Appendix N

Greenhouse Gas Assessment

GREENHOUSE GAS ASSESSMENT

BALMORAL SOUTH IRON ORE PROJECT

PREPARED FOR:

INTERNATIONAL MINERALS

DECEMBER 2008

KEWAN BOND PTY LTD

ENVIRONMENTAL ACCOUNTING AND CONSULTING SERVICES

Executive Summary

The Balmoral South Iron Ore Project involves the development of an open pit magnetite iron ore mine, processing facility and associated infrastructure in the Cape Preston region of Western Australia, 80 km south-west of Karratha. Once mined, the magnetite ore will undergo crushing, high pressure grinding, milling and magnetic separation to form a concentrate. Concentrate will be produced at a rate of 24 million tonnes per annum, of which 10.4 Mtpa will be exported as concentrate. The remaining 13.6 Mtpa will be combined with bentonite and dolomite and heated to form pellets for export.

A combined cycle gas-fired power station will be constructed to supply up to 450 MW of power for the Project. With standby capacity, the size of the installed power station will be up to 600 MW and will generate an estimated 3.8 million MWh per annum.

The calculation of greenhouse gas emissions from project construction and operation has considered emissions of the six Kyoto greenhouse gases – carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) hydrofluorocarbons (HFC's), perfluorocarbons (PFC's) and sulphur hexafluoride (SF_6). These gases each have a different capacity to contribute to global warming, which is known as its global warming potential (GWP). Total emissions are expressed as carbon dioxide equivalents (CO_2-e), which considers the quantity of each gas and its GWP. The Project is expected to generate greenhouse gas emissions to a maximum of 2.6 million tonnes CO_2-e per annum. Over the thirty one year life of the Project total emissions are estimated to be 66.6 million tonnes CO_2-e.

Figure 1 and Table 1 present the emissions estimated from each major source throughout the project.

