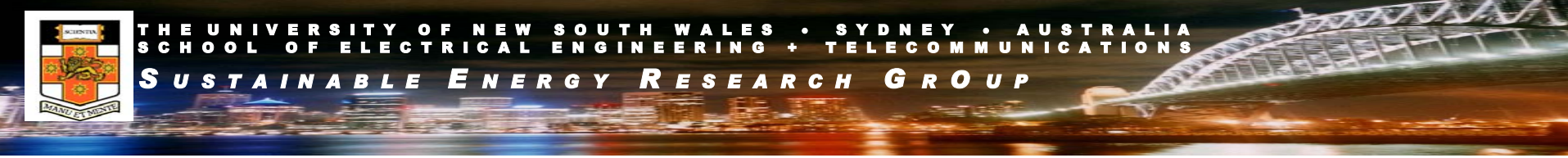

Cambridge DAE Seminar
June 2004

Some Recent Developments in Australian Electricity Industry Restructuring

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www.sergo.ee.unsw.edu.au

UNSW **S**ustainable **E**nergy **R**esearch **GrO**up

- An informal discussion and research collaboration group

  "focussing on research into electricity restructuring, from the operation of the Electricity markets in Australia and elsewhere, emerging power technologies, through to wider questions of appropriate energy policy directions and electricity industry sustainability."

- Based in UNSW School of Electrical Engineering
  - headed by Assoc. Professor Hugh Outhred
  - includes links to Securities Industry Research Centre (SIRCA), the Aust. Graduate School of Management (AGSM), Key Centre for PV Engineering, Faculty of Commerce + Economics, and more.

- *Very much a work in progress…*
  - *From ERGO to Sustainable Energy Research Group (SERGO)…*
    now a proposed ***Centre for Energy + Environmental Markets (CEEM)***

Some recent areas of work *(www.sergo.ee.unsw.edu.au)*

- Energy policy and sustainability
  - Policy frameworks for energy + greenhouse
  - Electricity industry restructuring
  - Environmental markets - MRET, NSW Greenhouse Abatement Scheme, National Emissions Trading
  - Policy to counter market failures in energy efficiency, infrastructure
- Energy technologies
  - Promising renewables – Wind + PV
  - Technology innovation – technology roadmapping, policy frameworks
  - Carbon Capture + Geosequestration in the electricity sector
- Australian electricity industry restructuring + the NEM
  - NEM Design + structure
  - Operation of Spot, Ancillary and Forward markets
  - The NEM and distributed, intermittent, mainly renewable, resources

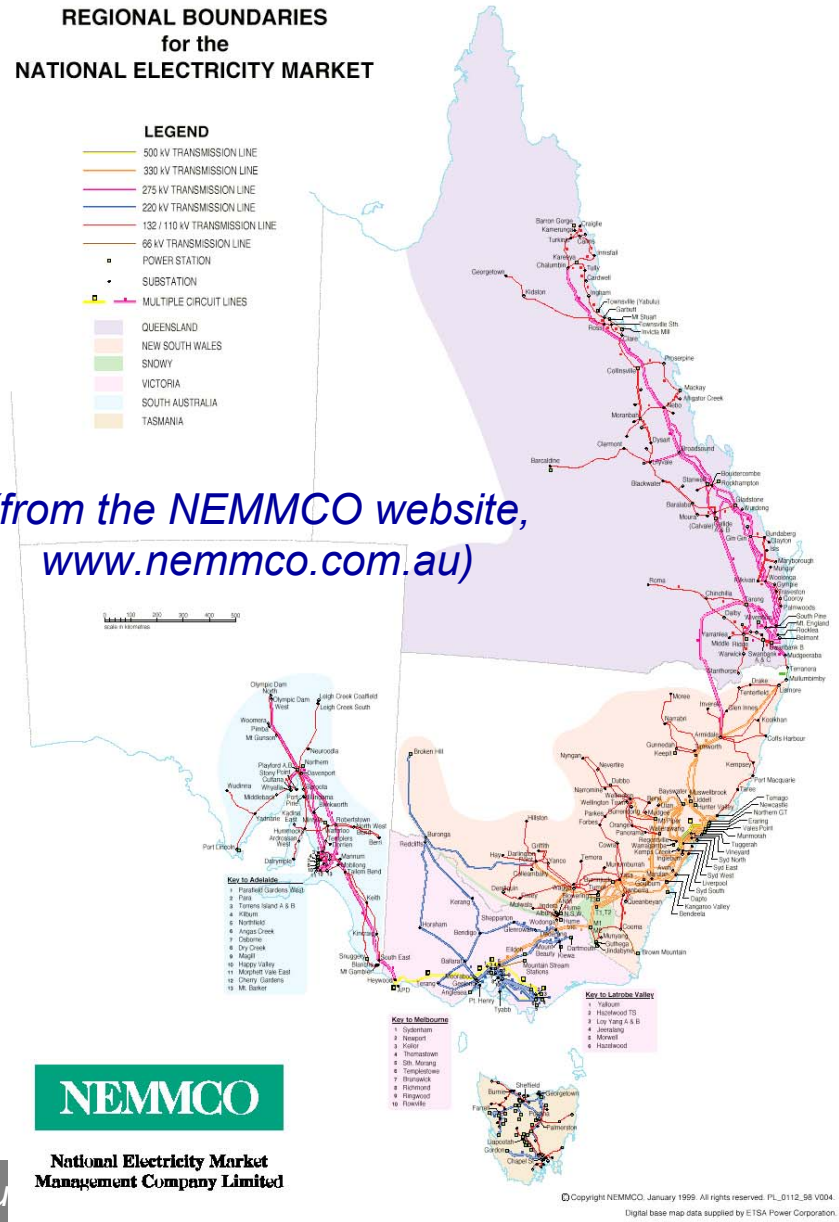
Presentation outline

- A brief overview of Australian National Electricity Market (NEM)
- The NEM's performance to date
- The CoAG Energy Market Review and its recommendations
- The Ministerial Council on Energy (MCE) response
- Some related environmental regulatory developments in the electricity sector
- Our proposal for a new interdisciplinary UNSW Centre for Energy + Environmental Markets (CEEM)

Scope of the NEM

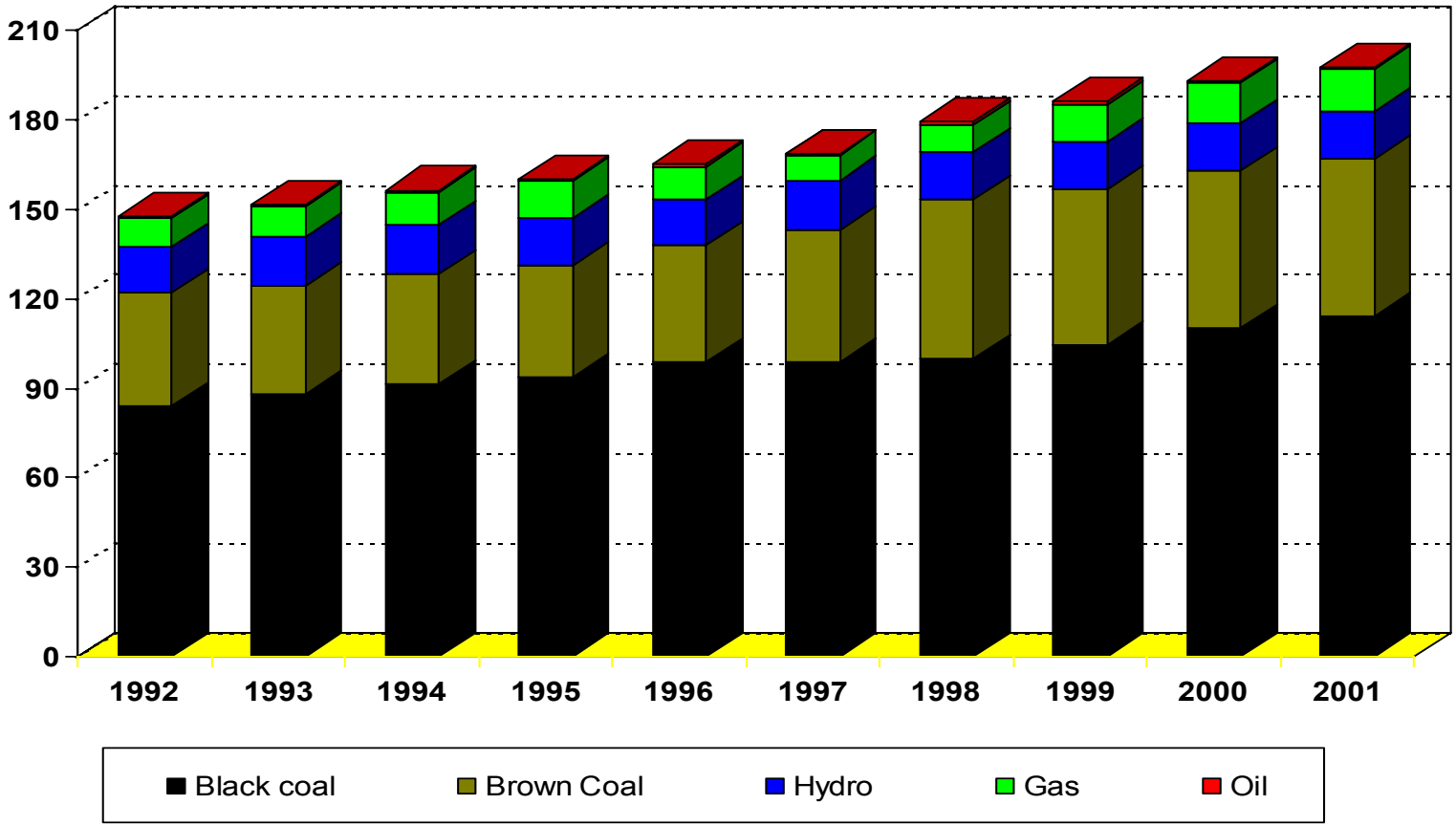
- Queensland
- New South Wales & ACT
- Victoria
- South Australia
- Tasmania (coming soon, with connection to mainland expected in 2005)

Around 4000km in length, nearly all in one time zone



(from the NEMMCO website, www.nemmco.com.au)

Australia's present electricity generation mix

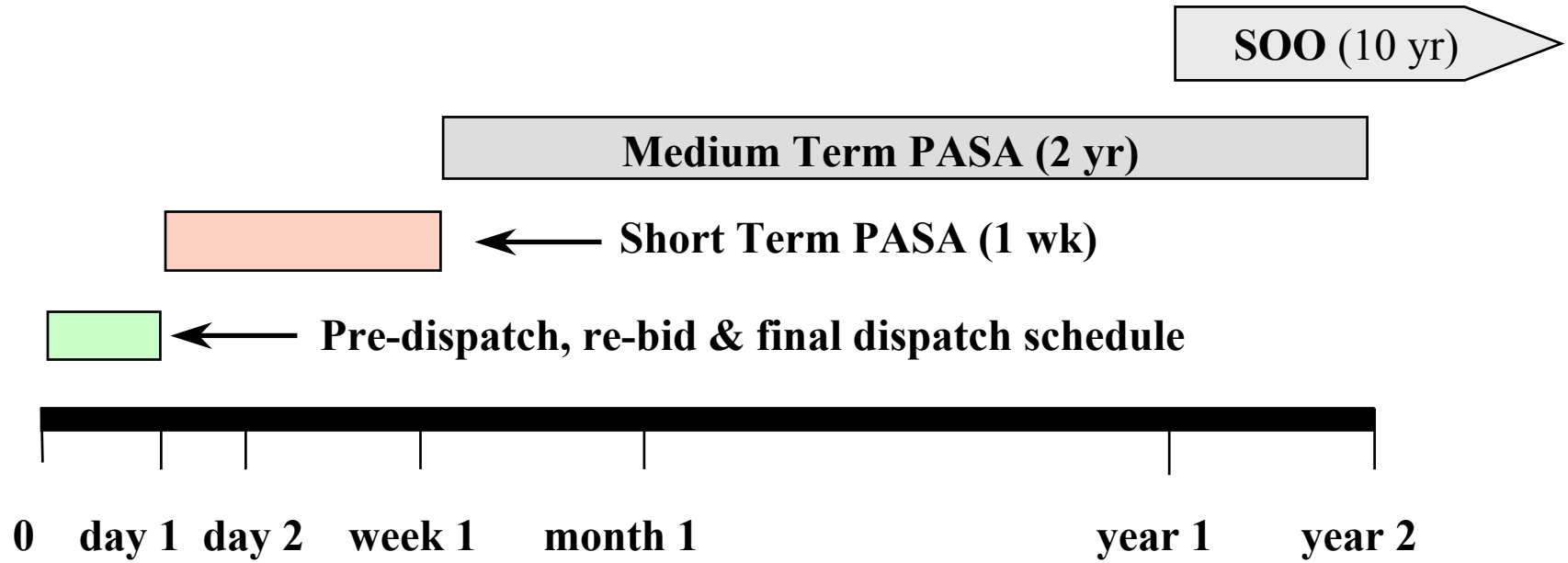


(ESAA, Electricity Australia, 2002)

Key NEM features

- NEM covers all participating states:
  - A multi-region pool (modified transport model) with static intra-regional loss factors
  - Spot market with 30 minute bidding
  - Ancillary services market for frequency control
  - Auctions of inter-regional settlement residues
  - Active forward trading of financial instruments
- Compulsory participants in NEM:
  - All generators & dispatchable links > 30 MW
  - Network service providers & retailers
  - Contestable consumers *may* buy from NEM

Dispatch, Pre-dispatch, PASA & SOO within the NEM



Statement of opportunities (SOO) is intended to inform generation and network investment decisions (10 year horizon, yearly update)

