Centre for Energy and Environmental Markets

UNSW

Necessary conditions for effective full retail competition

Masterclass: Transitioning to Full Retail Competition

Queensland Power & Gas Conference, Brisbane, 27/2/06

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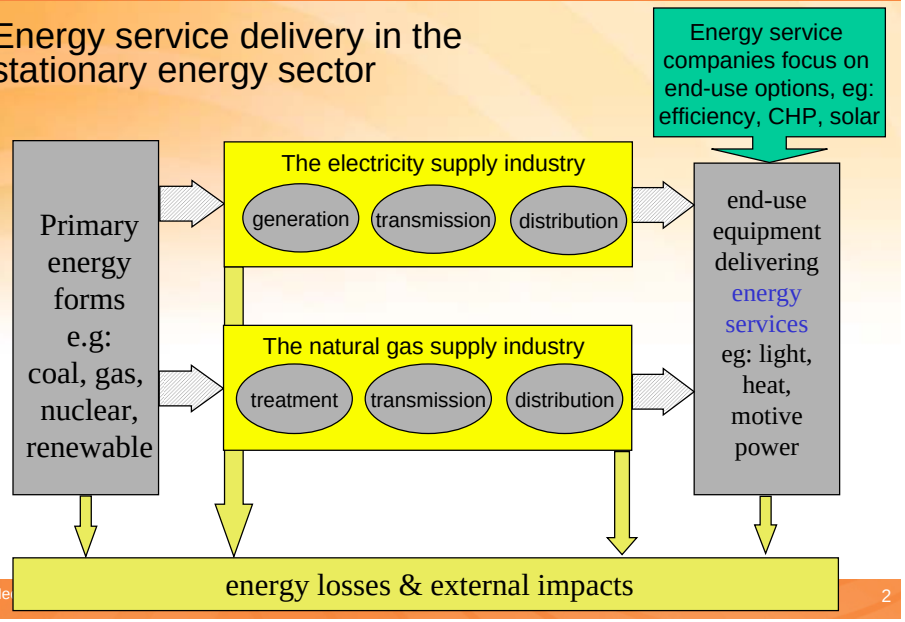
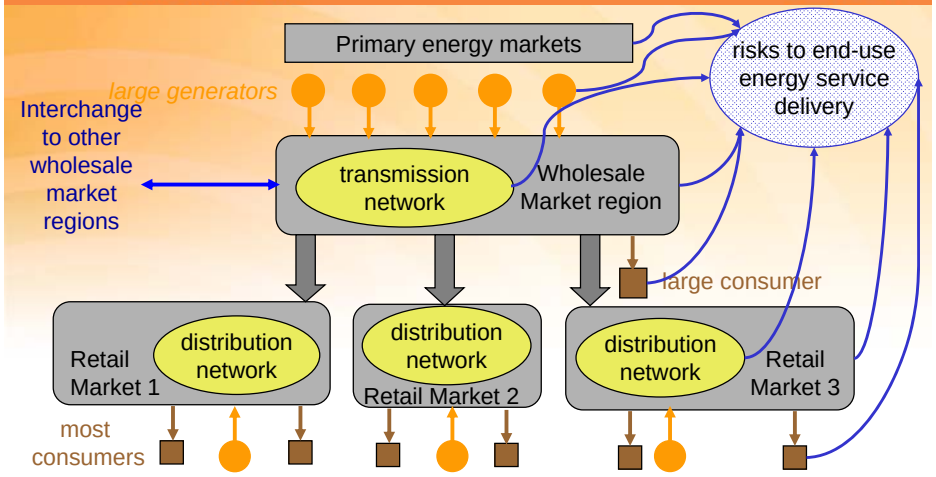
Energy service delivery in the stationary energy sector



An electricity trading framework

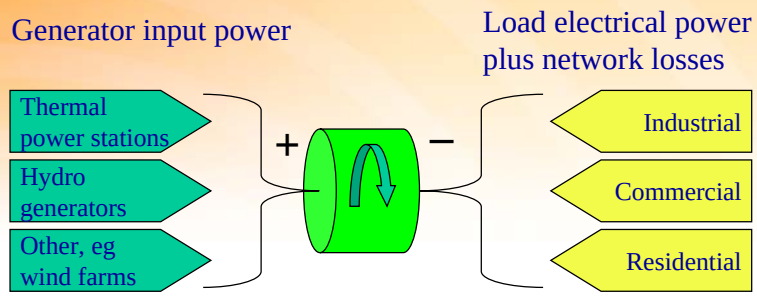


- *Small consumers, embedded generators & storage should be supported by energy service advisers*
- *Wholesale & retail designs should be compatible, with spot & derivative markets that model flow constraints*

