
GREENHOUSE GAS ASSESSMENT

KOOLANOOKA / BLUE HILLS REMNANT DIRECT SHIPPING IRON ORE (DSO) MINING PROJECT

PREPARED FOR:

ECOLOGIA ENVIRONMENT

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KEWAN BOND PTY LTD

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AND CONSULTING SERVICES



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1. Project Overview

The 'Koolanooka/Blue Hills Remnant Direct Shipping Iron Ore (DSO) Mining Project' (the Project) involves the recommencement of open pit mining activities at Koolanooka and at the Mungada East and Mungada West pits at Blue Hills. The Koolanooka minesite is located approximately 160 km south east of Geraldton and 21 km east of Morawa, and the Blue Hills minesite is located 60 km to the east of Koolanooka.

Iron ore will be crushed and screened at Koolanooka before being transported 20km by road to a rail siding at Tilley siding north of Morawa. It will then be transferred onto trains for railing to the Geraldton Port

The Project is expected to run for a period of 3 to 5 years, with development scheduled to commence in the fourth quarter of 2007.

Energy consumption associated with the Project (i.e. diesel and electricity) will be the main contributors of greenhouse gas emissions. Diesel will be used to fuel mining equipment, while electricity will be used to power the crushing and screening plant. Electricity will either be generated on site by diesel-fired gensets, or will be sourced from the Western Australian grid. Greenhouse gas emissions have been estimated for both electricity scenarios.

Approximately 62 hectares of land will require clearing, which will also generate greenhouse gas emissions. However, the vegetation (low shrubland) to be cleared comprises of re-growth and previously uncleared areas in a semi-arid environment. Emissions from land clearing are therefore considered insignificant and have not been estimated as part of this assessment.



2. Greenhouse Assessment Methods

The Greenhouse Gas (GHG) assessment involved calculating the greenhouse gas emissions likely to be associated with the Project. The following energy sources were included in the assessment:

- Fuel consumption by mobile mining equipment
- Fuel consumption by mobile electricity generators and lighting plants
- Electricity sourced from the Western Australian grid supply (if electricity is not generated on site)
- Fuel consumption by equipment used to transport the final product to the Tilley railway siding.

The main greenhouse gases associated with the Project are:

- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)

These gases differ in their capacity to trap heat and contribute to the greenhouse effect. The capacity of each gas to contribute to global warming is referred to as its 'global warming potential' (GWP) and is measured relative to that of carbon dioxide i.e. carbon dioxide has a GWP of 1, whereas methane has a GWP of 21 because one tonne of methane has the same capacity to contribute to global warming as 21 tonnes of carbon dioxide. The greenhouse gases applicable to the Project and their respective GWP's are provided in Table 1 below.

Gas	Global Warming Potential
Carbon dioxide	1
Methane	21
Nitrous Oxide	310

Table 1 Global warming potential of greenhouse gases

Emissions have been calculated in accordance with methods provided by the Australian Greenhouse Office (AGO). The emission factors used to calculate greenhouse gas emissions from the Project are stated in terms of carbon dioxide equivalents (CO₂-e) and consider the various GWP's of the different greenhouse gases.

Estimated greenhouse gas emissions include both direct and indirect emissions. Consistent with Australian and international protocols for reporting greenhouse gases, emissions are separated into Scope 1, Scope 2 and Scope 3 emissions.

Scope 1 emissions are direct emissions from sources within the boundary of an organisation such as fuel combustion and manufacturing processes (AGO, 2006). For this Project, this includes emissions from diesel combustion on site (e.g. Mining equipment and diesel generators).

Scope 2 emissions include indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation. Scope 2 emissions are only applicable to



the Project in the scenario whereby electricity is sourced from the Western Australian grid supply.

Scope 3 emissions include all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation. For this Project, this includes emissions associated with the extraction, refinement and delivery of the diesel that is consumed on site.



3. National and State Strategies

3.1. National

Although deciding not to ratify the Kyoto Protocol, the Australian Government has committed to Australia's internationally agreed target of limiting emissions to 108% of 1990 levels between 2008 and 2012.

