Experience of Power Generation Investment in Liberalised Markets: In the Middle of the Stream

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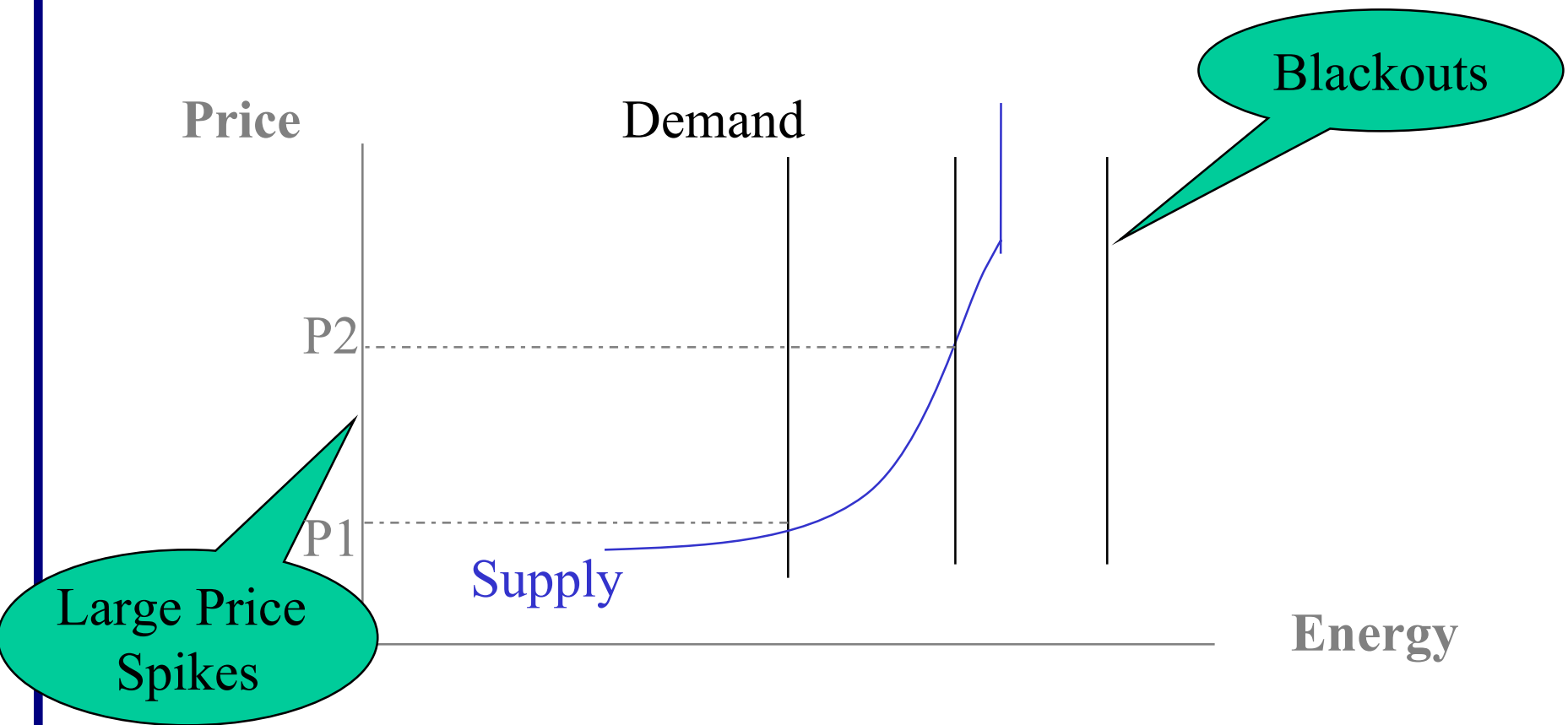
What is so special about electricity?
One sided markets do not work well

Because demand does not respond to price

Because Market Power is exacerbated by lack of demand response



Where we come from

The old paradigm, stemming from the 30s:

- Centralized power generation based on steam process: coal, (oil and gas), nuclear
- Increasing economies of scale to 70s
- Regulated business,exclusive concessions, integrated companies
- Strong growth rates in power consumption
- Large reserve capacity
- Costs passed on to consumers
- Little consumer choice, even for industry

Drivers of Electricity Market Reform

Political drivers:

- New political paradigm in the 80s: e.g. Thatcher Revolution
- Environmental concerns (pollution/GHG)

