Centre for Energy and Environmental Markets

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Distributed energy options, opportunities and challenges for the Australian National Electricity Market.

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An Environmental Audit of the NEM

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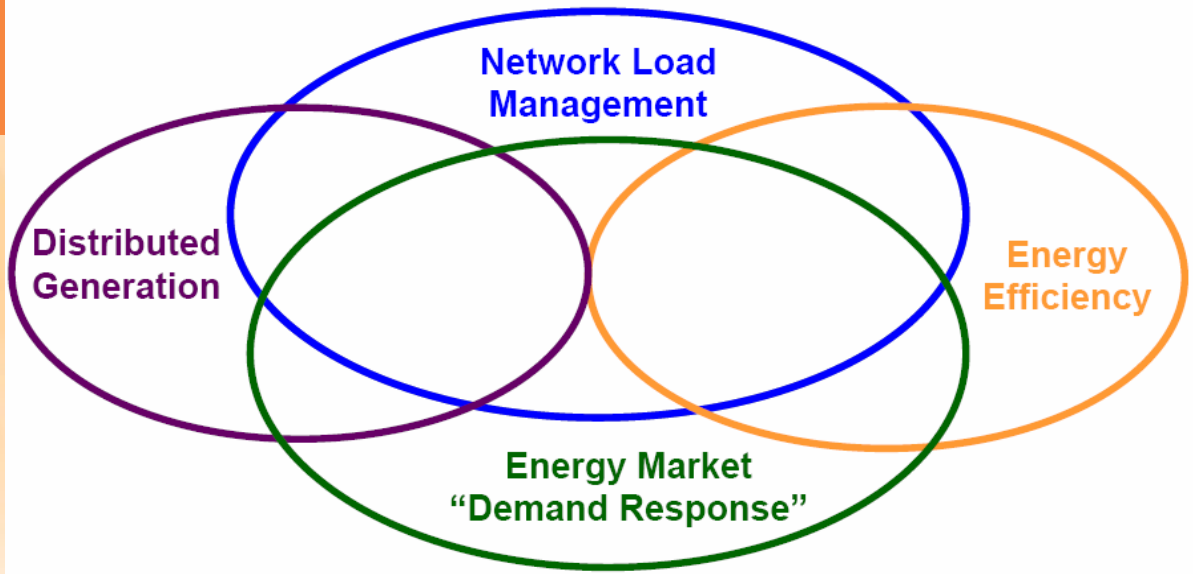
Distributed Energy options



(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

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
  - Generation, 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*

Overall electricity industry objective

- Appropriately contribute to maximising the value of delivered energy services given all of the costs of delivering these
- Private and public energy service values
- Public and private aspects of costs of provision
  - Industry-wide supply/demand balance
  - Network losses and constraints
  - Externalities ‘shared’ by wider community
- Setting appropriate specific industry objectives depends on the wider policy context
  - Industry arrangements to deliver or facilitate delivery of wider societal objectives such as sustainability?

