Centre for Energy and Environmental Markets

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Outlook for the Australian stationary energy sector

Hugh Outhred

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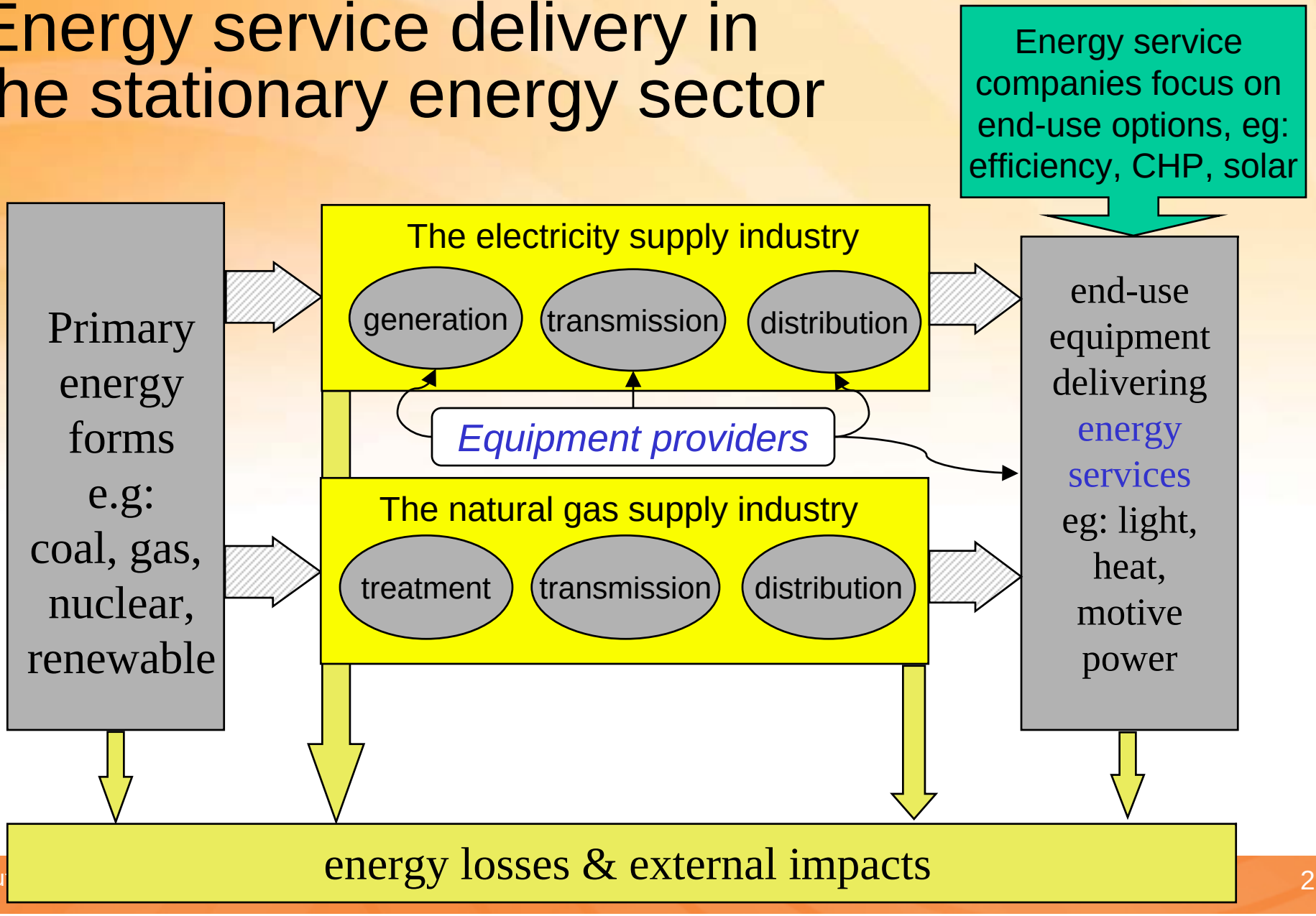
Energy service delivery in the stationary energy sector



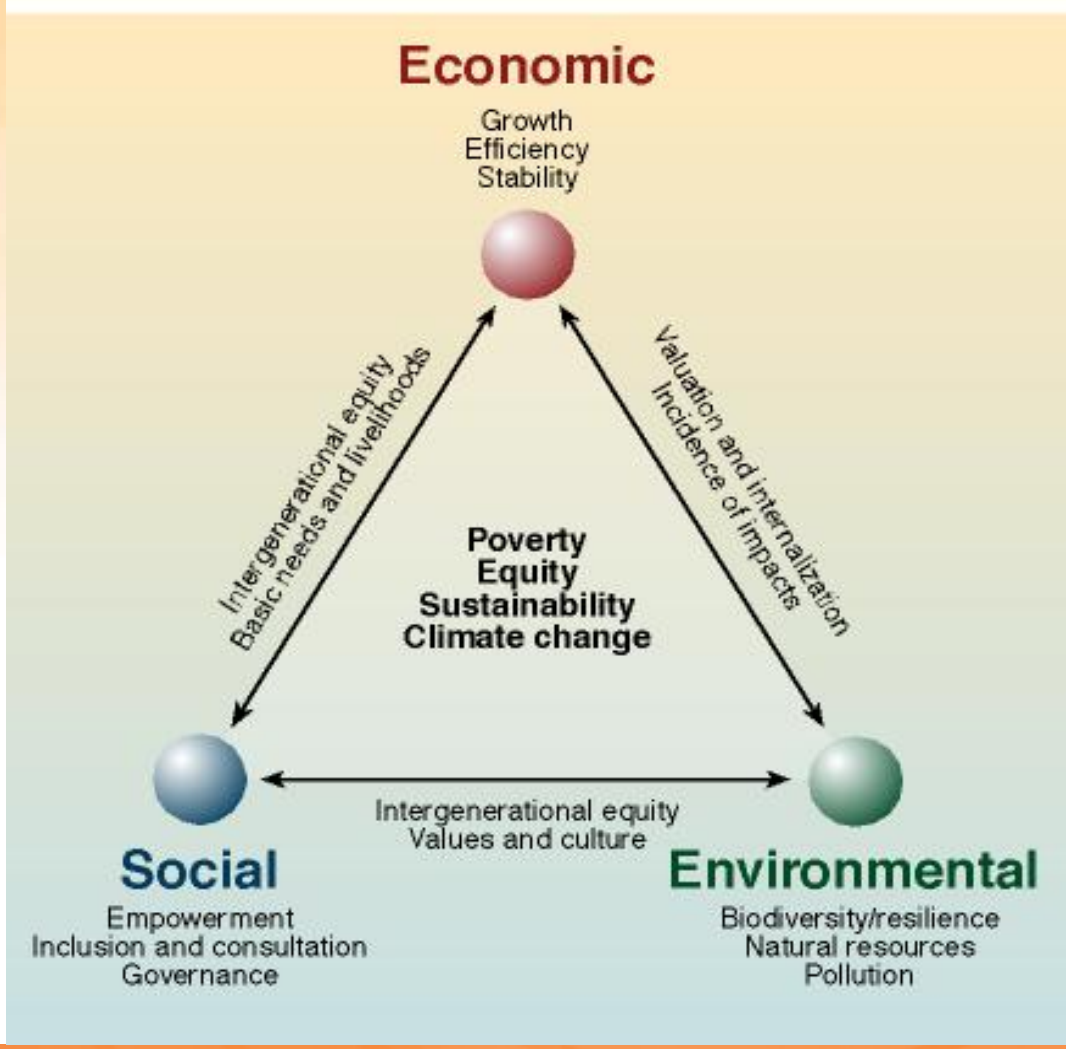
Electricity industry restructuring objective: *decentralised decision making*

