Centre for Energy and Environmental Markets

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Water: managing a scarce resource

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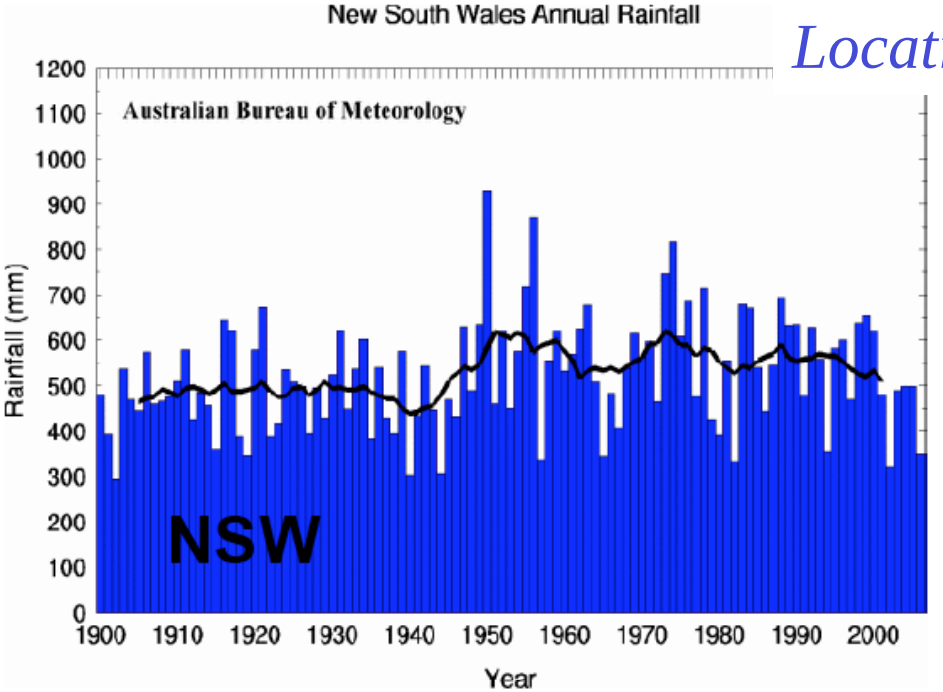
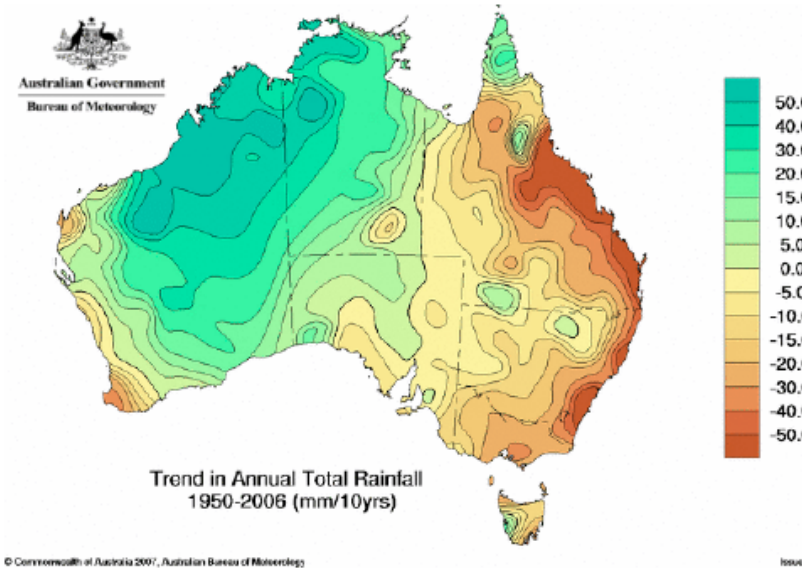
Water - the resource & its use

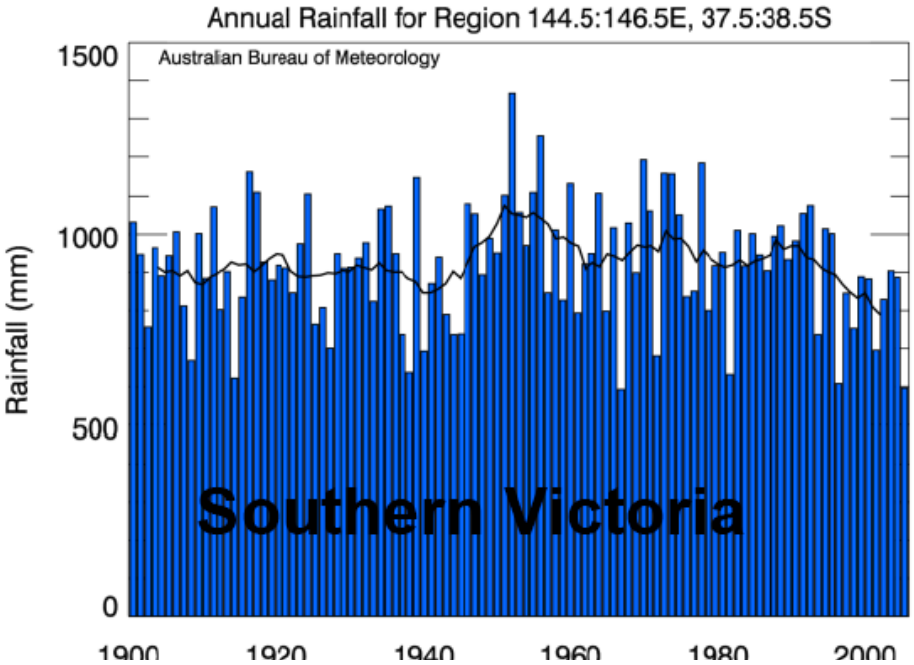
- Water resources (subject to quality & availability):
  - Rainfall (relatively low & highly variable in Australia)
  - Above ground flows & storages (rivers, lakes, dams, etc.)
  - Groundwater flows & storages (if identifiable, accessible)
  - Convertible resources (eg sea-water, waste water)
- Water uses & values:
  - Ecosystem services (humans, plants, animals):
    - Quality often matters
  - Agriculture, industry, commerce, recreation
  - Water & electricity generation: hydro & cooling water
  - *Water is more than a commodity*

