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Facilitating the integration of distributed energy resources into the Australian National Electricity Market - the challenge of retail market design

ISES-AP – 3rd International Solar Energy Society Asia-Pacific Conference
Sydney, 26-28 November 2008

Dr Iain MacGill, Joint Director - CEEM

www.ceem.unsw.edu.au

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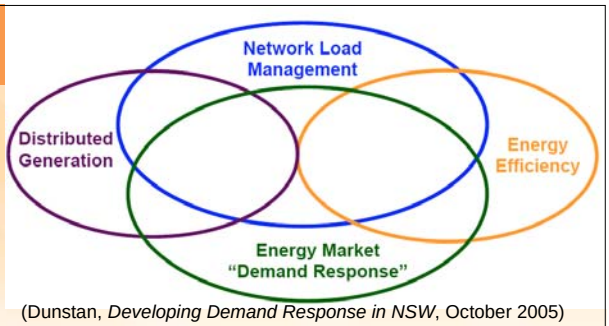
Distributed Energy options



(Dunstan, *Developing Demand Response in NSW*, October 2005)

- *Technical options within Dx system that actively participate in EI decision making*
  - renewable energy sources including solar thermal, photovoltaics (PV) smaller-scale wind, biomass
  - small-scale fossil fuelled generation, combined heat and power (CHP) plants powered with engines, gas turbines or fuel cells,
  - direct energy storage; chemical 'battery' technologies, super-conducting magnetic systems, flywheels
  - electrical end-uses that actively respond to changing conditions; eg. 'smart' buildings that control heating & cooling to exploit their inherent thermal energy storage
  - End-use energy efficiency

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DE's complex yet promising characteristics

- Conceptual complexities
  - Demand side participation
    - … beyond consuming energy and paying bills
  - Controllable loads
    - … controlled with respect to evolving industry objectives
  - Energy efficiency
    - Difficult to define in useful ways
  - Distributed eneration, storage or demand
    - Can be technically near entirely fungible wrt overall industry operation
  - Decision makers
    - End-users, retailers or Network Service Providers
- Potentially valuable characteristics
  - Some highly cost-effective alternatives to centralised supply and associated network options
  - Environmental benefits from use of renewable energy resources or highly efficient fossil-fuel use (eg. Cogeneration)
  - Opportunities for greater end-user engagement in achieving desired energy services
- *However, generally limited role played to date in most electricity industries around the world*

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Challenges and opportunities for Distributed Energy

- How well do electricity industry arrangements establish and allow DE to suitably receive
  - Energy and network values
    - Locational, time varying + contingent value of energy and necessary network flows: *spot but also future prices b/c decisions now impact on later decisions*
  - Environmental values
    - 'command and control' regulation yet also possible schemes incl. ETS, MRET and feed-in tariffs that internalise environmental & social externalities
- In restructured industries a question of wholesale & retail market design, network regulation & policy frameworks
  - Challenges of technology and participant neutrality for emerging DE options that have very different technical & economic characteristics, location near and ownership by end-users
  - *Retail markets where DE resides are the 'unfinished' business of many electricity industry restructuring processes*
  - *Intersection of regulated network and competitive supply/demand options invariably complex and imperfect*
  - No serious efforts yet in most jurisdictions to address environmental, energy security and wider social externalities of energy markets

