)

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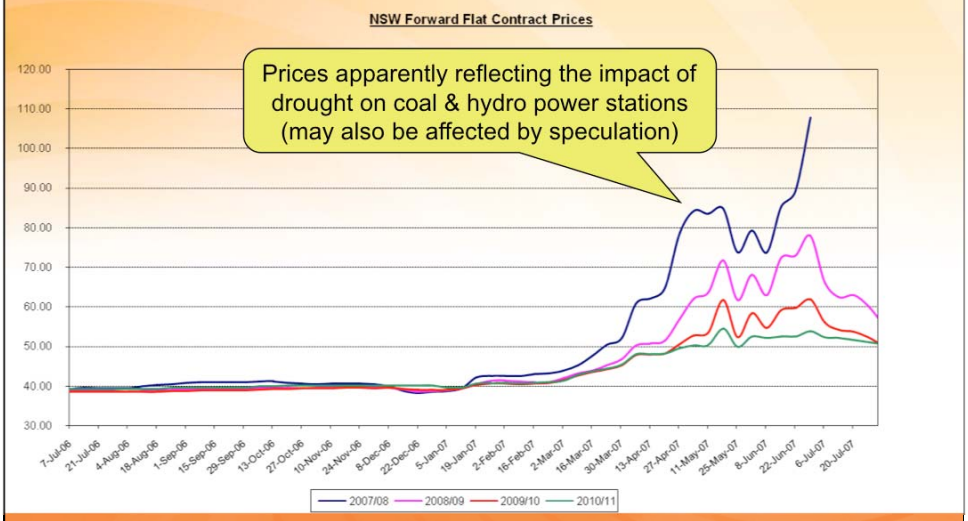
Flat annual CFD prices for NSW (NGF, 2007)



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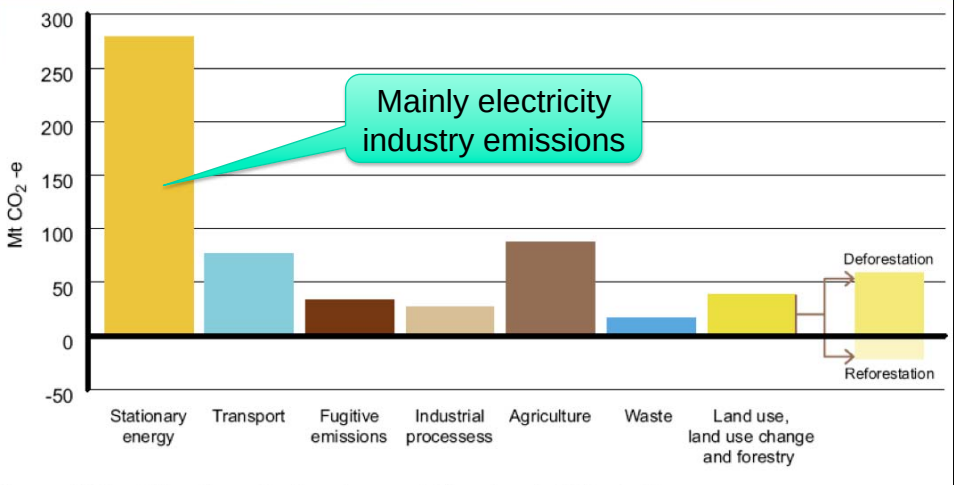
Australian greenhouse emissions, 2006
(Carbon Green Paper, 2008)



