



**Queensland Power and Gas Conference  
Workshop on Network Services and Ancillary Services  
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# **Distribution Network Services & Distributed Resources in the National Electricity Market**

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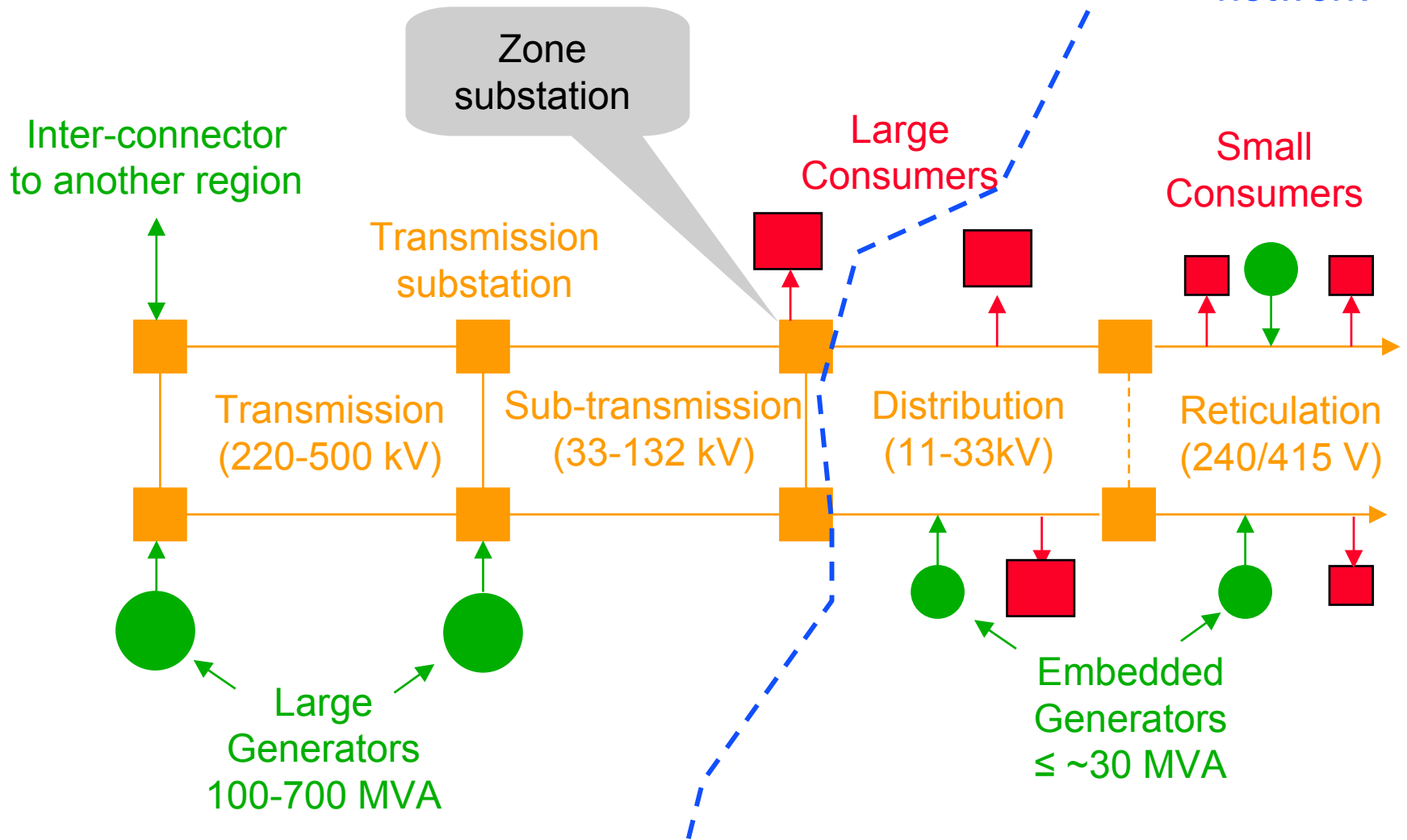
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# A regional electricity network

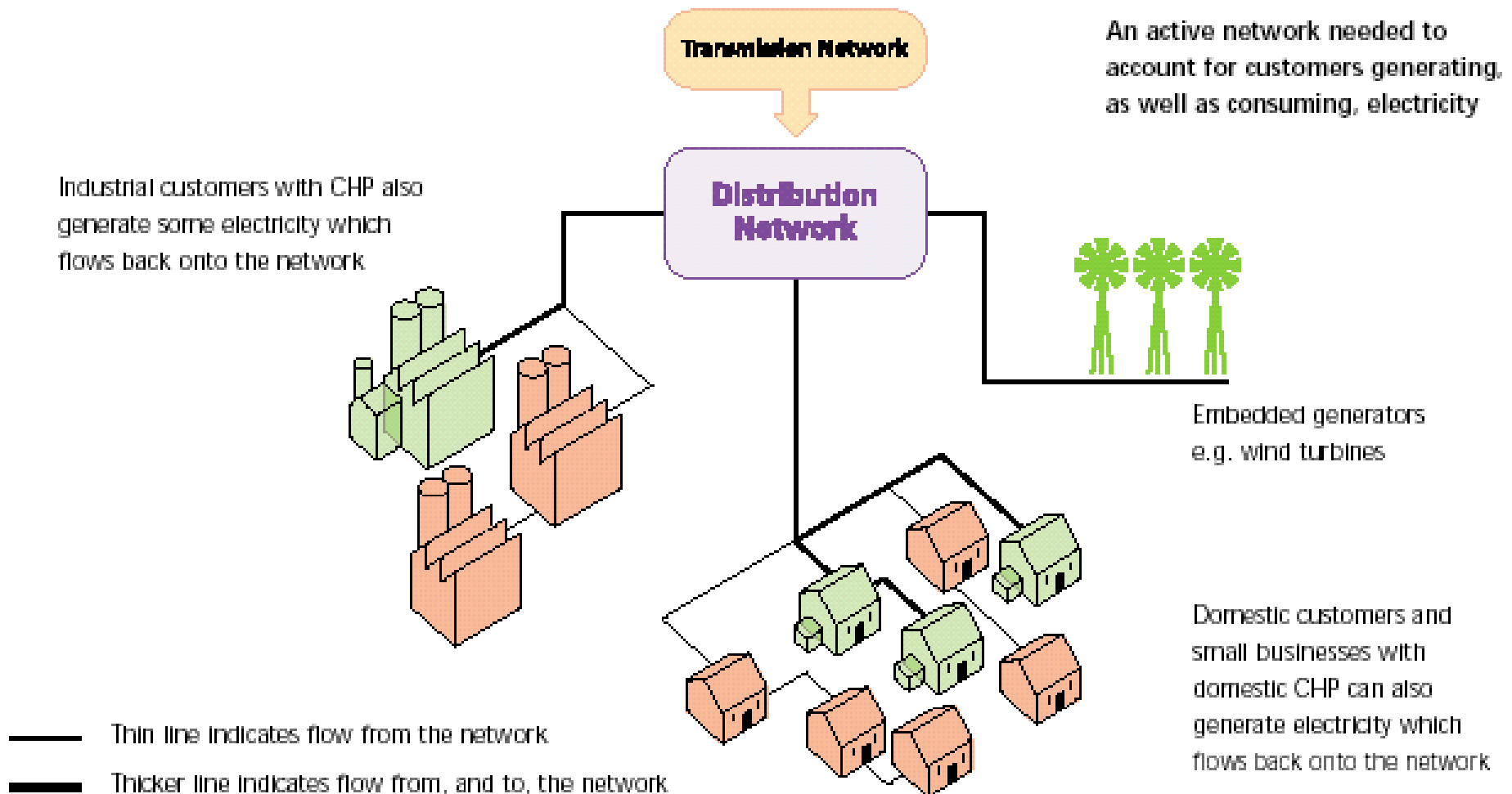
Meshed transmission network

Radial distribution network



# Distribution network with embedded generation

([www.ofgem.gov.uk/docs2002/26distgenfactsheet.pdf](http://www.ofgem.gov.uk/docs2002/26distgenfactsheet.pdf))



