



Centre for Energy and
Environmental Markets

UNSW
THE UNIVERSITY OF NEW SOUTH WALES
SYDNEY • AUSTRALIA



Renewable generation in the National Electricity Market, and related environmental markets

Iain MacGill, Research Coordinator, CEEM

CIVL4815, University of Sydney

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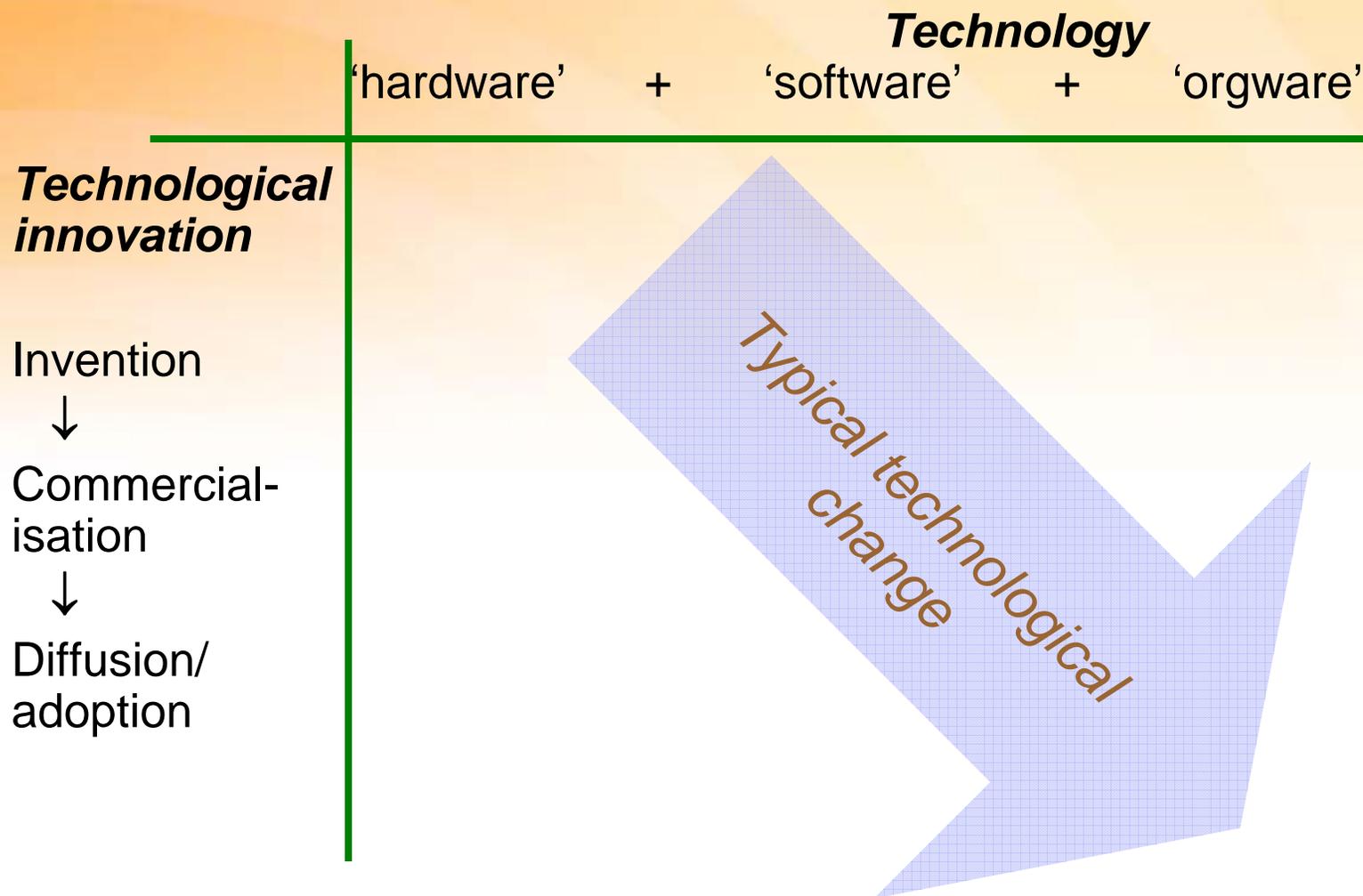
CEEM established ...

- *to formalise* growing interest + interactions between UNSW researchers in Engineering, Commerce + Economics, Arts + Social Sciences, Science, AGSM, IES...
- *through Research Centre* undertaking research in interdisciplinary design, analysis + performance monitoring of energy + environmental markets, associated policy frameworks
- *in areas of*
 - Physical energy markets (with an initial focus on ancillary services, spot market + network services for electricity + gas)
 - Energy-related derivative markets (financial + environmental including interactions between derivative and physical markets)
 - Policy frameworks and instruments in energy and environment
 - Experimental market platforms and AI ‘intelligent agent’ techniques to aid in market design
 - Economic valuation methodologies
- www.ceem.unsw.edu.au



Some dimensions of technological change

(IIASA)





The need for innovation policy

- Technological change is too important to leave to:
 - *Imperfect markets*: currently have severe climate *externality* failings, generally under-deliver R&D, more systemic problems too..
 - *Technology ‘champions’*: dangers of undue techno-optimism
- Government policy roles in:
 - *Invention*: support R&D into promising socially beneficial yet unproven technologies
 - ***Commercialisation***: support demonstration and initial deployment of promising, technically proven, technologies
 - ***Diffusion/Adoption***: ensure markets reflect societal prefs



Federal Government technology assessment

- Not clear what criteria applied, process by which established

Table 2: Technology assessments

Market leader	Fast follower	Reserve
Play a leading role in international R&D efforts.	Strongly position Australia to follow international developments quickly.	Position Australia to monitor international developments and follow as needed.
Energy supply technologies		
Advanced brown coal	Advanced black coal	Hydrogen
Geosequestration	Natural gas	Tidal
Hot dry rocks	Wind	Large-scale hydro
Photovoltaics	Biomass	Nuclear
Remote area power systems	Wave	
Coal mining and extraction		
Energy demand technologies		
Solid Oxide Fuel Cells	Intelligent transport systems	Other fuel cells
	Energy efficiency	
	Advanced conventional vehicles	
	Hybrid electric vehicles	



Australia's current innovation policy

- Climate change + energy initiatives *White Paper, 2004*
 - \$500m low emissions technology demonstration fund
 - \$100m renewable energy development initiative
 - \$75m solar cities
 - \$27m on low emission technology and abatement
 - \$13m on local greenhouse action
 - \$20m on advanced energy storage technologies for electricity from intermittent sources
 - \$14m to develop wind forecasting system
 - Improving grid accessibility
 - **Continue with present MRET**
 - **No Emissions Trading or Carbon taxes**



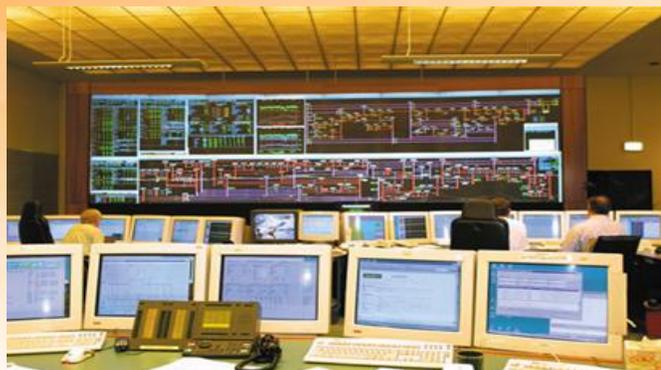
The market for demonstration funds...

- REDI Merit Criteria
 - management capability of the customer
 - commercial potential of the project
 - technical strength of the project and the technical capability and resources available to the customer
 - extent to which the project is likely to provide national benefits
 - the need for funding
 - potential for greenhouse gas abatement.

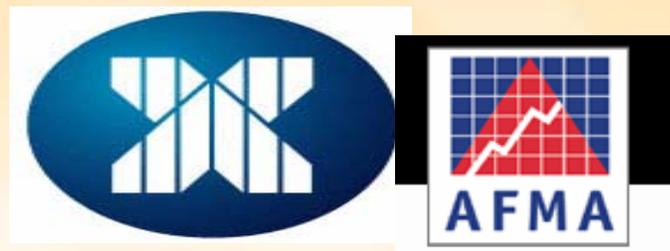


For commercial renewables, potentially many markets...

Electricity Spot Market



Derivatives Markets



Carbon markets.....