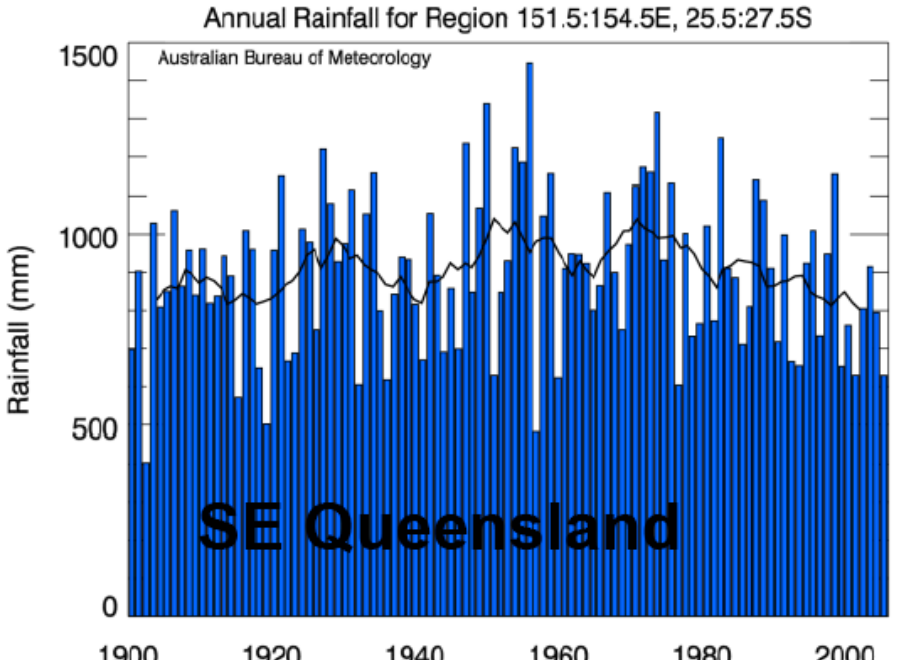
Trends in rainfall (Power & Whetton, 2007)

Location matters!



