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Publicly owned hydro: Hydro Tasmania & Basslink; The Snowy Mountains Scheme

www.ceem.unsw.edu.au

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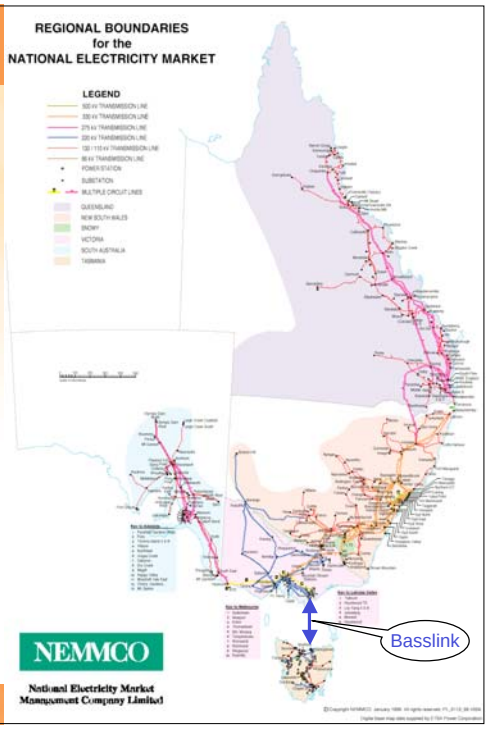
Scope of the NEM

- Queensland
- New South Wales & ACT
- Victoria
- South Australia
- Tasmania

(Basslink in 2006)

NEM regions are indicated, and their boundaries need not be on state borders (e.g. two regions in NSW)



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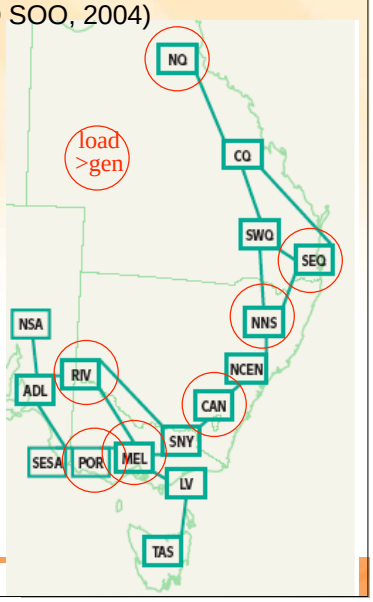
Node	Pk Ld (MW)	Gen Cap (MW)	Net Gen (MW)
NQ	1250	800	- 450
CQ	1900	4150	2250
SWQ	200	2150	1950
SEQ	4350	1450	- 2900
NNS	800	150	- 650
NCEN	10000	11650	1650
CAN	800	300	- 500
SNY	800	3900	3100
MEL	5750	800	- 4950
LV	900	7000	6100
POR	650	0	- 650
SESA	100	150	50
RIV	500	50	- 450
ADE	2100	2250	150
NSA	200	1100	900
TAS	1500	2500	1000

16 region NEM model
(NEMMCO SOO, 2004)



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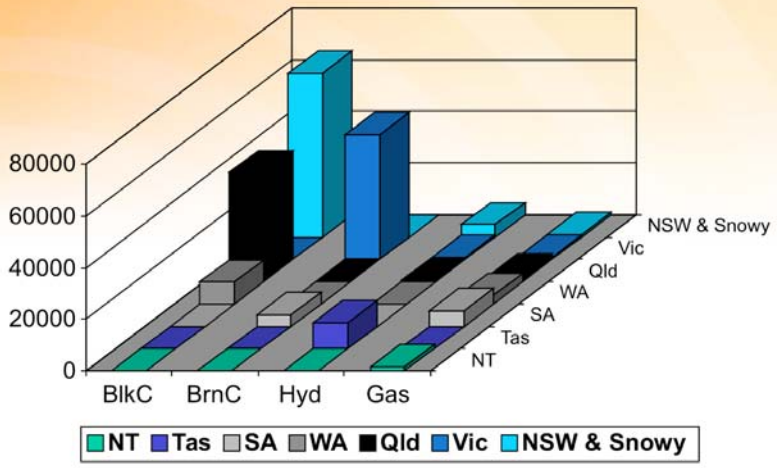
Electricity generation by fuel type & State (GWH/yr) 1900/01 (ESAA, 2002)



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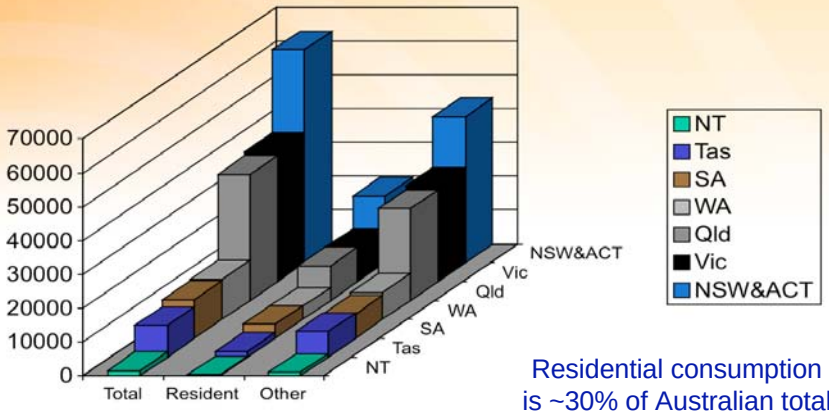
Electricity consumption by class (GWH/yr) 1900/01 (ESAA, 2002)



Residential consumption is ~30% of Australian total (higher in SA, lower in Tas)

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Current ownership status of the Australian electricity supply industry

Public ownership	Private ownership
▪ Most supply industry in NSW, Qld, Tasmania, WA, NT ▪ Tas & Snowy hydro schemes	▪ All supply industry in Victoria (all leased in SA) ▪ Most Queensland retail ▪ Basslink

Notes:
- Victoria & SA govts have a different perspective from other state govts
- Privately owned retailers in most states
- Concerns about existing or potential concentration of ownership
- End-use sector of the electricity industry is largely privately owned
- Basslink & Hydro Tasmania have a long-term contract that gives HT control over offers & Basslink operating profits (ACCC required HT to divest southward profit)

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Basslink (www.basslink.com.au)

- *"An electricity interconnector between Tasmania and Victoria. Securing supply and increasing competition. Bringing green Tasmania energy to mainland Australia. Reducing dependence on non-renewable energy."*
- Justification for high-cost link (approx $750m):
  - *"Energy needs*
  - *Increased competition and economic benefits*
  - *Environmental*
  - *Thorough approval process"*