As part of Australia's National Greenhouse Strategy, a number of programmes and processes have been developed to support the modules listed above. For the mining industry, these include:

- The consideration of likely greenhouse gas emissions and contributions to global warming as part of project assessments by the Commonwealth Government.
- Development of a National Greenhouse Gas Inventory, based on international guidelines.
- The Greenhouse Challenge Plus programme - a programme of cooperative agreements between industry and government whereby companies undertake action to abate their greenhouse gas emissions through energy efficiency and other measures. Companies are required to participate in the Greenhouse Challenge Plus programme in order to receive more than \$3 Million in fuel rebate credits.
- The Energy Efficiency Opportunities (EEO) programme - encourages large energy-using businesses to improve their energy efficiency by improving the identification, evaluation and implementation of cost effective energy savings opportunities. Participation is mandatory for corporation that use more than 0.5 petajoules of energy per annum.

3.2. Western Australia

The Western Australian Greenhouse Strategy was released in 2004 and is due for review in 2008. The Strategy includes a number of elements, which are designed to achieve the objectives of the strategy. The most significant element involves reducing greenhouse gas emissions and involves a number of actions to facilitate those reductions. These actions include the requirement for major industrial emitters to:

- Report greenhouse gas emissions annually to the WA Greenhouse Gas Inventory (WAGGI)
- Provide estimates for future emissions
- Develop strategies for minimising emissions
- Report publicly every 3 years
- Conduct triennial audits.

It is planned for these requirements to become mandatory for significant emitters at decreasing thresholds; however this process has been delayed. The thresholds stated in the 2005 Annual Progress Report for the WA Strategy are:

- 500,000 tonnes of CO₂-e/annum for 2004/05
- 250,000 tonnes of CO₂-e/annum for 2005/06
- 100,000 tonnes of CO₂-e/annum for 2006/07

WA's Environmental Protection Authority (EPA) considers greenhouse gas emissions and the contribution to global climate change during its project assessment process. The EPA



released the WA Guidance Statement for Minimising Greenhouse Gas Emissions in 2002. The Guidance provides advice to proponents, and the public generally, about the minimum requirements for environmental management which the EPA would expect to be met when the Authority considers a proposal during the assessment process. The guidelines recommend that proponents of projects that are likely to result in significant greenhouse gas emissions should:

- Estimate gross emissions likely to be emitted from the proposed project for each year of its operation
- Detail the project lifecycle greenhouse gas emissions and the greenhouse gas efficiency of the proposed project (per unit of product and/or other agreed performance indicators). The parameters should be compared with similar technologies producing similar products or their analogues.
- Indicate the intended measures and efficient technologies to be adopted to minimise or reduce total greenhouse gas emissions in the proposed project.
- Consider a wide range of carbon sequestration options and include intended measures for research and adoption.
- Commit to an ongoing programme of monitoring, investigation, review and reporting of internal and external greenhouse gas abatement measures.
- Consider and advise whether they will join the Commonwealth Government's "Greenhouse Challenge"



4. Greenhouse Gas Emissions

4.1. Scenario 1 - Site-Generated Electricity

The estimated annual consumption of fuel and energy and the resulting emissions of greenhouse gases associated with the Project are shown below in Table 2. This scenario assumes that the site will be generating its own electricity via diesel-fired generators. Subsequently, there are no Scope 2 emissions, which are associated with the consumption of electricity that is generated elsewhere.

Further details of energy consumption and greenhouse gas emissions associated with this scenario are included in the inventory shown as Appendix 1. This inventory also provides anticipated production rates and calculates energy and emission performance indicators (CO₂-e per tonne of ore and material mined).

Energy Source	Annual Consumption	Energy (GJ)	Annual Greenhouse Gas Emissions (tonnes CO ₂ -e)			
			Scope 1	Scope 2	Scope 3	TOTAL
Diesel Mobile	2,467 kL	95,237	6,647	0	743	7,390
Diesel Stationary	372 kL	14,371	997	0	112	1,109
ANFO	792 t	n/a	132	0	0	132
TOTAL		109,608	7,777	0	855	8,632

