

ENERGY EFFICIENCY OPPORTUNITIES PUBLIC REPORT 2011

Cristal Australia Pty Ltd is a wholly owned subsidiary of The National Titanium Dioxide Company Limited (Cristal), a private company with headquarters in Jeddah, Kingdom of Saudi Arabia. In 2008, Cristal Australia Pty Ltd acquired all of the shares in Bemax Resources Limited (Bemax) and triggered participation in the Energy Efficiency Opportunity programme. Bemax was previously registered for EEO in it's own right.

Bemax is one of Australia's premier mineral sands miners. Bemax's mining and mineral separation operations are located in two significant mineral sands provinces in Australia namely, the Murray Basin and south west Western Australia.

Historically, Bemax has grown through successful exploration and acquisitions, including the acquisition of the Western Australian based Cable Sands Group in May 2004, which was one of Australia's first Titanium minerals producers having commenced production in 1956. The Bemax West operations include the North Shore Mineral Separation Plant and the Gwindinup Minesite.

In late 2004 and early 2005, Bemax commenced construction of the Ginkgo Mine and Broken Hill mineral separation plant in the Murray Basin. The first heavy mineral concentrate production at the Ginkgo Mine was in December 2005 and commissioning of the Broken Hill mineral separation plant occurred in February 2006.

Part 1 - Corporation Details

Controlling Corporation

Period to which this report relates

Cristal Australia Pty Ltd

From

1 July 2009

To

30 June 2011

Table 1.1 - Major Changes to Corporate Group Structure or Operations

Table 1.1 – Major Changes to Corporate Group Structure or Operations

Nil

Table 1.2 – Aggregate energy assessed covered in this report

Total energy use covered by all assessments in this report	253,088	GJ
Total energy assessed as percentage of total energy use of the corporate group*#	25.5	%

Declaration

Declaration of accuracy and compliance

The information included in this report has been reviewed and noted by the board of directors and is to the best of my knowledge, correct and in accordance with the *Energy Efficiency Opportunities Act 2006* and *Energy Efficiency Opportunities Regulations 2006*.


Dominic Manganaro
(Director Cristal-Bemax)

Date 19th December 2011

Part 2 - Assessment Outcomes

Table 2.1a – Assessment Details – North Shore

It is compulsory to complete a separate table for each group member, business unit, or key activity that has been assessed

Name of group member or business unit or key activity

North Shore Mineral Separation Plant

Total energy use in the last financial year

157,495 GJ

Energy use assessed in this entity as a percentage of total entity energy use*

84 %

Energy use assessed in this entity as a percentage of total corporate energy use

13.3 %

Accuracy of above estimates related to energy use assessed - only required if not $\pm 5\%$ or better

Within $\pm 5\%$ %

Period over which assessment was undertaken

August 2008

June 2011

Description of the way in which the entity carried out its assessment

Crystal Australia contracted EnerVative Solutions, a specialist energy and climate change consultant, to facilitate the implementation of the EEO at Bemax North Shore and Broken Hill plants. The approach taken was structured to meet the requirements of the EEO, while taking advantage of the existing engineering expertise at each site. The key activities included:

1. Initial education of key staff on the requirements of the EEO.
2. An initial opportunity identification workshop was held involving a range of site and external personnel.
3. A gap analysis was undertaken in August 2008, to evaluate the 6 elements of the EEO against the current business practices, and provide recommendations.
4. Additional metering and upgraded SCADA systems were installed to monitor energy use.
5. An energy mass balance has been prepared for the mineral separation plant.
6. Existing EMS documentation has been updated and added to as required to meet key requirements.
7. In many cases smaller projects were directly implemented; larger projects were / are being further analysed and business cases developed.

* Please note that, for individual sites that use more than 0.5PJ of energy, all energy use must be assessed (less a small proportion for non integral energy use).

Table 2.2a - Energy efficiency opportunities identified in the assessment – North Shore

It is compulsory to complete a separate table for each group member, business unit, or key activity that has been assessed

Table 2.2 – Energy efficiency opportunities identified in the assessment									
Status of opportunities identified to an accuracy of better than or equal to $\pm 30\%$		Total Number of opportunities	Estimated energy savings per annum by payback period (GJ)						Total estimated energy savings per annum (GJ)
			0 – < 2 years		2 – \leq 4 years		> 4 years		
			No of Opps	GJ	No of Opps	GJ	No of Opps	GJ	
Business Response	Implemented	2	2	3,186	nil	nil	nil	nil	3,186
	Implementation Commenced	nil	nil	nil	nil	nil	nil	nil	nil
	To be Implemented	nil	nil	nil	nil	nil	nil	nil	nil
	Under Investigation	nil	nil	nil	nil	nil	nil	nil	nil
	Not to be Implemented	1	nil	nil	1	385	nil	nil	385
Outcomes of assessment	Total Identified	3	2	3,186	1	385	nil	nil	3,571
Status of opportunities identified to an accuracy of worse than $\pm 30\%$									
Business Response	Implemented	nil	nil	nil	nil	nil	nil	nil	0
	Implementation Commenced	nil	nil	nil	nil	nil	nil	nil	0
	To be Implemented	nil	nil	nil	nil	nil	nil	nil	0
	Under Investigation	1	nil	nil	nil	nil	n.y.d.	n.y.d.	n.y.d.
	Not to be Implemented	8	1	607	nil	nil	7	4,000 +	4,600 +
Outcomes of assessment	Total Identified	9	1	607	nil	nil	8	4,000 +	4,600 +