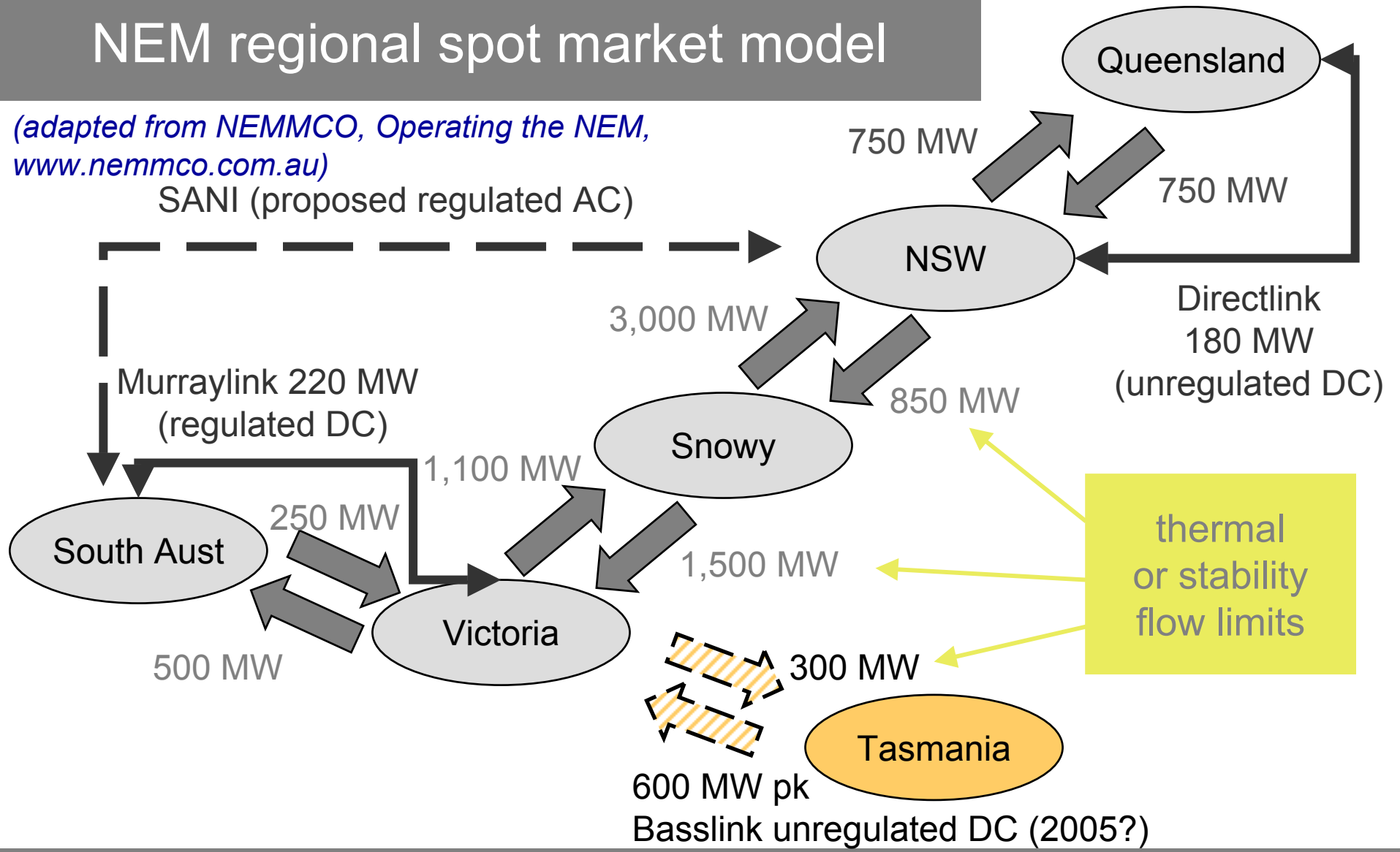
MT Projection of System Adequacy (PASA) is intended to inform near-term reliability assessment and reserve trader processes (2 year horizon, weekly update)

(NEMMCO, Operating the NEM, www.nemmco.com.au)

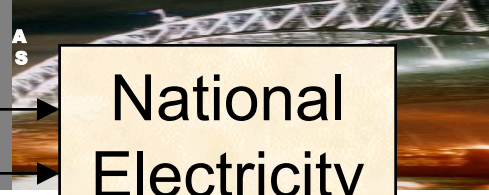
Derivative trading in support of NEM

- Trading in swap & cap contracts:
  - Bilateral trading
  - Over-the-counter instruments
  - Exchange-traded CFDs (swaps)
- Inter-regional hedges:
  - Specialised form of financial instrument:
    - to manage regional price difference risks
    - funded by interconnector settlement residues
    - NEMMCO inter-regional settlement residue auctions commenced 1999

NEM regional spot market model



NEM Regulation



National Electricity Tribunal

National Electricity Law

NECA

RP & CCP

National Electricity Code

ACCC

Dispute resolution

NEMMCO

NEM participants:
* Generators
* Retailers
* Direct customers
* Network service providers

ASIC

State Regulation

NEM Ownership – Private and Government

State And Private Asset Ownership In The National Electricity Market

		Energy Providers	Generators	Transmission	Distribution	Retail
% State owned	Few		70%	70%	70%	60%
Value of Assets			$7b	$4b	$18.2b	$1.8b
% Private Owned	Most		30%	30%	30%	40%
Value of Assets			$3b	$2b	$7.8	$1.2b

State Owned Enterprises = $31b (69%)

Private = $14b (31%)

(Bach Consulting, Report to NEMMCO on Risk Management in the NEM, 2003)

Restructuring objectives

- COAG has agreed to the following national energy policy objectives: (COAG ENERGY POLICY DETAILS: 8 JUNE 2001)
  - Encouraging **efficient provision of reliable, competitively-priced energy services** to Australians, underpinning wealth and job creation and improved quality of life, taking into account the needs of regional, rural and remote areas;
  - Encouraging responsible **development of Australia's energy resources, technology and expertise**, their efficient use by industries and households and their exploitation in export markets; and
  - **Mitigating local and global environmental impacts**, notably greenhouse impacts, of energy production, transformation, supply and use.

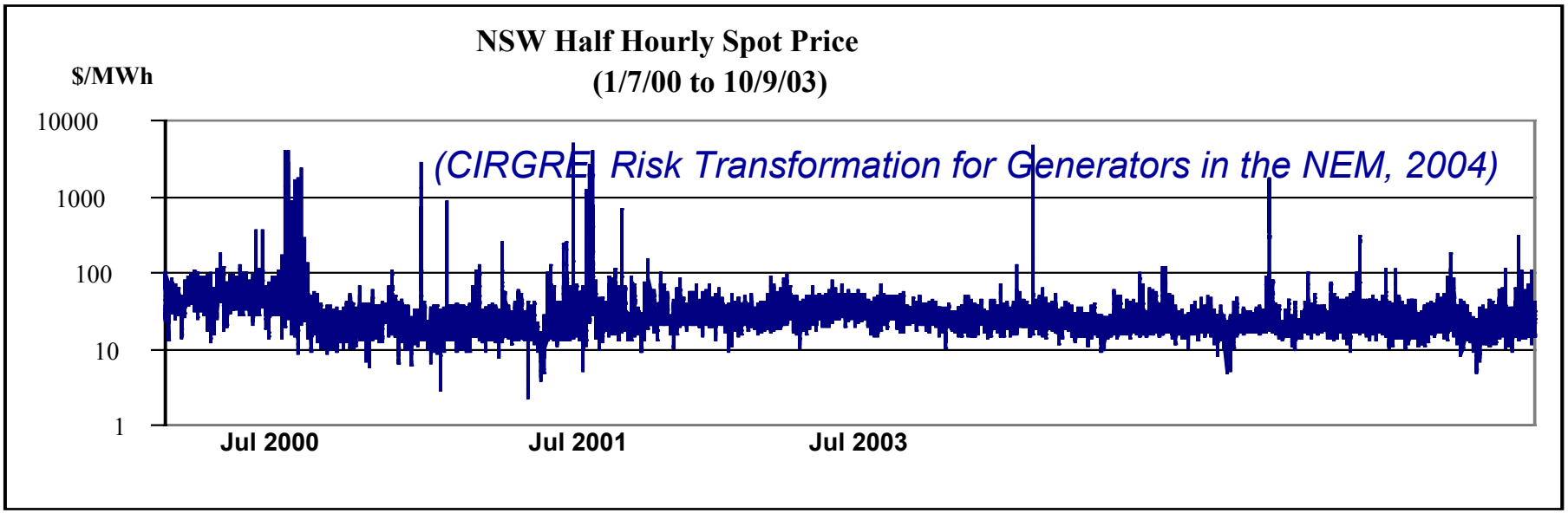
Australian Electricity Industry Value Chain

	Fuel Providers	Generators	Transmission	Distribution	Retail	Totals
Value Added	$2b	$3b	$2b	$5b	$1b	$13b
Assets (Depreciated Value)	$2b	$10b*	$6b	$26b	$3b	$47b
Rev:Asset	1:1	1:3	1:3	1:5	1:3	1:3.6
c/kW	1.2c	1.8c	1.2c	3.1c	0.6c	8c

Source: Derivation of figures from annual reports of participants and the NEMMCO SOO
* Written down asset value; replacement value is approx. $40b

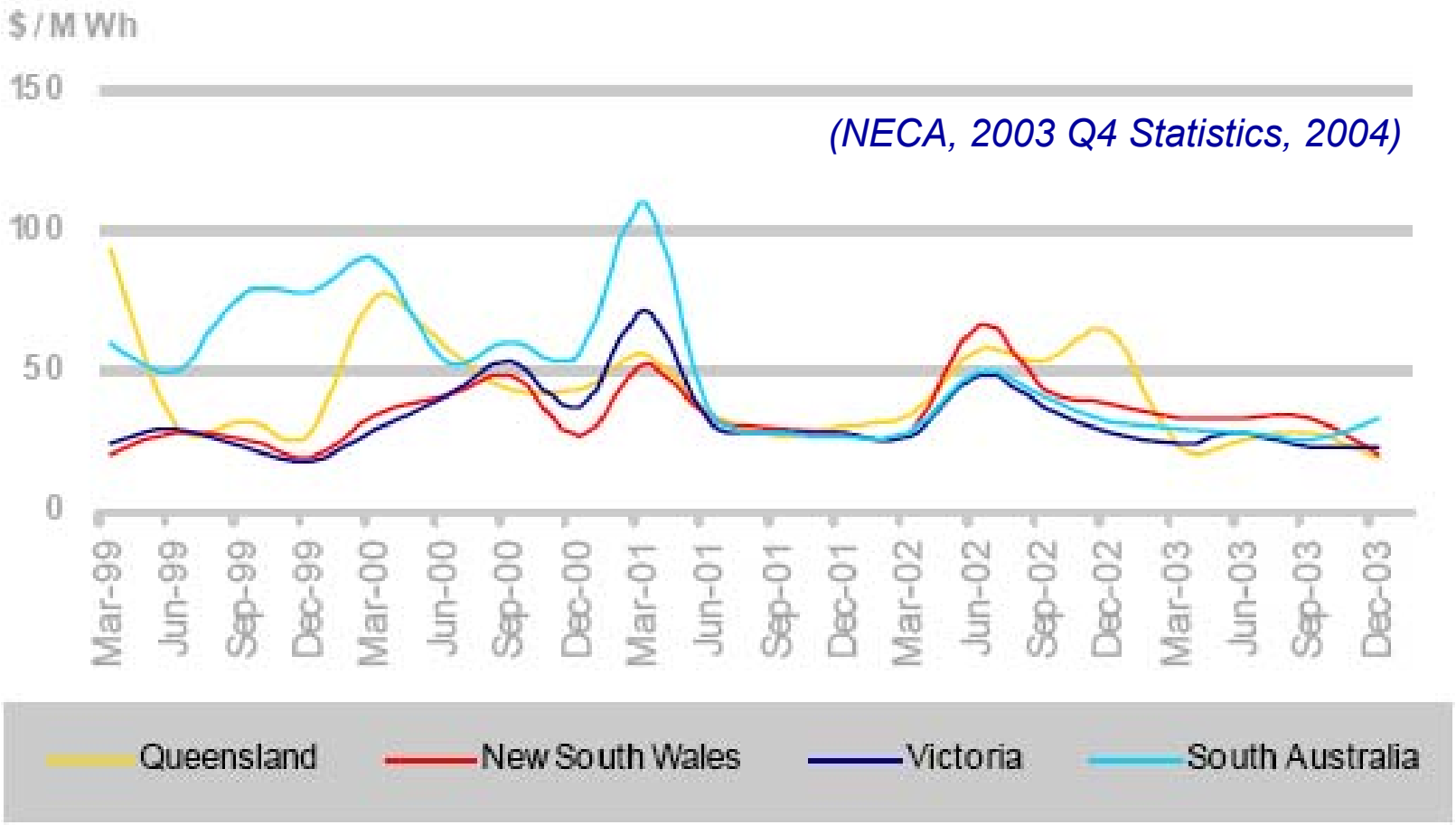
(Bach Consulting, Report to NEMMCO on Risk Management in the NEM, 2003)

Spot prices in the NEM

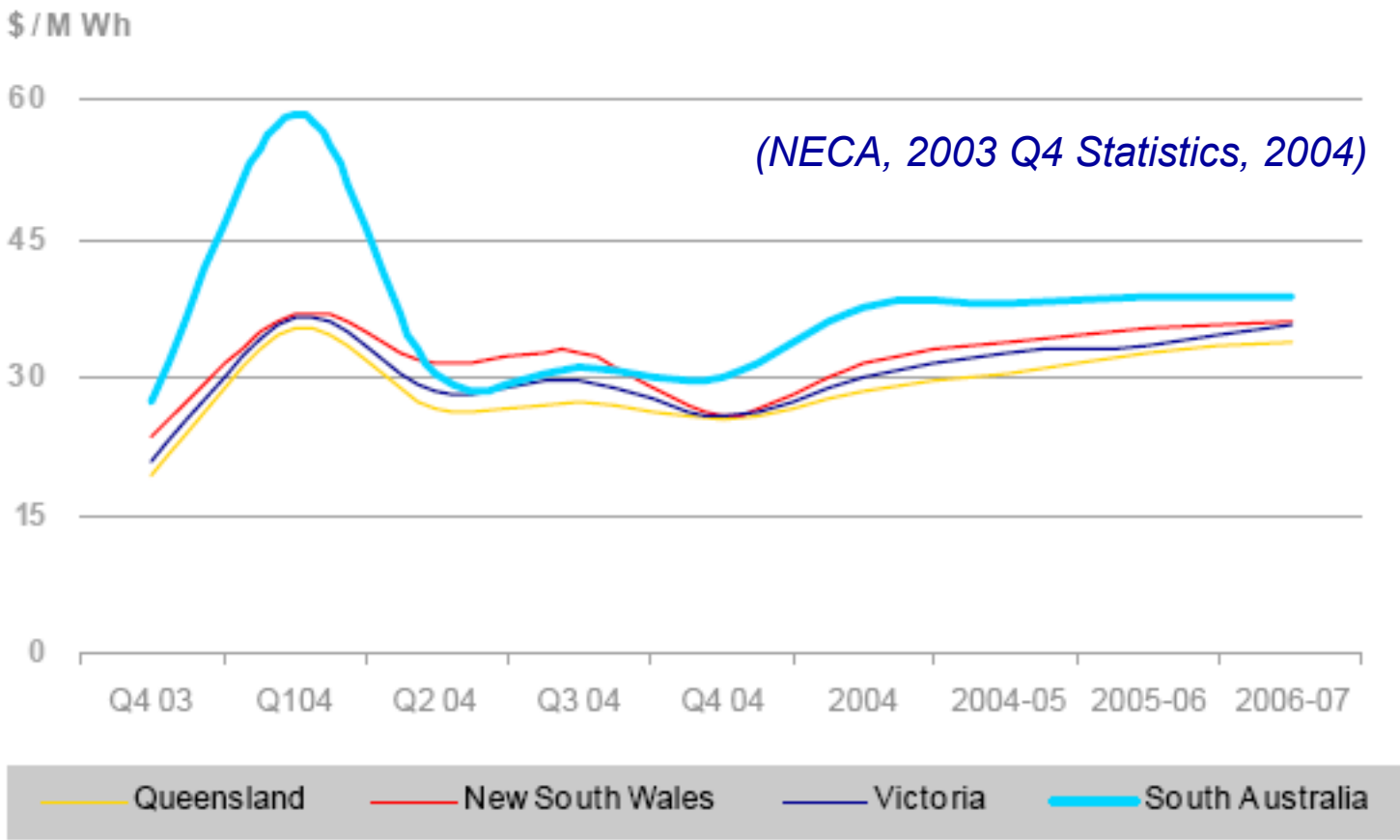


- Spot prices < $50/MWh: $23/MWh (~ 17,000 half hours)
- Spot prices > $50/MWh <$2,000/MWh: $ 7/MWh (~ 515 half hours)
- Spot prices >$2,000/MWh : $ 5/MWh (~ 5 half hours)
- **Average annual Spot price : $35/MWh (~ 17,520 half hours)**