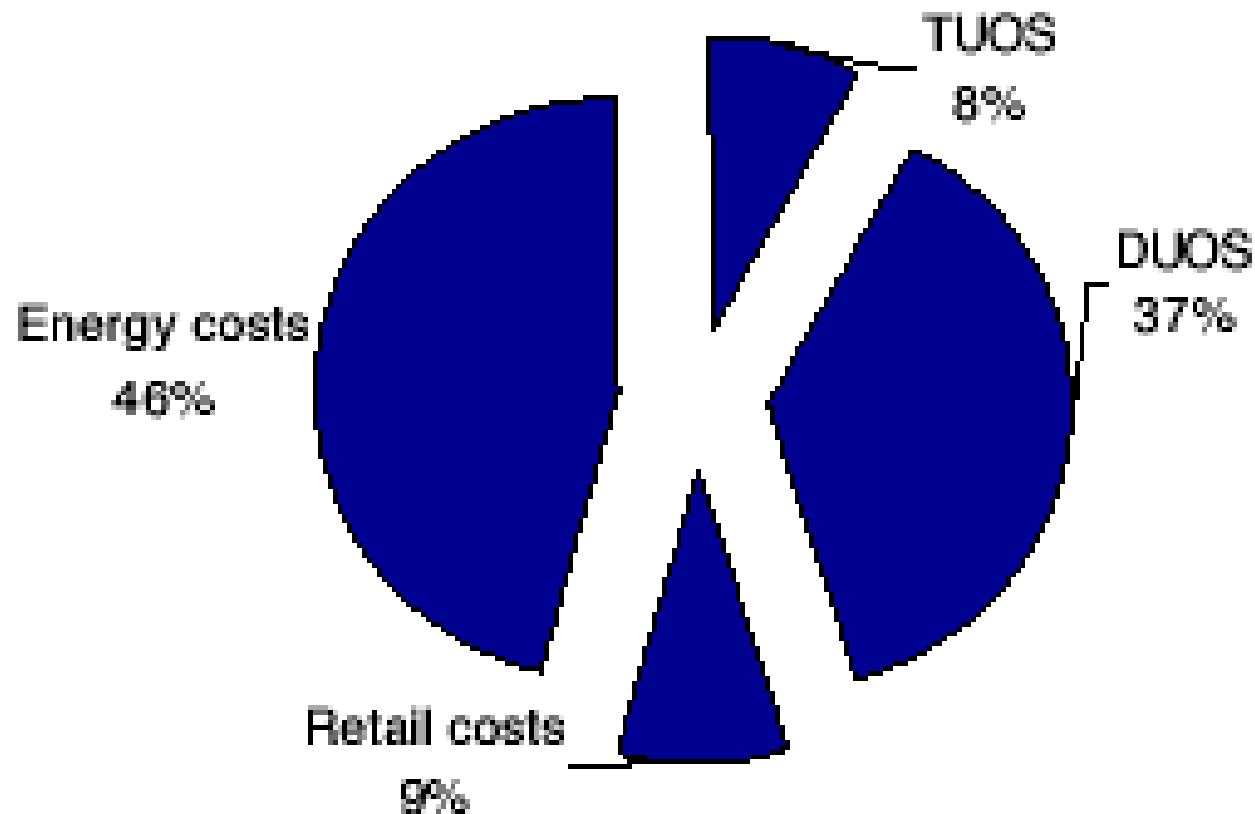
# Network services: transmission versus distribution

- An electricity network is a continuum:
  - From largest generator to smallest consumer
  - Each consumer receives a mix of energy from all generators connected to the network
- Network design differs with voltage level:
  - Transmission networks usually meshed:
    - Network element outage doesn't often cause blackout
  - Distribution networks usually radial:
    - Network element outage will then cause a blackout
  - T&D networks usually meet at a Zone Substation

# Electricity markets: wholesale versus retail

- Distinction between wholesale & retail markets is vague, eg in the NEC:
  - Contestable consumers may participate in NEM
    - All customers will be contestable once franchise is fully eliminated
  - All generators must register with NEMMCO:
    - Unless granted exemption by NEMMCO
  - All generators must sell their electricity to NEM unless they sell all their output to one of:
    - A customer at the same location
    - The local retailer (definition vague with FRC)

# Composition of typical residential electricity bill (IPART, DNSP Review, 2003)



# Concerns about joint distributor/retailers

(eg: ACCC FRC Determination, 2001; IPART Ring Fencing Guidelines, 2003; Metrology Review, 2003)

- Potential barriers to entry:
  - Discriminatory charges or requirements
  - Network data, metering & control equipment
  - Ownership of customer data, customer inertia
  - Economies of scale & cross-subsidies
- Ring-fencing options for distribution & retail:
  - Legal, accounting or operations separation:
    - Legal separation clearly the strongest requirement
- Metrology issues paper 2003:
  - Meters to be owned by the distributor?

# Implications for effective retail market design

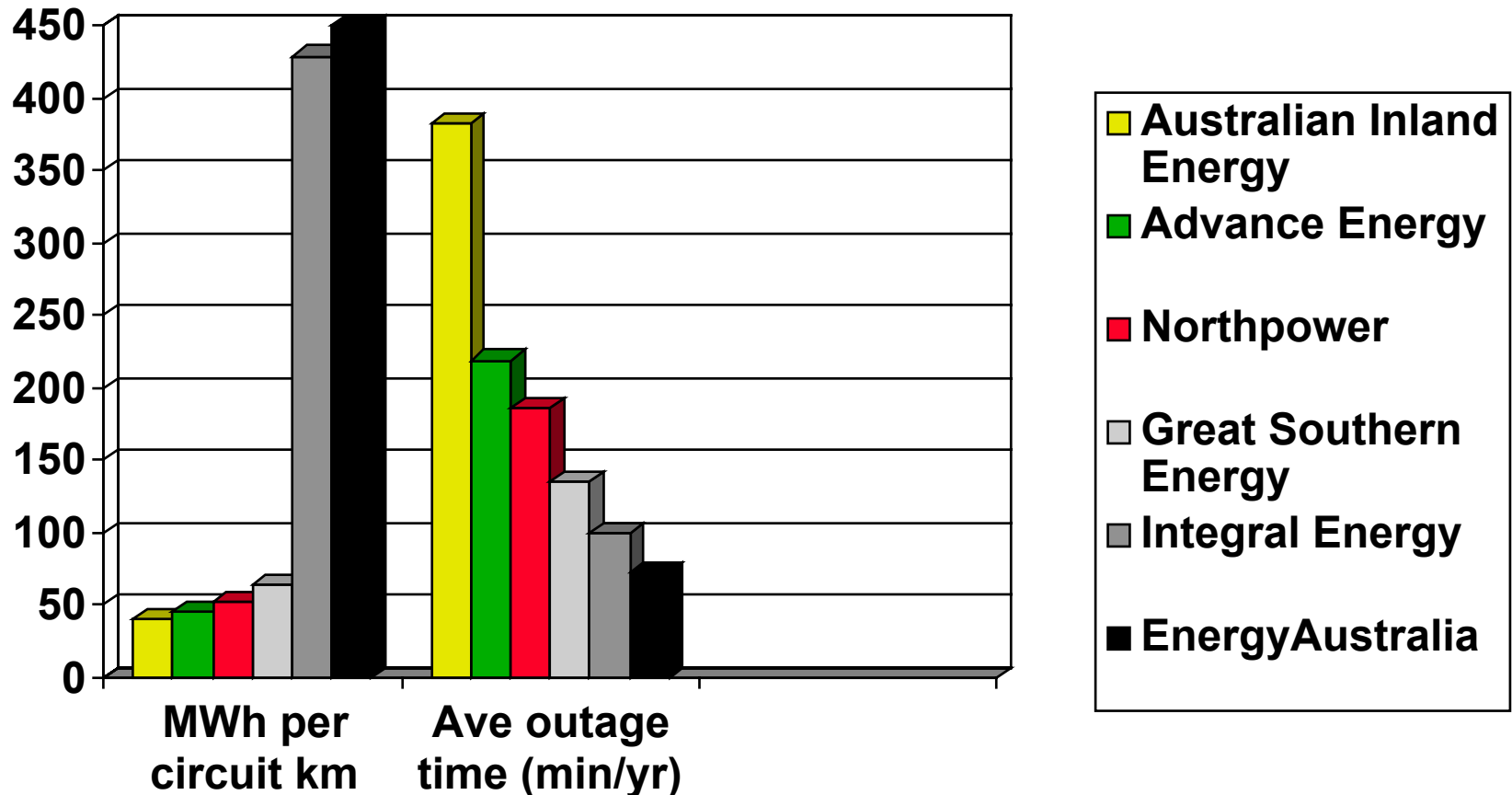
- Necessary conditions:
  - Efficient price signals for operation & investment:
    - Including distribution network contestability
  - Informed decision making:
    - Small consumers need appropriate support
- Difficult to achieve:
  - Social, environmental & network externalities, e.g.
    - Important role of supply availability & quality
  - Lack of consumer knowledge, skills & interest
  - Metering & communication costs



