



CEEM Specialised Training Program

El Restructuring in Australia

Market power issues in the NEM

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Network Loss factors – calculated from data in the previous financial year, applied for the next financial year

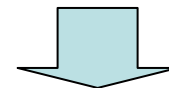
Distribution connection point (average loss factor) DLF

- Apply MW and MWAr data to calculate loss factors for each trading interval in the previous financial year
- Volume-weighted averaged over the financial year

Transmission connection point (marginal) MLF

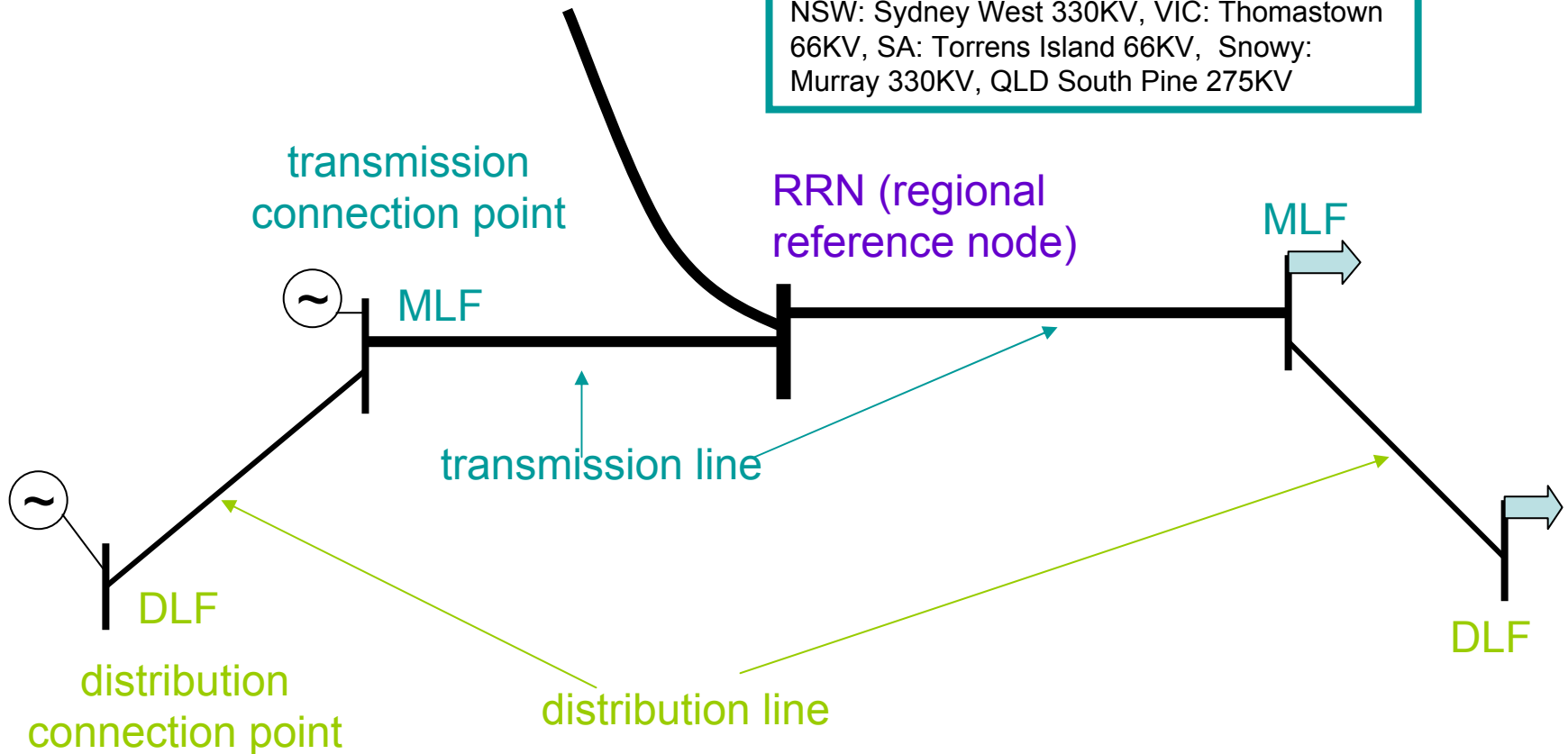
- Identify variables of determining inter-region losses (e.g generation, load, network factors)
- Regression analysis of the data in the previous financial year to fit the loss equation

Typical loss in transmission network 2.5-4.5%, and in distribution network could be much higher than this, especially in rural area. Totally is around 10%



Inter-regional Settlement Residual Auction

NSW: Sydney West 330KV, VIC: Thomastown 66KV, SA: Torrens Island 66KV, Snowy: Murray 330KV, QLD South Pine 275KV



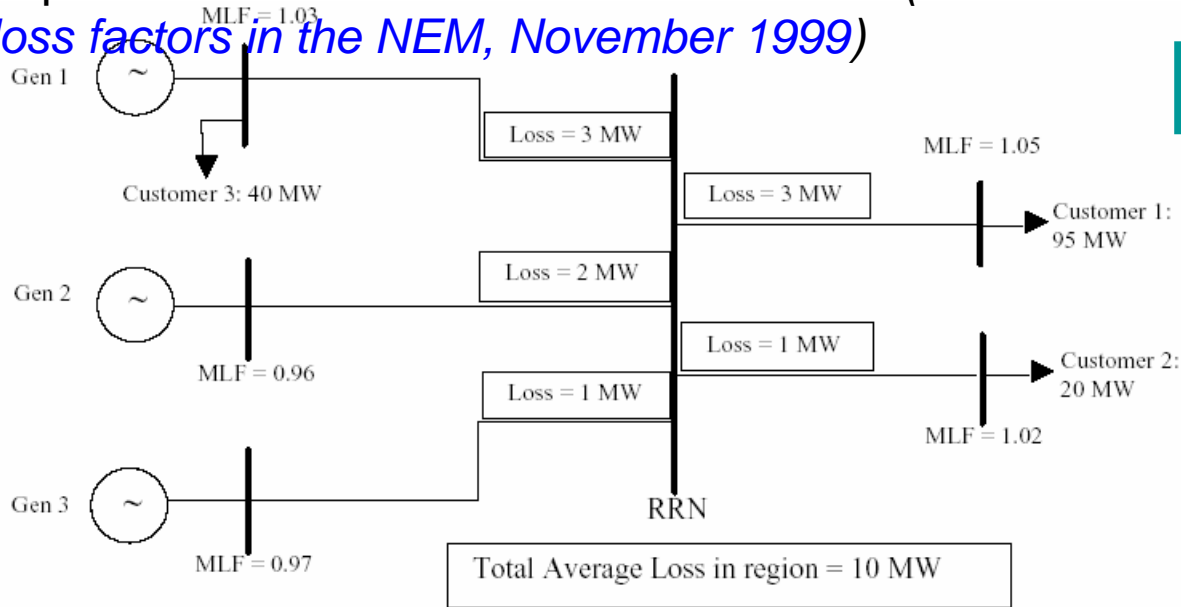
$$\text{Generator bid price at RRN} = \text{Generator bid price at connection point} / (\text{MLF} * \text{DLF})$$

$$\text{Demand offer price at RRN} = \text{demand offer price at connection point} / (\text{MLF} * \text{DLF})$$

$$\text{Price at generator's connection point} = \text{RRN spot price} / (\text{MLF} * \text{DLF})$$

$$\text{Price at demand's connection point} = \text{RRN spot price} / (\text{MLF} * \text{DLF})$$

Impact of loss factors on market outcomes (*From NEMMCO, Treatment of loss factors in the NEM, November 1999*)



Locational advantage

Allocated loss factors

Generator	Capacity	Block 1		Block 2		Block 3	
		MW	Price at Gen	MW	Price at Gen	MW	Price at Gen
1	20 MW	-	-	15	\$20	5	\$50
2	200 MW	120	\$0	50	\$25	30	\$30
3	30 MW	-	-	30	\$25	-	-

Generators' bids

Price/MLF



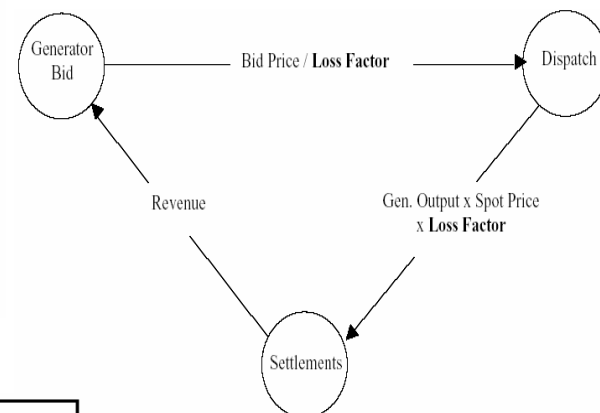
Generator	Capacity	Block 1		Block 2		Block 3	
		MW	Price at RRN	MW	Price at RRN	MW	Price at RRN
1	20 MW	-	-	15	\$19.42	5	\$48.54
2	200 MW	120	\$0	50	\$26.04	30	\$31.25
3	30 MW	-	-	30	\$25.77	-	-

Generators' bids after loss adjustment

System merit order

Impact of loss factors on market outcomes (*continued*)

Price at RRN	Generator	Block	MW	Cumulative MW
\$0	2	1	120	120
\$19.42	1	2	15	135
\$25.77	3	2	30	165
\$26.04	2	2	50	215
\$31.25	2	3	30	245
\$48.54	1	3	5	250



Payment received from customers

Customer	Spot Price _{RRN} * MLF	LOAD	Payment by Customer
1	\$27.06	95 MW	\$2571
2	\$26.29	20 MW	\$526
3	\$26.54	40 MW	\$1062
Total			\$4159

Payment made to generators

Generator	Spot Price _{RRN} * MLF	Output Dispatched	Payment to Generator
1	\$26.54	15 MW	\$398
2	\$24.74	120 MW	\$2969
3	\$25	30 MW	\$750
Total			\$4117

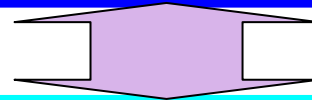
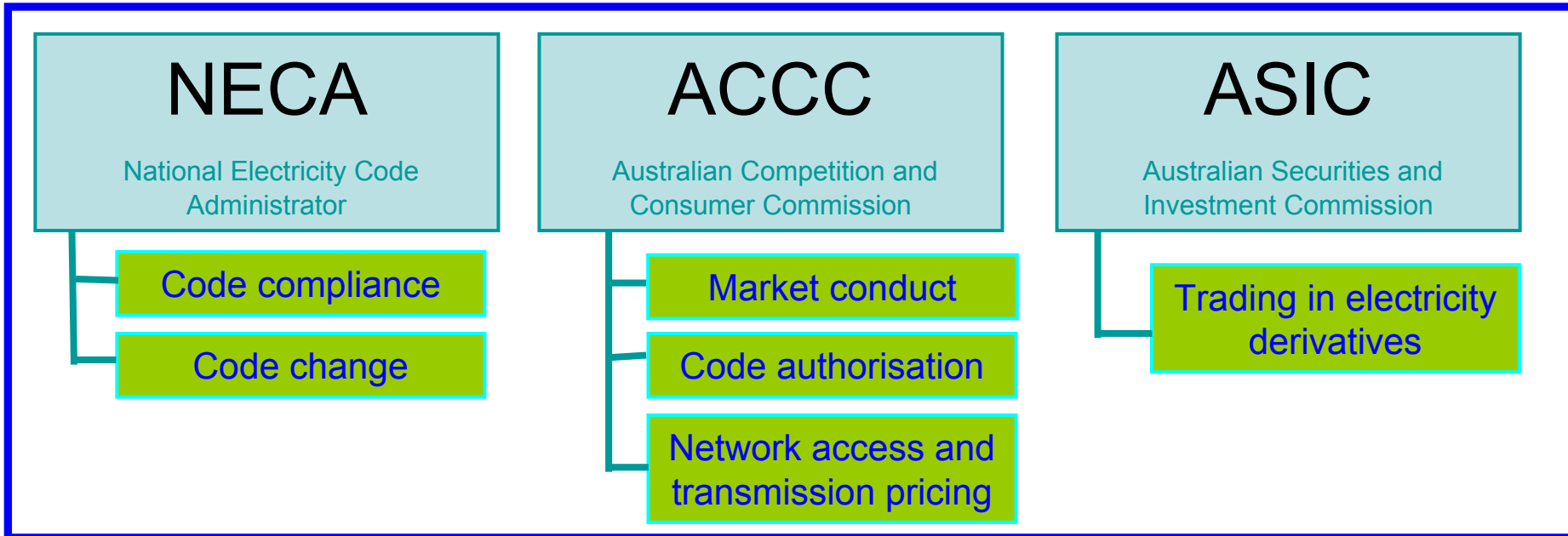
Market settlement surplus = \$4159 - \$4117 = \$42



