

# MANGOOLA OPEN CUT

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GLENCORE

*Plan for Mangoola Coal Operations Pty. Limited*

## Energy Savings Action Plan

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## Document Control

Version	Date Reviewed	Reviewed By	Amendment
V1	August 2010	Xstrata Mangoola	Initial development of document.
V2	January 2011	Xstrata Mangoola	Incorporated feedback from DP&I
V3	July 2011	Xstrata Mangoola	Incorporated feedback from DP&I
V4	September 2013	Mangoola Coal	Added regulator correspondence/approval to ESAP appendices.
V5	July 2014	Mangoola Coal	3 yearly review of ESAP.
V6	October 2017	Energetics Mangoola Coal	Following the 3-yearly review and audit in December 2016, consumption data was updated and the opportunities list was revised.
V7	October 2017	Energetics Mangoola Coal	Approved by Department of Planning and Environment.
V8	November 2019	Energetics Mangoola Coal	Following the 3-yearly review and audit in December 2019, consumption data was updated and the opportunities list was revised.

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# 1 Introduction

## 1.1 Background

Mangoola Coal Operations Pty Limited, owned by Glencore, operates Mangoola Open Cut mine (Mangoola ) located near Wybong, approximately 20 kilometers west of Muswellbrook and approximately 10 kilometers north of Denman in the Muswellbrook Local Government Area (refer to Figure 1-1: Mangoola Locality Plan).

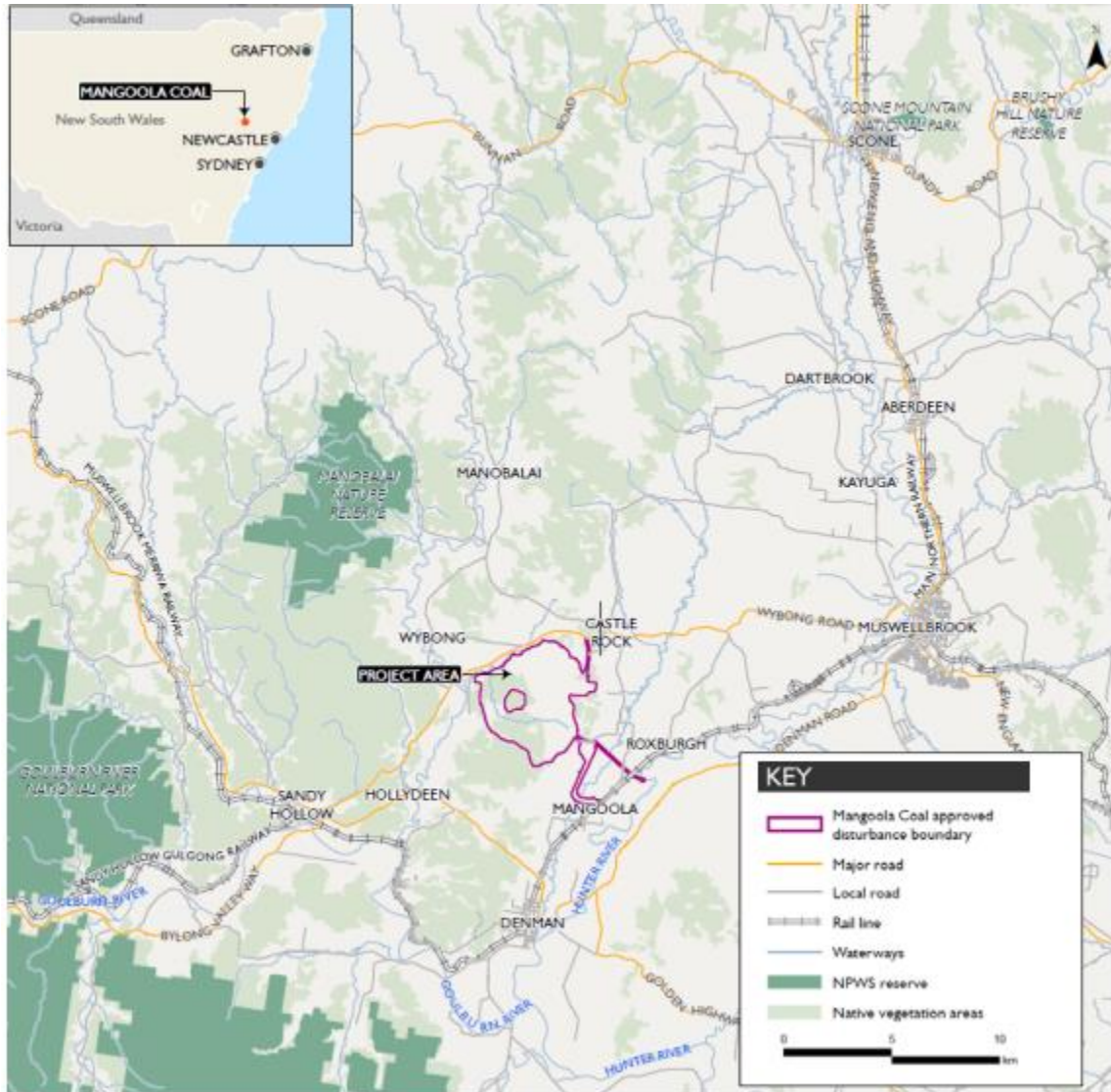


Figure 1-1: Mangoola Locality Plan

## 1.2 Project description

Mangoola operates in accordance with Project Approval 06\_0014 (as modified) with an approved maximum production rate of 13.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. A detailed description of Mangoola Coal Project and the subsequent modifications is provided in Chapter 3 of the Modification 6 Environmental Assessment (EA). An overview of the greenhouse gas (GHG) assessment findings can be found in Chapter 9 of the EA. The modifications have not altered the original consent period of 21 years.

The primary mining method is by hydraulic excavators loading rear dump trucks, assisted by dozer push and blasting of overburden where appropriate. Dump trucks haul ROM coal to the coal handling and preparation plant (CHPP) facility along haul roads. The general mining sequence includes the stripping of topsoil, removal of overburden, extraction of coal resource, in-pit overburden emplacement and progressive rehabilitation.

Mining operations, coal handling and washing, rail load out and all associated activities operate on a 24-hours-per-day, 7-days-per-week basis with the exception of the mobile gravel crushing plant, which is restricted to 7am to 6pm Monday to Friday and 8am to 1pm on Saturdays with no operations on public holidays or Sundays. Blasting is typically undertaken between the hours of 9.00 am and 5.00 pm Monday to Saturday. No blasting is undertaken on Sundays or public holidays.