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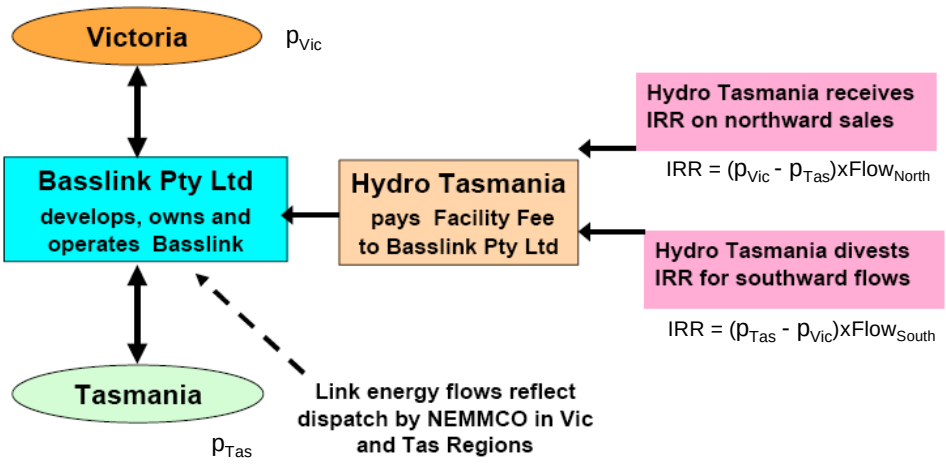
Basslink business model (Tas Govt, 2000)



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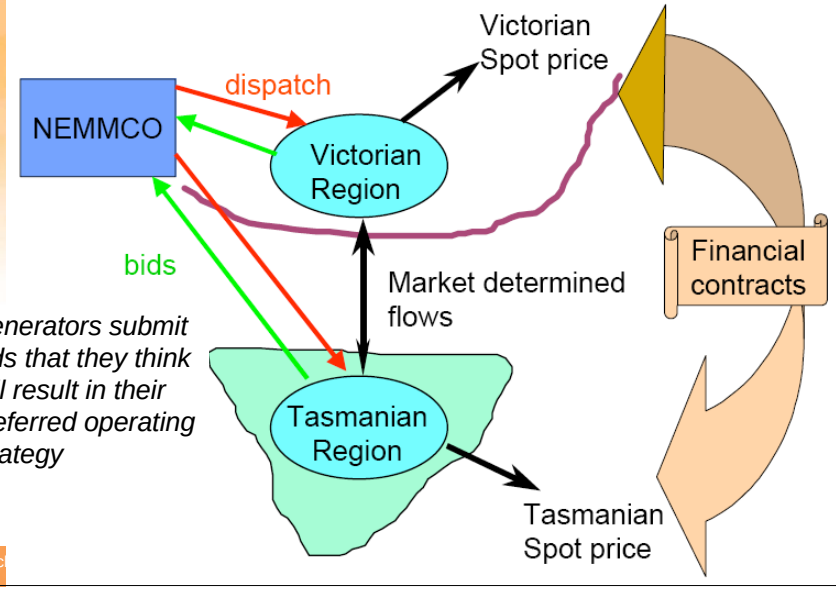
Basslink market operation (Tas Govt, 2000)



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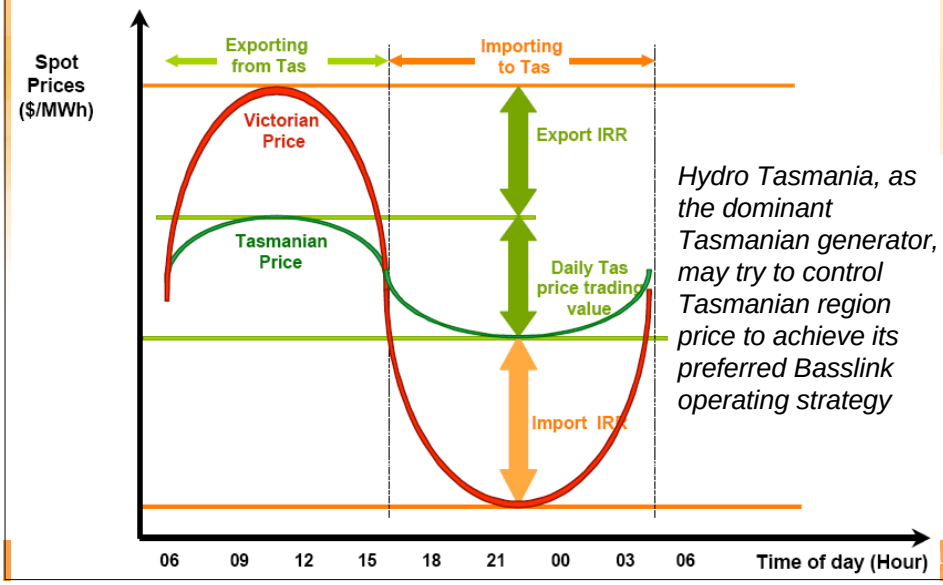
Spot price scenarios (Tas Govt, 2000)



Hydro Tasmania, as the dominant Tasmanian generator, may try to control Tasmanian region price to achieve its preferred Basslink operating strategy

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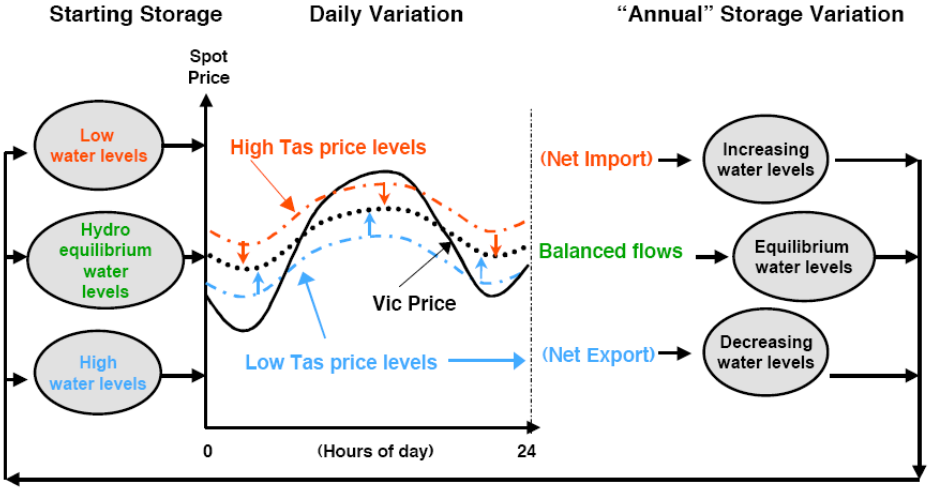
Expected storage level - price relationship
(Tas Govt, 2004)



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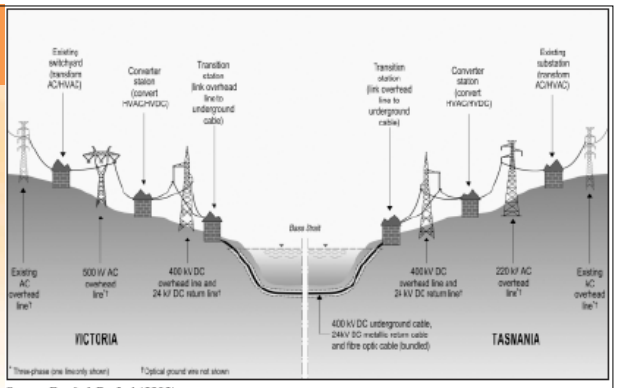
Basslink project
(JAP report, 2003)



Source: Basslink Pty Ltd (2002).