CEEM Training Program – *El Restructuring in Australia*

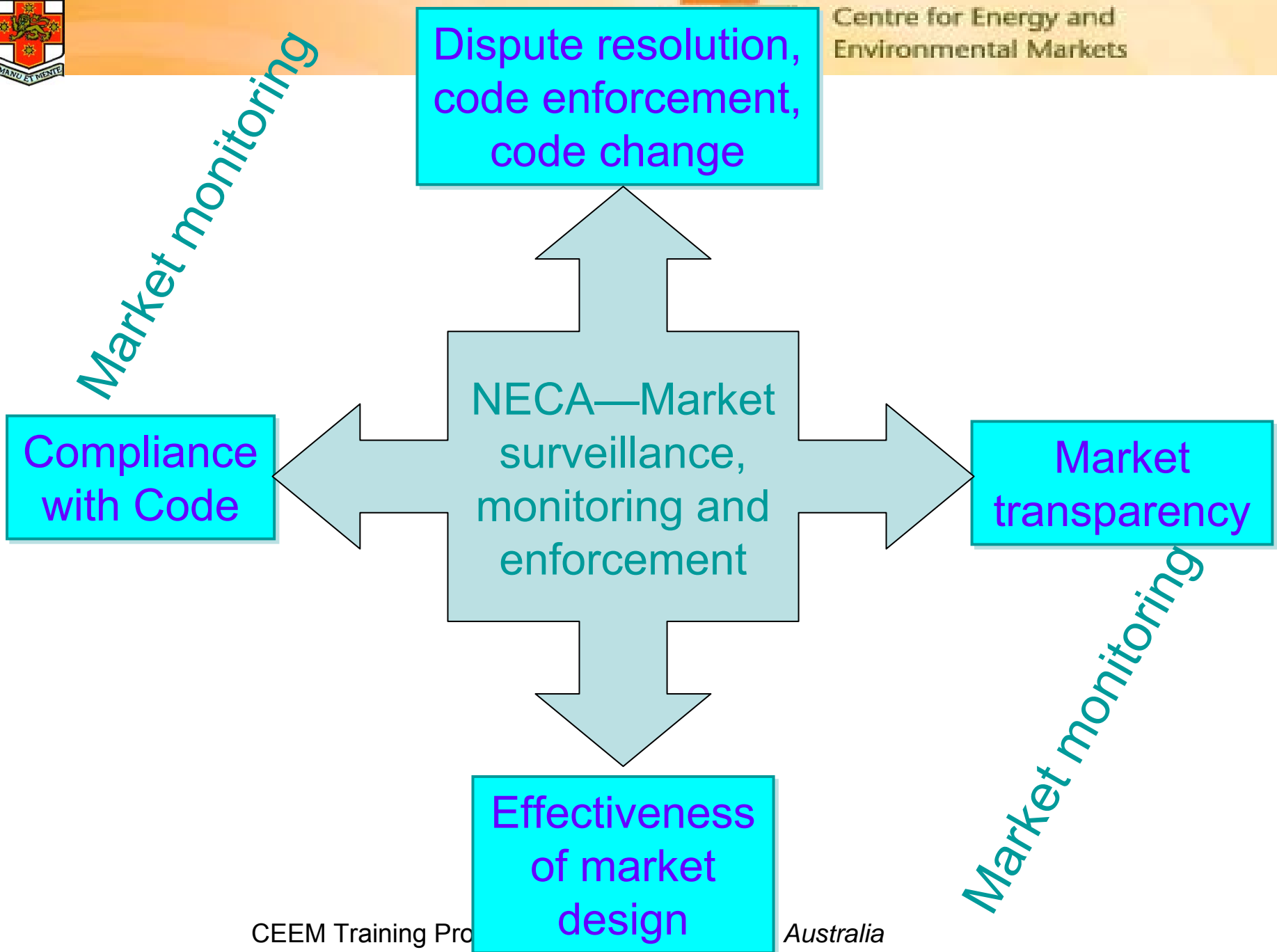
Settlement Residual Auction

Major regulators and functions



Functions of State and Territory Regulators

- Distribution access, licensing and compliance
- Distribution network charges
- Retail licensing and compliance



Market power – definition and some measurements

Market power is defined as a capability of producers to maintain the **market price** above the **marginal cost** of production over a **sustainable period**

Price-cost index (ex-post)

$$= \frac{\text{Actual price} - \text{competitive price}}{\text{competitive price}} \times 100\%$$

Herfindahl-Hirschman Index (HHI)

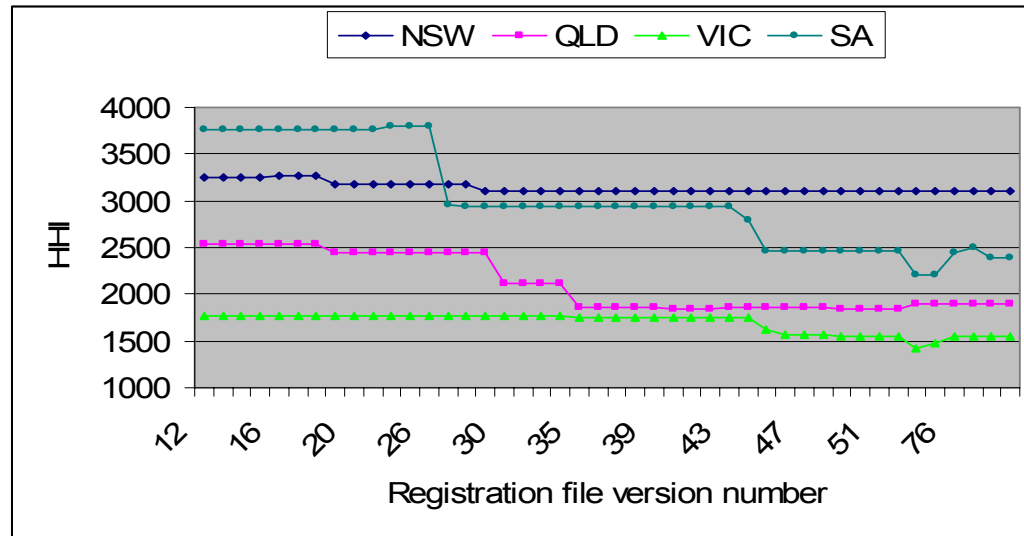
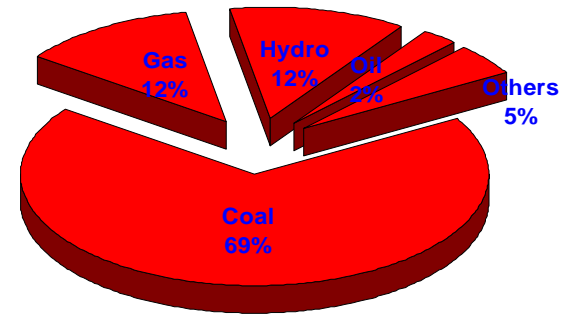
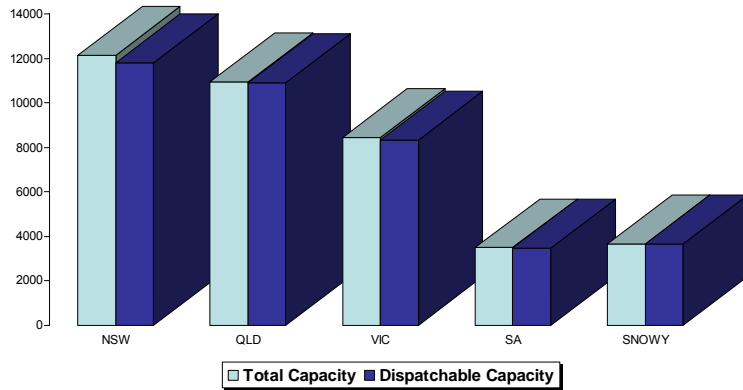
$$= \sum (\text{individual market share})^2$$

For example, National power (52%), PowerGen (33%), Nuclear Electric (15%). Then $\text{HHI} = 52*52 + 33*33 + 15*15 = 4018$ in the England & Wales market

Equilibrium models:

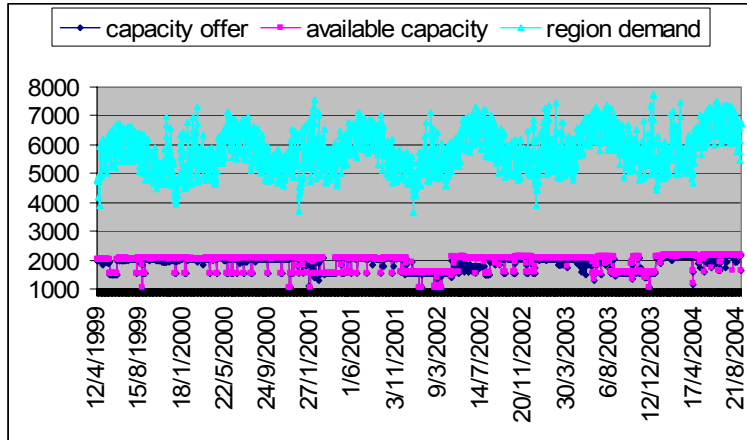
Oligopolistic models (game theory models), simulation models, multi-agent models (Bunn&Oliveira 2003)

Market concentration

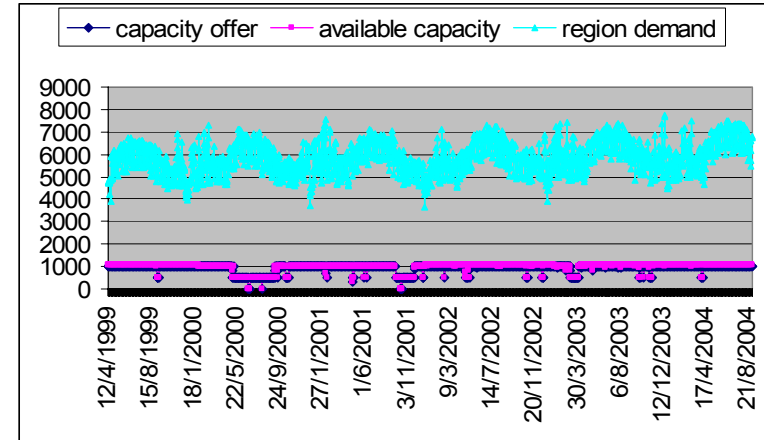


The Herfindahl-Hirschman Index (HHI) for four NEM regions

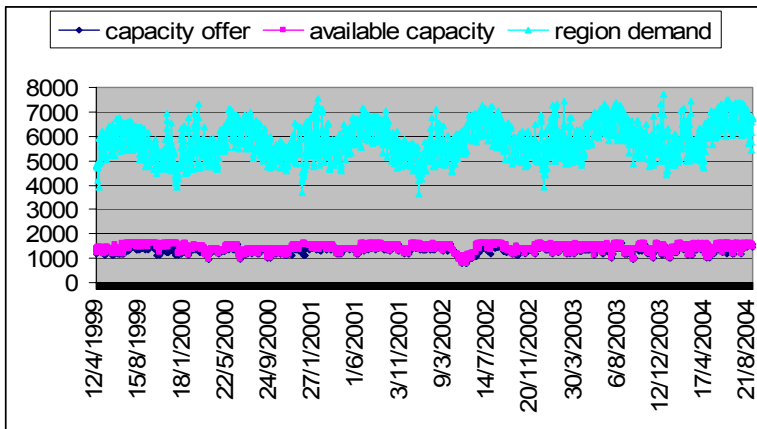
Four Victorian base-load generators' capacity offer at \$40/MWh for the 18:00 trading intervals from April 12, 1999 to August 31, 2004



Loy Yang 4X520MW



Edison 2X500MW

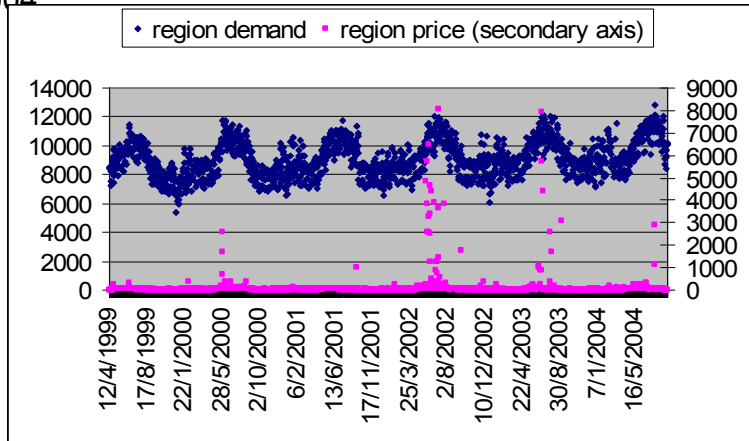


Hazelwood 8X200MW

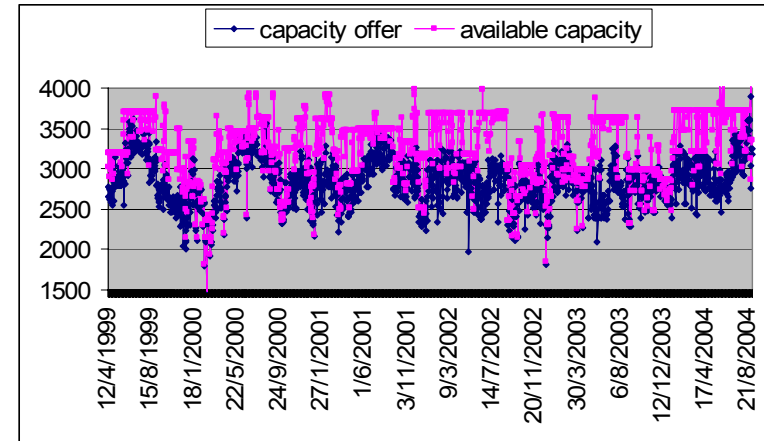


Yallourn 2X350MW + 2X375MW + 32MW (gas)