- Improve economic efficiency by facilitating competition & new entry, which assumes:
  - Effective markets & sound legal & policy frameworks
- Enhance accountability to end-users & society through 'customer choice', which assumes:
  - End-users become active participants in the industry
  - End-users are independent agents who make "informed" decisions & efficiently manage the associated risks:
- Implement a market-based approach to social & environmental externalities:
  - Assumes political will to regulate non-monetary impacts
- Release government funds by asset sales:
  - Creates a moral hazard for politicians

The broader context of sustainability that electricity industry restructuring should address
(IPCC COP7)

Engineering criteria must also be met: *availability & quality of supply*

Key elements of sustainable development and interconnections



Economic efficiency objectives

- Allocative efficiency:
  - Appropriate choice between goods & services:
    - For example, electricity versus gas
- Technical or productive efficiency:
  - Cheapest method to produce a good or service:
    - Best available technology & work practices
- Dynamic efficiency:
  - Support innovation & response to change:
    - R&D & technological change
    - Environmental impacts, social expectations, etc.
  - Very important in a capital intensive industry

Other drivers for change in infrastructure industries

- Improving theoretical understanding:
  - Imperfect regulation versus imperfect markets
  - A theory of electricity spot pricing from 1979
- Evolving political context in western world:
  - Emphasis on individual choice & accountability
- Challenging conditions for central planning:
  - Slow &/or uncertain growth in demand
  - Technological progress creating new options:
    - Eg metering, communications & demand-side options
  - Growing climate change concerns

Microeconomic reform

- *Objective* - to improve economic efficiency
  - Particularly challenging for infrastructure:
    - Potential for natural monopolies in essential goods & services
- *Means* - reduce barriers to competition, eg:
  - Remove monopoly franchises & introduce competition
  - Break-up large state-owned enterprises
  - Privatise state-owned enterprises
  - Improve strategies for industry regulation
- *Assumptions:*
  - The key public interest issue is economic efficiency
  - The best mechanism is competition
  - Participants act as profit-maximising economic agents
  - Sound legal framework in which restructuring can occur

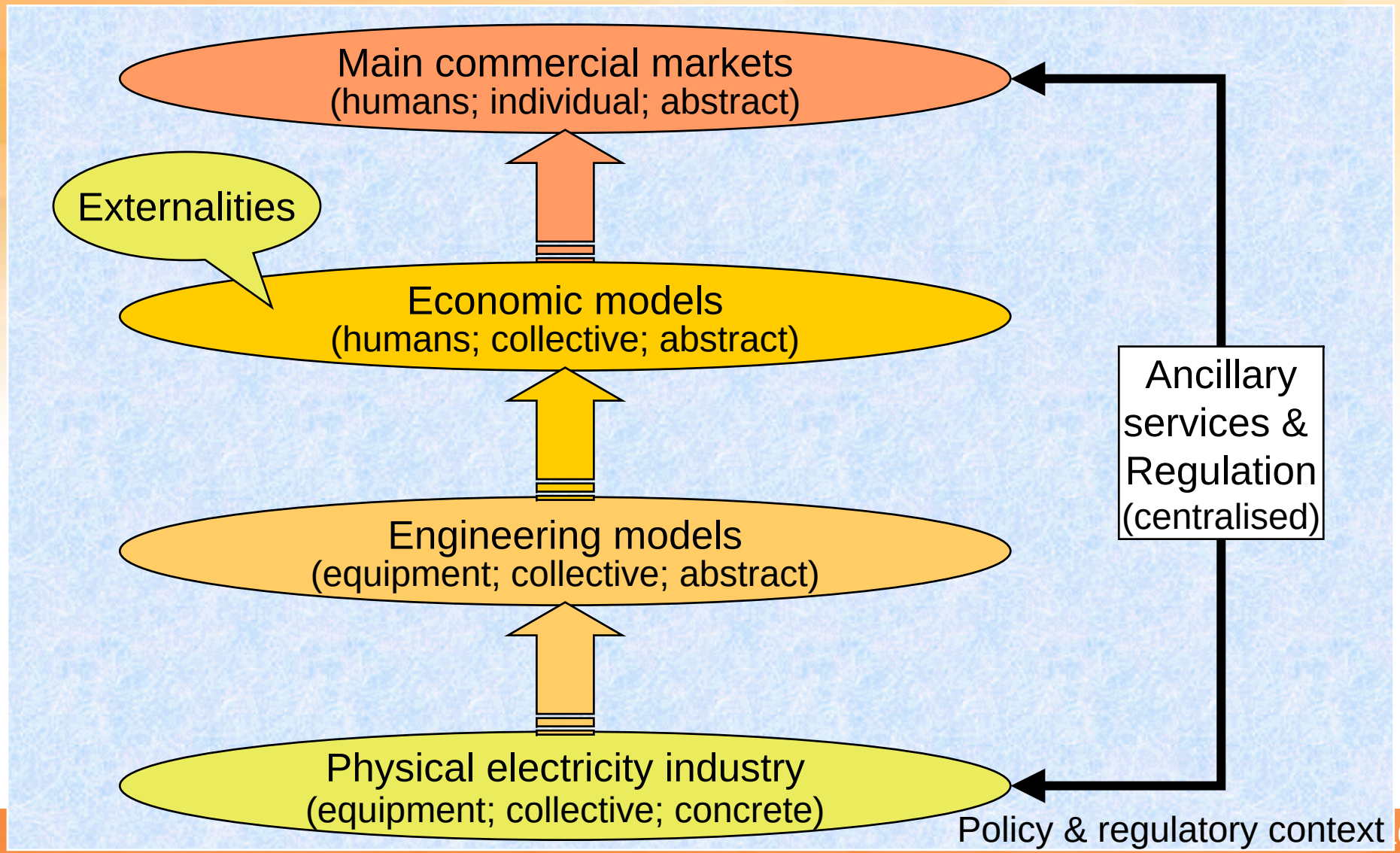
Evolution of competition policy in Australia

- Development of COAG process in late 80's
  - Formal interface between federal & state gov'ts
- National Competition Policy,1993 Hilmer Rpt:
  - Facilitate competition where effective & pro-competitive regulation where not
  - Treat public & private firms equally
  - Develop access regimes for essential facilities
- Competition Reform Act, 1995:
  - Amended TPA, established ACCC, promoted competition
- Ministerial Energy Council, 2004:
  - Policy development role for stationary energy sector