500kV AC | 400kV, 290km DC monopole | 220kV AC

Hydro Tasmania Press release, 30/8/06:

"The winter rains have not arrived. It has been a very dry winter in most parts of the State. If it wasn't for Basslink, our storages would be in a lot worse shape than they are now"

"Since it commenced commercial operation at the end of April, Basslink has been doing the job it was designed for. It is assisting in drought-proofing Hydro Tasmania's lakes and reflecting the true value of our unique integrated power system in a National Electricity Market environment"

"Basslink has also increased the efficiency of our hydro system by reducing spill from our smaller lakes at times of heavy rainfall and therefore increasing our energy production"

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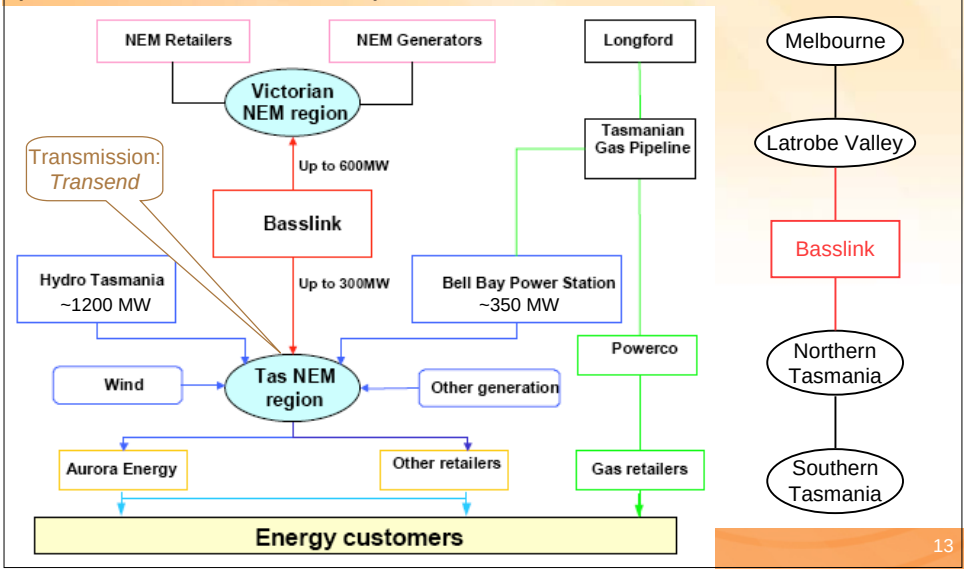
Tasmanian electricity & gas industries & Basslink
(Govt. of Tasmania, 2003)



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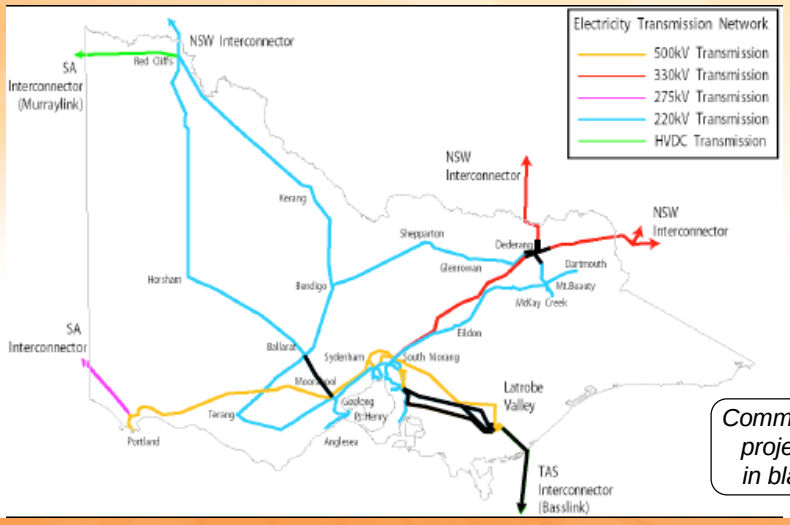
Victorian network (Vencorp, 2005)