Valuing EI related energy services requires…

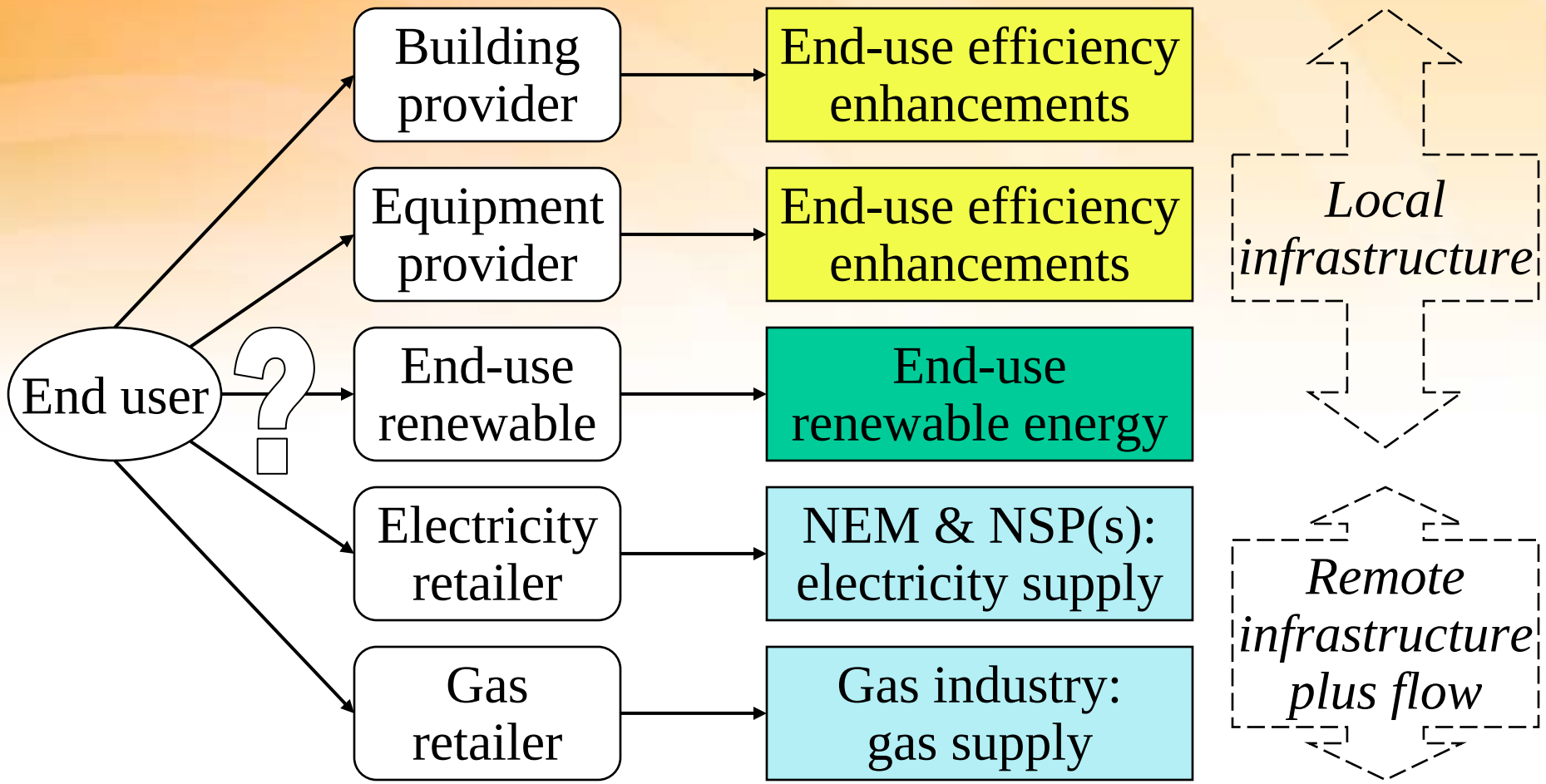
- Energy value
  - Locational, time varying + contingency value on energy: *spot* + *forward*
  - Investment decisions determine most of this value
  - Value on Quality of Supply attributes
- Network value
  - Locational time varying + contingency value on network flows: *spot + forward*
  - Network investment decisions determine most of this value
- Environmental value
  - A range of adverse environmental impacts associated with different generation technologies, locations
  - Schemes that internalise externalities such as GHG emissions through Carbon Tax, Emissions Trading, niche market support (eg. MRET) can be used to 'capture' some of these values

DE's potential role, and the challenge

- **Energy services** have values that vary with time, location and uncertainties
  - Key end-use equipment decisions are investment
- **Electricity supply and associated network infrastructure** have associated costs that vary with time, location and uncertainties
  - Key generation and network decisions are investment
- Many energy services
  - can be delivered with more efficient end-use equipment and infrastructure
  - Have some flexibility in terms of time of use
    - Eg. Pool pumps, heating and cooling in well designed buildings

- Different characteristics from conventional centralised supply resources
  - technical operation; eg. intermittent renewable resources
  - Varied investment versus operational cost structures
  - small unit scale yet large numbers could aggregate to significant resources
  - location near end-users & in Dx system
  - potential ownership by end-users & close integration with their processes & equipment; eg. Cogen

Ideal decision making in the stationary energy sector: *led by the end-user*



Barriers to good end-user decision-making

- Barriers for local infrastructure options:
  - Knowledge, cash flow, innovation & risk exposure
  - Limited influence over options (dependence on others eg. landlords)
  - Need for coordinated decision making to value diversity
- Barriers for remote infrastructure & flow options:
  - Limited knowledge & influence (dependence on others)
  - Revenue recovery retail tariffs (ex-post taxation)
  - Business as usual (status quo rather than innovation)
  - Regulators & system operators take key decisions:
    - To maintain availability & quality of energy flow
    - For which end-users bear most of the costs