Renewable Energy Markets





Australia's National Electricity Market

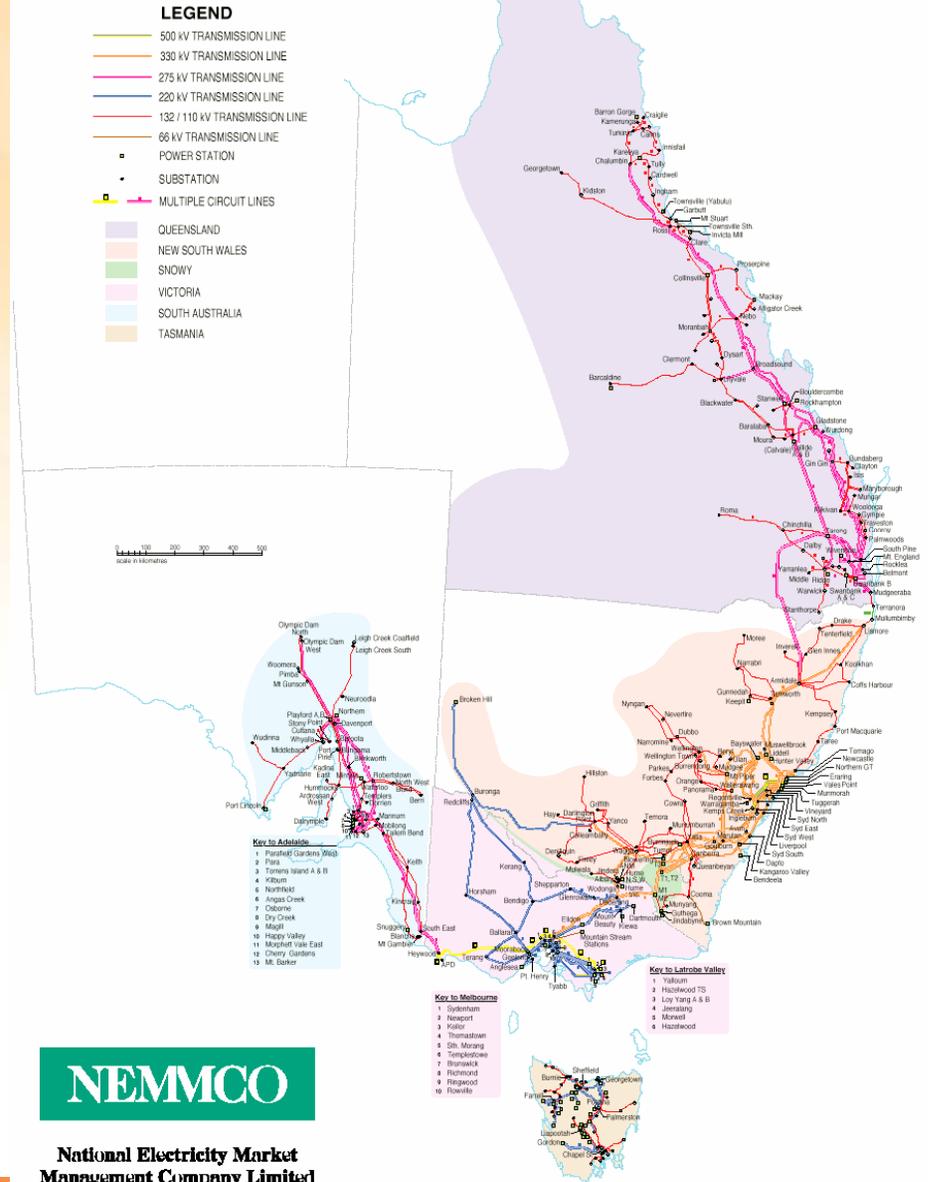
- NEM covers all participating states:
 - A multi-region pool
 - Ancillary services, spot market & projections
 - NEM doesn't formally include forward markets
 - Operated by NEMMCO (owned by states)
- Compulsory participants in NEM:
 - All dispatchable generators & links > 30 MW
 - Network service providers & retailers
 - Contestable consumers may buy from NEM



Scope of the NEM

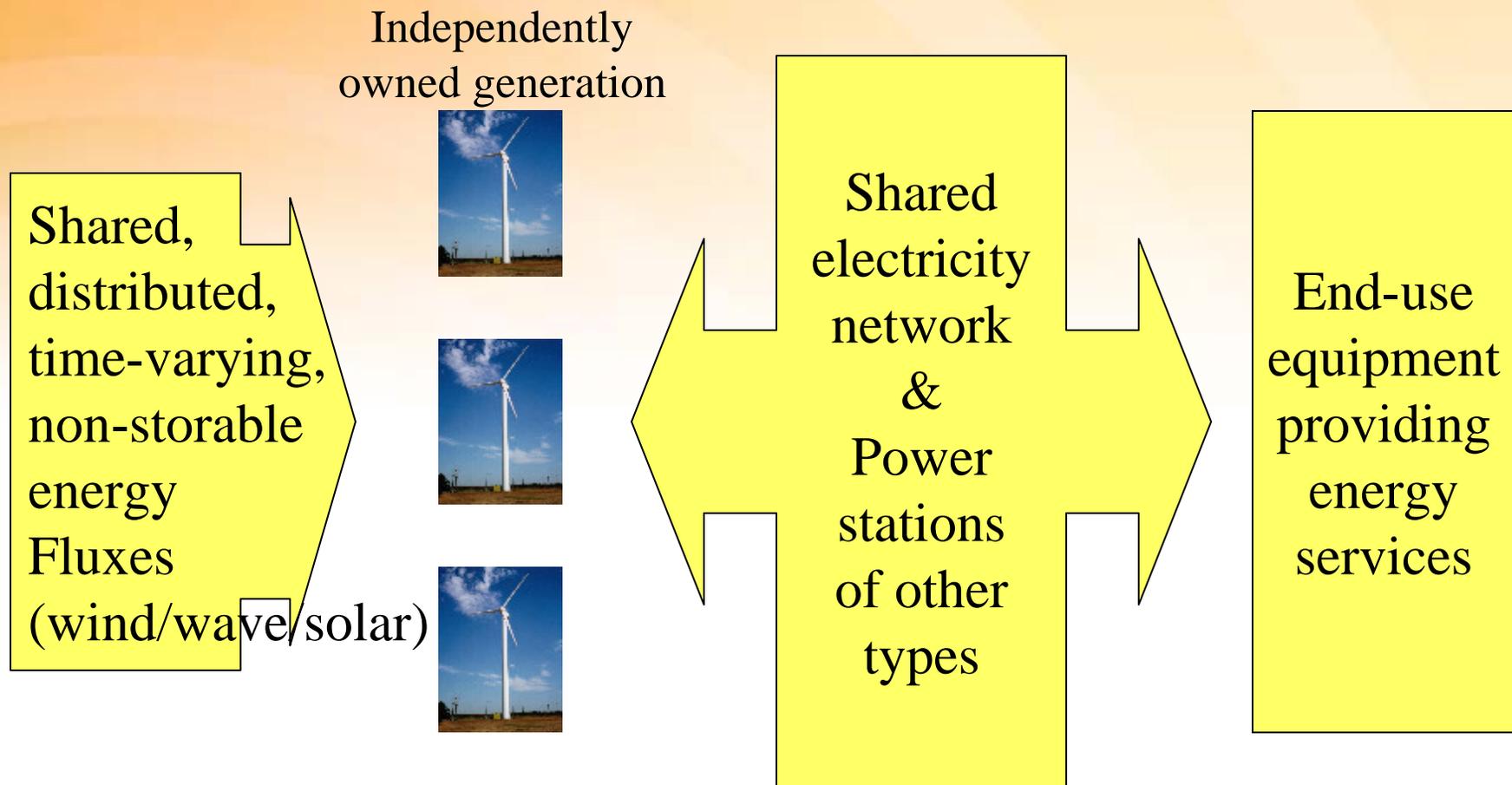
- Queensland
- New South Wales & ACT
- Victoria
- South Australia
- Tasmania (on connection to the mainland)