Weekly average NEM spot prices since market inception

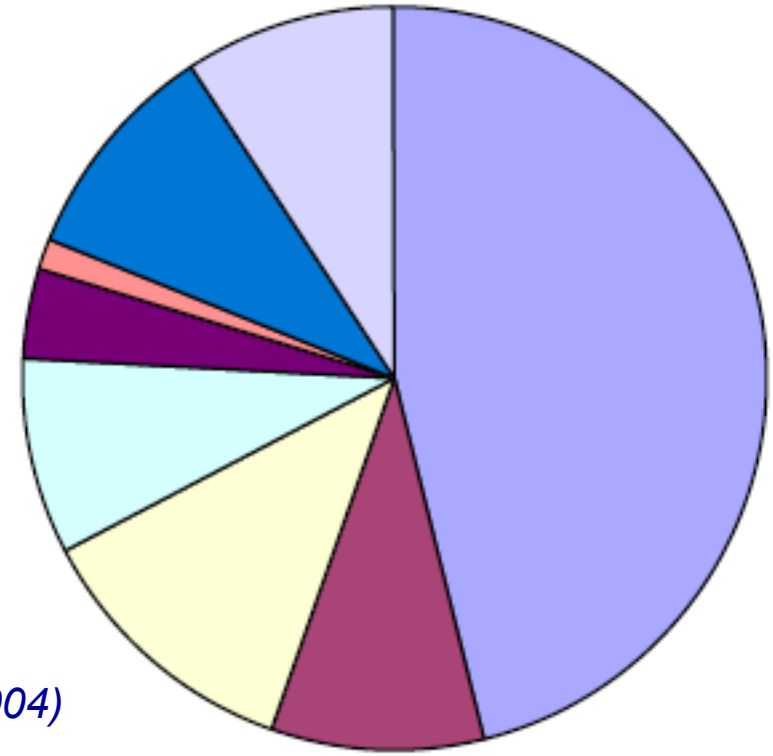


Recent flat contract prices



Recent FCAS cost distribution

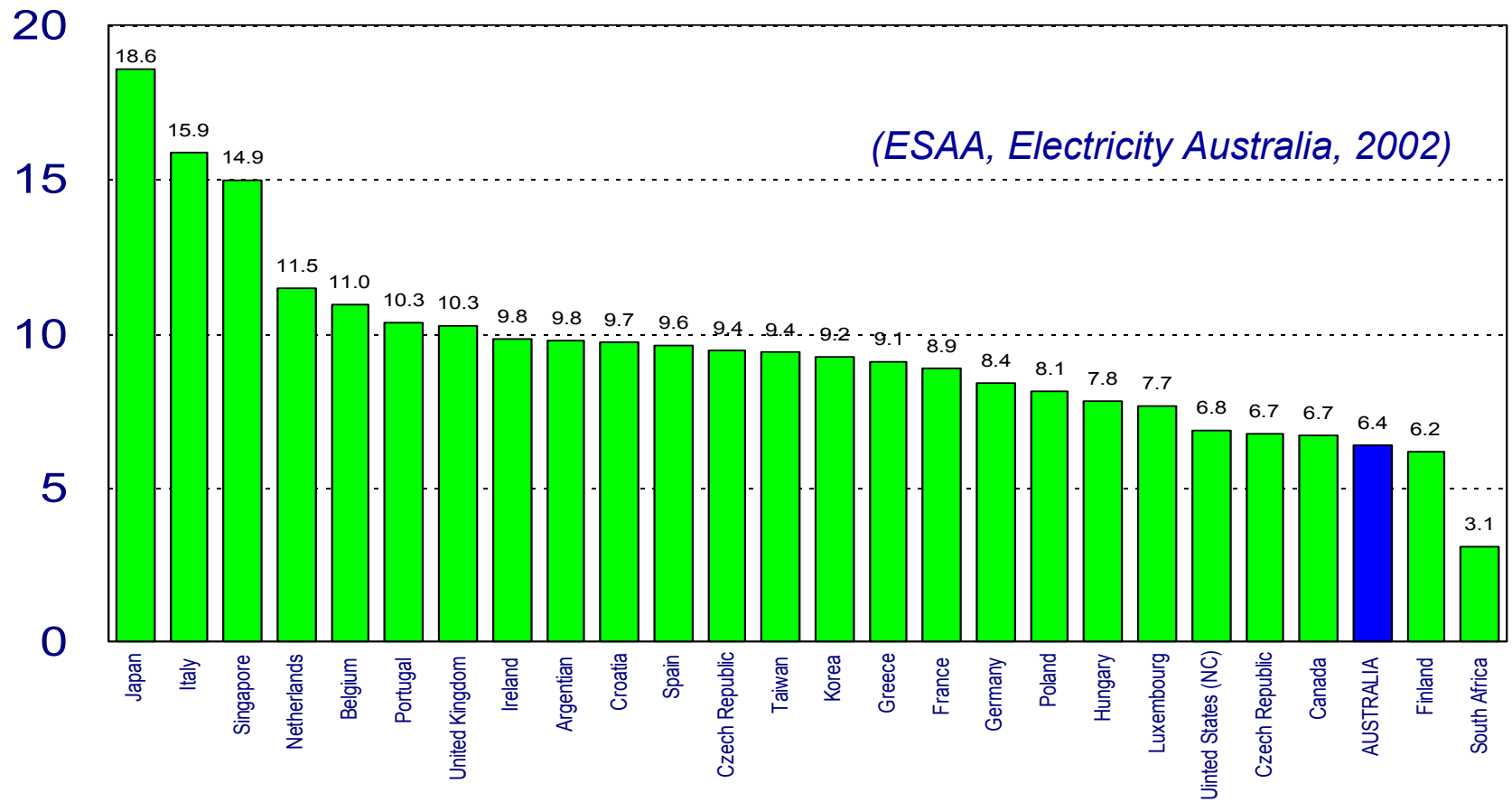
FCAS Services generally cost <1% of spot market turnover



(NECA, 2003 Q4 Statistics, 2004)

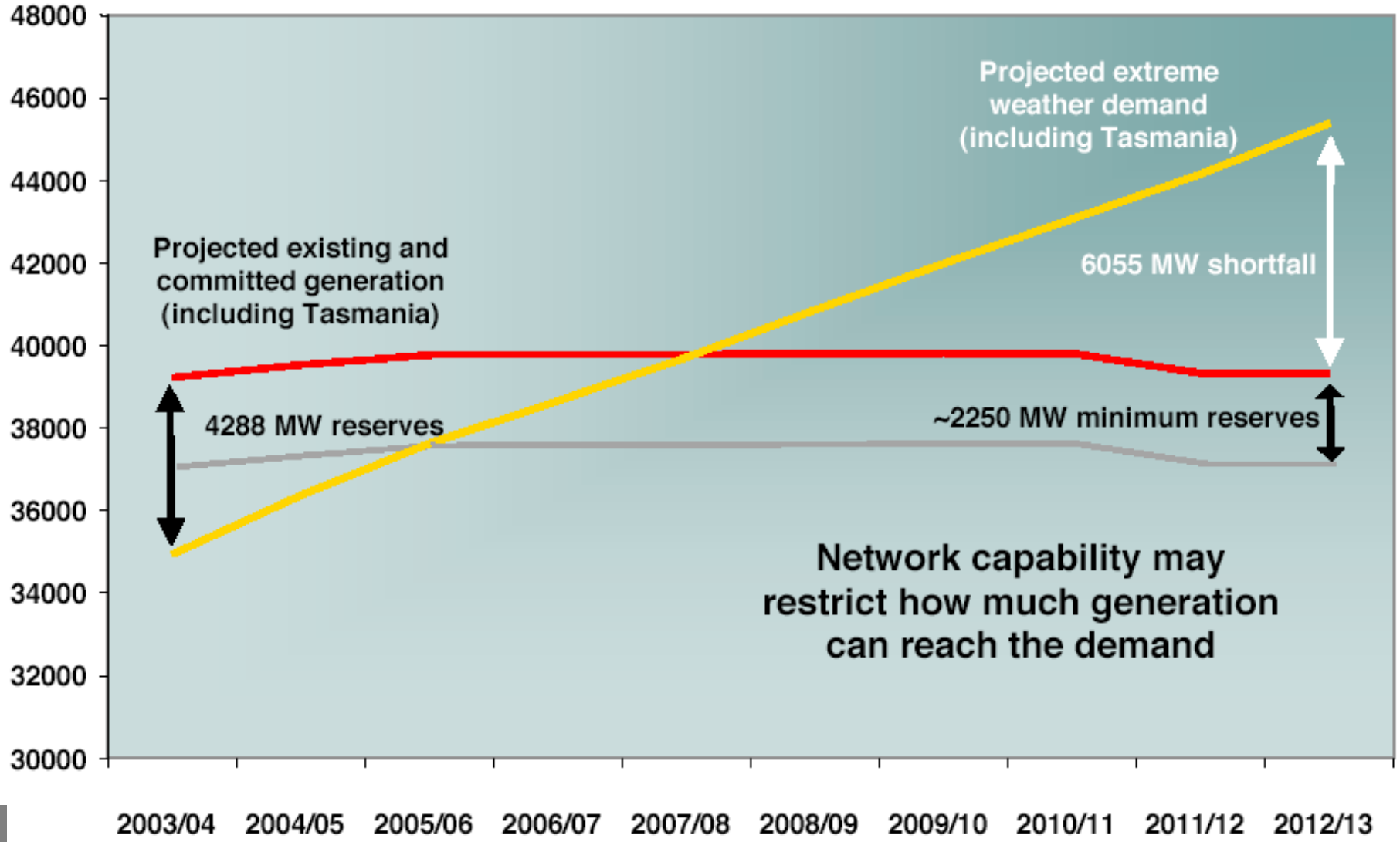
Raise 6 Sec | Raise 60 Sec | Raise 5 min | Raise regulation
Lower 6 Sec | Lower 60 Sec | Lower 5 min | Lower regulation

International comparison – elec. prices (industrial)



SOO: Projected generation & summer peak demand

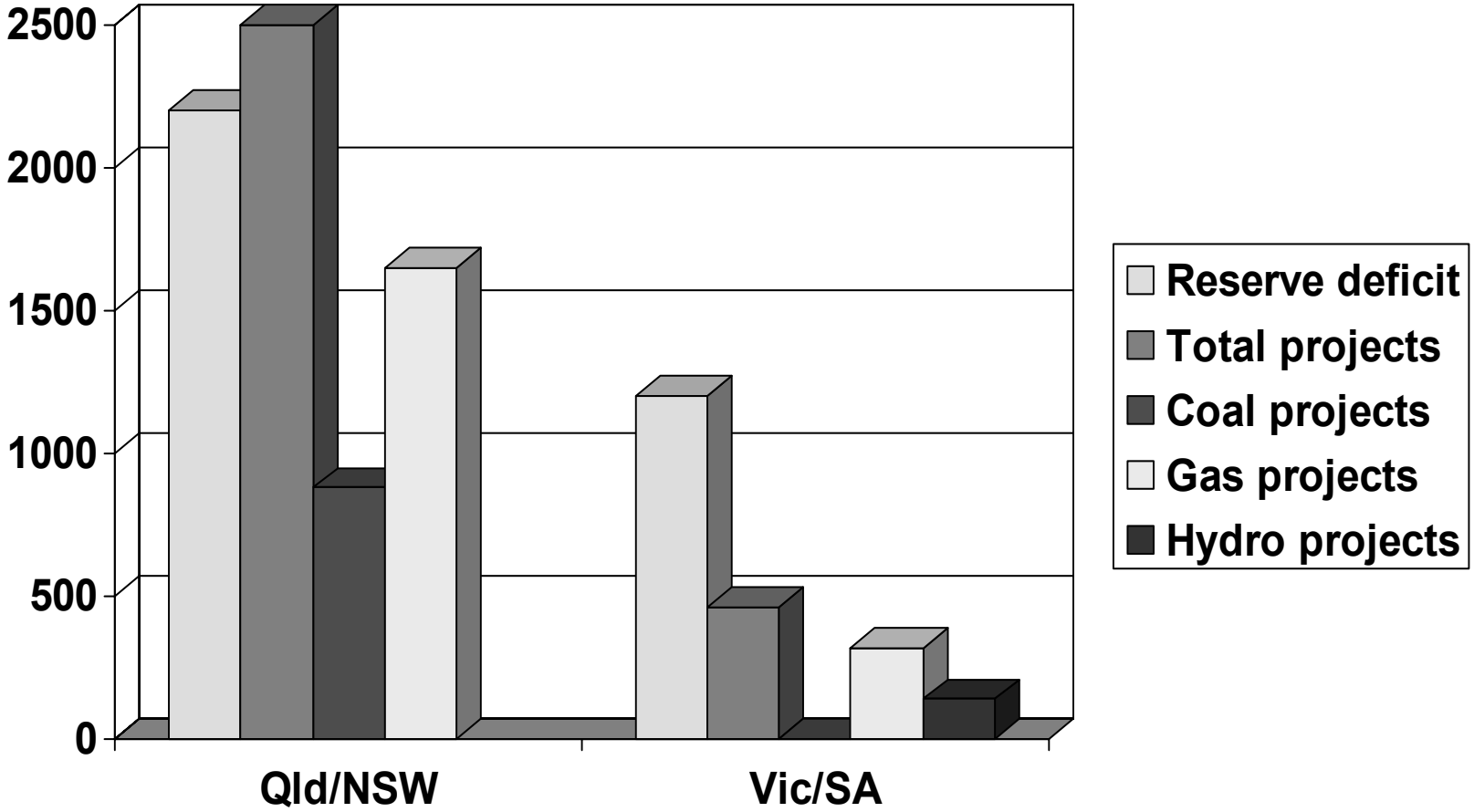
(Medium growth + extreme weather: *NEMMCO Statement of Opportunities, July 2003*)



