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The Australian National Electricity Market (NEM) and renewable energy

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ENERGY POLITICS and GOVERNANCE

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CEEM objectives and current research efforts

- *An interdisciplinary centre established between Faculties of Engineering and Business, with formal links to Science, Law, Social Sciences, researching:*
- Facilitating wind and PV integration in the Australian NEM
- Renewable energy policy support options in restructured industries
  - Expanded eRET, feed-in tariff options, wider policy support
- Generation investment in competitive electricity industries
  - Particularly in the context of possible low-carbon industry objectives
- Integrated energy and climate policy frameworks
  - Focus on market-based measures including emissions trading
- Technology assessment for sustainable energy policy frameworks
  - Energy efficiency, gas and cogeneration, renewables, CCS, nuclear options
- Techno-economic modelling of Distributed Energy options
- Energy efficiency technologies, economics and policy
- Policy frameworks for technology innovation
  - Emerging renewables, Carbon Capture + Storage (CCS)
- Sustainable energy services for developing countries

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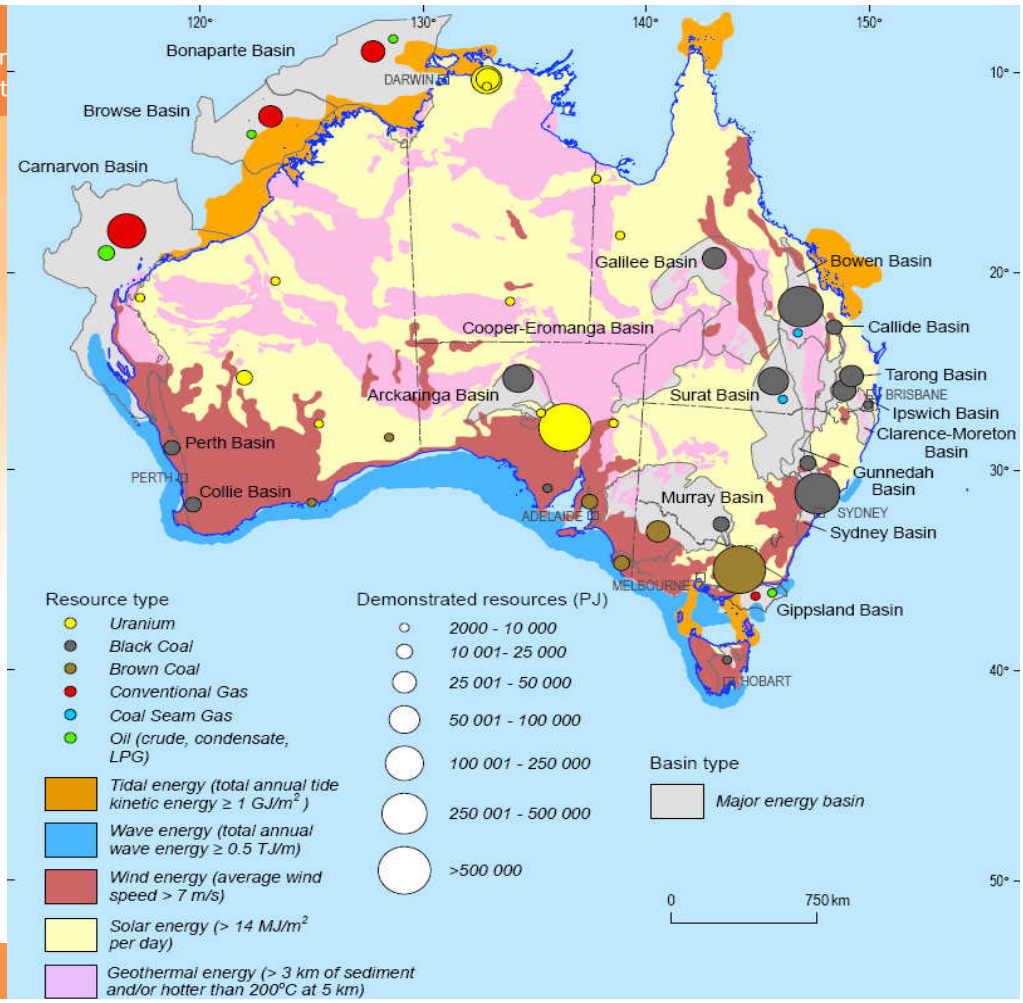
Australia's many energy options



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Renewable energy's diverse values