Major objectives of Australian Energy Market Reform

Established during 1990's, See Energy Market Review, Issue paper, March 2002

Reform Objectives

- Restructuring government-owned utilities
- Removing barriers to inter-state and intra-state trade of energy
- Establishing a transparent, wholesale spot market for electricity to enable competition among generators and retailers in the eastern states
- Establishing open access to electricity networks and third-party access to natural gas networks, and economic regulation of transmission and distribution networks to ensure efficient and transparent pricing of network services
- Enabling customer choice down to the smallest retail customer
- Achieving competitive neutrality in relation to fuel sources, between incumbents and new entrants and between government-owned and privately-owned businesses

The (new) overall objective for the 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*** *& the reliability, safety and security of the* ***national electricity system***
- Possible short-comings of this objective:
  - Emphasises electricity rather than end-use energy services
  - Fails to mention sustainability - in 1991, COAG said the NEM should be *efficient AND sustainable*
  - What about technology + participant neutrality?
- *Key principle: effectiveness of competition should be assessed wrt efficient delivery of energy services*

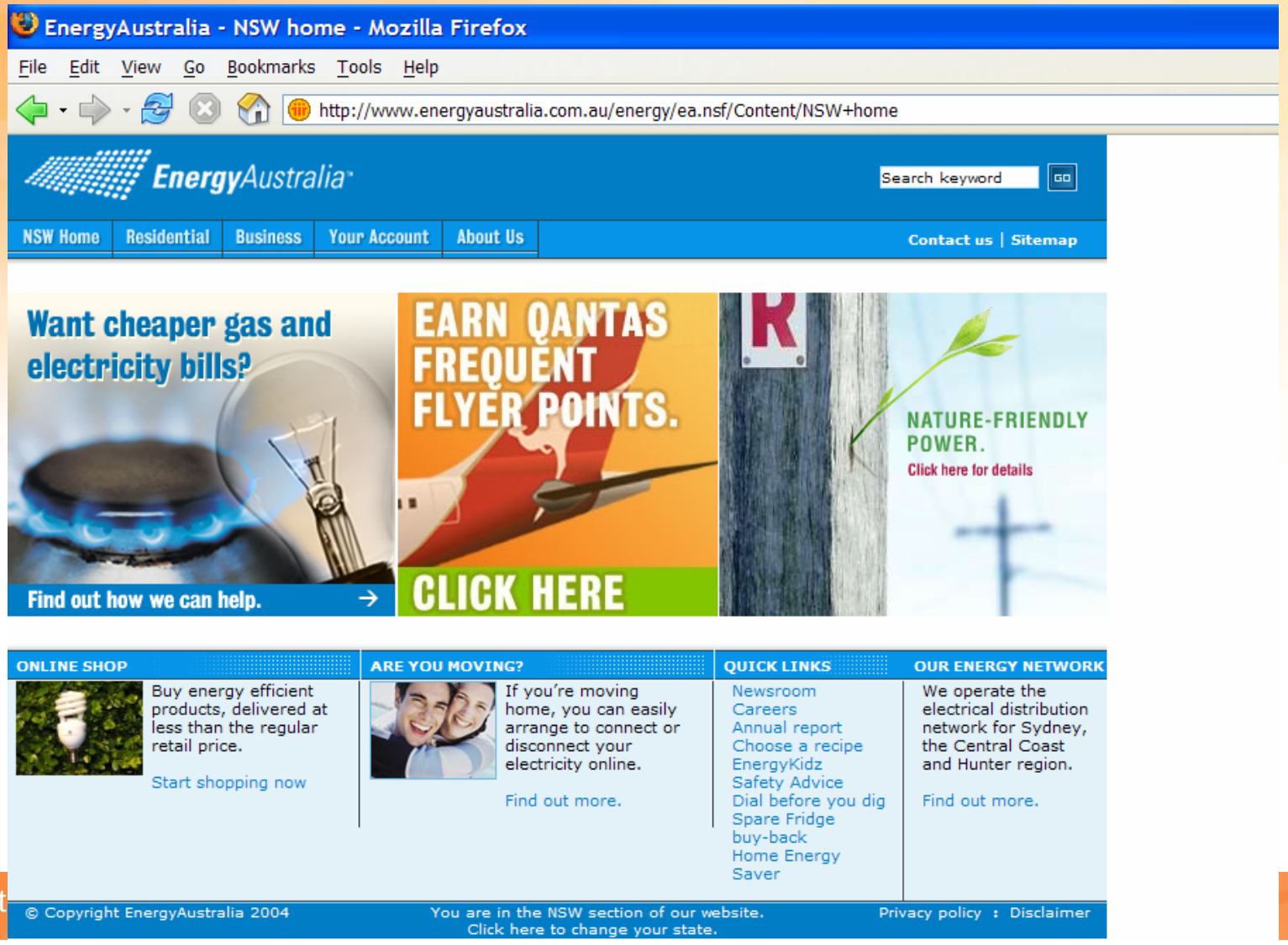
Energy service objectives in practice?