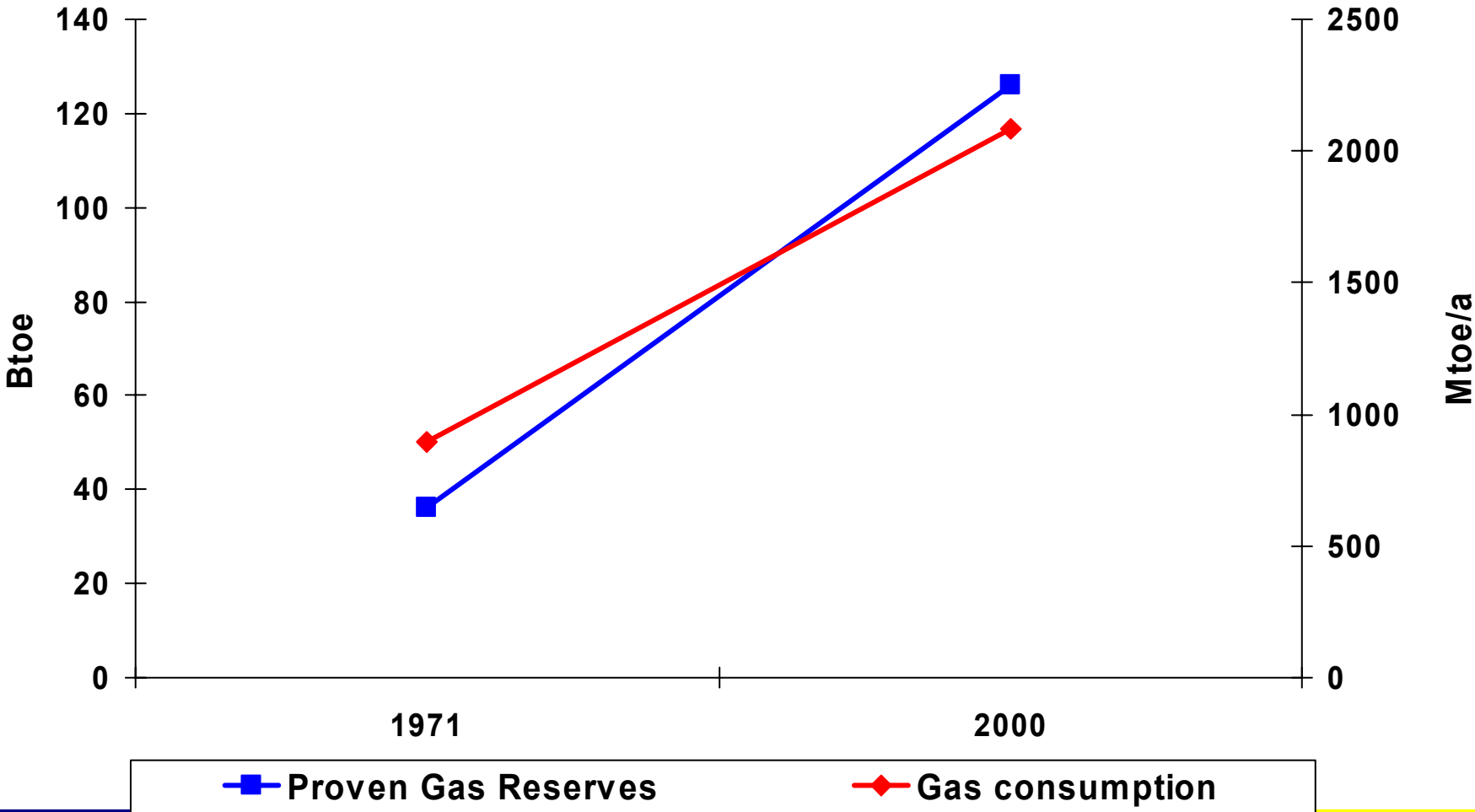
Economic drivers:

- Need to reduce budget deficits
- Development of Gas Turbine Process

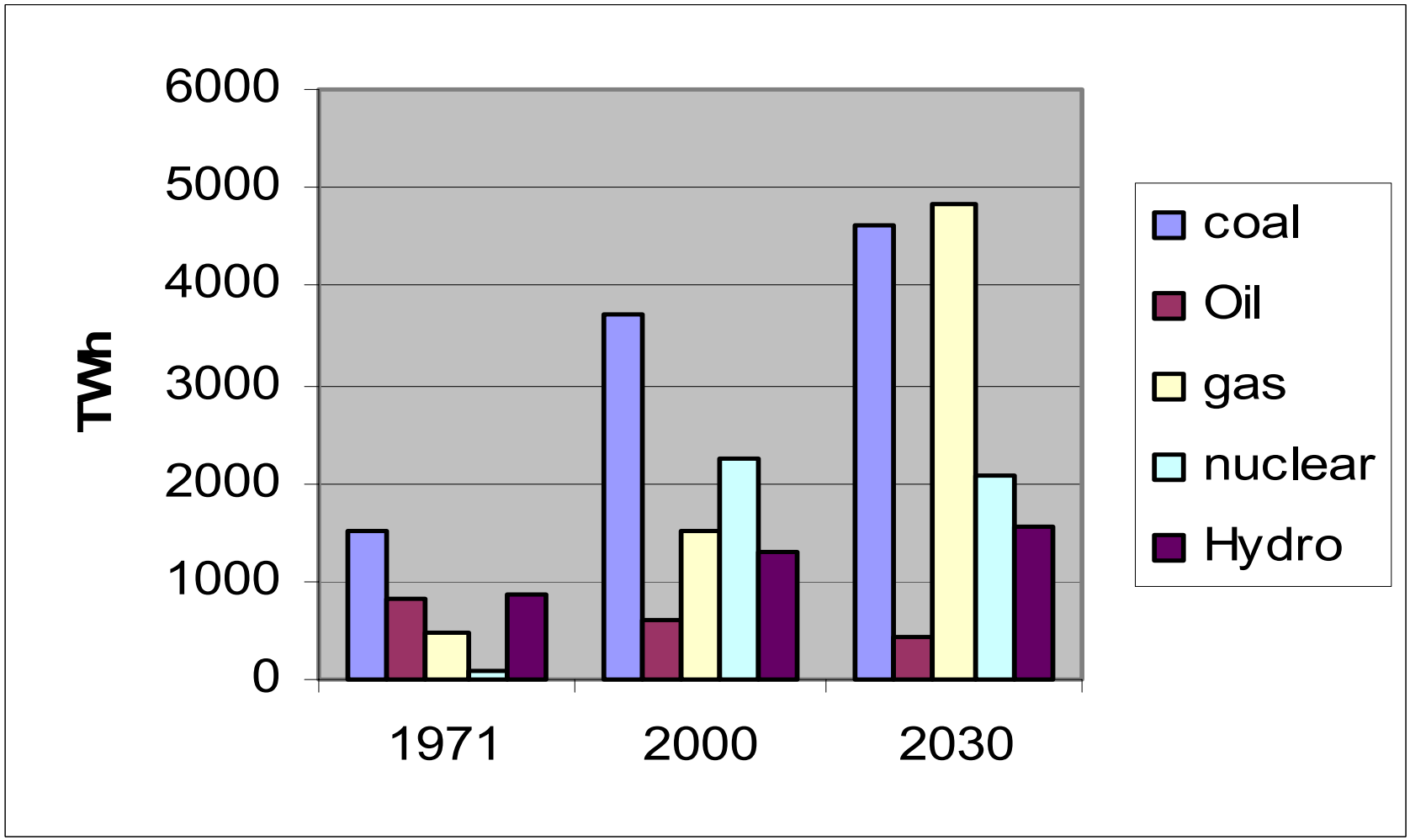
  =>CCGTs / low economies of scale / decentralized power / CHP / standardization / modularity