The electricity industry restructuring process

Issue	Transition	Key challenges
Industry structure	*From* monopoly *To* competing firms *Plus* system operator(s)	Cultural change; Adequate competition; *Accountability*
Commercial framework	*From* cost recovery *To* market prices	Market power; Market design fidelity; *Accountability*
Industry regulation	*From* rate of return *To* Incentive Reg'n	Multiple objectives; Measuring outcomes; *Accountability*
Sustainability	*From* direct cost *To* full costs	Variable RE energy flows End-user participation; *Accountability*

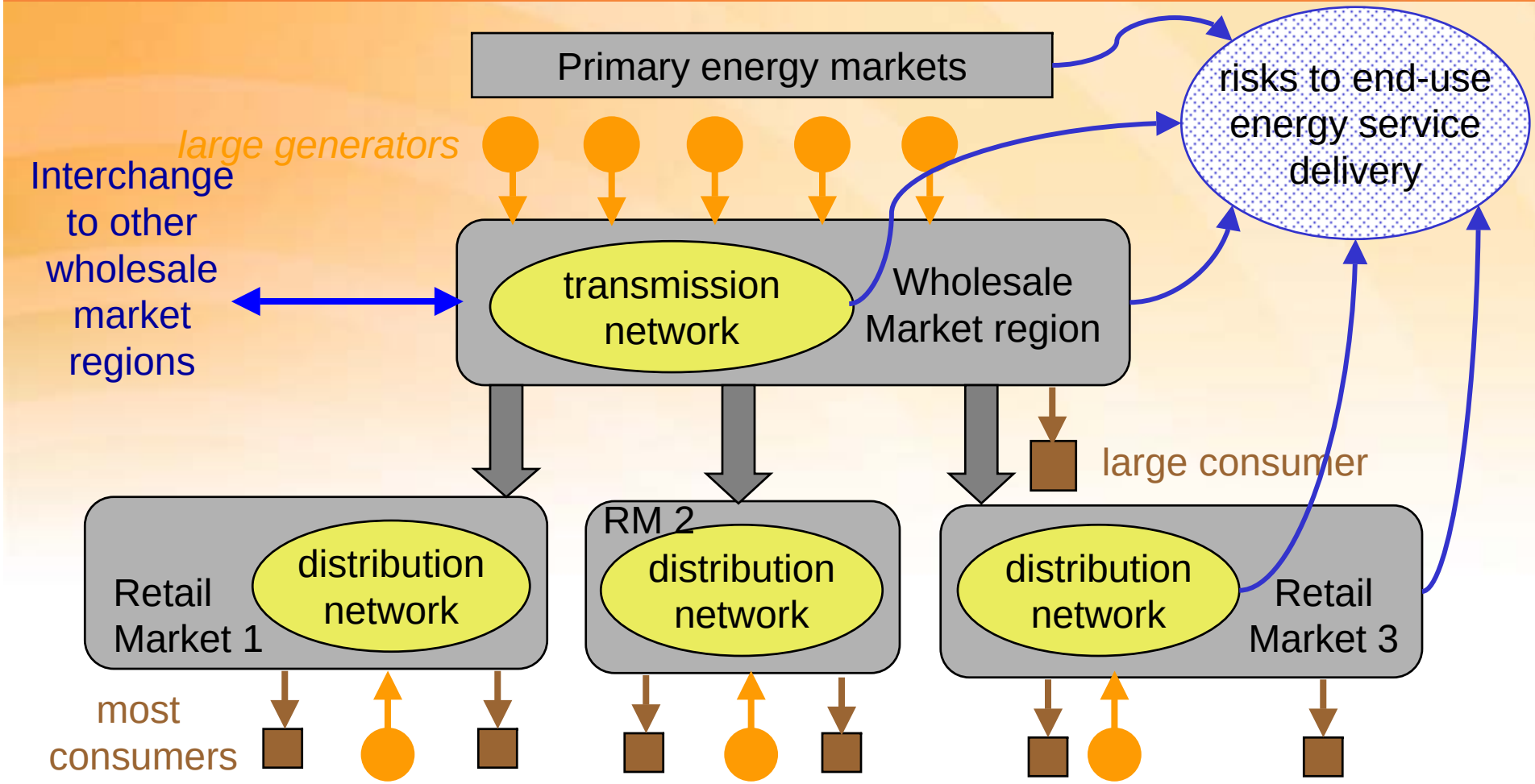
Trading in electricity:- an abstraction from reality



Challenges for a restructured industry

- Consistency between centralised & decentralised processes:
  - *Centralised:* most ancillary services; industry operation; industry design & regulation; government policy for the stationary energy industry
  - *Decentralised subject to physical laws:* some ancillary services; spot & derivative markets
- Sound interface between centralised & decentralised processes:
  - Clear accountabilities & “hand-overs”
- Active involvement of informed end-users:
  - Should take more responsibility for timing of demand, “resource adequacy” & sustainability