# Quality of supply in distribution networks

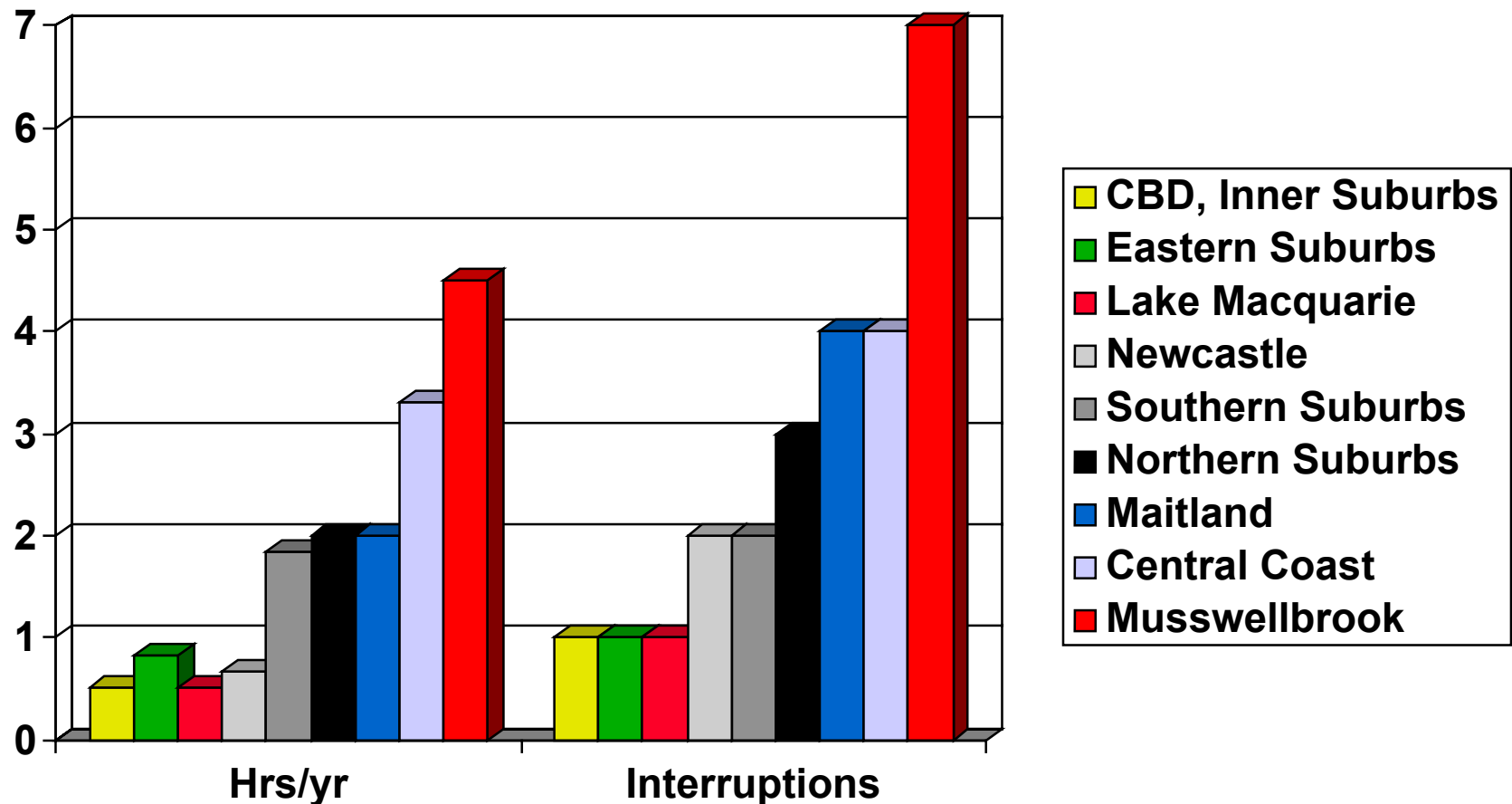
- Quality of supply attributes (QOS):
  - Voltage, frequency, waveform purity
  - Supply availability
- Practical network can't achieve perfect QOS:
  - Supply availability can vary widely within distribution networks
  - Poor QOS can cause electrical equipment to malfunction
  - Customer equipment can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

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



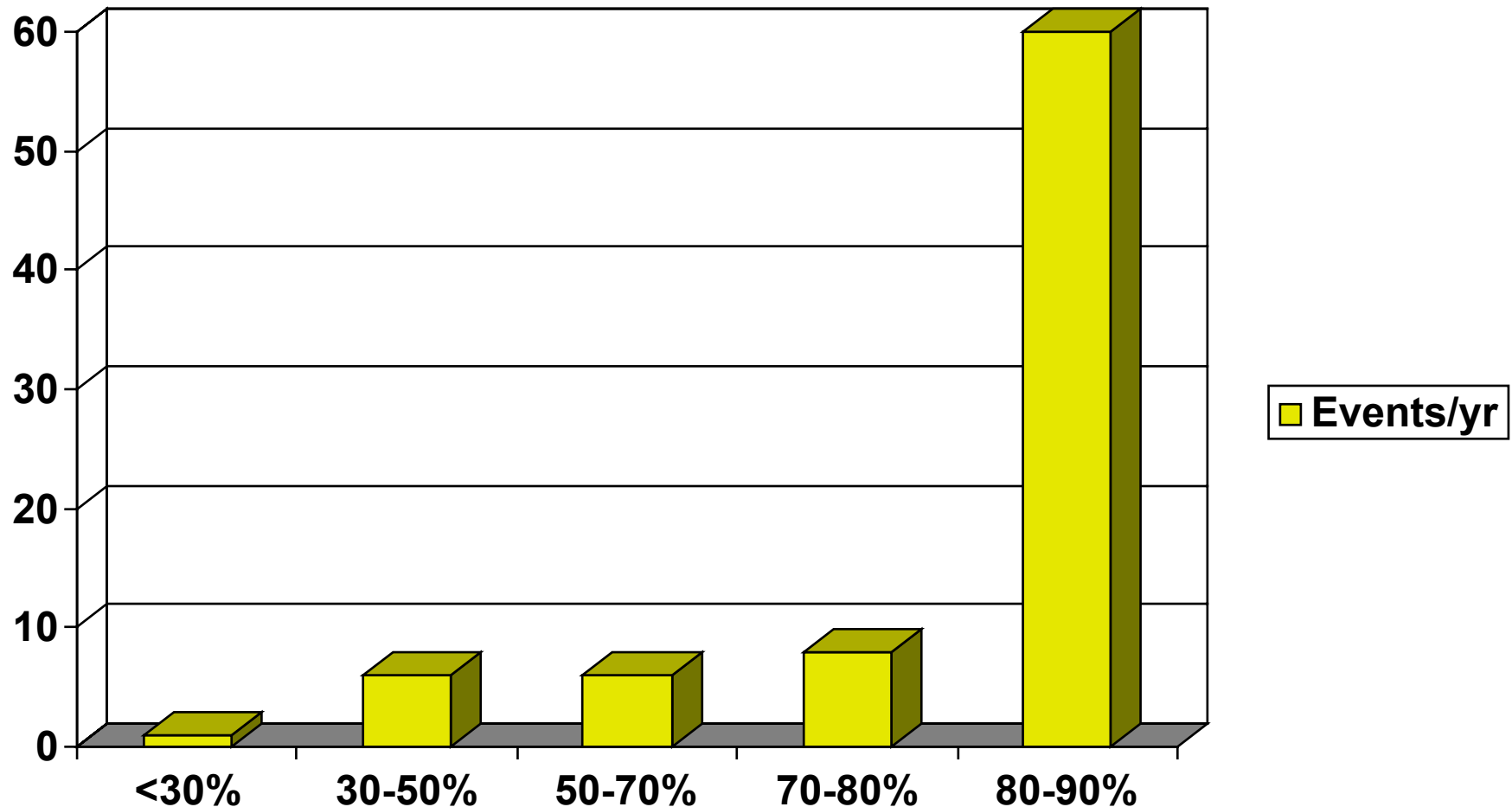
# Average reliability in EnergyAustralia regions