SOO - key messages *(NEMMCO SOO, July 2003)*

1. Demand growth	***Strong in NSW and Queensland 1000-1400 MW a year NEM-wide***
2. Reserves declining	***NEM-wide decline in reserves due to demand***
3. Investment required	***"Needle peaks" impact on mix of base load - peaking - demand side***
4. Interconnection	***Will not by itself help supply-demand balance beyond 2005-06***

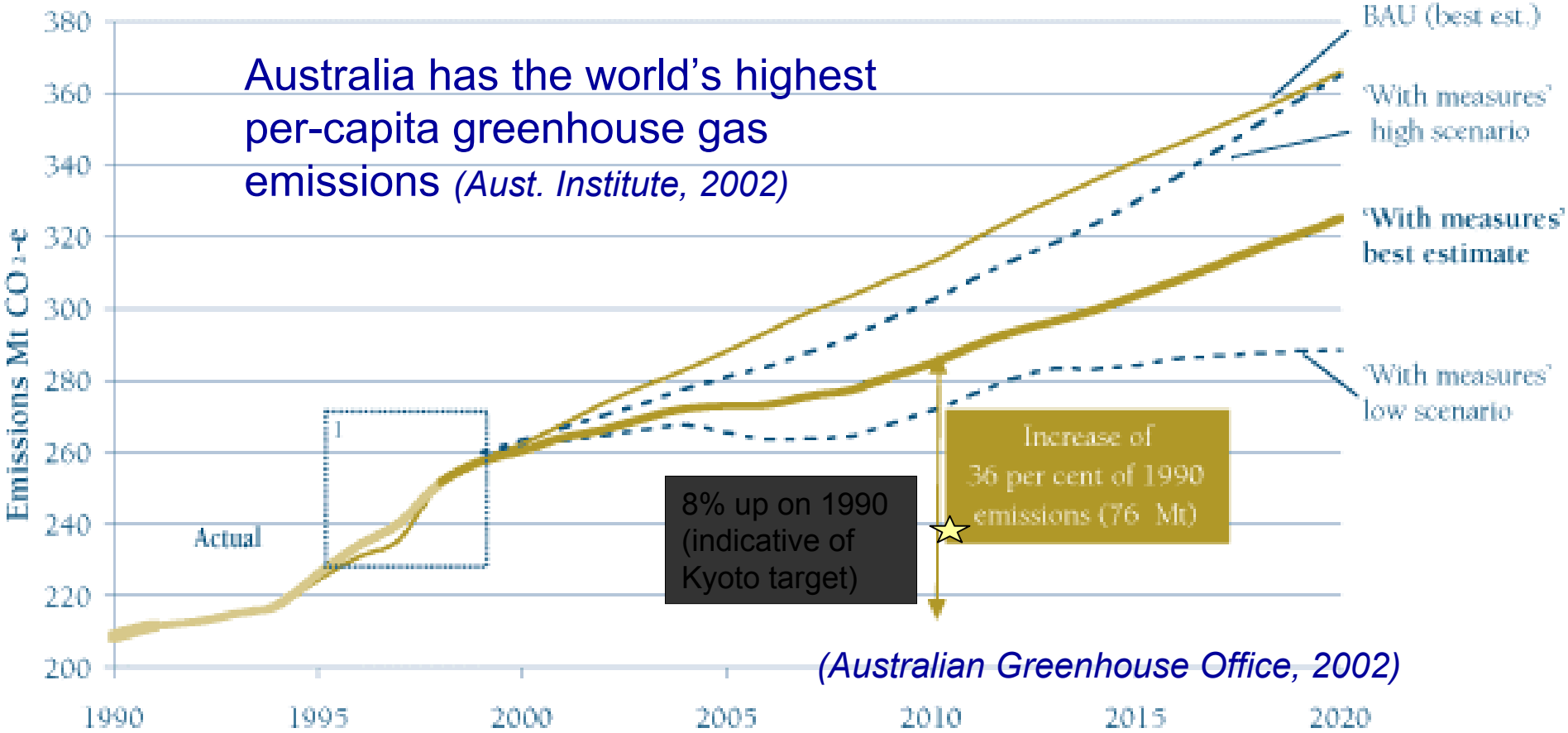
Advanced or publicly announced generation projects compared to expected reserve deficit in 2008/09



Projected emissions from Stationary Energy sector, 1990-2020

Some GHG emission projections

Australia has the world's highest per-capita greenhouse gas emissions *(Aust. Institute, 2002)*



(Australian Greenhouse Office, 2002)

Impact of Australian EI restructuring on GHG

- NEC doesn't include specific environmental objectives
- *However*, expectation by some that would help "14 MtCO2 reduction from BAU in 2010":
  (Commonwealth Govt, Climate Change: 2nd Communication to IPCC, 1997)
  - Efficient competition in supply by cogen + renews
  - More sensible energy use through incentives for investment in EE
  - Greater penetration of natural gas
- *Instead*, now projected up 0.1MtCO2 above BAU *(CoAG, 2002)*
  - Low cost of coal fired generation in Australia
  - Excess electricity capacity depressing prices
  - Relatively immature and inflexible gas market
  - Reduced emphasis on EE from lower prices
  - **Current failure to price greenhouse emissions**
  - **Market design and regulation that favours incumbents Supply-side orientation of reforms to date**

Terms of reference for 2002 COAG Energy Market Review

- Identify impediments to the full realisation of the benefits of energy market reform
- Identify strategic directions for further reform
- Examine regulatory approaches that balance incentives for new supply investment, demand responses & benefits to consumers
- Assess the benefits for regions & small business
- Assess the relative efficiency & cost-effectiveness of options to reduce greenhouse gas emissions
- Identify means to increase penetration of gas

Deficiencies identified in the report

- Confused governance; excessive regulation; perceived conflicts of interest
- Insufficient generator competition in spot market
- Flawed electricity network operation & investment; poorly defined market regions
- Financial instrument markets Illiquid & hampered by regulatory uncertainty
- Insufficient competition in east-coast gas & uncertainty surrounding new pipelines
- Ad hoc & poorly targeted greenhouse response
- Regional areas disadvantaged in the NEM

Some key report recommendations

- Governance + regulation
  - Establish National Energy Regulator (NER)
  - Ministerial Council on Energy sole provider of policy direction on electricity & gas
  - Improve network regulation:
    - Sharing of savings; performance incentives; distribution price cap not revenue cap
- Market mechanisms + structure
  - Further disaggregate NSW & WA generation
    - Divest generation once disaggregated
  - Governments to address transmission problems
  - Abolish NSW ETEF + Qld Benchmark Pricing Agreement
  - Explicit ACCC merger guidelines to control market power

Some key report recommendations (continued):

- Electricity transmission
  - NEM-wide planning function in NEMMCO
    - Identify augmentation opportunities & tender
  - NEMMCO offer/underwrite firm inter-region FTRs
    - FTRs to provide augmentation benchmarks
  - Commercial cost-benefit to approve intra-regional augmentation
  - TNSP performance incentives
  - Increase number of NEM regions, full nodal pricing in 7-10 years
- Financial market development
  - Abolish NSW ETEF & Queensland BPA
  - All code changes should consider impact on financial markets
    - Including reviews of VOLL

Some key report recommendations (continued):

- Demand-side participation
  - NEM dispatch market to pay demand reduction on “as bid”
  - Interval meters mandated & phased in over 5-10 years
  - FRC in all jurisdictions within 3 years
- Greenhouse response
  - Cross-sectoral emission trading
  - Delete (with grandfathering):
    - MRET: Gen Efficiency Standards; GGAP
    - NSW retailer benchmarks; Qld 13% gas
- Exclude traded sector from ET if world’s best practice

MCE response to the CoAG review

(Ministerial Council on Energy Communique, 1/8/03)

- Recommended the establishment of:
  - A single energy market governance body
  - A new national legislative framework
  - Two new statutory commissions from 1/7/04:

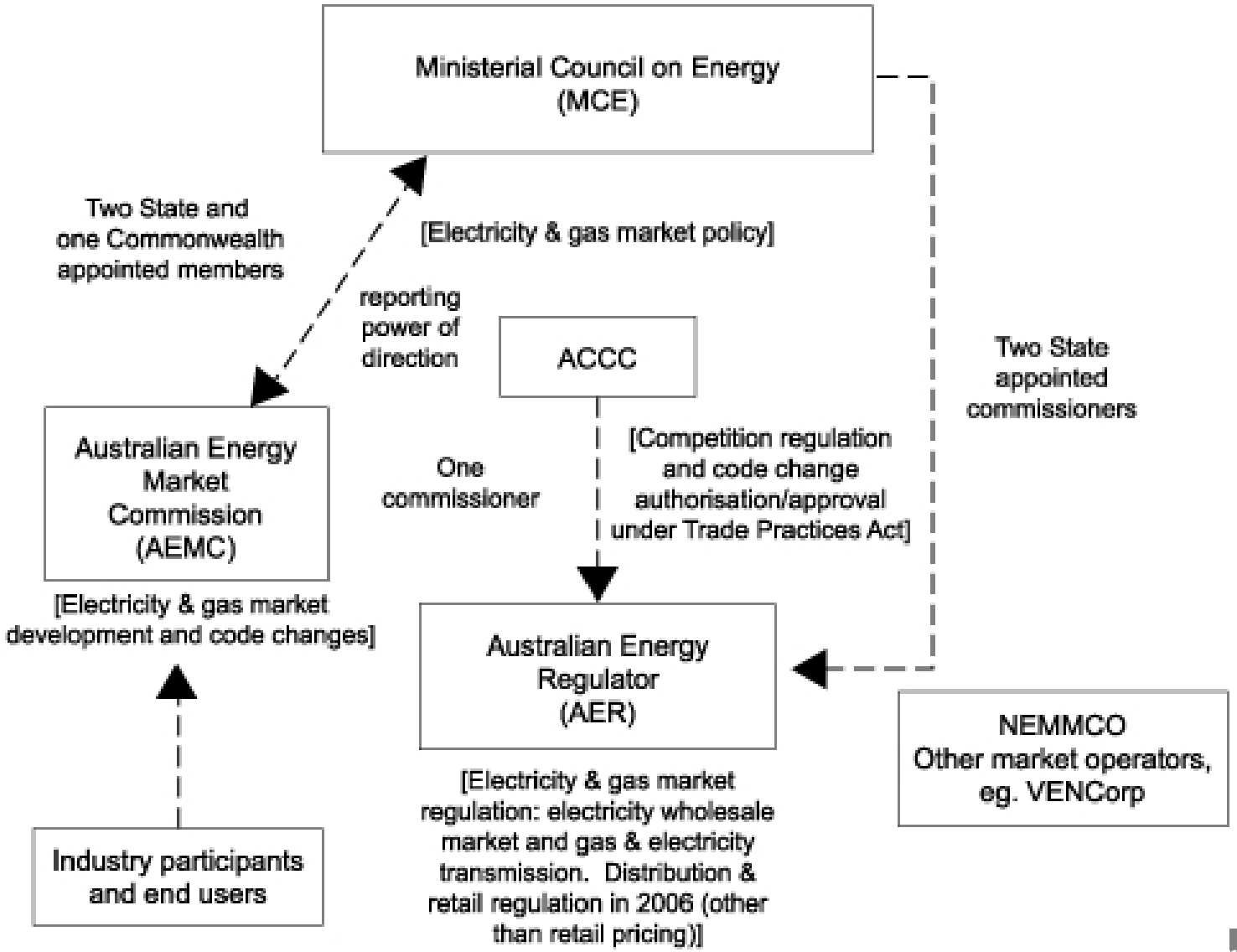
    (electricity (& later gas) wholesale market & transmission)
    - Australian Energy Market Commission (AEMC):
      - Rule making & market development, replacing NECA
    - Australian Energy Regulator (AER)
      - Wholesale market & transmission regulation & possibly distribution & retail; partly taking over ACCC role
- Undertake comprehensive transmission review & consider national planning function

MCE response to the CoAG review (continued):

- Examine options to enhance user participation, including interval metering
- Respond to current Productivity Commission review of National Gas Access Regime
- Review upstream gas arrangements
- Address greenhouse emissions from energy sector on a national basis

New governance & institutions arrangements

(as seen by Allens Arthur Robinson, December 2003)



MCE on Electricity transmission:

- Central & ongoing role for regulated transmission with some scope for competitive (market) transmission
- The aim of the regulatory test is to identify:
  - The least-cost augmentation if required for reliability reasons
  - The augmentation that maximises (>0) the present value of the market benefit in a majority of reasonable scenarios, cf. alternative projects
- Distributed options considered as well as network augments
- ANTS - an integrated overview:
  - Future constraints on major transmission paths
  - Information on augmentation options
  - Incorporated into SOO + its projection of supply-demand balance
- Regional boundaries
  - new process to be developed for assessing wholesale regional boundaries, while maintaining jurisdictional boundaries for retail customer pricing"
  - **However, some clear challenges in achieving this…**

MCE on user participation: demand-side response

- NEM options considered:
  - Pay-as-bid (by COAG energy market review)
  - Aggregation facility (based on EUAA trial)
- Aggregation facility preferred & further work to be commissioned on this option
- Also to be addressed:
  - End-use capacity building
- Full Retail Competition…. remain to be convinced of value?
- *Improved retail market design not included in this scope of work, and where is a national greenhouse response?*

Ministerial Council on Energy program summary (12/03)