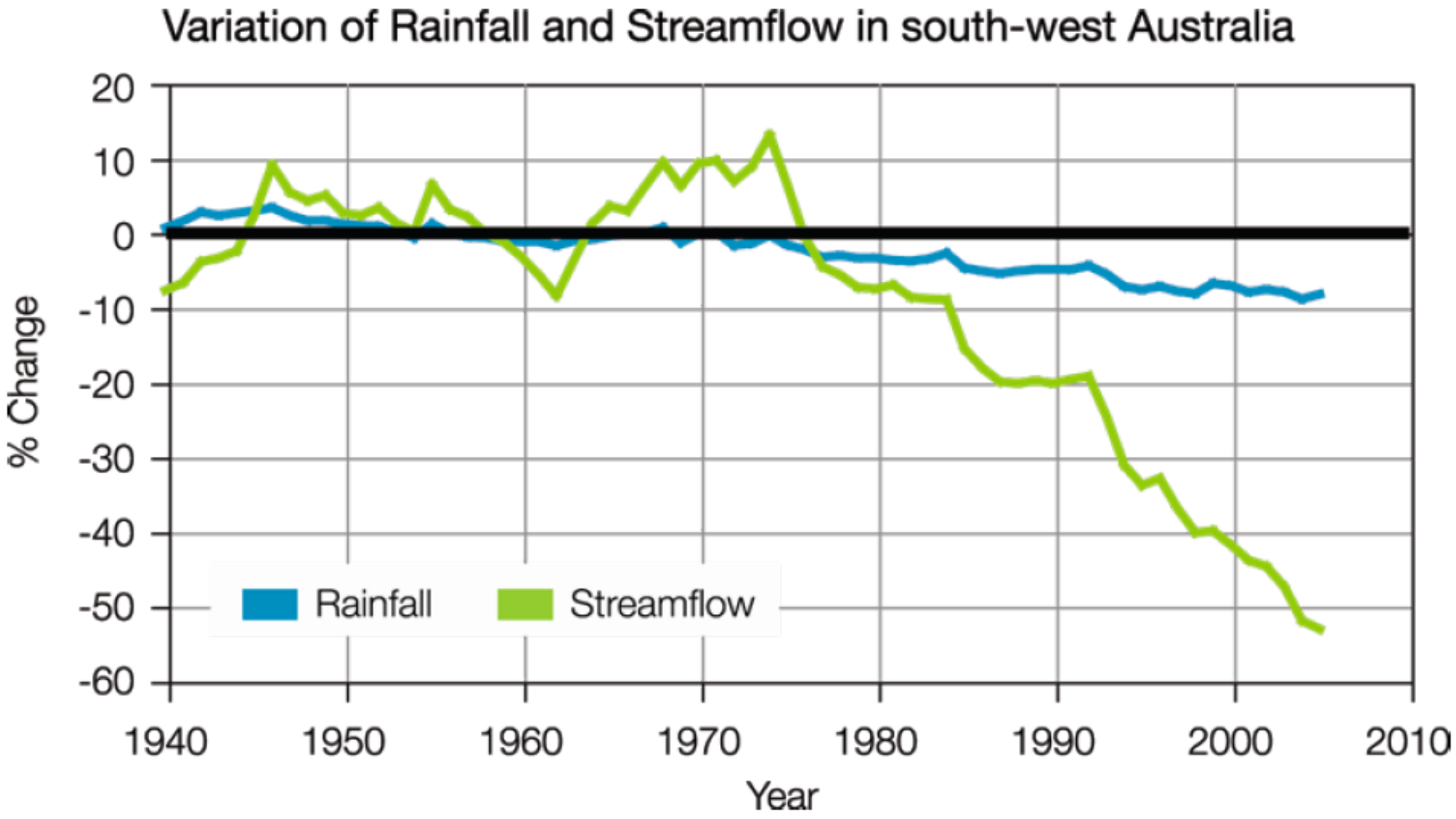






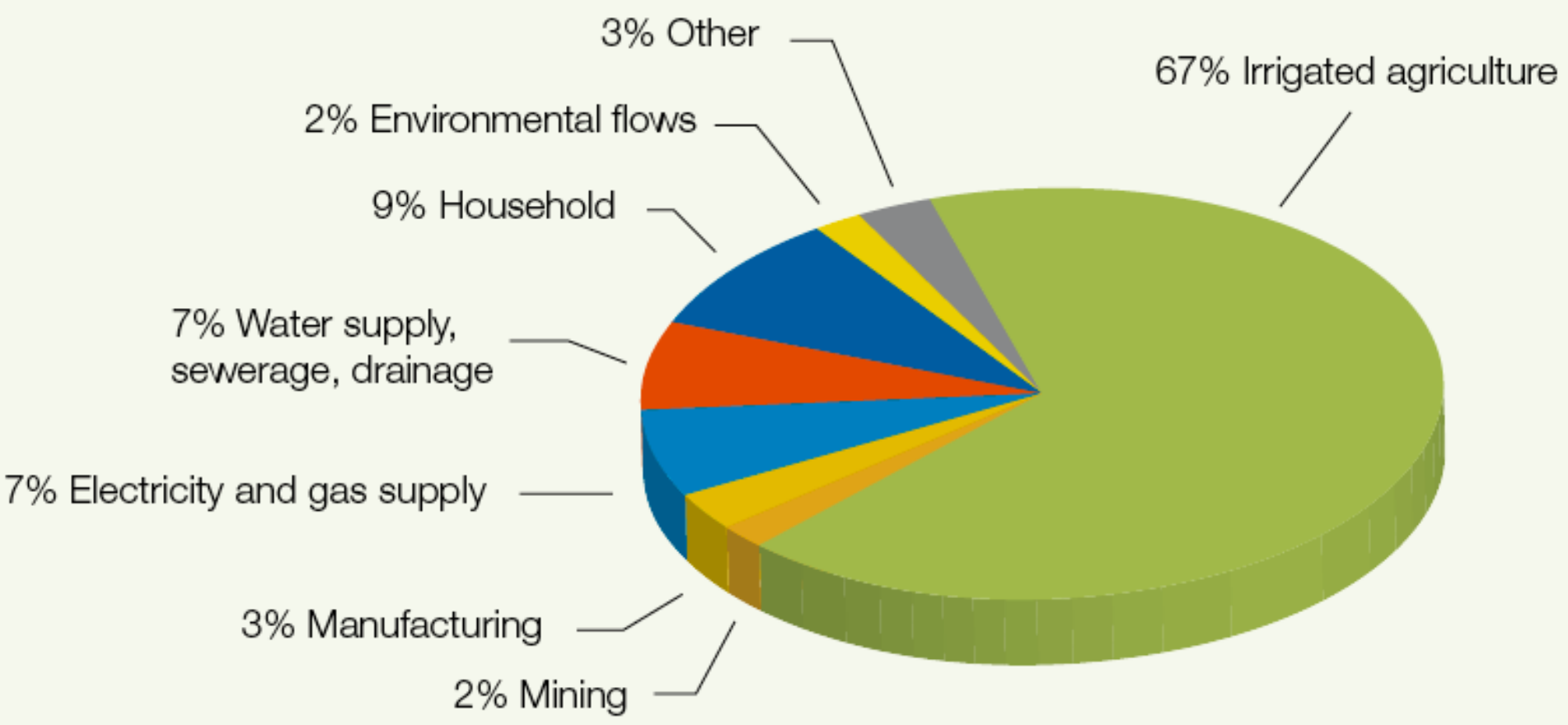
Streamflow depends on evaporation rate
(Power & Whetton, 2007)