REGIONAL BOUNDARIES for the NATIONAL ELECTRICITY MARKET



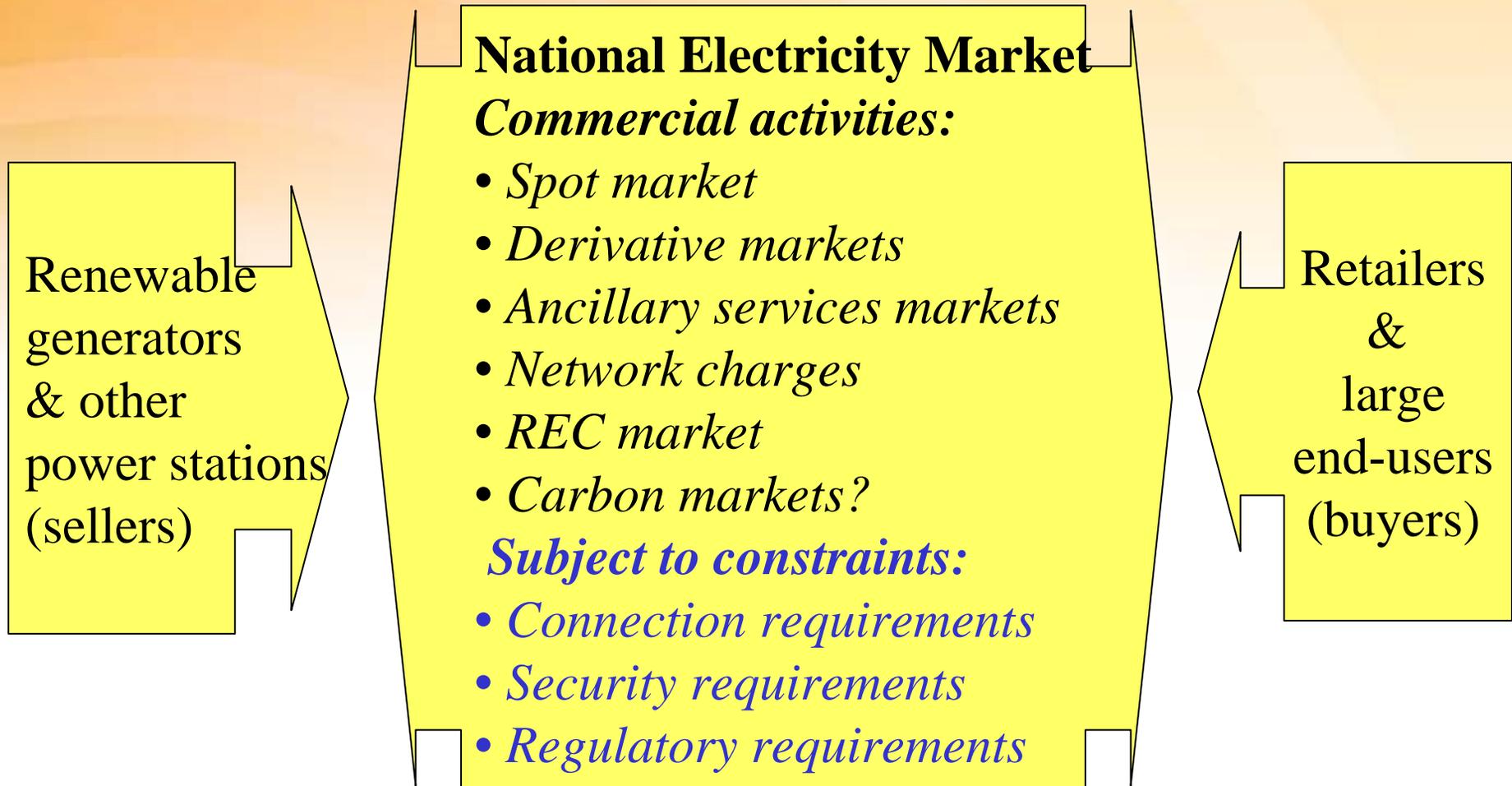


Physical context for intermittent renewables - power system integration



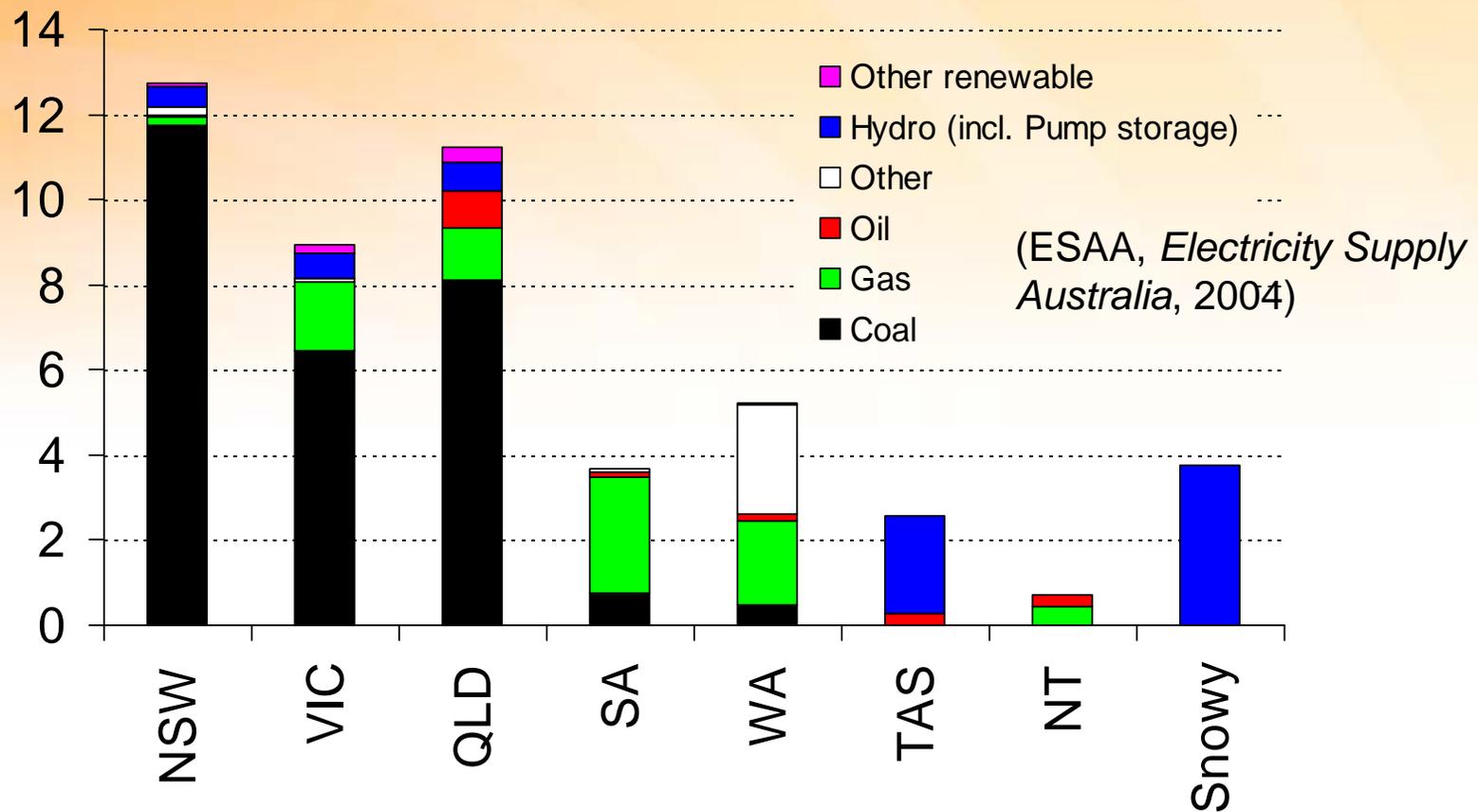


Commercial context for intermittent renewables - power system integration in NEM





Installed capacity mix



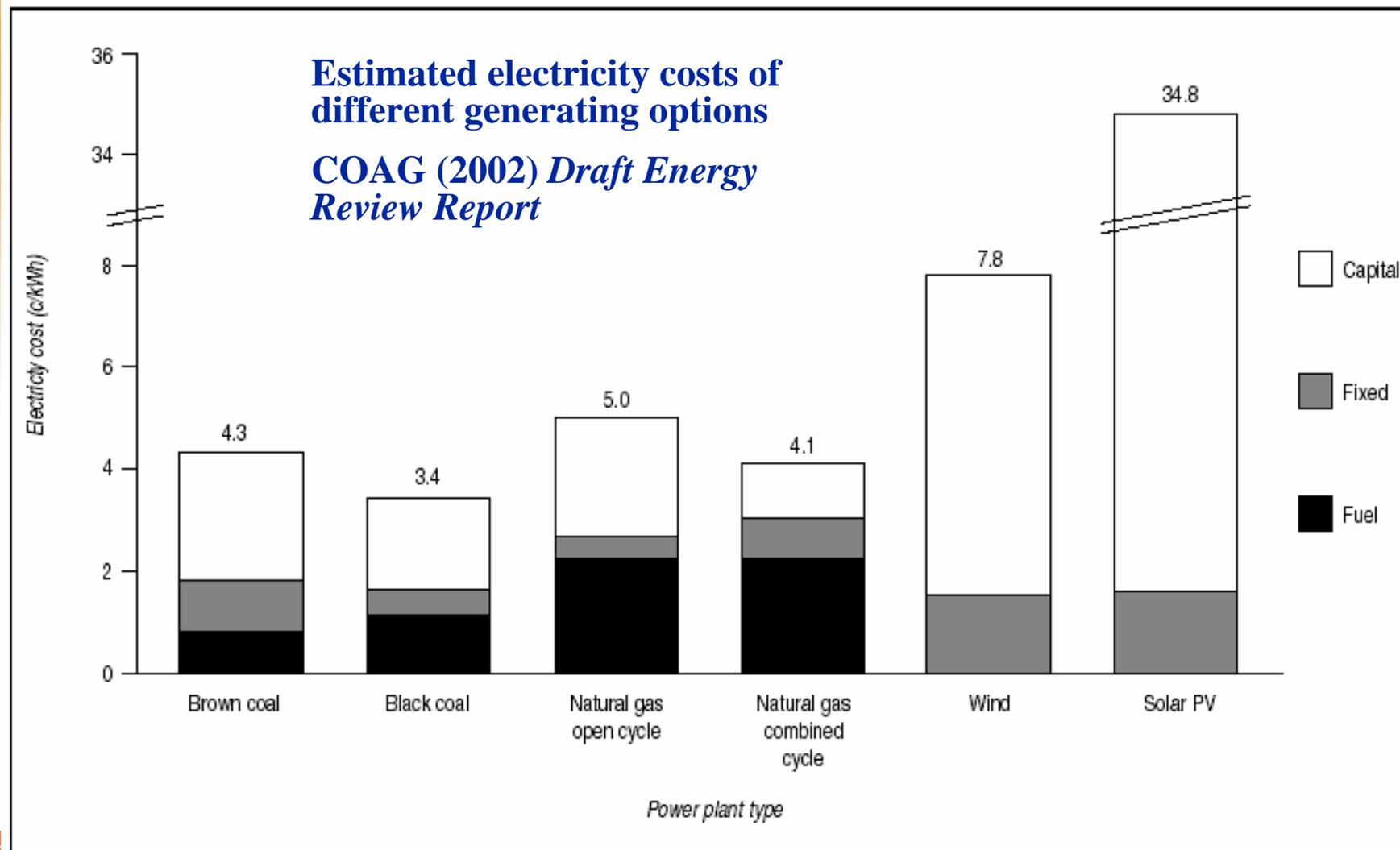


Equal consideration – National Electricity Code

- Objectives
 - Market should be competitive
 - Customers should be able to choose with which supplier they trade
 - Any person wishing to do so should be able to gain access to the interconnected T&D network
 - A person wishing to enter the market should not be treated more or less favourably than incumbents
 - A particular energy source or technology should not be treated more or less favourably than another energy source or technology
- However, hard to achieve in practice