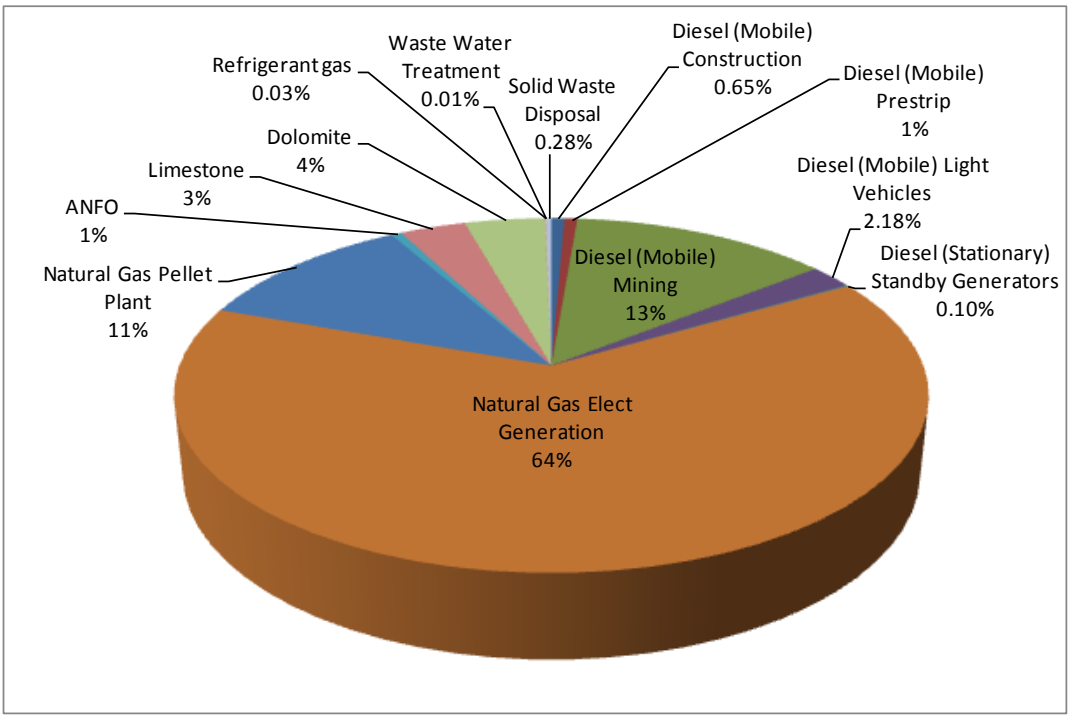

Figure 1 Project Emissions by Source

Source	Annual Energy (TJ)	Scope 1 Annual ($t CO_2$-e)	Scope 1 Project ($t CO_2$-e)	Scope 3 Annual ($t CO_2$-e)	Scope 3 Project ($t CO_2$-e)
Diesel - Construction	n/a[1]	n/a[2]	404,142	n/a[2]	30,687
Diesel - Pre-Strip	n/a[2]	n/a[2]	404,142	n/a[2]	30,687
Diesel - Mining	4,632	323,314	8,486,982	24,550	644,427
Diesel - LV's	772	53,886	1,347,140	4,092	102,290
Diesel - Generators	37	2,549	63,875	194	4,871
Nat. Gas - Elect Generation	28,900	1,482,570	37,064,250	219,640	5,491,000
Nat. Gas - Pellet Plant	5,100	261,630	6,540,750	38,760	969,000
ANFO	n/a	196,518	4,912,950	0	0
Limestone & Dolomite	n/a	13,430	344,250	0	0
Synthetic gases	n/a	774	19,343	0	0
Waste Water Treatment	n/a	284	10,234	0	0
Waste to Landfill	n/a	6,544	187,593	0	0
TOTAL	**39,441**	**2,341,497**	**59,381,509**	**287,236**	**7,242,275**

Table 1 Project Emissions

The Project is likely to be a significant emitter of greenhouse gas emissions. This is due largely to the energy intensive processing requirements associated with the magnetite ore. However, the selection of combined cycle natural gas electricity generation plant will ensure that the Project will have an emissions intensity (tonnes CO_2-e per MWh or per unit of product) that is significantly lower when compared to other electricity supply options (e.g. open cycle gas generation). The emission intensity of the Project also compares favourably against other magnetite iron ore operations proposed in Western Australia.

Energy represents a significant cost to the Project. As such, particular attention has been paid during the planning and design phases to maximise energy efficiency. The proposed introduction of the Carbon Pollution Reduction Scheme in 2010, has added further justification to maximising efficiency, reducing greenhouse gas emissions.

Given that nearly 70% of emissions are associated with electricity generation, it is appropriate that International Minerals have proposed the combined cycle natural gas and steam turbine electricity generation configuration – generally regarded as current industry best practice. It is fortunate that a supply of natural gas exists in relatively close proximity to the Project.

International Minerals have also given consideration to numerous other initiatives to improve energy efficiency and reduce greenhouse gas emissions. Some of these that are not currently financially viable may become viable with the introduction of carbon costs as part of the Australian Government's proposed Carbon Pollution Reduction Scheme.

[1] Construction and pre-strip activities are not included in the aggregation of annual operational emissions as they occur prior to the operation phase.

CONTENTS

TABLES

FIGURES

1. Project Overview

International Minerals Pty Ltd (IM) proposes to develop the Balmoral South Iron Ore Project (the Project), which consists of a magnetite iron ore mine, processing facility and associated infrastructure in the Cape Preston region of Western Australia, 80 km south-west of Karratha (Figure 2).

