

Brown Coal – Lignite

History

Coal, or more specifically for the Victorian context, brown coal, has played a hugely important role in Victoria's history and the transformation of Melbourne from a wealthy colonial outpost to the modern metropolis it is today. The story of the gold rushes of the 1850s and 1860s and the prosperity they brought to the fledgling colony are well known, however it was coal that provided Victoria with the electricity to transform from a wealthy colony to Australia's industrial giant.

The story of coal in Victoria began prior to the discovery of gold with the infant Colonial Government offering a reward for the discovery of a workable coal field in 1851. By the late 1870s over 30 sites were discovered, including at what have become the Melbourne suburbs of Altona and Newport. Despite these finds, Victoria was still dependent on black coal from NSW as its primary source of energy, as at the time the technology to use brown coal effectively for power generation was still in its infancy. Despite this technological barrier the deposits in the Latrobe Valley had already been identified as possibly the world's largest.

Geology

Coal is a combustible sedimentary rock with a high carbon percentage. Coal was formed millions of years ago from organic material accumulating in large wetlands. Over time, the organic material became covered with sediments which formed heavy rock layers. Over millions of years the pressure and great temperatures of the earth transform this material into coal. First brown coal or lignite is formed, and this makes up the majority of Victoria's coal. Over millions more years the lignite itself transforms into hard black coals with anthracite being the oldest and hardest type of coal. The older and harder coal is, the higher its carbon and therefore its energy content is. The process is known as 'coalification'.

Victoria

Following a number of false starts the development of Victoria's brown coal reserves began in earnest in 1921 and the establishment of the State Electricity Commission of Victoria, headed by the celebrated First World War General, Sir John Monash. Monash tackled his new role with the same tenacity and brilliance that had won him renown on the battlefields of France. The Yallourn power plant and brown coal mine in the Latrobe Valley began providing power to Melbourne in June 1924. Monash was able to rapidly develop the Victorian brown coal fired power industry, in part, from technology he had brought back from Germany, where brown coal was already used extensively for



Brown Coal in the Latrobe Valley
Source: GeoVic

power generation. The success of the initial Latrobe Valley power station proved that Victoria's brown coal reserves could provide the State with the electricity generation capacity to become a centre of manufacturing, industry and business.

Use

Since that first power station began generating brown coal has become Victoria's principal source of energy, providing 90 per centⁱⁱ of the state's electricity from six power stations.

Power station	Max. Capacity	Turbines
Anglesea	150 MW	1
Hazelwood	1,760 MW	8
Loy Yang A	2,200 MW	4
Loy Yang B	1,000 MW	2
Energy Brix	165 MW	5
Yallourn	1,480 MW	6
TOTAL	6755 MW	26

Besides its convenient location, the other advantage of the state's brown coal reserves is that they are relatively easy to mine, particularly the mega deposits of the Latrobe Valley. In these deposits the coal seams are often only 10 or 20 metres below the surface and can be up to up to 100 metres thick, often with multiple seams on top of each other making virtually continuous seams up to 230 metres thick. These massive seams, which continue over large areas, are at a shallow depth making Latrobe Valley brown coal one of the cheapest energy sources available to the state.

There is an estimated 430 billion tonnes of brown coal in Victoria. Of this approximately 33 billion tonnes is in the Latrobe Valley and much of it is economically extractable at today's coal prices and with current mining methodsⁱⁱⁱ. Victoria's brown coal is so abundant that it is estimated that there is enough brown coal to power Victoria for centuries at current usage levels.

The brown coal of the Latrobe Valley has a high moisture content which ranges from 48-70 per cent, this reduces its effective energy content (5.8 to 11.5 MJ/kg on a net wet basis or 25 to 29 MJ/kg on a gross dry basis). To date this has prevented it from being export quality coal. However, advances in drying, gasification and liquefaction technologies could see Victoria's brown coal develop into a major export commodity.

Typical Characteristics of Victorian Brown Coal^{iv}	
Energy value (net wet)	5.8 to 11.5 MJ/kg
Energy value (gross dry)	25 to 29 MJ/kg
Overburden thickness	10 to 20 metres
Strip ratio (coal: overburden)	0.5:1 to 5:1
Water	48 – 70%
Carbon	65 – 70%
Oxygen	25 – 30%
Hydrogen	4 – 5.5%
Ash	<4%
Nitrogen	<1%
Sulphur	<1%



Recently Extracted Brown Coal

The brown coal mining and energy industry accounts for a significant proportion of the economic activity and employment in the Latrobe Valley. The industry directly and indirectly provides employment to approximately 3000 people, close to 11 per cent of the workforce, in the Latrobe Valley. More tellingly one third of the higher paid jobs in the region are in the coal and energy industry^v.

Power generation from brown coal, having such a high moisture content is more emission intensive than other coals and power generation is currently a major contributor to Victoria's carbon dioxide emissions. However, the continued development of clean coal technologies will reduce this in the future. This will ensure the State will be able to take advantage of this abundant and economic natural resource well into the future.

ⁱ Parbo, A. (1992) *Down Under: Mineral Heritage in Australasia*. The Australian Institute of Mining and Metallurgy.

ⁱⁱ Department of Primary Industries, Earth Resources, Coal <http://www.dpi.vic.gov.au/earth-resources/coal>

ⁱⁱⁱ Victorian Government, Department of Primary Industries: Brown coal fact sheet. http://www.dpi.vic.gov.au/_data/assets/pdf_file/0006/37518/Brown-Coal-050710.pdf

^{iv} Parbo, A. (1992).

^v Weller, S., Sheehan, P. and Tomaney, J. (2011) *The Regional Effects of Pricing Carbon Emissions: An Adjustment Strategy for the Latrobe Valley*. Report to Regional Development Victoria. Centre for Strategic Economic Studies, Victoria University.