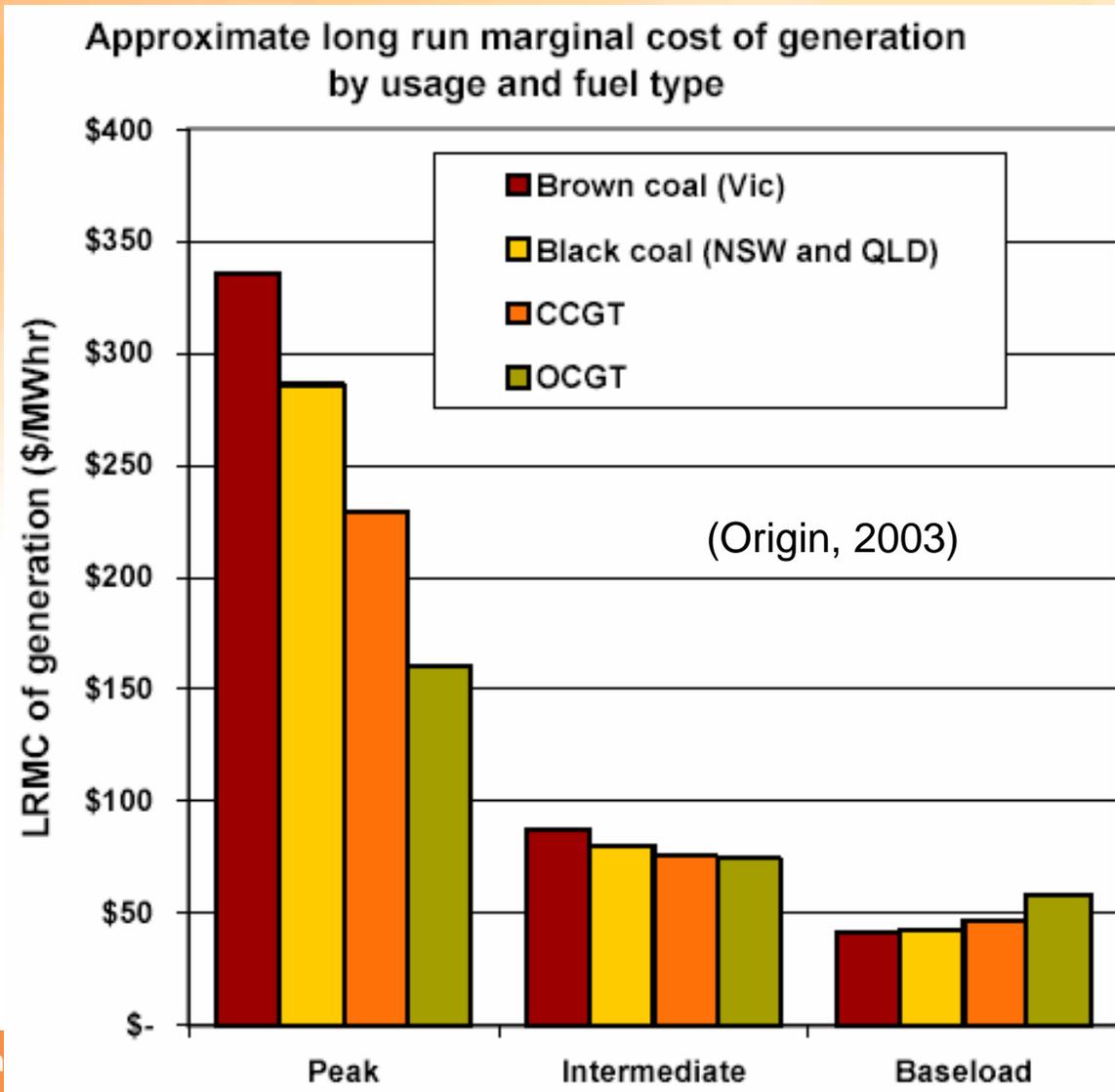


The competition - generator costs in Australia



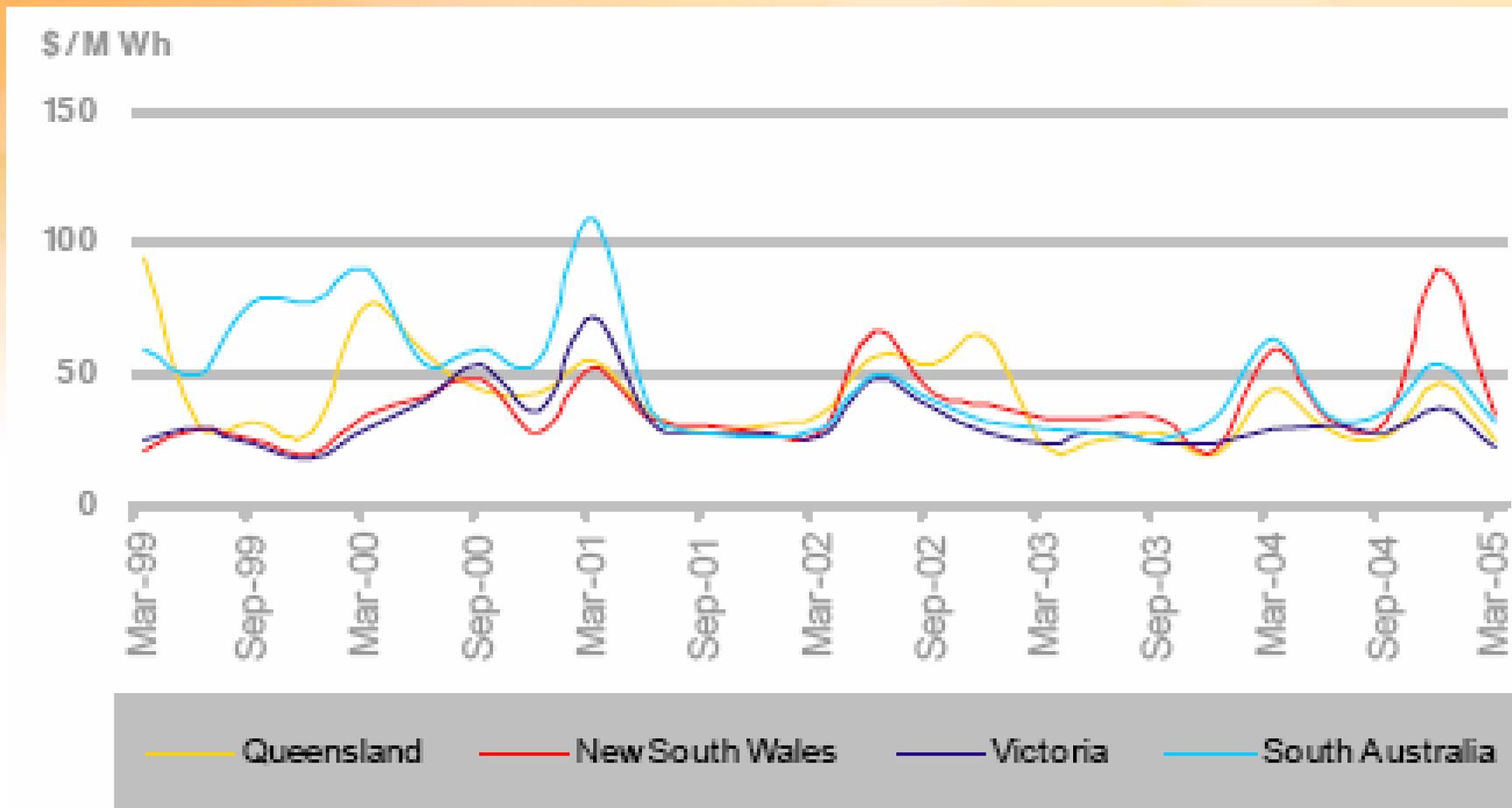


Gen. costs for baseload, intermediate + peak





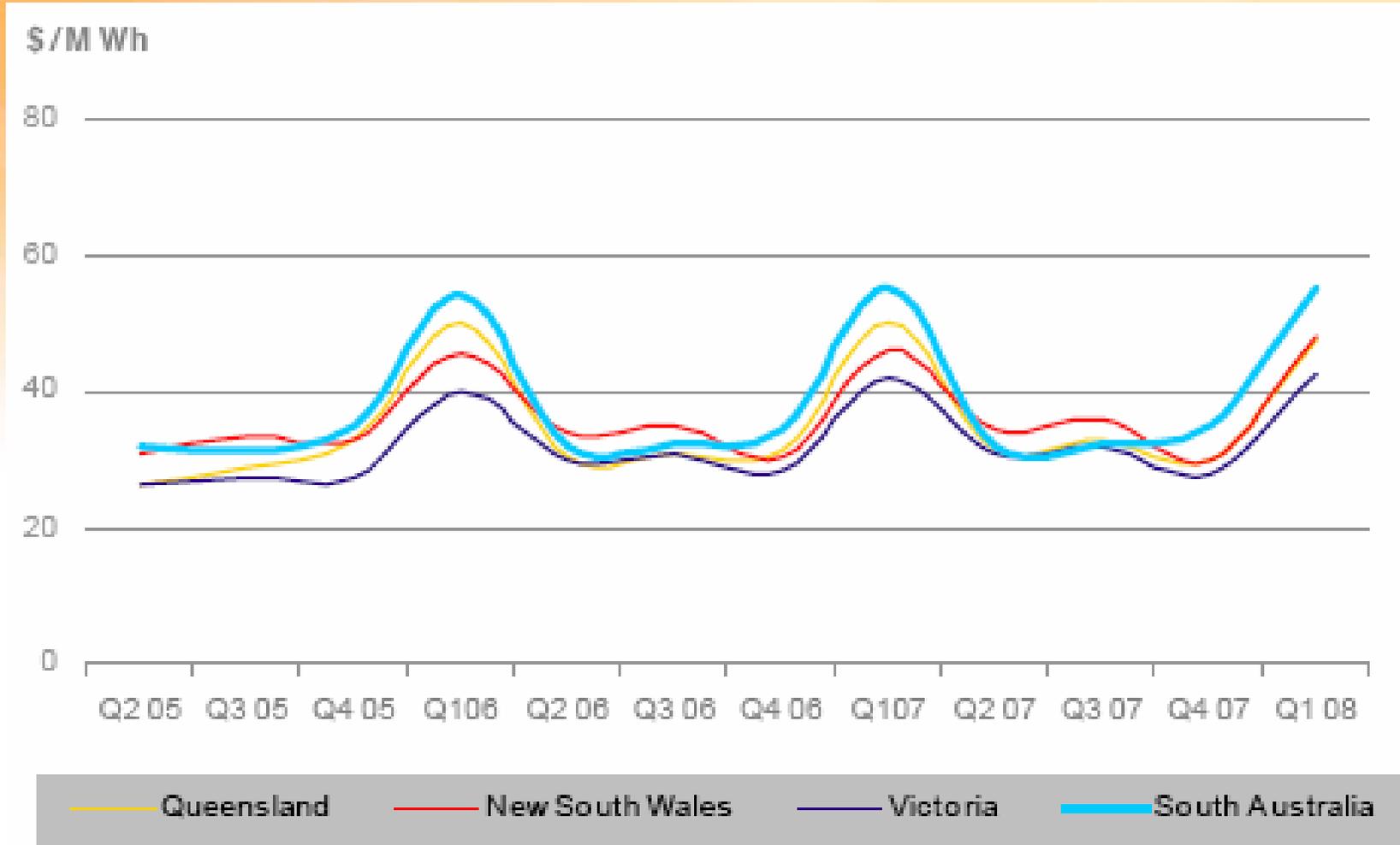
Weekly avg. NEM spot prices since market inception (NECA, 05Q1 Stats, 2005)