- "Efficient use of electricity services…for an individual consumer occurs when the value from using electricity exceeds to cost of producing and delivering it to the consumer."
  (NERA Consulting, *Draft Report: Review of the role of DSP in the NEM*, March 2008)
  - *What if we can deliver same or greater energy service value for lower supply costs?*
- "For electricity use to be efficient customers should face the marginal network and generation costs of providing electricity services to them"
  - *Key question is impact of decisions made now, particularly investment decisions, on future costs*
- Focus needs to be on pricing policy rather than 'price' & the context within which these prices sit

Present retail market design in Australia

- Retail market design for large end-users:
  - Competitive retail market (not yet mature)
  - Regulated network pricing (not yet mature)
- 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 embedded generation

Current Full Retail Competition limited

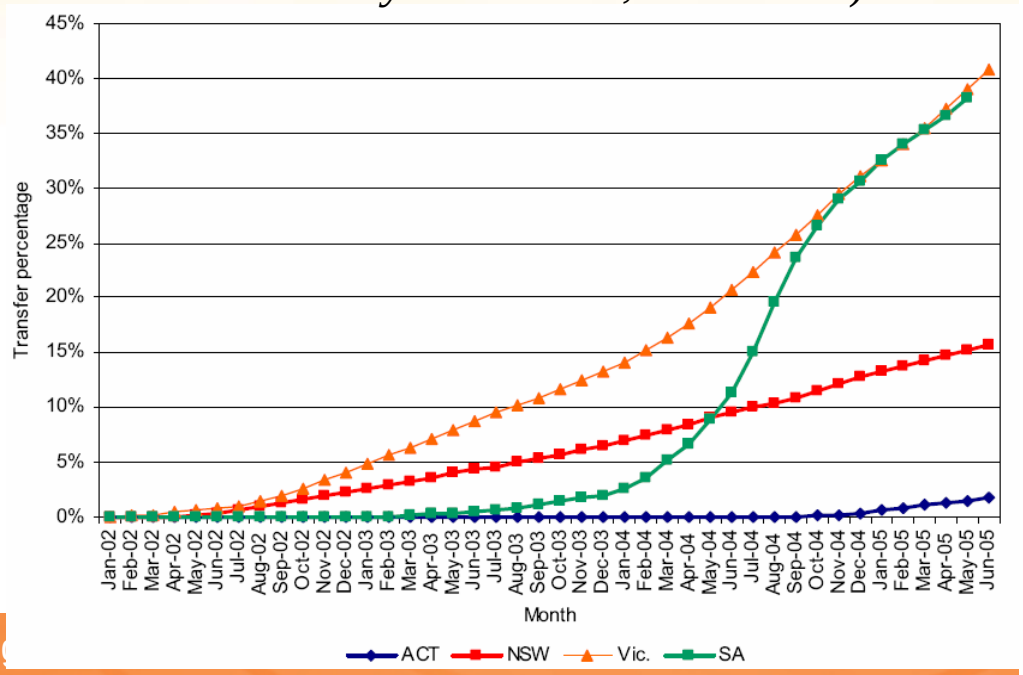


Typical measures of competition not very useful

- Retail transfers? Data limitations, relevance
- Price spreads? Can mean competition, or market failure