Please note that Corporate Groups **are not required** to report opportunities with a payback greater than 4 years. Reporting this data is voluntary.

n.y.d. = not yet determined

Table 2.1b – Assessment Details – Broken Hill

Name of group member or business unit or key activity

Broken Hill Mineral Separation Plant

Total energy use in the last financial year

120,705 GJ

Energy use assessed in this entity as a percentage of total entity energy use*

80% %

Energy use assessed in this entity as a percentage of total corporate energy use

12.2 %

Accuracy of above estimates related to energy use assessed - only required if not $\pm 5\%$ or better

Within $\pm 5\%$ %

Period over which assessment was undertaken

July 2010

June 2011

Description of the way in which the entity carried out its assessment

Crystal Australia contracted EnerVative Solutions, a specialist energy and climate change consultant, to facilitate the implementation of the EEO at Bemax North Shore and Broken Hill plants. The approach taken was structured to meet the requirements of the EEO, while taking advantage of the existing engineering expertise at each site. The key activities included:

1. Initial education of key staff on the requirements of the EEO.
2. A gap analysis was undertaken in November 2008, to evaluate the 6 elements of the EEO against the current business practices, and provide recommendations.
3. An opportunity identification workshop was held involving a range of site personnel.
4. A review of completed projects and ranking.
5. In many cases smaller projects were directly implemented by each site; larger projects were / are being further analysed and business cases developed.

An energy mass balance (EMB) including technical analysis of data and opportunities was undertaken at each site. The EMB was used to identify where the energy is used on site and uncover opportunities. The Broken Hill EMB is subject to additional ongoing analysis.

* Please note that, for individual sites that use more than 0.5PJ of energy, all energy use must be assessed (less a small proportion for non integral energy use).

Table 2.2b - Energy efficiency opportunities identified in the assessment – Broken Hill

Table 2.2 – Energy efficiency opportunities identified in the assessment									
Status of opportunities identified to an accuracy of better than or equal to ±30%		Total Number of opportunities	Estimated energy savings per annum by payback period (GJ)						Total estimated energy savings per annum (GJ)
			0 – < 2 years		2 – ≤ 4 years		> 4 years		
			No of Opps	GJ	No of Opps	GJ	No of Opps	GJ	
Business Response	Implemented	27	27	2,780	nil	nil	nil	nil	2,780
	Implementation Commenced	0	nil	nil	nil	nil	nil	nil	nil
	To be Implemented	0	nil	nil	nil	nil	nil	nil	nil
	Under Investigation	0	nil	nil	nil	nil	nil	nil	nil
	Not to be Implemented	0	nil	nil	nil	nil	nil	nil	nil
Outcomes of assessment	Total Identified	27	27	2,780		nil	nil	nil	2,780
Status of opportunities identified to an accuracy of worse than ±30%									
Business Response	Implemented	nil	nil	nil	nil	nil	nil	nil	nil
	Implementation Commenced	3	nil	nil	3	TBD	nil	nil	TBD
	To be Implemented	5	nil	nil	5	TBD	nil	nil	TBD
	Under Investigation	10	nil	nil	nil	nil	10	TBD	TBD
	Not to be Implemented	Nil	nil	nil	nil	nil	nil	nil	nil
Outcomes of assessment	Total Identified	18	nil	nil	8	TBD	10	TBD	TBD

TBD - Resources not available to commence energy savings determination and financial analysis. Awaiting installation of Power meters to determine energy usage across the MSP and Ancillary Administration, Workshop and Laboratory.