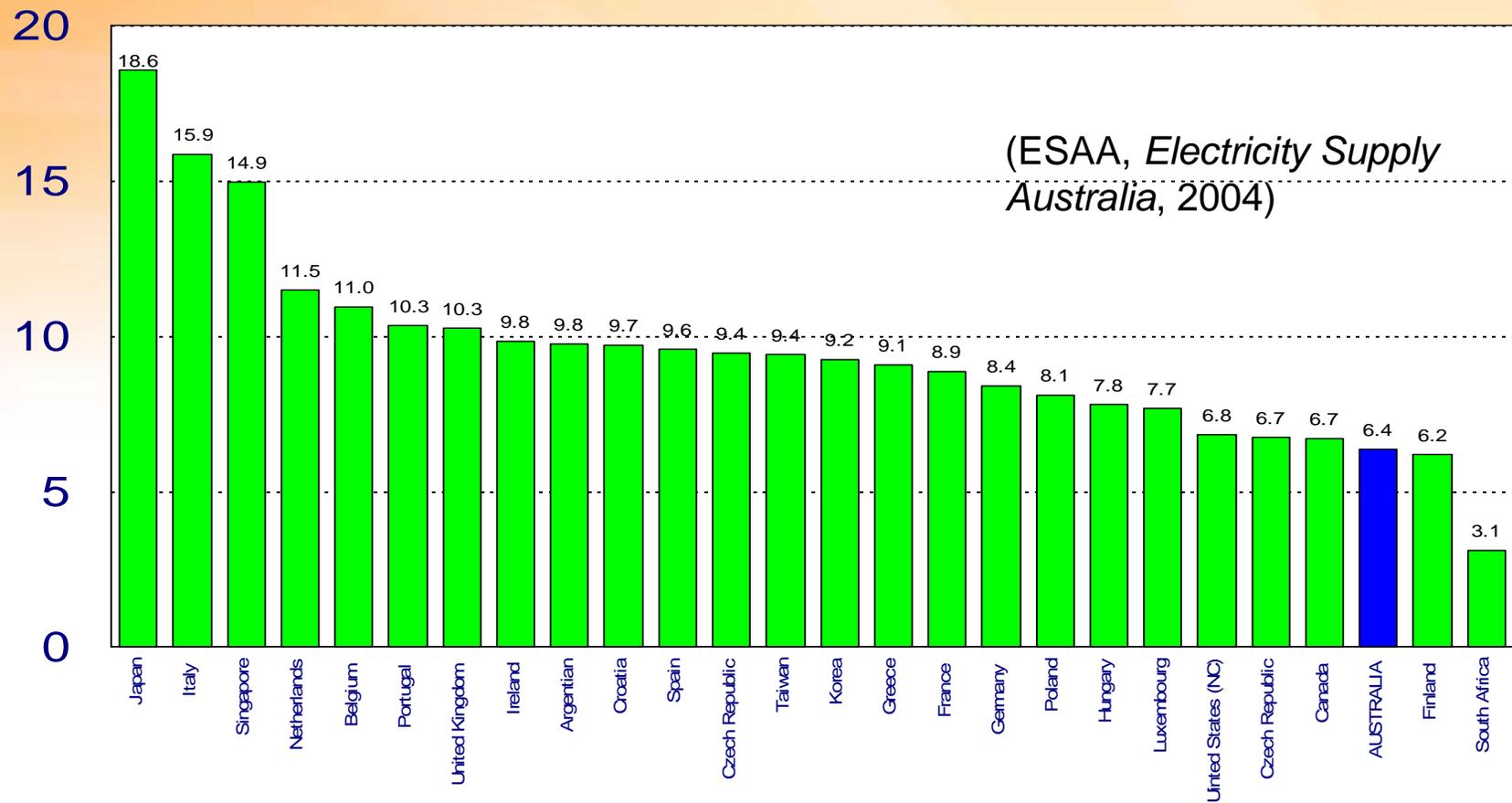
Flat contract prices, Q1 2005

(NECA, 05Q1 Statistics, 2005)



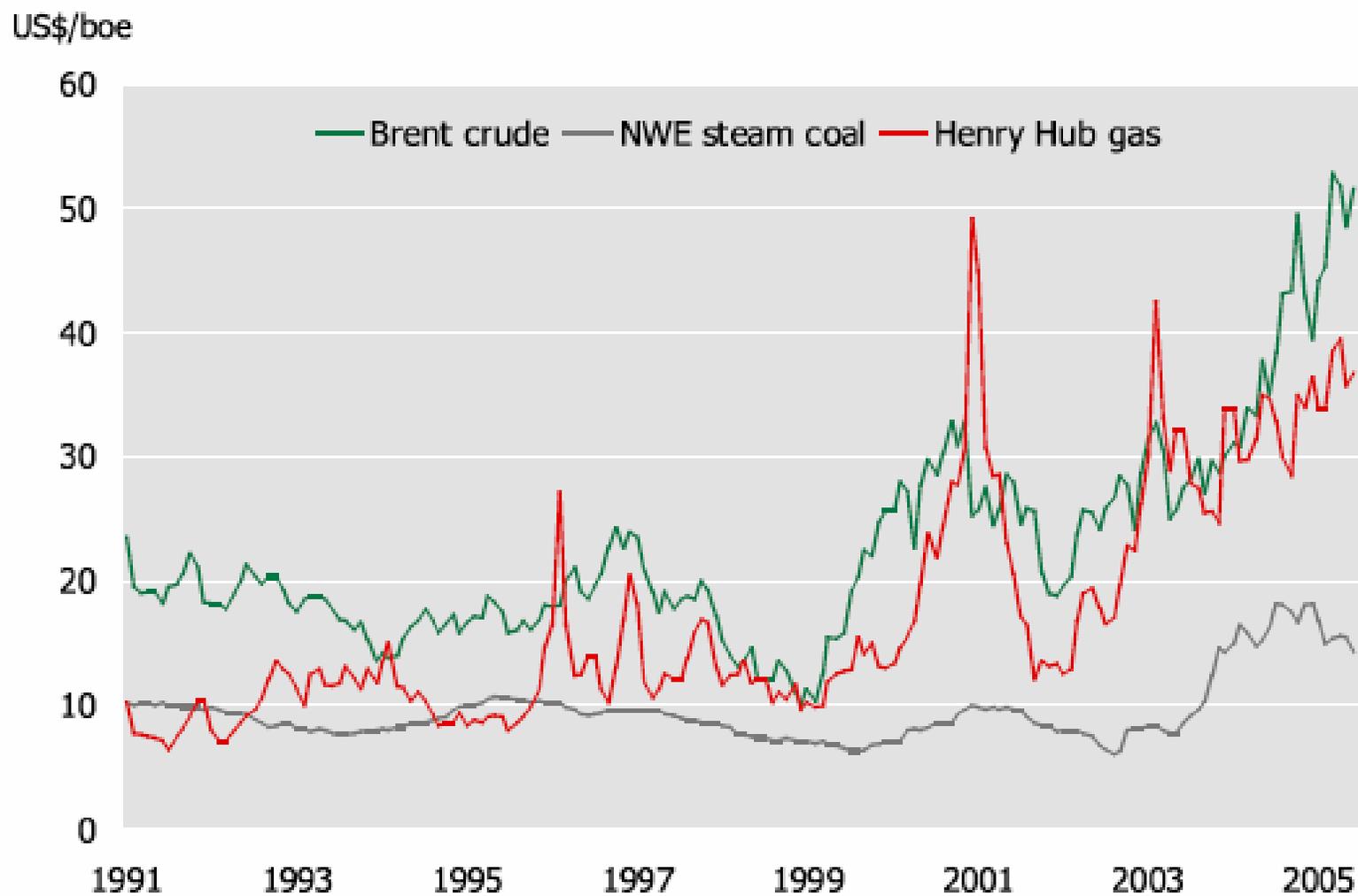


Economics: International elec. prices (industrial)





Prices for energy commodities (BP 2005)





Mandatory Renewable Energy Target



Renewable Energy (Electricity) Act 2000

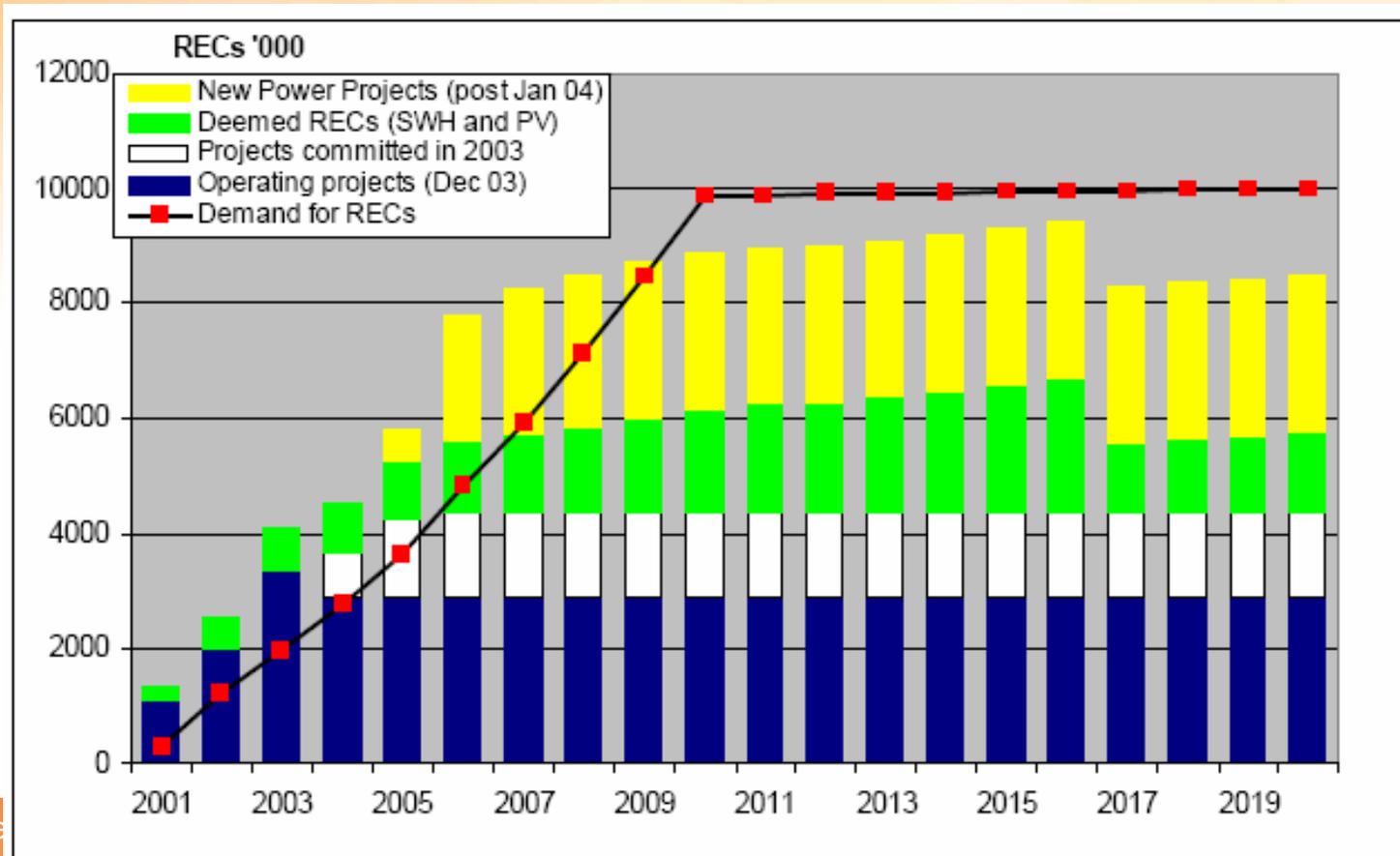
The objects of this Act are:

- (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.