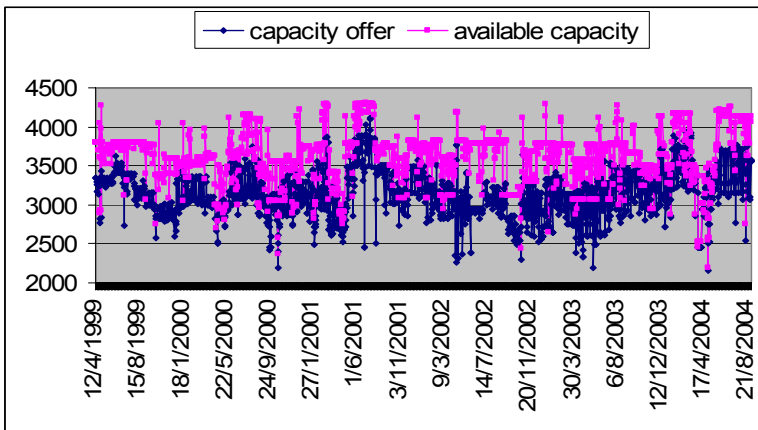
Three NSW base-load generators' capacity offer at \$40/MWh for the 18:00 trading intervals from April 12, 1999 to August 31, 2004



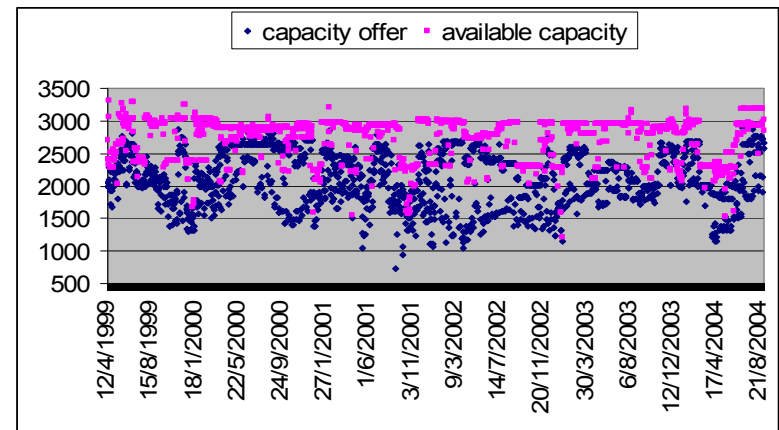
NSW region demand and prices at 18:00



Delta 660MW X 4 + 500MW X 2+ 300MW X 2 = 4240 MW



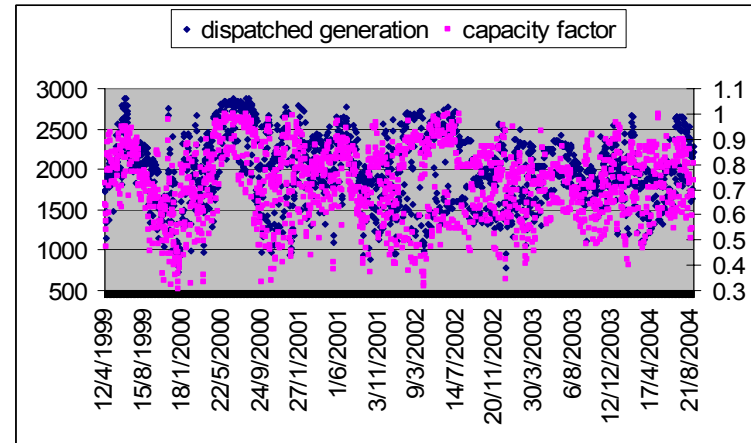
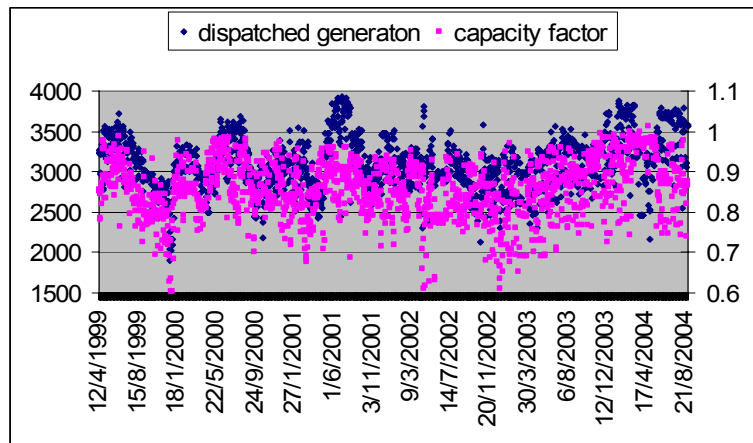
Macquarie 660MW X4+ 500MW X 4+ 50 MW (gas) = 4690 MW



Eraring 660MW X 4 + gas units + hydro units = 3676 MW

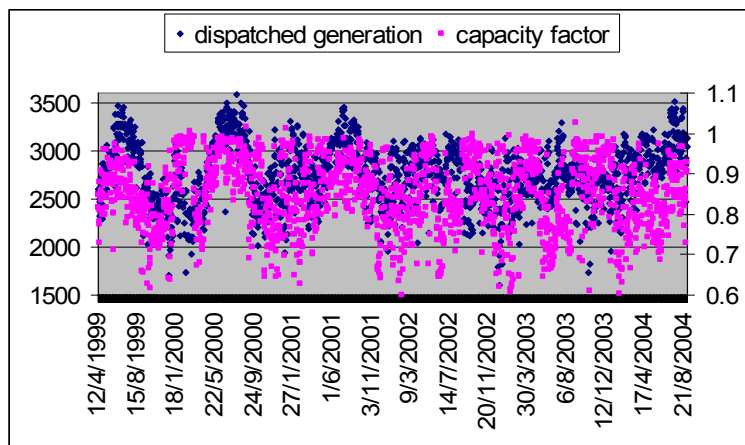


Three generators' dispatched generation and capacity factors in the NSW region for the 18:00 trading intervals from April 12, 1999 to August 31, 2004



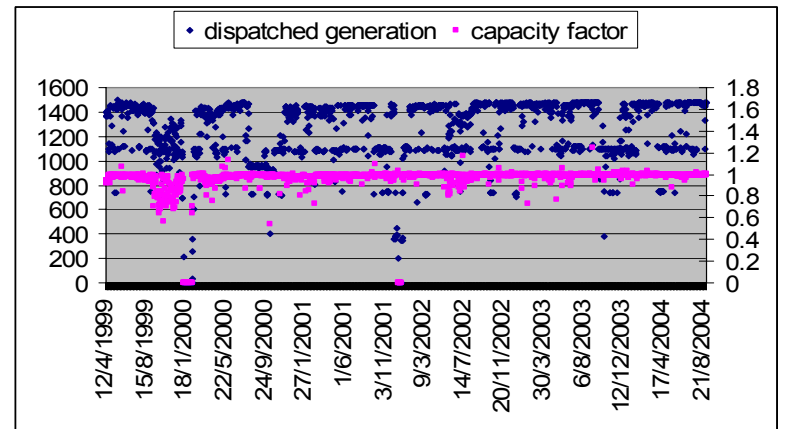
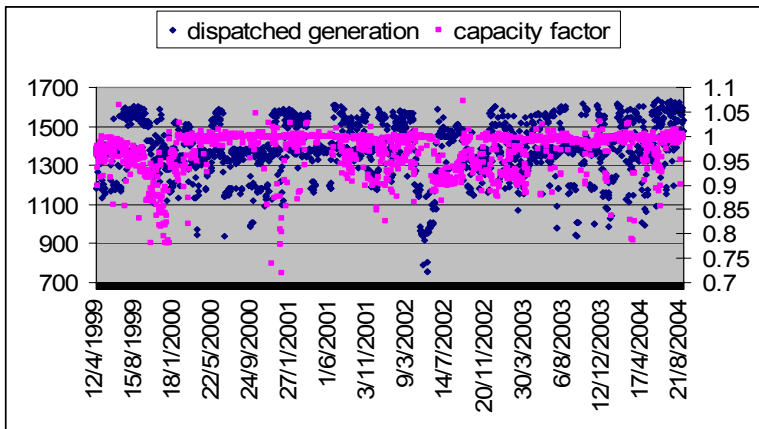
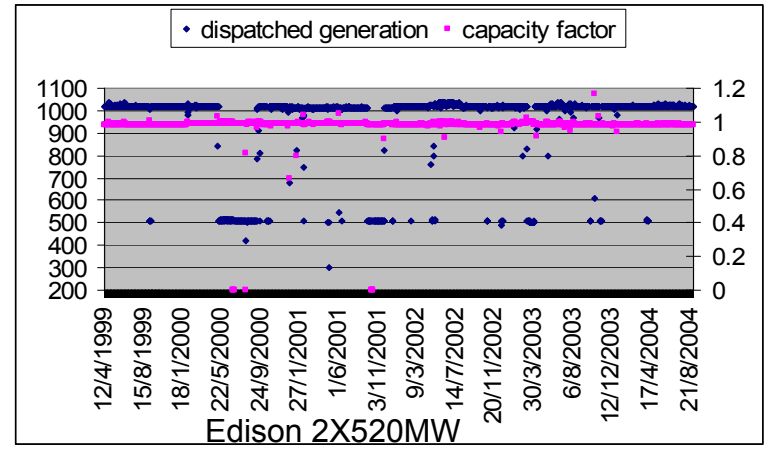
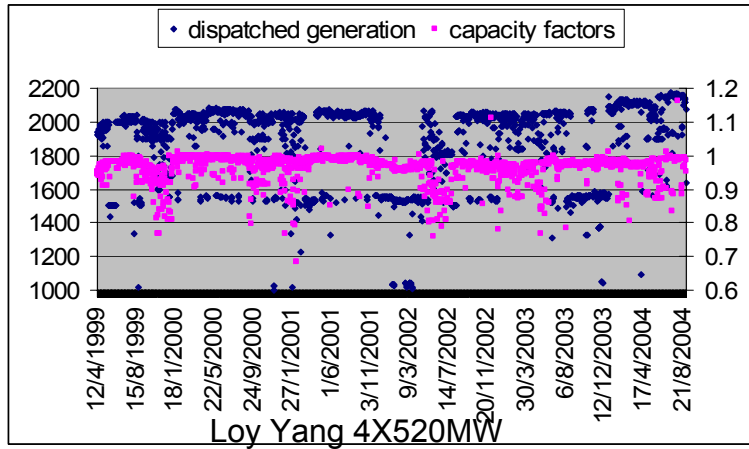
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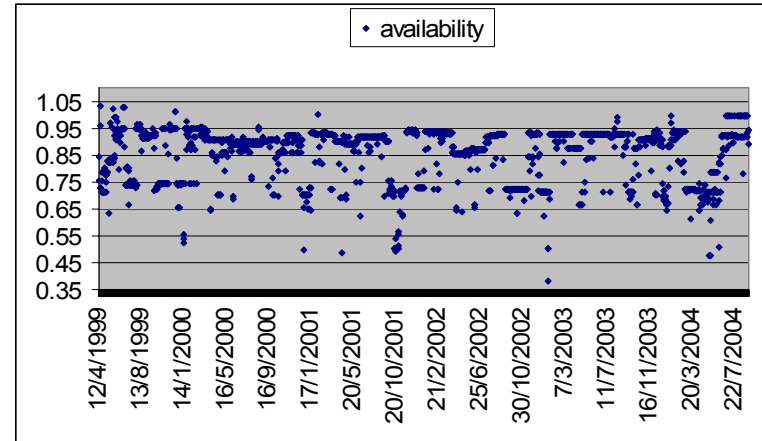
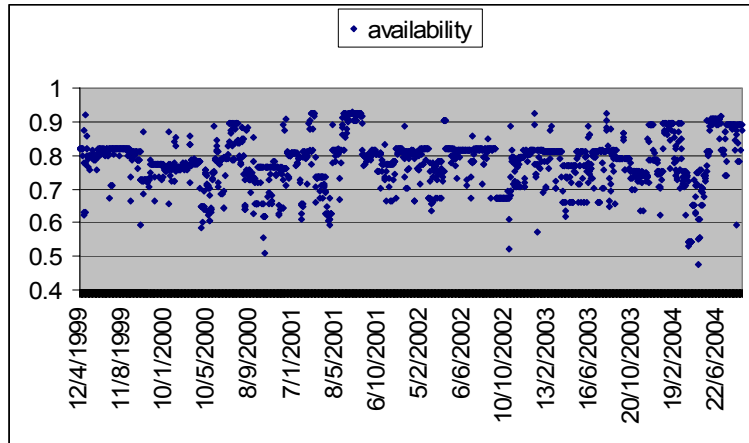
Delta 660MW X 4 + 500MW X 2+ 300MW X 2 = 4240 MW