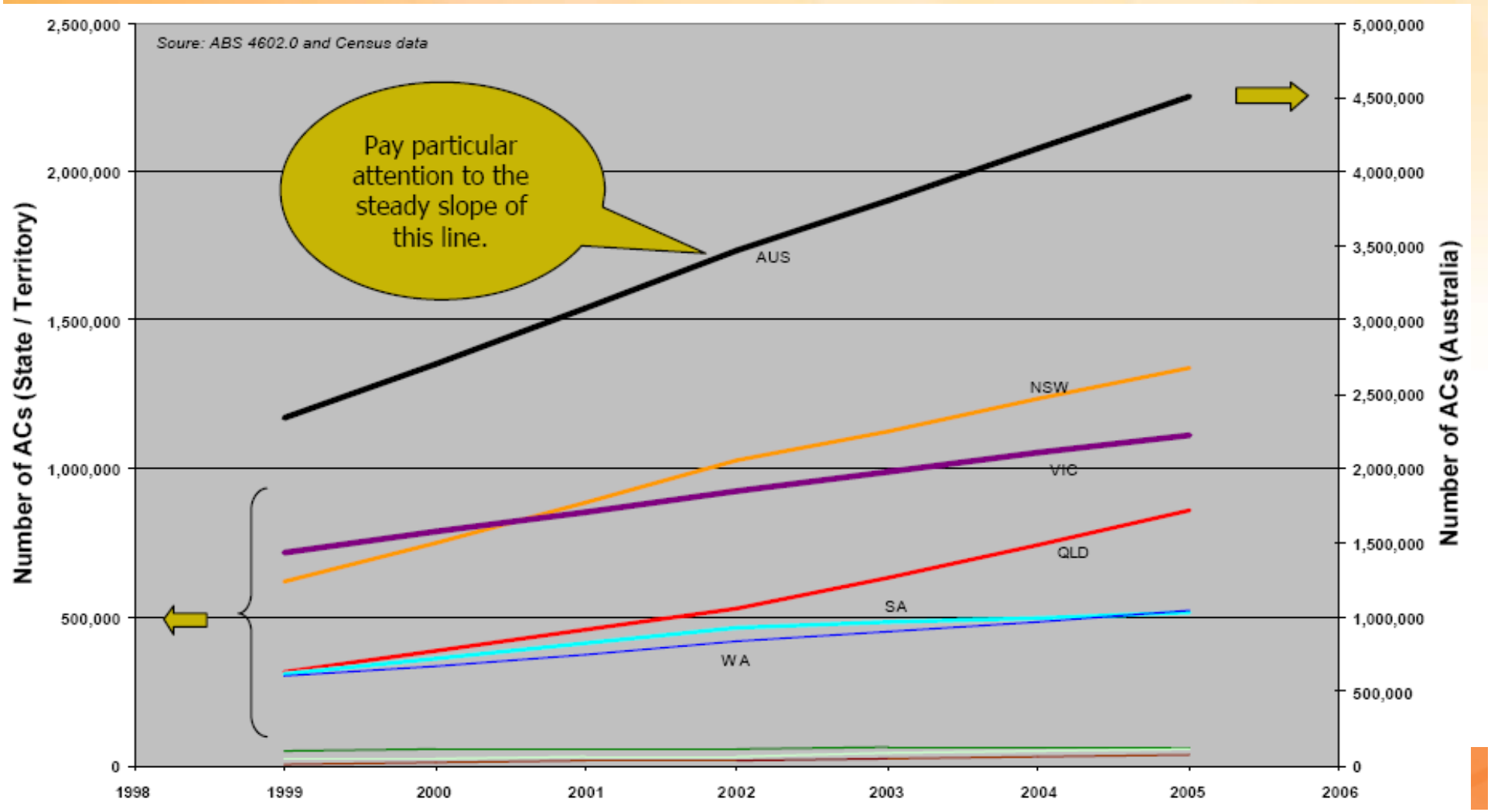
- …. an important reason there is effective competition in Victoria is "Because the provision of energy is viewed as a homogenous, low engagement service… "
  - AEMC, *Effectiveness of Competition in Victoria,* 2008

Retail transfers (ACT ICRC, *Retail Prices for Non-contestable Electricity Customers*, Nov. 2005)