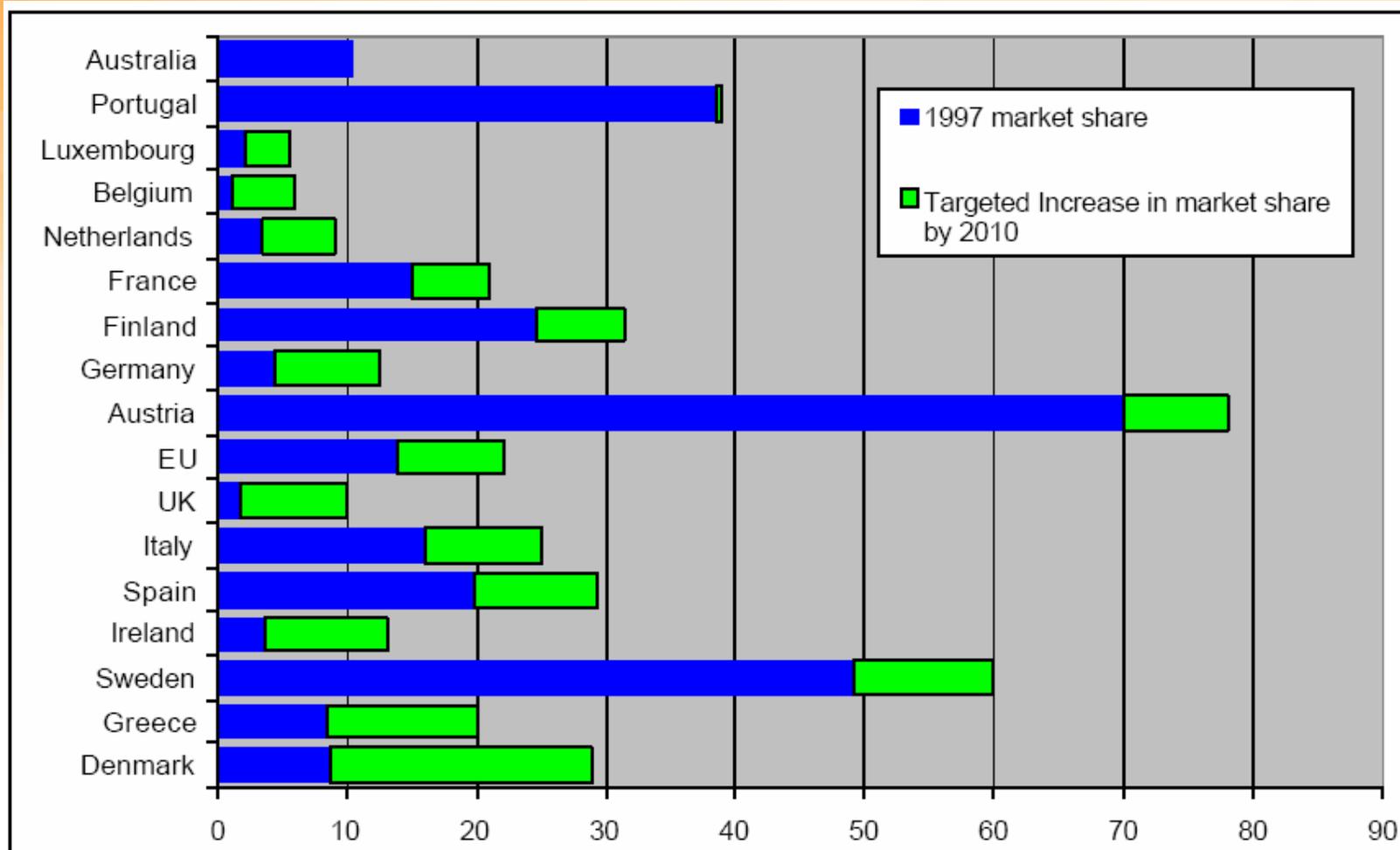
Present MRET is just about finished

- The Federal Govt. has rejected key review finding of a higher target to 2020
- BCSE estimates only approx. 700-800MW of new (post Jan04) projects required to meet existing target, and...
- ...project commitments > 500MW in 2004 leaves < 300MW new projects reqd





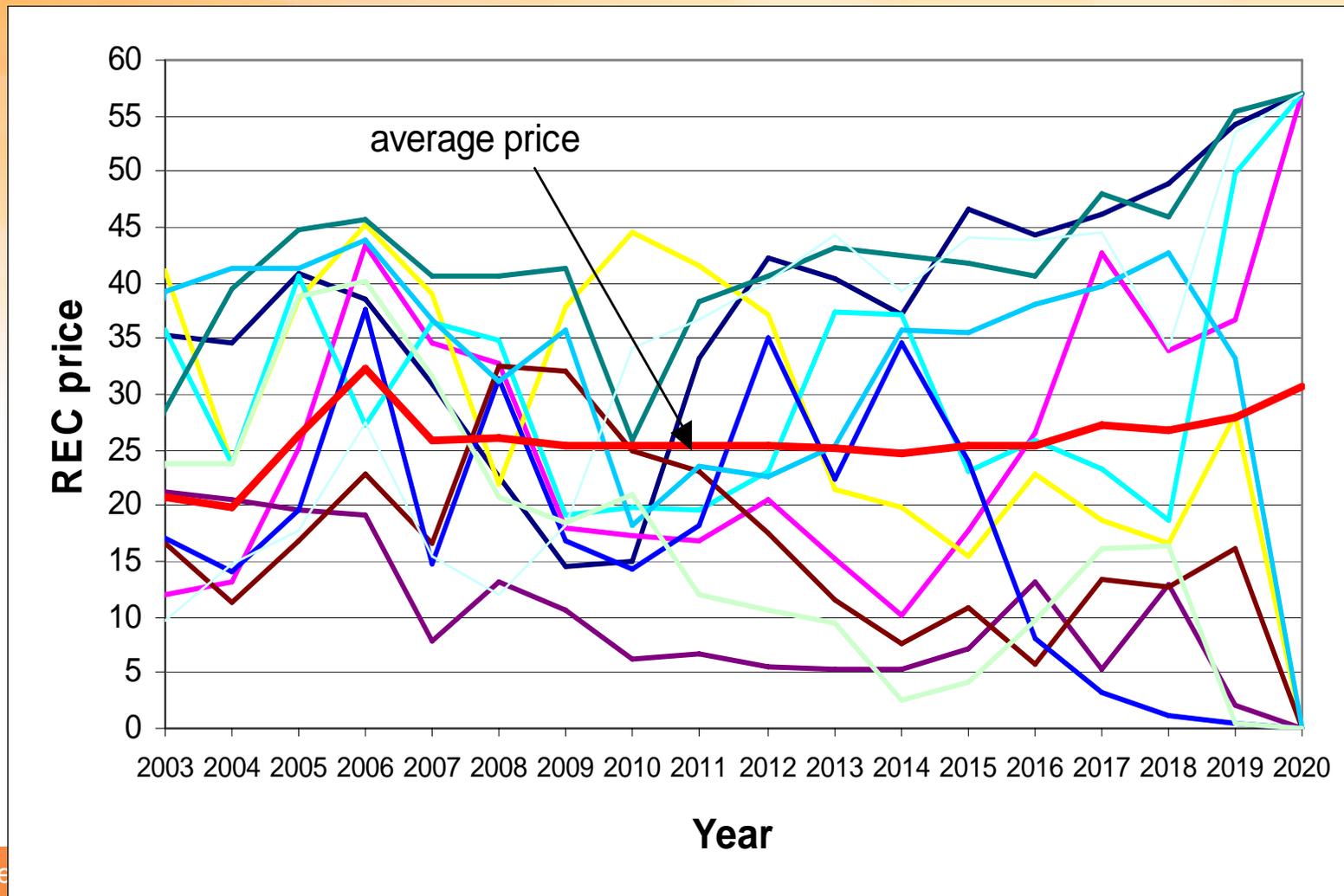
Some international renewable energy targets