Source: National Greenhouse Gas Inventory 2006, Department of Climate Change

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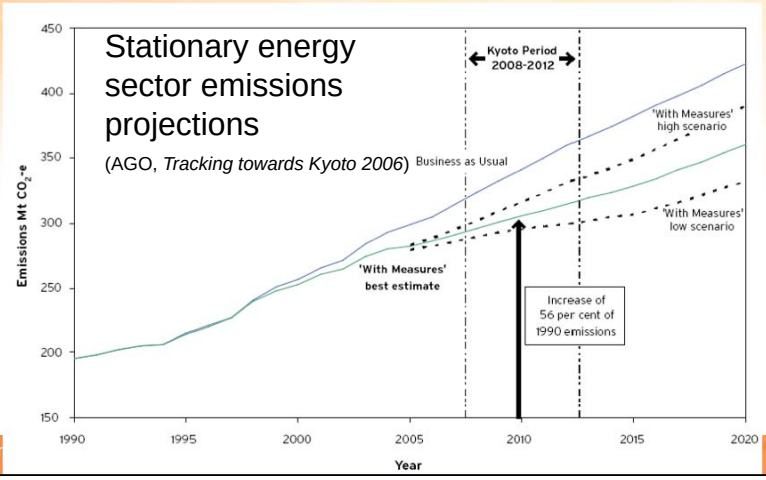
Rising Australian emissions scenarios

- Energy-related emissions climbing – 70% of total
  - Estimated +35% over 1990–2004, projected +56% in 2010
- Growing volume + value of energy exports



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Global fossil fuel flow constraints & climate change emissions

- Problems are far greater than politicians are willing to publicly admit
- Now faced with either:
  - Rapid but coherent global response to both problems
  - Severe social stresses within and between countries
- Near-term electricity industry options for Australia:
  - Coal-to-gas; proven renewable energy technologies; CHP; end-use efficiency; frugality *(of which frugality the most effective but least politically palatable)*

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Policies to enhance electricity industry sustainability

- *"Effective policies are those that support socially valued outcomes not only by harnessing selfish motives to socially valued ends but also by evoking, cultivating, and empowering public-spirited motives"* Gintis et al, 2005

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The most effective policy options depend on the context (Grubb, 2006)

	Voluntary, regulatory and systemic instruments	Economic instruments	Innovation instruments
Behaviour			
Substitution			
Technical innovation			

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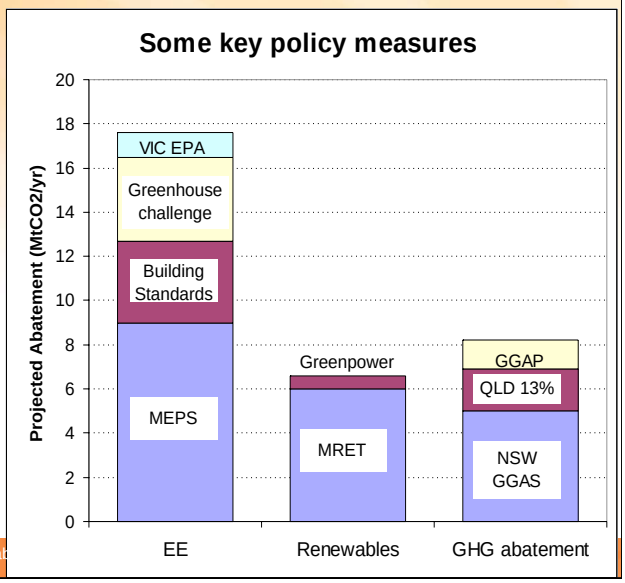
Australian emissions reduction Policies to 2007

Federal Govt:

- MRET
- NFEE
- RD&D funding for emerging techs

State Govts:

- NSW GGAS
- QLD 13% Gas
- VIC RET & EPA



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Energy efficiency policy

- NFEE
  - Stage 1: Seven implementation paths
    - Buildings (residential & commercial): Min. performance standards
    - Commercial and Industrial: Energy Efficiency Opportunities
    - Appliances and Equipment: Minimum performance standards
    - Government
    - Trade and Professional Training and Accreditation
    - Consumer Information; Finance
  - Stage 2: under consideration by CoAG/MCE
    - Could include broad based measures
- States:
  - VIC EPA license conditions: mandatory audit + action <3yr payback
  - NSW Energy Savings Fund (project funding + rebates on EE appliances)

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State renewable targets (Blake Dawson Waldron, July 2007)

