

An overview of Australia's electricity transmission networks

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An overview of Australia's electricity transmission networks (on photo: Transmission towers at 137 metres above sea level, Mt Cooper in Bundoora Park, the highest point in the metropolitan Melbourne area; by Natasha Abrahams)

Australia, there are transmission networks in each state and territory, with cross-border interconnectors that link some networks. The **National Electricity Market (NEM)** in eastern and southern Australia provides a [fully interconnected transmission network](#) from Queensland through to New South Wales, the Australian Capital Territory (ACT), Victoria, South Australia and Tasmania (**Figure 1**).

The transmission networks in Western Australia and the Northern Territory do not interconnect with the NEM or each other.

The NEM transmission network is unique in the developed world in terms of its long distances, low density and long, thin structure. It reflects the often long distances between demand centres and fuel sources for generation.

The **290 kilometre link** between Victoria and Tasmania, for example, is **one of the longest submarine power cable** in the world.

By contrast, [transmission networks in the United States](#) and many European countries tend to be meshed and of a higher density. These differences result in transmission charges being a more significant contributor to end prices in Australia than they are in many other countries - for example, transmission charges comprise about **10 per cent** of retail prices in the NEM3 compared with **4 per cent** in the United Kingdom.

Electricity can be transported over alternating current (AC) or direct current (DC) networks.

Most of Australia's transmission network is AC, whereby the power flow over individual elements of the network cannot be directly controlled. Instead, electrical power (*which is injected at one point and withdrawn at another*) flows over all possible paths between the two points.

As a result, decisions on how much electricity is produced or consumed at one point on the network can affect power flows in other parts of the network.

Australia also has **three DC networks**, of which all are cross-border interconnectors.