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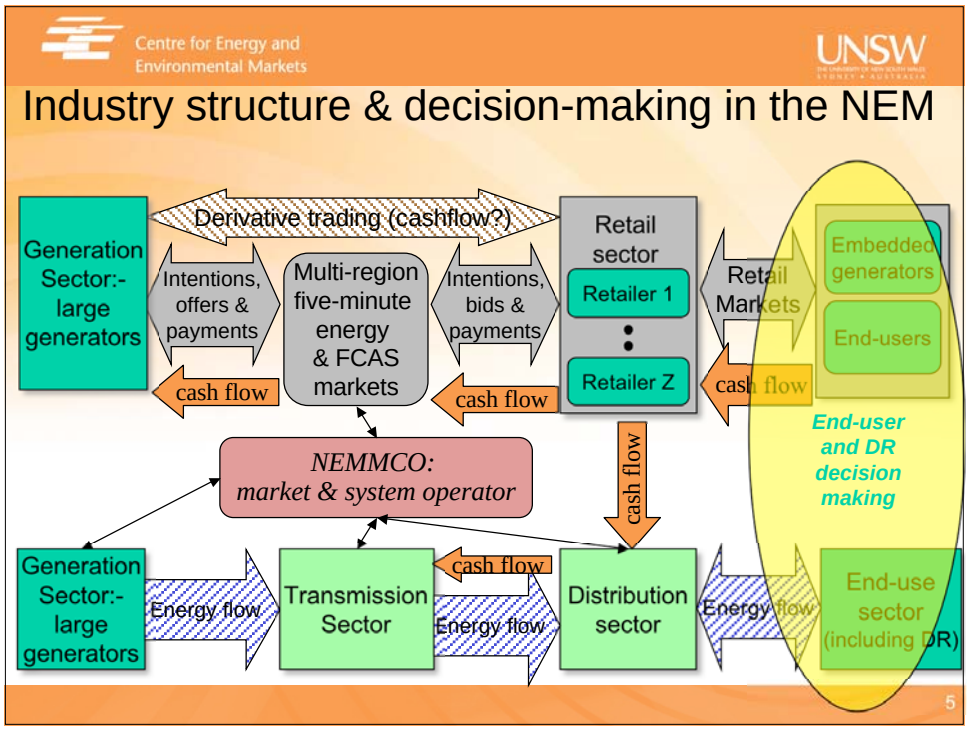
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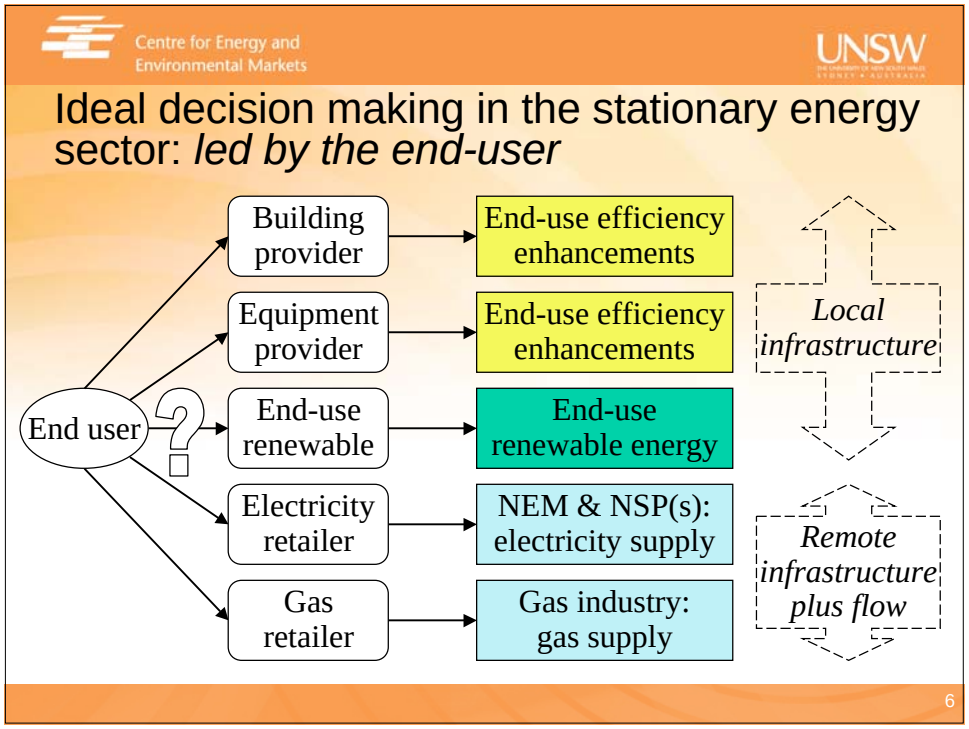
Industry structure & decision-making in the NEM
Generation Sector:- large generators
Derivative trading (cashflow?)
Intentions, offers & payments
Multi-region five-minute energy & FCAS markets
Intentions, bids & payments
Retail sector
Retailer 1
Retailer Z
Retail Markets
Embedded generators
End-users
cash flow
cash flow
cash flow
End-user and DR decision making
NEMMCO: market & system operator
cash flow
Generation Sector:- large generators
Energy flow
Transmission Sector
cash flow
Energy flow
Distribution sector
Energy flow
End-use sector (including DR)
5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Ideal decision making in the stationary energy sector: led by the end-user
End user
Building provider
Equipment provider
End-use renewable
Electricity retailer
Gas retailer
End-use efficiency enhancements
End-use efficiency enhancements
End-use renewable energy
NEM & NSP(s): electricity supply
Gas industry: gas supply
Local infrastructure
Remote infrastructure plus flow
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Present retail market design in Australia