Scheme	Target	Implementation	Period	Status
MRET (Federal)	Additional 9,500 GWh renewable electricity per year by 2010 (2.16% for 2007)	Renewable energy certificate scheme	To 2020	In operation since 2000
Victoria	10% by 2016 (additional 3,274 GWh per year by 2016)	Renewable energy certificate scheme	To 2030	Legislation commenced 1 January 2007. Operational rules not yet gazetted
NSW	10% by 2010 (additional 1,317 GWh per year) 15% by 2020 (additional 7,250 GWh per year)	Renewable energy certificate scheme	To 2030	Legislation to be introduced later this year
South Australia	20% by 2014	No details yet	No details yet	Framework legislation passed March 2007 – awaiting assent
Western Australia	15% by 2020 20% by 2025 (for the South West Interconnected Grid)	No details yet	No details yet	Legislation to be introduced
Queensland	6% by 2015 10% by 2020	Renewable energy certificate scheme	To 2030	Legislation to be introduced

QLD scheme to include other low-emission technologies

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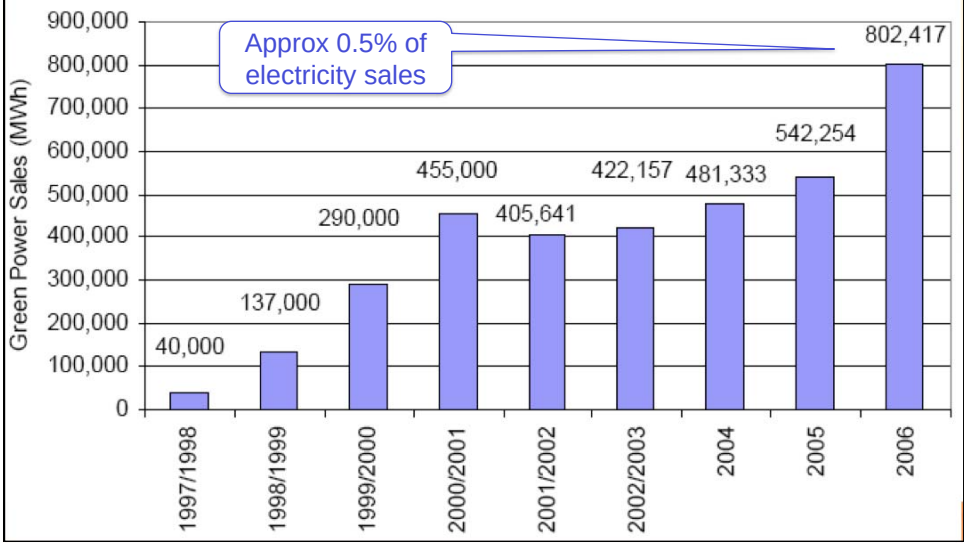
Green Power: Annual Sales (MWh)

(www.greenpower.gov.au)



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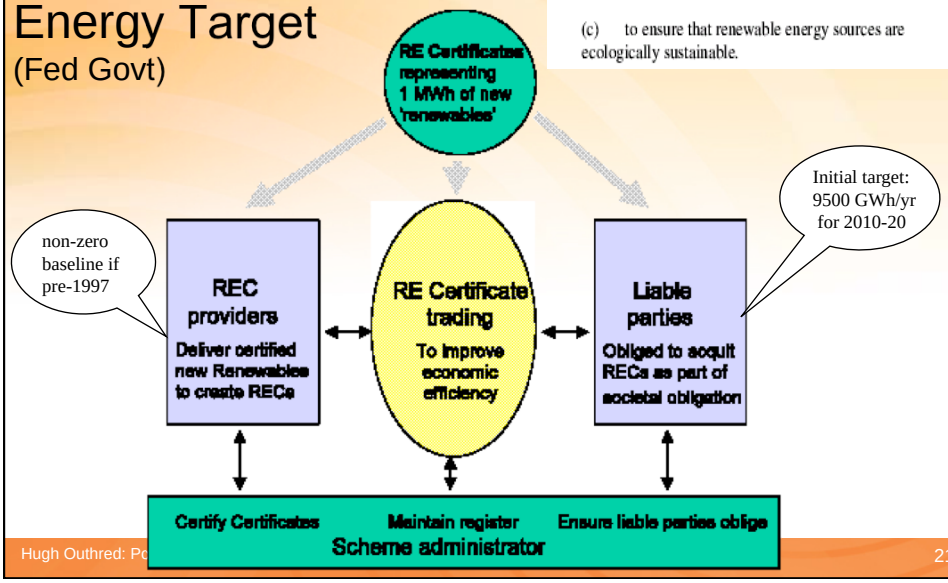
Mandatory Renewable Energy Target
(Fed Govt)