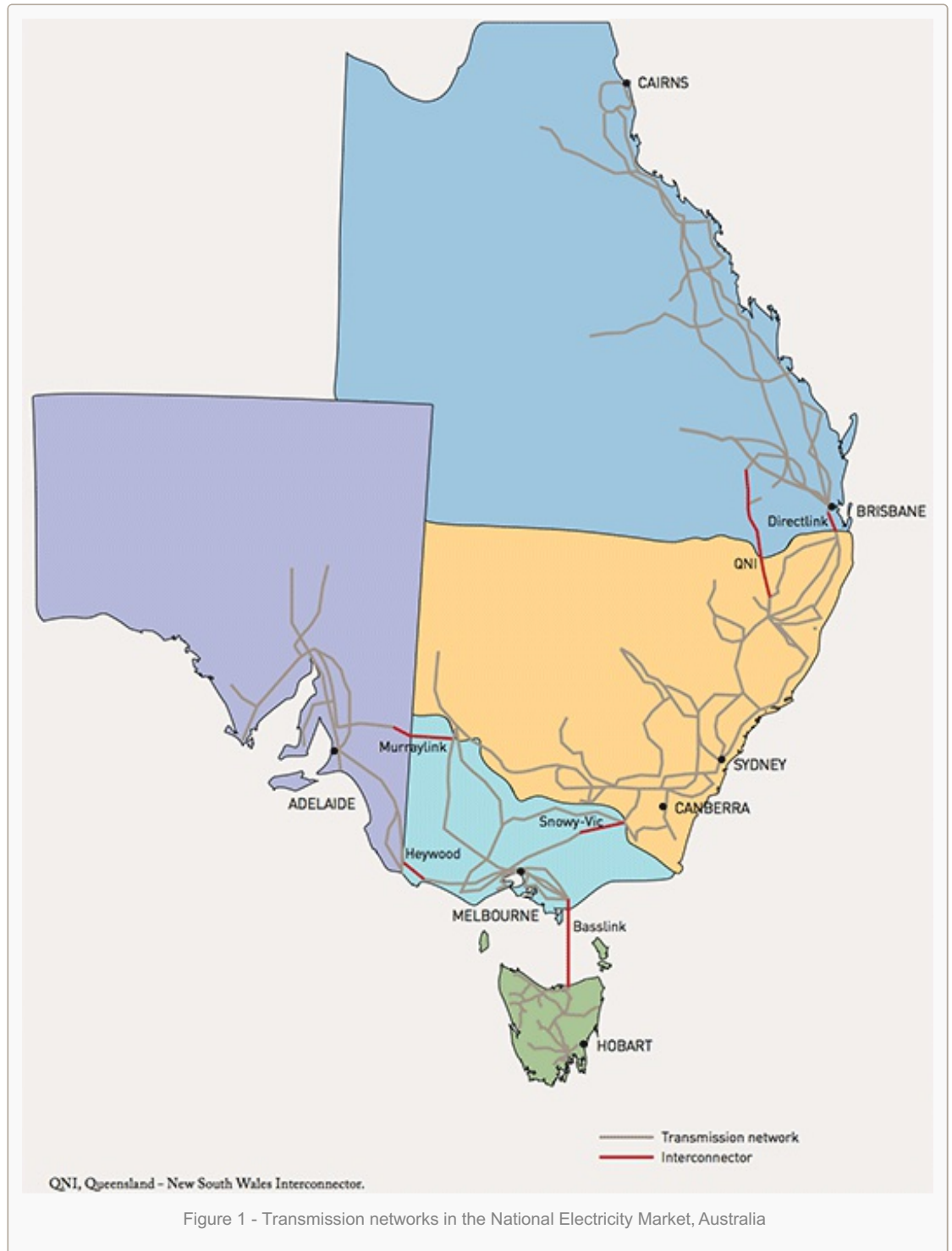


Figure 1 - Transmission networks in the National Electricity Market, Australia

Ownership

of transmission networks

Table 1 lists Australia's transmission networks and their current ownership arrangements. Historically, government utilities ran the entire electricity supply chain in all states and territories. In the 1990s governments began to separate the generation, transmission, distribution and retail segments into stand-alone businesses.

Generation and retail were opened up to competition, but this approach was not appropriate for the transmission and distribution networks, which became **regulated monopolies**.

1. The regulated asset bases are as set at the beginning of the current regulatory period for each network, converted to June 2008 dollars.

2. Investment data are forecast capital expenditure over the current regulatory period, converted to June 2008 dollars.
3. EnergyAustralia's transmission assets, at 1 July 2009, are treated as distribution assets for the purpose of economic regulation. Future performance of the network will be assessed under the framework applicable to distribution network service providers.

NETWORK	LOCATION	LINE LENGTH (KM)	ELECTRICITY TRANSMITTED (GWh), 2007–08	MAXIMUM DEMAND (MW), 2007–08	ASSET BASE (2008 \$ MILLION) ¹	INVESTMENT – CURRENT PERIOD (2008 \$ MILLION) ²	CURRENT REGULATORY PERIOD	OWNER
NEM REGION NETWORKS								
Powerlink	Qld	12 671	48 576	8 082	3 922	2 528	1 July 2007 – 30 June 2012	Queensland Government
TransGrid	NSW	12 486	76 359	12 954	4 064	2 405	1 July 2009 – 30 June 2014	New South Wales Government
EnergyAustralia ³	NSW	885	32 007	5 683	1 013	1 182	1 July 2009 – 30 June 2014	New South Wales Government
SP AusNet	Vic	6 553	51 927	9 850	2 232	990 ⁴	1 Apr 2008 – 30 Mar 2014	Publicly listed company (Singapore Power International 51%)
ElectraNet	SA	5 620	13 734	3 172	1 284	650	1 July 2008 – 30 June 2013	Powerlink (Queensland Government), YTL Power Investment, Hastings Utilities Trust
Transend	Tas	3 650	11 298	2 332	936	606	1 July 2009 – 30 June 2014	Tasmanian Government
NEM total		41 865	233 901	42 073	13 451	8 292		
INTERCONNECTORS⁵								
Directlink	Qld–NSW	63		180	130		1 July 2005 – 30 June 2015	Energy Infrastructure Investments (Marubeni 50%, Osaka Gas 30%, APA Group 20%)
Murraylink	Vic–SA	180		220	119		1 Oct 2003 – 30 June 2013	Energy Infrastructure Investments (Marubeni 50%, Osaka Gas 30%, APA Group 20%)
Basslink	Vic–Tas	375			845 ⁶		Unregulated	Publicly listed CitySpring Infrastructure Trust (Temesek Holdings (Singapore) 28%)
NON-NEM REGION NETWORKS								
Western Power	WA	6 792	14 500	3 420	2135 ⁷	1528 ⁷	1 July 2009 – 30 June 2012 ⁸	Western Australian Government