(EnergyAustralia Electricity Supply Standards, 1998)

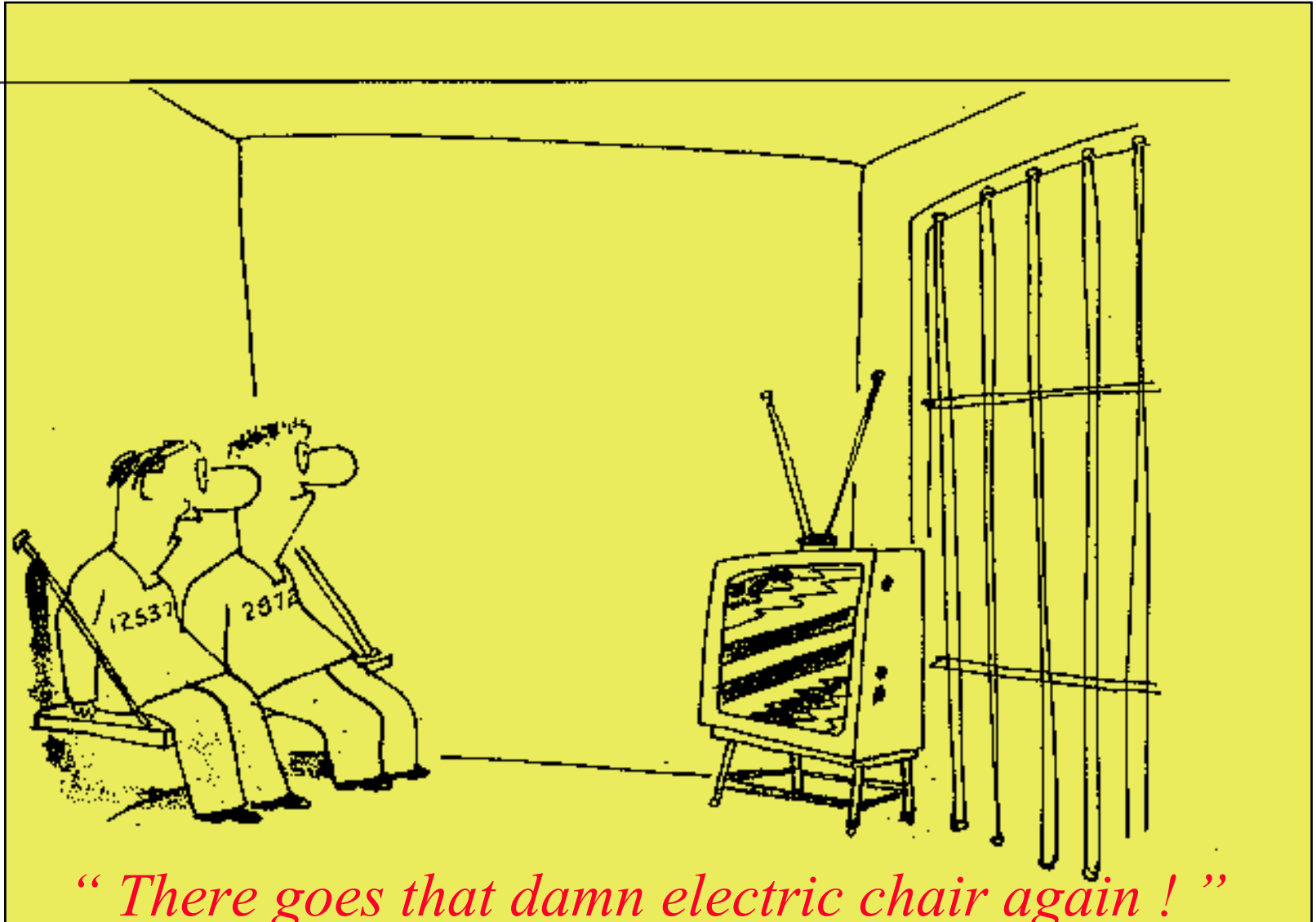


# Average voltage dip events in EnergyAustralia service territory

(EnergyAustralia Electricity Supply Standards, 1998)



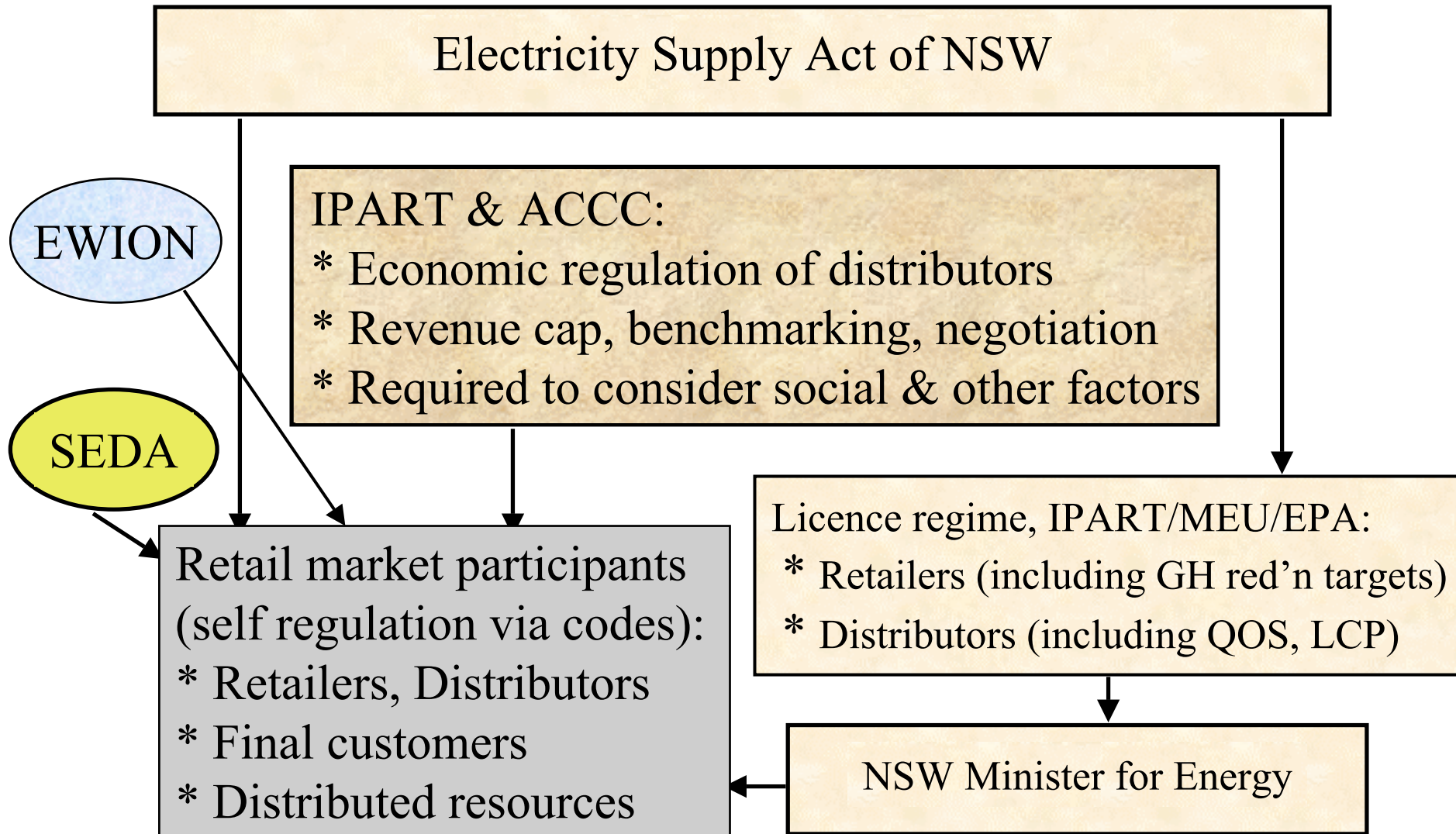
# One piece of electrical equipment may interfere with another