Projects	Qtr 4 / 2003	Qtr 1 / 2004	Qtr 2 / 2004	Qtr 3 / 2004	Qtr 4 / 2004	2005
1. Governance & Institutions [SA]						
Inter-Governmental Agreement	MCE note framework	SCO draft IGA	MCE approve IGA	CoAG endorse IGA		
National Legislation	MCE consider legislative models	MCE finalise legislative framework. SCO develop draft bills	MCE approve bills. Bills introduced in parliaments	Legislation enacted		
Establish AEMC & AER	SCO draft structure & operations paper	MCE endorse structure & operations paper	Commissioners selected	Operations commence		Transfer gas transmission*
MOU between ACCC-AEMC-AER	SCO draft framework	SCO develop MOU	MCE finalise negotiation & approve MOU	MOU implemented		
NECA & NGPAC Transition	SCO draft transition paper	SCO endorse transition plan		NECA dissolved		NGPAC dissolved (subject to PC gas review)
Subsume NEMMF into MCE	SCO review NEMMF work program	NEMMF work program continues under SCO/MCE		NEMMF dissolved		
2. Economic Regulation [Vic]						
Energy Access		SCO draft issues paper on national approach	MCE endorse preferred approach	SCO develop national approach (subject to MCE decision and consideration of PC gas review)		MCE agree national structure
Distribution & Retail	MCE agree policy & timing	SCO develop framework paper	MCE endorse framework paper	SCO develop detailed national structure		MCE agree national structure

Denotes stakeholder consultation

MCE denotes MCE decision point

Projects	Q4/03	Q1/04	Q2/04	Q3/04	Q4/04	2005
3. Electricity Transmission [Qld]						
Transmission Regulatory Reform	MCE endorse policy framework	Commission study on regional boundaries. Commence agreed code changes	MCE consider boundary report. Remove market biases	Implement new regulatory test and transmission availability incentives	Implement new transmission pricing	
National Transmission Planning	NEMMCO commence scoping ANTS.	MCE finalise new planning process	First ANTS produced	Implement last resort power		
4. User Participation [Tas]						
○ *Demand side response* ○ *Interval metering* ○ *Full Retail Contestability*	SCO develop issues paper	SCO prepare draft report	MCE approve user policy	Implementation commences		
5. Gas Market Development [NT]						
MCMPR Upstream Issues	Advice requested from MCMPR	MCMPR review unproduced areas for 3rd party access		MCE respond to MCMPR review		
PC Gas Access Review	PC issue draft report		PC issue final report	SCO draft response to report	MCE respond to PC review	
6. Program Coordination [C'wlth]						
Market Consultation	MCE endorse consultation plan	Market consultation (as above)	Consultation continues, as appropriate			

Denotes stakeholder consultation

MCE denotes MCE decision point

Some other issues for industry transformation

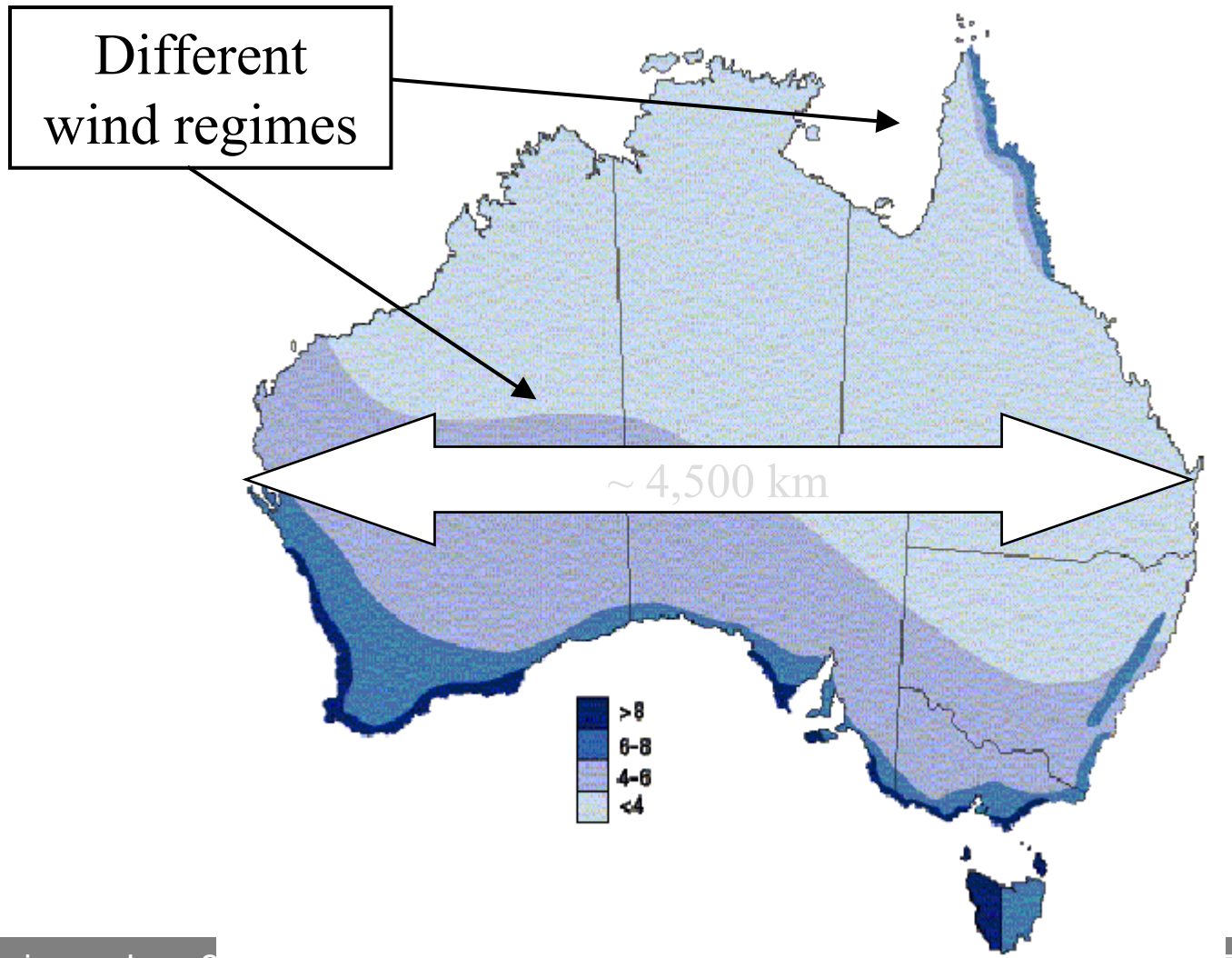
- NEC Objectives
  - Market should be competitive
  - Customers should be able to choose with whom they trade
  - Any person wishing to do so should be able to gain access to the interconnected T&D network
  - A person wishing to enter the market should not be treated more or less favourably than incumbents
  - A particular energy source or technology should not be treated more or less favourably than another energy source or technology
- *However, hard to achieve in practice*

NEC categories of generators

- Market, non-market or exempt
  - Market implies sell to NEM
    - Can then also sell ancillary services
  - Non-market or exempt implies sell to retailer
- Scheduled or non scheduled:
  - Scheduled implies centrally dispatched:
    - Must then participate in the NEM processes of bidding, pre-dispatch & PASA
    - Default category for generation projects > 30 MW
    - Not appropriate for “intermittent” generation, eg wind

Australian wind resource

(Simple estimates of background wind – AGO)



Wind turbine installations in Australia: history & forecast

Summary of wind farm projects at February 2004.

(*Approximate, based on www.auswea.com.au)*

Completed	200 MW
Under Construction	140 MW
Tendering	540 MW
Approved	920 MW
Planning	1100 MW
Total	**2900 MW**

National Electricity Code (NEC) requirements for generators

- Reactive power & voltage control capability
- Quality of electricity injected into network
- Protection requirements
- Remote control arrangements
- Excitation system requirements
- Loading rates
- Ride-through to avoid cascading outages:
  - Loss of largest generator; 175ms network fault

NEMMCO viewpoint on intermittent generation

- "Intermittent Generation in the NEM" 'issues'
  - Forecasting
    - Increased errors in price + reserve forecasts

    => Have just released proposal on how to deal with this
  - Frequency control ancillary services
    - increase in usage + cost of these

    => proponents need to know that 'causer pays' – stay 'tuned'
  - Network management
    - impacts on V regulation, sub 5min flows on network may cause power quality + stability issues

    => Proponents should be aware of conditions for permission to connect to network Currently under review - changes could impact on plant design

'Readily acceptable' wind penetrations in the NEM

- *"Readily accepted"* – technical solutions to any associated problems that are not prohibitively expensive

- NEM might be able to readily accept up to 8000MW ***if***
  - Wind installed in progressive manner
  - Wind farms widely + envely dispersed within NEM
  - Wind farms used advanced turbine technology + control systems with remote monitoring + control
  - Advanced wind forecasting techniques developed for regional projections up to 2 days ahead

(Outhred, 2004)

Comparing AusWEA forecast (www.auswea.com.au) & this readily acceptable (RA) wind capacity

	Qld	NSW	Vic	SA	Tas	WA	Aus
Inst MW	13	17	92	35	11	28	196
Prop MW	40	115	437	1190	570	347	2699
Total MW	53	132	529	1225	581	375	2895
RA MW	2100	3100	2200	500	500	500	8900

Possible responses for energy and frequency issues

- Improve management of short-term uncertainty, e.g:
  - Wind farm power forecasts - short & long term
  - Demand-side provision of ancillary services
- Improve management of system security:
  - Test ride-through capability of wind farms
  - Enhance demand-side participation
- Revisit broader NEM design philosophy:
  - FCAS, pre-dispatch, PASA

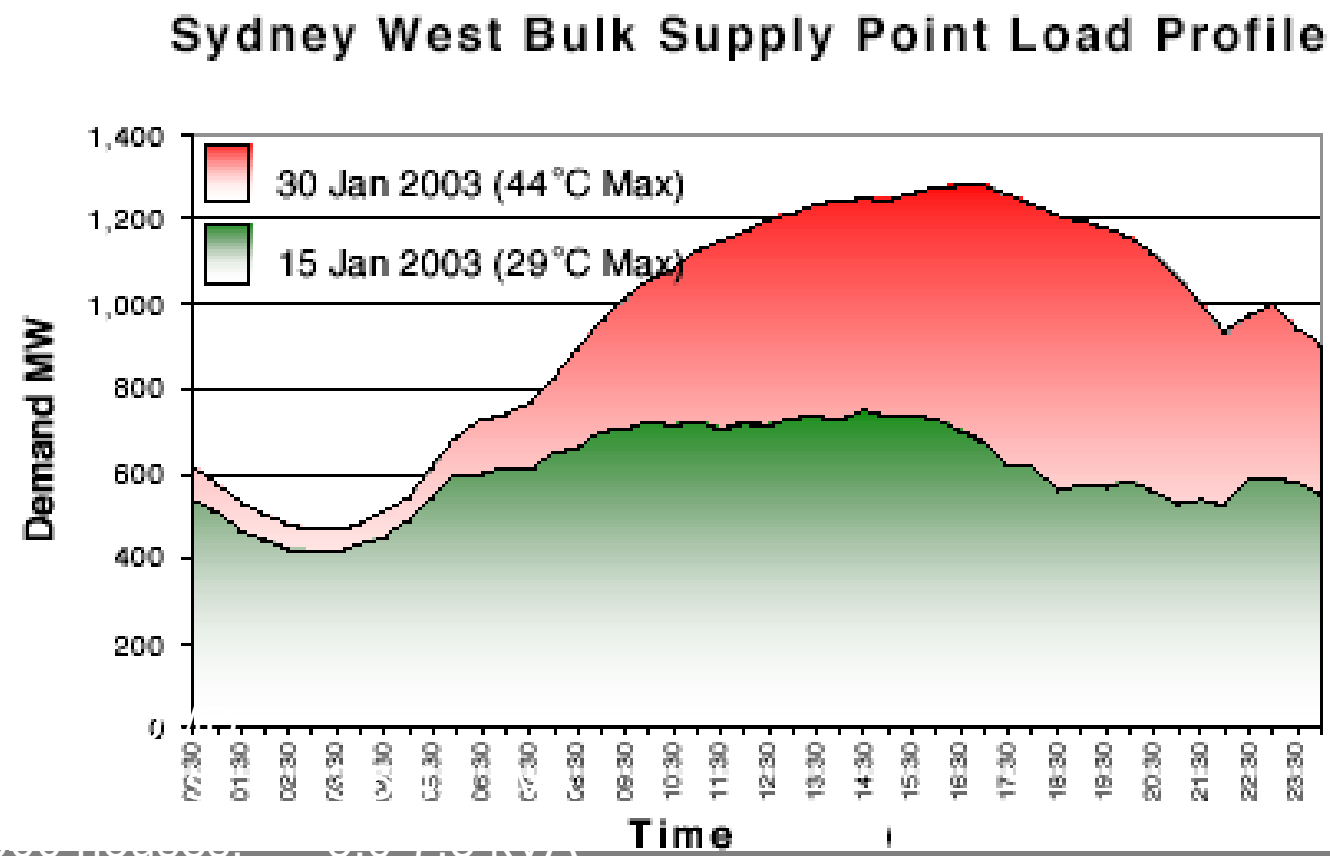
Some wider planning recommendations

- Develop a comprehensive wind farm planning framework - federal, state, local:
  - Staged regional development process:
    - Resource evaluation; regional wind development & grid connection strategy; wind farm siting
  - On-going monitoring & evaluation
  - Integrated forecasting process
- Adapt other models, such as:
  - Existing mineral industry
  - Emerging water catchment management

Large investments in distribution seem required – can Distributed Generation contribute?