- **Energy** costs and benefits
  - depends on other options, and value of providing energy services
- **Environmental** costs and benefits
  - greenhouse emission reductions – depends on other gen options
    Industry development provides future option for energy transformation
  - regional air + water benefits, possible amenity costs
- **Social** costs and benefits
  - possible investment + job outcomes with industry development
  - Major deployment will require social consensus

- *In the Australian context, NEM has a key role in determining renewable's energy and environmental costs and benefits*

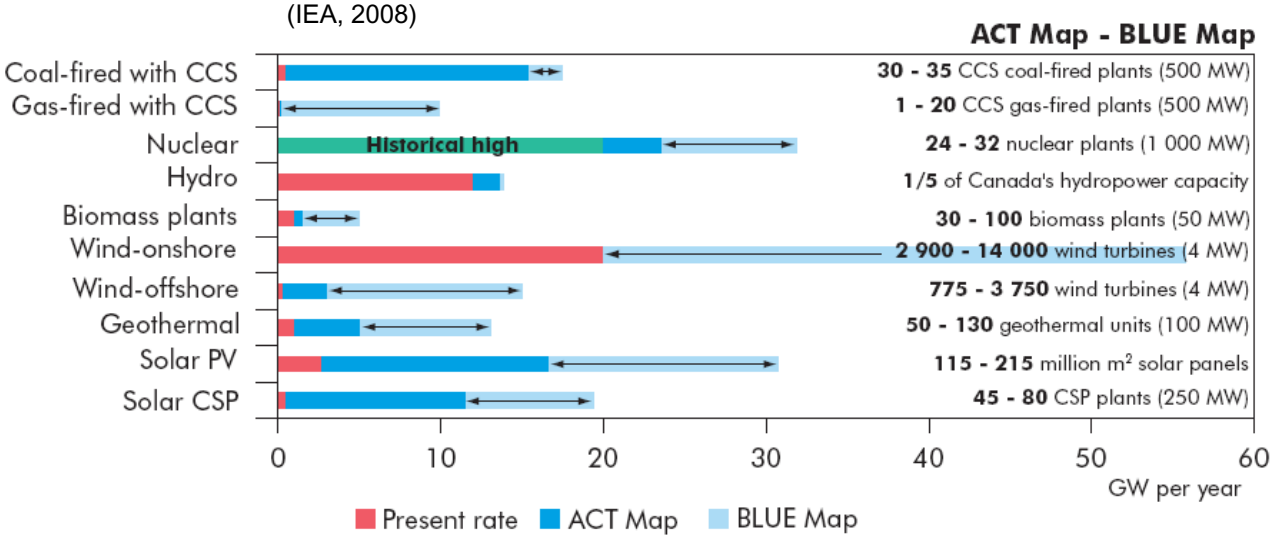
Renewable energy – proven potential for low-carbon energy futures… and significant future promise

Although technology assessments vary, renewables seem likely to have a key role for climate protection, certainly in short-med term

- IEA *Energy Perspectives Scenarios* (BLUE = 450ppm) for 2050

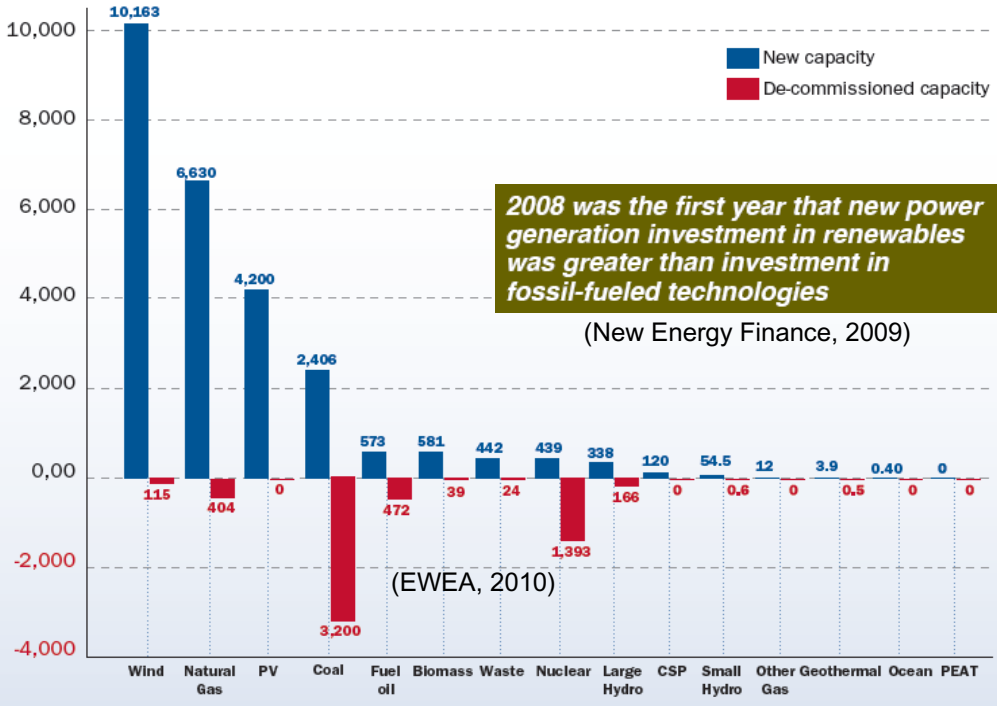
Figure ES.3 ▶ **Additional investment in the electricity sector in the ACT Map and BLUE Map scenarios (compared to the Baseline, 2005-2050)**