# A distribution network perspective on ancillary services

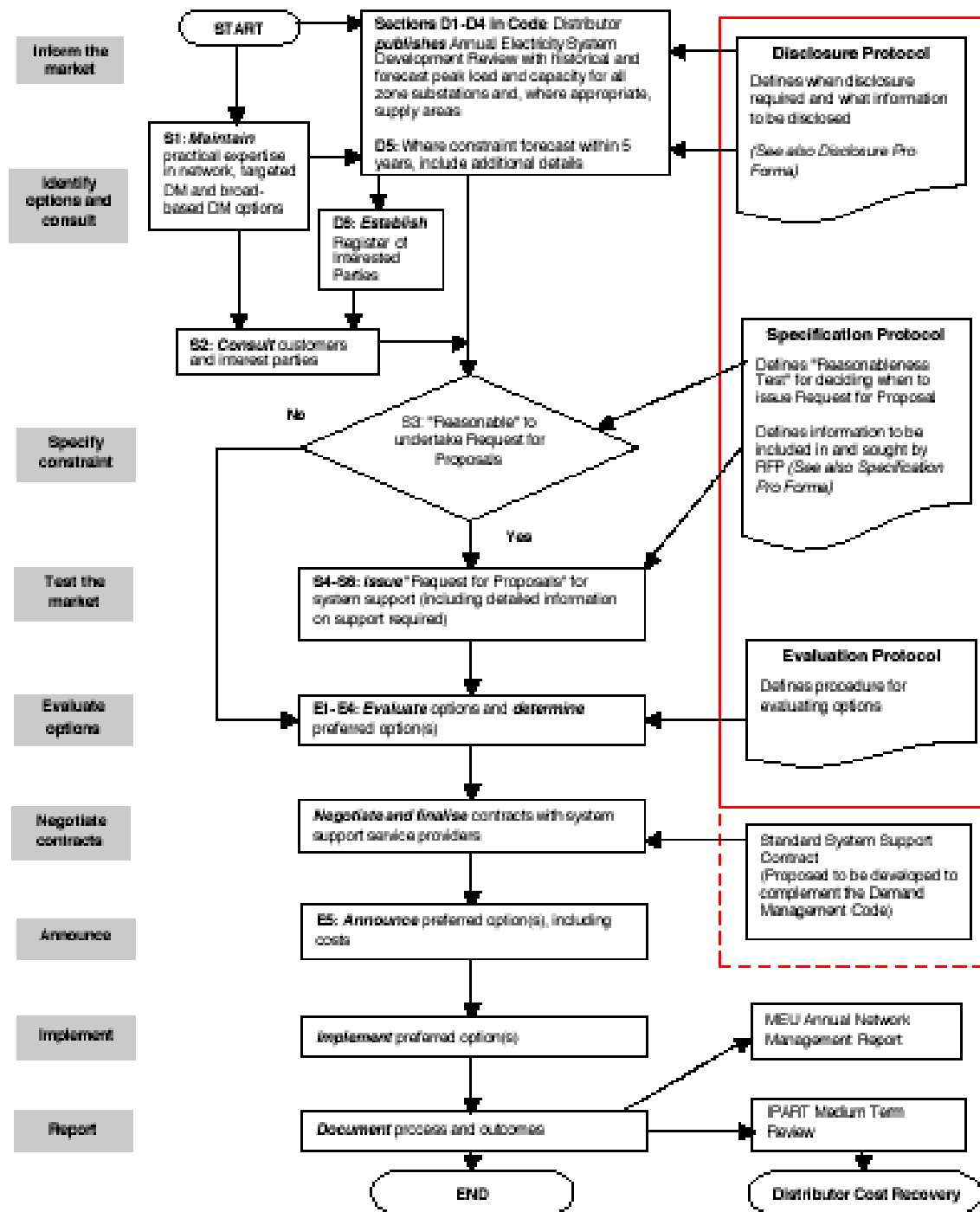
- Transmission level ancillary services have little impact on distribution network QOS:
  - Voltage regulation, waveform purity, phase balance & supply availability
- Distribution level ancillary services may also address transmission level QOS:
  - e.g. frequency & stability-related services
- Thus distribution-level AS may have greater value than transmission level AS

# NSW regulatory framework



**SED: Sustainable Energy Development Authority:- market transformation**

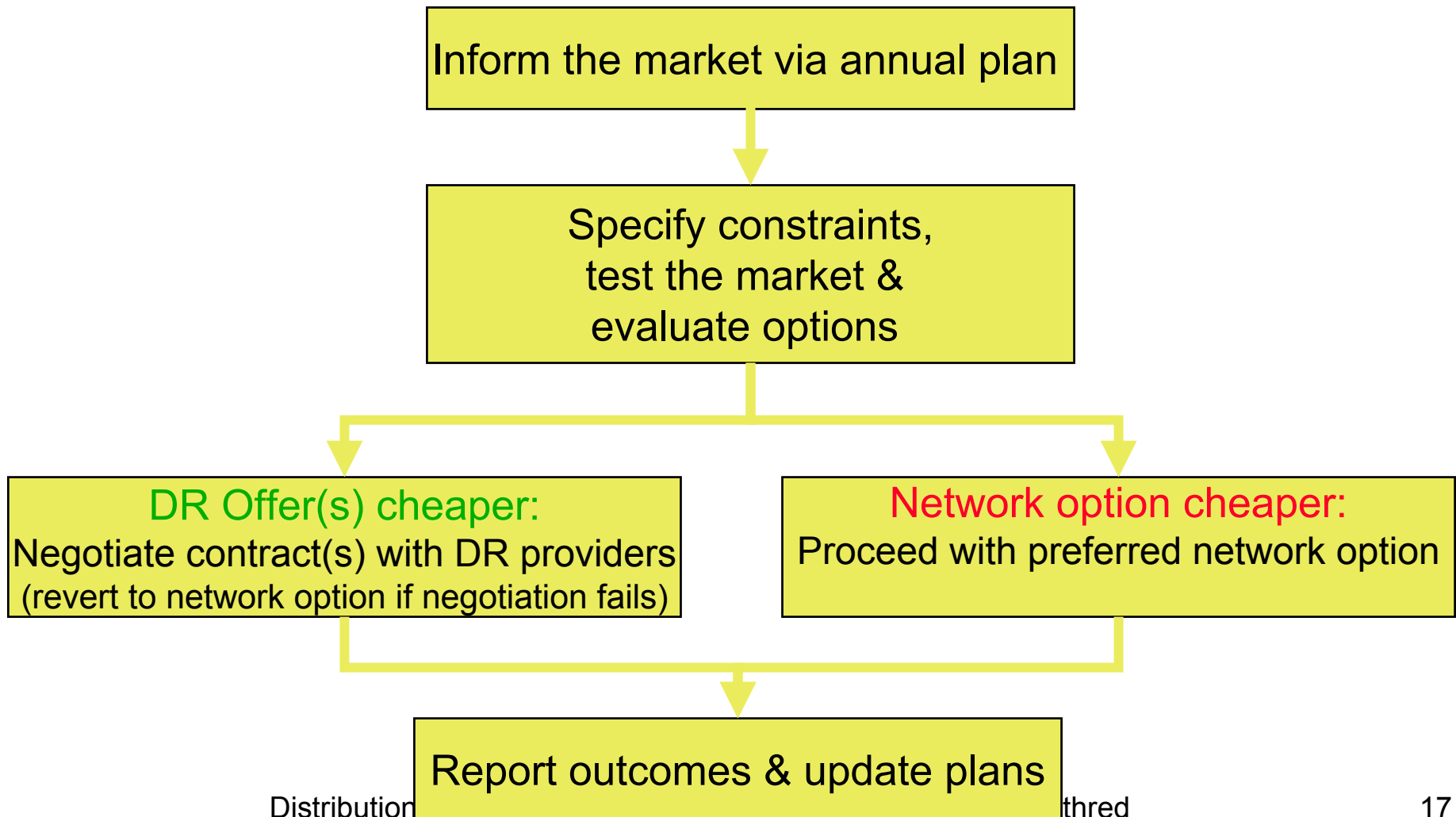
# NSW Demand Management Code of Practice for Distributors (May 2001)