- Retail market design for large end-users:
  - Competitive retail market (not yet mature, TOU tariffs)
  - Regulated network pricing (not yet mature, TOU and peak demand tariffs)
- Retail market design for small end-users:
  - Regulated or partially competitive retail market
  - Simplified tariff structure; immature metering; profiling
  - Network charges usually passed through retailer
  - Little support for informed end-user decision making
- Some social policy objectives internalised
- Some environmental objectives internalised
- Limited opportunities for distributed energy

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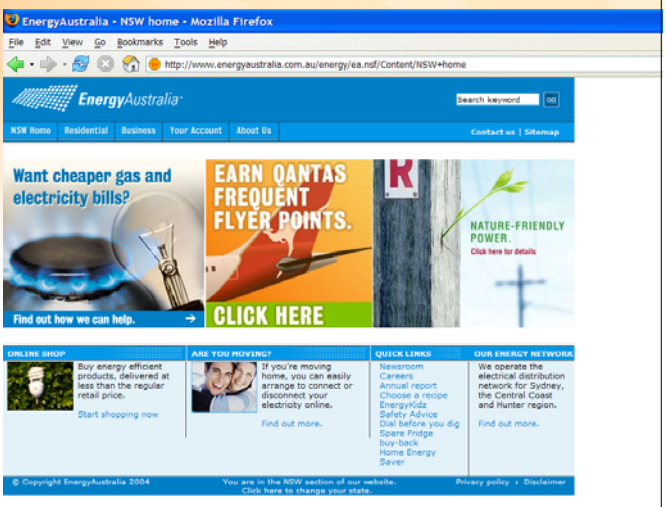
Current Full Retail Competition limited

". an important reason there is effective competition in Victoria is "Because the provision of energy is viewed as a homogenous, low engagement service…"

AEMC, *Effectiveness of Competition in Victoria*, 2008

Current measures of competition have questionable relevance
Retail transfers – churn?
Price spreads – sticky market consumers?



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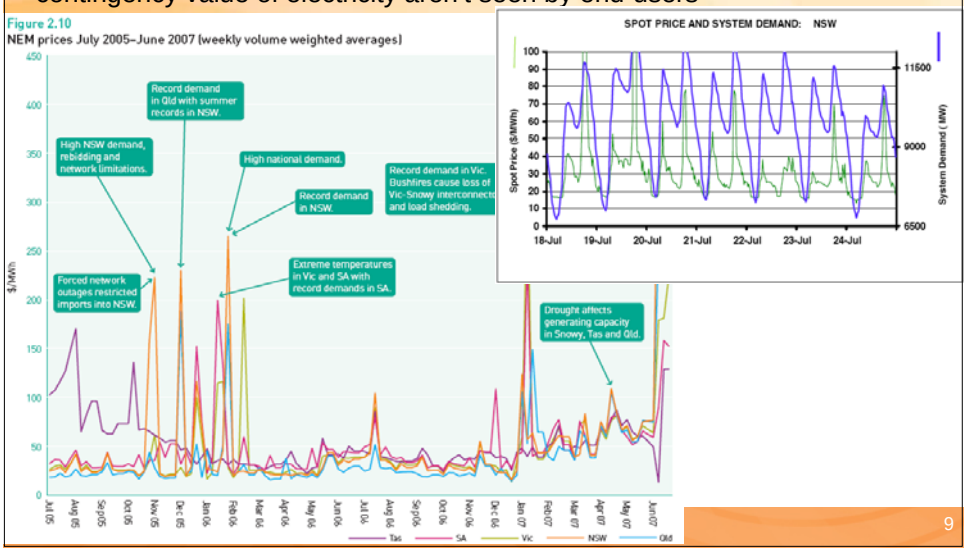
Meanwhile… back in the real world….