- 2007 Sept rainfall lowest on record & Jan-Sept ave temp highest on record for Murray-Darling Basin

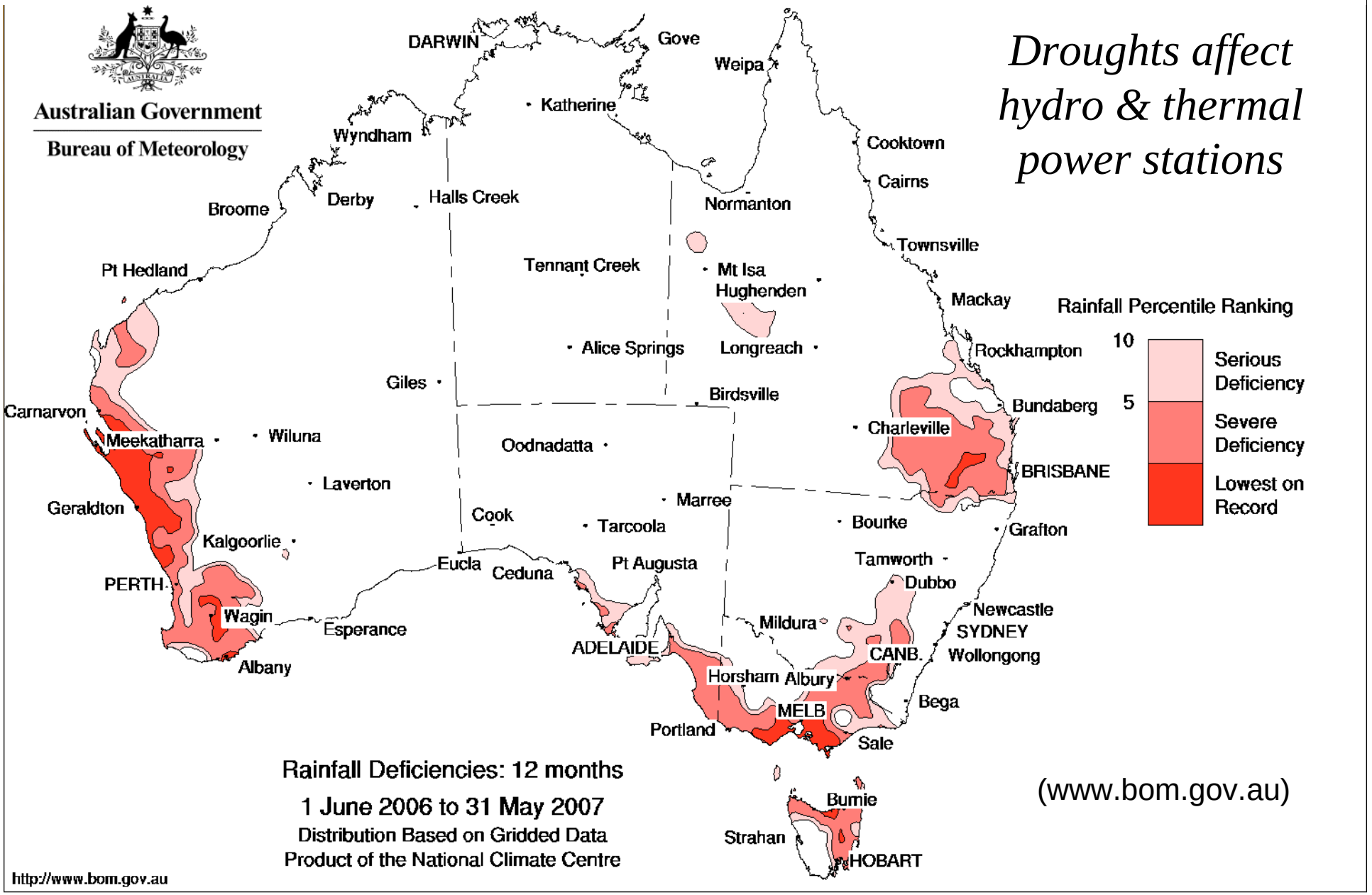


Water use in Australia

(State of Environment Report, 2006)



Drought & electricity generation (hydro & thermal)