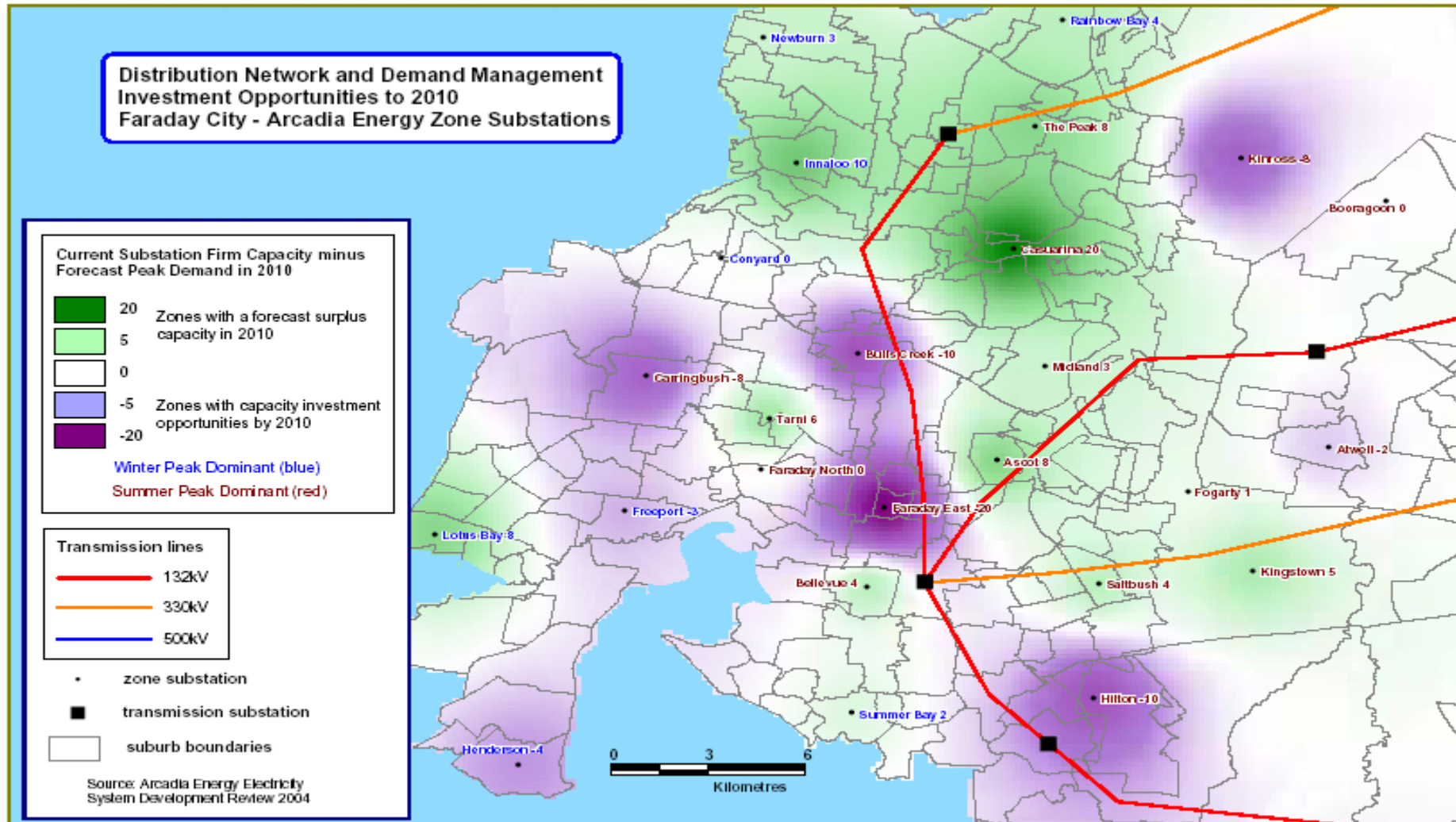


# Distributor investment considering distributed resources

(NSW Demand Management Code of Practice, 2001)