- Gas reserves increased more than consumption

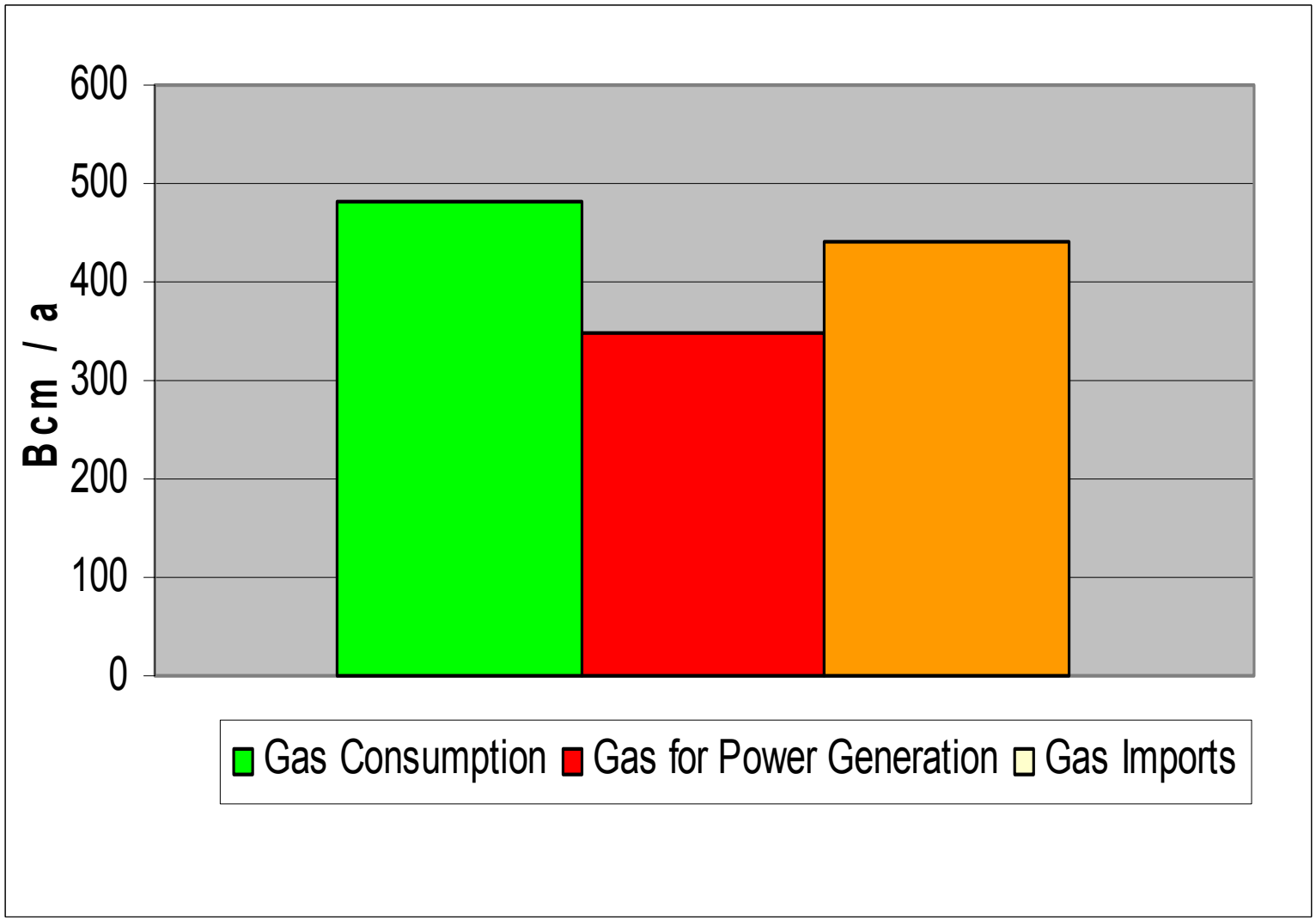
Gas Reserves growing faster than Consumption