Four generators' dispatched generation and capacity factors in the VIC region for the 18:00 trading intervals from April 12, 1999 to August 31, 2004





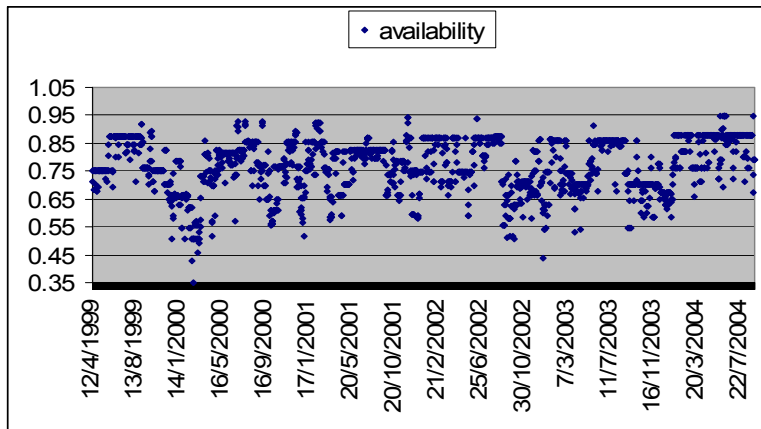
Capacity availability of three generators in the NSW region for the 18:00 trading intervals from April 12, 1999 to August 31, 2004



Macquarie 660MW X4+ 500MW X 4+ 50 MW (gas) = 4690 MW

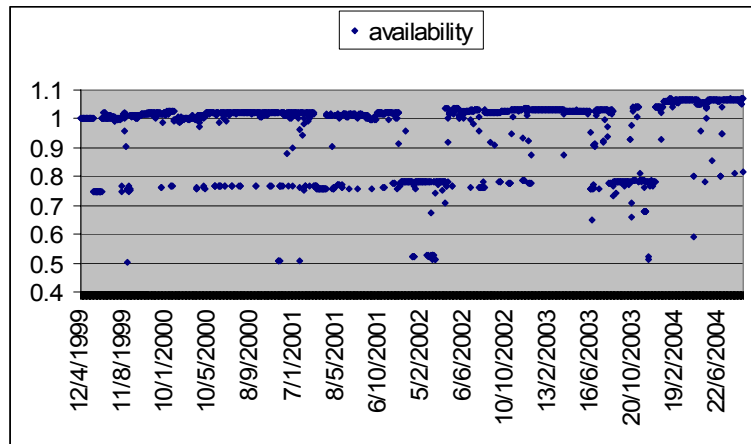
Eraring 660MW X 4 + gas units + hydro units = 3676 MW

Only considering 3200 MW due to pumps

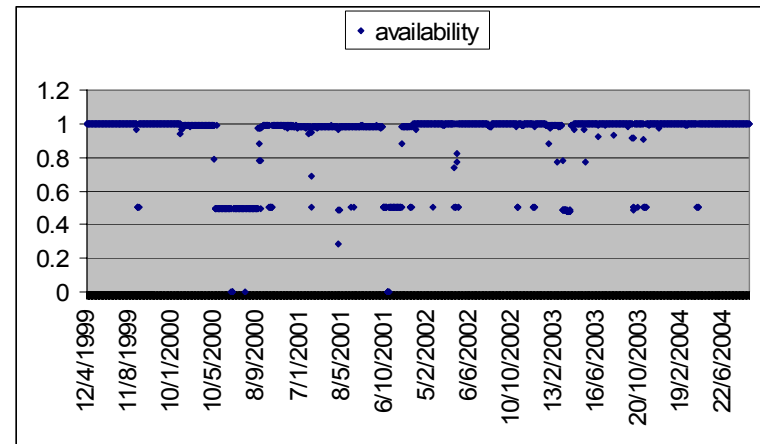


Delta 660MW X 4 + 500MW X 2+ 300MW X 2 = 4240 MW

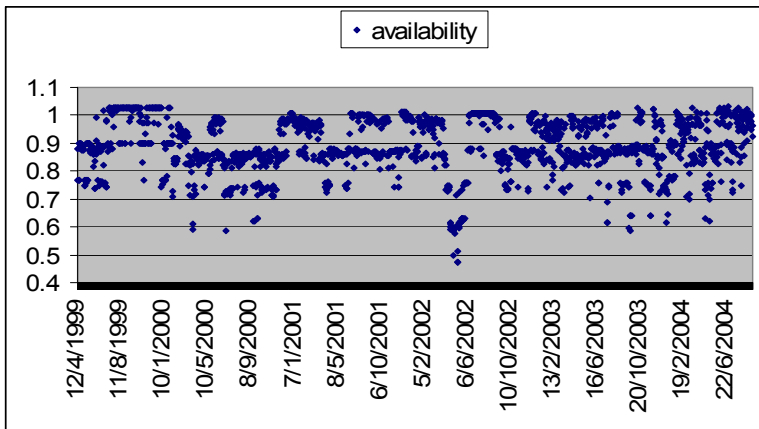
Capacity availability of four generators in the VIC region for the 18:00 trading intervals from April 12, 1999 to August 31, 2004



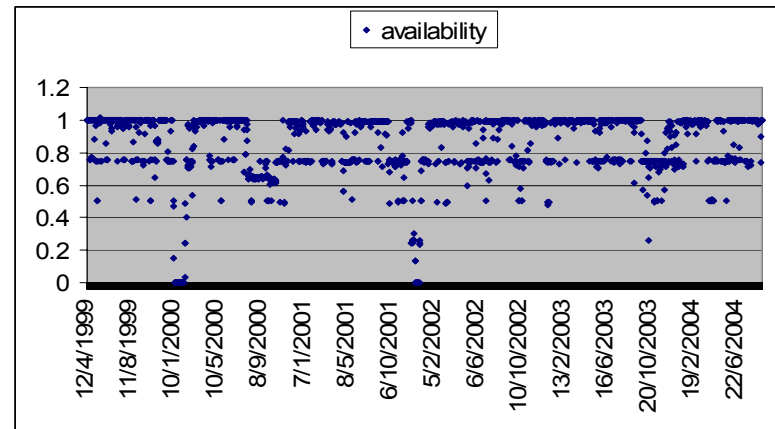
Loy Yang 4X520MW



Edison 2X520MW

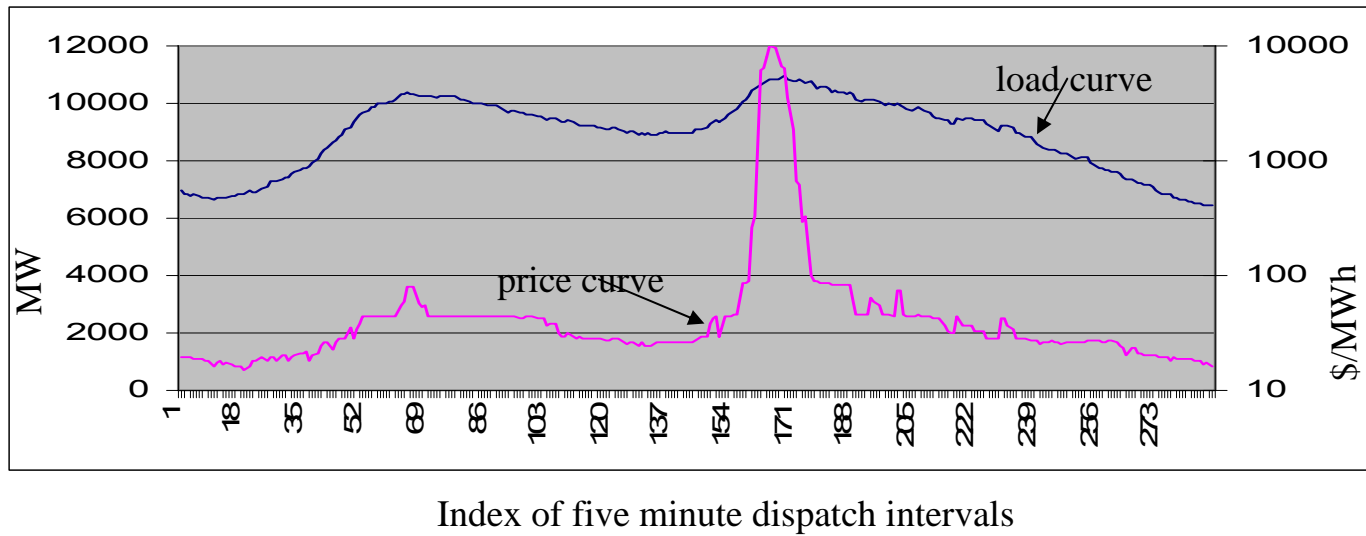


Hazelwood 8X200MW



Yallourn 2X350MW + 2X375MW + 32MW (gas)
[~1480MW]

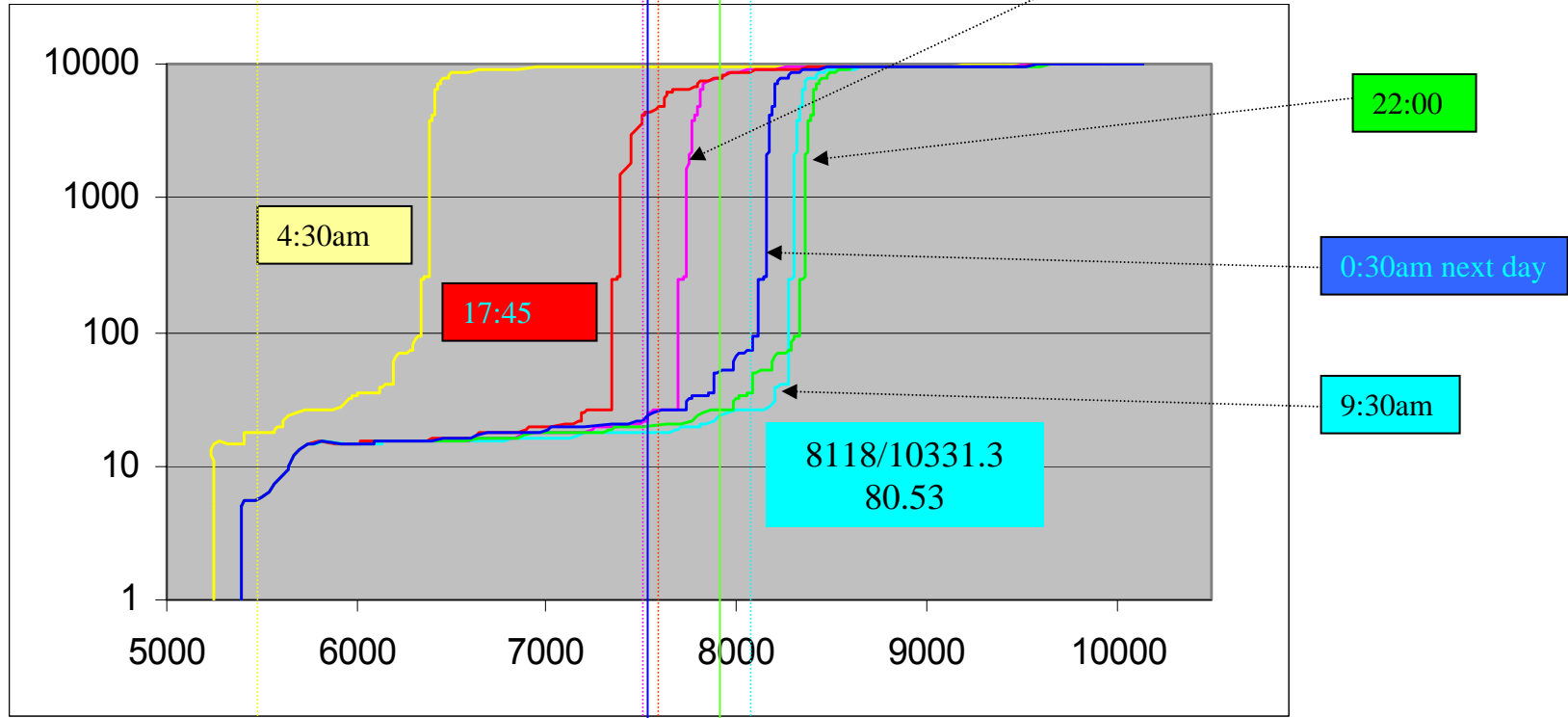
Price spikes and bidding/rebidding behavior (case study: June 29-30, 2002 in NSW)