Availability & quality of supply

- Quality of supply attributes (QOS):
  - Voltage, frequency, waveform purity
  - Supply availability
- ESI can't achieve perfect availability & quality:
  - Supply availability & quality can vary widely in distribution networks
  - Customer equipment can also affect quality
- Risks to availability & quality of supply threaten the flow of end-use energy services:
  - Directly or indirectly through equipment malfunction
  - Hard to define legal obligations (mainly on distributors) for availability & quality at end-user connection points

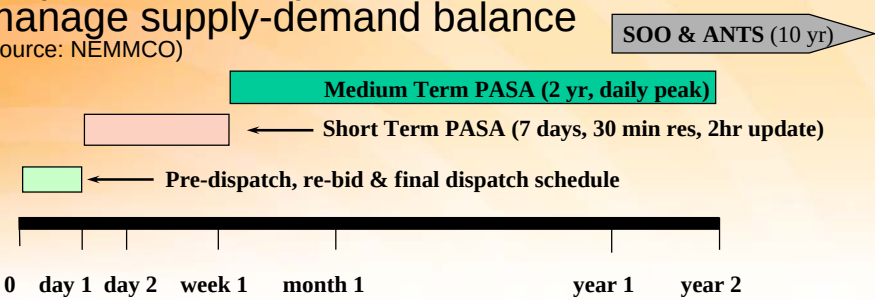
Supply-demand balance in the electricity industry (assuming perfect network)



- Frequency is a measure of supply-demand balance:
  - Always varying due to fluctuations in energy flows

Dispatch, Pre-dispatch, PASA, SOO & ANTS to manage supply-demand balance

(source: NEMMCO)



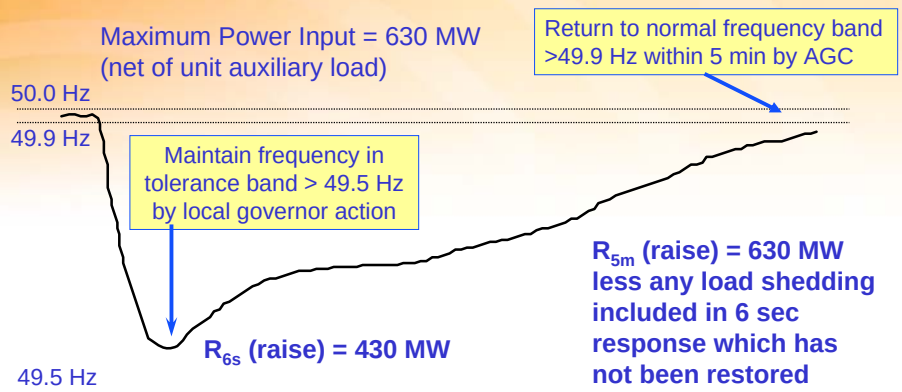
- ST & MT Projected Assessment of System Adequacy support reserve assessment & participant operating decisions. ST PASA projects region demand & reserve for 7 days @ 30 min resolution, updated every 2 hours. MT PASA projects region daily peak demand & reserve for 2 yrs, updated weekly.
- Statement of Opportunities (SOO) & Annual National Transmission Statement (ANTS) are intended to inform generation, demand & network investment decisions (10 year horizon, issued annually)

These procedures all rely heavily on demand forecasts

Large disturbance frequency control:

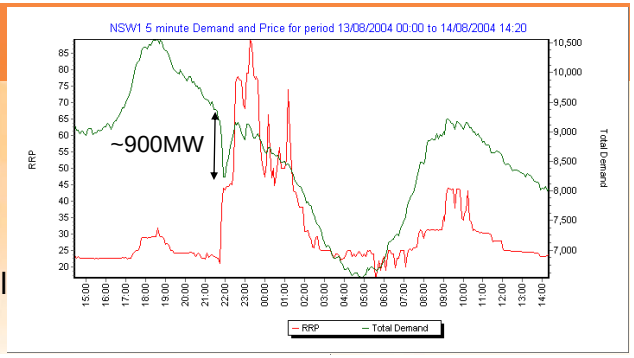
loss of NSW 660 MW Generator (source: NEMMCO)