The conceptual mine plan scenarios utilised in the EA include:

- Year 2 (end 2015) – coal extraction in the north-east area of the mine (the Northern Pit) and progressing in a south-easterly direction towards the mine infrastructure area. The overburden emplacement area is established behind the general progression of the pit;
- Year 5 (end 2018) – coal extraction in the north-west area (the Main Pit) and southern area (the Southern Pit) of the mine. The Main Pit progresses in a south-west direction around Anvil Hill and the Southern Pit in a north-west direction; and
- Year 10 (end 2023) – one active pit in the south-western area of the mine (the Southern Pit). The majority of the mined land is rehabilitated by this time and represents the end stage of the mine life.

As outlined in the EA, if Mangoola operates at a sustained increased maximum ROM coal extraction rate of 13.5 Mtpa, the annual average GHG may increase. However, under this scenario, the total emissions over the mine life will reduce by 12% from the original (2006) project environmental impact statement (EIS) predictions and will reduce by 9% from the pre-Modification 6 operations.

**Table 1-1: Comparison of total CO<sub>2</sub>-e emissions**

Category of emissions	Total CO <sub>2</sub> -e emissions (t CO <sub>2</sub> -e/year)		
	Original project (2006 EIS) <sup>1</sup>	10.5 Mtpa Operation <sup>1</sup> (Pre-Modification 6)	13.5 Mtpa Operation (Modification 6 EA)
Scope 1	N/A	2,280,751	1,247,706
Scope 2	N/A	623,836	585,265
Scope 3	261,499,252	250,803,595	229,980,467
Scope 1 + 2	3,351,478	2,904,587	1,832,972
<b>Total</b>	<b>264,850,730</b>	<b>253,708,182</b>	<b>231,813,438</b>
<b>Average annual emissions</b>	<b>13,242,537</b>	<b>16,913,670</b>	<b>19,317,787<sup>2</sup></b>

<sup>1</sup> Source: Greenhouse Gas and Energy Assessment SEE Sustainability Consulting 2010. N/A = not available

<sup>2</sup> Assumes the proposed maximum extraction rate of 13.5 Mtpa is sustained.

## 1.3 Purpose and scope

To satisfy Condition 55 and 56 of Schedule 3 of the Project Approval, an Energy Savings Action Plan (ESAP) needed to be prepared and implemented for the project. The ESAP was prepared in accordance with the requirements and guidelines of the Department of Industry, Resources and Energy (then the Department of Energy, Utilities and Sustainability), and submitted to the Director-General for approval prior to starting mining operations on site on 17<sup>th</sup> August 2010. The ESAP applies to Mangoola’s activities within the Project Approval area.

The objectives of the ESAP are to:

- ensure compliance with the project approval conditions
- reduce GHG emissions from the project area
- ensure annual reporting of GHG and tracking of energy savings opportunities

ESAP development was initially conducted in conjunction with meeting Glencore’s corporate requirements under the federal Energy Efficiency Opportunities (EEO) Act which were subsequently repealed. Guidelines for Energy Savings Action Plans were removed from the NSW government website as the broader ESAP scheme was wound up. However, in accordance with Mangoola Coal’s Project Approval, the site is required to continue to implement the ESAP.

The ESAP was first reviewed in July 2014 and then in October 2017. This will be the third review of the ESAP since the original submission.

The third review (this document) focuses on baseline data and Key Performance Indicators (KPIs) energy management systems and processes including roles and responsibilities and potential GHG and energy savings measures identification and implementation.

## 1.4 Objectives

The objectives of this ESAP review are to:

- explain the energy use across the site through presentation of energy KPIs for the last five years of operation
- describe the energy management system used by Mangoola
- provide a list of energy efficiency measures identified in 2019 for implementation
- involve key mine personnel in the review of monitoring outcomes and identifying any further opportunity for improvement
- to communicate updates, where applicable, on greenhouse gas and energy saving initiatives to mine personnel.

## 1.5 Regulatory requirements

Mangoola will review, monitor and report energy consumption in accordance with Mangoola’s Project Approval (Application 06\_0014) as shown in Table 1-2 below.

**Table 1-2: Project Approval Conditions**

Schedule/ Condition	Project Approval Condition	Section of Document
Schedule 3/ Condition 22	The Proponent shall: ... (b) implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site; ... to the satisfaction of the Director-General.	ESAP

Schedule/ Condition	Project Approval Condition	Section of Document
Schedule 3/ Condition 55	The Proponent must prepare and implement an ESAP for the project to the satisfaction of the Secretary. This plan must be prepared in accordance with the requirements and guidelines of the Department of Primary Industries (DPI) Water and submitted to the Secretary for approval prior to starting mining operations on site. The Proponent must implement the approved action plan as approved from time to time by the Secretary.	1.8 & 1.9
Schedule 3/ Condition 56	The Proponent must: <ul style="list-style-type: none"> <li>a) monitor the GHG generated by the project;</li> <li>b) investigate ways to reduce greenhouse gas emissions generated by the project; and</li> <li>c) report on greenhouse gas monitoring and abatement measures in the Annual Review,</li> </ul> to the satisfaction of the Secretary.	2.3, 2.4, 3 & 4

## 1.6 Roles and responsibilities

The roles and responsibilities of Mangoola employees and contractors in relation to energy savings management and monitoring are outlined in Table 1-3.

**Table 1-3: Roles and Responsibilities**

Role	Responsibility
Operations Manager	<ul style="list-style-type: none"> <li>• Providing resources to implement this plan</li> </ul>
Area Managers	<ul style="list-style-type: none"> <li>• Reviewing energy efficiency of their area and identifying improvement opportunities</li> <li>• Overseeing action implementation for their area when required</li> <li>• Participation in annual reviews and 3-yearly audits as required</li> <li>• Assisting in provision of data for energy consumption calculation</li> </ul>
Environment and Community Manager	<ul style="list-style-type: none"> <li>• Coordinating the review of this ESAP</li> <li>• Reporting performance against KPI's to Management Team</li> <li>• Scheduling 3-yearly audit</li> </ul>
Environment and Community Coordinator	<ul style="list-style-type: none"> <li>• Updating procedures and training as required</li> <li>• Assisting in annual review and 3-yearly audit process</li> </ul>

## 1.7 Definitions

The terminology used in this ESAP is defined in Table 1-4.