The objects of this Act are:

(a) to encourage the additional generation of electricity from renewable sources; and

(b) to reduce emissions of greenhouse gases; and

(c) to ensure that renewable energy sources are ecologically sustainable.



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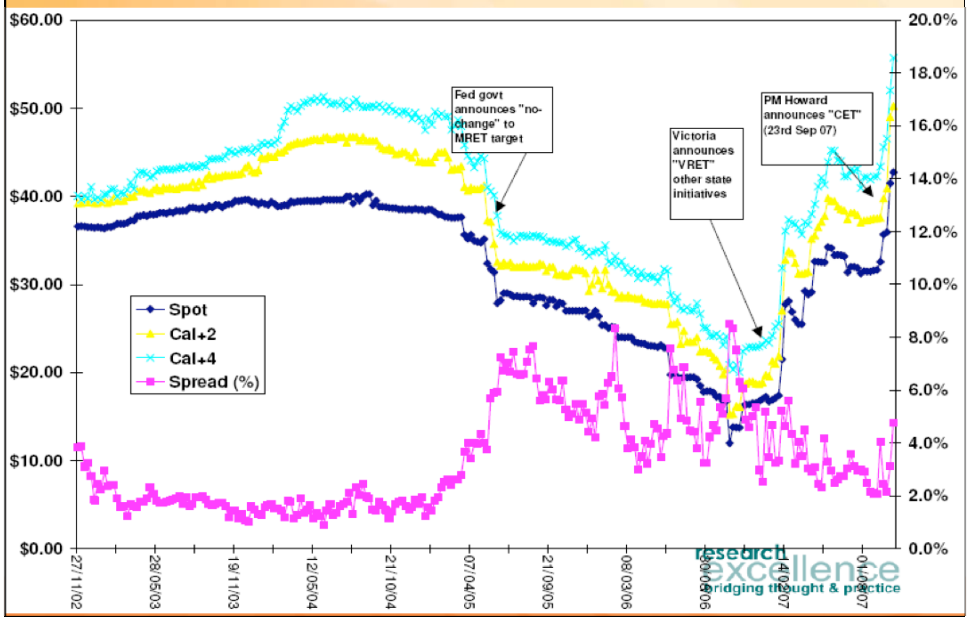
MRET performance to date

- Strengths:
  - Has promoted renewable energy generation:
    - About half income from selling energy and half from selling RECs
  - REC target easily met + considerable new investment
  - Apparent efficiency – highly competitive RECs market with low project costs by international standards
  - Technology flexibility has proved valuable
    - eg. biomass an expected winner but slow uptake in practice
      => wind + others filled the gap
- Weaknesses:
  - Windfall gains for 'old hydro'
  - Boom + Bust cycle due to fixed end-date (2020)
  - Policy uncertainty has also caused REC price volatility

REC market price outcomes

(Nolles, Garnaut Review Presentation, 2007)