An electricity trading framework

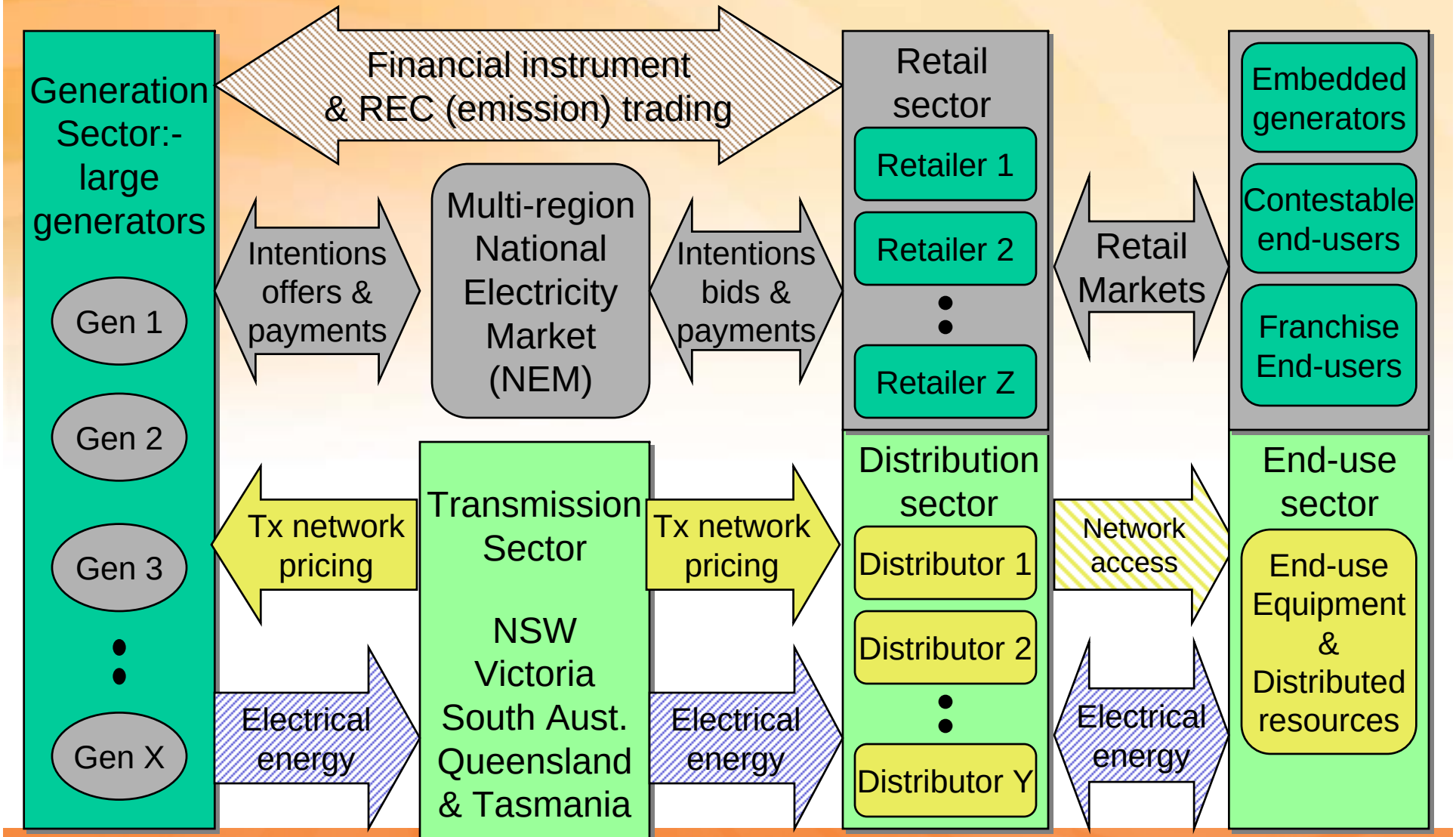


- *Small consumers, embedded generators & storage should be supported by energy service advisers*
- *Wholesale & retail market designs should be compatible*
  - *Both should include network models*

Electricity market models

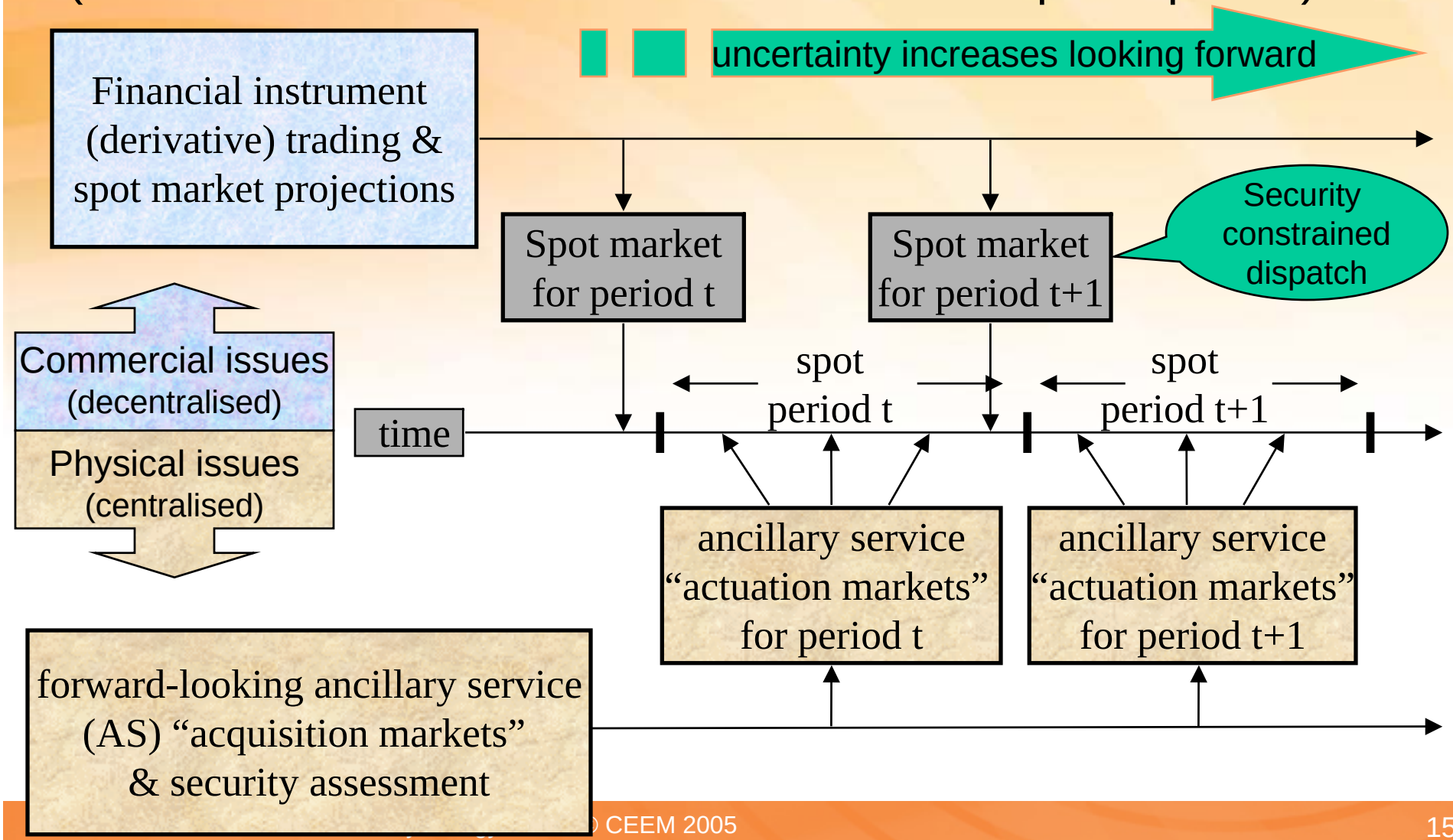
- *Should be formally designed to reflect the physics*
- Gross pool (eg NEM):
  - Temporal & location risk managed collectively:
    - Ancillary services, spot & derivate markets
    - PASA, SOO, ANTS
    - Security constrained dispatch
- Net pool (eg UK NETA):
  - Long term & location risk managed bilaterally:
    - Network not modelled in trading arrangements
    - Resource adequacy managed partly as a bilateral issue
  - Short-term operational risk managed collectively:
    - System operator typically have one day's notice of bilateral trades

Electricity industry structure in SE Australia



Timeline for electricity trading in NEM

(some locational information & demand-side participation)