**Table 1-4: Terminology used in the ESAP**

Term	Definition
BAI	Business Activity Indicator
DPIE	Department of Planning Industry and Environment
CHPP	Coal Handling and Preparation Plant
EA	Environmental Assessment
EIS	Environmental Impact Statement
ebcm	equivalent billion cubic meters
EEO	Energy Efficiency Office
ESAP	Energy Savings Action Plan
DPI	Department of Primary Industries
GCAA	Glencore Coal Assets Australia
GJ	Gigajoules
kV	Kilovolt
kWh	Kilowatt hours
LOM	Life of Mine
KPI	Key Performance Indicator
Mangoola	Mangoola Coal Operations Pty. Limited
PJ	Petajoules
ROM	Run of Mine (coal)

## 2 Baseline energy use and detailed breakdown

### 2.1 Overview of energy sources

Diesel consumption accounts for around 85% of Mangoola’s total energy use. The remaining 15% is from electricity consumption. Diesel is used to power the mining equipment that extracts and moves both overburden and the Run of Mine coal from the bottom of the pit to the surface.

Electricity is a secondary source of energy mostly utilised in the CHPP. Electricity is supplied to site via a 66kV power line, 66kV to 11 kV transformers and a substation at the Mangoola mine site. An 11kV main supply lines services the infrastructure and pumps associated with water transfer from the Hunter River to the Raw Water Dam on site. Power is supplied to the CHPP, site facilities and mine site buildings via 11kV to 415V transformers. These have electricity meters to monitor electricity usage.

For reference, Table 2-1 illustrates the comparative relationship between diesel consumption and electricity use. The average ratio between diesel and electricity consumption between FY15 and FY19 is 5.8:1. Fluctuations in this ratio are driven by a number of factors including:

- Total volume of material mined
- Volume of material processed by the CHPP
- Volume of coal rehandled

It should be noted that the upward trend in diesel usage is expected to continue as the mine ages due to increases in the effective haulage lengths.

**Table 2-1: Ratio of diesel to electricity consumption**

Year	Material mined and rehandled (ecbm)	Diesel consumption (GJ)	Electricity consumption (GJ)	Ratio
FY15	50,564,134	1,020,268	187,668	5.4:1
FY16	50,031,058	1,243,040	232,038	5.4:1
FY17	58,346,955	1,469,801	245,470	6.0:1
FY18	48,963,984	1,267,587	220,125	5.8:1
FY19	56,883,222	1,540,873	235,372	6.5:1

#### 2.1.1.2 FY18

Figure 2.1 below charts year on year diesel and electricity usage, material mined, and material mined plus rehandled coal. In 2014 the MOD 6 EA was approved allowing the expansion of production to 13.5Mtpa. Since approval production at Mangoola has steadily ramped up with FY17 being the first year the facility achieved maximum production volume. Thereafter electricity consumption is expected to remain relatively stable while year on year diesel consumption will increase.

However, FY18 saw a 16% decrease in total material mined plus rehandled product. This reduction in production was due to Protected Industrial Action undertaken by the workforce.

FY18 should be viewed as an exception. A comparison of performance between FY17 and FY19 is much more indicative of future trends. Between these two periods total material mined and rehandled fell by 2.5%, electricity consumption fell by 4.1% while diesel usage increased by nearly 5%. Again, this highlights the ongoing projection that each tonne of coal mined and rehandled will become more energy and emissions intensive

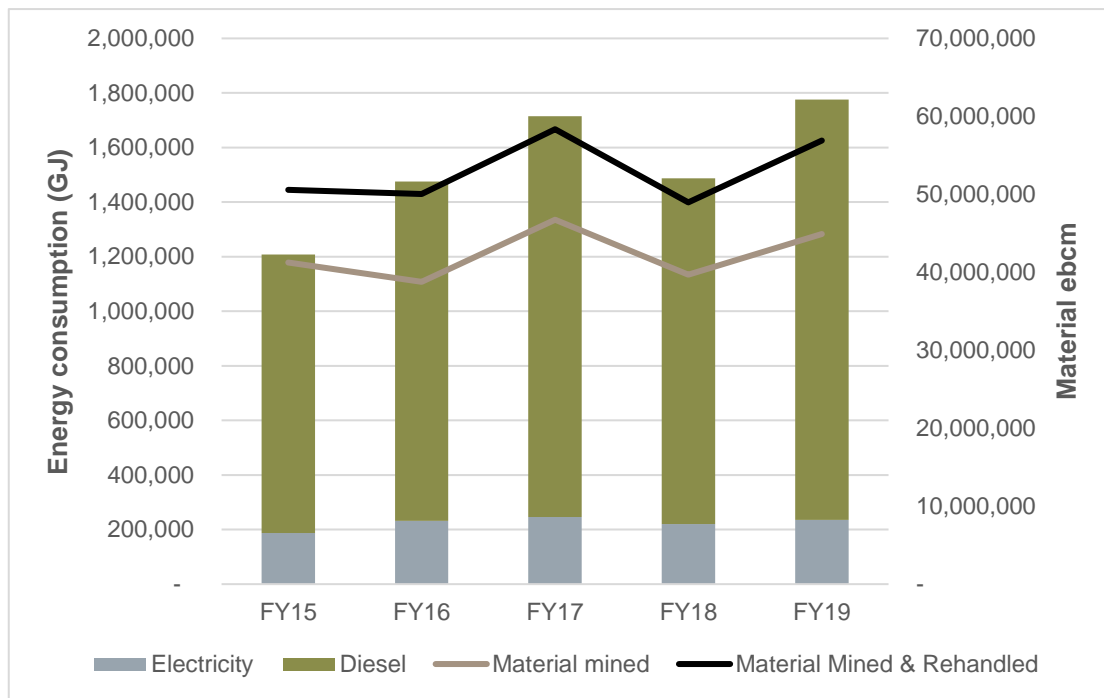


Figure 2-1: Year on year energy consumption, material mined and material mined and rehandled

### 2.1.1.3 FY19 forecast comparison

Table 2-2 below compares forecast and actual ROM production, diesel usage and electricity consumption. The forecast is based on the MOD 6 EA approved in 2014. In a Business-As-Usual (BAU) scenario electricity usage will likely remain at or below forecast while production remains at maximum permitted yield.