Table 2 Annual Energy Consumption and Emissions - Site-Generated Electricity

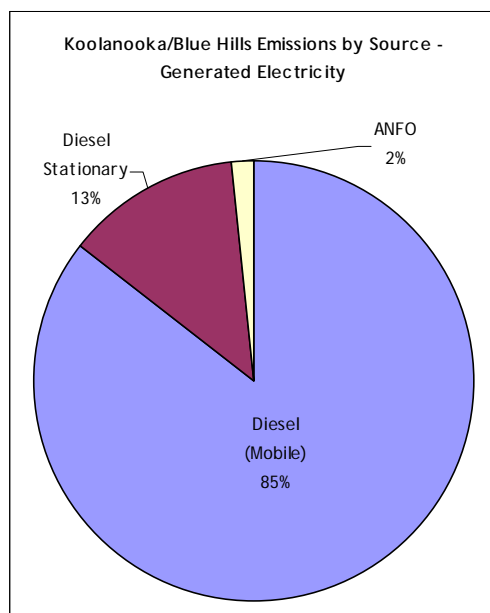


Figure 1

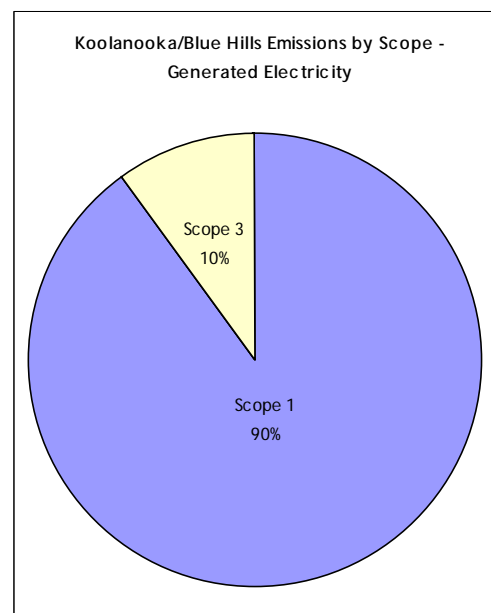


Figure 2



4.2. Scenario 2 - WA Grid Electricity

Table 3 provides the estimated fuel and energy consumption and resulting emissions, assuming that electricity is sourced from the Western Australian grid. This results in higher emissions than if electricity is generated on site - due largely to the fact that much of the WA grid electricity is sourced from coal-fired generators, which, although cheaper, is more greenhouse intensive than diesel-fired generators.

Appendix 2 shows the energy and emissions inventory for this scenario. It also contains details of production rates and calculates energy and emission performance indicators.

Energy Source	Annual Consumption	Energy (GJ)	Annual Greenhouse Gas Emissions (tonnes CO ₂ -e)			
			Scope 1	Scope 2	Scope 3	TOTAL
Grid Electricity	6,570 MWh	23,652	0	5,511	639	6,150
Diesel Mobile	2,467 kL	95,237	6,647	0	743	7,390
Diesel Stationary	44 kL	1,691	117	0	13	130
ANFO	792 t	n/a	132	0	0	132
TOTAL		120,579	6,896	5,511	1,395	13,802

Table 3 Annual Energy Consumption and Emissions - WA Grid Electricity

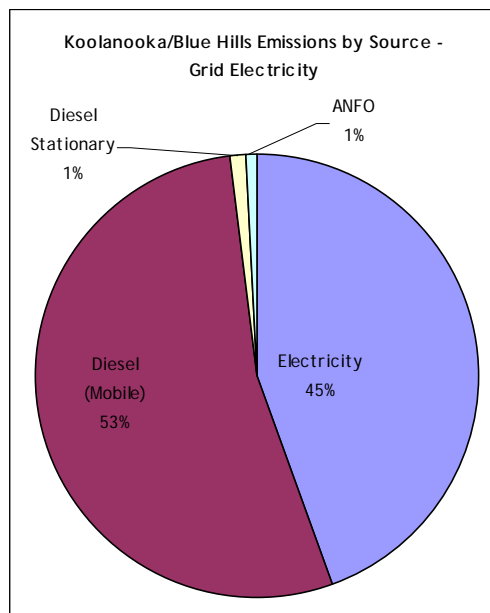


Figure 3

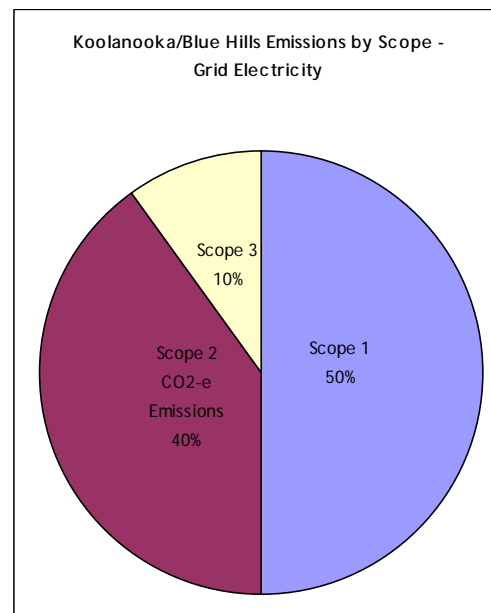


Figure 4



5. Conclusions and Recommendations

It is unlikely that the Project will be considered as a significant contributor to Western Australia's greenhouse gas emissions by the regulators assessing the project. This is due to the short period of mining and the relatively small scale of the proposed operation with regards to energy consumption and subsequent greenhouse gas emissions.