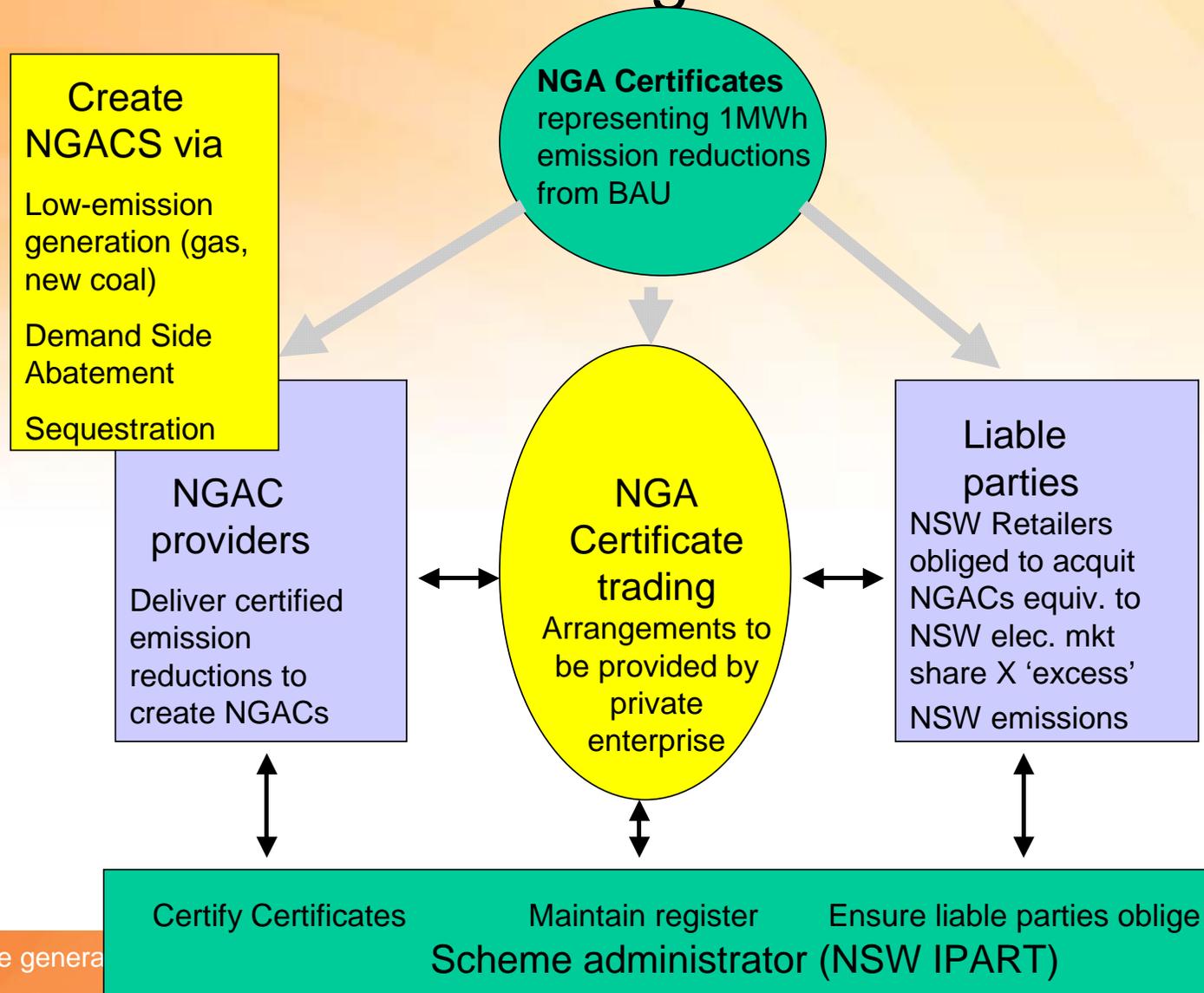
Prediction of REC Prices (A\$/MWH)

(ORER, 2003)





NSW Scheme – a ‘designer’ carbon market



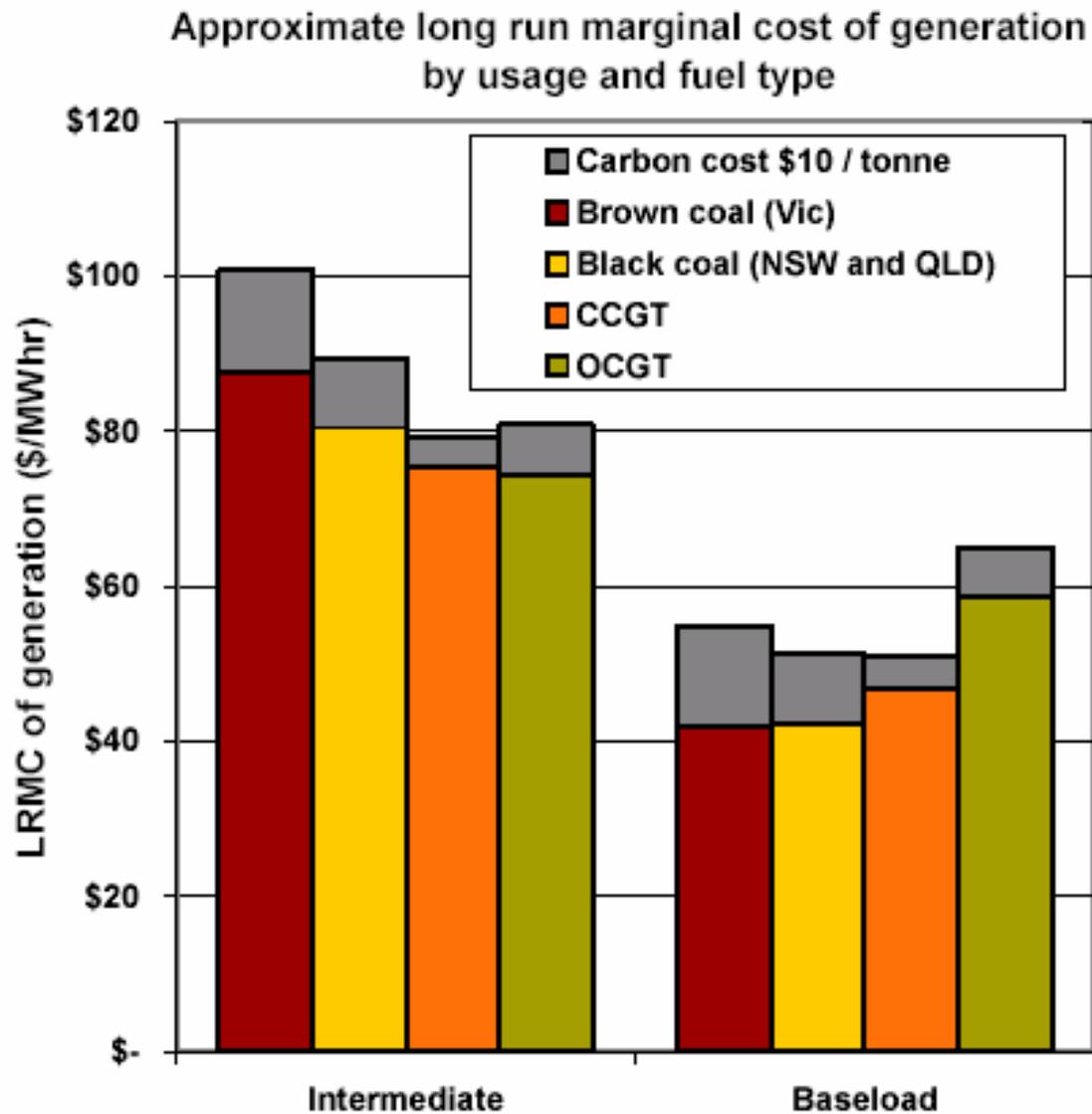


Current prices for NGACs (AMFA, 2005)

Non-Quorate (<5 contributors) on SOME contracts.					
NSW Greenhouse Gas Abatement Certificate (or equivalent)					
Term	Mean all Bids	Mean All Offers	Std Dev of Mids (All)	Number of Contributions Received	
Spot	\$12.21	\$12.59	0.14	7	
Cal 05	\$12.59	\$12.85	0.18	7	
Cal 07	\$13.92	\$14.49	0.28	7	
Cal 09	\$14.90	\$15.58	0.39	7	



Possible role of carbon tax / ETS





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