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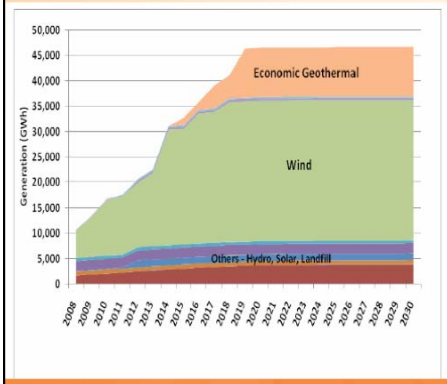
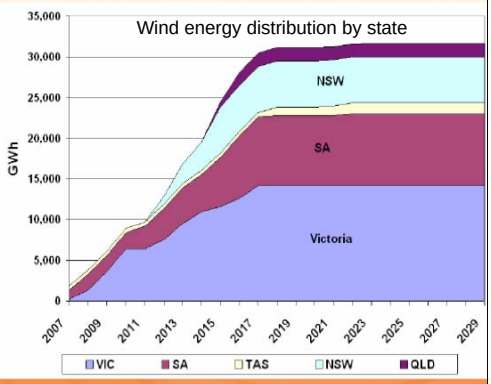
Proposed MRET target of 20% by 2020

- Rules still to be finalised but possibly >45TWH pa in 2020
- Possible high wind penetration in SA + Vic

(IES, *NSW Privatisation Conference*, 2008)





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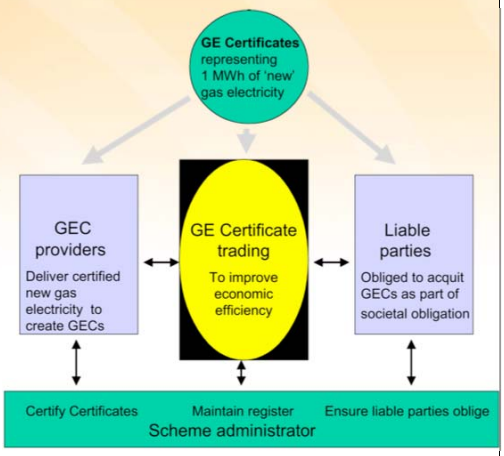
Qld 13% Gas Scheme (now 18% by 2020)

- Motivation
  - Concern about coal dependence
- Implementation
  - Retailers obliged to source >13% of elec. from 'new' gas -fired gen. after Jan 2005
- Performance to date
  - Qld now has considerable gas-fired generation + associated supply infrastructure



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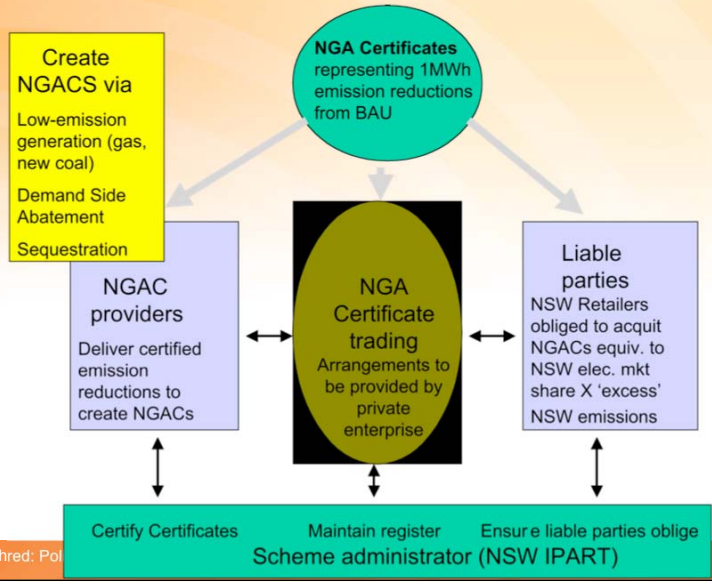
NSW GGAS Scheme



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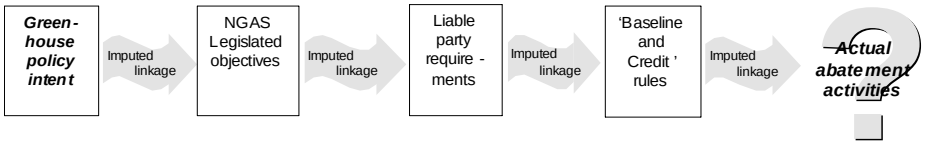
Challenges of GGAS design