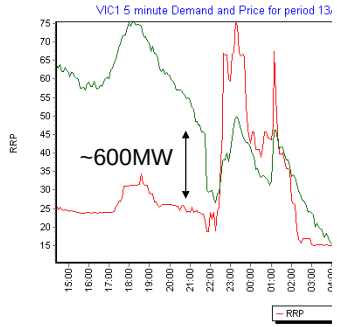
Frequency control capability requirement = R

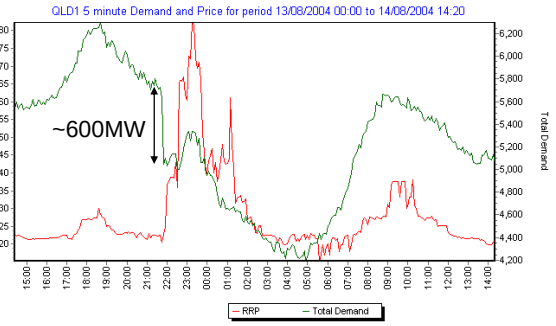


Load reduction at 49.5Hz is ~200 MW for a typical minimum load of 10 GW

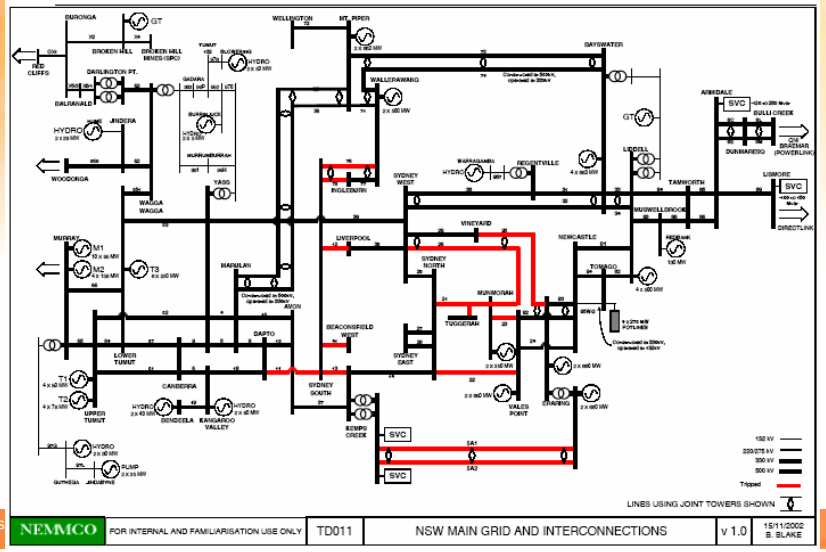
Transgrid CT failure @ 2142 13/8/04 led to 3100 MW gen trip. Frequency fell to 48.9Hz, ~2100 MW load shed in NSW, Ql Vic & SA



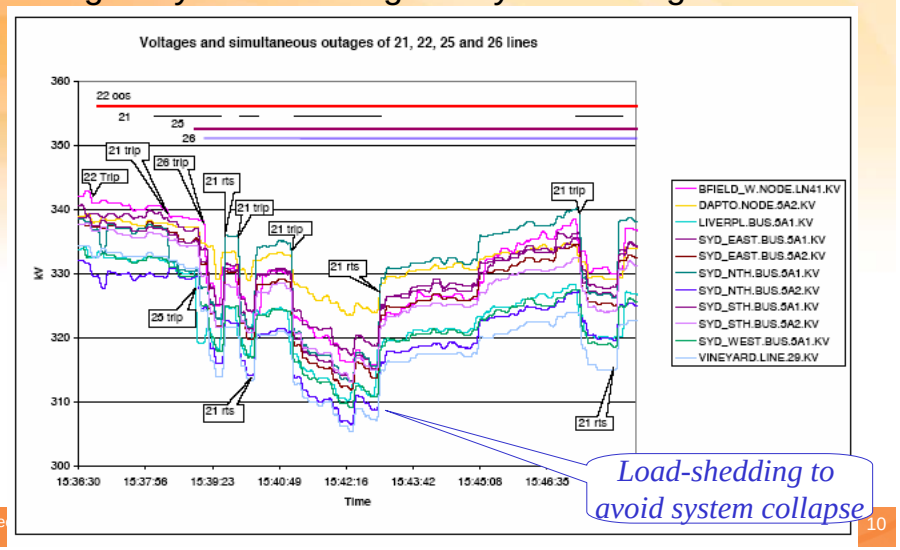




Australian management of severe network contingencies: NSW bushfires Dec 2002; lines with multiple trips shown in red