(IEA, 2008)



Renewables becoming increasingly significant regionally and globally

NEW INSTALLED CAPACITY AND DE-COMMISSIONED CAPACITY IN EU 2009 IN MW. TOTAL 25,963 MW — FIGURE 1.2



2008 was the first year that new power generation investment in renewables was greater than investment in fossil-fueled technologies

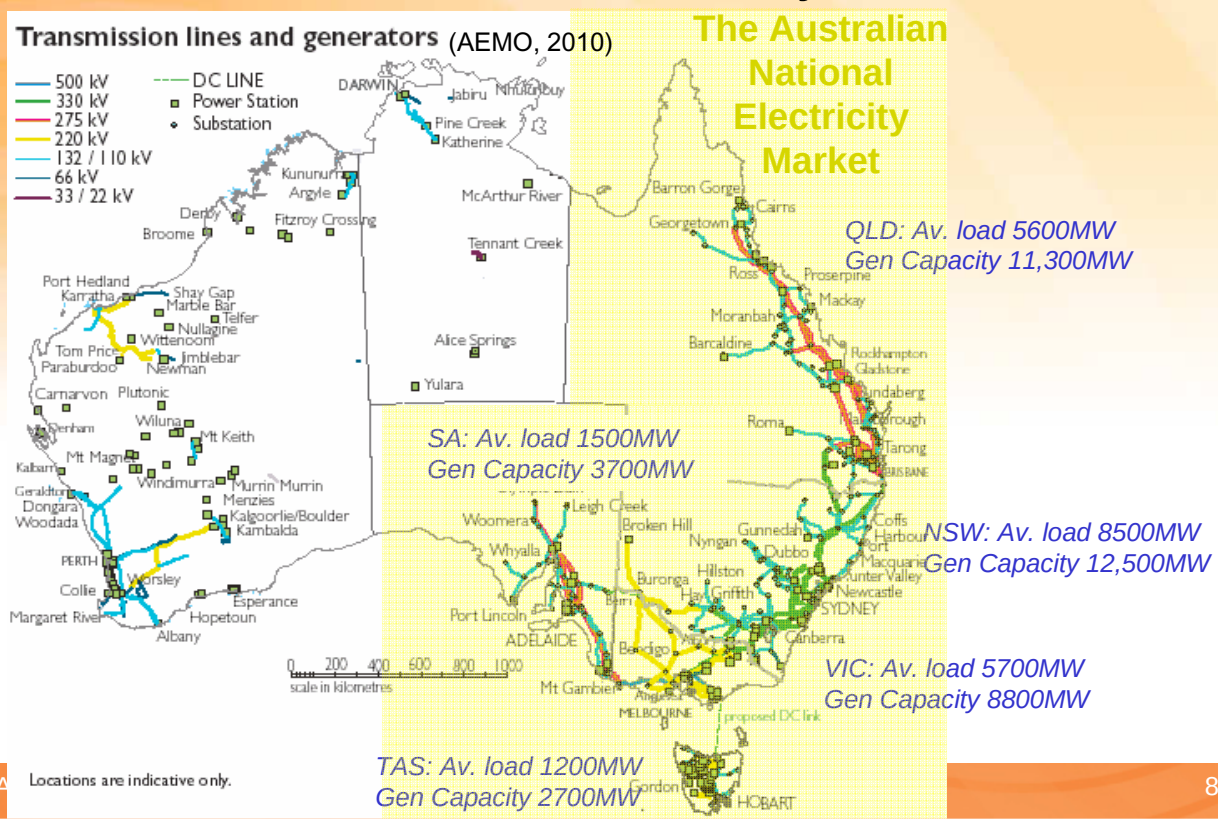
(New Energy Finance, 2009)

(EWEA, 2010)