Annual energy consumption by the project (109,608 - 120,570 GJ) is substantially less than the 500,000 GJ (0.5 PJ), which triggers a company's participation in the EEO programme. However, if the owner of the Project consumes energy elsewhere in the company so that company-wide energy consumption exceeds 0.5 PJ, then the Project may need to be included in the programme.

Annual emissions of greenhouse gases (8,632 - 13,802 tonnes CO₂-e) are also substantially less than the lowest emission threshold for reporting to the WA Greenhouse Gas Inventory (100,000 tonnes).

It is acknowledged that the short period of mining limits the payback available for energy-efficiency initiatives. However it is likely that opportunities still exist to maximise energy efficiency. Some of these opportunities may already form part of the proposed operation.

It is recommended that the Environmental Impact Assessment for the Project include some details of how the Project planning and operation will be in accordance with the relevant Government greenhouse and energy policies, guidelines and standards (i.e. WA Greenhouse Strategy). Some examples of these details might include:

- Explaining how the calculation of greenhouse gas emissions (as part of this assessment) was conducted in accordance with relevant standards and methods;
- Providing details of Project design features that improve energy efficiency and/or represent best practice for energy efficiency (e.g. purchase of high-efficiency generators or electric motors);
- Providing details of operational procedures/processes that maintain or improve energy efficiency;

It is also recommended that data on energy consumption and greenhouse gas emissions be maintained throughout the operational phase of the project for potential future internal or external reporting. It is likely that the project will be required to collate most of this data anyway for reporting against the National Pollutant Inventory.



6. References

Australian Greenhouse Office (2006), *AGO Factors and Methods Workbook - December 2006*.

Commonwealth of Australia - Department of Industry Tourism and Resources (2006), *Energy Efficiency Opportunities Industry Guidelines*.

Commonwealth of Australia (1998), *The National Greenhouse Strategy*.

Commonwealth of Australia (2000), *National Greenhouse Strategy - 2000 Progress Report*.

Western Australian Government (2004), *Western Australian Greenhouse Strategy - September 2004*.

Western Australian Government (2006), *Western Australian Greenhouse Strategy - Annual Progress Report 2005, March 2006*.

Western Australian Government - Environmental Protection Authority (2002), *Guidance for the Assessment of Environmental Factors, Guidance Statement for Minimising Greenhouse Gas Emissions No. 12 -October 2002*.



Appendix 1 - Energy / Greenhouse Inventory (Site-Generated Electricity)

Raw Data	Units	Year 1
Production		
Ore Mined	Tonne	1,778,693
Waste Mined	Tonne	1,617,263
Material Mined	Tonne	3,395,956
Electricity		
Electricity	kWh	6,570,000
Diesel		
Haul Trucks	kL	687
Grader	kL	31
Watercart	kL	67
D9 dozer	kL	164
Cat 988 loader	kL	562
Excavator	kL	329
Light Vehicles	kL	47
Drill Rigs	kL	131
Explosives crew	kL	47
Tilley Loaders	kL	80
Tilley Water Cart	kL	67
Tilley Roadtrains	kL	256
Diesel (Mobile)	kL	2,467
Crushing Plant (Elect Generation)	kL	329
Lighting Plants	kL	22
Generators (small)	kL	22
Diesel (Stationary)	kL	372
Explosives		
ANFO	Tonne	792
Energy Use in GJ		
Electricity	GJ	23,652
Diesel (Mobile)	GJ	95,237
Diesel (Stationary)	GJ	14,371
Total Energy (Excludes electricity)	GJ	109,608
Scope 1 CO₂-e Emission Factors		
Diesel (Mobile)	Tonne CO ₂ e/GJ	0.0698
Diesel (Stationary)	Tonne CO ₂ e/GJ	0.0694
ANFO	Tonne CO ₂ e/Tonne	0.167
Heavy ANFO	Tonne CO ₂ e/Tonne	0.178
Emulsion	Tonne CO ₂ e/Tonne	0.166
CO ₂ Direct	Tonne CO ₂ e/Tonne	1
Scope 2 CO₂-e Emission Factors		
Electricity	Tonne CO ₂ e/GJ	
Scope 3 CO₂-e Emission Factors		
Electricity	Tonne CO ₂ e/GJ	
Diesel (Mobile)	Tonne CO ₂ e/GJ	0.0078
Diesel (Stationary)	Tonne CO ₂ e/GJ	0.0078
Scope 1 CO₂-e Emissions		
Diesel (Mobile)	Tonne	6,647.53
Diesel (Stationary)	Tonne	997.33
ANFO	Tonne	132.26
Total Scope 1 Emissions	Tonne	7,777.13
Scope 2 CO₂-e Emissions		
Electricity	Tonne	0
Scope 3 CO₂-e Emissions		
Electricity	Tonne	0.00
Diesel (Mobile)	Tonne	742.85
Diesel (Stationary)	Tonne	112.09
Total Scope 3 Emissions	Tonne	854.94
Total CO₂-e Emissions		
Electricity	Tonne	0.00
Diesel (Mobile)	Tonne	7,390.38
Diesel (Stationary)	Tonne	1,109.42
ANFO	Tonne	132.26
Total Emissions	Tonne	8,632.07
Indices (per Tonne Ore Mined)		
Total Energy	MJ/Tonne	61.62
Total CO ₂ e	Kilogram/Tonne	4.85
Indices (per Tonne Material Mined)		
Total Energy	MJ/Tonne	32.28
Total CO ₂ e	Kilogram/Tonne	2.54