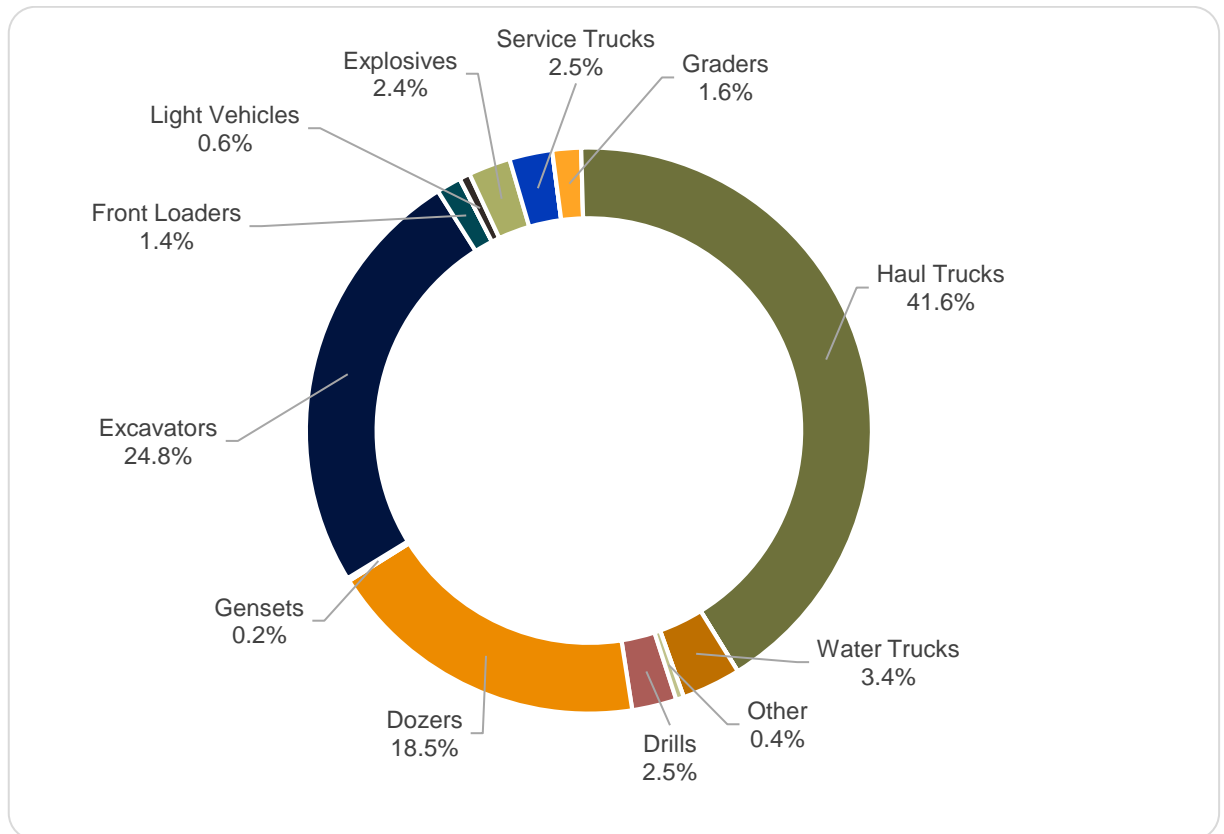
Table 2-2: FY19 ROM, diesel consumption and electricity usage against EIS forecast

	ROM tonnes	Diesel use (kL)	Electricity Usage (MWh)
Modification 6 Forecast	13,500,000	40,500	71,867
FY19 actual	13,084,746 (-3.08%)	39,919 (-1.43%)	65,381 (-9.02%)

## 2.2 Diesel use

Diesel at Mangoola is used to power mobile equipment and is used in association with extraction and movement of overburden and ROM coal as well as some rehandling of product coal at the CHPP.

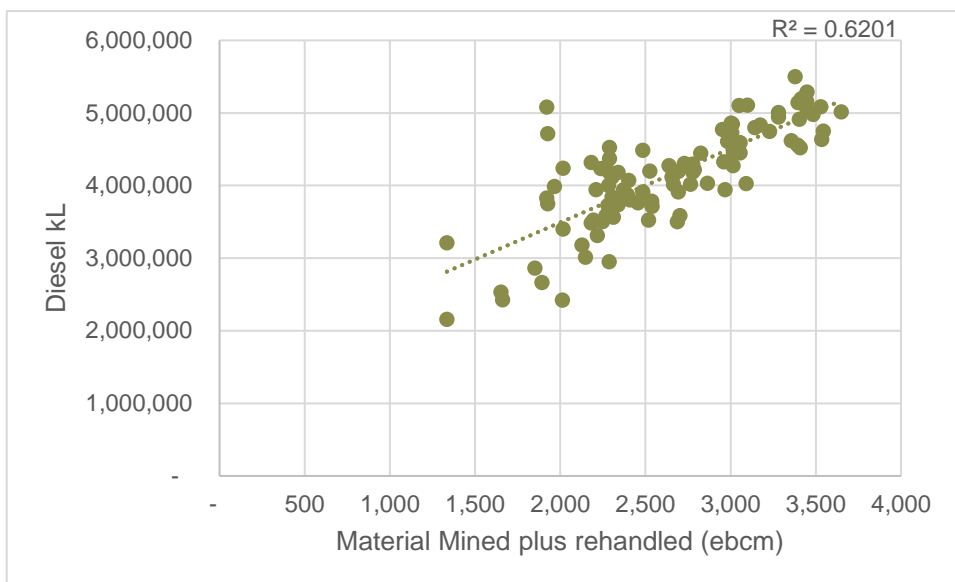
Figure 2-2 shows the diesel breakdown by equipment at Mangoola. Excavators, haul trucks and dozers are responsible for nearly 85% of diesel consumption on site, their activity is directly related to the coal extraction process.



**Figure 2-2: Breakdown of diesel usage by equipment type**

Figure 2.3 below illustrates the correlation between ebcm of ‘material mined plus rehandled’ and diesel in kilo litres. While there is a clear correlation, the wide scatter pattern and R<sup>2</sup> value of 0.62 indicates there are other factors which affect the efficiency of the mining operation and subsequent diesel use. These may include;

- the strip ratio
- distance of haul
- design and grade of haul roads.
- idle times
- engine overhauls and maintenance
- diesel fuel specifications.