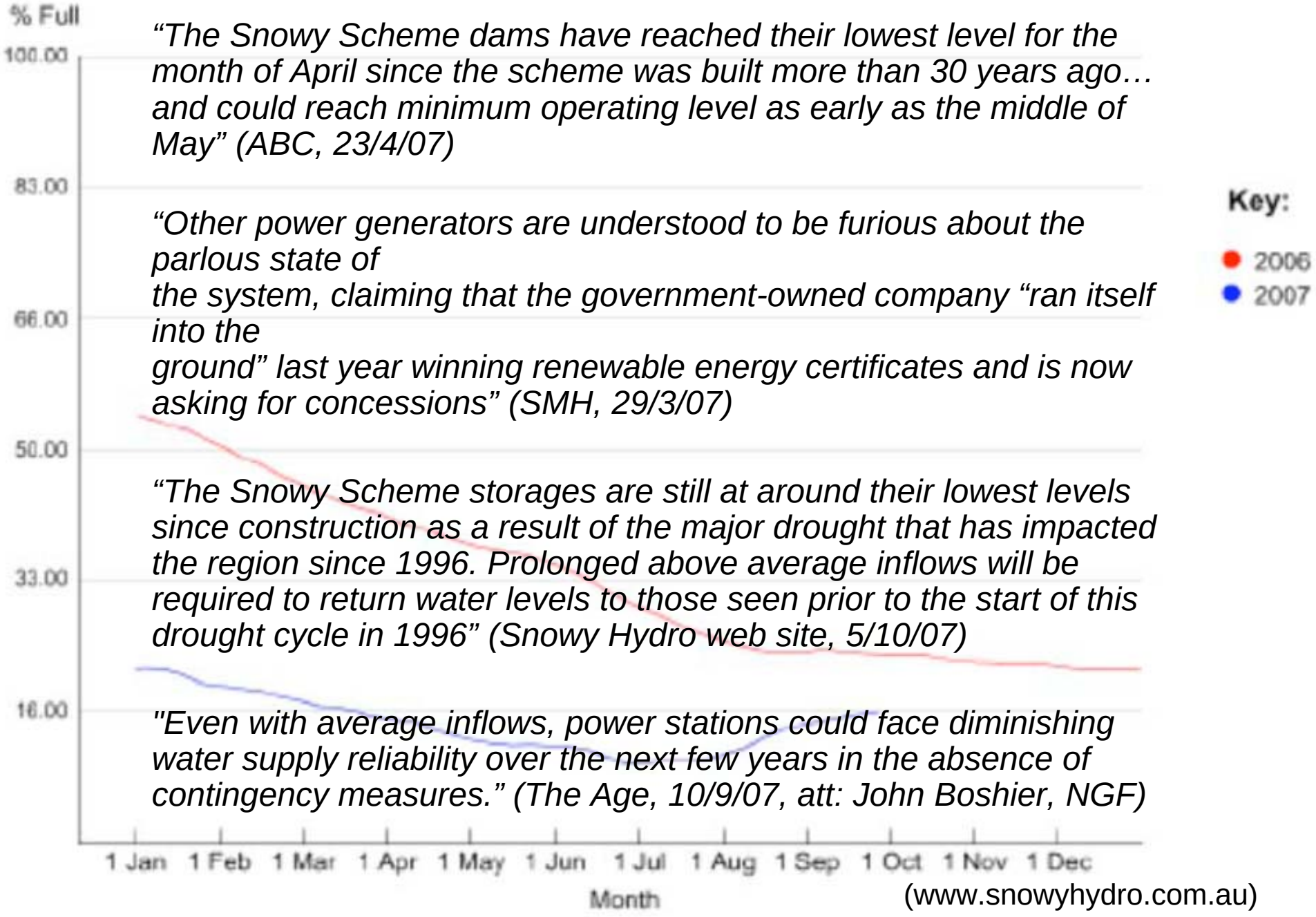


Droughts affect hydro & thermal power stations

(www.bom.gov.au)

Issued: 01/06/2007

Lake Eucumbine gross water 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)