NSW regional supply, demand, and prices for trade day 29/6/2002—30/6/2002

Dispatched gen/demand price



5604/6747.7
18.56

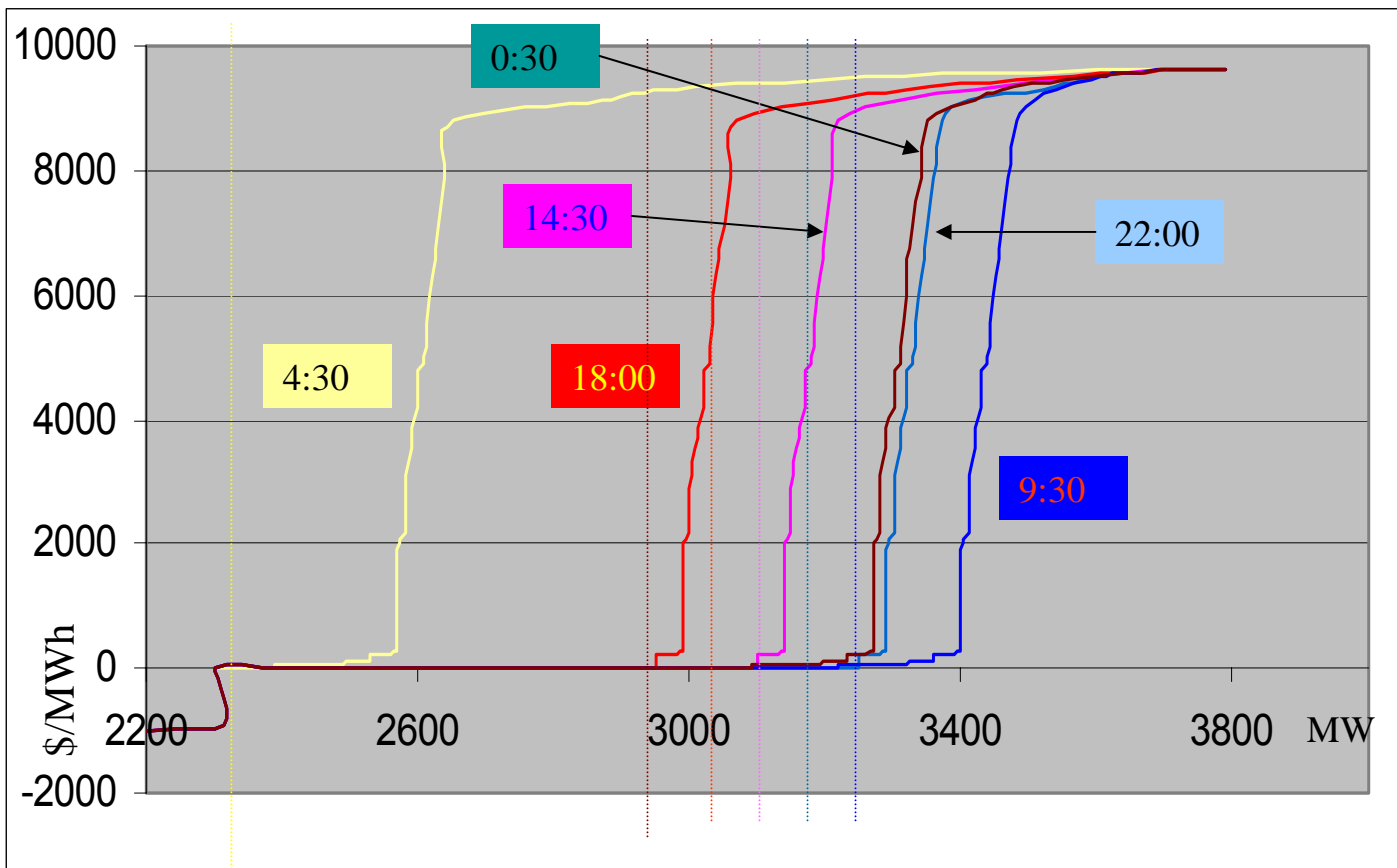
7546/9036
26.47

7988/9296.37
31.44

7551.44/8283.5
25.45



Dispatch offers from Macquarie Generation for 29-30/6/2002 (no rebids made by this company in this period)

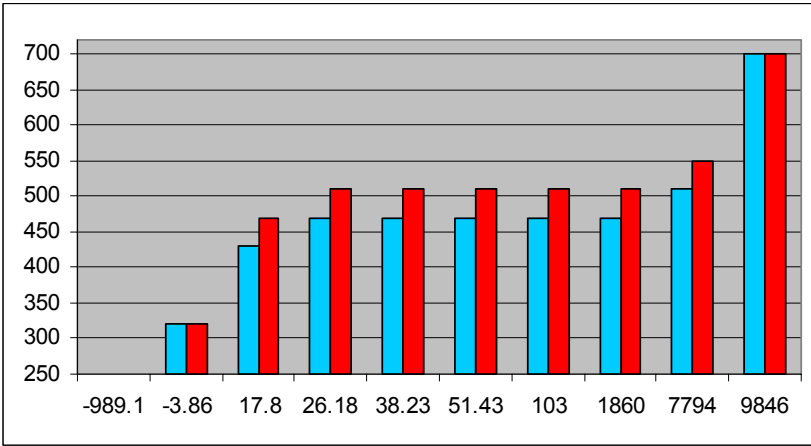


Total base-load capacity 4640 MW (black coal) and peak-load capacity 50MW (fuel-oil)

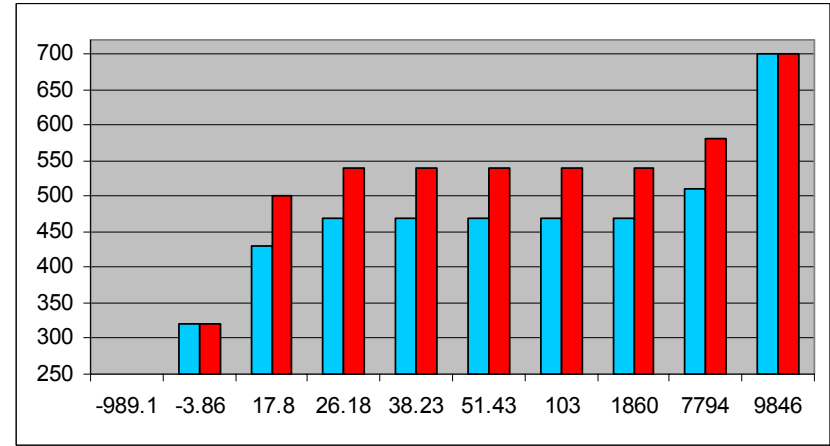
2334.83 4:30	2964.67 0:30	3044.3 18:00	3100 14:30	3166.83 22:00	3252 9:30
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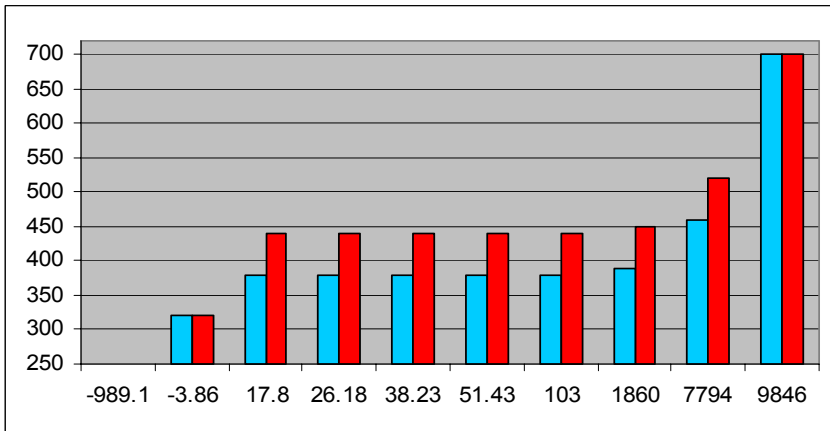
Bidding and rebidding strategies



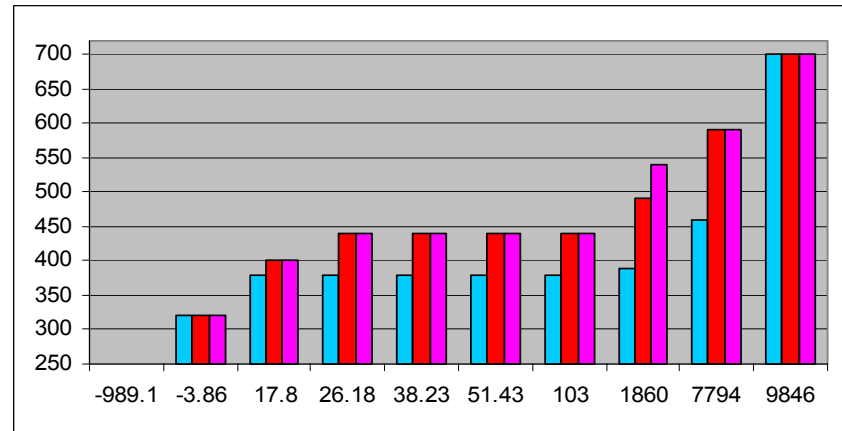
8:00 29/6/2002



11:30 29/6/2002



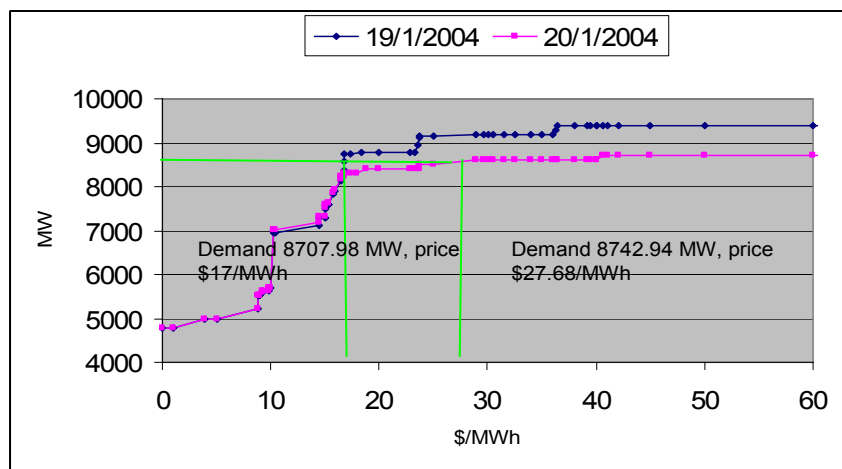
16:00 29/6/2002



18:00 29/6/2002

Blue for daily bid, red for rebid (VP 5)

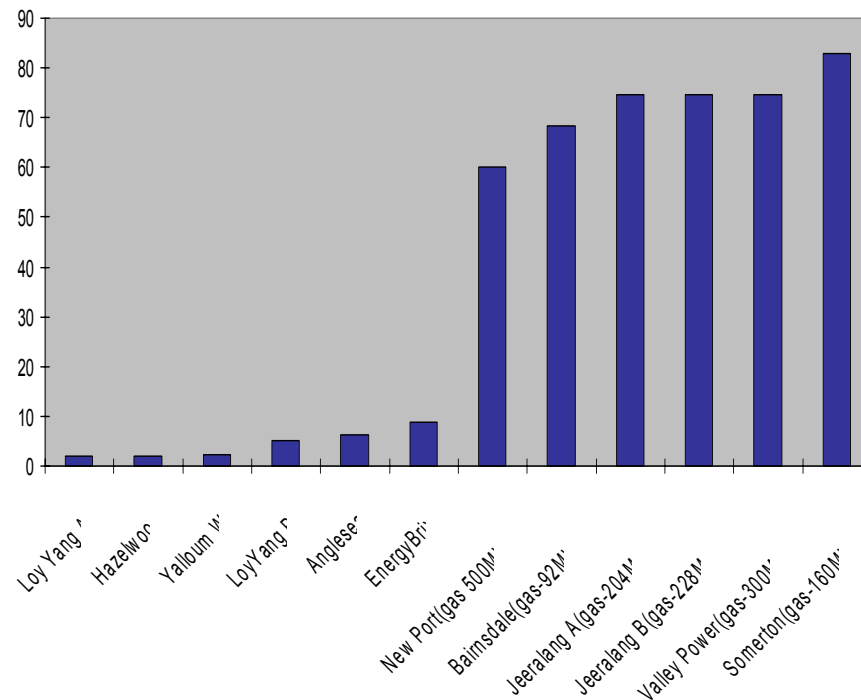
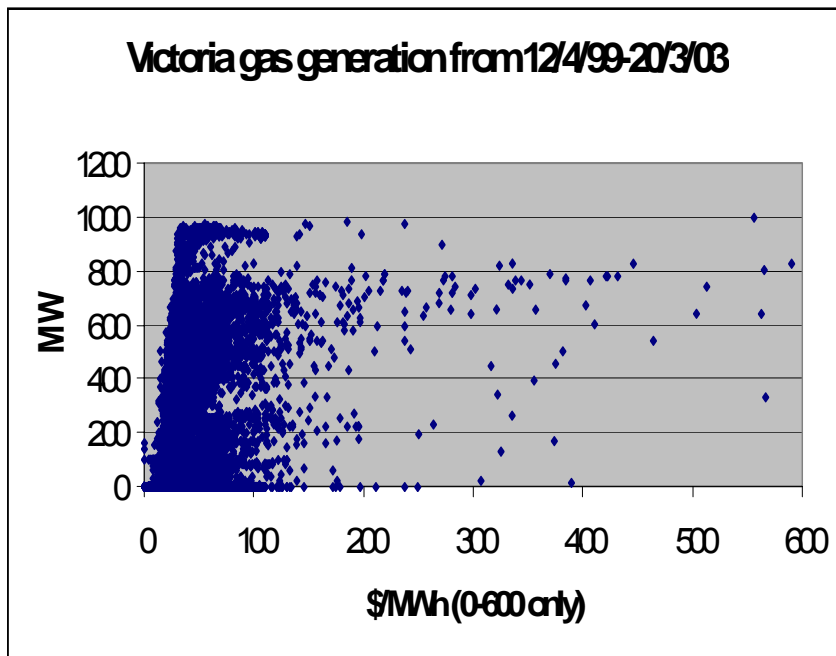
Economic capacity withholding strategy used occasionally, comparing offers for the same trading interval one week before