The renewables integration challenge

- Maximise the contribution of our renewable energy options towards overall energy, environmental + social values
- Key electricity industry issues
  - How well do industry arrangements mesh underlying economic energy value with commercial signals to market participants?
  - *…and in particular, wrt new technology + participants*
    - *For example, Wind the first significant intermittent generation: now testing the adequacy of industry arrangements & governance around the world*
  - Do industry arrangements incorporate environmental and social value
  - Interactions with specific renewable policy support measures

The Australian National Electricity Market



National Electricity Law: *Overall objective for the National Electricity Market (NEM)*

- *NEL Section 7:*
  - *The national electricity market objective is to promote efficient investment in, and efficient use of, electricity services for the long term interests of consumers of electricity with respect to price, quality, reliability and security of supply of electricity and the reliability, safety and security of the national electricity system*
- Lack of environmental and wider sustainability objectives is a **design choice**
- *If societal desire that NEM contribute to achieving sustainability objectives then governments have to implement 'external' policies that will drive such changes*
  Not an imposition but an obligation for market participants…
- …and the NEM needs to facilitate technical, institutional and behavioural change towards such changes

NEM's large & growing emissions – it's about coal

(Australian figures – NEM has higher per-capita emissions & intensity

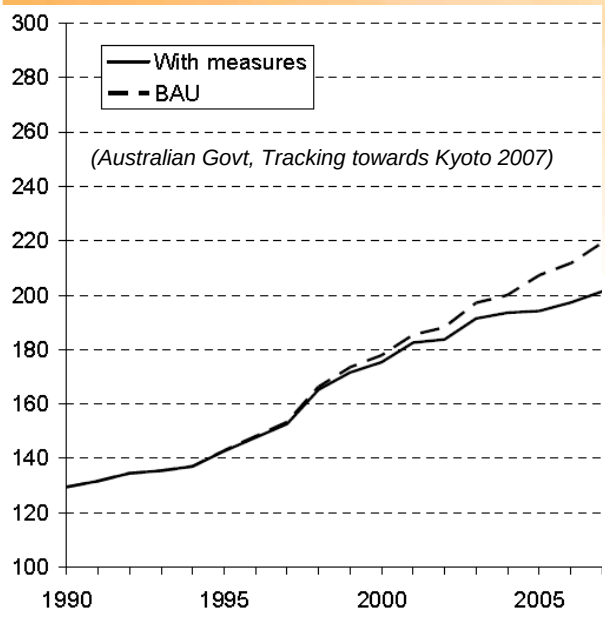
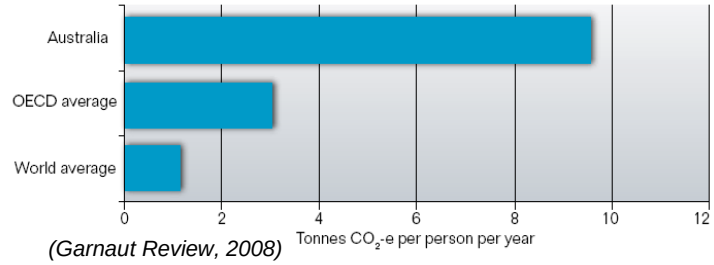
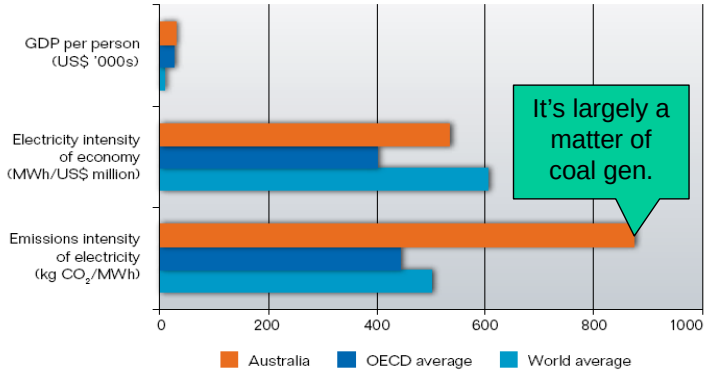