Sydney region voltages during 2002 bushfire outages: managed by under-voltage relays shedding load



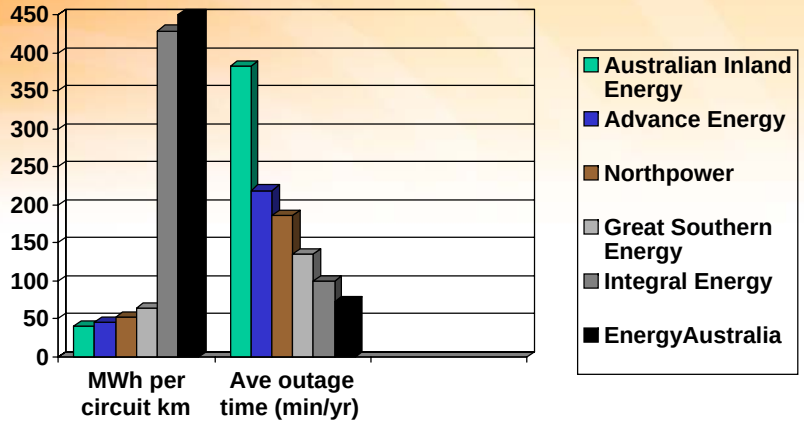
A distribution network perspective on ancillary services

- Transmission level ancillary services have little impact on distribution network QOS:
  - Voltage regulation, waveform purity, phase balance & supply availability
- Distribution level ancillary services may also address transmission level QOS:
  - e.g. voltage, frequency & security services
- Thus distribution-level AS may have greater value than transmission level AS:
  - Not yet reflected in National Electricity Rules
  - Must be addressed to deliver effective FRC

Quality of supply in distribution networks

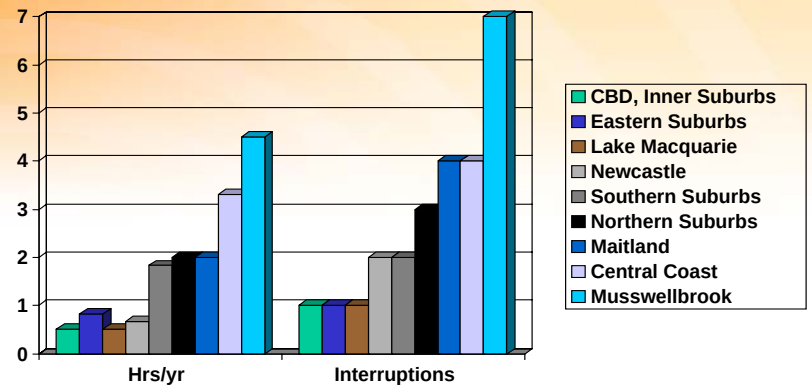
- Quality of supply attributes (QOS):
  - Voltage, frequency, waveform purity
  - Supply availability
- Practical network can't achieve perfect QOS:
  - Supply availability can vary widely within distribution networks
  - Poor QOS can cause electrical equipment to malfunction
  - Customer equipment can affect QOS

Energy density & reliability of NSW Distributors (IPART, 1996/97)



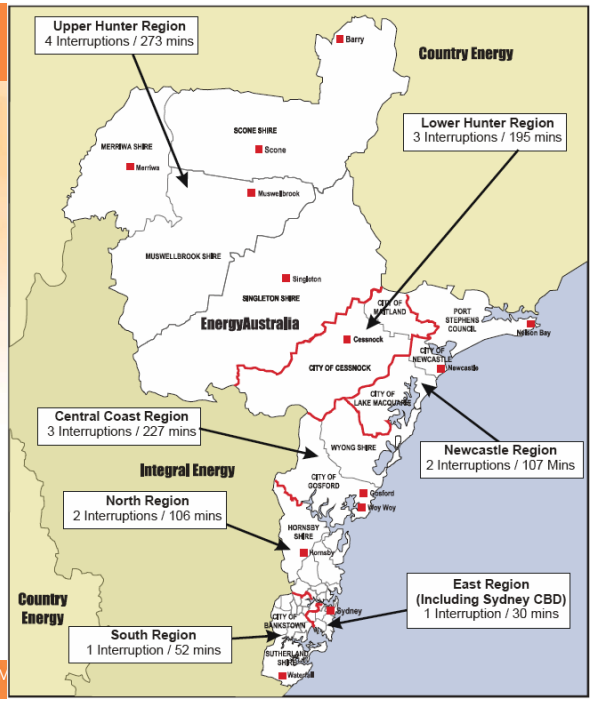
Average reliability in EnergyAustralia regions