	04:00 (total 1752 counts)		18:00 (total 1751 counts)	
	$\Delta C < 0$	$\Delta C \approx 0$	$\Delta C < 0$	$\Delta C \approx 0$
Capacity offer reduction	290	305	399	352
Generation down	245	239	377	301
Price up	153	159	224	195
Revenue up	120	136	184	173
Revenue up and demand up	65		120	

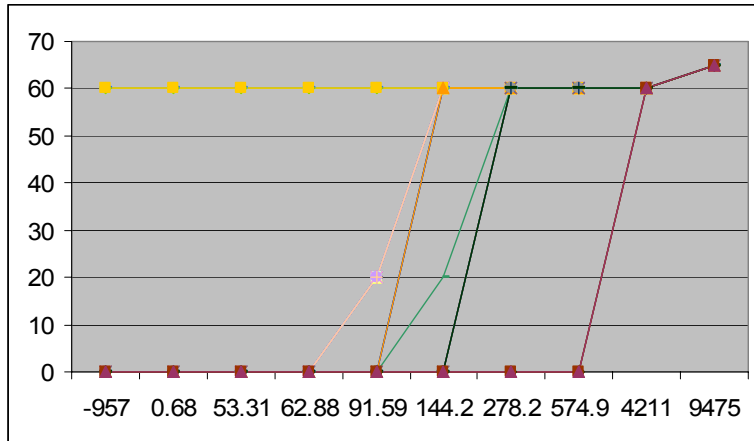
ΔC is the change of available capacity comparing to the same trading interval in previous week

Peaking generators and contracts to run

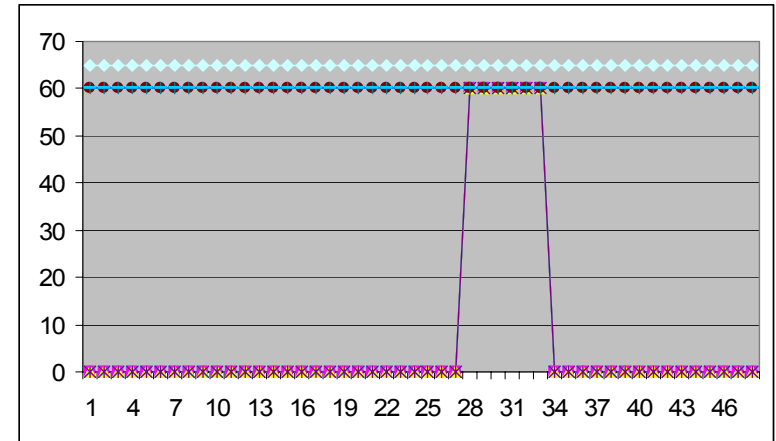


Prices at which gas units were dispatched do not match the short term marginal cost of the units for a significant number of incidences

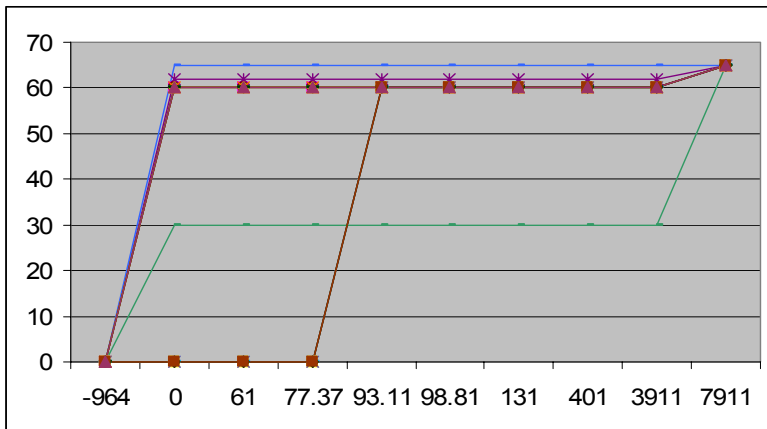
Two Victorian peaking units (gas-turbines) dispatch offers in June 2004



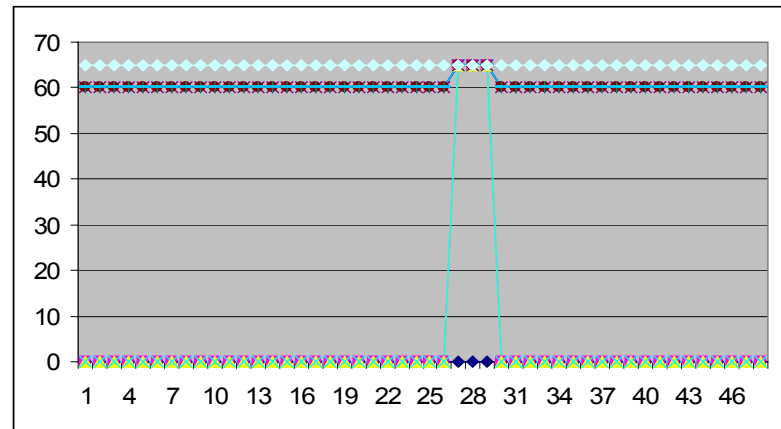
JLA01-June 2004, 18:00 trading intervals



JLA01-June 9, 2004, 04:30am-04:00am trading intervals



VPGS1-June 2004, 18:00 trading intervals



VPGS1-June 17, 2004, 04:30am-04:00am trading intervals

Contract and bidding strategies

Suppose you hold a bilateral contract with a retailer having a contract volume Q at a strike price F

The spot market price is p , your dispatched generation level is q
with a generation cost $c(q)$

Your spot market profit is

$$pq - c(q)$$

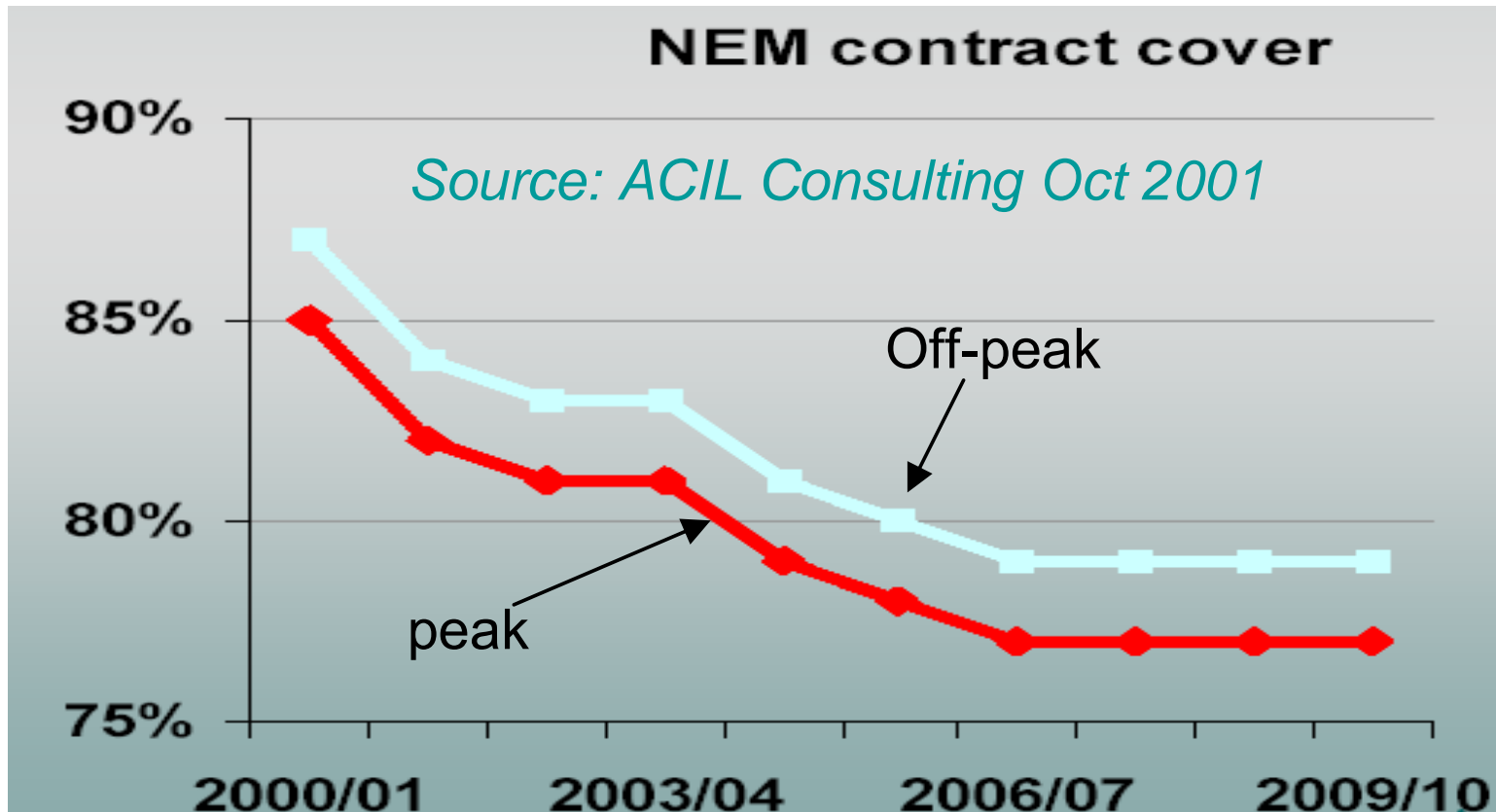
Your net profit from
the contract is

$$(F - p)Q$$

Your total profit is

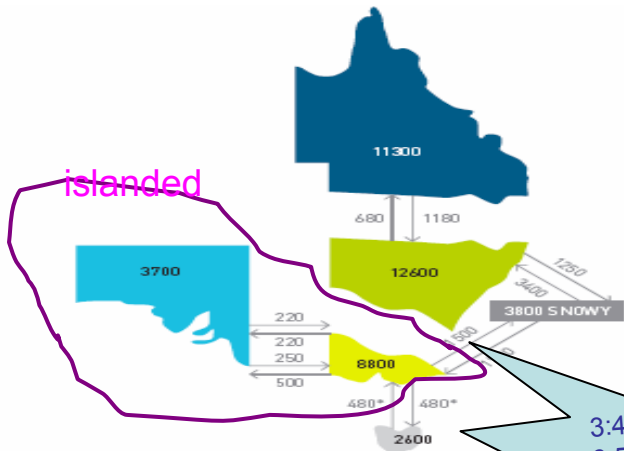
$$p(q - Q) + F * Q - c(q)$$

Do you want the spot price higher or lower?