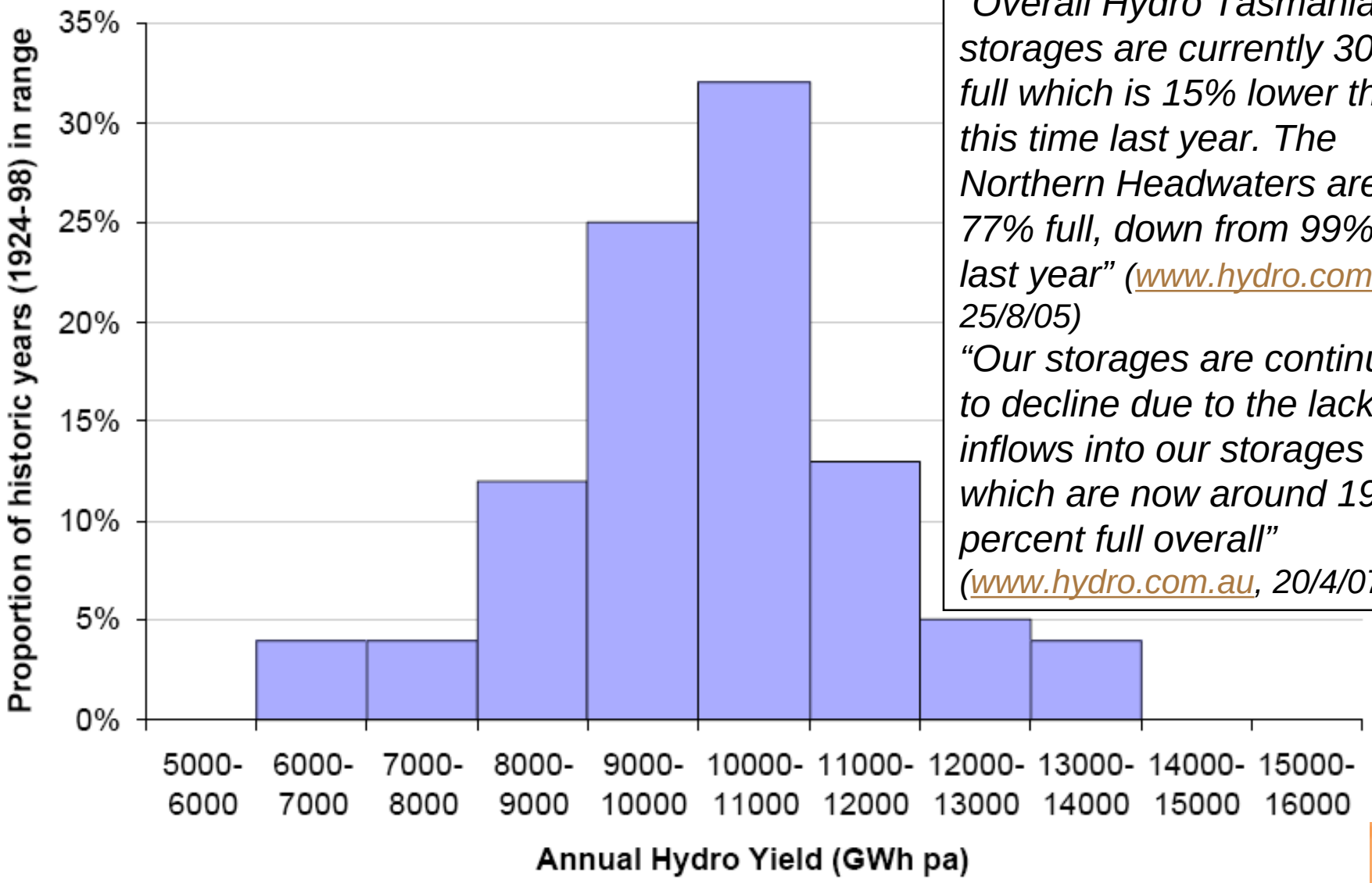
"Other power generators are understood to be furious about the parlous state of the system, claiming that the government-owned company "ran itself into the ground" last year winning renewable energy certificates and is now asking for concessions" (SMH, 29/3/07)

"The Snowy Scheme storages are still at around their lowest levels since construction as a result of the major drought that has impacted the region since 1996. Prolonged above average inflows will be required to return water levels to those seen prior to the start of this drought cycle in 1996" (Snowy Hydro web site, 5/10/07)

"Even with average inflows, power stations could face diminishing water supply reliability over the next few years in the absence of contingency measures." (The Age, 10/9/07, att: John Boshier, NGF)

(www.snowyhydro.com.au)

Distribution of 64 annual yields (Tas Govt 2000)