(EnergyAustralia Electricity Supply Standards, 1998)



5-year average reliability in EnergyAustralia regions

(EnergyAustralia Electricity Network Standards, 2004)

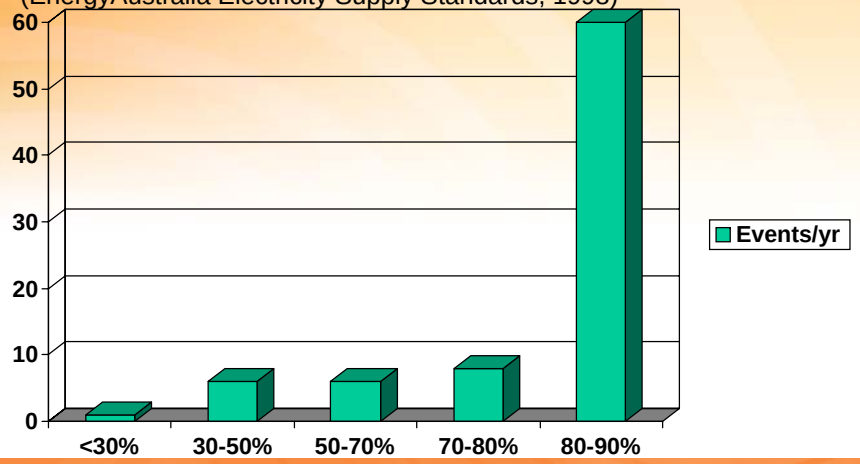


NSW IPART's recommended guaranteed customer service standards (IPART, 2004)

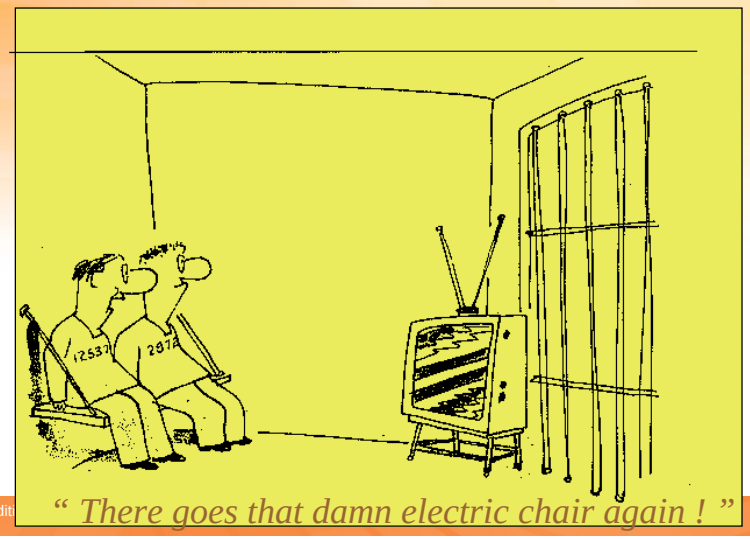
- DNSPs to compensate customers if the number of outages per financial year exceed:
  - For EnergyAustralia & Integral:
    - 9 for customers on urban feeders; 15 on rural feeders
  - For Country Energy & Australian Inland Energy:
    - 12 for customers on urban feeders; 20 on rural feeders
- Compensate all affected DNSP customers if an individual outage exceeds 12 hours
- Up to a limit of 4 payments per year per customer

Average voltage dip events in EnergyAustralia service territory

(EnergyAustralia Electricity Supply Standards, 1998)