**Figure 2-3: Correlation between material mined and rehandled, and diesel consumption.**

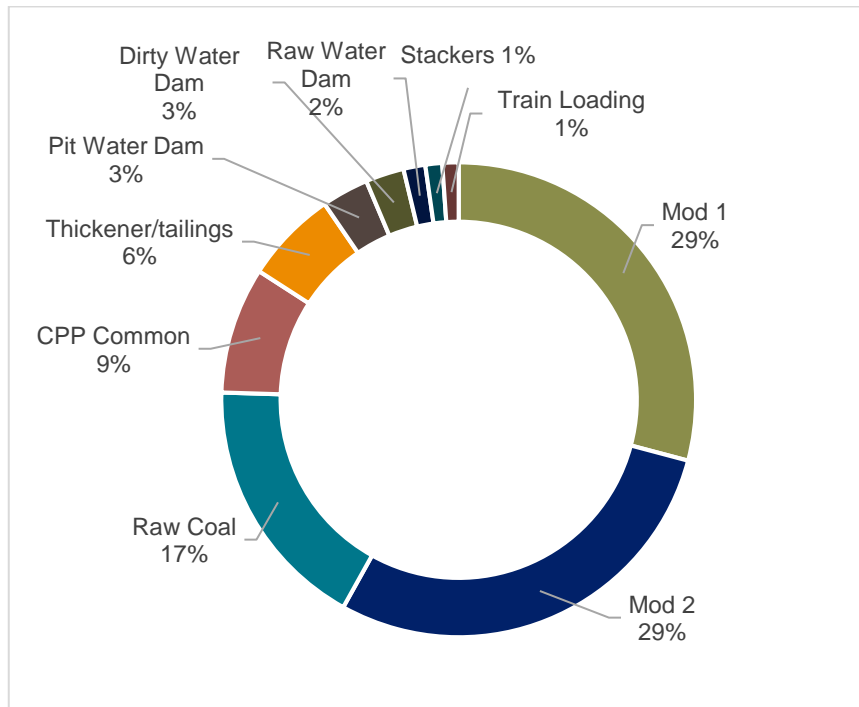
Table 2-3 details Mangoola Coal’s annual diesel use over the past five years based on the invoiced diesel amount, and the material mined and rehandled. As stated previously FY18 is not representative of the standard operation of the site and should be considered an outlier. FY19 compared with FY17 provides a more indicative comparison. Between these two periods diesel use has increased by 4.8% while total material mined plus rehandled fell by 2.5%. This indicates a degradation in overall performance as the mine progresses away from infrastructure and haul lengths increase..

**Table 2-3: Diesel use and material mined and rehandled**

FY	Diesel use (kL)	Material mined and rehandled (ebcm)
FY15	26,432	50,564,134
FY16	32,203	50,031,058
FY17	38,078	58,346,955
FY18	32,839	48,963,984
FY19	39,919	56,883,222

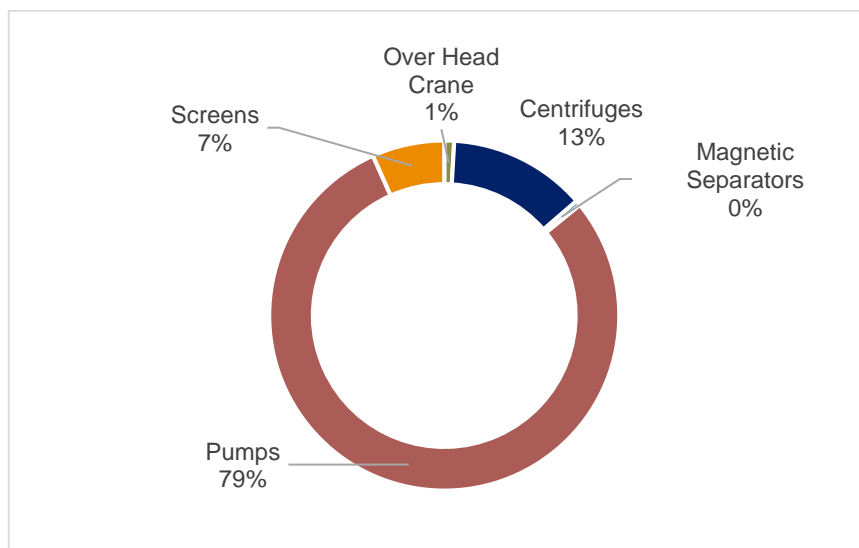
## 2.3 Electricity use

Reviewing FY13 end use electricity data shows the handling of Run of Mine coal and its processing within the CHPP accounts for over 83% of electricity usage on site. Figure 2.4 below illustrates the full electricity end use profile of Mangoola Coal.



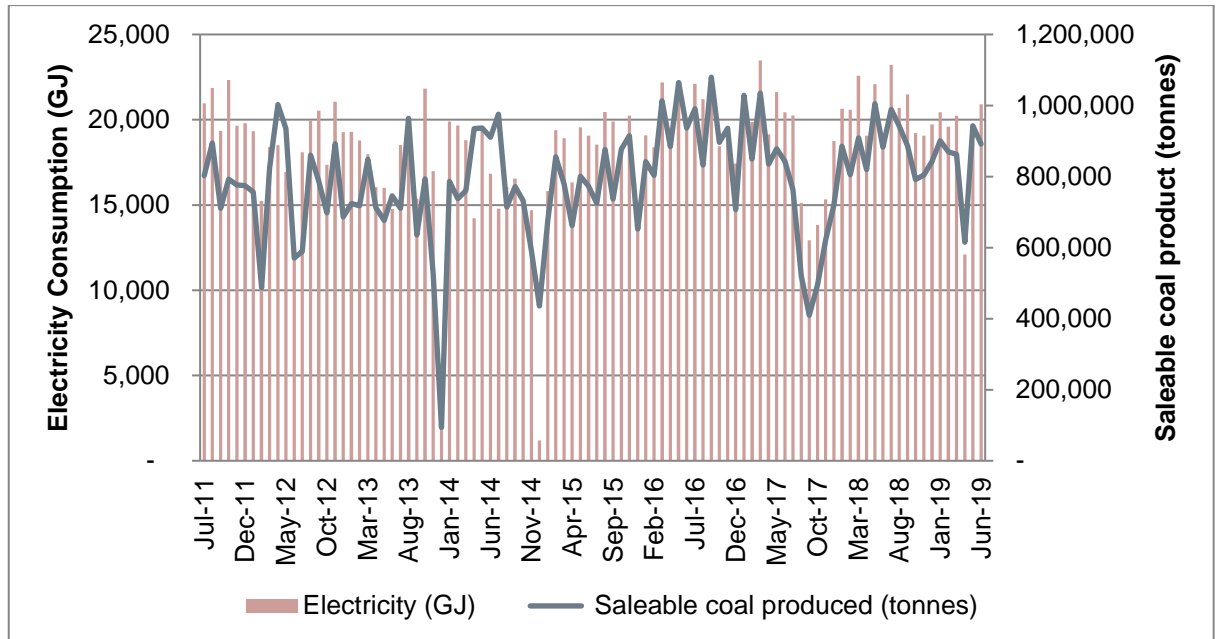
**Figure 2-4: Electricity end use by area**

As the two CHPP modules account for over 57% of the electricity use at Mangoola Coal it is useful to understand the end use electricity breakdown further in these areas. Nearly 80% of consumption within the CHPP is attributed to pumping highlighting the importance of control strategies linked to production and ongoing planned preventative maintenance (PPM).