- Highly abstracted design
  - major separation between policy objectives, commercial arrangements + physical outcomes
- Very wide scope
  - Adds complexity, dilutes accountability
  - Risks creating a 'market for lemons'



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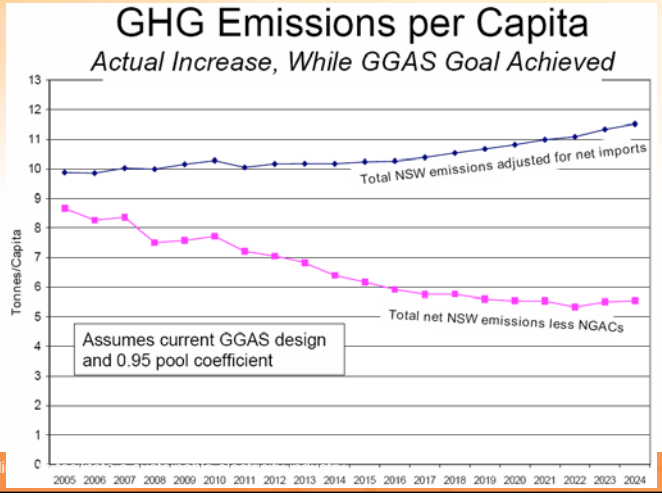
Environmental effectiveness?

- Example: A scenario of NSW GAS performance to 2025 (Nemtzow, NSW Power and Gas Conference, 2005)



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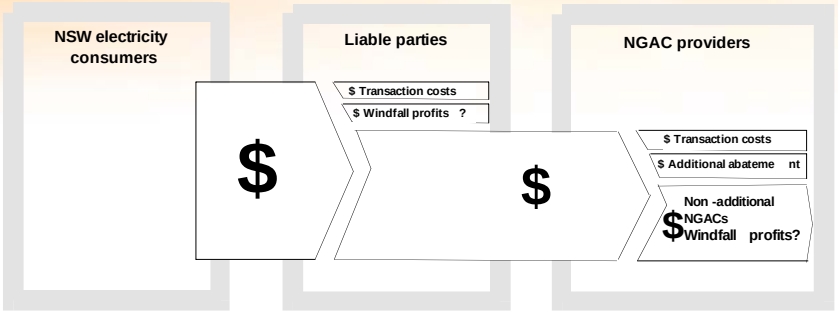
Efficiency + equity?

- Efficiency generally low when environmental effectiveness low
  - especially when high transaction costs + windfall profits
- Equity often threatened when environmental effectiveness low
  - Potential that some key stakeholders have captured the policy process



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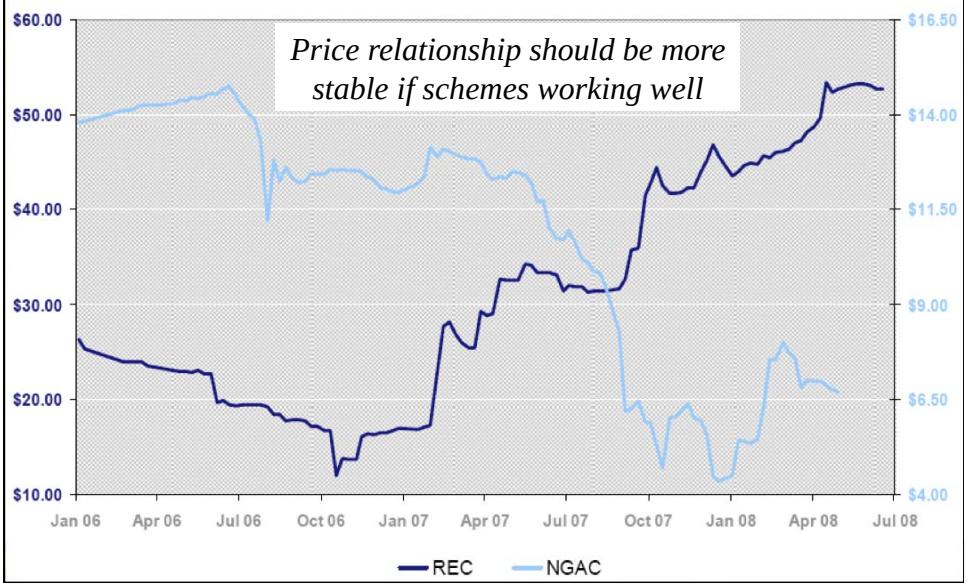
Price history – NGAC & REC (ANZ, 2008)