Wholesale electricity price signals on the temporal, locational and contingency value of electricity aren't seen by end-users

Figure 2.10
NEM prices July 2005–June 2007 (weekly volume weighted averages)



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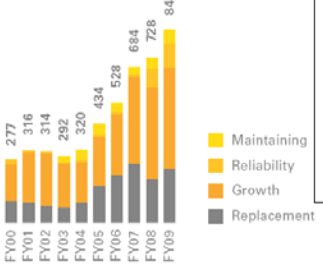
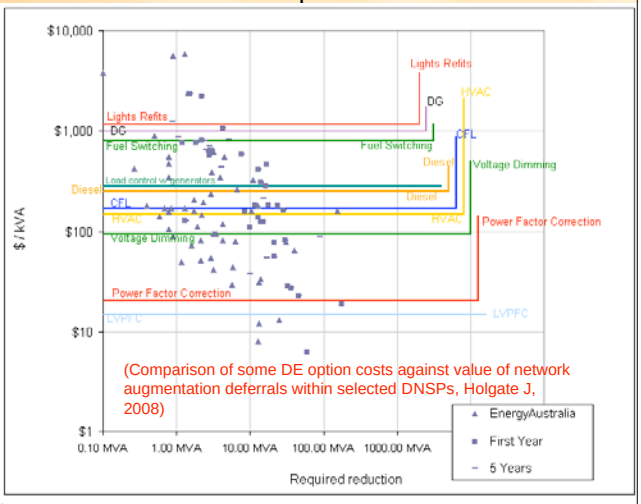
Load growth driving major network expenditure

while highly attractive DE alternatives aren't taken up

Figure 5.5: Capital expenditure by driver (FY07 $m real)

(Energy Australia, 20010-14 Expenditure Plans)





(Comparison of some DE option costs against value of network augmentation deferrals within selected DNSPs, Holgate J, 2008)

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Energy consumption continues to climb

Figure 12: Trends in Total Energy Consumption by Major End Use – Australia

Enhanced NEM structure with active end-user participation

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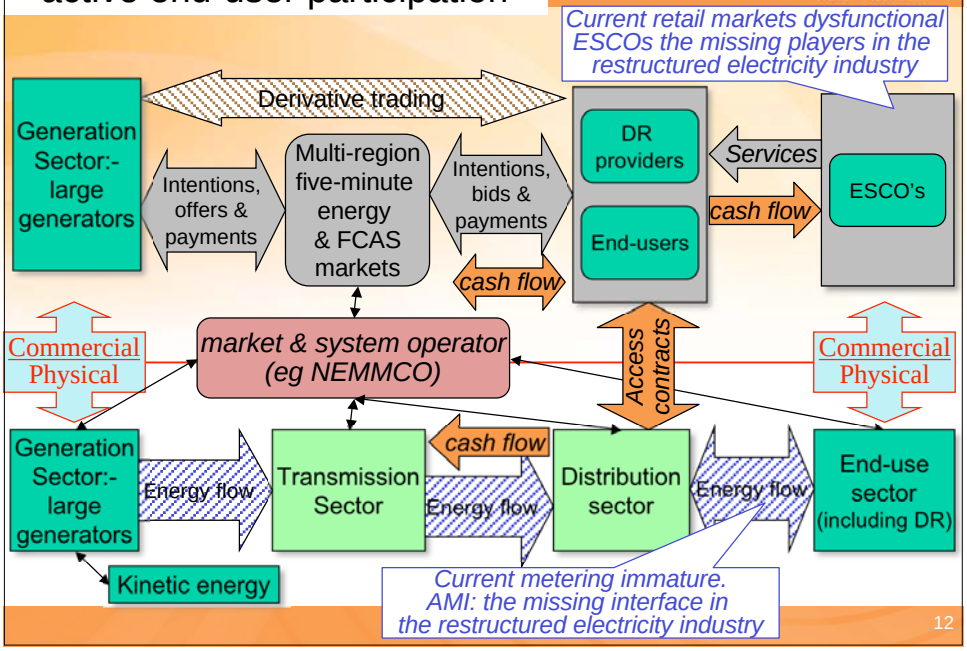