Appendix 2 - Energy / Greenhouse Inventory (WA Grid Electricity)

Raw Data	Units	Year 1
Production		
Ore Mined	Tonne	1,778,693
Waste Mined	Tonne	1,617,263
Material Mined	Tonne	3,395,956
Electricity		
Electricity	kWh	6,570,000
Diesel		
Haul Trucks	kL	687
Grader	kL	31
Watercart	kL	67
D9 dozer	kL	164
Cat 988 loader	kL	562
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Light Vehicles	kL	47
Drill Rigs	kL	131
Explosives crew	kL	47
Tilley Loaders	kL	80
Tilley Water Cart	kL	67
Tilley Roadtrains	kL	256
Diesel (Mobile)	kL	2,467
Crushing Plant (Elect Generation)	kL	0
Lighting Plants	kL	22
Generators (small)	kL	22
Diesel (Stationary)	kL	44
Explosives		
Anfo	Tonne	792
Energy Use in GJ		
Electricity	GJ	23,652
Diesel (Mobile)	GJ	95,237
Diesel (Stationary)	GJ	1,691
Total Energy (Excludes electricity)	GJ	120,579
Scope 1 CO₂-e Emission Factors		
Diesel (Mobile)	Tonne CO ₂ e/GJ	0.0698
Diesel (Stationary)	Tonne CO ₂ e/GJ	0.0694
ANFO	Tonne CO ₂ e/Tonne	0.167
Scope 2 CO₂-e Emission Factors		
Electricity	Tonne CO ₂ e/GJ	0.233
Scope 3 CO₂-e Emission Factors		
Electricity	Tonne CO ₂ e/GJ	0.027
Diesel (Mobile)	Tonne CO ₂ e/GJ	0.0078
Diesel (Stationary)	Tonne CO ₂ e/GJ	0.0078
Scope 1 CO₂-e Emissions		
Diesel (Mobile)	Tonne	6,647.53
Diesel (Stationary)	Tonne	117.33
ANFO	Tonne	132.26
Total Scope 1 Emissions	Tonne	6,897.13
Scope 2 CO₂-e Emissions		
Electricity	Tonne	5,511
Scope 3 CO₂-e Emissions		
Electricity	Tonne	638.60
Diesel (Mobile)	Tonne	742.85
Diesel (Stationary)	Tonne	13.19
Total Scope 3 Emissions	Tonne	1,394.64
Total CO₂-e Emissions		
Electricity	Tonne	6,149.52
Diesel (Mobile)	Tonne	7,390.38
Diesel (Stationary)	Tonne	130.52
ANFO	Tonne	132.26
Total Emissions	Tonne	13,802.68
Indices (per Tonne Ore Mined)		
Total Energy	MJ/Tonne	67.79
Total CO ₂ e	Kilogram/Tonne	7.76
Indices (per Tonne Material Mined)		
Total Energy	MJ/Tonne	35.51
Total CO ₂ e	Kilogram/Tonne	4.06