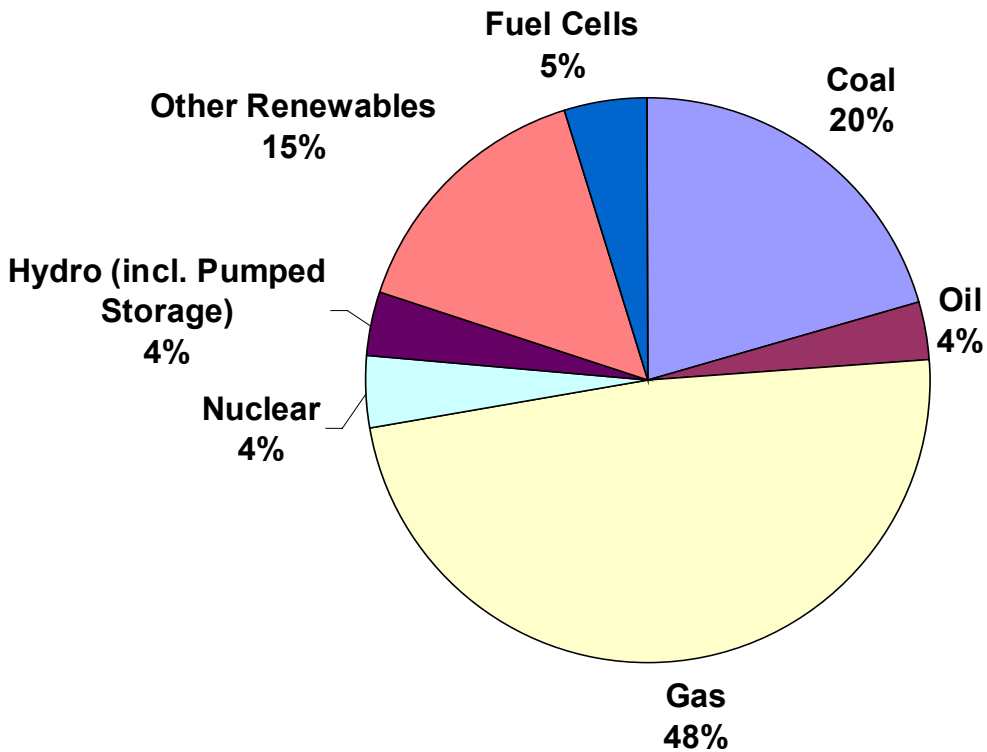
Development Conventional Power OECD



Increase in Gas Import and Consumption OECD Europe 2000 - 2030



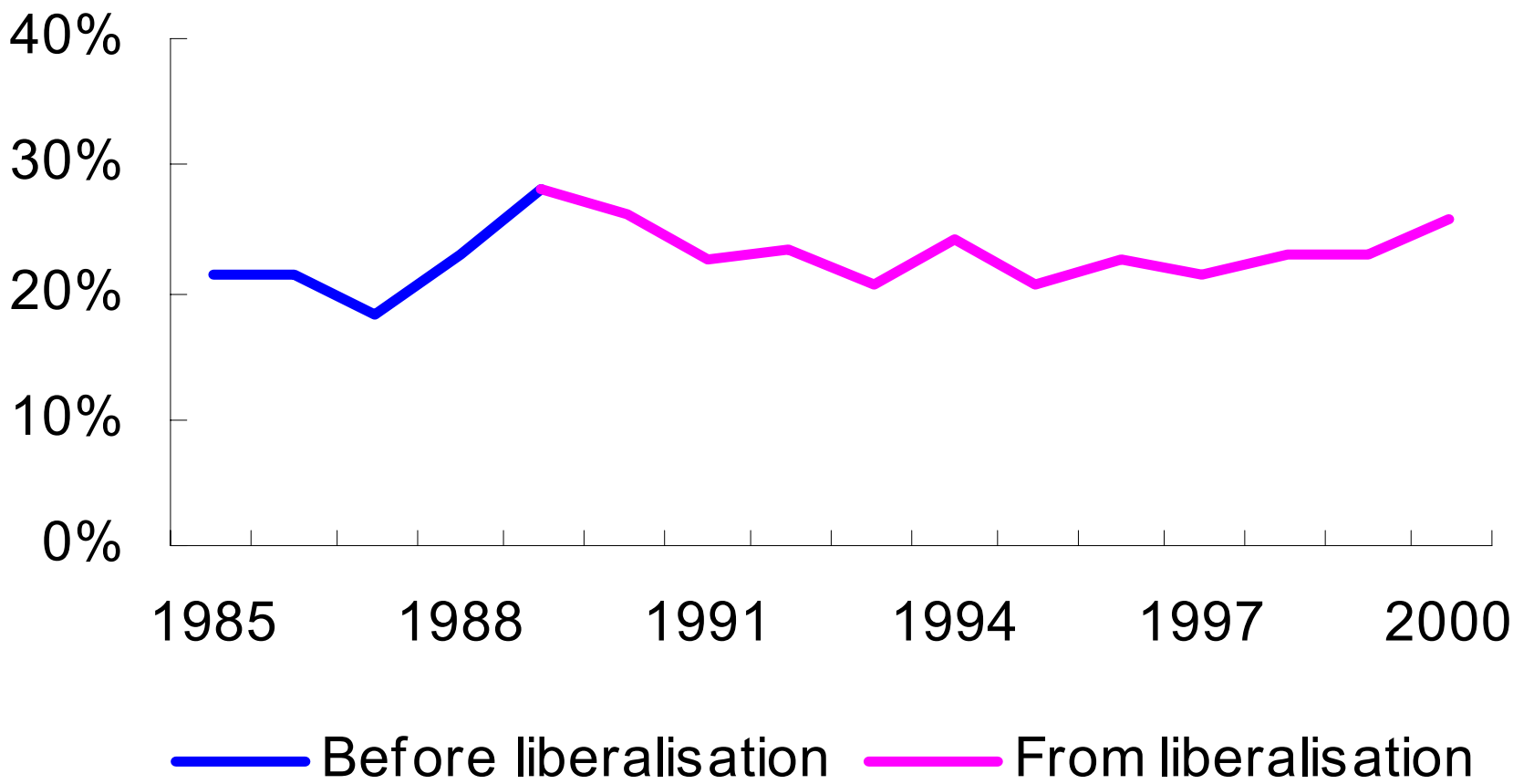
Gas Dominates Future OECD Investment