Table 1 - Electricity transmission networks in Australia

4. SP AusNet's investment data include forecast augmentation investment by AEMO (formerly VENCORP).
5. Not all interconnectors are listed. The unlisted interconnectors, which form part of the state based networks, are Heywood (Victoria – South Australia), QNI (Queensland – New South Wales), Snowy – New South Wales and Snowy–Victoria.
6. Given Basslink is not regulated, there is no regulated asset base. The asset value listed is the estimated construction cost.
7. Data from the ERA's draft decision on proposed revisions to Western Power's access arrangement for the period 2009–10 to 2011–12.
8. At July 2009 Western Power's access arrangement for the period 2009–10 to 2011–12 was not finalised. Principal sources: AER, Transmission network service providers: electricity performance report for 2007–08, Melbourne, 2008, and previous years; AER/ACCC revenue cap decisions; ERA (Western Australia).

Scale of the transmission networks

Figure 2 compares asset values and capital expenditure in the current regulatory period for the transmission networks. It reflects asset values as measured by the **regulated asset base (RAB)** for each network.

The RAB is the asset valuation that regulators use, in conjunction with rates of return, to set returns on capital to infrastructure owners.

In general, it is set by estimating the replacement cost of an asset at the time it was first regulated, plus subsequent new investment, less depreciation. More generally, it indicates relative scale.

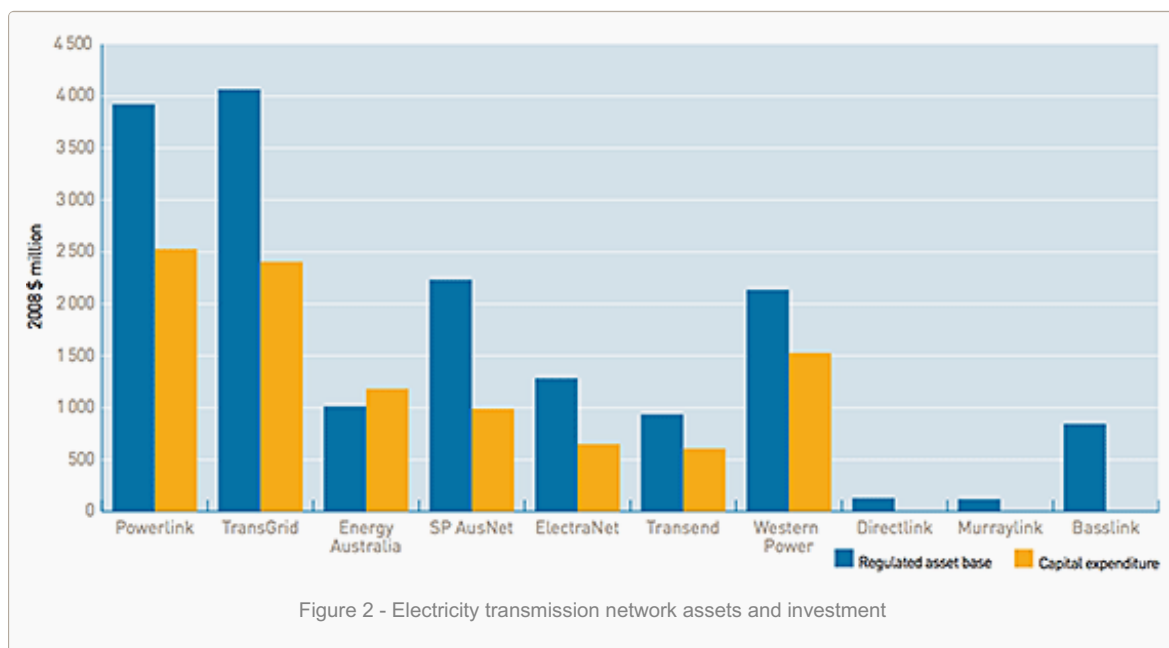


Figure 2 - Electricity transmission network assets and investment

Powerlink

(Queensland) and **TransGrid** (New South Wales) have significantly higher RABs than those of other networks.

Many factors can affect the size of the RAB, including the basis of original valuation, network investment, the age of a network, geographic scale, the distances required to transport electricity from generators to demand centres, population dispersion and forecast demand profiles.

The combined RAB of all transmission networks is around \$15.6 billion. This amount will continue to rise over time, with investment in the current regulatory periods forecast at almost \$10 billion.

Reference: Australian Energy Regulator – State of electricity market (aer.gov.au)

Source:

<http://electrical-engineering-portal.com/an-overview-of-australias-electricity-transmission-networks>