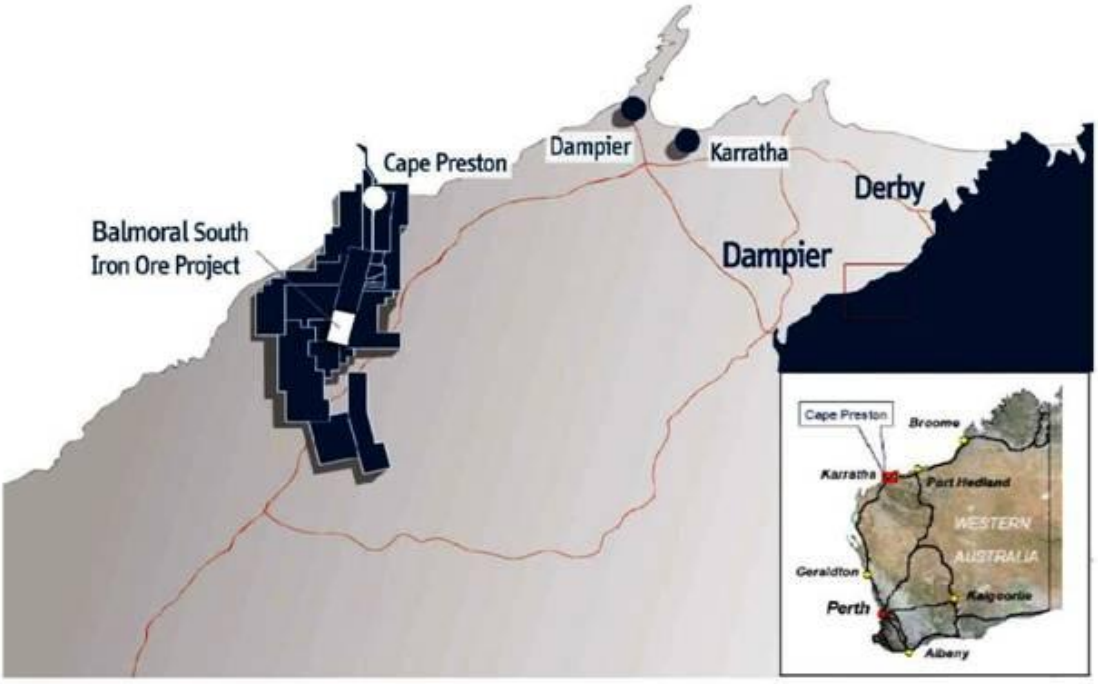

Figure 2 Project Location

The Project will comprise:

- Pre-strip of 100 million tonnes of overburden;
- an open-cut iron ore mine producing 80 Mtpa of magnetite ore and 80 Mtpa waste rock;
- processing facilities including crusher, concentrator and pellet plant;
- the production of 24 Mtpa of concentrate - 13.6 MT will be used to produce 14 MT pellets, while the remaining 10.4 Mtpa will be exported with the pellets as concentrate;
- waste rock from the open pit and process waste material (tailings) to be deposited into Waste Disposal Facilities (WDFs)
- materials handling facilities including 30 km of conveyors linking the plant site to port stockyard facilities located at Cape Preston;
- utilities including a 40 GLpa desalination plant and 600 MW combined cycle power station; and
- accommodation village for 4,000 construction and 1,500 operations personnel; and
- offices, workshops and other supporting infrastructure including explosives magazine, landfill, fuel storage and distribution, and warehousing.

The Project will be developed in two phases. Phase 1 will allow the production of 12 Mtpa of concentrate. The construction of Phase 1 facilities is expected to take 3 years, after which the construction of Phase 2 will commence and take another 3 years. The operation of Phase 1 will occur concurrently with the construction of Phase 2, which will allow an additional 12 Mtpa of concentrate to be produced to a total production rate of 24 Mtpa. During construction of Phase 1, mining pre-strip of waste overlying ore will also be conducted.

Project construction is expected to commence in 2009. The Project is expected to operate for at least 28 years after the first 3 years of construction and commissioning, with extensions beyond this being dependant on continued contracts for ore supply, and the Project continuing to be economically viable.

Ore will be sourced from a single open pit. Unlike direct shipping iron ores, the Balmoral South Project magnetite ore requires beneficiation prior to export to steel mills. The processing facilities for the Project will include:

- primary and secondary crushing;
- high pressure grinding rolls;
- milling / grinding;
- concentration via magnetic separation;
- waste disposal; and
- pelletising.

The pellet plant will comprise a:

- balling section, where the damp concentrate from the filter plant is mixed with approximately 7.5 kg/t of bentonite and 10 kg/t of ground limestone and formed into pellets 12-16 mm in diameter;
- drying section, where the pellets are dried;
- induration section, where the pellets are heated to 1200^{o} C. At this temperature the limestone calcines, the magnetite oxidises and the limestone, bentonite and silica in the concentrate combine to form complex calc silicates which give the pellets high strength; and
- cooling section, where heat is recovered from the fired pellets.

Reclaimed concentrate and pellets will be transported to the Mineralogy Central Block port via a 30km conveyor.

A combined cycle gas-fired power station will be constructed adjacent to the concentrator / pellet plant complex to supply up to 450 MW of power for the Project. With standby capacity, the size of the installed power station will be up to 600 MW and will generate an estimated 3.8 million MWh per annum.