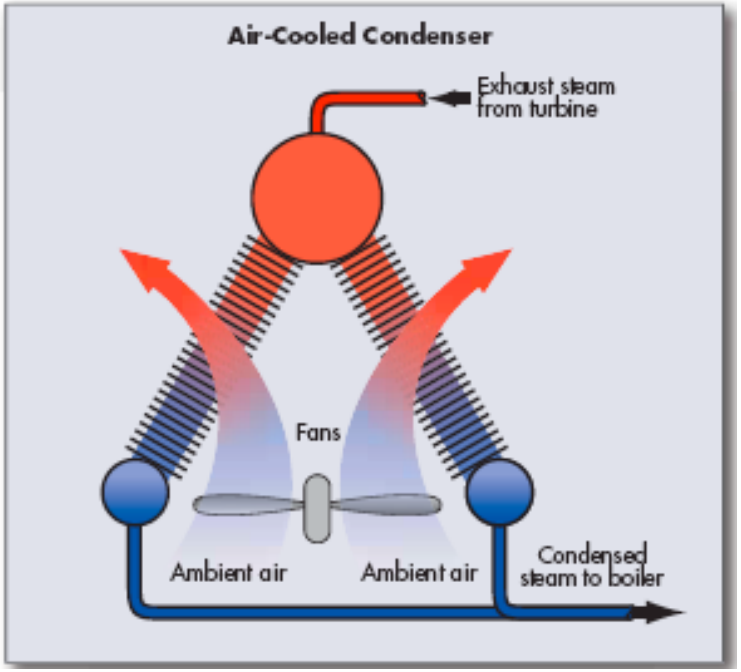


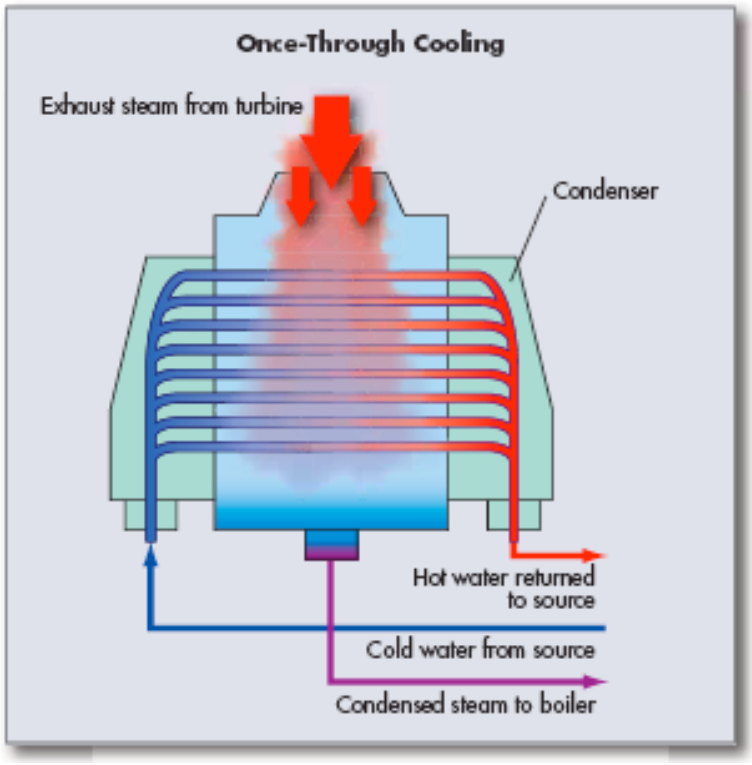
"Overall Hydro Tasmania's storages are currently 30% full which is 15% lower than this time last year. The Northern Headwaters are 77% full, down from 99% full last year" (www.hydro.com.au, 25/8/05)

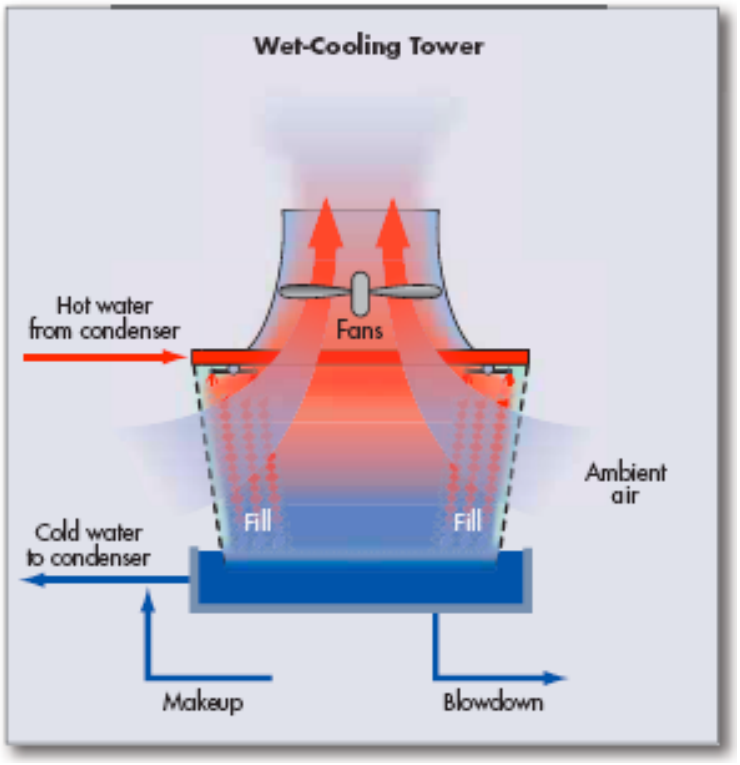
"Our storages are continuing to decline due to the lack of inflows into our storages which are now around 19 percent full overall" (www.hydro.com.au, 20/4/07)

Condensing steam in a thermal power station (EPRI, 2007)

- Once-through cheapest but heats water source (sea, lake, river)
- Wet-cooling requires make-up to replace evaporative water loss
- Dry-cooling uses least water but costs most & has efficiency penalty







NEMMCO Drought Scenarios Investigation, August 07

Capacity Reductions – Low rainfall Scenario									
		2007		2008				2009	
Region[6]		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
QLD	MW	820	820	700	820	820	500	500	500
	%	8%	8%	7%	8%	8%	5%	5%	5%
NSW	MW	0	0	0	0	0	0	0	0
	%	0%	0%	0%	0%	0%	0%	0%	0%
VIC	MW	220	600	1,635	2,845	635	1,015	1,030	1,860
	%	2%	7%	18%	32%	7%	11%	11%	21%
TAS	MW	5	5	5	5	10	10	10	10
	%	0%	0%	0%	0%	0%	0%	0%	0%
NEM Total	MW	1,045	1,425	2,340	3,670	1,465	1,525	1,540	2,370
	%	3%	3%	6%	9%	4%	4%	4%	6%

NEMMCO Drought Scenarios Investigation, August 07

- Risks appear to be growing with climate change, eg to:
  - Agriculture in Murray-Darling Basin
  - More than 50% of Australia's electricity generation
  - Higher electricity prices & reduced reliability of supply?