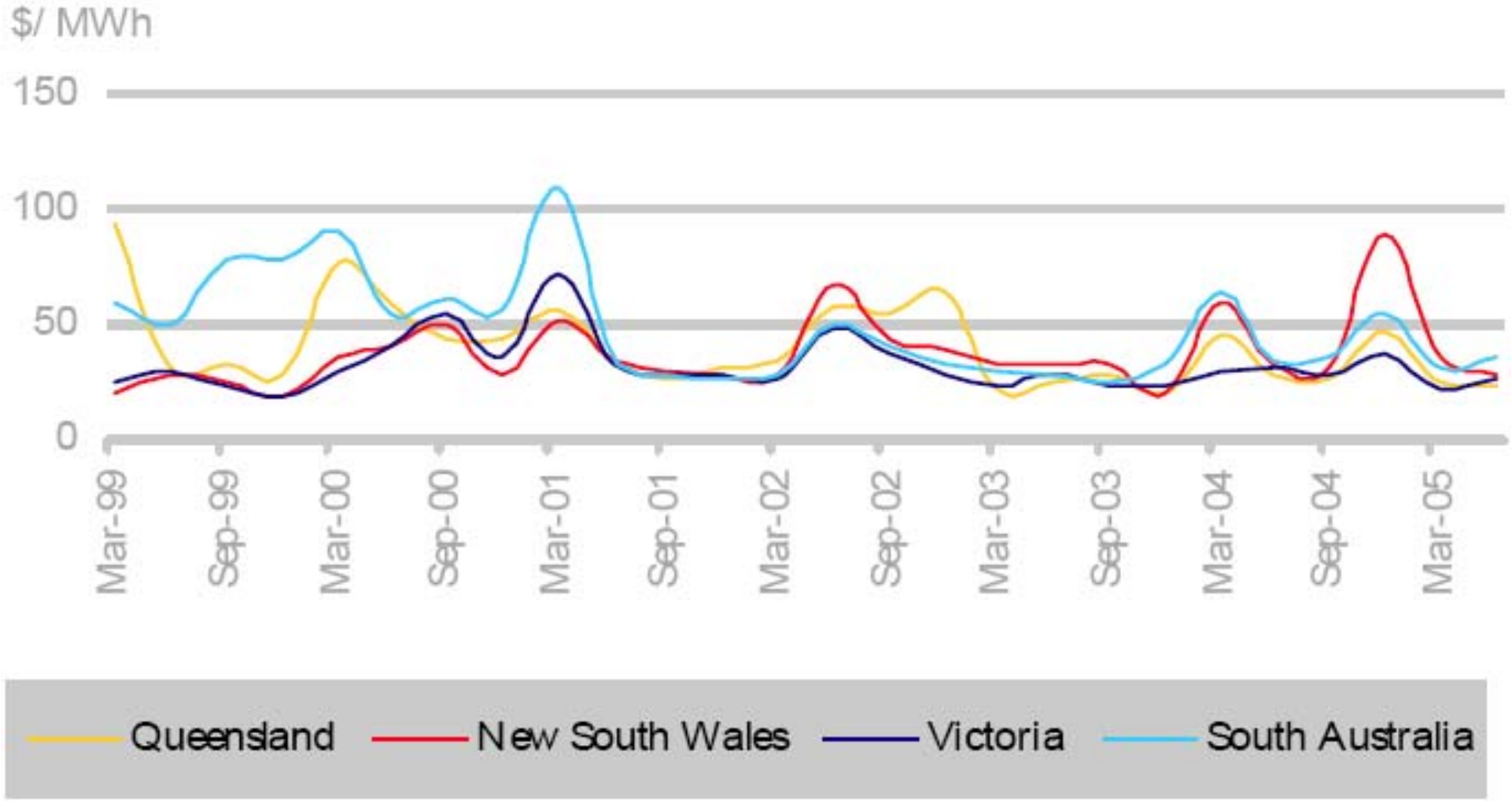
Uncertainty & risk in electricity trading

Time scale	Issues	Mechanisms
< 30 minutes	• Demand fluctuations • Contingencies	• Ancillary services
30 minutes to several days	• Demand uncertainty • Inter-temporal links, eg • Unit commitment	• Ex-ante spot market • Short term derivative market

Weeks to years - *operation*	• Inter-temporal links, eg
	  • Retail tariff setting
	  • Hydro scheduling
		• Long term derivative market

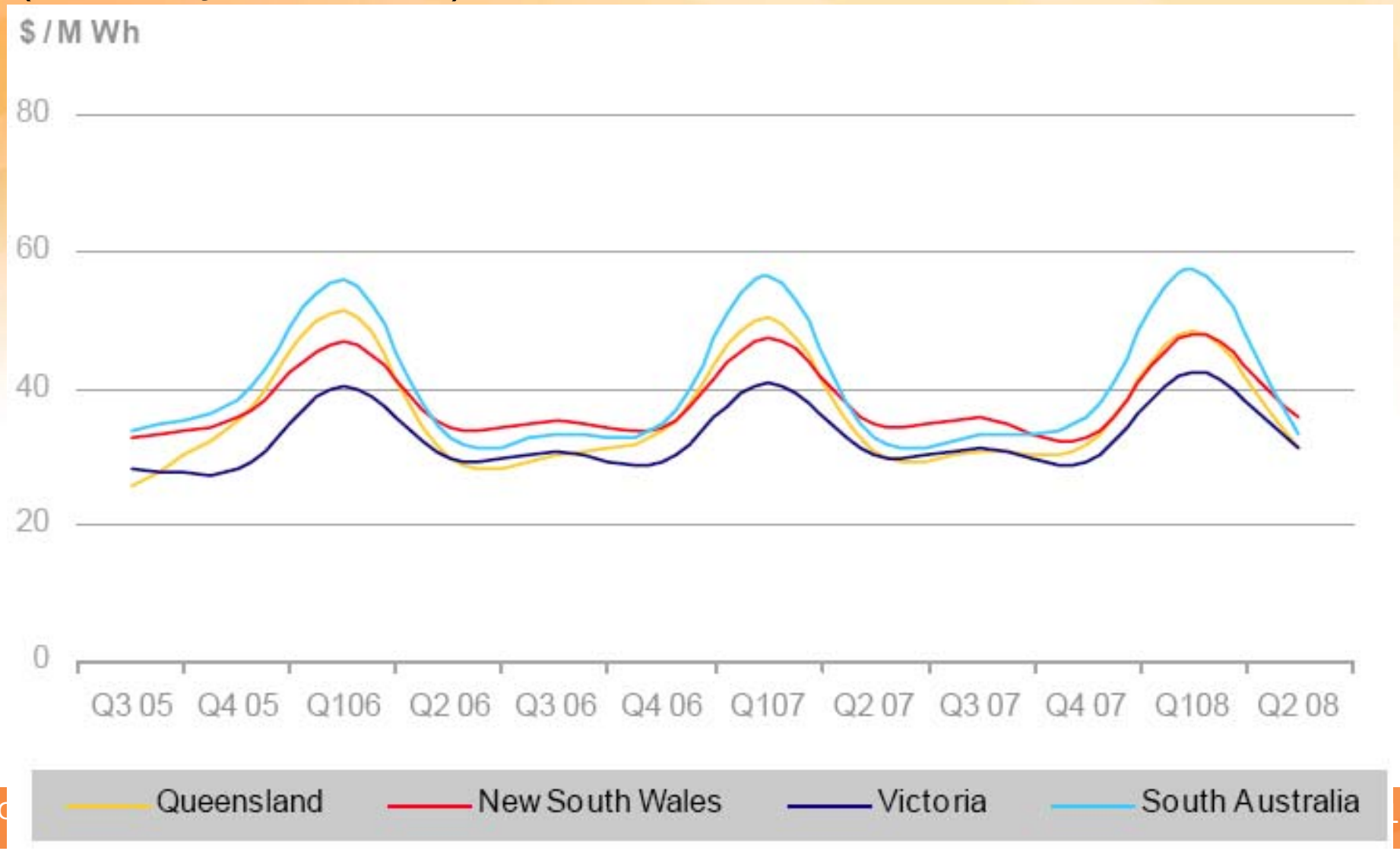
Weeks to years Š *investment*	• Optimal investment decisions	• Long term derivative market • Policy framework