**Figure 2-5: CHPP module electricity usage by end use**

Figure 2-5, below, tracks Mangoola’s annual electricity consumption and saleable coal product over the last five years. Electricity consumption closely tracks saleable coal product indicating CHPP operation aligns with coal production well. FY19’s annual electricity consumption is comparable with FY17 when a similar level of production was seen. If saleable coal tonnage remains at similar FY17 and FY19 levels electricity consumption is projected to remain constant. If electricity usage fails to track saleable product tonnage this should be viewed as a trigger for further investigation.



**Figure 2-5: Relationship between electricity and saleable coal produced**

In the MOD 6 (EA), the electricity consumption figures were reviewed to consider a scenario where the ROM coal extraction rate is sustained at 13.5 mtpa for the life of mine (LOM). Table 2-4 compares actual ROM and electricity usage, with the MOD 6 forecast. Electricity consumption, even at maximum allowable ROM extraction, is consistently below forecast.

**Table 2-4 Forecast and actual coal extraction and electricity consumption in FY15 to FY19**

	ROM tonnes	Electricity Usage (MWh)
MOD 6 Forecast	13,500,000	71,867
FY15 actual	10,789,252 (-20.08%)	52,130 (-27.46%)
FY16 actual	12,757,392 (-5.50%)	64,455 (-10.31%)
FY17 actual	13,515,531 (0.12%)	68,186 (-5.12%)
FY18 actual	11,080,517 (-17.92%)	61,146 (-14.92%)
FY19 actual	13,084,746 (-3.08%)	65,381 (-9.02%)

Revised baseline information for FY19 is provided in the table below, with a comparison to current performance. Electricity consumption for the mining infrastructure area is assumed to be relatively constant and would only be affected by site shutdowns.

**Table 2-5: Baseline information – Electricity Consumption**

Mod 6 baseline	2016	2017	2018	2019	
Organisation Name	Mangoola Coal Operations Pty. Limited				
Start Date	July 2013	July 2015	July 2016	July 2017	July 2018
End Date	June 2014	June 2016	June 2017	June 2018	June 2019
Baseline electricity use (GJ per annum)	218,180 <sup>3</sup>	232,038 <sup>4</sup>	245,470	220,125	235,372
Greenhouse emissions (tonnes per annum)	75,808 <sup>5</sup>	63,810 <sup>6</sup>	56,594	50,751	52,958
Is the value representative of ordinary performance	No	No	Yes	No	Yes
If no, describe variance	On 28/4/2014, Mod 6 was approved at which time we may mine up to 13.5mtpa ROM coal (was 10.5mtpa on calendar year)	The production rate has not yet reached the expected rate of 13.5 mtpa		Production was 16% below 13.5 mtpa cap	
Quantify impact of variance on baseline	+ 40,552 (based on year of 13.5mtpa ROM production)	+ 26,694 (based on year of 13.5mtpa ROM production)	+ 13,262 (based on year of 13.5mtpa ROM production)	+ 38,607 (based on year of 13.5mtpa ROM production)	+ 23,360 (based on year of 13.5mtpa ROM production)
Baseline energy use including variance (GJ)	258,732				
Business activity indicator	Washed Plant Feed tonnes '000				
Quantity of BAI per year	13,500				
Baseline energy use KPI	19.2				
Baseline KPI units	GJ/ Washed Plant Feed tonnes '000				
Summer Peak Demand (kVA)	To be determined				
Winter Peak Demand (kVA)	To be determined				

3. Average used for December 2015 as reduced power consumption that month was not a typical result.

4. Average used for December 2015 as reduced power consumption that month was not a typical result.

5. Estimated using full fuel cycle emission factor for NSW electricity from NGA Factors, July 2013 and using baseline GJ including variance

6. Estimated using full fuel cycle emission factor for NSW electricity from NGA Factors, July 2013 using FY16 consumption

### 3 Key performance indicators

An assessment of indicators to be used in open cut mines has been conducted to inform energy intensity reduction achieved by Glencore Coal Assets Australia sites against targets set at a corporate level.

A joint KPI including diesel and electricity use was deemed inappropriate as each energy source is used in a specific manner, for a specific purpose. Additionally, these operations are managed by separate teams with differing working strategies. As a result, the reporting and actioning of KPIs has been separated.

#### 3.2 Electricity consumption KPI

The majority of electricity consumption is linked to the processing of material in the CHPP. Electricity usage directly correlates with CHPP throughput (saleable product) making a GJ or kWh/tonne of saleable product a meaningful performance indicator and forecasting metric.