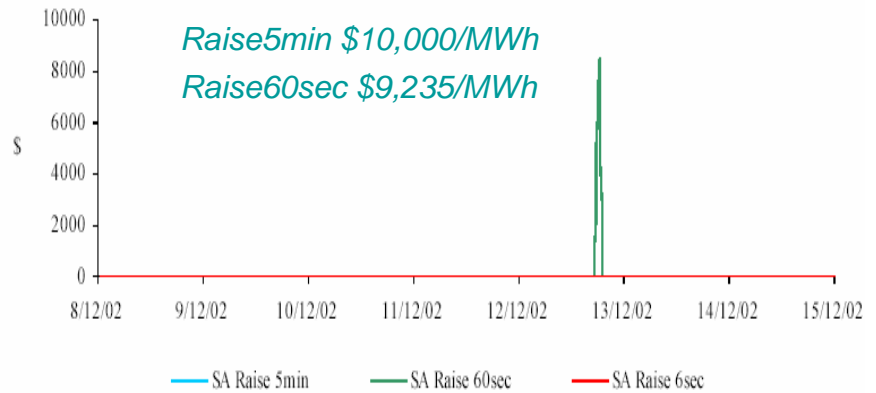
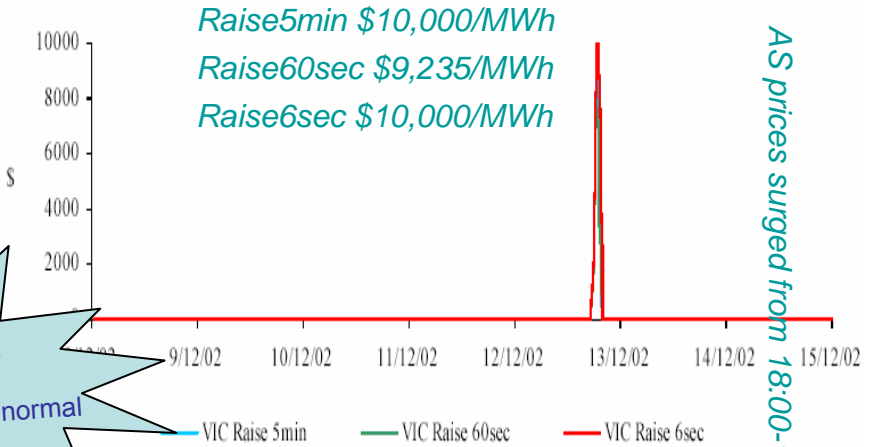
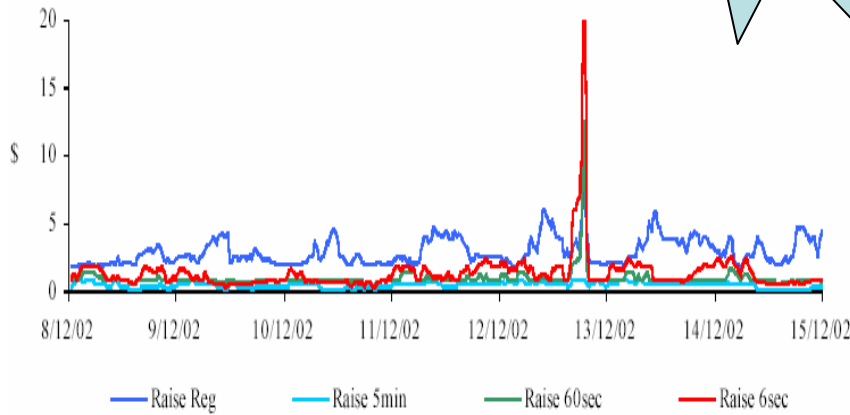




Market interactions between network, ancillary service and generators strategic behavior—an incidence analysis December 12, 2002

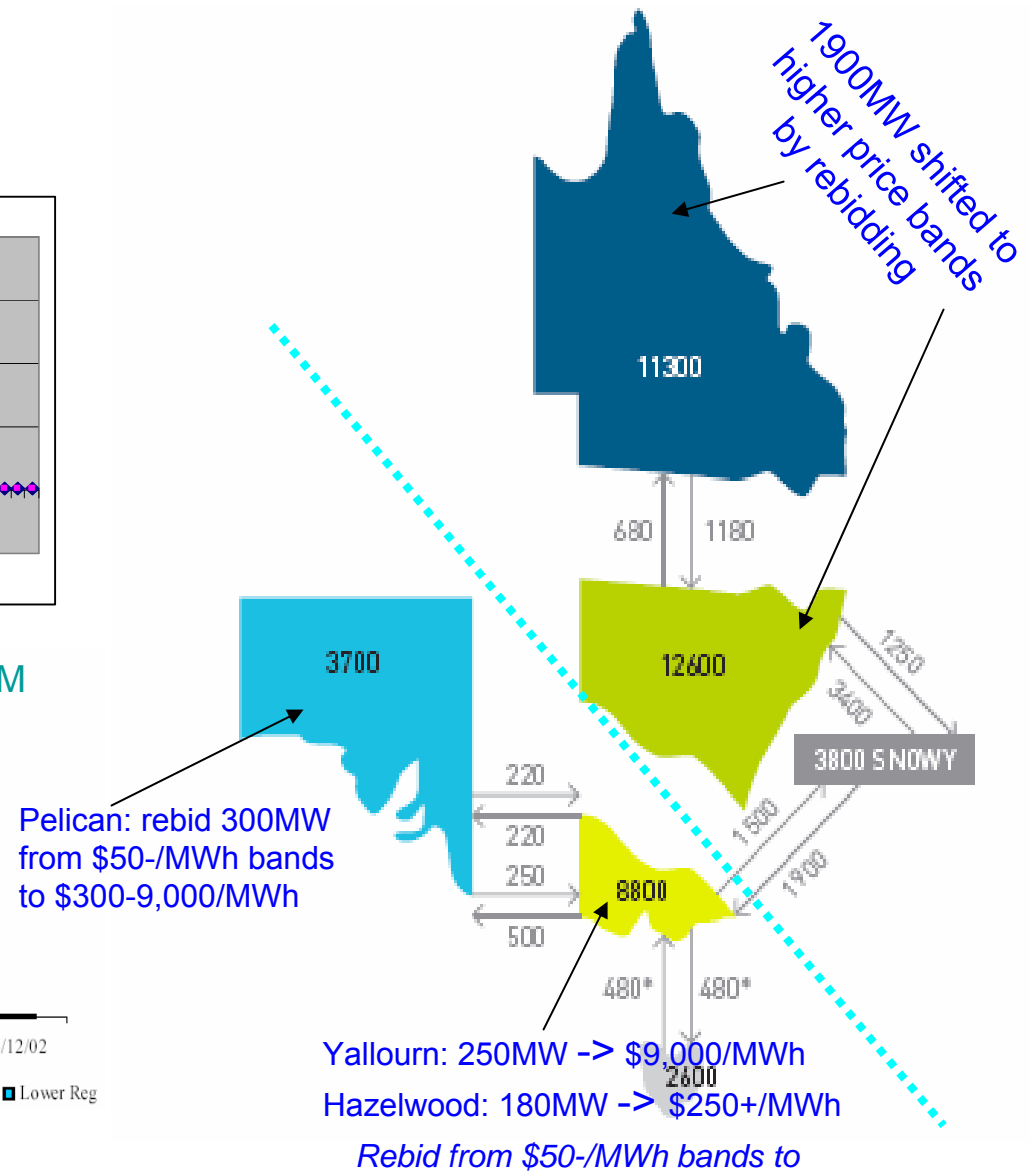
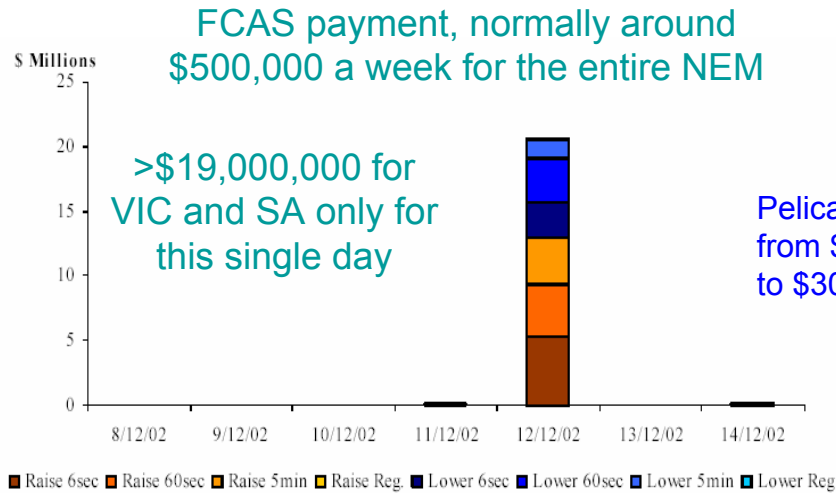
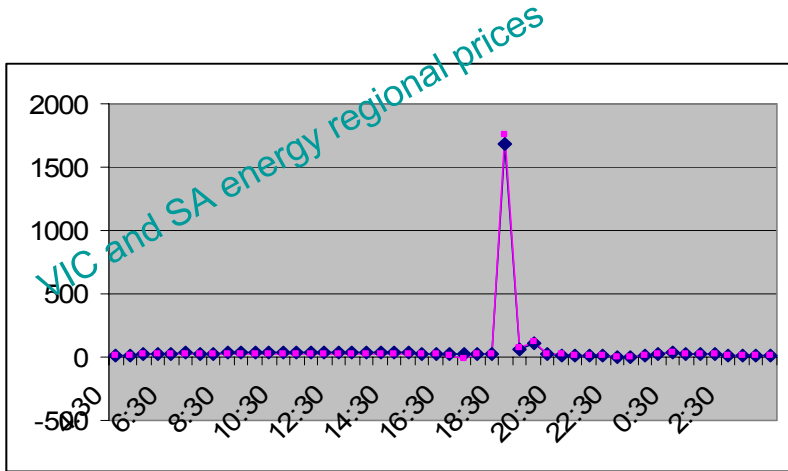


3:43pm line down
6:57pm restored
11:55pm back to normal



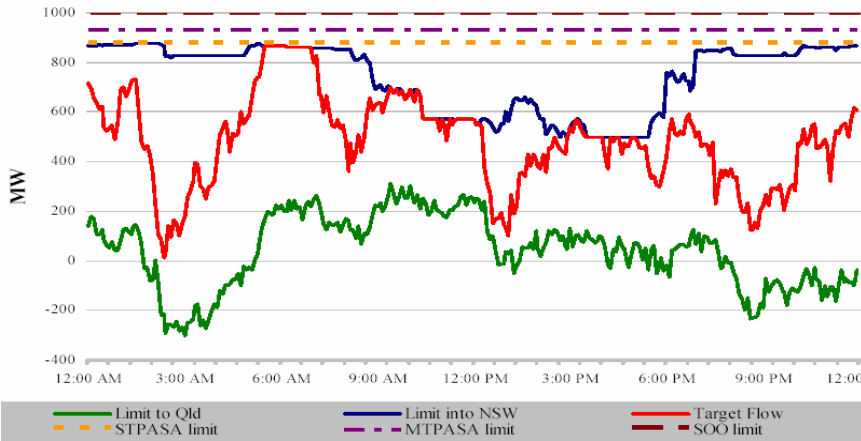


Effects on AS payment and generators behavior (during the high AS price periods)

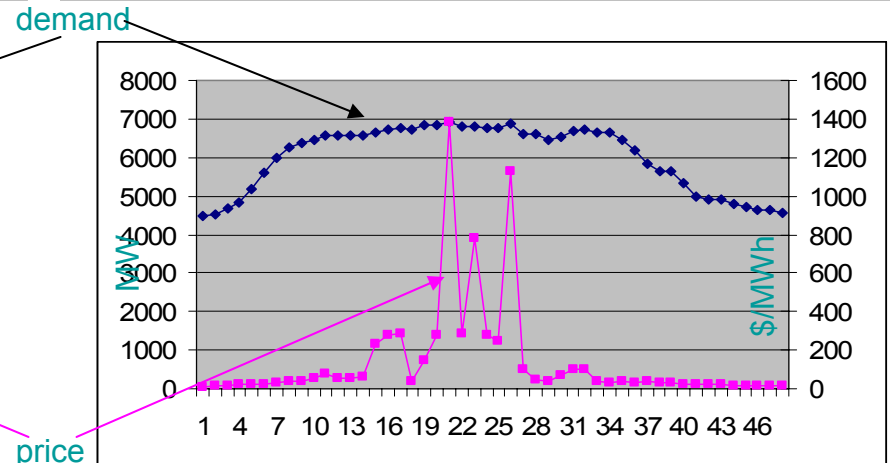
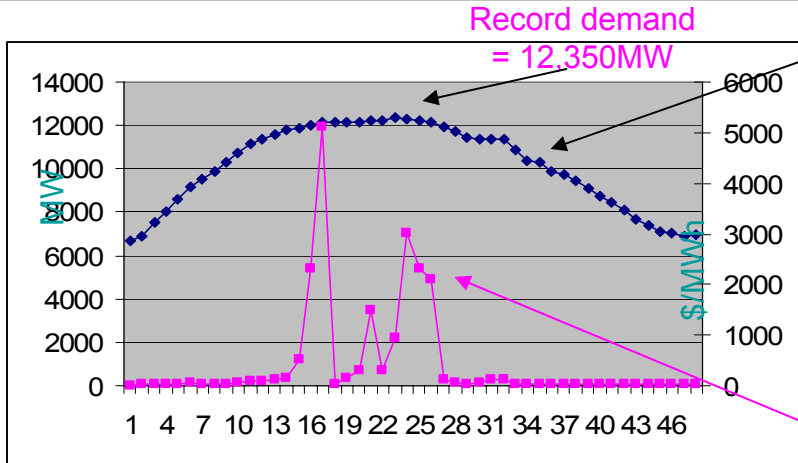
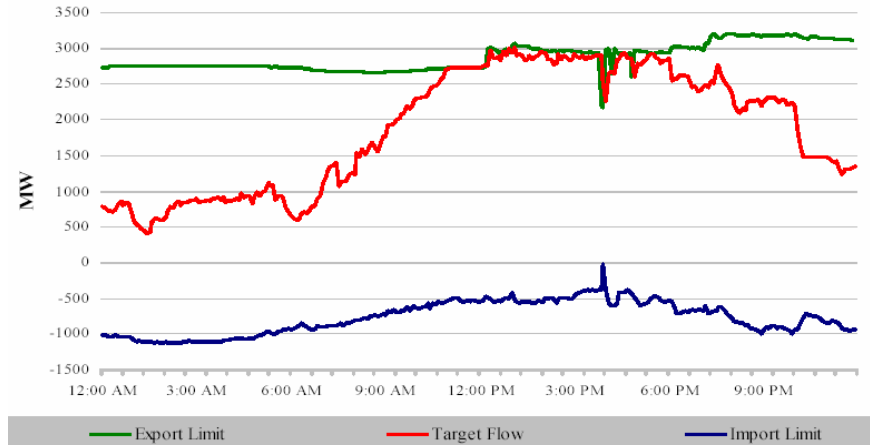