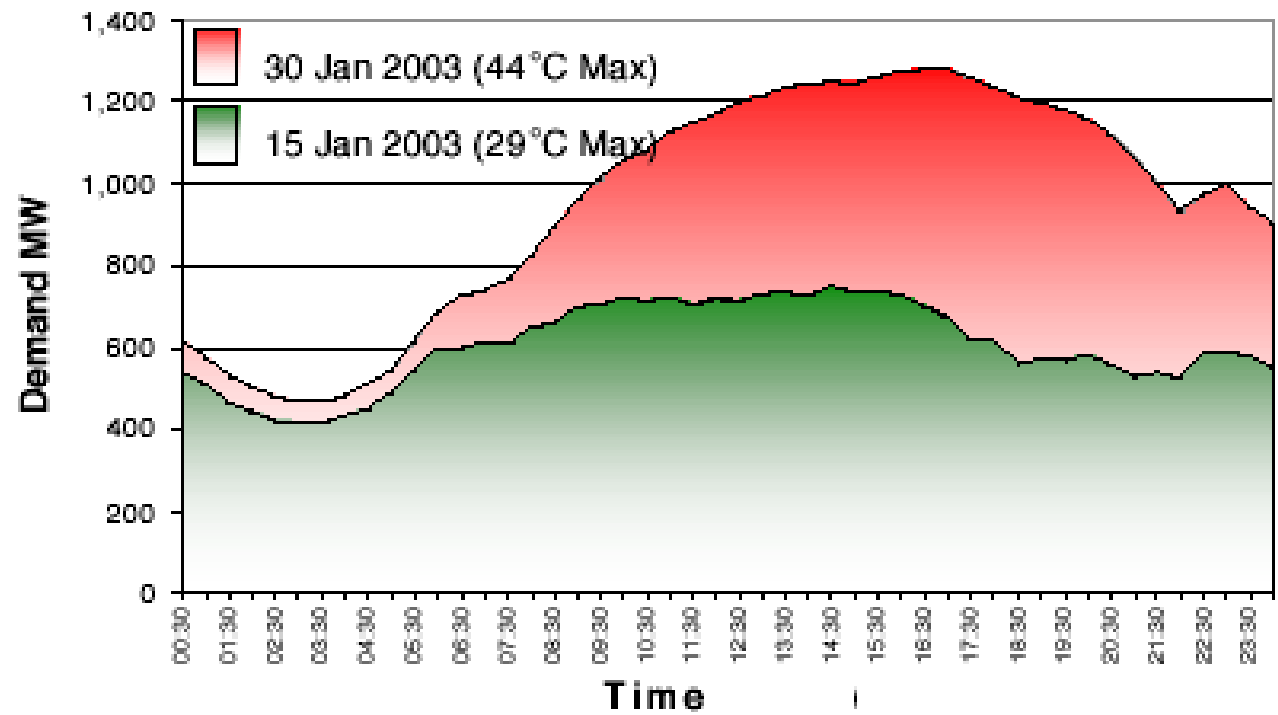


# Proposal for publicising distributed resource opportunities (SEDA, 2004)



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

**Sydney West Bulk Supply Point Load Profile**



Residential ADMD

Pre 2000 houses: 3.5-4.0 kVA

Post 2000 houses: 5.0-7.5 kVA

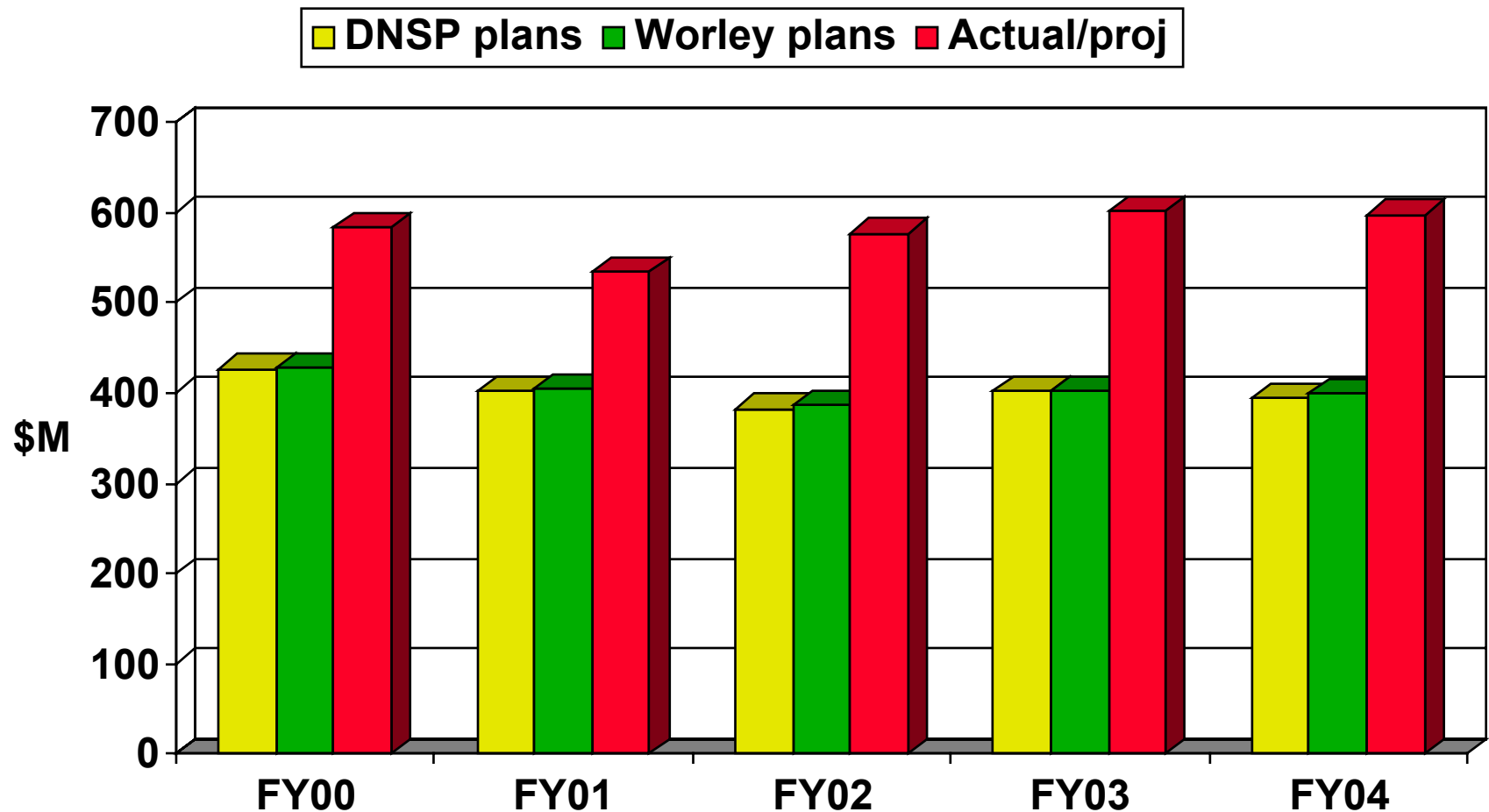
# Integral Energy actual & forecast growth 2000-2004 & 2005-2009

(IE Submission, IPART DNSP Review, 2003)

<b>Demand Compound Growth rates (2000 – 2004)</b>	<b>1999 Determination forecasts</b>	<b>Actual/Forecast</b>
Winter	1.5%	0.4%
Summer	1.3%	2.9%

<b>Demand Forecast (2005-2009)</b>	<b>Medium Growth Scenario %</b>
Total Energy Sales (GWh)	2.0 pa
Customer Numbers	2.3 pa
Standard Weather Maximum - Winter Demand	2.0 pa
Standard Weather Maximum - Summer Demand	2.7 pa

# Actual & projected DNSP capital expenditures (IPART, DNSP Review, 2003)



Capital expenditure greater than expected due to unanticipated growth in demand  
Distribution network services & distributed resources © H Outhred

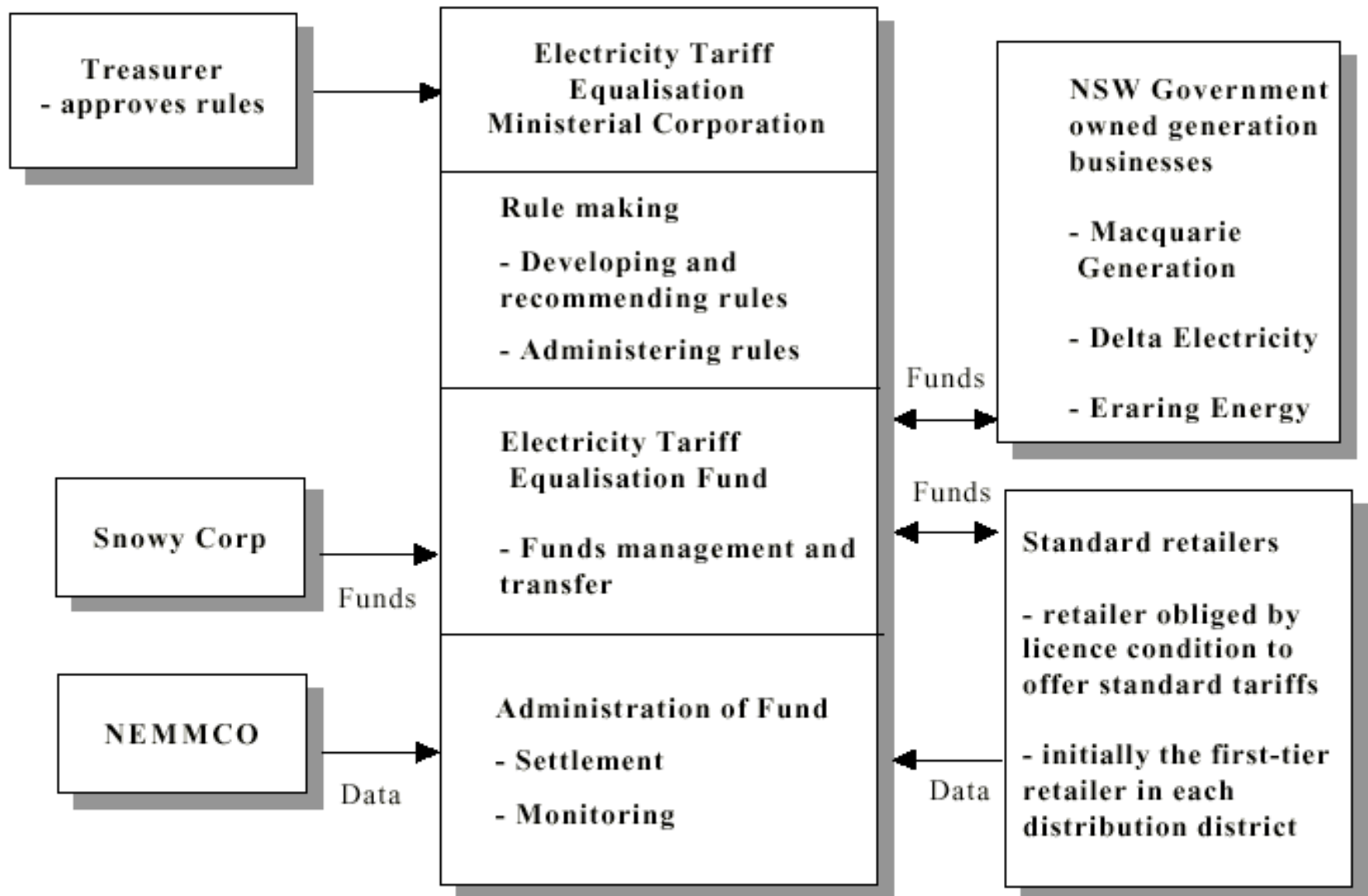
# NSW Electricity Tariff Equalisation Fund