One piece of end-use electrical equipment may interfere with another



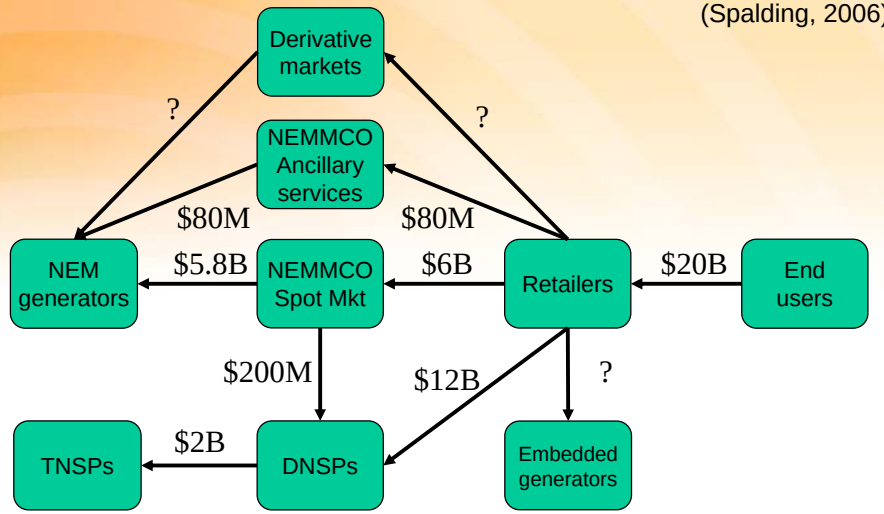
" There goes that damn electric chair again ! "

Australian electricity restructuring to date

- Has focussed on wholesale market design, network services & ancillary services
- Has not focussed on retail market design or on end-user concerns about quality of supply
- Small end-users have not been encouraged to participate:
  - Represented by demand forecasts or demand profiles
  - Left with old-fashioned accumulation meters, typically read every 3 months if at all
  - Given an impossible "guarantee" of both cheap and reliable supply, regardless of end-use behaviour

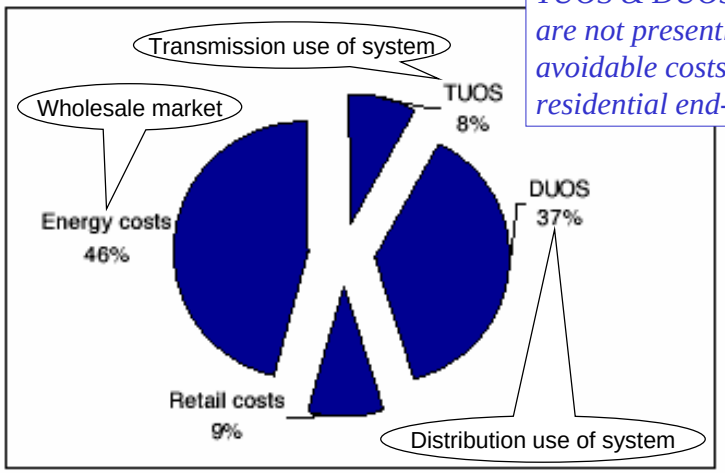
Cash flow in SE Australia electricity industry

(Spalding, 2006)



Residential electricity bill cost components
(IPART, DNSP Review, 2003)

TUOS & DUOS are not presently avoidable costs for residential end-users

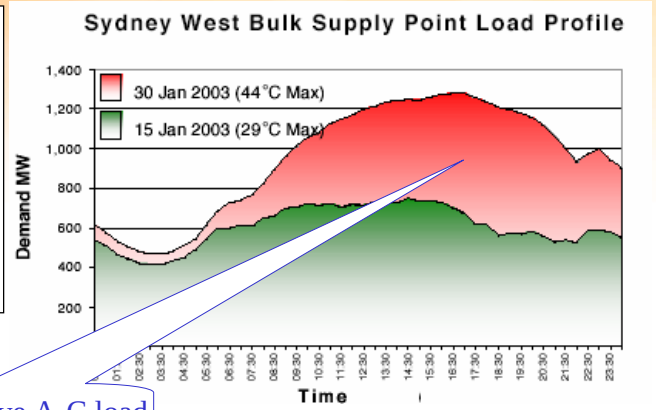


Residential & commercial air conditioning is the key driver for peak demand growth
(IE Submission, IPART DNSP Review, 2003)