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Carbon permit trading schemes

- Surrender permits (eg 1 tonne CO2) equivalent to greenhouse emissions or pay a penalty
- Some design issues *(efficiency & equity):*
  - Scheme coverage (eg energy, agriculture, etc)
  - Measurement of actual emissions
  - Trajectory of future emissions cap (no. of permits released on an annual basis)
  - Permit allocation (free or auctioned) & compensation
  - Banking and/or borrowing of permits (inter-temporal)
  - Links to other comparable schemes
  - Efficacy of trading arrangements

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Emerging global carbon markets (ANZ, 2008)

Carbon Credit	Schemes	2006		2007	
		Volume (MtCO2e)	Value (US$M)	Volume (MtCO2e)	Value (US$M)
EUA	EU ETS	1101	$24,357	2061	$50,097
NSW	NGAC	20	$225	25	$224
CER and ERU	CDM and JI under the Kyoto Protocol	508	$5,477	832	$13,376
CFI	Chicago Climate Exchange	10	$38	23	$72
VER/VCU's	Voluntary	33	$146	42	$265
Total		**1,745**	**31,235**	**2,983**	**64,035**

- Turnover doubled from 2006 to 2007

Source: State and Trends of the Carbon Market 2008 – World Bank

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EU emission allowances – Dec 08 contract

(ANZ, 2008)

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Some lessons for market-based instruments

- Potential advantages in restructured energy industries but mixed success so far wrt effectiveness, efficiency + equity
- Weaknesses:
  - Hard to predict performance
  - Poor design choices can greatly impact effectiveness + efficiency
- Rigorous + transparent design process required with stakeholder management
  - Incumbency, information asymmetry + potential gaming of design
- Interactions between measures may reduce effectiveness
  - Economy-wide schemes will have many interactions
- Need transparent, liquid + efficient markets for price discovery + risk management
  - Derivative markets critical to support investment decision making

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Uncertainty in estimates of Australian climate change emissions

(4th Aust Communication to UNFCCC, 2005)

Category	Uncertainty
Stationary energy sector & transport	<10%
Fugitive emissions from fuels	5-20%
Industrial processes	10-30%
Agriculture	10-80%
Land use change & forestry	20-60%
Waste	50%
Aggregate inventory for 2003	±5%

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Climate change policy recommendations

- Coherent innovation strategy involving many options
  - Carbon capture & storage:
    - An important area of R&D but not ready for deployment:
      - Early in demonstration phase (eg. US Clean Coal)
      - IEA: best applications may not be in electricity
  - Renewable energy:
    - Ready now but needs support for innovation & deployment:
      - eg. expanded MRET, PVRP, Solar Cities, NER refinement
  - Embedded generation & energy efficiency:
    - Ready now but needs support for innovation & deployment:
      - eg. improved retail electricity market & ESCOs
- Emission price signal:
  - Tax preferred to cap & trade due to design challenges

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Technology-specific issues

- Coal-to-gas shift issues (including CHP):
  - Coordinating coal retirement & gas commissioning:
    - Made more complicated by NSW privatisation process
  - Potential gas resource & pipeline flow constraints with associated high gas prices
    - Impact on off-peak & average spot market prices
- End-use efficiency & frugality policies:
  - Reduced spot & derivative prices & volumes
- Rapid growth of wind energy to high penetration:
  - Security concerns may lead to operating constraints:
    - Tension between security & commercial regimes
  - May lead to volatile & often low spot market prices & volatile derivative market prices & volumes

