Institute for Energy Economics and Financial Analysis
IEEFA.org

River's Edge
3430 Rocky River Drive
Cleveland, OH 44111
216-688-3433
staff@ieefa.org

IEEFA background briefing

Australian Export Coal Quality

There is a growing reference in the media by Australian politicians that Australian coal is high quality, and there is an environmental benefit in its use relative to other sources.[1] This fact-sheet aims to provide a concise briefing on coal quality.

How is coal quality measured?

Coal is valued by the international market using one key measure, that being **energy content** (measured in kilocalorie/kilogram (kcal/kg), net as received (NAR)). In other words, the higher the number of kcal, the greater the amount of energy produced per kg of thermal coal.

A secondary value driver is the **ash content.**

Coal itself contains in trace quantities of **heavy metals** and other elements like Lead, Arsenic, Mercury, Selenium, Boron, Thallium, Phosphorus and Chlorine – many with cancer causing and / or toxic health impacts if released. When coal gets burned, these elements do not, so their presence is concentrated in the residual coal ash. These toxic chemicals increase the environmental risks during the processing, storage and disposal of coal ash, either by leaching into groundwater, and/or runoff, or being disposed of in streams via effluent pipes or dust.[2]

Coal washing can reduce the ash content, and increase the remaining energy content per kilogram. Environmental disasters relating to the collapse or overflowing of coal ash waste ponds are regularly reported on, particularly after flooding, as occurred in July 2015 with devastating impact in Vietnam.[3]

Sulphur content is a third quality factor, and generally ranges from 0-1%. Almost all Asian countries have import restrictions requiring sulphur content to be below 1%.

A note on thermal vs metallurgical coal

Thermal (steaming) coal is burned in power stations. Metallurgical (coking coal) is used to make steel.

[1] http://www.afr.com/news/politics/china-accepts-australian-concerns-on-coal-20151121-gl4rxt
[2] http://www.catawbariverkeeper.org/coal-ash-fact-sheet
[3] http://www.sourcewatch.org/index.php/July_2015_coal_ash_disaster,_Vietnam

Comparing thermal coal quality

Six sources of coal provide context for this question of coal quality:[4]

- Australian thermal export coal benchmark – 6,000kcal, 12-14% ash content
- Australian thermal export coal secondary benchmark – 5,500kcal, 20% ash content (referred to as the API5 index)
- Indonesian thermal export coal – 4,500-5,500kcal, 2-10% ash content
- South African thermal export coal – 6,000kcal, 15% ash content
- Russian thermal export coal – 6,500kcal, 10-25% ash content
- Indian domestic thermal coal – 4,400kcal, 25-45% ash content (raw)

To better understand these figures, we compare use of the highest Australian benchmark thermal coal relative to Indonesia, the world's largest exporter of thermal coal. Australian thermal coal is higher in energy content, so 20% less coal is required to be burnt to generate a unit of electricity.

But with an ash content double Indonesia's export average, the ash pollution is double. It is therefore of dubious merit to claim burning Australian coal provides a better environmental outcome.

Further to this point, Australia has historically developed its best coal resources closest to the port first, such that the average quality of new resources being proposed is declining with time. As a result, the Australian benchmark is gradually giving way to a lower quality secondary benchmark with 10% lower energy content and almost double the ash content (5,500kcal, 20% ash).

The IEA referred to the rise of lower grade, "off-spec" coal in its Medium-Term Coal Market Report 2013 (page 51-52), noting this trend stems from the declining quality of coal in some of the main exporting countries, i.e. Australia, South Africa, America and Colombia. This lower grade coal typically trades at a material discount to its energy adjusted to 6,000kcal equivalent.

Such is the case for Adani's proposed Carmichael thermal coal, which IEEFA estimates would be valued at a 30% discount to the Australian thermal 6,000kcal benchmark per tonne.

Carmichael – little cleaner than Indian coal

With an energy content of only 4,950kcal and 26% ash content, Carmichael is only 10% above the average quality of domestic Indian thermal coal in terms of energy content. Further, any environmental impact analysis would need to account for the requirement that this low energy, high ash thermal coal needs to be transported 5-10 times the distance

[4] Wood Mackenzie, August 2014, "Changing coal quality preferences for Asian power plants - impact on seaborne trade".

of domestic Indian coal. If compared to Russian, Indonesian or South African export coal, it is clear that the Carmichael coal proposal is "low energy, high ash."

Indian coal plans

Energy Minister Piyush Goyal this month proposed that India build 250 million tonnes pa of coal washing facilities across the country in order to reduce the ash content of domestic Indian coal (and by result, also lift the average energy content) as part of his plan to cease thermal coal imports.[5] India historically has only washed 1-2% of all domestic coal produced. Given the water limitations in arid central Queensland, extensive coal washing of Carmichael coal would be an expensive luxury.

As to sulphur content, most Asian countries have a straight ban on the importation of thermal coal with a sulphur content in excess of 1.0%. Australian coal exports sulphur content generally range from 0.5-1.0%.[6] Other than high sulphur Columbian thermal coal (which for geographical reasons doesn't materially supply the Asian market), most of Indonesian, Russian and South African thermal coal exports also meet this requirement.

China

China's coal fired power industry has been producing less electricity from coal for the last two years, despite the construction of significant new coal-fired power plant capacity. Utilisation rates have fallen from 58% in 2013 to 54% in 2014, and down to an average of only 49.7% in the year-to-September 2015. This has seen total Chinese coal consumption decline by 2.6% in 2014, and an estimated 5.7% in 2015. With lower consumption, the Chinese power sector has moved to protect domestic coal mining, such that domestic coal production year-to-date in 2015 is down 4.3% while coal imports into China are down 30% year-on-year.[7]

While the logistics costs of imported coal provide a natural competitive advantage to domestic coal, China also imposed a 6% tariff on imported thermal coal in October 2014 (although we note that Indonesia is exempt from this due to a pre-existing free trade agreement). In addition, random trace element testing of imported coal cargos was stepped up at the start of 2015.

Platts describes the trace element limits still being tested by China as:[8]

- phosphorus in imported cargoes is limited to 0.1% starting July 2015 (down from 0.15%);
- chlorine is limited to 0.15% (halved from 0.3% previously);
- arsenic of 40 millionth of one gram (halved from 80 millionth of one gram); and
- mercury requirement limited to a maximum of 0.6 millionth of one gram.

[5] http://www.deccanherald.com/content/512164/india-wont-need-coal-imports.html
[6] http://www.businessspectator.com.au/article/2014/9/17/energy-markets/will-chinas-dirty-coal-ban-hurt-australian-miners
[7] http://www.thestar.com.my/Business/Business-News/2015/11/08/China-October-iron-ore-imports-dip/?style=biz
[8] http://www.platts.com/latest-news/coal/perth/little-impact-for-most-australian-coal-from-new-26000307

Australia: polluting power stations

For countries seeking to limit the externalities of coal-fired power generation pollution, tighter emissions limits and greater enforcement of requirements is key. China has required all coal-fired power plants to be retrofitted with emissions reduction technologies over the last four years. This is something Australia has studiously avoided doing. As a result, Australia has the most emissions intensive coal-fired power generation fleet in the world, behind even India.

Tim Buckley – Director, Energy Finance Studies Australasia, IEEFA

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