Figure 7.9 Per capita emissions due to electricity, 2005



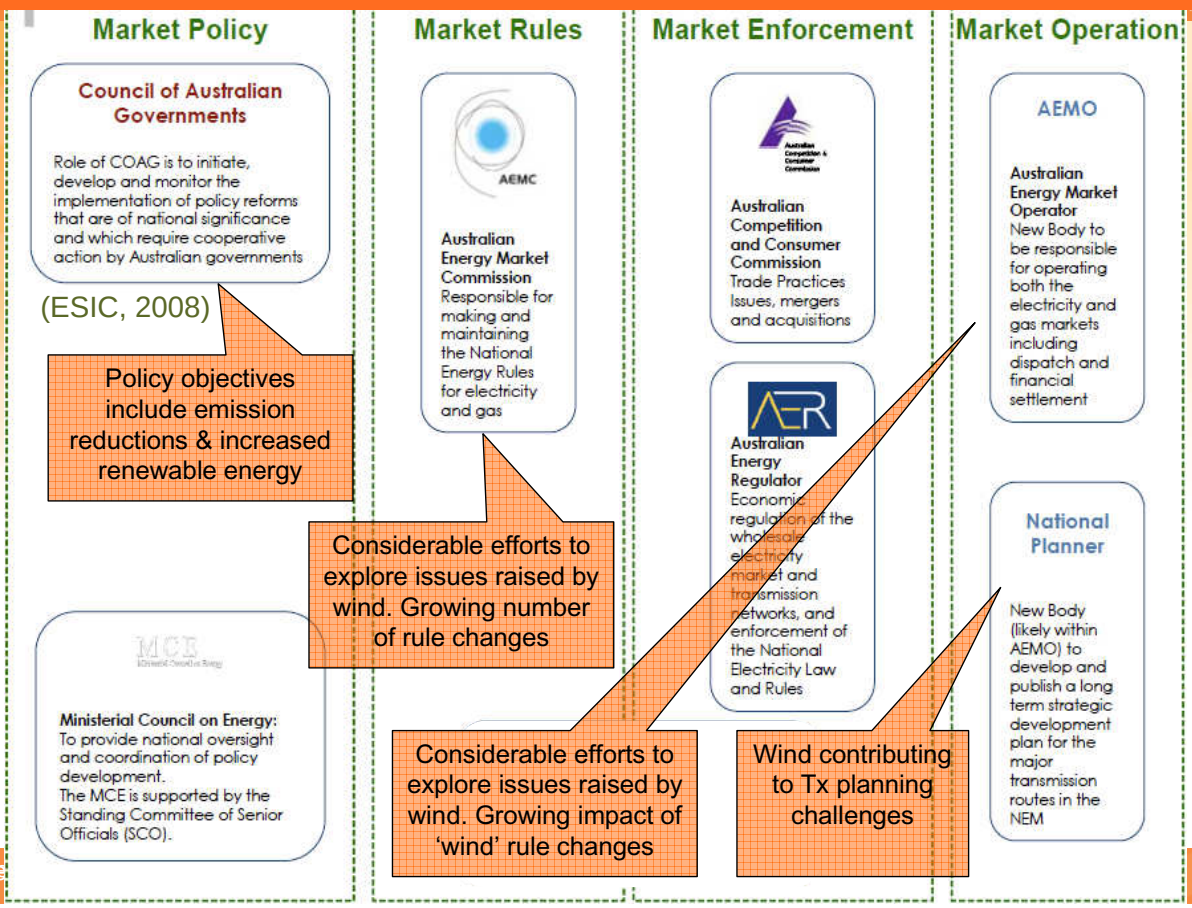
(Garnaut Review, 2008)

Figure 7.10 Factors underlying per capita electricity emissions, 2005



Source: IEA (2007a).

Aust. stationary energy sector governance & security



Renewable policies: MRET/eRET 'designer' markets

… will succeed or fail on quality of governance

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.

RE Certificates representing 1 MWh of new 'renewables'

non-zero baseline if pre-1997

REC providers
Deliver certified new Renewables to create RECs

RE Certificate trading
To improve economic efficiency

Liable parties
Obliged to acquit RECs as part of societal obligation

Initially set as 9500 GWh/yr 2010-20. Now 45,000 GWh/yr 2020-30

Certify Certificates | Maintain register | Ensure liable parties oblige
Scheme administrator