Residential ADMD

Pre 2000 houses: 3.5-4.0 kVA

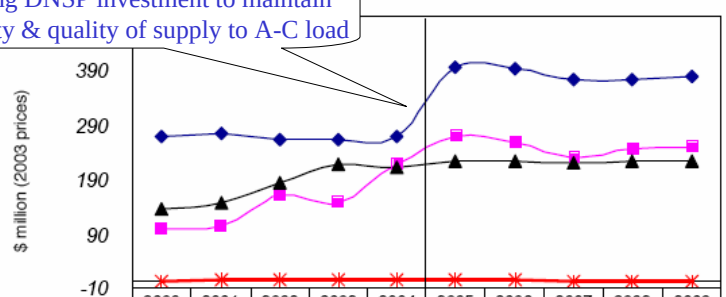
Post 2000 houses: 5.0-7.5 kVA



Temperature-sensitive A-C load

NSW distributor actual & forecast capital expenditure (IPART, Dist Pricing Draft Rpt, 2004)

Increasing DNSP investment to maintain availability & quality of supply to A-C load



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Energy Australia	271	275	264	263	270	398	394	374	375	379
Integral Energy	101	106	162	148	218	270	257	230	248	249
Country Energy	138	148	185	218	213	225	224	222	224	224
Australian Inland	3	3	4	3	5	3	3	3	2	2

Some objectives for retail market design

- Economic efficiency objectives:
  - Spot & derivative markets that correctly signal risks
- Social policy objectives:
  - Cross-subsidies to particular groups, eg:
    - Rural & disadvantaged residential
    - Electricity intensive industry
- Environmental objectives:
  - Green pricing
- Simplification objectives:
  - Subsume network pricing; quarterly energy only tariffs

Retail market design: *economic efficiency*

- Objectives:
  - Mirror wholesale spot & derivative markets
  - Correctly signal network flow constraints & losses
  - Allow end-users & embedded generators to provide ancillary services & contest network service investment
- Prerequisites:
  - Interval metering for all retail market participants that also measures quality & availability of supply
  - Direct operator control of end-use equipment & embedded generation for ancillary services
  - Support for demand-side decision making & enhanced end-use equipment; removal of obligation to supply

Retail market design: *social policy*

- Objectives:
  - Support disadvantaged end-users
  - Promote industry development
- Prerequisites:
  - Ability to cross-subsidise target end-user groups:
    - Regulated retail tariffs with limited retail competition, or
    - Subsidies from general government revenue

Retail market design: *environment*

- Objectives:
  - Reduce environmental impacts associated with the electricity industry
- Prerequisites:
  - Provide end-users with meaningful “green power” options:
    - Audited or unaudited green power schemes
    - Performance standards for end-use equipment, buildings, etc
  - Place mandated requirements on electricity retailers:
    - Federal Mandatory Renewable Energy Target (MRET)
    - New South Wales Greenhouse Abatement Scheme (NGAS)
    - Queensland Gas Certificate Scheme

Retail market design: *simplification*

- Objectives:
  - Reduce need for small end-users to actively participate
- Prerequisites:
  - Simple metering (eg rotating disk accumulation meter)
  - Regulated or default tariffs for small end-users
  - Regulated distribution network service providers
  - Obligation to supply

Necessary conditions for effective FRC

- Advanced Metering Interface for all end-users:
  - Interval metering that measures availability & quality of supply, with communication to end-user & NEMMCO
- End-use equipment that is flexible & can contribute to maintaining availability & quality of supply:
  - Including embedded generation & storage
- Separate retail and DNSP contracts for ancillary services & energy
- Innovation by end-users, DNSPs, retailer-ESCOs & equipment providers

Current NEM metering (based on Colebourn, 2006)

	Spot pricing	kVA demand ToU	kW demand ToU	Seasonal energy	ToU energy	single rate energy
NER Type 3 meter (>735 MWh p.a.)	✓	✓	✓	✓	✓	✓
NER Type 4 meter (>160 MWh p.a.)	✓	✗	✓	✓	✓	✓
NER Type 5 meter (MRIM)		✗	✗	✓	✓	✓
Older time of use energy meter		✗	✗	✗	✓	✓
Single rate energy meter		✗	✗	✗	✗	✓
Improved cost reflectivity	←					

Some international experience with AMI

- N. Ireland
  - ¼ of customers on pre-payment meters with potential for 3 TOU tariffs, separate customer interface unit
- Ontario
  - Requiring distributors to introduce basic smart metering system with 2-way communication + open network interface – to be completed in 2010
- ENEL
  - Advance meter rollout to 30 million customers – integrates metering + billing, 2 way communication, varied TOU capabilities – program near complete
- Sweden
  - Distributors have to introduce automatic meter reading by 2009
- United States
  - Numerous State (eg. California) + other Utility efforts

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