



To specification

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Boggabri Coal, Australia,

describes how technology is
enabling miners to meet targets
for the ash content of coal.

Boggabri Coal Pty Ltd (Boggabri), a wholly-owned subsidiary of Idemitsu Australia Resources Pty Ltd (IAR), owns and operates the Boggabri coal mine in New South Wales, Australia. Operations commenced in 2006 with approximately 275 million t of coal reserve. As of December 2010, Boggabri produces 2.8 million tpa of ROM coal, and also produces thermal and pulverised coal injection (PCI) coals. It is exported through the Port of Newcastle to customers in Japan, Malaysia, Taiwan and other parts of Asia. Approval has been granted to increase production to 4.3 million tpa by 2013. In

In addition, there is a feasibility study to increase production to 6.5 million tpa, including expanding rail and port infrastructure capacity.

To date, operations include opencast mining, coal preparation and handling and mine rehabilitation. Coal is mined by excavator/truck, and then crushed to a maximum size of 50 mm before being delivered to the Boggabri coal terminal. From the terminal, an automatic batch weighing train loading system loads the coal onto trains for transport 364 km southeast to the Port of Newcastle.

Coal specifications

Four seams are currently mined by Boggabri: the Merriown, Jeralong, Bollol Creek and Braymont seams. In the future, Boggabri plans to mine a total of seven seams. These coals are classified as high volatile A bituminous (hvAb) under the ASTM system and fall within various class 6 groupings of the Australian classification and coding system for coals.

In general, the coals have low inherent ash contents (<6%, with significant sections <4%); low total sulfur (generally <0.4%); low secondary

mineral contents; and favourable ash chemistry (low quantity of trace elements). The coals have initial deformation temperatures of 1450°C and above. However, ash on a seam by seam basis can vary from 3 – 25% ash.

Between October 2006 and December 2010, 6.2 million t of unwashed coal was sold from Boggabri with a cumulative average of 10.5% ash, 10.1% moisture and 0.37% sulfur. Boggabri coal ash is also low in other elements including selenium and phosphorous. In 2010, 89% of Boggabri



Dual energy transmission technology

Scantech's Coalscan 2100 is based on dual energy transmission technology (DUET). The analyser is a C-frame that is installed on the conveyor. Radioactive sources are enclosed in a small holder below the belt and a detector above the belt measures the gamma rays transmitted through the coal. The electronics cabinet, with an onboard computer and plant interfacing, is attached to the C-frame.



The technology is based on the absorption of americium and caesium gamma ray sources stored in the holder. The count rate of the gamma rays transmitted through the coal is measured by the detector. The absorption of gamma rays from the americium source is proportional to coal depth and ash content of the coal, and the absorption of gamma rays from the caesium source is proportional to coal depth. Thus, dividing the americium count rate by the caesium count rate, provides a ratio that is proportional to the ash content.

The relationship between the ash content of the coal and this ratio varies, though, if the quantity of iron oxide (Fe_2O_3), calcium oxide or quicklime (CaO) or barium oxide (BaO) in the ash changes significantly. As different seams at Boggabri coal mine have a significantly different percentage of each oxide, the blending ratios are changed to ensure that the product coal has the target ash content.

coal was sold as thermal coal with the remaining 11% as PCI coal at 4.2% ash. Boggabri plans to add a semi-soft metallurgical coal product to its range in 2011.

Ash monitoring

A Coalscan 2100 analyser was part of the initial plant design to monitor the coal product to produce different coals with different ash targets. The equipment is installed on the outgoing conveyor, post-crusher. Apart from borehole analyses and the associated geological model, it is the only equipment that is used to control and confirm product coal. Onsite, a sampling system can be used to check the analyser's performance. However, day to day, the operations rely on the Coalscan results.