(NSW Electricity Supply Amendment Act, 2000, applying from 2001)

- Hedging facility to cover “default tariff” load:
  - Between state-owned retailers & Ministerial Corp’n, underwritten by state-owned generators:
    - Strike price based on IPART estimate of LRMC
    - Volume set *ex-post* at NEM settlement:
      - Uncertain volume deters gens from other contracts
    - Return of ETEF surplus to gen’s is discretionary:
      - Reduces their incentive to offer lower than LRMC
      - Encourages them to bid up spot price if ETEF high
- Poor social, economic & environmental policy
  - Winners: residential air-cond, interstate gen’s
  - Losers: low income & contestable consumers

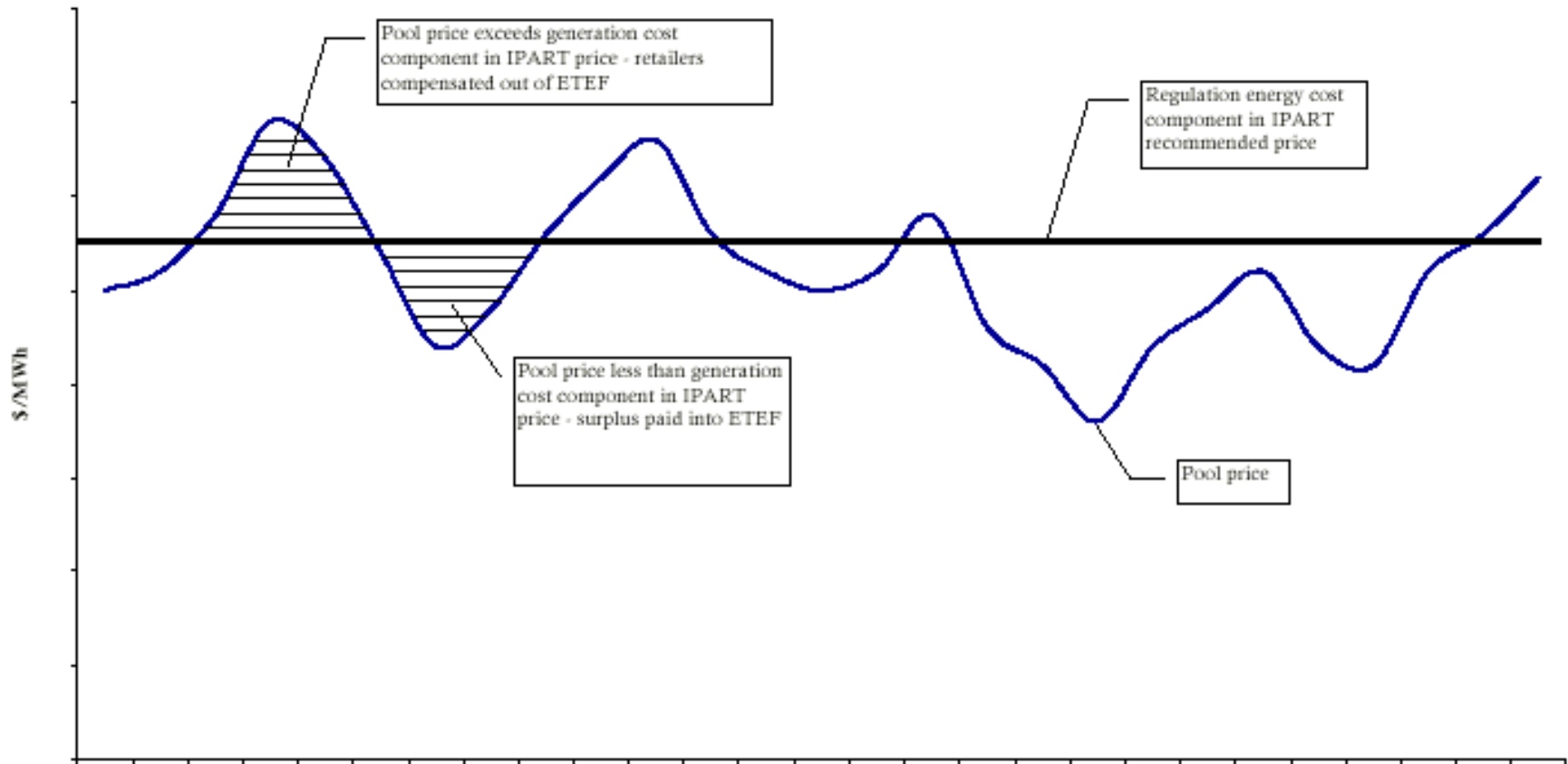
# Institutional structure for ETEF

(NSW Treasury, December 2000)



# NSW Electricity Tariff Equalisation Fund

(NSW Treasury, December 2000)



For each retailer, the volume of energy covered is that supplied under default (regulated) retail tariffs. This creates moral hazards for both retailers & customers. The load-shape may worsen & the effective LRMC rise.



# EnergyAustralia residential airconditioning marketing campaign, December 2000

“EnergyAustralia can provide you with advice on your airconditioning needs. Just call 131364 and talk to our energy experts about 2 years interest free on any airconditioning system”  
(EnergyAustralia “bill stuffer”, 12/00)

*Supported by NSW government’s  
Electricity Tariff Equalisation Fund,  
with volume set ex-post*

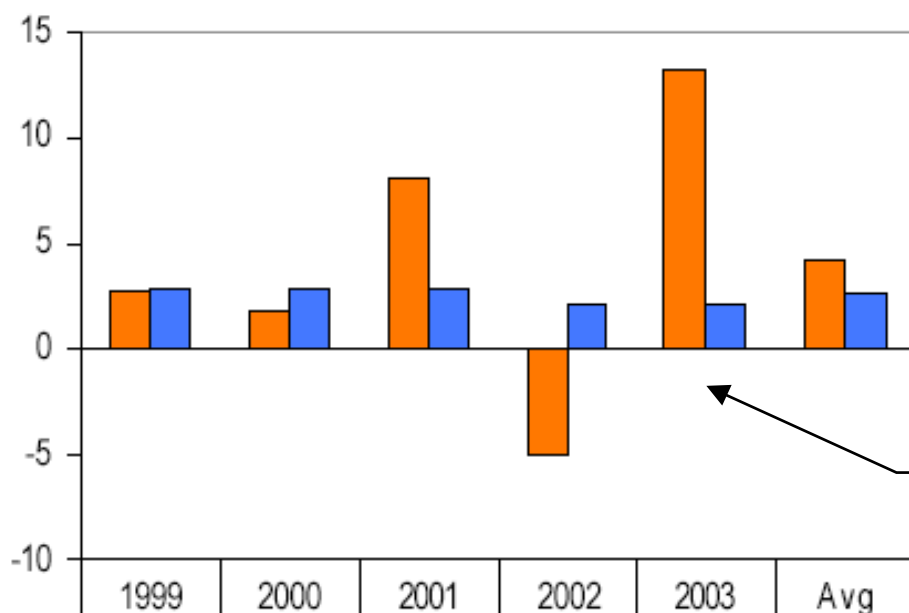
# EnergyAustralia summer peak demand

(EA submission, IPART DNSP review, 2003)

## Summer peak actual vs forecast

1999 - 2003

Annual Growth (%)



## Actual summer demand growth

- EnergyAustralia moving to summer peaking
- Shape of summer demand de-rates existing capacity.

Uncertain weather-driven  
needle peak demand

Actual	2.8	1.7	8.1	-5	13.3	4.2
1998 Forecast	3	3	3	2	2	2.6

Summer of Year

# Conclusions

- Distribution network services:
  - Important to availability & quality of supply
  - Significant fraction of bill for small end-users
- Potentially in competition with distributed resources but difficult to achieve in practice:
  - Dysfunctional retail market design
  - Near-impossible to regulate effectively
- Improvements to retail market design:
  - Metering: interval energy & quality of supply
  - Tariffs: spot & forward design; ancillary services