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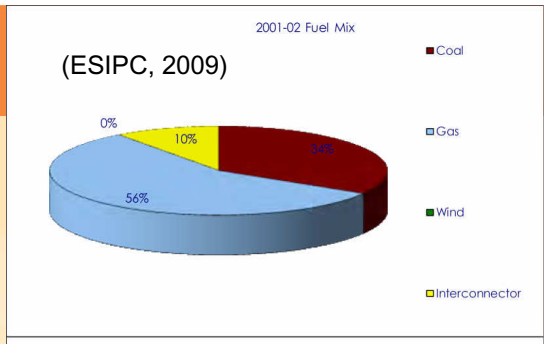
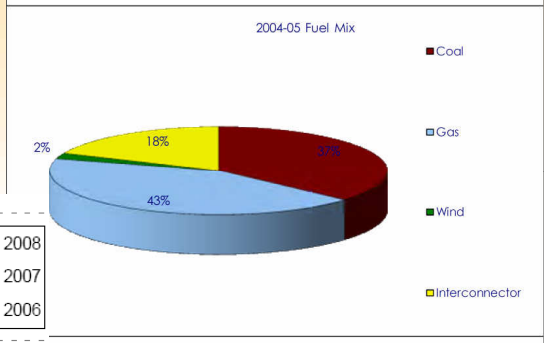
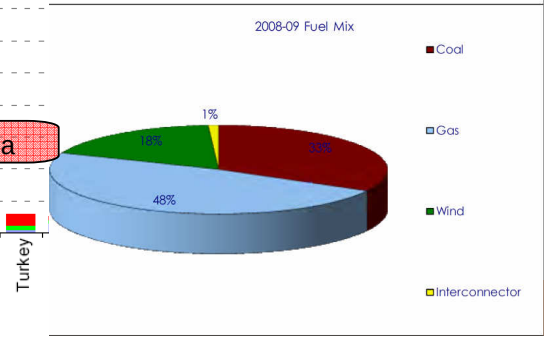
South Australia

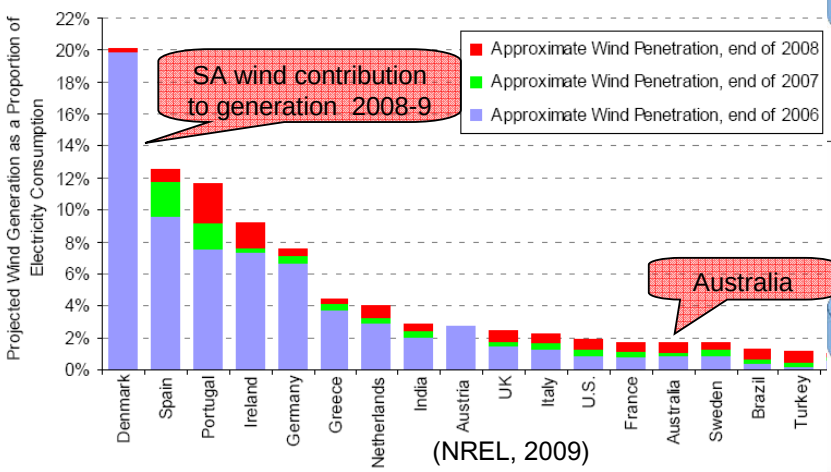
- A world leading jurisdiction for assessing wind integration challenges and options
  - A large and rapid deployment
  - A necessarily proactive framework for managing this integration within the NEM
    - MCE, AGO / DRET, ESIPC, NEMMCO / AEMO, AEMC, AER, SA Government
  - High wholesale spot/ancillary service market transparency



(ESIPC, 2009)







(NREL, 2009)