Committed projects in black

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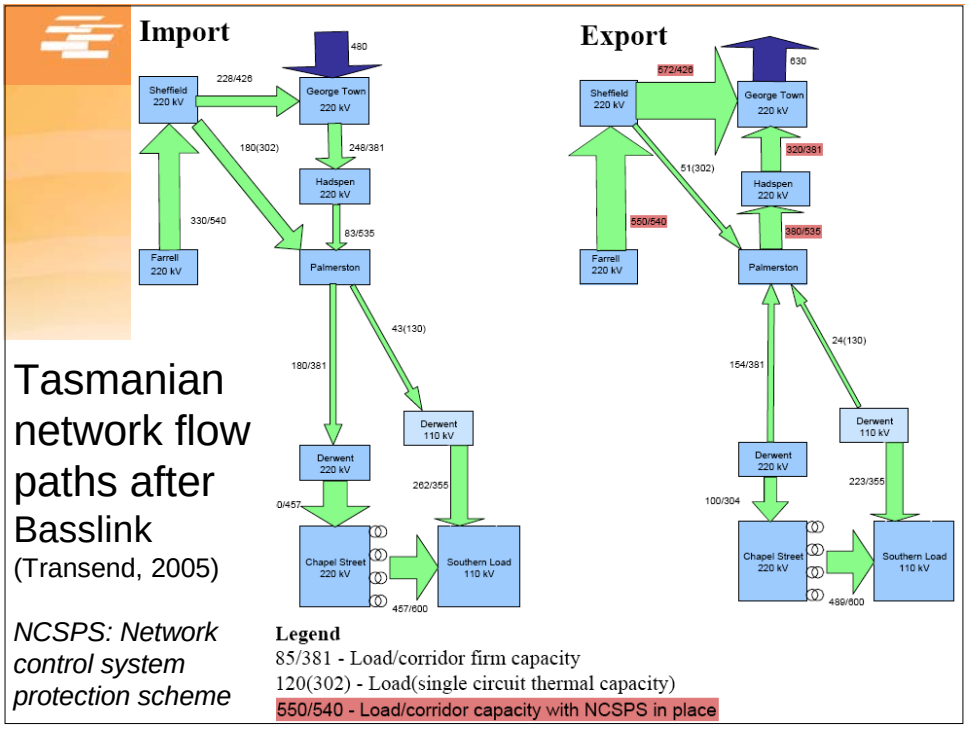
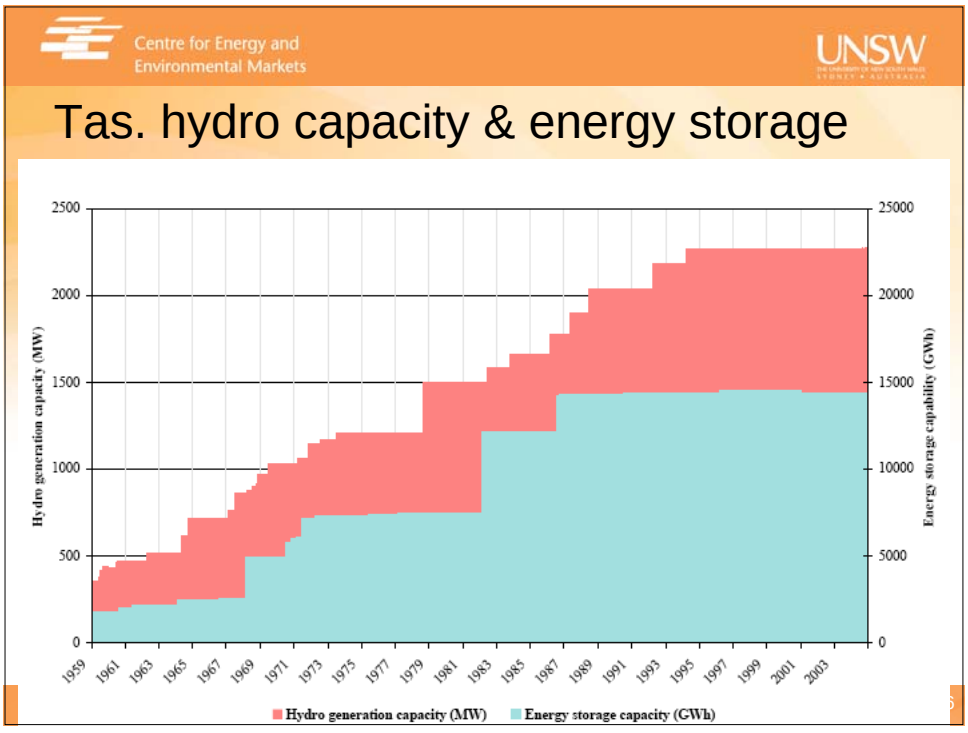
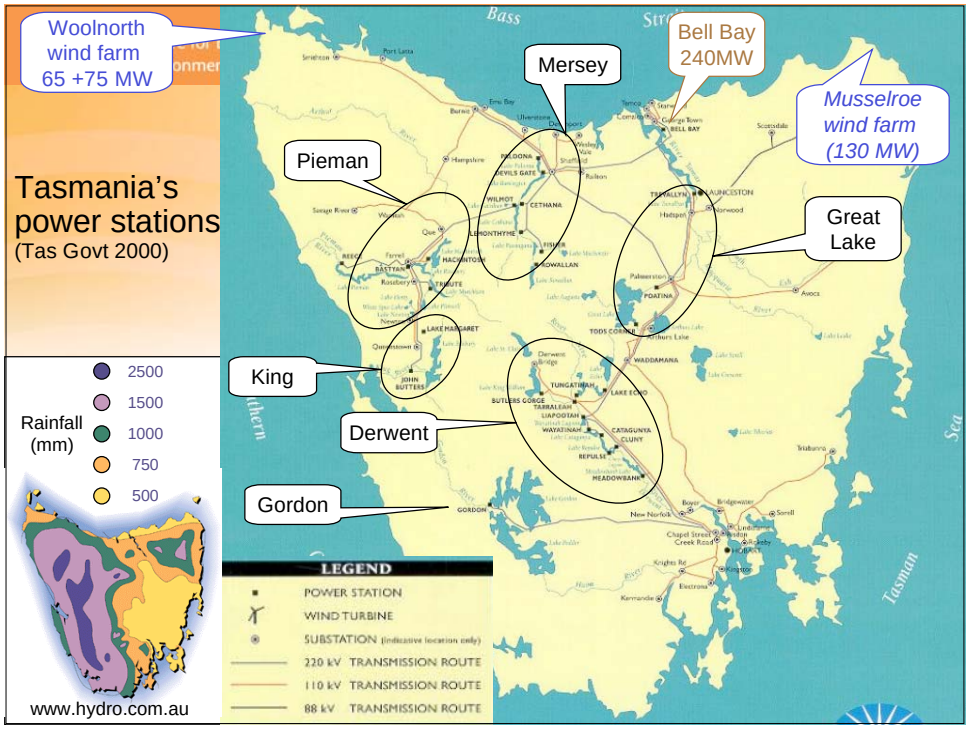


Tasmanian network flow paths after Basslink
(Transend, 2005)

NCSPS: Network control system protection scheme





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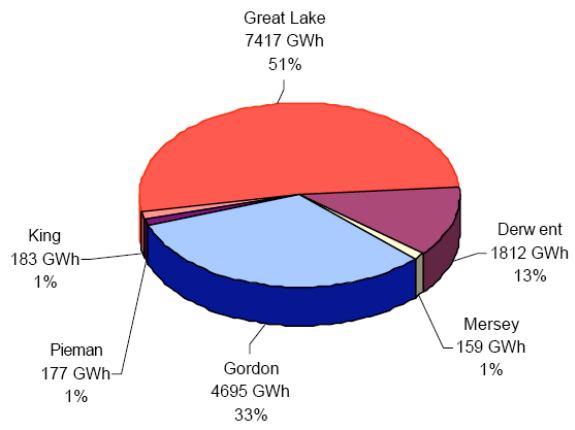
Tasmanian hydro storage capacities (GWh)
(Tas Govt, 2000)