Residential & commercial air conditioning is the key driver for peak demand growth

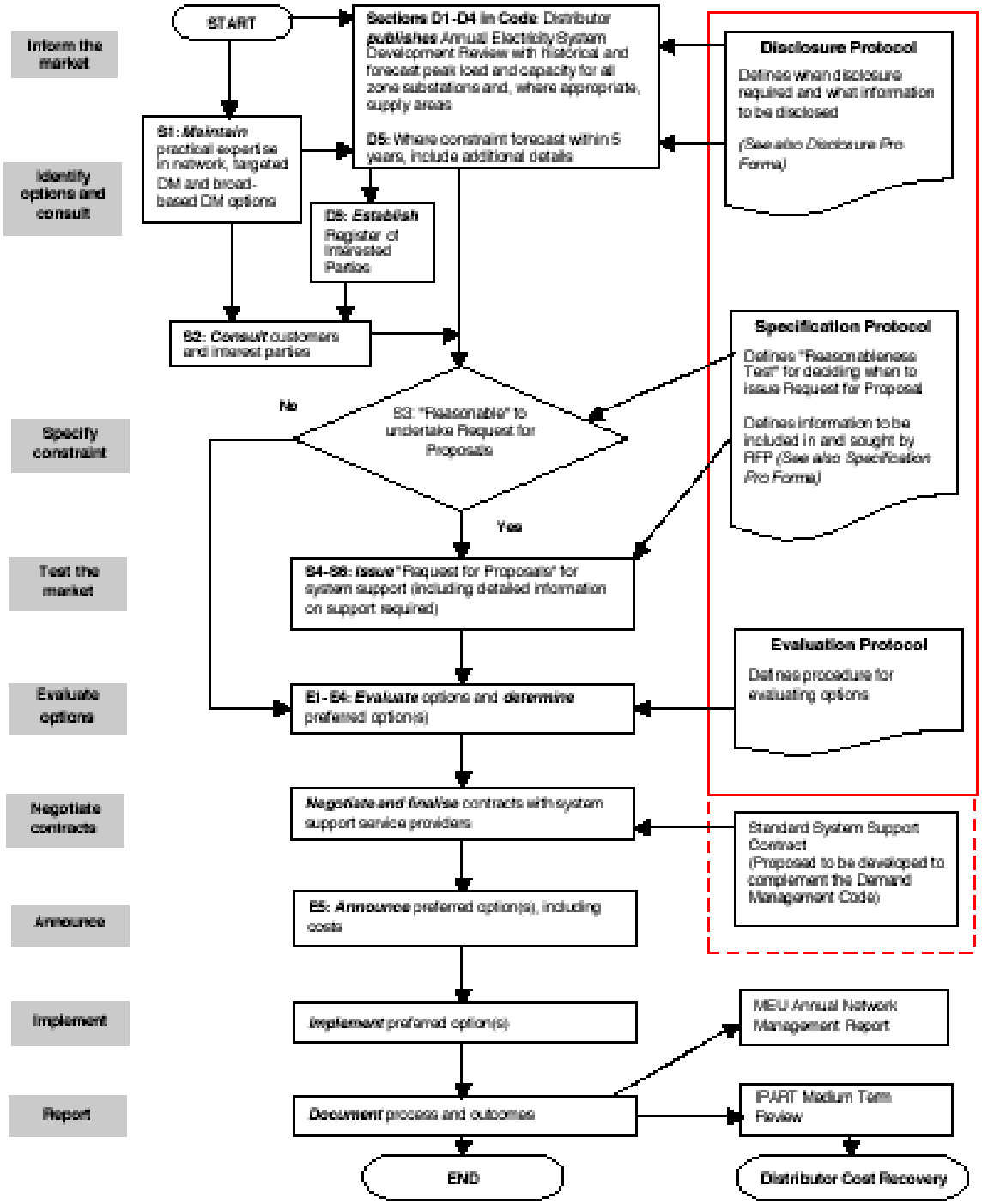
(IE Submission, IPART DNSP Review, 2003)



NSW Demand Management Code of Practice for Distributors *(May 2001)*

An attempt to allow distributed resource options to compete with Dx augmentation….

but note the complexity of this process

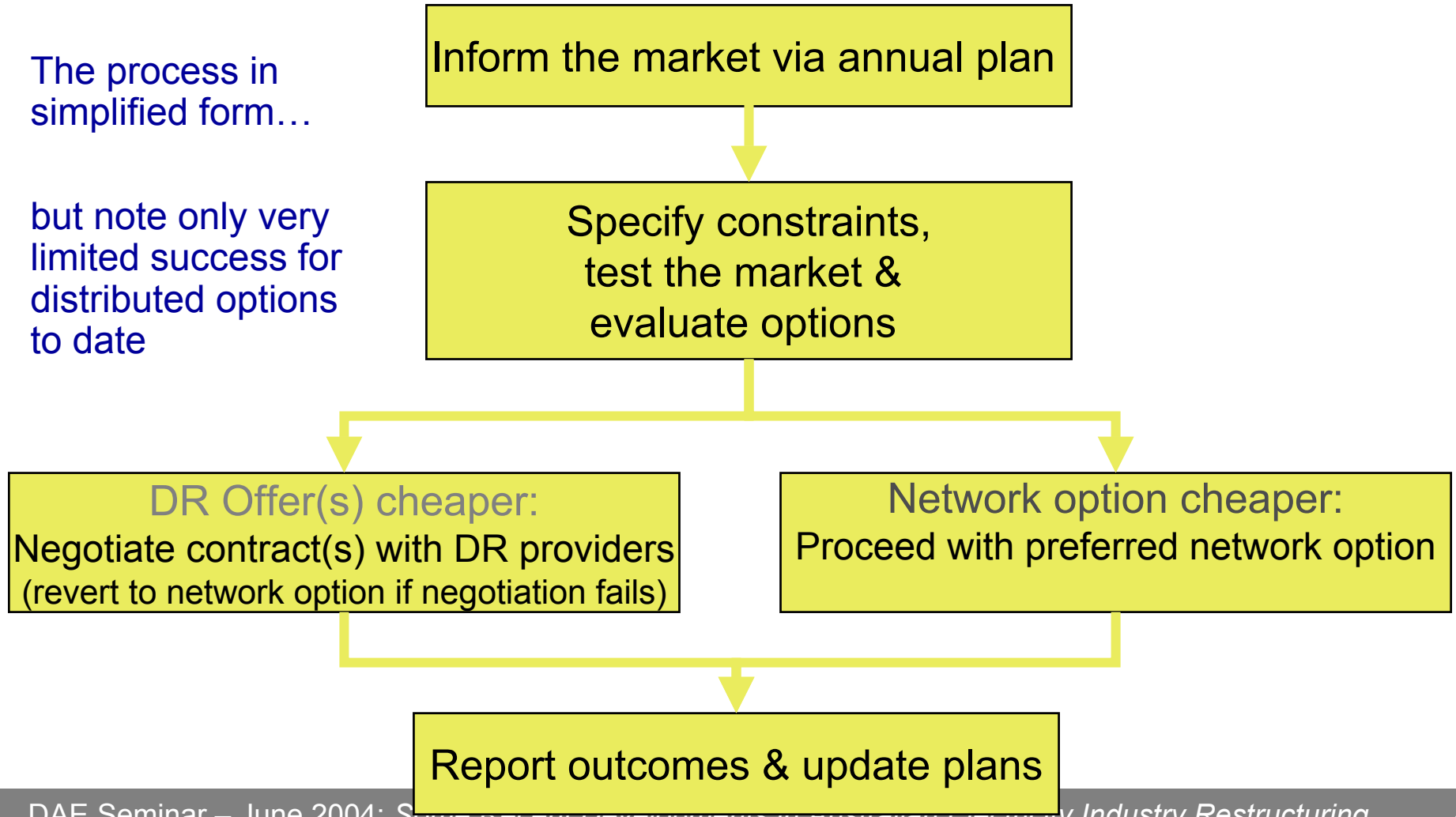


Distributor investment + distributed resources in practice

(NSW Demand Management Code of Practice, 2001)

The process in simplified form…

but note only very limited success for distributed options to date



Mandatory Renewable Energy Target

Renewable Energy (Electricity) Act 2000

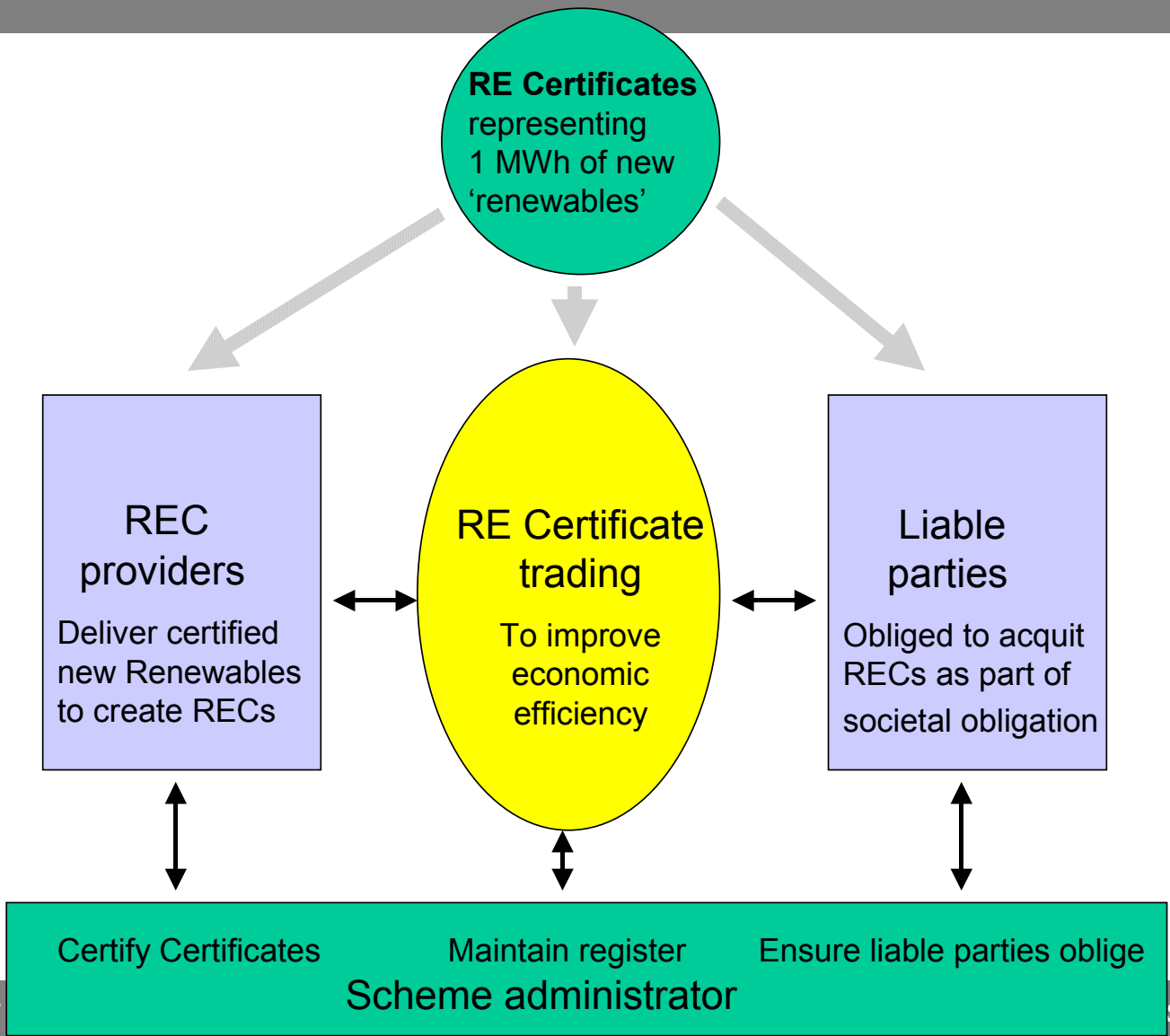
The objects of this Act are:

(a) to encourage the additional generation of electricity from renewable sources; and

(b) to reduce emissions of greenhouse gases; and

(c) to ensure that renewable energy sources are ecologically sustainable.