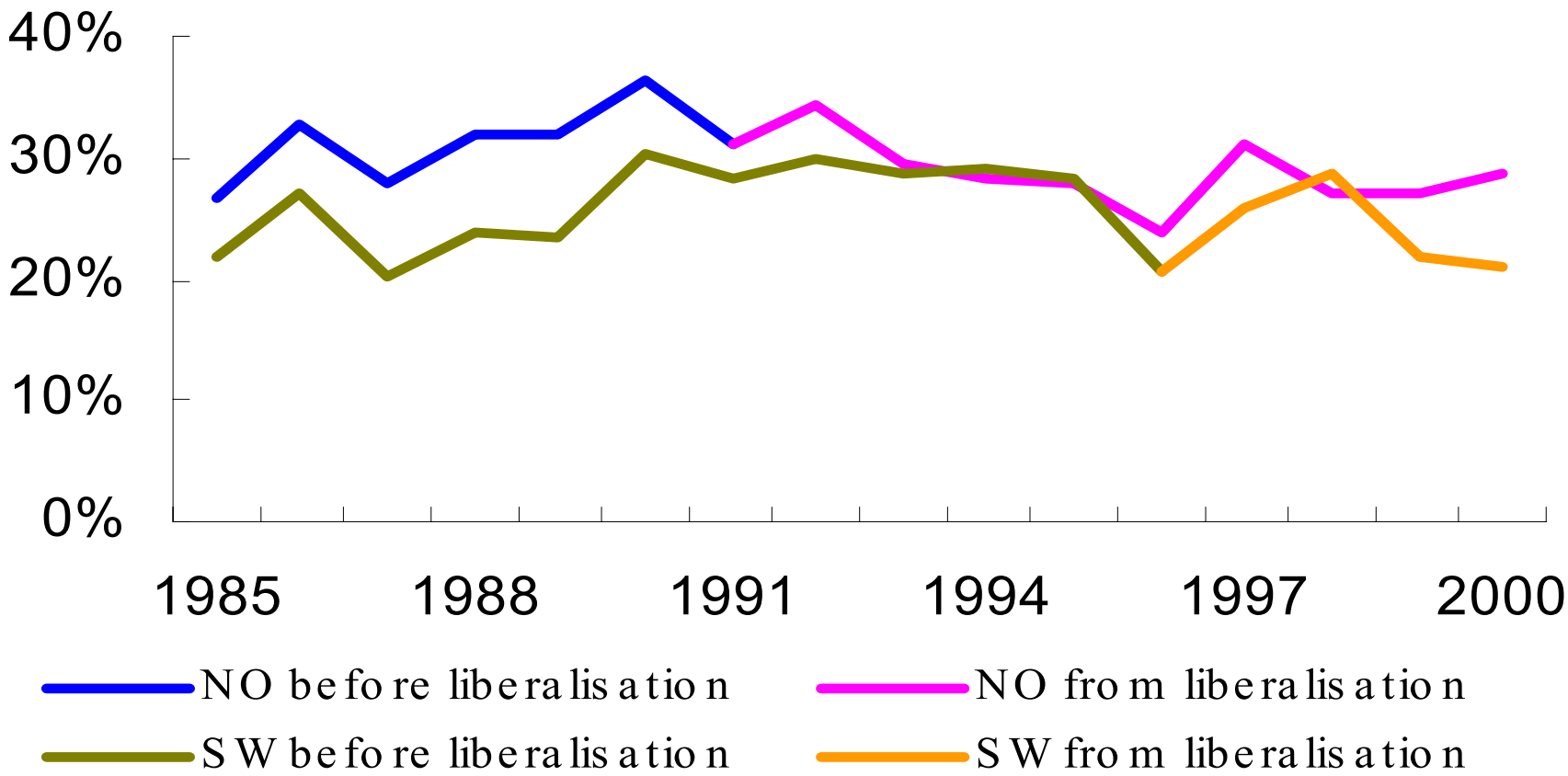
Where we are so far

- Only short experience in most countries
- IEA publication "Security of Supply in Electricity Markets" analysed for key countries:
  - Investment performance in power generation
  - Expansion of grids

