Electricity Industry Restructuring for Efficiency & Sustainability - *Lessons from the Australian Experience*

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The stationary energy sector: *Can we mainstream ESCOs?*

- **The electricity supply industry**
  - generation
  - transmission
  - distribution

- **The natural gas supply industry**
  - treatment
  - transmission
  - distribution

Non-storable, continuous energy flow

Energy service companies focus on end-use options, eg: efficiency, CHP, solar

End-use equipment delivering energy services eg: light, heat, motive power

Energy losses & external impacts

Primary energy forms e.g: coal, gas, nuclear, renewable
Why improve efficiency of energy use?

- Some arguments for energy efficiency policies:
  - Economic efficiency - electricity markets don’t work
  - Climate change (*Hansen: reduce emissions this decade*)
  - Social policies, particularly for the disadvantaged

- Some arguments against energy efficiency policies:
  - Economic efficiency - electricity markets do work

- What has been the Australian experience?
  - Electricity cheap & ESCO role small
  - Electricity use & CO2 rising, load factor worsening
  - Difficult to implement effective white certificate trading

Present electricity industry structure in SE Australia

- Generation Sector: large generators
  - Gen 1
  - Gen 2
  - Gen 3
  - Gen X

- Financial instrument & REC (emission) trading

- Multi-region National Electricity Market (NEM)
  - Intensions offers & payments

- Transmission Sector
  - Tx network pricing
  - NSW
  - Victoria
  - South Aust
  - Queensland
  - & possibly Tasmania

- Distribution sector
  - Distributor 1
  - Distributor 2
  - Distributor Y

- Retail sector
  - Retailer 1
  - Retailer 2
  - ... Retailer Z

- Network access
  - Network pricing

- End-use sector
  - End-use Equipment & Distributed resources

- Contestable end-users

- Franchise End-users

- Embedded generators

- Contestable end-users

- Franchise End-users
Average NEM spot prices since market inception (12/98 to 12/05) (AER long term analysis)

Spot price duration curve, SA, Jan-Mar 05
(NECA, 05Q1 Stats, 2005; half-hour spot prices)
Cash flow in SE Australia electricity industry

Should we allocate more of these funds to distributed resources?

End-use efficiency?

Residential electricity bill cost components

Transmission use of system

Wholesale market

DUOS 37%

TUOS 8%

Energy costs 46%

Retail costs 9%

Distribution use of system
Availability & quality of supply:- the dominant policy issue for the electricity industry

- Quality of supply attributes of electrical energy flow:
  - Voltage, frequency, waveform purity
- ESI can’t achieve perfect availability & quality:
  - Can vary greatly in distribution networks
  - Customer equipment can be to blame
- Risks to availability & quality of supply threaten the flow of end-use energy services:
  - Directly or indirectly through equipment malfunction
  - Poorly defined legal obligations (mainly on distributors) for availability & quality at end-user connection points
  - Managed mainly by supply-side investment

Managing system security in the NEM

Unreachable or unacceptable futures

Present state

Growing uncertainty

Time

Emergency control

Possible futures managed by decentralised (market-based) decisions

Could distributed resources play a greater role in managing future uncertainty?

5 min

Possible futures managed by centralised decisions
Australian electricity restructuring to date

- Has focussed on wholesale electricity & ancillary services market design & network services
- Has not focussed on retail market design or encouraged active end-user participation
- However, there are now some relevant policies:
  - NSW DM code, energy efficiency fund & NGAS
  - Roll-out of interval metering in NSW & Victoria
  - Regulatory test for network augmentation
  - National Framework for Energy Efficiency
  - State policies on enhanced building energy performance for commercial & residential sectors

NSW Demand Management Code

- DNSPS required to develop DR expertise
- DR options to be developed in-house & externally
- Market must be tested for options when reasonable
- Market to be informed well in advance of constraint
- Network & DR options to use the same database
- Clear & transparent option comparison
- Process assessed by DNSP regulator:
  - Regulator allows full cost recovery for cost-effective options as well as additional incentives for DR activities

- Endorsed in 2002 by Ministerial Council on Energy:
  - To set directions for energy efficiency policy & programs
  - To promote a uniform approach across Australia
  - To reduce the predicted gap between supply & demand
  - To reduce the energy intensity of the economy & in the process, increase the GDP

- Proposed mechanisms:
  - Enhance mandatory energy performance standards
  - Facilitate the uptake of cost-effective measures
    - Reduce barriers & constraints in a nationally coordinated manner


- Estimates have high uncertainty however potential clearly very large (NFEE, 2003)
- Rebound effect may negate reduction in energy use unless electricity prices rise

Figure 4: Percentage cost-effective energy consumption reduction potential across different sectors.
State policies on building energy performance

- NSW: all new houses & major refurbishments must pass BASIX assessment of energy use & other aspects of sustainability
- Victoria: 5-star code requirement for all new houses

Example: Sydney region DM project

- Participants:
  - Transgrid, EnergyAustralia (distributor), NSW Dpt of Industry, Planning & Natural Resources (DIPNR)
- Objectives:
  - Identify & develop cost-effective DR options to defer or avoid network augmentation in inner Sydney region
- Options considered (2003 to 2006):
  - Stand-by generation, interruptible load, power factor correction, innovative HVAC, building design (Basix)
NSW transmission network, Sydney region (M Park, 2005)
EnergyAustralia distributor meter & network tariff strategy (H Colebourn, 2005)

- Only half-hour meters installed since July 2004
- Replacement half-hour meters for most of 25,000 40-160 MWH end-users installed by June 2005
- Replacement half-hour meters for 110,000 15-40MWH end-users by June 2010
- 3-rate TOU network tariff from March 2005
- Seasonal TOU network tariff from July 2005
- Residential trials of non-predetermined pricing & interruptible loads
Possible next step: spot & forward network access contract (based on EA trial)

Forward contract profile based on ave WWD demand
End-user pays spot price for (spot - contract)

End-user is paid spot price for (contract - spot)

Profile example: SCE Residential load
(http://www.sce.com/AboutSCE/Regulatory/loadprofiles/2006loadprofiles.htm)
Default residential forward contracts

- Forward demand profile to meet basic household needs for normal weather conditions:
  - Energy and network access
- Forward price profile determined by area-specific network LRMC estimate for cost of supply:
  - Considering economically efficient investment in either supply-side or demand-side options
- Forward term to be 3-5 years with annual update
- Local spot price derived from wholesale market:
  - Allowing for network losses & flow constraints
Conclusions on valuing DR contribution

- Important issues in valuing DR:
  - Availability of supply
  - Quality of supply, particularly voltage & frequency
  - Obligation to serve, particularly network flow constraints

- DR role can be facilitated by coordinated technical & market mechanisms
  - Spot (30 minute) prices for energy & ancillary services
  - Interval metering with QOS measurement
  - Retail tariffs restructured as spot & forward contracts

- Enhanced role for ESCOs:
  - Key source of advice & options for end-users

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