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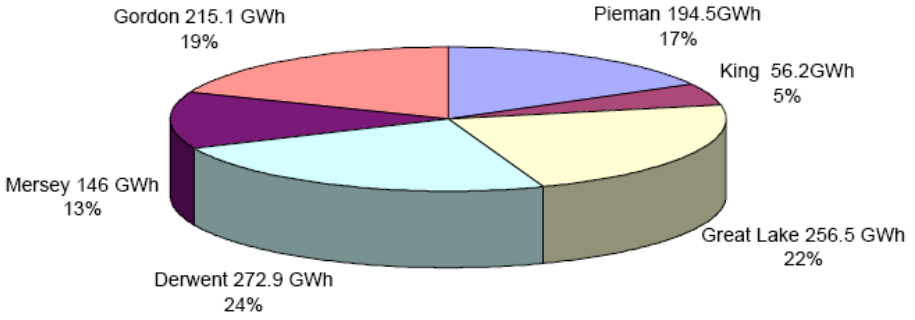
Tasmanian hydro production, FY00
(Tas Govt, 2000)



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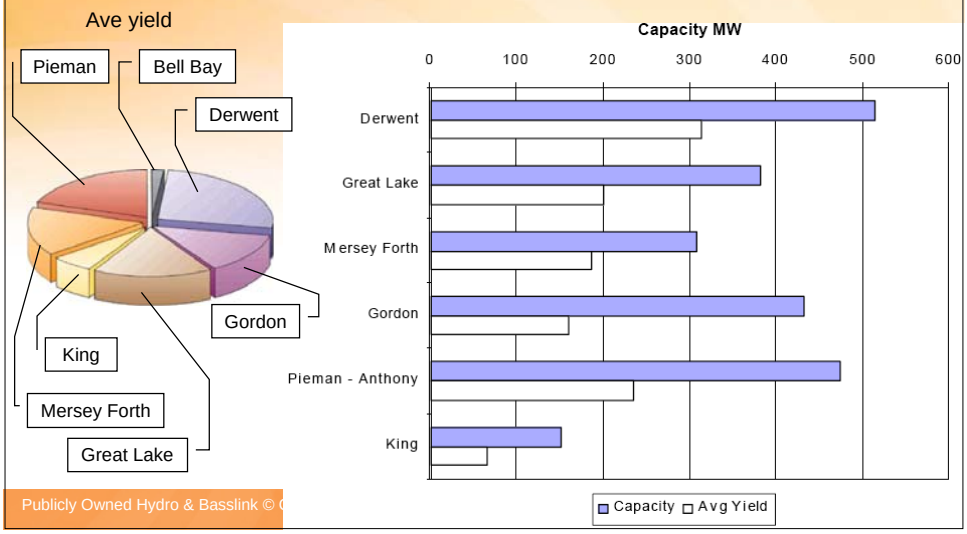
Hydro scheme ratings & average yields:
total ave. yield = 1180 MW (HydroTas. & Tas Govt, 2000)



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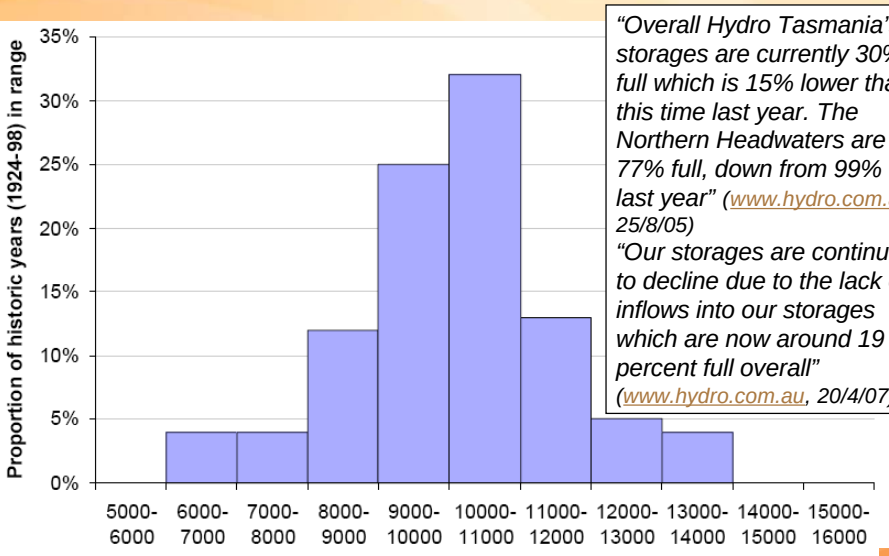
Distribution of 64 annual yields (Tas Govt 2000)



"Overall Hydro Tasmania's storages are currently 30% full which is 15% lower than this time last year. The Northern Headwaters are 77% full, down from 99% full last year" (www.hydro.com.au, 25/8/05)

"Our storages are continuing to decline due to the lack of inflows into our storages which are now around 19 percent full overall" (www.hydro.com.au, 20/4/07)

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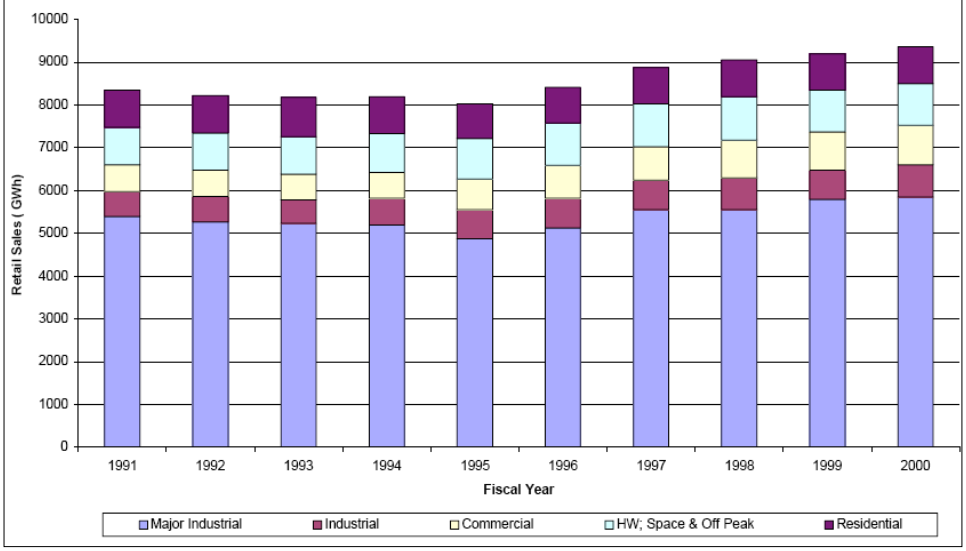
Tasmanian electricity sales (Tas Govt, 2000)