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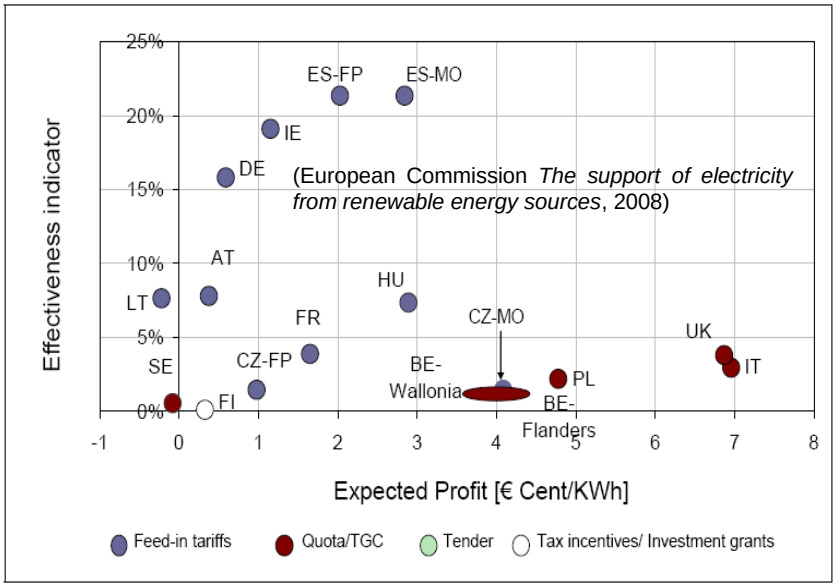
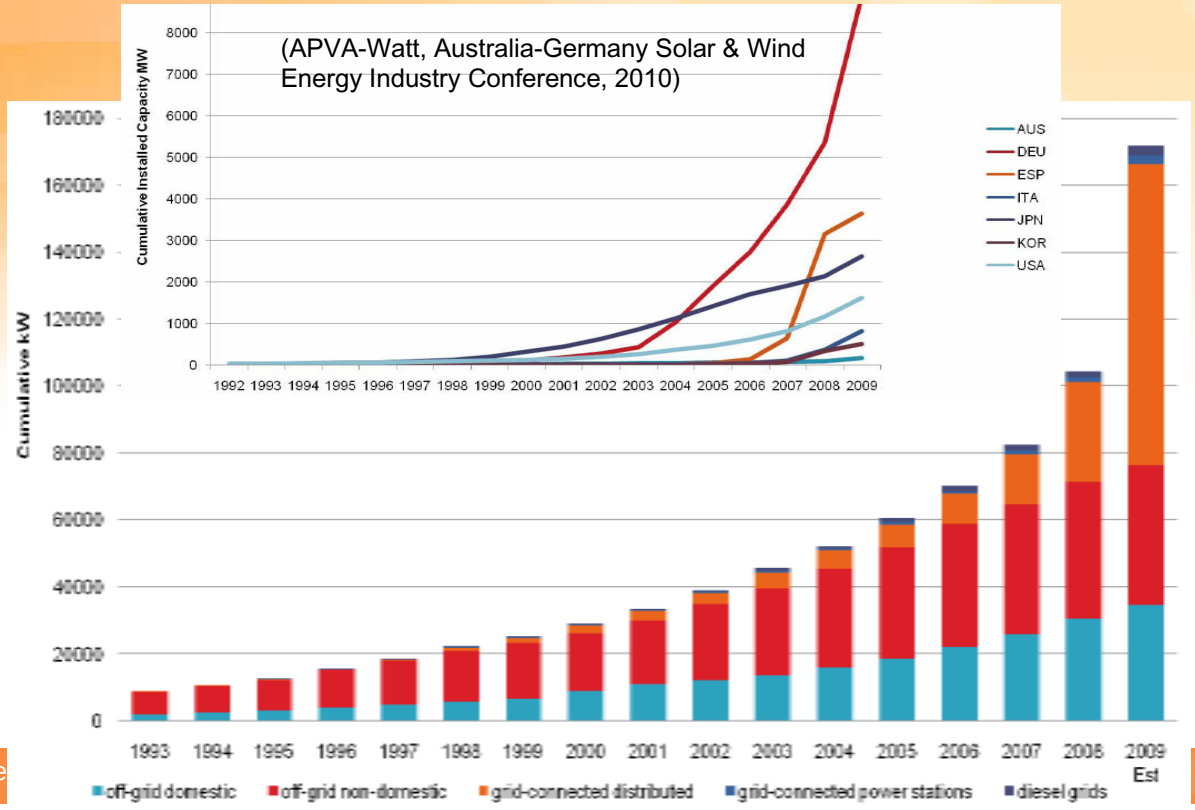
MRET performance to date… and for 2020?

- **To date:** modest ramping target easily met + considerable new investment with apparent efficiency – low subsidy $/MWh by international standards
- **Yet:** international experience generally poor with certificate schemes for reasons that seem to include governance capture by incumbents, risks for developers, market power on 'buy' side, single price for all
- **NEM** increasingly stressed infrastructure, changing structure including gentailers
- **Hence,** past modest success no guarantee of future performance with a significant target



(European Commission *The support of electricity from renewable energy sources*, 2008)

PV uptake in Australia to date



… and policy drivers

- eRET (4000GWh small-scale?)
- Flagships
  - 400MW of centralised PV?
  - 400MW of CSP?
- Jurisdictional feed-in tariffs

State	Size Limits	Rate c/kWh	Duration Years	Type
Victoria	5 kW	60	15	Net
South Australia	10 kW	44	20	Net
Australian Capital Territory	< 10 kW	50.05	20	Gross
	10 - 30 kW	40.04		
Northern Territory (Alice Springs Solar City)	$5 per day cap	45.76	20	Gross
Queensland	10 kW	44	20	Net
New South Wales	10 kW	60	7	Gross