Table 2.3 - Details of significant opportunities identified in the assessment

Description of Opportunity
<p>No attritioning for Gwindinup non-magnetic feedstock</p> <p>Attritioning of feedstock is undertaken at the North Shore MSP to liberate coatings from the mineral grains so as to improve the effect of electrostatic separation processes, thereby improving recovery of minerals. This involves a total of 180kW of installed electrical capacity.</p> <p>As the quality of the Heavy Mineral Concentrate varies from the West Coast mine depending upon mining area the need for attritioning is assessed by laboratory testwork investigating the separation performance before and after attritioning. In the event that there is no tangible performance benefit the attritioners would be bypassed. No capital cost is involved as the bypass pipework is already in place.</p> <p>The savings vary year to year depending upon throughput and the quality of feed from the mine allowing for bypassing of the attritioners. Typically a saving of ~ 460 GJ/annum and \$17,000/year would be expected.</p>
<p>Description of Opportunity</p> <p>No attritioning of Ginkgo/Snapper Non Magnetics</p> <p>Mineral supplied to the North Shore MSP from an Eastern States orebody was being processed through various preliminary stages to optimise separation performance in the subsequent electrostatic circuit. The attritioners alone have a total of 180kW of installed electrical capacity.</p> <p>Laboratory testwork and plant trials confirmed that just washing the mineral without the spiral and attritioning stages resulted in sufficiently clean mineral grains for the electrostatic dry separation.</p> <p>Hence pipework and a cyclone was installed at a cost of ~ \$11,000 to enable bypassing of the spirals and attritioners. This resulted in an annual energy saving of 2722 GJ for power savings of ~ \$99,000.</p>
<p>Description of Opportunity</p> <p>Solar Drying of ilmenite stockpiles.</p> <p>Analysis of site energy and material flows identified the significance of the moisture content in the ore before it enters the drying phase of the process. This analysis also identified the impact of sunny and windy weather conditions in reducing the moisture content of the ore before it enters the initial process hopper.</p> <p>When the weather is permitting, large stockpiles on site at Broken Hill can be harvested of their wind and sun dried mineral from around the base / sides of the stockpile. Upon removal of this mineral by collecting, the floor mineral, it rejuvenates and re fills with more dry mineral.</p> <p>Previous practice was to load direct from the core, by pushing in and up. This loading practice collected the damper mineral in the middle of the stockpile. By skirting around the base, with a Bob Cat and pushing up, for the front end loader to collect, increases dryer throughput by 60%, using the same volume of gas.</p> <p>Apart from educating operators, the opportunity had zero capital cost.</p>

Description of Opportunity

Trash Mineral Removal at the Mine sites.

The mineral suite in the Murray Basin is such that it has valuable heavy minerals, Rutile, Zircon and ilmenite and light heavy minerals namely, trash Titanium Silicates, Alumina Silicates, and iron alumina silicates.

Analysis of site energy and material flows identified the significance of the moisture content of the ore and the quality of the ore being freighted from the mine to the Mineral Separation Plant (MSP) located 230km from the mine. Increased moisture and trash in the ore increases the cost per tonne of usable ore arriving at the MSP and also increases the quantity of trash to be freighted back to the mine for disposal. In addition it reduces the energy required to produce a tonne of product.

Historically the mine undertook a general separation, with the main high intensity separation undertaken at the Broken Hill MSP 230km away. The business case was to retune the mine processing equipment to and intensify the yield of all minerals at the mine, reducing the quantity of trash freighted and process the remaining mineral ore at Broken Hill.

Confidence in the capabilities of the mining operations allowed Bemax to reject the trash minerals at the mine concentration stage. This unloaded the recirculating loads in the mining concentrator plants and improved on valuable Rutile recovery. The trash component transported to Broken Hill reduced by 200tonnes per day, which previously required haulage to Broken Hill and returned as waste.

By not sending high volumes of trash to MSP at Broken Hill, opened the plant to increased feed tonnes of quality valuable heavy minerals and increased yield to product, as there is less trash to reject, hence increased feed tonnes and increased product tonnes.

Plant increases of 66% have been achieved, without upgrading pump drives or the use of additional plant energy. It had been identified previous to down size some drives in order to improve on their power efficiency but it is now evident that we have improved the power efficiency of the existing drives by increasing their duty through increased tonnes. The opportunity was implemented through operational management and no capital required.

Description of Opportunity

Swap Tails and Concentrate Product Pumps.

With the improvements in quality of the ore arriving from the mine the tonnage of ore processed in the plant increased and the trash (waste material) was significantly reduced. These changes in the ore quality significantly changed the duty, up and down, of two pumps.

The tails pump, which pumps the trash material to stockpiles ready for trucking back to the mine, is the largest pump in the process. With the removal of trash mineral at the mine sites, this pump has a limited tonnage to transfer to the waste storage, which is relatively close by. The Concentrator pump is smaller and was now required to pump increased tonnage, as a consequence of the plant running at 66% above normal duty. Also the distance required to pump to the product drainage pad is significant.

Analysis of the major pump drives identified the opportunity to swap the duty of the two pumps and unloaded the power draw on the Concentrator and Tails pumps.

The project was implemented using existing staff and required limited capital. The changes resulted in a 5kW reduction in demand as the pumps run all year the total energy and greenhouse gas saving are 160GJ and 44 tonnes CO₂e.