Smoothed NEM Regional Ref Prices (RRPs) since market inception (AER, 05Q2 Stats, 2005)



Annual average RRP flat contract prices

(AER, 05Q2 Stats, 2005)



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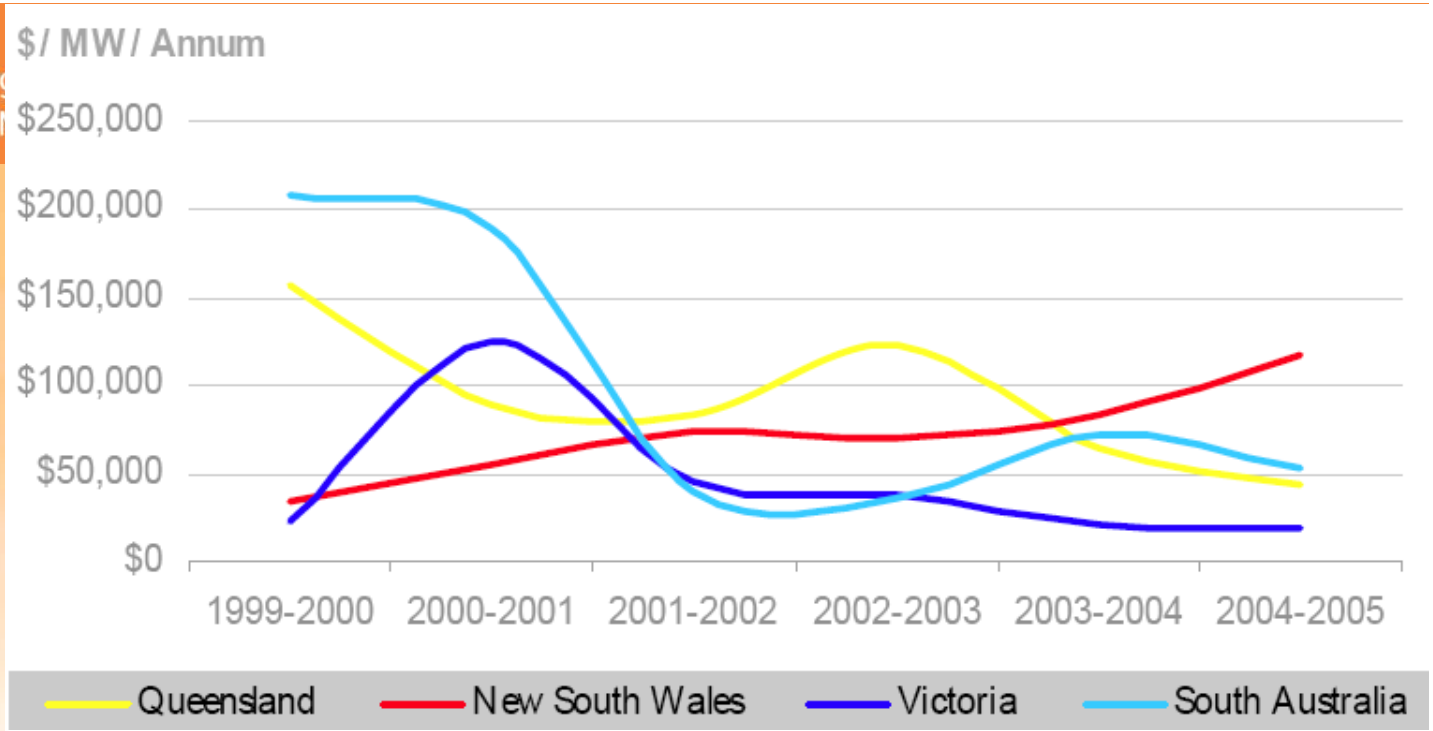
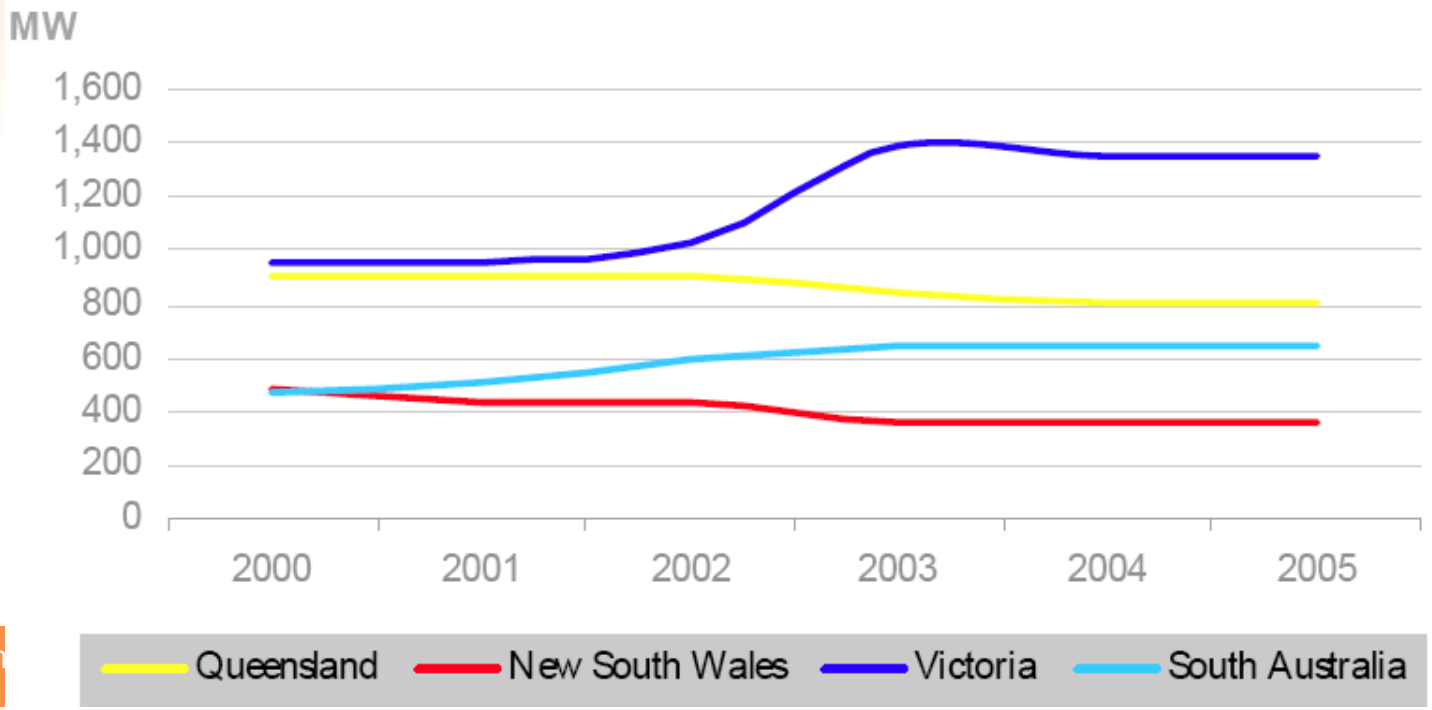
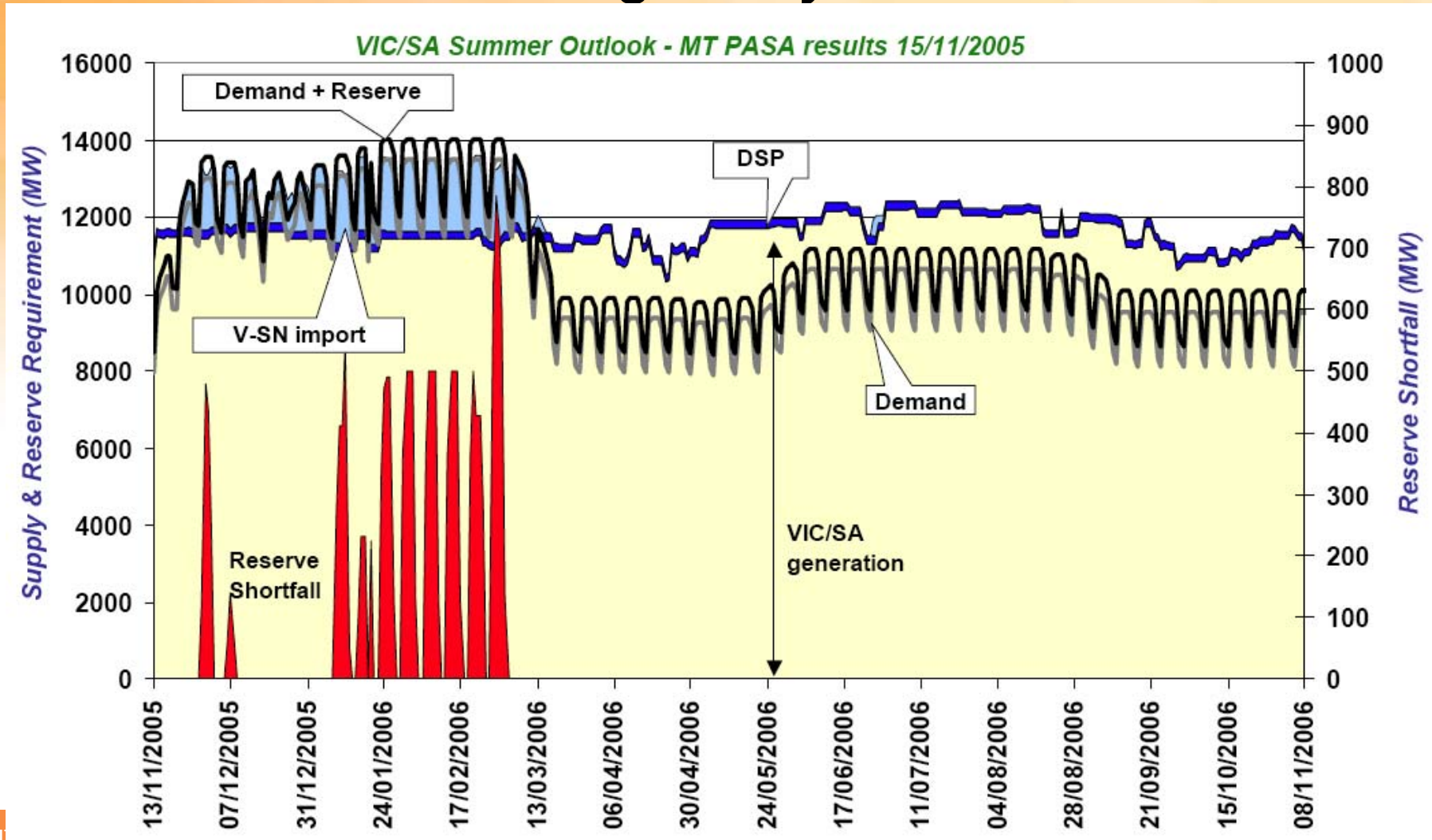
Premium at 50 $/MWH strike price (above) & installed peaking capacity (below) by NEM region