Once mined, ROM coal is stacked separately in stockpiles. A front end loader (FEL) then feeds ROM product into the 650 tph, 50 mm topsize crusher with a target ash set to meet customer specifications. Ash determination of crushed product occurs as the coal travels via conveyor through the analyser to the truck loadout bin. The ash percentage is determined by measuring the attenuation in a beam of gamma rays transmitted upwards through the coal. The coal is then transported to the terminal for stockpiling and subsequently railing.

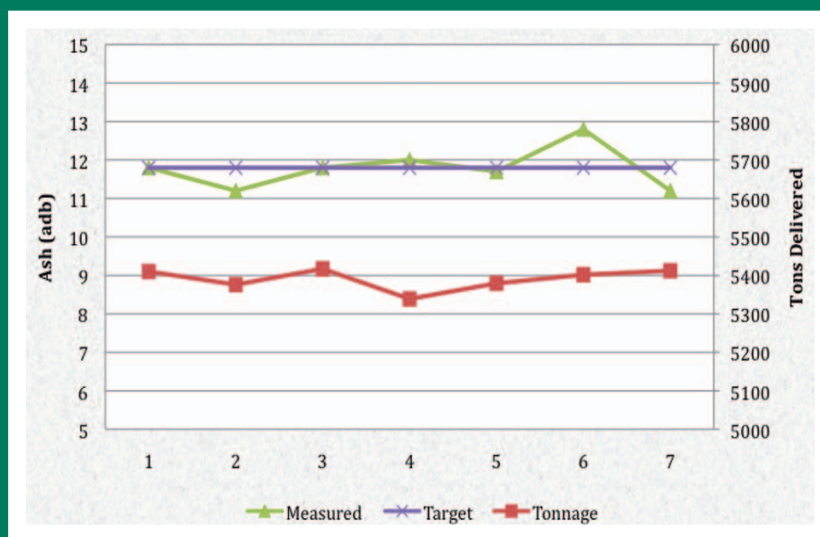
In order for the FEL operator to control the outgoing product coal, both the instantaneous (equal to one belt cycle time) and a tonnage weighted ash value is transmitted live to a screen at the crusher. The blend is adjusted if the tonnage weighted ash is off target and the instantaneous result is monitored in case there is a sudden departure from the expected ash. By understanding the product blend at the ROM, the mine is able to produce products to strict customer ash specification. The programmable logic controller (PLC) connected to the analyser also stores the information that can be extracted at any time for analysis.

Directly after installation in 2006, the Coalscan was calibrated according to the coals being processed at that time. In order to maintain and adapt this calibration to different coal seam blends and ash targets, Boggabri requires tonnage weighted average Coalscan ash

Checking performance

The accuracy of the Coalscan 2100, and the blending process as a whole, is checked as each coal delivery is sampled at the port. The ash content of the sample is then measured and used for tariff payment. For the seven coal deliveries in December 2010, the target ash was 11.8%. Some coal contracts have ash bonuses and penalties. Boggabri therefore determines the optimal target ash based on these financial considerations, as well as the quality, abundance and ease of accessing their various coal seams.

On this basis, the target ash was calculated to be 11.8% for these December coal deliveries. As can be seen in the following graph, the measured tonnage weighted average ash content for these deliveries is very close to the target ash.



Ash content for coal deliveries (December 2010).



and blend ratios to be reported on a shift by shift basis. The product is then tracked from stockpile to port and the ash is reconciled from laboratory train results from samples collected at the port.

Because a significant proportion of coal is mined just under the limit of oxidation, migratory elements in ash, coal and iron will vary across a single strip. By understanding the geological model, keeping track of a blend's ratios at the ROM and reconciling product ash from laboratory train results collected at

the port, Boggabri is able to deliver successfully to customer specifications. The coal production at Boggabri Coal, using the selective mining method and a Coalscan 2100, has been successful and will continue to apply this method for bypass coal. In order to increase the value of high ash coal and also to optimise the total value of products, Boggabri Coal will soon construct a coal preparation plant to process the high ash coal and for semi-soft coking and PCI coals. 