Forecast (STPASA, MTPASA, SOO), network constraints and market efficiency (constrained-on/off)

QNI and DLINK combined to NSW from QLD



Snowy transmission lines to NSW from SNOWY



8:20am—5pm

NSW regional demand and prices for 30/01/2003

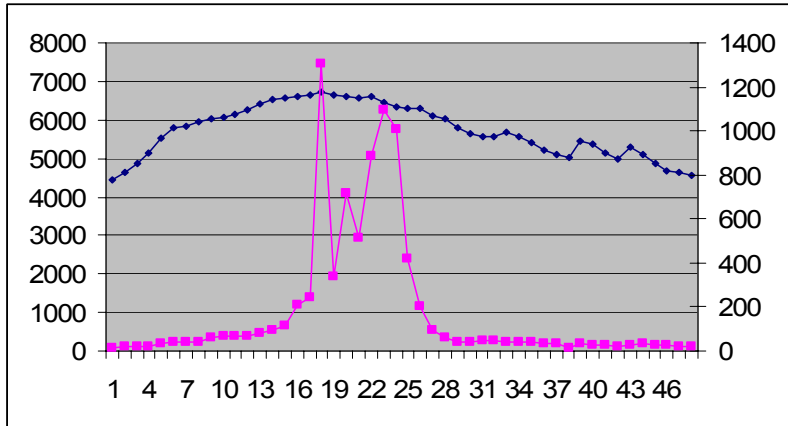
QLD regional demand and prices for 30/01/2003



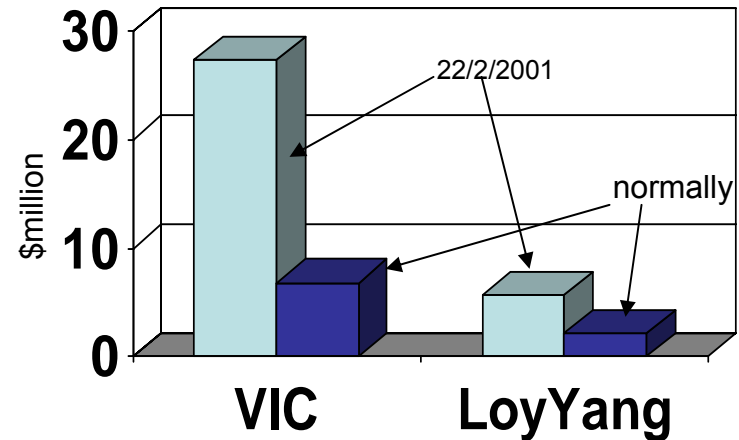
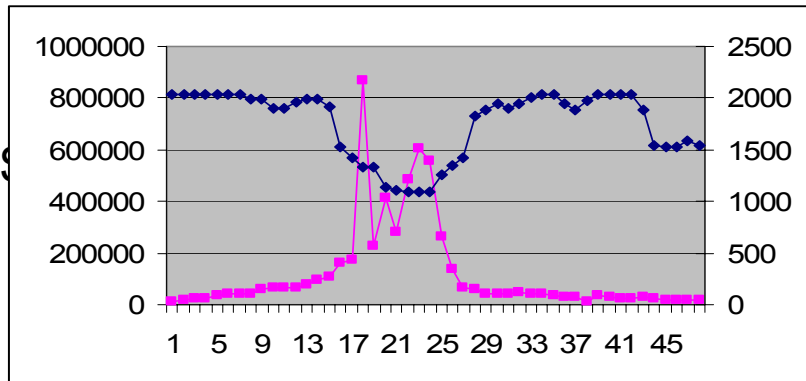
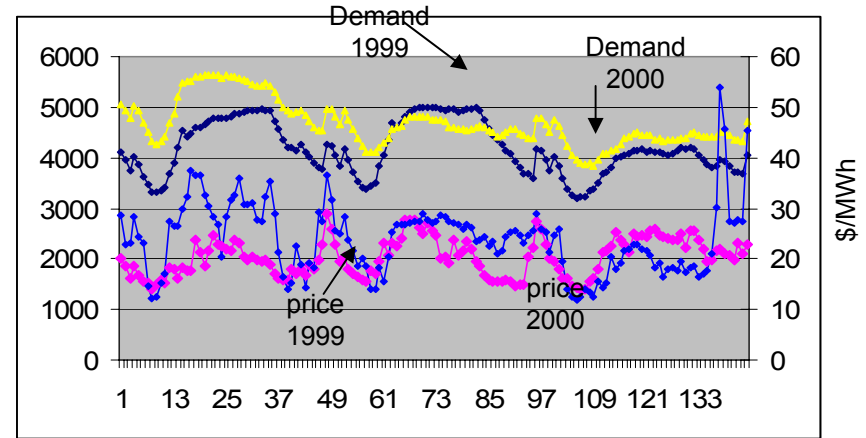
Physical withholding capacity (NEM event on 22/1/2001)

(event: summer day, from 11:30 to 17:00, reduction of capacity)

Victorian demand and prices from 4:30am 22/1/2001 to 4:00 23/1/2001 (price cap at \$5000/MWh)



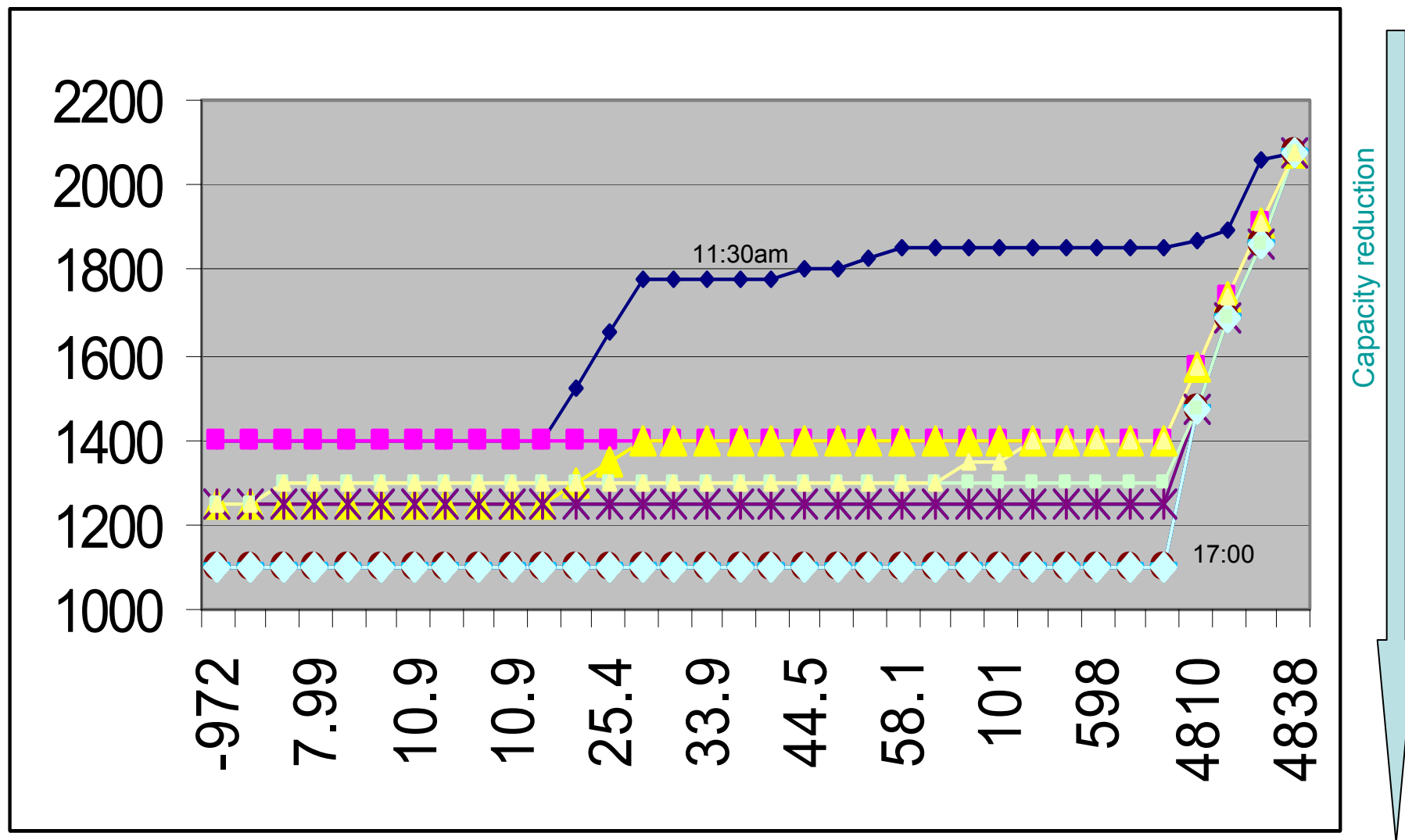
Victorian demand and price from 0:00 21/1 to 0:00 24/1



Loy Yang's generation and revenue from 4:30am 22/1/2001 to 4:00 23/1/2001

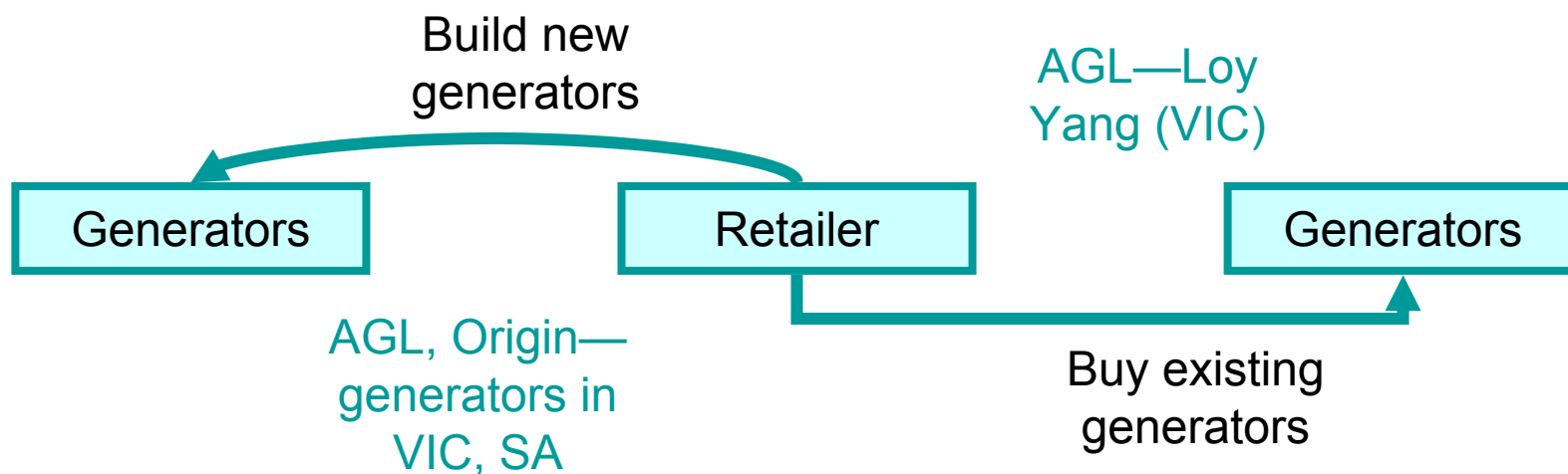
Comparison of revenue of Vic generators and Loy Yang

Dispatch offers by Loy Yang for 11:30-17:00 on 22/1/2002



Concerns over Mergers and acquisitions

Spot market price risks force retailers to hedge
the risks by seeking more broad portfolios



Loy Yang Power: purchase by a consortium including **AGL** (since 2000, the former owners of Loy Yang Power were trying to sell the power station which has a debt of AUD3.2 Billions, **AGL** was vigorously seeking to buy it. **GEAC (Great Energy Alliance Corporation)** was formed in the early of 2003 by **AGL** (35%), the Tokyo Electric Power Company Incorporated (TEPCO, 35%) and a group of financial investors led by the Commonwealth Bank (30%) to acquire Loy Yang.)

Former owners of Loy Yang: Loy Yang is 50 per cent-owned by CMS Energy and 25 per cent-owned by Xcel Energy unit, NRG Energy, which are eager to sell the debt-laden power plant. The remaining 25 per cent is owned by Horizon Energy Investments. This consortium bought Loy Yang at a cost of \$4.5billion in May 1997 from Victorian government.

On December 19, 2003, Federal Court supports the acquisition of GEAC of Loy Yang.

Concerns about regulation—industry regulators’ potential biased regulations

OECD (Organisation for Economic Cooperation and Development) (1999) study shows tendency of sector-specific agencies to be biased in decision-making in favor of industry over consumers and other interested parties—so called “regulatory capture”.

This is a particular concern by an economic regulator like ACCC

Mitigating market power

ACC and Energy
Review Committee

Increase trading between regions—enhancing power transfer capability between regions

Increase number of competing generators in each states

New entry

Increase efficiency of inter-markets

Financial or contract markets

Improving market design and regulation