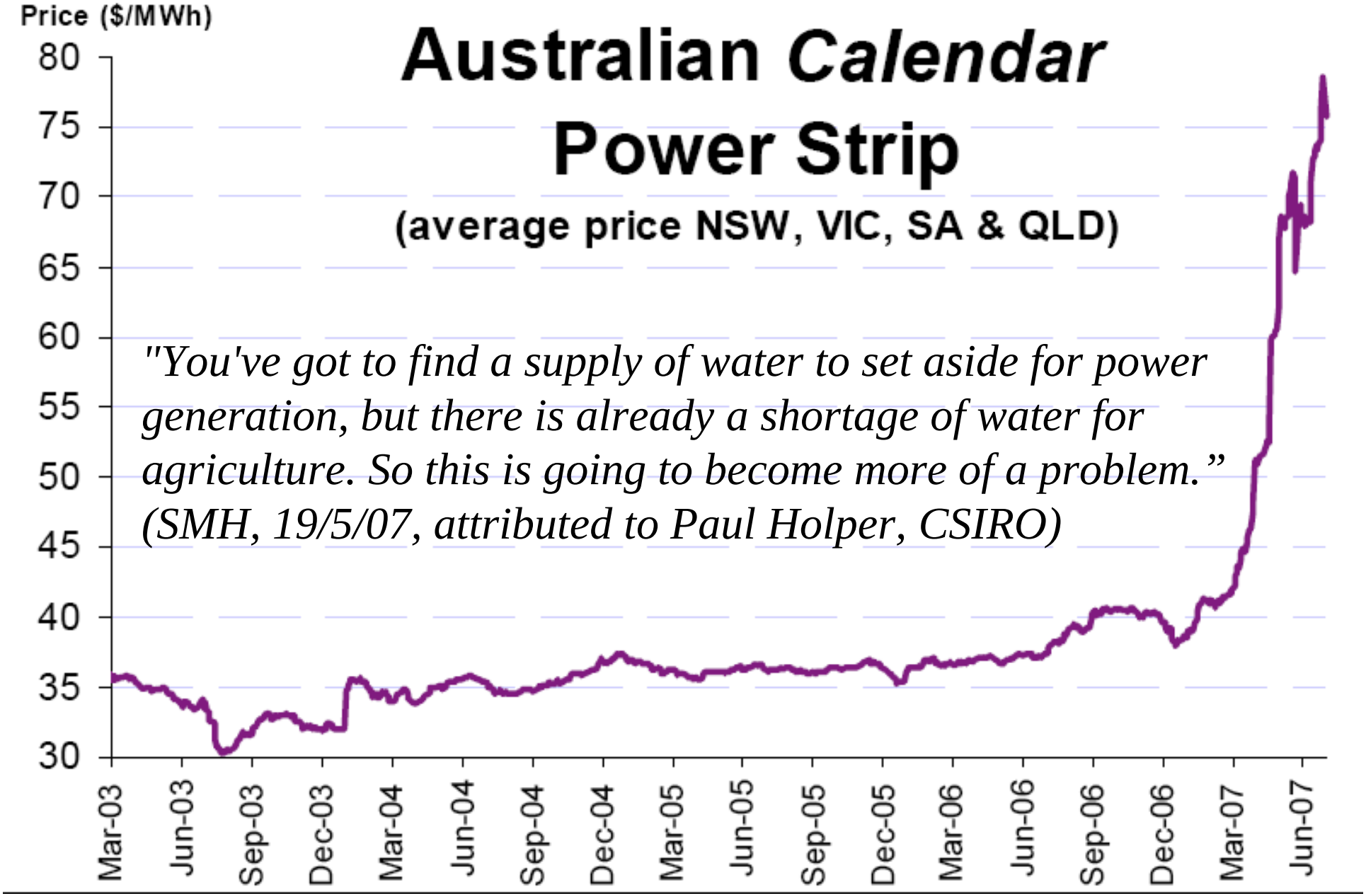
Annual EUE

Low rainfall		NSW	QLD	SA	TAS	VIC
2007/08	April report	0.001 %	0.004 %	0.003 %	0%	0.002 %
	August update	0%	0.002%	0.002%	0%	0.005%
2008/09	April report	0.009 %	0.006 %	0.007 %	0%	0.004 %
	August update	0%	0.001%	0.001%	0%	0.003%

(NEMMCO to provide quarterly updates)

Average rainfall		NSW	QLD	SA	TAS	VIC
2007/08	April report	0%	0%	0.003%	0%	0.002%
	August update	0%	0.002%	0%	0%	0%
2008/09	April report	0%	0.002%	0.005%	0%	0.003%
	August update	0%	0%	0%	0%	0%

Drought influencing CFD price? (D-Cypha)



Water - management issues & tools

- Issues:
  - Social & cultural issues important in water management
- Supply side options (few & expensive):
  - Reduce climate change emissions; desalination; river diversion; cloud-seeding; catchment management
- Demand-side options:
  - Improved water use practices:
    - Agriculture, industry, commerce and homes
    - Dry cooling for thermal power stations
  - Population stabilisation & relocation:
    - Voluntary or forced by drought
  - *Water markets may play a role in facilitating change*

Summary & conclusions

- Future water availability is now a major risk issue for the electricity industry:
  - Hydro and thermal power stations:
    - 50% of Australia's electricity supply at risk
  - Also, increasing electricity use for desalination & pumping
- Water is a critical resource for many purposes:
  - Ecosystems, agriculture, industry, commerce, recreation
  - The electricity industry will have to negotiate entitlements
  - Not yet clear what role water markets can & will play

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