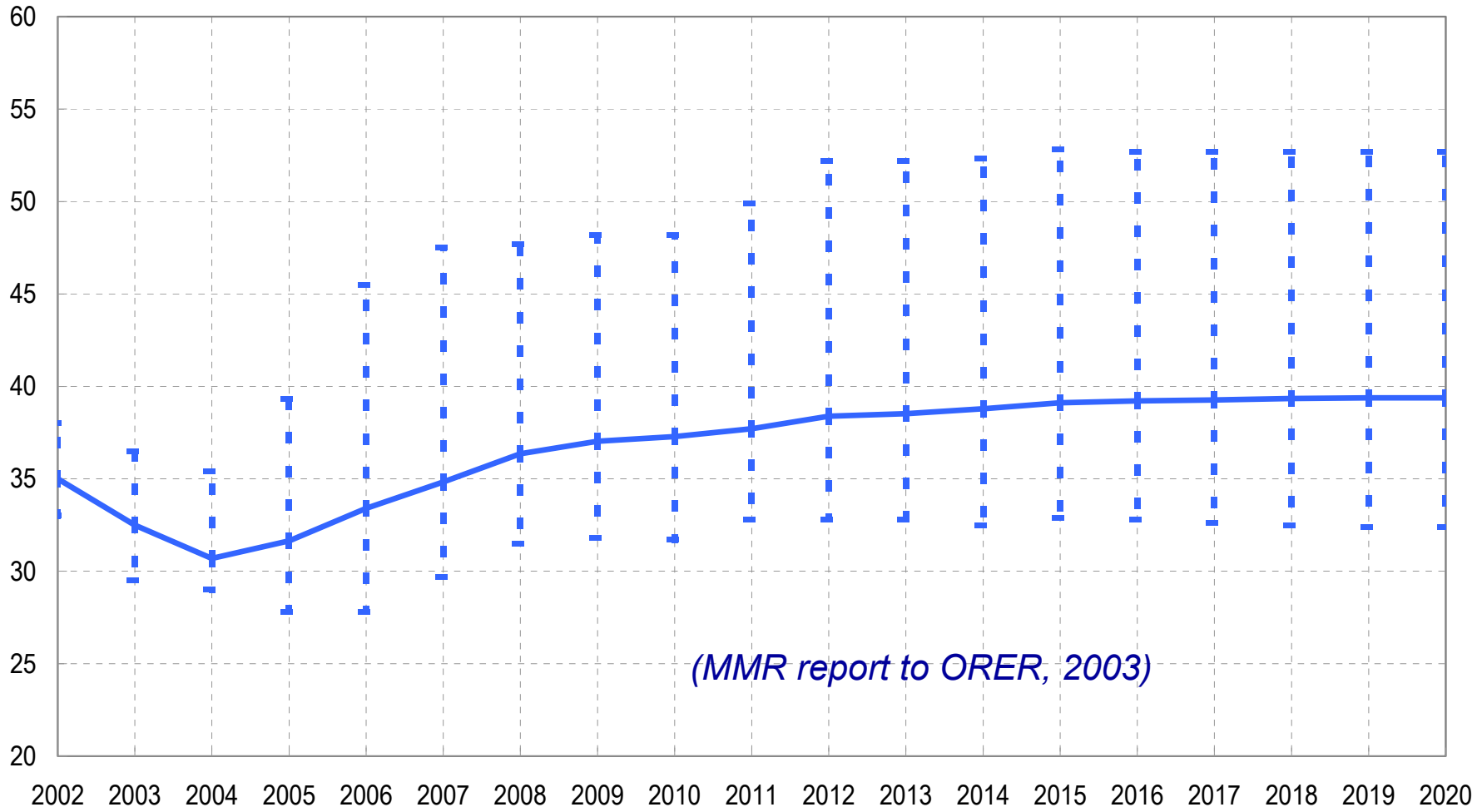
MRET – a 'designer' market



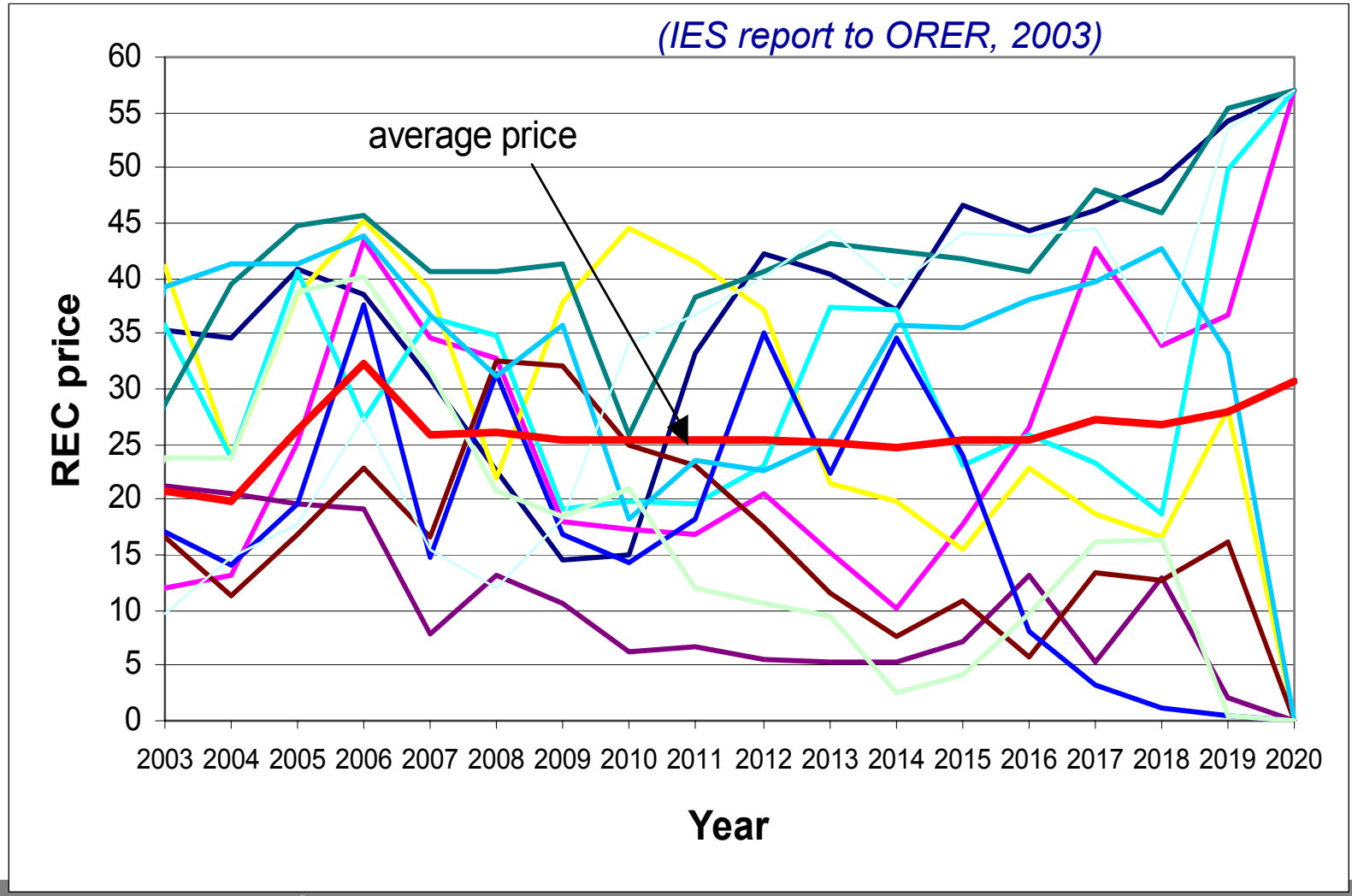
MRET performance to date

- Now operating for two years
- Ramping target easily met
- Challenges
  - Public opposition to some 'eligible' renewables
  - Inadequate target, in terms of settings (+2%) and objectives for greenhouse + industry development
  - Market information failures
    - Can register RECs any time => information asymmetry
    - Only annual acquittal => poor price discovery
- **Baselines**
  - **All BAU baselines are 'made up'**
  - **Large hydro particularly problematic**
    - Baselines for hydro scheme where output limited by demand
    - Variable renewable generation and 'The ratchet'

Renewable Energy Certificate price projections (A$/MWH)



Other Renewable Energy Certificate price projections (A$/MWH)



MRET Review

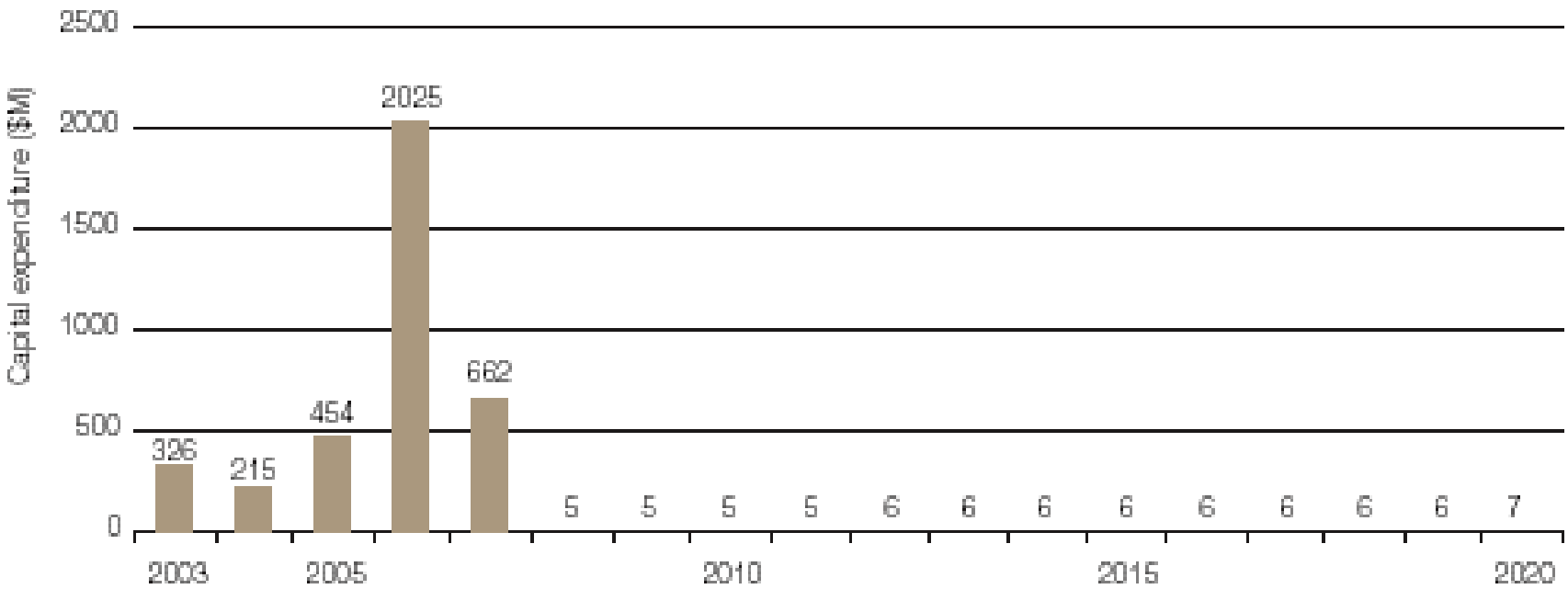
'Independent' review undertaken under requirements of act *(www.mretreview.gov.au, 2003)*

"Objective is to create a viable industry at minimum cost to the economy while continuing to assist in the abatement of GHG emissions"

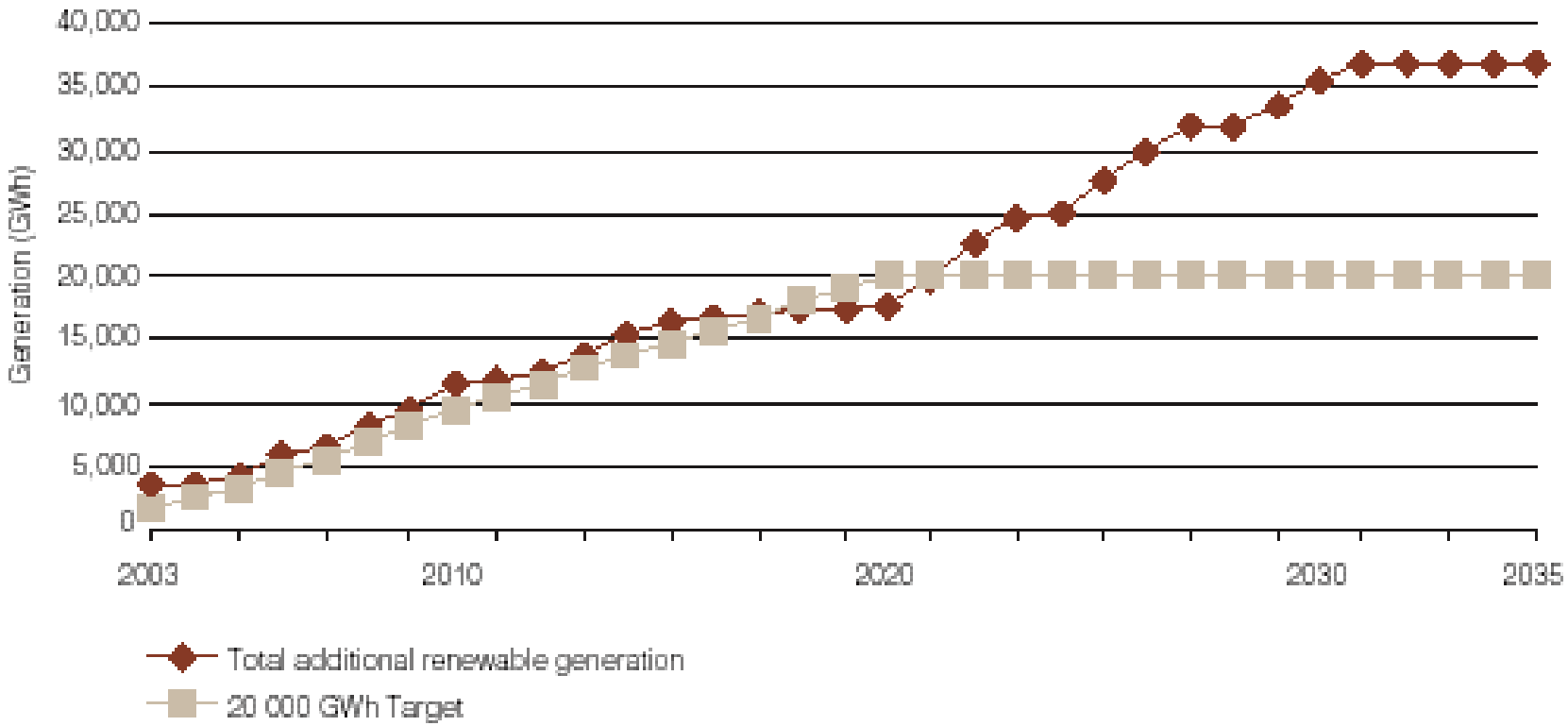
- Don't increase 2010 target (difficult to achieve) but extend target ramping to 2020 = 20,000GWh (maintain momentum + enhance industry development)
- Eligible pre-2005 generators only earn RECs to 2020, post-2005 generators earn RECs for full 15 years
- Short-fall charge indexed to CPI 2010-20
- Increased transparency for the RECs market
- Possible special arrangements required for PV, biomass
- …implement another review if National Emissions Trading is implemented or large shortfalls, but not otherwise.

MRET Review –

(target of 9,500GWh in 2010 then no change to 2020 => all investment made by 2007)

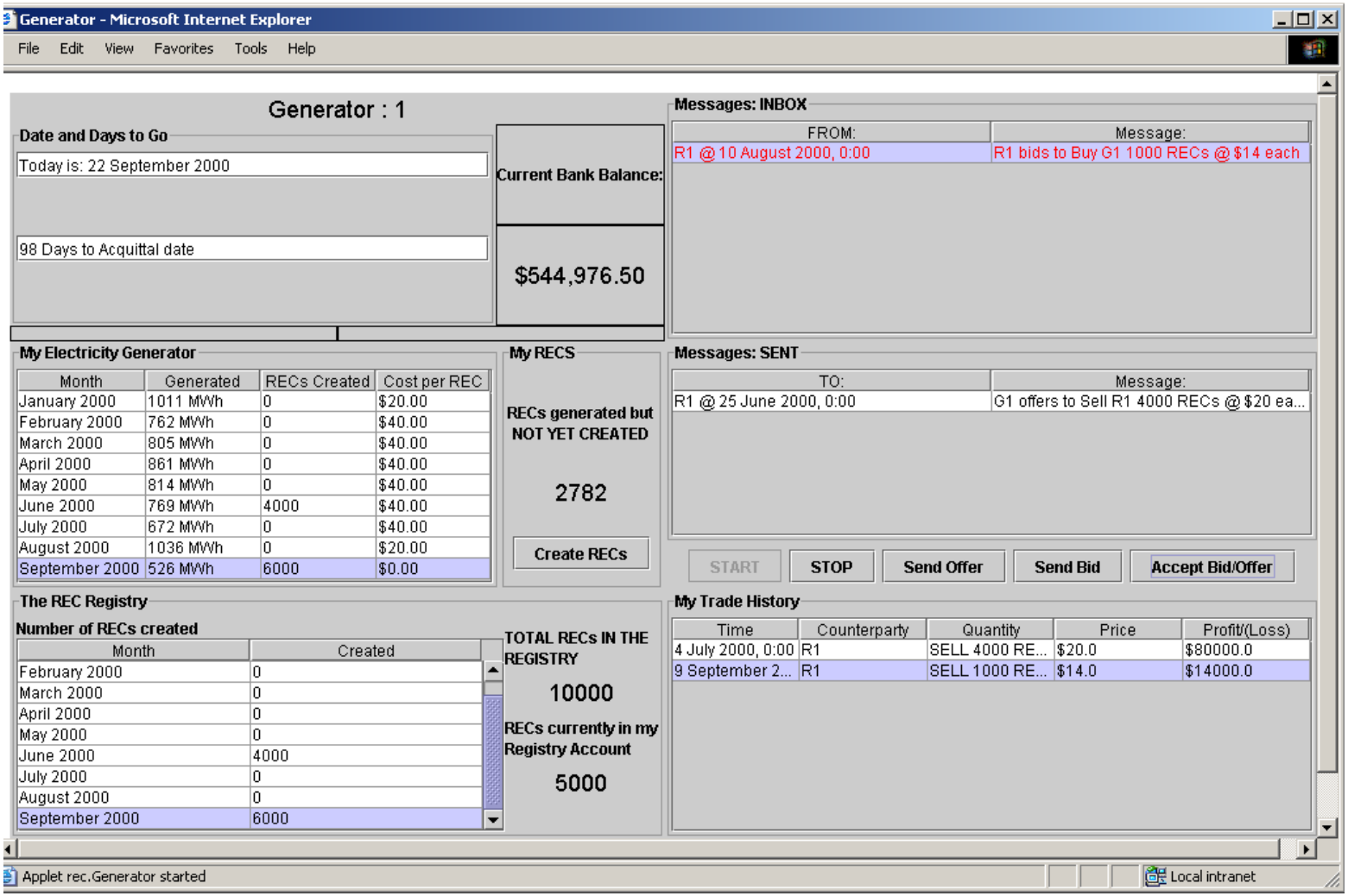


(proposed to extend 2010 target of 9500GWh through to target of 20,000GWh in 2020)



