





Electricity Industry Restructuring: Lessons from the Australian experience

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Electricity industry restructuring:

- Is like deciding to change from driving on the right hand side of the road to driving on the left hand side of the road. Without stopping the traffic.
- It is better not to do it at all unless:
 - You are sure you want to do it
 - You know what you want to do and have a clear transition strategy
 - You don't stop halfway
- Australia took its time to plan what to do & decide it wanted to do it. It then did the job (sufficiently) well.





Trading in electricity:- an abstraction from reality



Managing supply-demand balance in NEM

Scope of the NEM

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

NEM regions are indicated, and their boundaries need not be on state borders (e.g. two regions in NSW)

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Average weekly price & demand, SA, Q1 2005 (NECA, 05Q1 Stats, 2005)

Spot price duration curve, SA, Jan-Mar 05

(NECA, 04Q4 Stats, 2005; half-hour spot prices)

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

Running weekly accumulation of (336) RRPs & cumulative price threshold (CPT) (NECA, 05Q1Stats, 2005)

Distribution of NEM spot prices & revenues

(Federal Government: Securing Australia's Energy Future, 2004)

Flat contract prices, Q1 2005

(NECA, 05Q1 Statistics, 2005)

D-cyhpaTrade exchange-traded call options for NSW peak period (www.d-cyphatrade.com.au)

Figure 4 New South Wales Summer Outlook

Figure 5 Victoria and South Australia Summer Outlook*

- reserve capacity support from the Snowy Hydro Scheme and Queensland provide additional available capacity in 2006/07 and 2007/08
- in 2008/09, New South Wales experiences deficits, even though Queensland has additional available capacity. This is due to interconnector transfer limits from Queensland
- in 2008/09, New South Wales cannot source additional capacity from Snowy, as Victoria and South Australia are already experiencing deficits
- from 2005/06 onwards, following commissioning of Basslink, there is an additional available capacity of 600 MW to the Victoria and South Australia region
- an LRC point occurs in the following year (2006/07), when the Extra Capacity for Reliability is 321 MW
- in 2006/07 and 2007/08, reserve support from Snowy, New South Wales and Queensland is limited by the capability of the Snowy to Victoria interconnector

Changing generation offer to raise spot market price (2/8/03)

graph courtesy of Stuart Thorncraft & Intelligent Energy Systems EMIS facility (www.iesys.com.au)

(possible demand-side responses: derivative contract or reduce demand)

Robustness example. Transformer failure at 2142, 13 Aug 04: 3,100MW gen lost; Frequency 48.9Hz; 2,100 MW load shed in NSW, Qld, Vic, SA

Total Demanc

Robustness example: NEM energy revenue, 13/8/04

Robustness example: NEM FCAS revenue 13/8/04

1995 NEM rules trading experiments

- Implemented key features of the NEM rules:
 - NEM bid and offer structure & network loss functions
 - Multi-region spot market with embedded network model
 - 1 & 2 day ahead STFMs with embedded network model
 - Short term PASA with broadcast warnings of constraints
- Provided a sufficiently realistic trading environment:
 - Key participant characteristics
 - Uncertainty in availability, weather
 - Reporting on trading activity & simple decision support
- Operated faster than real time:
 - 2 weeks of trading per day with 3 hour spot market period
 - NEM rules use a half-hour spot market interval
- Used for education as well as formal experiments:
 - >1,000 participants prior to actual market start

Technology types in '95 NEM simulation model

- Seven thermal generator portfolios (subject to outages):
 - Fast start generators (instantaneous start)
 - Slow start generators:- all other thermal plant (self commitment)
 - Max & min load; hot, warm & cold start-up times
 - Start-up costs; fixed & variable operating costs
 - Mean time to fail, mean time to repair, cost of repair
- One hydro generator:
 - Headpond capacity & initial level, inflow rate, pumping
- Seven demand side participants (uncertain temperature):
 - Retail tariff load (daily & weekly patterns, temp. coef't)
 - Demand management (psuedo generator with op. cost)
- One reserve participant (small thermal plant)

Simulation results: single region prices

Occasional zero spot prices. After the initialisation phase, the STFM prices provide reasonable predictions of average spot prices

Simulation results: single region quantities

Contract cover is a compromise between generator interests and demand side interests. Some contract speculation evident on the final Monday. Generators de-committing at weekends but not overnight.

Outcomes from trading experiments

- A sophisticated simulation package can adequately represent NEM market trading conditions:
 - Operational focus; two weeks of simulated trading per day
 - Suitable for exploring operation of market rules & for training
- Experiments demonstrate that generators can exercise market power if insufficient competition:
 - Only under outage conditions for single region experiments:
 - Largest generation participant then had 'must run' plant
 - Most of the time in each region for five region experiments:
 - Single or larger generation participant in each region had 'must run' plant because of tie-line flow constraints
 - Forward contract cover can protect a buyer from the effects of spot market power

Conclusions on the Australian experience

- Successful electricity restructuring required:
 - Care in developing & maintaining consensus
 - A high level of professionalism in key roles
 - Extensive peer-review & auditing of market design
- Australian NEM uses a coherent design approach:
 - Decision making & risk management framework
 - Applied consistently to engineering & commercial issues, recognising strengths & weaknesses of each
 - Experimental economic techniques used to test design
 - Design works successfully with a weak network, weathersensitive demand & a growing level of wind generation

Key references (*these & other publications at <u>www.ceem.unsw.edu.au</u>): H R Outhred & R J Kaye, "Incorporating Network Effects in a Competitive Electricity Industry: An Australian Perspective", Chapter 9 in M Einhorn & R Siddiqi (eds), <i>Electricity Transmission Pricing and Technology*, Kluwer Academic Publishers, 1996. H R Outhred, "The Evolving Australian National Electricity Market: An Assessment" in *Power Progress: An Audit of Australia's Electricity Reform Experiment* edited by Graeme Hodge, Valarie Sands, David Hayward and David Scott, Australian Scholarly Publishing, Melbourne, ISBN 1 74097 034 9, 2004.