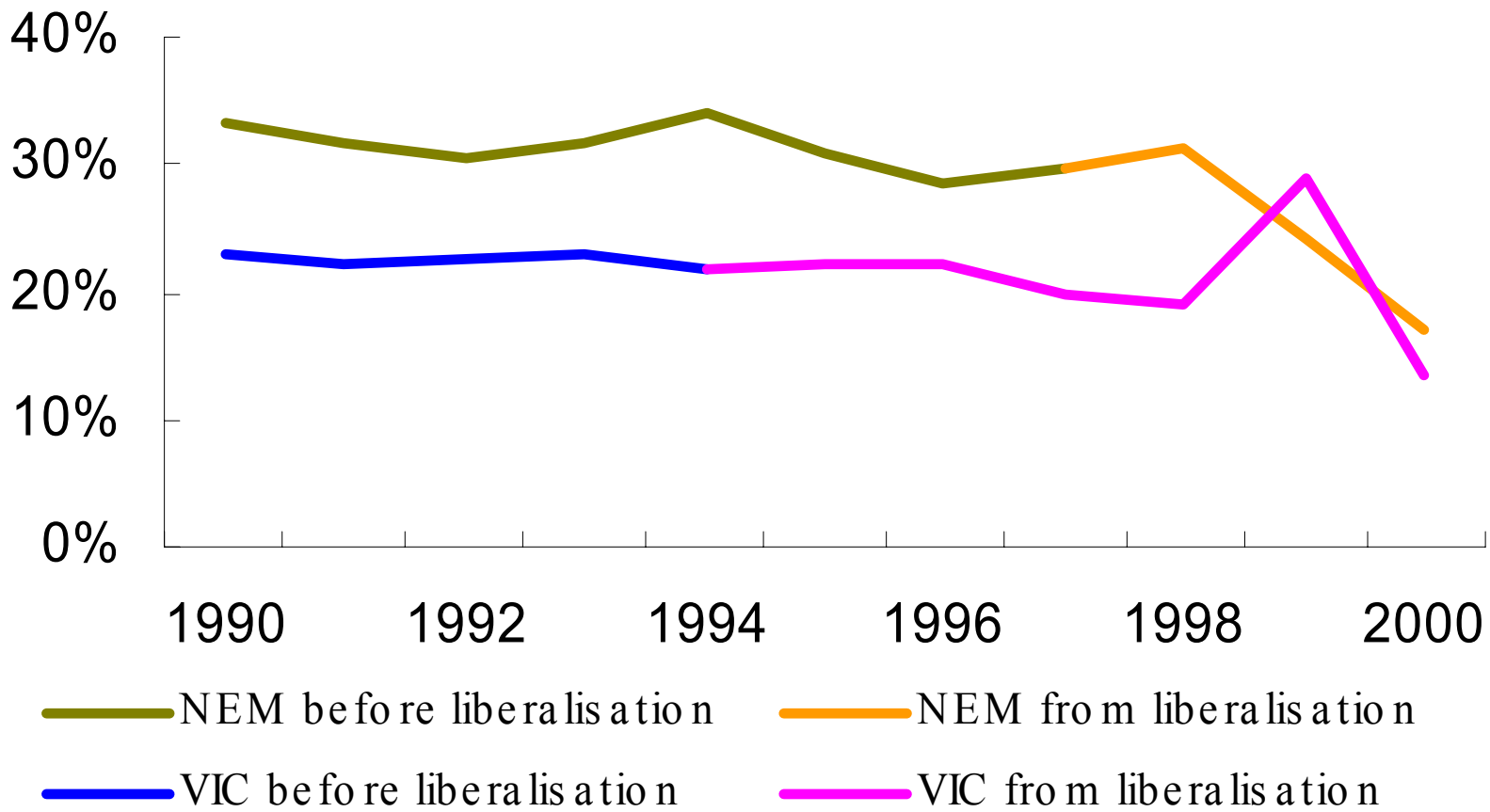
Reserve Margins in UK



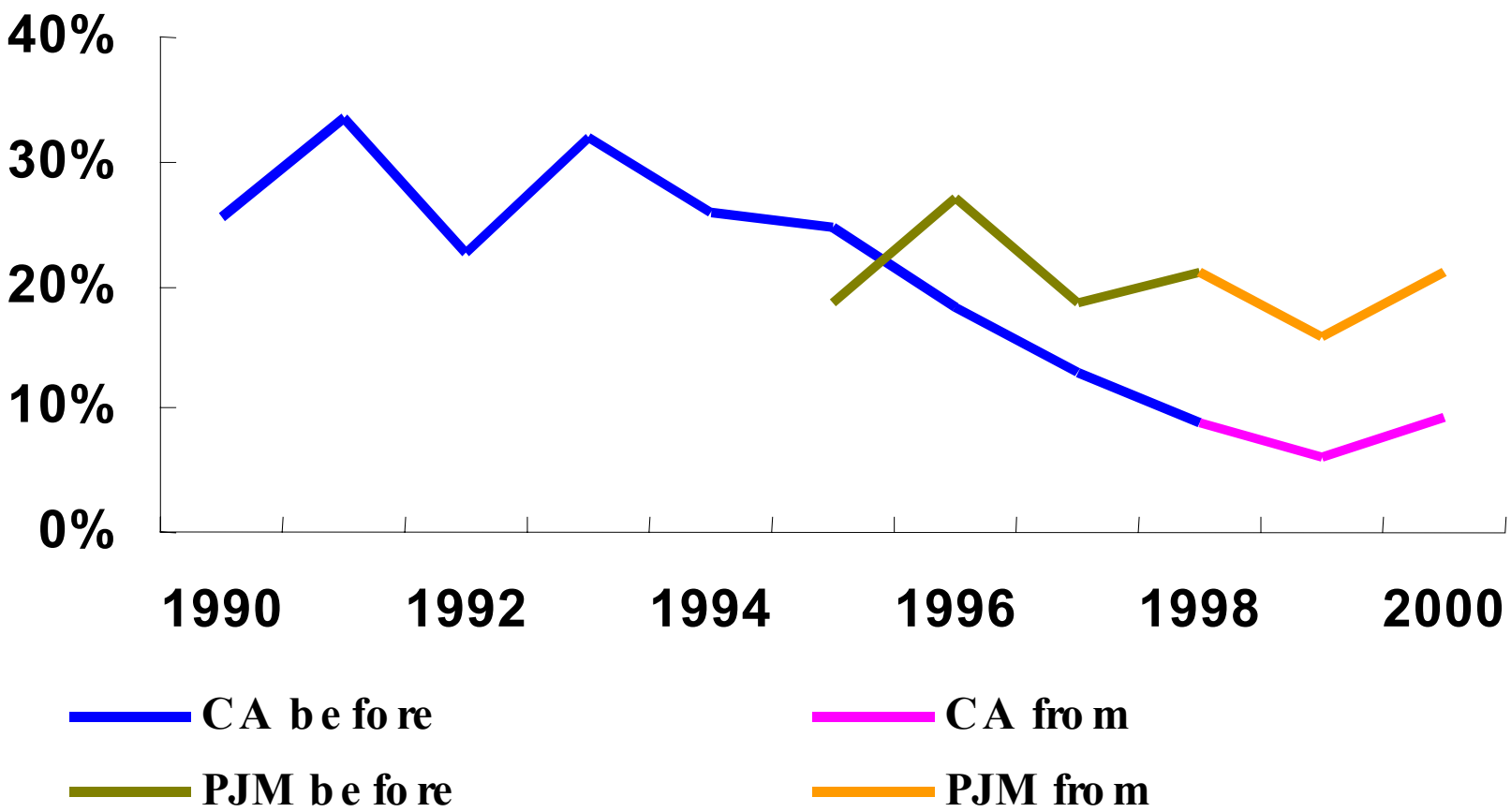
Reserve Margin in Scandinavia



Reserve Margin in Australia



Reserve Margins in US Markets



Wholesale prices and entry costs

	UK: E&W (£/MWh)	Norway (NOK/ MWh)	Sweden (NOK /MWh)	Victoria[1] (AU$/MWh)	South Aus [1] (AU$/ MWh)	California (US$/ MWh)	PJM [2] (US$/MWh)
1990	23						
1991	27						
1992	28						
1993	30	90					
1994	29	180					
1995	27	110					
1996	27	260	250				
1997	27	140	130				
1998	26	120	110	15		30	24
1999	24	110	110	26	54	30	34
2000	24	100	120	29	69	115	31
Indicative range of entry cost (3)	17-20	250-300	250-300	32-40	32-40	27.5-32.4	27.5-32.4

[Shaded cells indicate price is below min. indicative entry cost]

(1) Fiscal year ending June.