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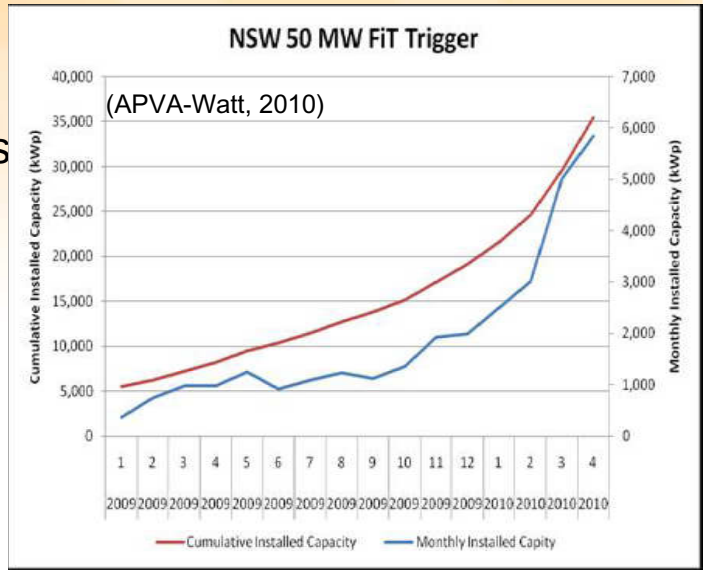

What is the key to facilitate RE? **Software+Orgware**

- RE poses significant challenges for existing industry knowledge and capabilities, and institutional frameworks

The Art of Knowing and Doing

The study of **technology** concerns *what* things are made and *how* things are made. Technology, from the Greek *science of* (practical) *arts*, has both a *material* and an *immaterial* aspect.

Technology = Hardware + Software + "Orgware"

(IIASA, *What is technology?*, 2006)




Hardware

Software

Orgware

Hardware: Manufactured objects (artifacts)

Software: Knowledge required to design, manufacture, and use technology hardware

"Orgware": Institutional settings and rules for the generation of technological knowledge and for the use of technologies

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Distributed renewables particularly challenging…

- Hardware often arrives before software and orgware
- New technologies being deployed by new players with limited 'software' understanding and inadequate institutional frameworks

Garrett under fire over dodgy solar installations

By Samantha Hawley for AM

Updated Thu Feb 18, 2010 9:38am AEDT

(www.abc.net.au, 2010)

As Environment Minister Peter Garrett grapples to control his home insulation program, there are now concerns about the potential for house fires because of badly-installed solar panels.

ABC's Lateline program has revealed that up to 2,000 homes could be at risk of electrical fires from poorly installed roof-top solar panels, and Mr Garrett's department is now considering an audit into the scheme.

Ted Spooner, from Standards Australia's committee on renewable energy, has told Lateline that there is no restriction to stop panels which do not meet the Australian standards being imported into Australia.

Mr Spooner says there needs to be more inspectors and an audit of the scheme.

"There is very, very limited inspection of houses to make sure they actually meet those requirements," he said.

"If you have poor quality modules, you can have fractures in electrical joints, and that can lead to arcs and then fires, and these burn at quite high temperatures."

Up to 2,000 homes could be at risk of electrical fires from poorly installed roof-top solar panels (ABC News, file photo)

VIDEO: Dodgy solar panels spark fire concerns (Lateline)

AUDIO: More Garrett woes with questions over solar panel installation (AM)

RELATED STORY: Industry rejects substandard insulation claims

RELATED STORY: Garrett phones mum after son's insulation death

Peter Marshall from the United Firefighters Union of Australia says there are concerns faulty panels could cause high voltage fires.

"The problem is, there's been a rush towards installing this type of equipment," he said.

There have not been any solar panel fires in Australia yet, but it is understood that the Department of Environment is looking into whether an audit is needed.

In conclusion

- NEM has performed reasonably well in integrating modest levels of large-scale renewables…
- Emissions trading to date largely a debacle
  - EU ETS has had very limited impact on emissions yet sending extraordinary cashflows to large emitters and other major players
    - Little support for renewables beyond higher yet increasingly uncertain energy prices – will this alone be sufficient to drive major change?
- Renewables deployment
  - Some measures have achieved far greater success in reducing emissions, establishing new industries & beginning transformation of electricity industries; RETs and RPS, FiTs
  - Challenge of finding policy approaches that maximise electricity industry value of renewables while driving transformation
  - Other institutional frameworks potentially critical – eg. planning laws
- Distributed Renewables (eg. domestic PV)
  - Immature retail market design, inadequate technical interface and very limited institutional capacities for major deployment; ***much to be done!***

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Thank you… and *questions*

Comments, suggestions and corrections regarding this presentation are all welcome. Please contact Iain at i.macgill@unsw.edu.au

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