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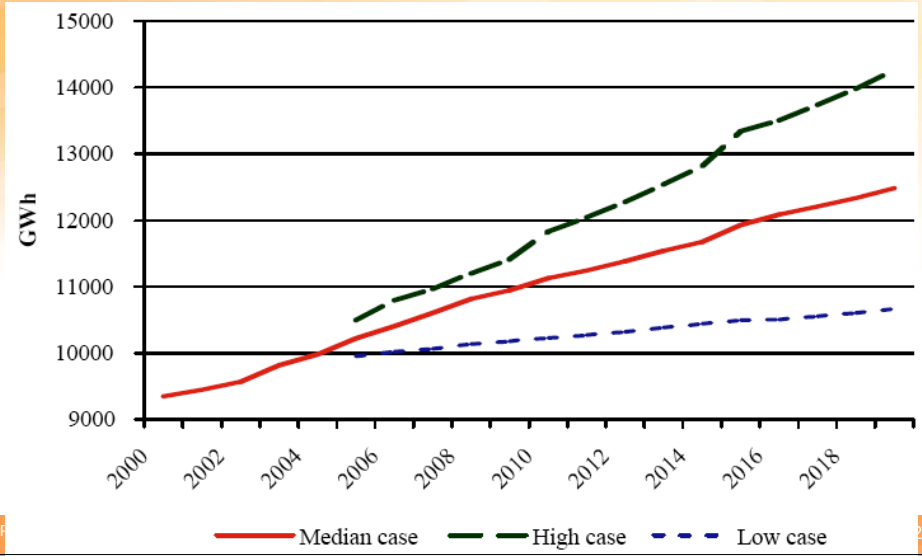
Projected Tasmanian annual electricity use
(Transend, 2005)



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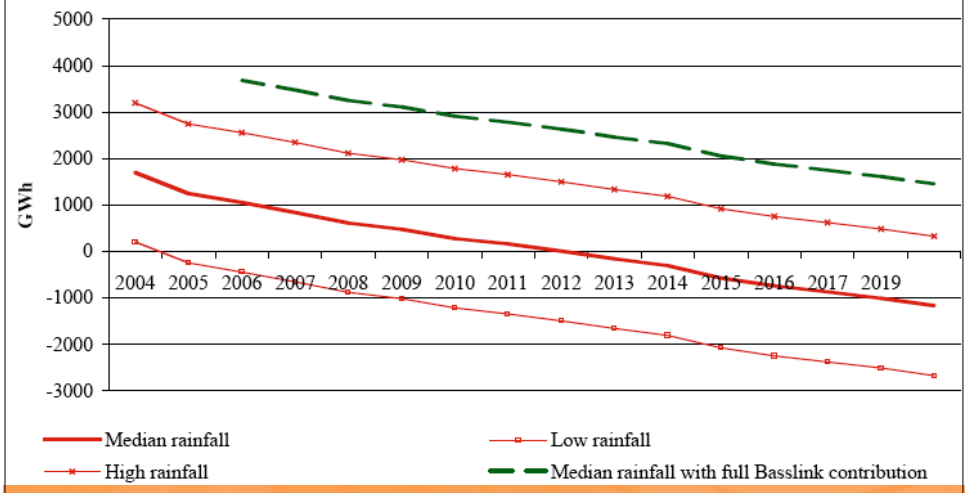
Projected Tasmanian excess energy capacity
(Transend, 2005)



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Tasmania & mainland electricity industries
(Tas Govt, 2000)

Box 1: Tasmania in Comparison with the NEM

Tasmania	NEM States
• Small generation sector - 9800 GWh	• Large generation sector - 158,000 GWh
• Almost exclusively hydro generation	• Largely thermal generation
• Integrated operation of generation facilities to ensure maximum generator efficiency	• Competition drives efficiency
• Energy constrained	• Capacity constrained
• Most electricity generated is used by a small number of major customers	• More balanced load profile
• ~~No natural gas at present~~	• Natural gas available

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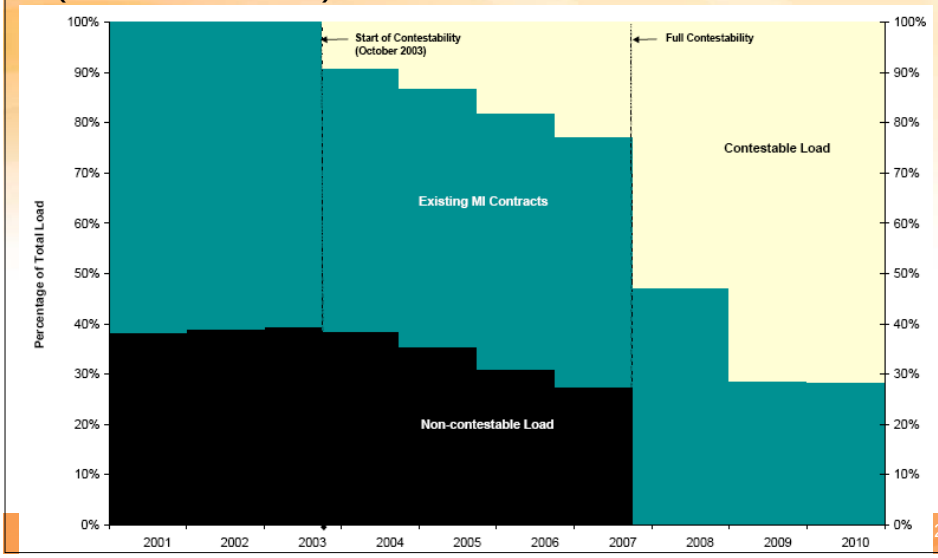
Anticipated increase in contestability
(Tas Govt, 2000)



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Issues for Tasmania

- Primary energy resource issues:
  - Hydro & wind energy:- resource uncertainty
  - Basslink & gas pipeline:- cost recovery
- End-use issues:
  - Electricity-intensive industry; retail contestability
- Electricity network issues:
  - Basslink & network within Tasmania
- Electricity market issues:
  - Competition in wholesale & retail markets
- Regulatory framework

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Primary energy resource issues

- Hydro energy:
  - Excellent resource but unsuited to competition:
    - Inter-temporal & catchment links in generation
    - Climate change uncertainty in inflow: both Tasmania & Snowy
- Wind energy:
  - Large resource; potential entry barriers including MRET, network augmentation, planning
  - Implications for system operation:
    - Added uncertainty in power flows, displacing high-inertia hydro
- Basslink & gas pipeline:
  - Unsuited to competition in first decade after construction:
    - Capital cost recovery takes precedence
  - Basslink reliability?