(AER, 05Q2 Stats, 2005)



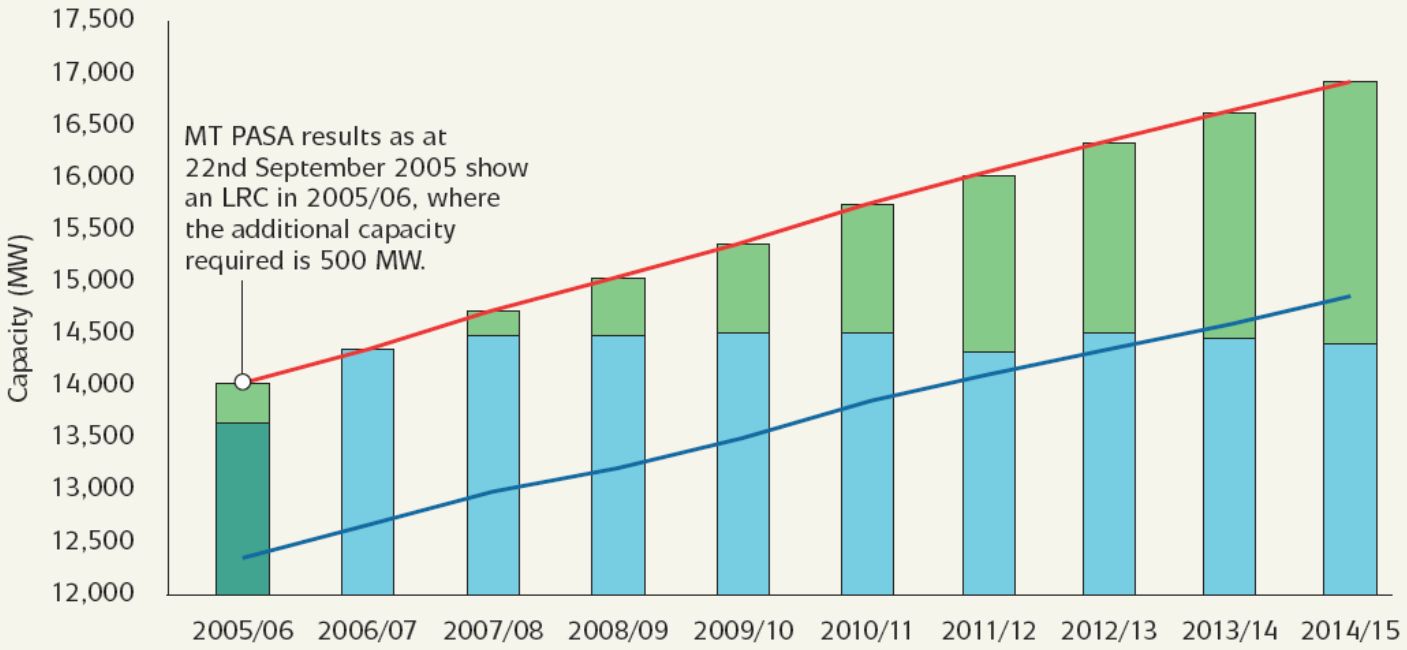


Projected summer reserve shortfall in Vic & SA due to commissioning delays (NEMMCO MTPASA, 15/11)