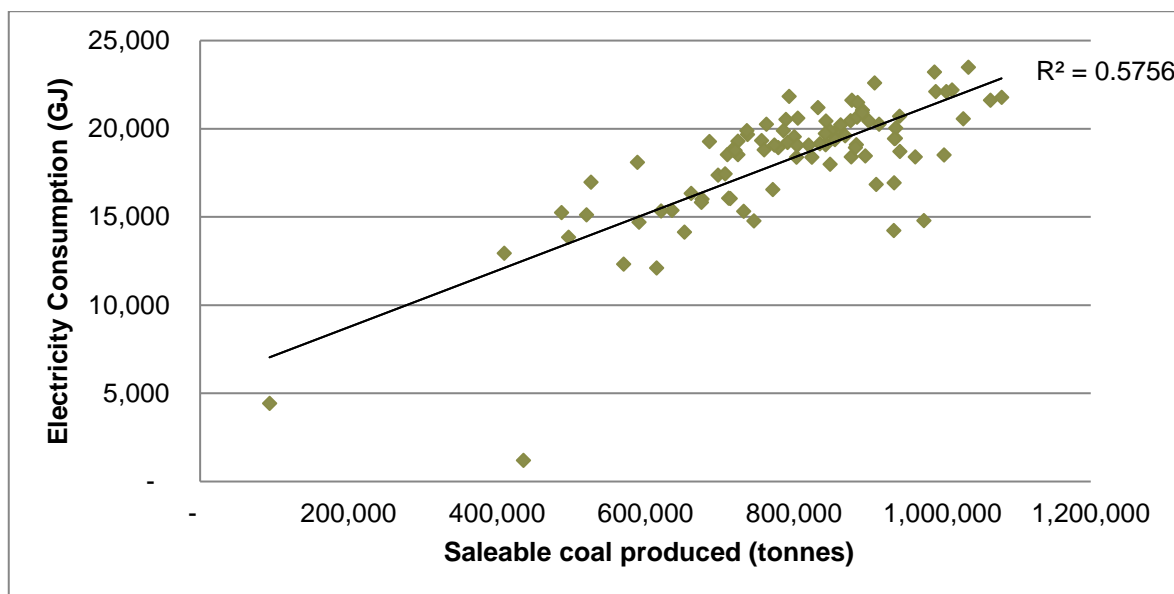


Figure 3-1: Electricity KPI FY 15-19

Figure 3.2 tracks the electricity KPI for the past seven years. The average KPI across this period is 6.57 kWh/tonne, with FY19 performing better than average at 6.31 kWh/tonne, equating to a saving of over 2.5MWh.

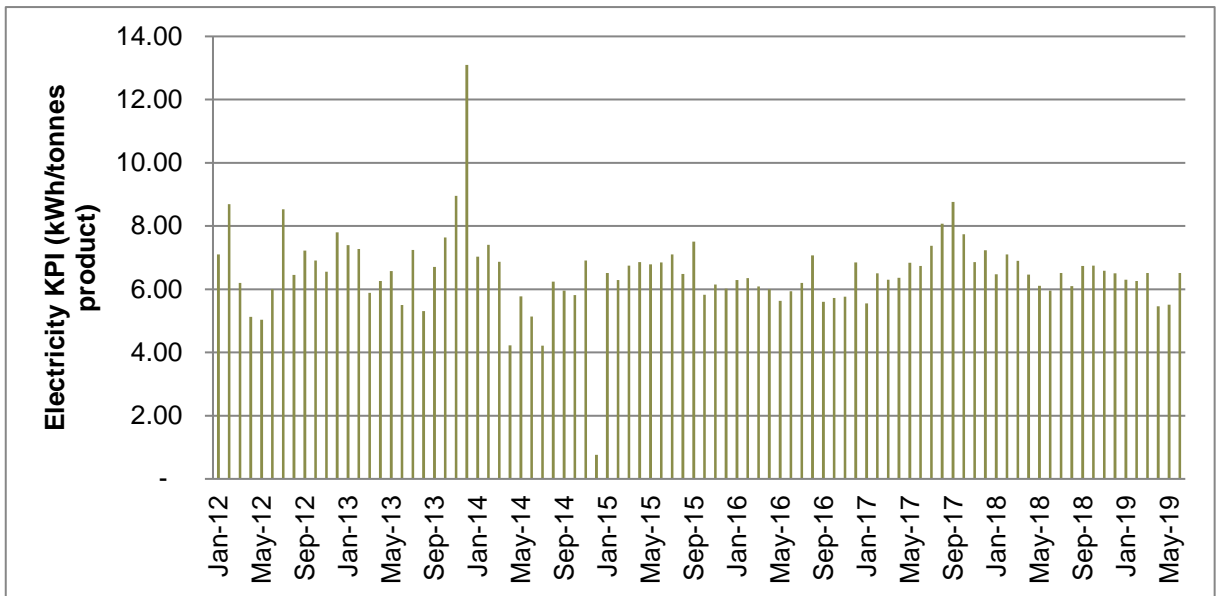


Figure 3-2: Electricity KPI

### 3.3 Diesel consumption KPI

Diesel consumption is directly related to the volume of material mined and rehandled. The KPI is tracked in figure 3.3.