(2) Prices do not include the price of installed capacity.
(3) Based on a variety of sources and IEA estimates. Estimates differ by country according to local conditions

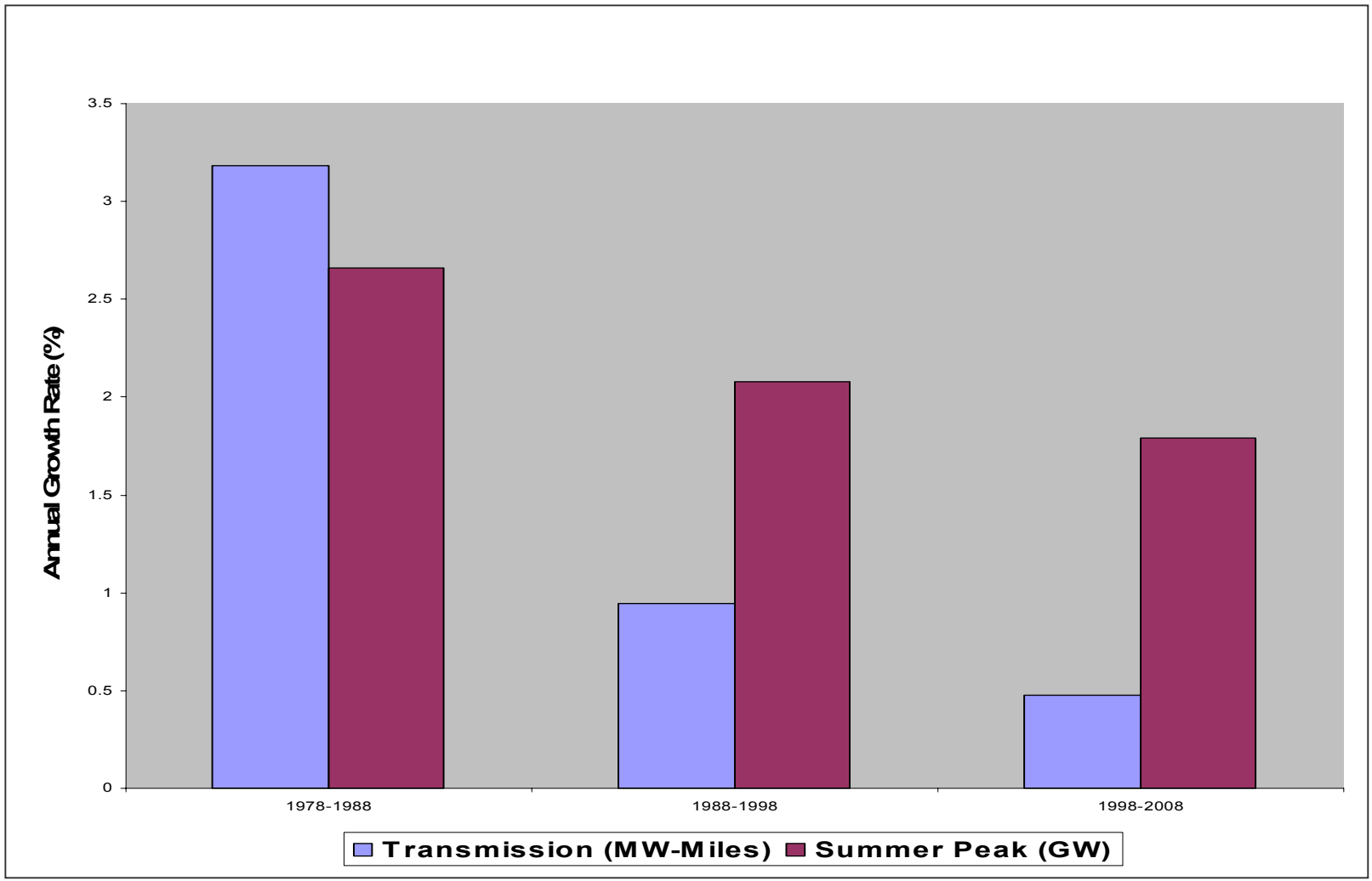
Investment Activity
Change in Generating Capacity

	UK	Norway	Sweden	Australia NEM	US: Cal.	US: PJM
Average annual change (MW/a)	585	69	-62	1695	13	573
As % of capacity in 2000	0.7	0.2	-0.2	1.8	0.0	1.0
Period since	1990	1991	1996	1997	1998	1998

Authorisations of New Power Capacity

- Market opening does not prevent construction of adequate capacity
- Authorisations are complex everywhere
  - manageable provided timeliness, predictability of process
  - but can result in a major barrier to investment (e.g. California)
- HSE regulation procedures often not in line with liberalised markets