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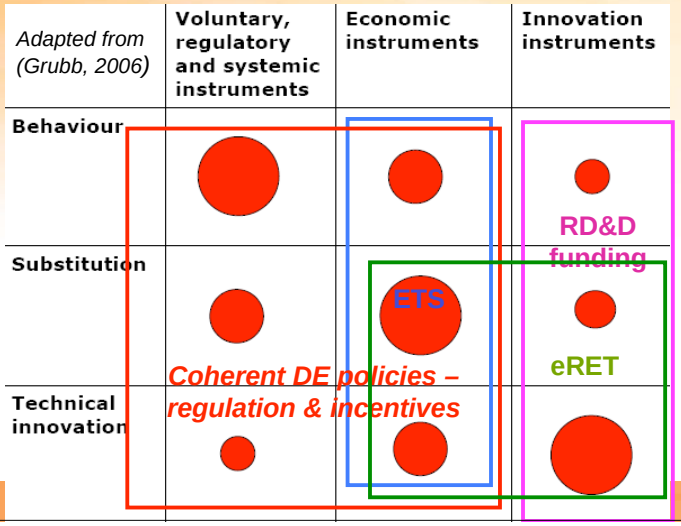
What's still missing for a coherent sustainable energy policy framework?



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Wider policy frameworks to address externalities

- 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 energy market participants
    - Little support for DE beyond higher energy prices
- Renewables deployment
  - Some measures have achieved far greater success in reducing emissions, establishing new industries & beginning transformation of electricity industries
  - Challenge of finding policy approaches that maximise electricity industry value of these renewables while driving transformation
    - Mixed experience with some Green Certificate schemes
    - Feed-in tariffs demonstrated success but 'hide' energy market signals
- Distributed Energy
  - Diversity of technologies and opportunities will require comprehensive & coherent policies wrt information, regulation & incentives sufficient to overcome existing barriers

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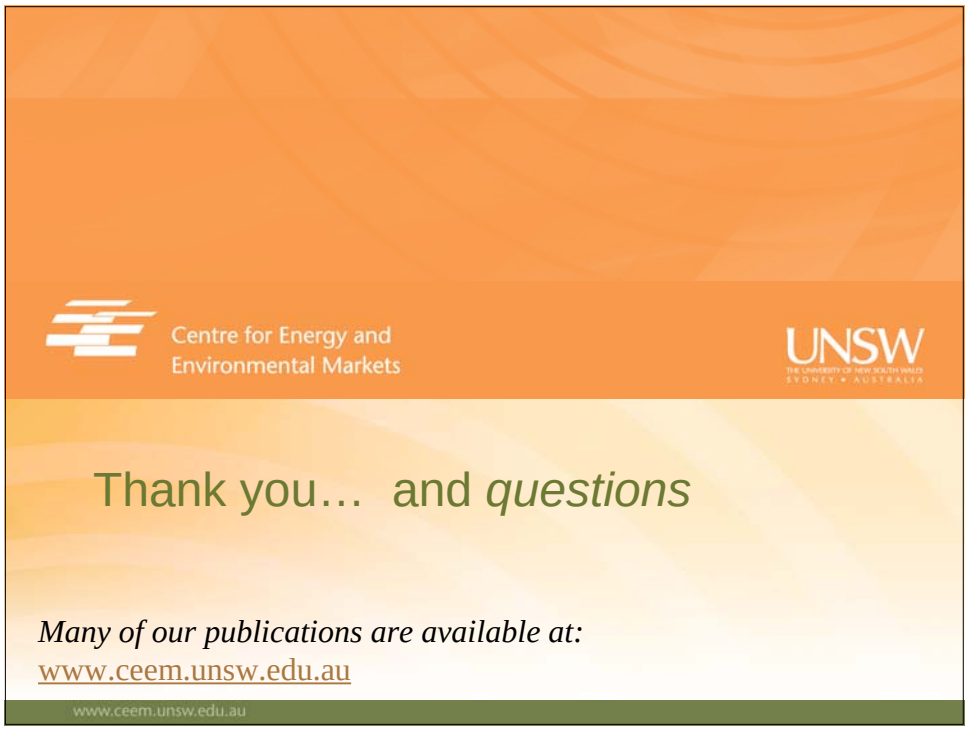
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Thank you… and *questions*
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