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Key electricity industry issues for high-penetration renewable energy #1

- Structural issues:
  - Robust security regime with security-constrained dispatch
  - Efficient commercial regime (operation & investment)
  - Effective regulation of network services
  - Compatible arrangements for gas industry
- Development issues:
  - Innovation in renewable energy technologies
  - Forecasting for security & commercial regimes
  - Active end-user participation (value, timing, efficiency)
  - Education & training in all relevant areas

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Key electricity industry issues for high-penetration renewable energy #2

- Auction-style, security-constrained markets:
  - For spot energy, ancillary services **& derivatives**
  - Active end-users supported by ESCOs & equity policies
- Efficient network service regime:
  - Augmentation; availability & quality; distributed resources
- Renewable energy forecasting tools for:
  - Security, commercial & governance regimes
- Internalisation of un-costed fossil fuel externalities:
  - Carbon taxes or rigorous emissions trading scheme
- Electricity demand responsive to fluctuating supply

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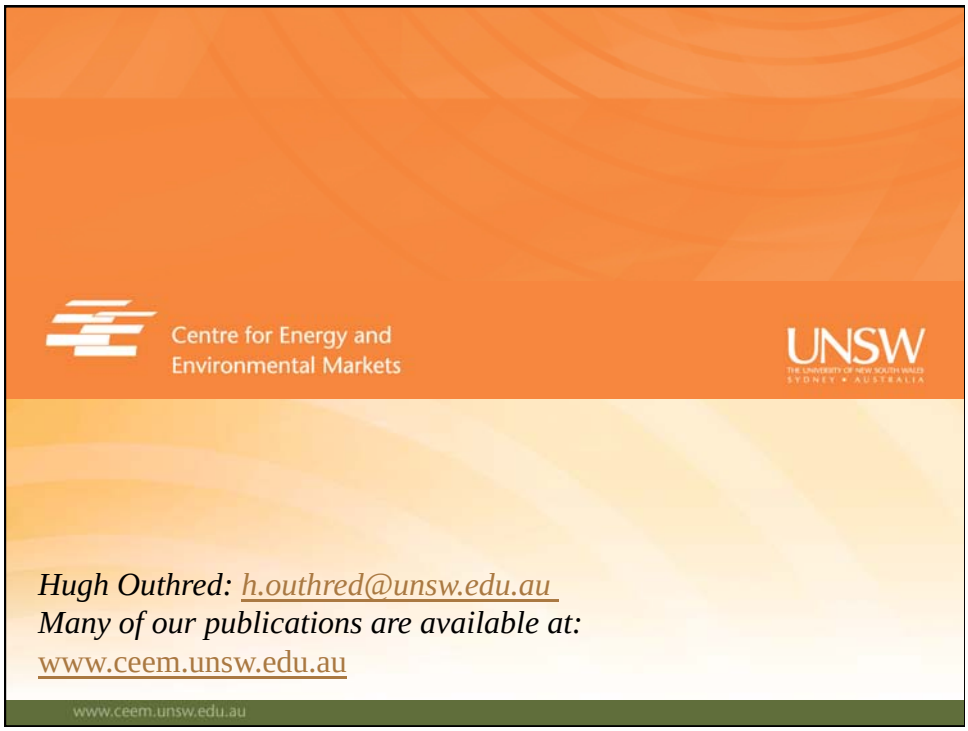
Conclusions

- Electricity industry is a key source of greenhouse emissions, which must be urgently reduced:
  - *Primarily a question of intra- & inter-generational equity*
- Key near term options are frugality, end-use efficiency, coal-to-gas & renewable energy:
  - *Require advanced electricity industry restructuring*
- Emission taxes & associated industry & equity policies preferred to emission trading:
  - *Concerns about the efficacy & equity of emission trading*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