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Concerns about high wind penetration in Tasmania (Piekutowski et al, 2005)

- Frequency management:
  - Low inertia, effects of large frequency excursions & high rates of change
- Fault ride through capability of wind farms:
  - Risk of cascading outages
- Use of induction generators in wind turbines:
  - Reactive power and voltage control
  - Effects on supply quality
  - *Power electronic interfaces may reduce these impacts*

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Gas market issues

- Gas important for Tasmania:
  - Direct end use & electricity generation
  - More cost-effective energy transport than Basslink?
    - Gas ~ 1 $/GJ (3.6 $/MWH); Basslink ~ $20-25 $/MWH
- How competitive will Tasmanian gas market be?
  - Pipeline access terms; wholesale market rules
    - Minimise barriers to entry, manage peaks efficiently

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End-use issues

- Energy-intensive industry (Major Industrial):
  - Large volumes; sold at prices lower than NEM?
- Potential future role of gas in end-use & improvements in end-use efficiency:
  - What impact on electricity sales?
- Potential entry of independent retailers:
  - Hedging contracts for Tasmania RRP?
    - How efficient will SRA auctions be?
    - How reliable will Basslink be?
  - Traditional role of Tasmania's state-owned enterprise

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Electricity prices for aluminium smelters

"Drawing on an extensive range of sources, this paper concludes that smelters in Australia pay, on average, around $21 per megawatt-hour (MWH) of electricity. The notable exceptions are Portland and Point Henry in Victoria, where the smelters pay closer to $14 per MWH. For other smelters, the best estimates are that Bell Bay pays at most $23 per MWh, Tomago $22 and Kurri Kurri closer to $27."

H Turton, "The Aluminium Industry", The Australia Institute, Report No. 44, January 2002

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Electricity network issues

- Basslink:
  - Will be discussed next
- Network issues within Tasmania:
  - Flow constraints on existing network
  - Connection costs for wind farms
  - Technical requirements for wind farms
  - Who will determine & pay for network augmentation?

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Basslink

- Basslink article in *The Mercury*, 2/5/01:
  - "Unlikely to lead to increased competition" (attributed to Roger Oakley, Loy Yang Power)
    - This comment is "outrageous, naïve and ill-informed" (attributed to Tony Warnock, Hydro Tasmania)
- Key issues in resolving this argument:
  - Equality of access to Basslink by all participants
  - Extent of competition in Tasmanian wholesale & retail electricity markets
  - Who will pay for return on investment for Basslink?
    - 2-2.5 c/kWh appears to be required

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Equality of access to Basslink

- Basslink services agreement (BSA):
  - Hydro Tasmania pays fee to owner, NGIL
  - HT receives inter-regional revenue for 25 years
  - Basslink to bid at zero unless requested by HT
- Apparent implications:
  - HT gains full control over Basslink operation
  - HT to sell southward IRR
    - But as a monopolist & dominant Tasmanian generator
- Conclusion:
  - This doesn't look like equal access

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Generation competition in Tasmanian wholesale electricity market

- HT to be retained as a single entity:
  - Independent consultant recommended two?
  - 2260 MW capacity, 1150 MW long term ave:
    - *Assume 150 MW ave flow north over Basslink and thus 1000 MW ave in Tasmania*
- New entrants:
  - Bell Bay JV (234-365 MW, *say 200 MW ave*)
  - Basslink (300 south, *say 100 MW ave south*)
  - Bell Bay Govt (114 MW, *say 50 MW ave*)
  - Others (~100 MW, *say 50 MW ave*)

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Tasmanian retail electricity market

- Single incumbent retailer:
  - Risky choice?
  - Implications of BSA & MI vesting contracts?
- Desirable to separate distribution & retailing:
  - Reduce barriers to entry for new retailers
  - Allow more equal treatment of distributed resources
  - Separate quality and availability of supply & distribution pricing from energy pricing

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Tasmania's regulatory framework

- Particularly important given small market size and emerging role of gas & "new" renewables:
  - Sale of Hydro Tasmania would be difficult
- Important to achieve consistency between:
  - Electricity and gas
  - Economic and technical regulation
  - Industry regulation & social policy
- Limits to regulation:
  - Competition preferable to regulation
  - Supervised negotiation when insufficient competition

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The effects of restructuring in Tasmania

- Electricity market issues:
  - Will there be adequate competition in wholesale & retail markets? *Possibly not*
  - Will full retail competition in electricity & gas be politically acceptable? *Electricity prices may rise*
- Gas market issues:
  - Should Tasmania adopt the Vencorp gas market design? *Deserves careful consideration*
- Regulatory issues:
  - Will there be adequate regulatory independence? *Essential to achieving good social outcomes*

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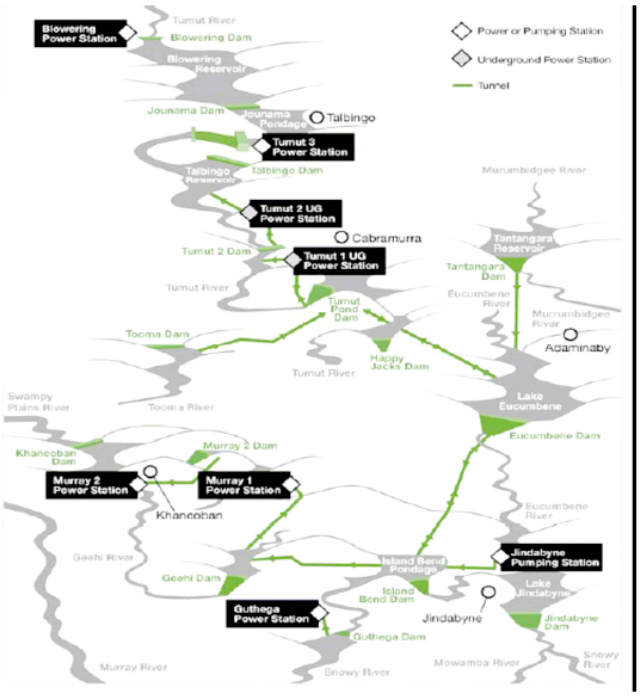
Snowy Mountains Scheme
(NSW LC, 2006)



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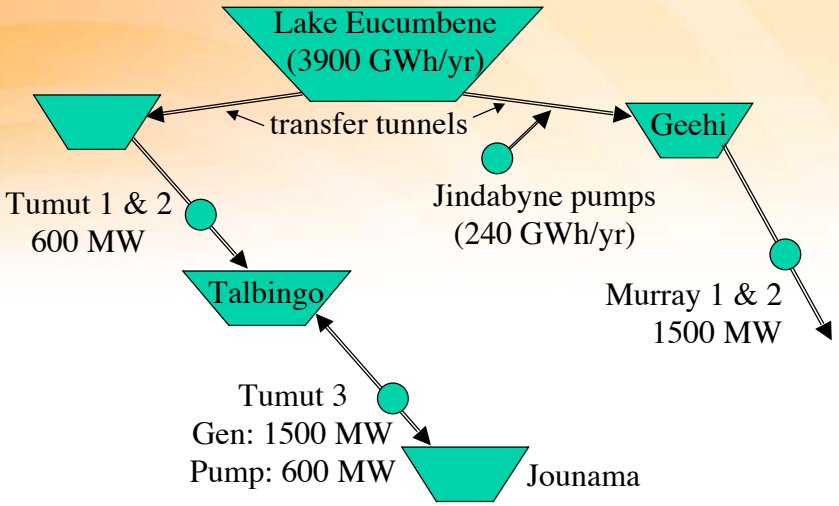
Snowy Mountains Scheme