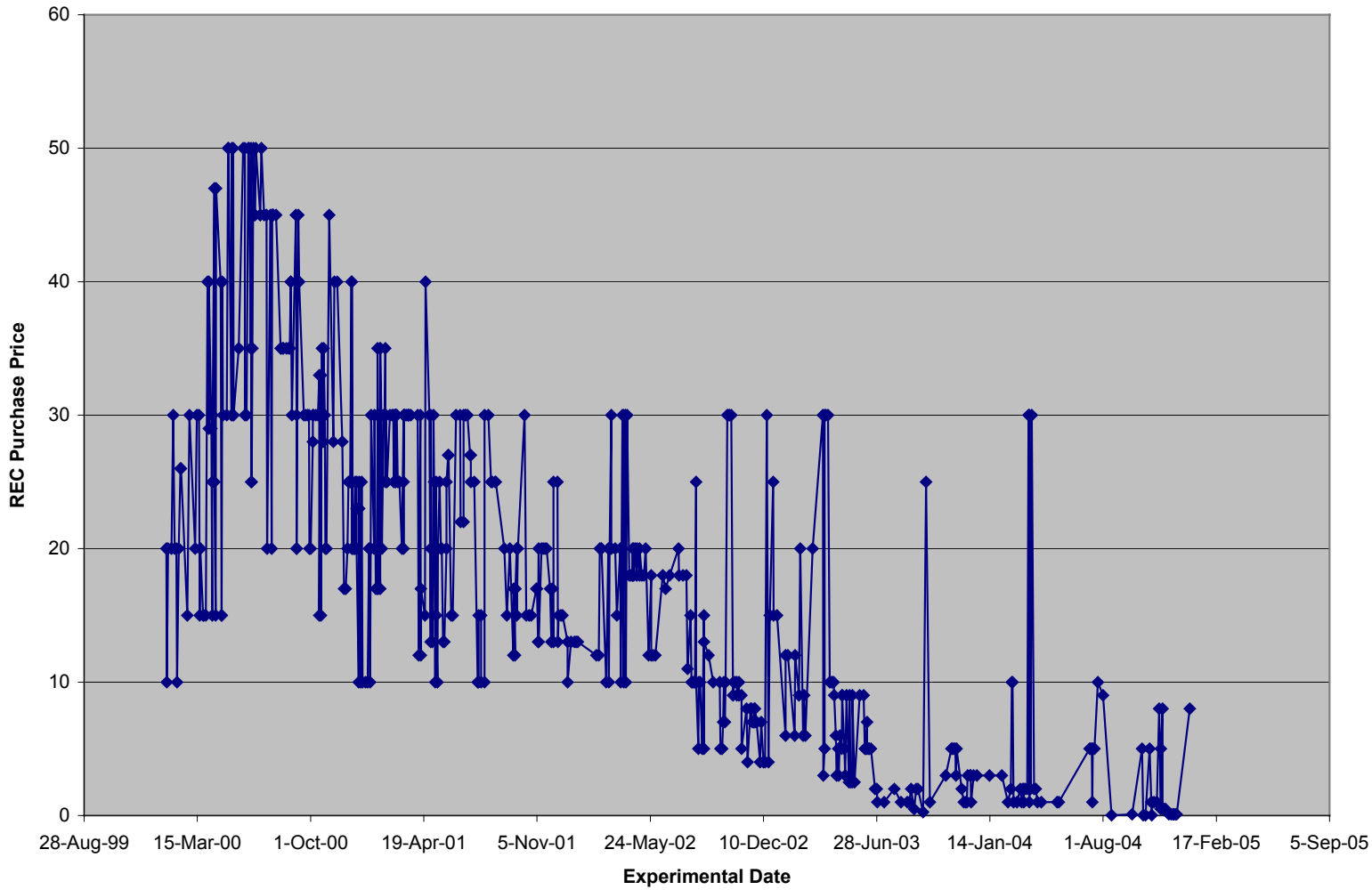
Some experimental economics work on the MRET market

(being undertaken by Karel Nolles here at UNSW and GMU to explore present info asymmetry)



A trial run for this MRET experimental trading game

Renewable generators can register their RECS into ORER register at any time after their creation



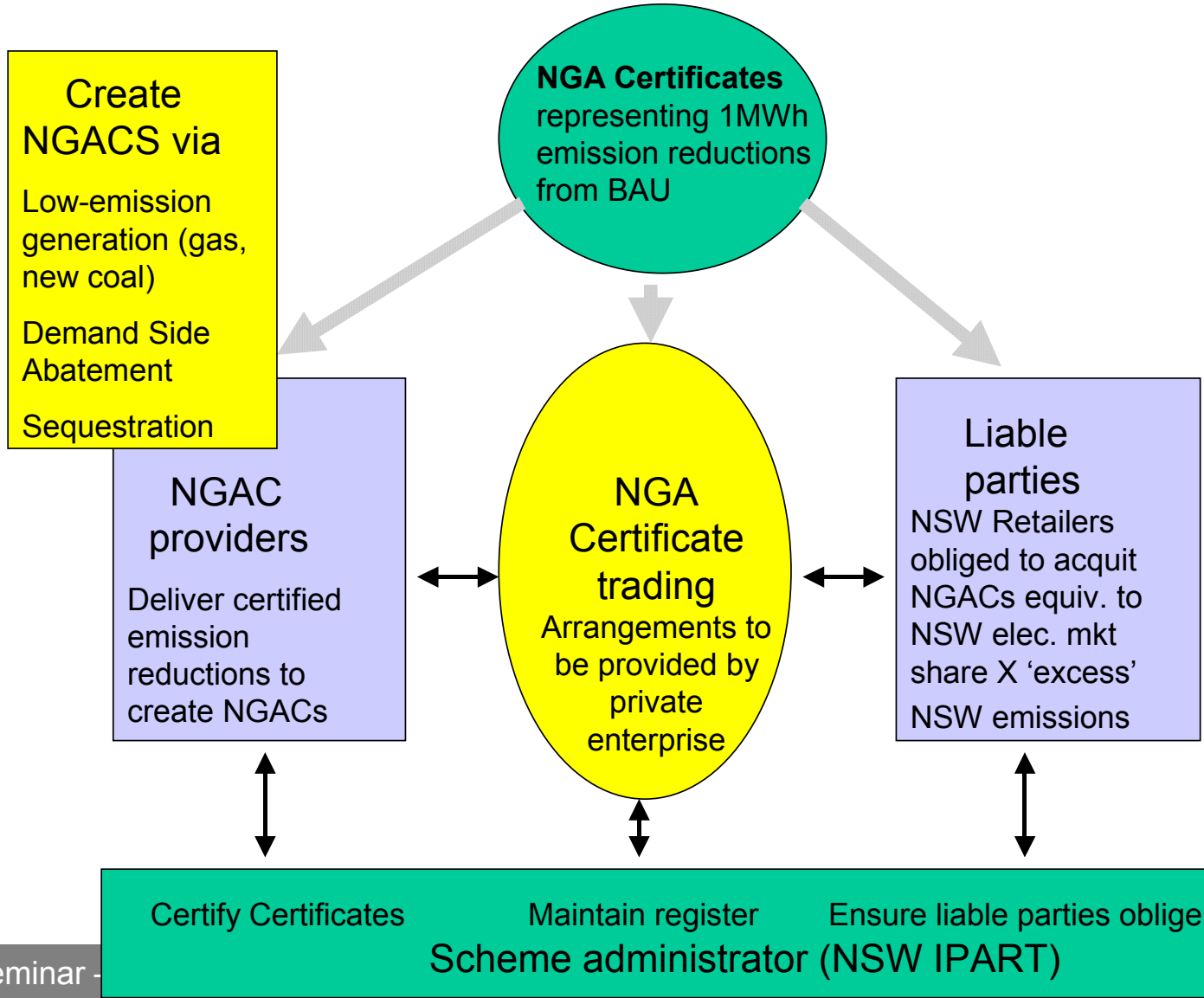
Typical market behaviour (for these simplified MRET trials)

- Generators generate electricity (thus enabling them to create RECs) but withhold actually creating those RECs in the registry.
- Thus an overhang of generation builds up, since there is no signal to generators that the target has already been met.
- At some point generators begin to bring that prior generation into the REC market, and the REC registry then shows the market that a considerable number of RECs are appearing.
- At this time Retailers realise that there are more RECs than previously expected, and Generators find they have already incurred the generation cost for surplus RECs. As a result Generators become prepared to sell at any positive price, and the price crashes.

NSW Greenhouse Benchmarks Scheme

- Policy intent
  - "reduce greenhouse gas emissions associated with the production and use of electricity..."
    (Overview to the Electricity Supply Amendment Bill, 2002)
- Implementation
  - State per-capita greenhouse gas emissions targets for the NSW Electricity Industry via Retailer Licence Conditions
    (NSW Electricity Supply Act, 1995)
  - Baseline+credit 'emissions reductions' trading

NSW Scheme – a 'designer' market



NSW scheme - some lessons from experience to date

- **Early days….**
  - Interim targets seem likely to be met
    - How demanding are these targets and how accurate are the 'energy savings' estimates used to assess performance?
  - Very limited trading underway in NSW *(AFMA forward curves)*
- **However**
  - Abstraction is key to 'designer' environmental markets but carries risks of error + moral hazards
  - Complexity can be very significant + this means transaction costs (+ risks of errors + moral hazards)
    - Eg. 'imputed' emissions from NSW electricity sector use a notional electricity pool coefficient (more a historical benchmark) X energy consumption – verified 'emissions reductions'
    - NSW Act (48pp), 5 rules (100pp) 48 guides + forms, 21 fact sheets + more..
  - Fungibility (between EE + other abatement options, and between EE options) offers efficiency improvements
    However, is all EE the *same* (cavity insulation vs CFLs)

NSW scheme - some more lessons from experience ..

- Additionality' is hard to assess but matters
  - Establishing baselines for the myriad energy end-use activities in the economy is difficult (+ prone to errors + moral hazards)
    b/c have to estimate what would happen in absence of EECT
    …or ignore additionality altogether as with NSW Scheme
    NOTE difficulties with renewables baselines – EE much harder
  - Participants can be expected to push the rules eg. UK Suppliers only want to promote 100W equivalent CFLs
- Jurisdiction doesn't always match scope
  - Eg. NSW retailers 'claiming' NSW electricity related emissions reductions from new / improved generating plant in other States
- Potential for double-counting across policy measures
  - Eg. MRET + NSW Benchmarks, UK EEC + fuel poverty schemes
- Carrots without sticks (or socialised sticks) may not deter deleterious activities eg. how would NSW Benchmarks handle Redbank II
- Appear to be 'markets for lemons' risks
  - First providers might be those who are doing something anyway - how effective is additional financial motivation for end-users who already ignore cost effective EE options

Example – the difficulties with baselines

- ***Orica Ltd.*** in the NSW Scheme
  - Commissioned ChlorAlkali plants in Victoria + NSW in 1998 to replace existing 1940s technology in use on site;
    New NSW plant completed September 2002
  - Successfully applied for accreditation under DSA rule for its NSW plant + will earn estimated 250k NGACs (= say $2m).

Example: Complexity of verification

- SEDA Lighting Upgrade Project
  - Eligible for estimated 15000 NGACS (perhaps $120-150k)
  - However, initial costs for SEDA of application, pre-accreditation audit $10k + requires annual report confirming SEDA inspection of stores for 10 years confirming that units still installed + fully operational and that layout of stores + their use has not materially changed, possible spot audits too.

Longer-term energy policy development

- Australia committed to meeting Kyoto target
  - modest target + generous **land-use rules**
    => no major additional policy effort in energy sector required
  - AGO projections that we are within "striking distance" of Kyoto even with energy emissions up 40% from 1990 – 2010

…and preparing for for the large scale emissions reductions required over coming century

- Require global 50-60% emissions reduction over century
  (IPCC, Third Assessment Report, 2001)
- developed countries potentially obliged to take greater cuts over shorter time frame *(UK White Paper, 2003)*
- Australian per-capita emissions **2 X** *developed* world average
  (Australia Institute, Updating per capita emissions for industrialised countries, 2003)

Australian innovation policy for climate change

- Current measures
  - targeted R&D through CRCs, demonstration programs: eg. RECP, deployment programs: eg. MRET, GGAP
- Growing Government interest + support for coal-fired electricity generation with **geosequestration**
- *Question:* Is the Aust. Govt. trying to 'pick winners'? How do they justify apparent geosequestration focus?
- *Answer*: ...supported by **PMSEIC** technology assessment
  - **finds that *"..within foreseeable future only carbon capture and geosequestration has the potential to radically reduce Australia's greenhouse signature"***

  => *recommends "Establish a national program to scope, develop, demonstrate and implement near zero emissions coal based electricity generation"*

Centre for Energy + Environmental Markets (CEEM)

A proposal

- *to formalise* growing interest + interactions between UNSW researchers in Engineering, Commerce + Economics… + more
- *through a UNSW Centre* that provides Australian research leadership in interdisciplinary design, analysis + performance monitoring of energy + environmental markets, and associated policy frameworks
- *in the areas* of
  - Physical energy markets (with an initial focus on ancillary services, spot market + network services for electricity + gas)
  - Energy-related derivative markets (financial + env. Incl. interaction)
  - Policy frameworks + instruments in energy + environment
- *with tools* including
  - Market data analysis, algorithmic development, and
  - Experimental market platforms + AI (evolutionary programming) techniques

Proposed CEEM work program

- *Build upon* present research + teaching, incl. current projects
  - development of a 'complex electricity market' experimental program with GMU ICES (Interdisciplinary Center for Economic Science)
  - ARC project 'Understanding participant behaviour in wholesale electricity markets' led by AGSM
- *with*
  - Project-based collaboration between UNSW researchers, also external academic researchers, govt + industry stakeholders
  - Inter-disciplinary research training via support for cross-faculty supervision, scholarships etc.
  - Eminent visitor program, outreach through seminars, short courses etc
  - More coordinated + extended consultancy work, particularly to facilitate transfer of research outcomes to industry + govts, obtain guidance on future research priorities