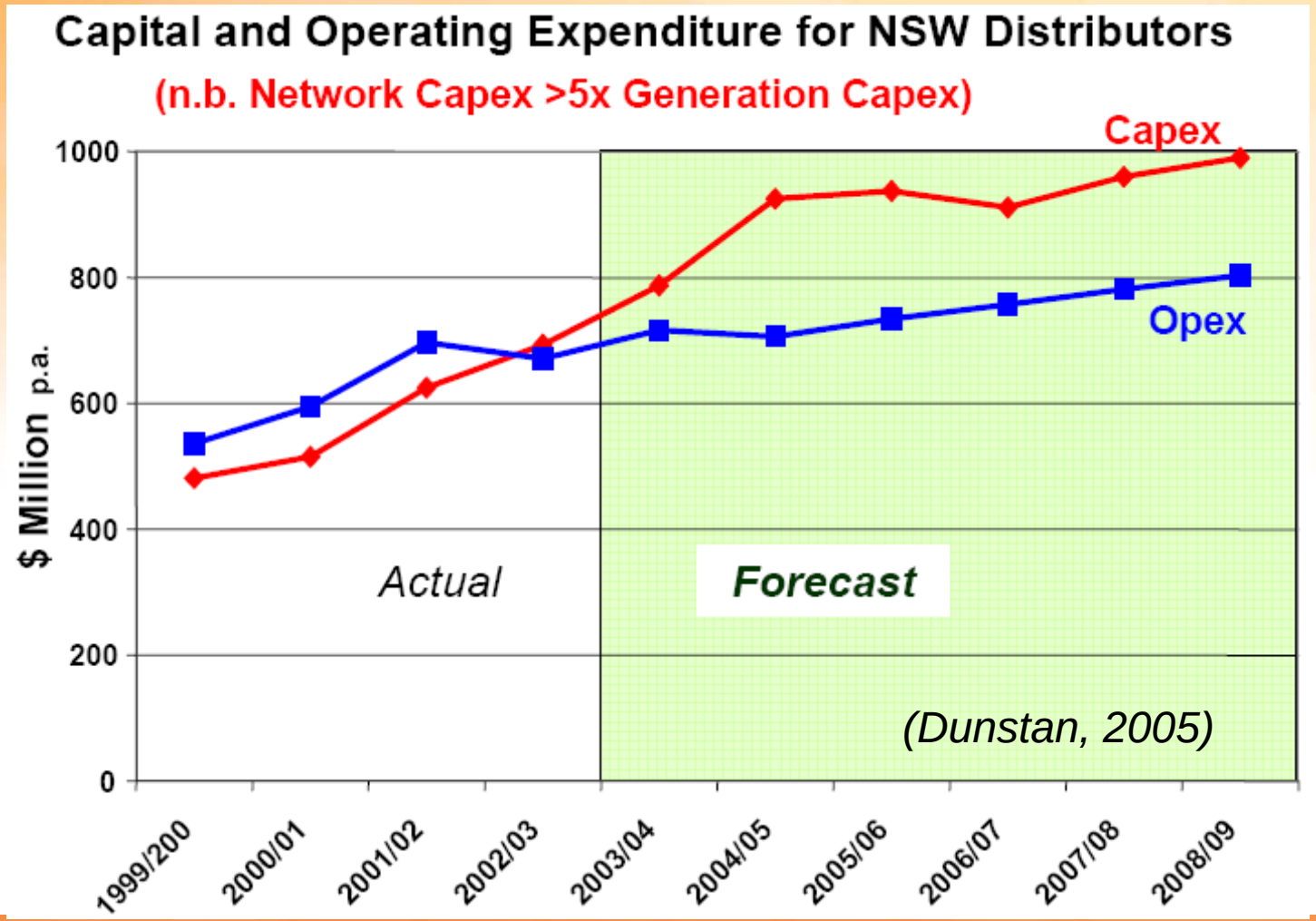


Meanwhile, decision making in the real world

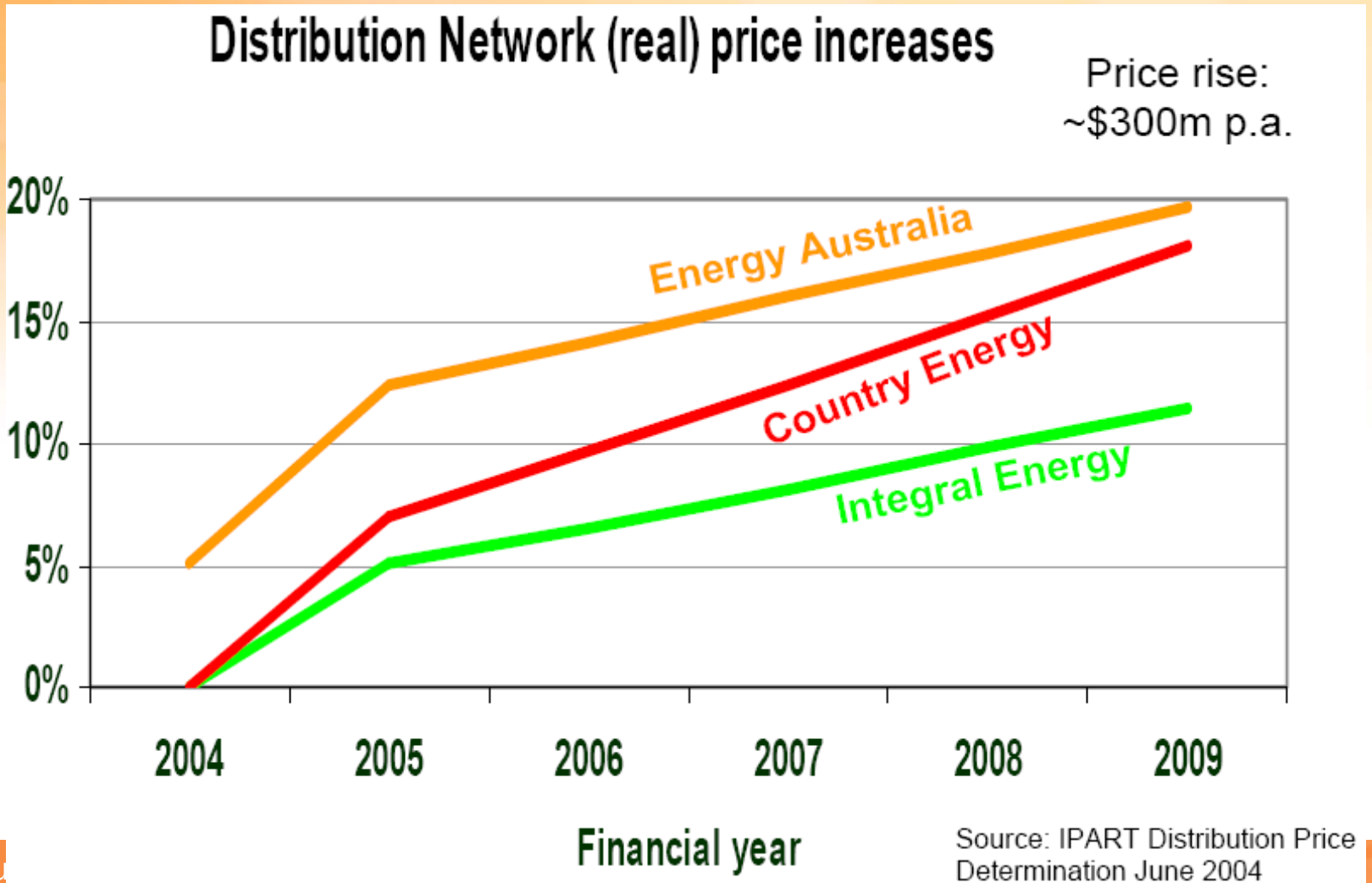
(Washusen, 2005)



Load growth driving network expenditure



….and now increasing prices… but note actual costs very location specific (Dunstan, 2005)



Australian electricity restructuring to date

- Has focussed on wholesale market design, network services & ancillary services
- Has not focussed on retail market design or end-user drivers & options wrt energy services
- **Market design and wider policy needs**
  - Advanced Metering Infrastructure has a key facilitation role
  - End user pricing 'policies' that include better time, location and uncertainty signals – spot *and forward*
  - Agents to support end-user decision making; ESCOs have key role to play
  - A comprehensive & coherent wider set of policies to 'appropriately' frame electricity industry decision making wrt wider economic, social and environmental imperatives
    - Planning, building standards, MEPs and more

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