Transmission Capacity and Summer Peak Demand in North America



Market Reform and the Grid

- Building new lines is difficult
- More transmission creates more competitive pressure on generation
- Grid to grid competition with gas
- Sending / receiving the right signals
- New grid design due to distributed power

So far, so good

- Reserve margins in power still comfortable
- Exception CA, which can be explained by bad market design and narrow margins before
- Incentives to de-bottleneck networks by distributed generation

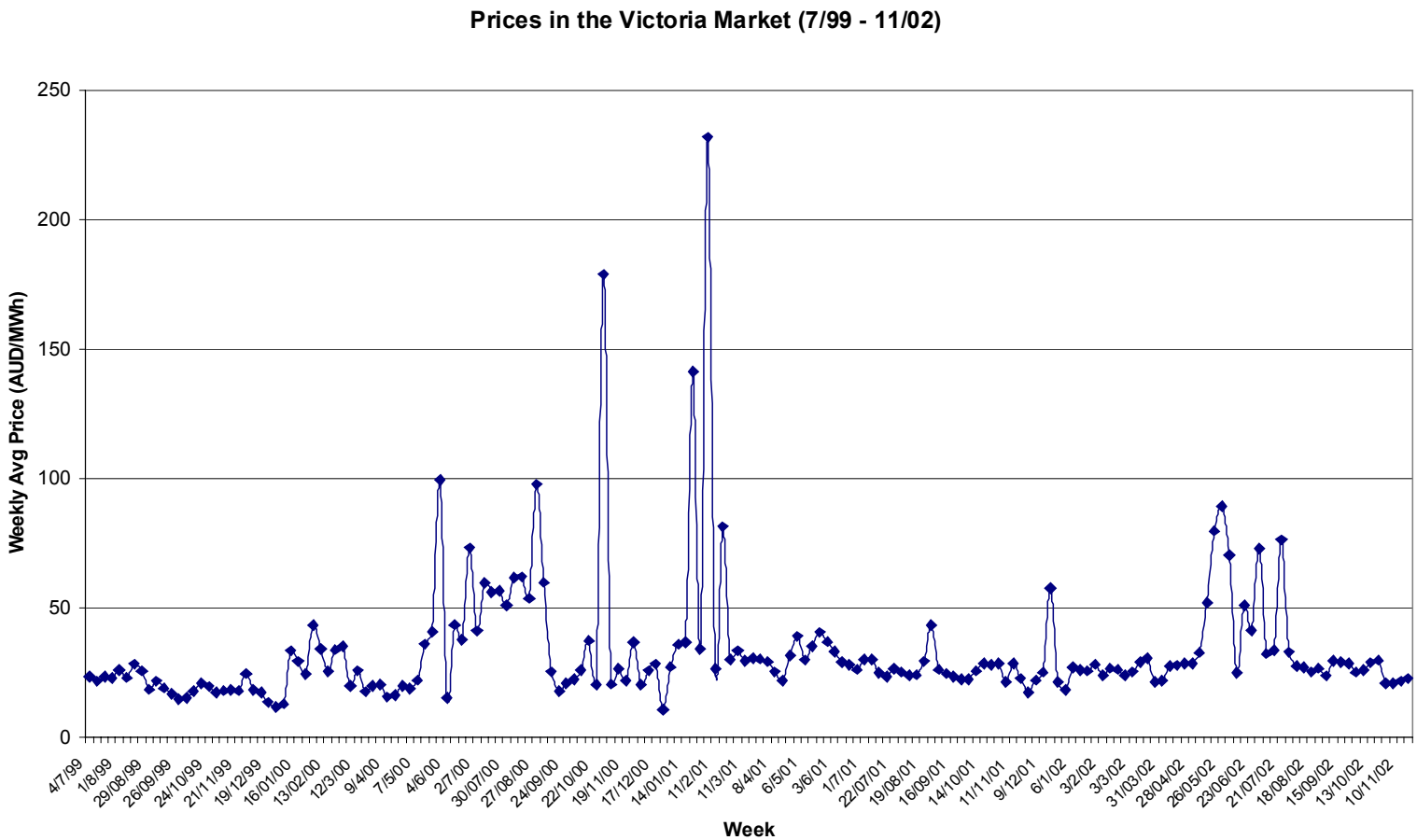
But some concern:

- ENRON fallout
- Lowered credit rating due to regulatory uncertainty
- Recent price hikes in Norway, Texas
- Bail out of British Energy by UK Government

In the middle of the Stream: Open questions on Market Reform

- Transition period: New paradigm very recent, implementation based on existing infrastructure
- Will investment in new power be attractive?
  - for investors: How to recoup fixed costs? How to realize value of flexibility?
  - for financial institutions: Impact on credit rating?
- Market design:
  - Concentrated markets
  - Asymmetry: low prices acceptable to consumers, politicians / high prices needed by investors to recover investment, but not acceptable to politicians
  - Illiquid forward markets

Price spikes can stimulate investment ... and intervention!



More questions on the implications of market reform

- Mechanisms to ensure security of supply?
  - Forward markets, capacity payments, demand response
- Fuel mix / diversification:
  - Renewables promoted by policy
  - Dominance of gas: increasing imports from non OECD
  - How to fit coal / nuclear into a liberalized market?
- Grid design and operation? Decentralized power?
- Will the CO2 policy overwrite market reform?
- What is different in developing countries?

Upcoming IEA Work

- WEO 2003: Investment Outlook
- Publication : Investment and Market Liberalization
  - Publication end 2003
- Study / Publication on status of Electricity market reform
  - First stage: dealing with Generation , Publication in 2004
- Follow up of IEA/NEA workshop in 2004
- With NEA: Generation cost study
  - Publication in 2004/05