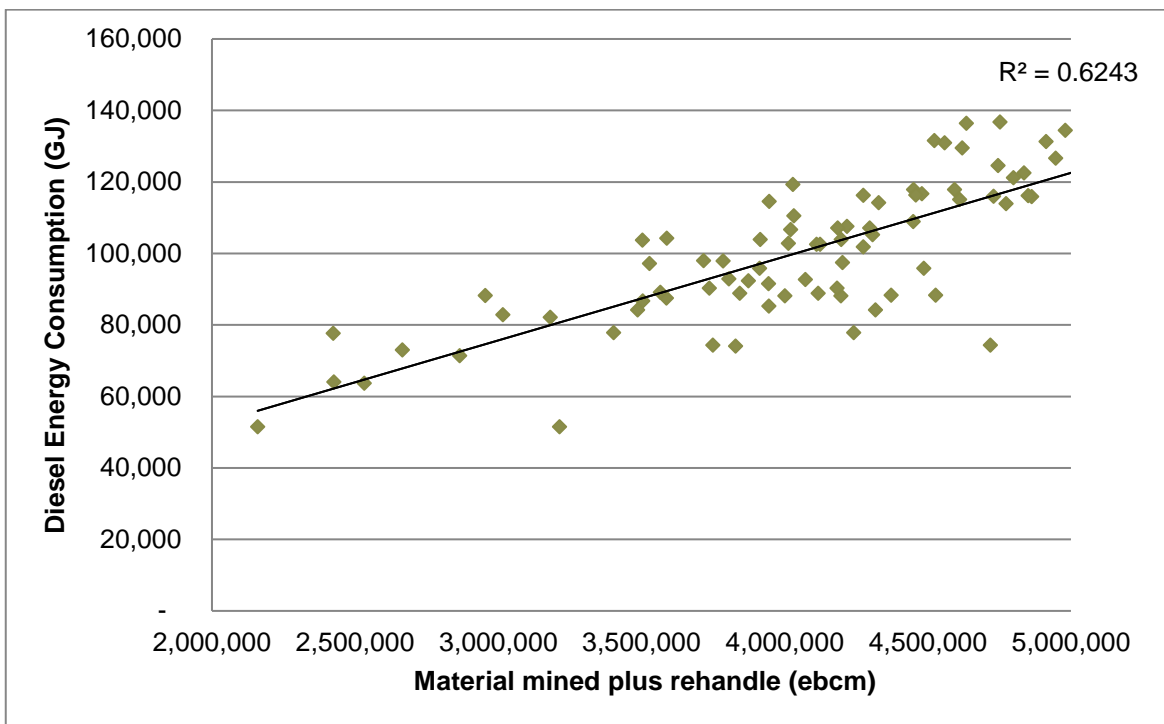
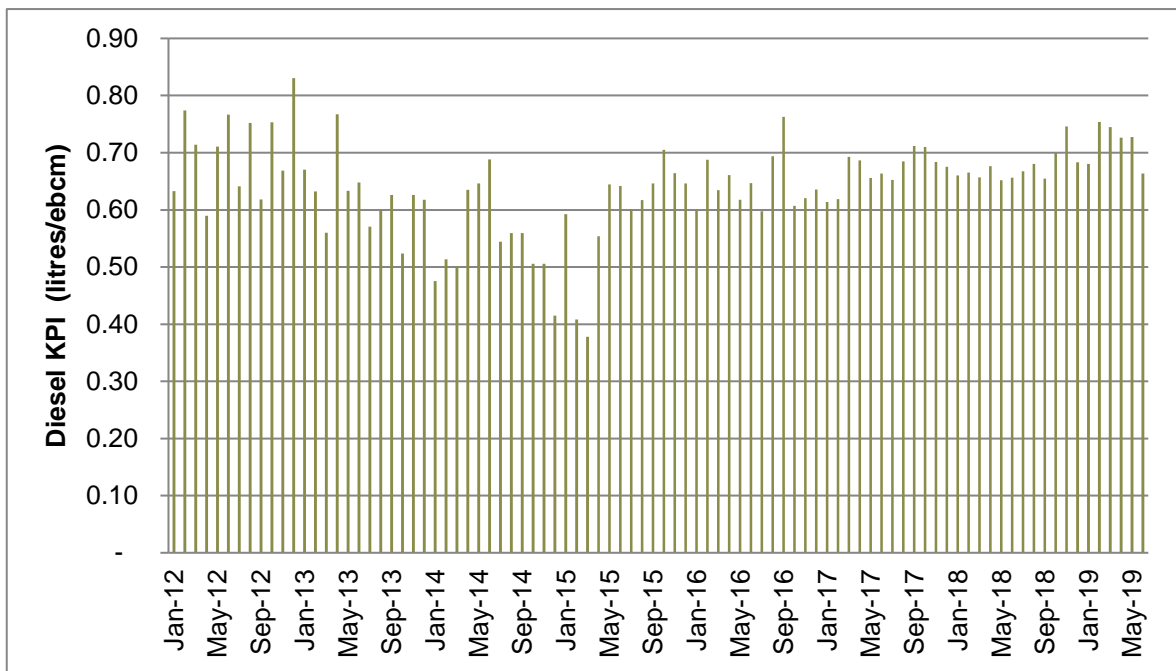


Figure 3-3: Diesel KPI



**Figure 3-4: Historic Diesel KPI value**

For the past three years, (2016-19) the value of the diesel KPI has steadily increased (figure 3.4). While past increases in diesel consumption i.e. 2013, have been attributed to an increase in out-of-pit dumping, this consistent upwards trend is indicative of changing operational norms.

Table 3-1 below details the average annual diesel KPI for the last three fiscal years and the total material mined plus rehandled coal. While expansion of mining operations will naturally lead to a degradation in the diesel KPI as effective haulage lengths increase, the increase in ROM & rehandled product over the last three years indicates potential for future minor efficiency improvements.

*Table 3-1 details the year on year increase in*

Year	Average KPI (L/ebcm)	Total material mined plus rehandled ebcm
FY17	0.65	58,346,955
FY18	0.67	48,963,984
FY19	0.7	56,883,222

## 4 Energy management system

Mangoola Coal use a simple reporting structure to communicate energy performance using the electricity and diesel KPIs. This is done on a monthly basis using the Global Corporate Practice Reporting system.

The review and reporting function is the responsibility of the Environment and Community Manager, who co-ordinates data gathering and disseminates insights to management teams. The Operations Manager is responsible for appropriate allocation of resources to achieve the objectives of the ESAP..

An annual energy review takes place to monitor performance across the financial year, identify trends and ensure global KPIs are being met. Mangoola Coal also seeks to identify lessons learnt and develop best practice using insight from differing areas of the business.

## 5 Opportunities identification

Mangoola continually assess the viability of initiatives to improve energy efficiency and reduce GHG emissions from operations. Table 5-1 below details the recent energy opportunity that was identified in the 2019 3 yearly Energy Audit period and will be analysed during the ESAP period prior to the next 3 yearly audit.

**Table 5-1: Opportunities under investigation**

Operating Area	Improvement Under Investigation
In Pit Dozer Overburden Dozer Push	In 2018 Mangoola identified an opportunity for dozer push to move low passes of interburden to uncover coal. Dozer push can be one of the most cost-effective methods of moving overburden. Depending on geotechnical conditions and pit configuration, dozer bulk push can replace some of the truck-shovel operations. Mangoola Coal is currently investigating the operational efficiency improvement and diesel saving associated with dozer push conducted in 2018 and 2019.

## 6 Review and Improvement

### 6.1 Annual energy efficiency review and reporting

Performance against KPI's will be reviewed annually with a full review of the ESAP conducted every 3 years. Improvement opportunities will continue to be investigated, to determine if they are feasible and actioned accordingly. A summary of review outcomes and action status will be reported in the Annual Review. This is in accordance with, Schedule 5, Condition 6 of PA 06\_0014.

### 6.2 Review of ESAP

A review of the ESAP will be undertaken every 3 years or if triggered under Schedule 5, Condition 9 of PA 06\_0014.

## 7 References

### 7.1 Legislation

Energy Efficiencies Opportunities Act 2006  
Energy Efficiencies Opportunities (Repealed) Act 2014

### 7.2 Guidelines

Guidelines for Energy Savings Action Plans (Department of Energy, Utilities and Sustainability, 2005)  
– note, the original ESAP referred to these guidelines which are no longer available.

## 7.3 Mangoola Coal project approval

Project Approval 06\_0014MOD 8- Viewed at <https://www.planningportal.nsw.gov.au/major-projects/project/14661>

## 7.4 Energy Audit

Mangoola Energy Audit, Outcomes Report, Energetics, 23 December 2019

# Appendix 1: Authority Correspondence