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Snowy Scheme operating characteristics

- Physical short-term risk management:
  - On average supplies about 14% of NEM energy
  - Can provide up to 1GW in 5 minutes & 3GW in 10 min
  - Frequency & network control ancillary services
- Financial short-term risk management:
  - Derivative contracts with retailers & other generators
- Subject to:
  - Technical performance
  - Water release obligations (irrigation, environmental)
  - Inflows into storages

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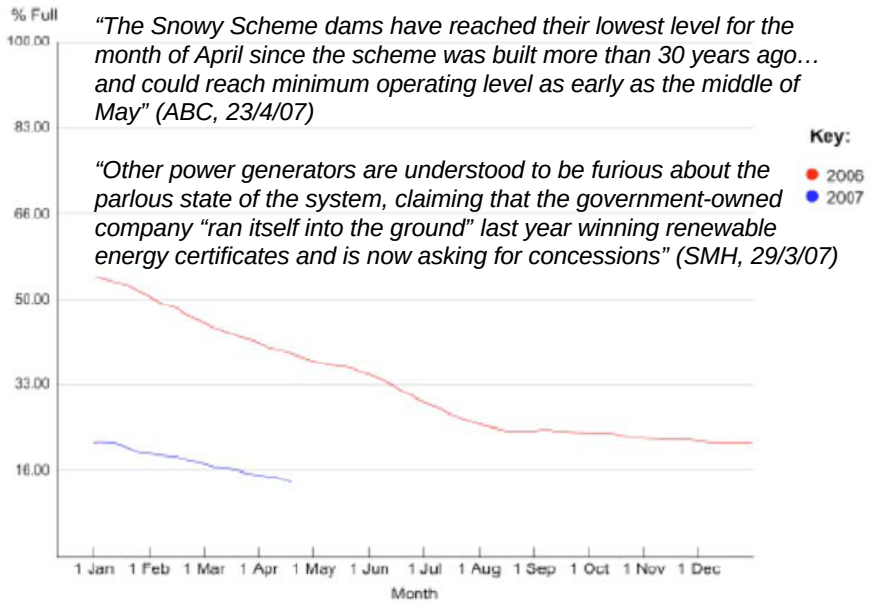
Key issues for the Snowy Scheme

- Operating characteristics:
  - Large storages on the east side of the mountains
  - Small operating storages on the west of the mountains, which run dry if high power output maintained too long
  - East-west transfer tunnels are gravity-fed & so flow drops as eastern storage levels drop
- Long-term issues:
  - Management of inflows & eastern water storages
  - Refurbishment and enhancement of the Scheme
  - Irrigation & environmental releases, which are seasonal

Lake Eucumbene Levels - 2006 & 2007

"The Snowy Scheme dams have reached their lowest level for the month of April since the scheme was built more than 30 years ago… and could reach minimum operating level as early as the middle of May" (ABC, 23/4/07)

"Other power generators are understood to be furious about the parlous state of the system, claiming that the government-owned company "ran itself into the ground" last year winning renewable energy certificates and is now asking for concessions" (SMH, 29/3/07)



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Attempted Snowy Scheme sale, 2006

6/02	Snowy scheme corporatised: *Snowy Hydro Limited*
12/05	Snowy sale announced
6/06	Snowy sale cancelled

Controversial issues:
- Snowy's perceived growth imperative & need for capital
- Water "entitlements" for irrigation & environment
- Concern about privatising an icon
- Consultation during the sale process

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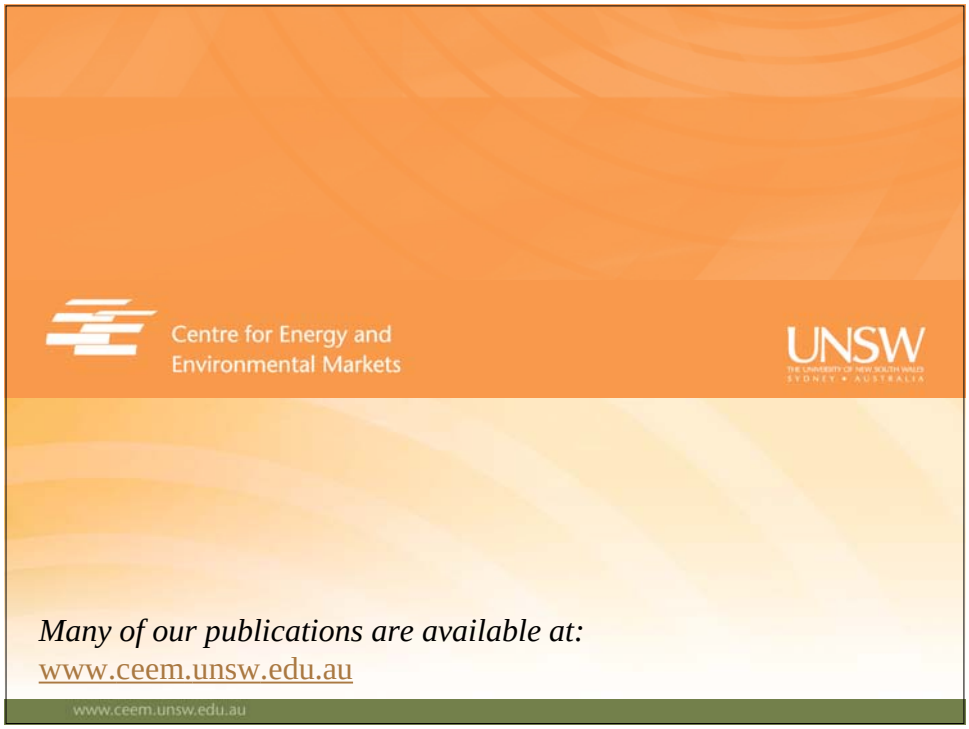
Conclusions

- Basslink:
  - Monopoly, expensive DC link between 2 NEM regions
  - DC links are complex, expensive, may be unreliable & are difficult to model well in NEM market rules
- Large hydro schemes:
  - Capital intensive, long asset lives, large externalities (water values, environmental impacts, uncertain inflows)
  - High operating values: flexibility, reliability, low water cost
  - Difficult to privatise in a reasonable manner
- Both DC links & hydro require effective governance:
  - Have revealed weaknesses in the NEM case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