Longer-term outlook for Victoria & SA
(NEMMCO SOO, 2005)

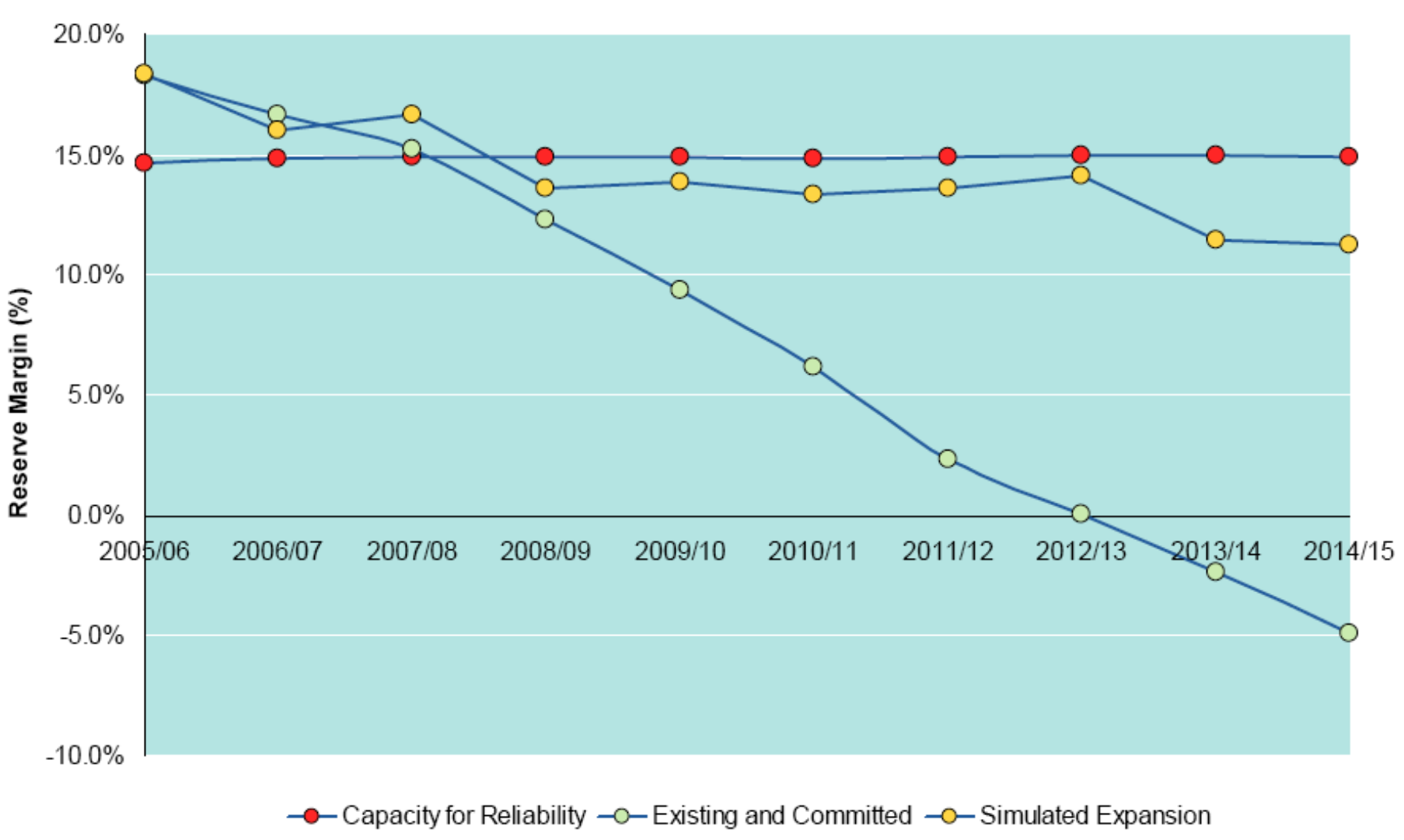
Figure 5 Victoria and South Australia Summer Outlook



- from 2006/07 onwards, following commissioning of Basslink, there is an additional 590 MW available to Victoria and South Australia;
- from 2005/06 to 2007/08, reserve support from Snowy, New South Wales and Queensland is limited by the Snowy to Victoria inter-connector's capability; and
- the next LRC point occurs in 2007/08, where the additional capacity required is 237 MW. Lower longer-term demand growth in Victoria resulted in the second LRC point occurring one year later than reported in 2004.

Note: uncertainty in future supply-demand balance is inevitable in a restructured industry with decentralised decision-making

Projected NEM-wide reserve margin
(NEMMCO SOO, 2005)



Outcomes to date from electricity industry restructuring in Australia

- Largely solved problems:
  - Security-constrained dispatch of existing generators
  - Ancillary services & operator interventions
- Unsolved problems or jury still out:
  - Adequacy of investment in new generation
  - End-user participation in spot & derivative markets
  - Market-based versus regulated network services
  - High levels of stochastic renewable energy penetration
  - Reduction of climate change emissions
  - Consistency & stability in policy settings

Enhancing end-user participation

- Increased end-user participation now essential to further progress in EI restructuring in Australia
- Key steps required:
  - Interval metering that also measures availability & quality of supply *for all end-users*
  - Retail energy tariffs converted to spot & derivative form
  - Network service contracts that facilitate end-user & embedded generator provision of ancillary services
  - Advanced spot market designs that incorporate AC transmission network models & voltage-value functions

Market-based versus regulated network services

- Network services in a restructured industry:
  - Difficult to separate from generation & end-use services
  - HV transmission services can be:
    - Partially modelled in an electricity market & made competitive
  - Sub-transmission & distribution:
    - Regulated at present, likely to remain so but difficult to do well
    - Can be partly contested by distributed resources
- Importance of active end-user participation:
  - Allow energy price elasticity (value) to be observed as well as the value of reliability & quality
  - Reduce reliance on “obligation to serve” as a surrogate

Overview of electricity industry climate change response options

Option	Risk scope	Cost	Social Extern	Enviro Extern	Life (years)
Frugality & efficiency	Local	Low	Low	Low	Unlim
Renewable energy	Local	High	Low	Low	Unlim
Natural gas & CCS	Global	High	?	?	~100
Coal & CCS	Global	High	?	?	~100
Nuclear (conventional)	Global	High	?	?	~100

Gas industry restructuring in Australia

- Natural gas of growing strategic importance to the electricity industry:
  - Climate change response
  - Peak-load generation
- Hence growing but variable demand for gas
- National gas network more feasible than truly national electricity network:
  - Important to develop a national gas market design that efficiently allocates pipeline capacity:
    - Intra-day pricing to manage volatile gas demand

Conclusions for the stationary energy sector

- A mix of technical, economic & policy issues:
  - Physical behaviour continuous & cooperative
  - Commercial behaviour individual & competitive
- Restructuring is a “designer” process:
  - Industry-specific laws, codes, market designs
  - A “social experiment” with risks & ethical issues
- Restructuring is still a learning situation:
  - No complete successes, some disastrous failures, difficult to go back to traditional model
  - Must solve commercial, technical, institutional & environmental challenges (each must function well)