Mine waste rock and dewatered process tailings will be co-disposed in the designated disposal areas (WDF1 to the west of the pit and WDF2 to the east of the pit).

The Project's rehabilitation objectives are to ensure that reconstructed landforms are safe and stable, and a self-sustaining vegetation community is established, where practicable, to replicate current vegetation and support the post-Project land-use of pastoral. Rehabilitation of the WDFs will occur progressively.

2. Global, National and State Strategies

2.1. Global Assessment of Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is the international body responsible for assessing the state of knowledge about climate change. The IPCC provides guidance to the international community on issues related to climate change response. The IPCC's findings provide the rationale for international action on climate change.

According to the Fourth Assessment Report of the IPCC (IPCC 2007):

- Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level – as indicated in **Figure 3**.
- Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases.
- Global greenhouse gas emissions due to human activities have grown since pre-industrial times, with an increase of 70% between 1970 and 2004.
- There is high agreement and much evidence that with current climate change mitigation policies and related sustainable development practices, global greenhouse gas emissions will continue to grow over the next few decades.
- Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century.

The 2007 IPCC report also projected the following changes due to climate change by the end of this century:

- Sea level increases of up to 59cm
- Global temperature increases of up to 4.0°C
- Increasingly acidic oceans impacting on fish stocks and marine life
- Shrinking snow cover and glaciers affecting water supplies
- More frequent droughts and heat waves
- More intense tropical cyclones, heavier rains and more natural disasters
- Changes in wind, rain, and temperature patterns affecting agriculture and livestock production and access to water in tropical and subtropical regions

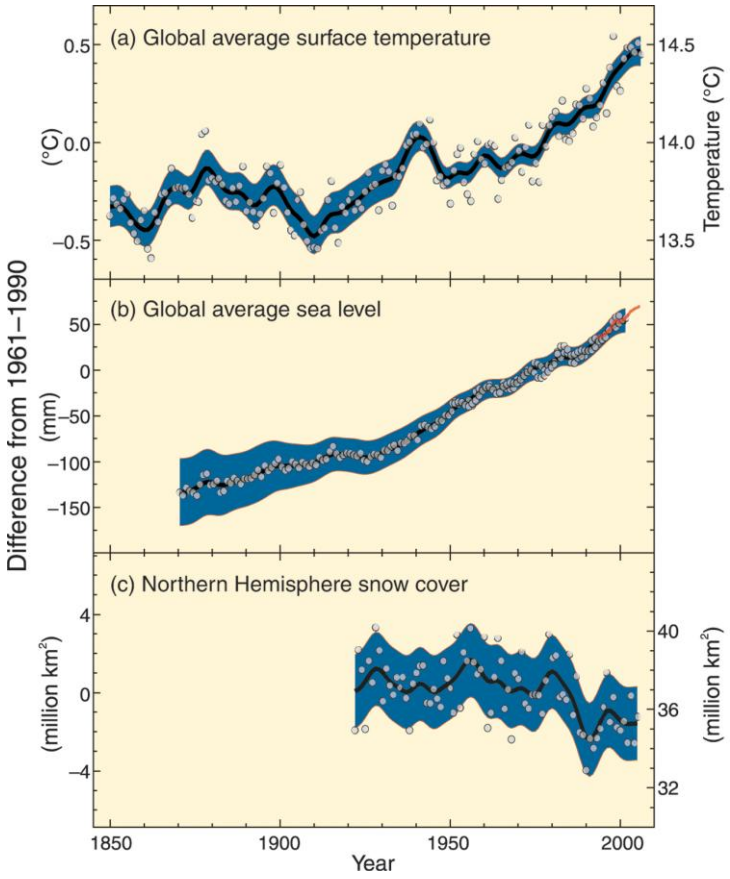

Figure 3 Changes in temperature, sea level and Northern Hemisphere snow cover

Source – IPCC, 2007

The United Nations Framework Convention on Climate Change (UNFCCC) is the basis for developing an international response to climate change.

The Kyoto Protocol to the Convention on Climate Change was developed through the UNFCCC negotiating process. It is an international treaty designed to limit global greenhouse gas emissions by setting legally-binding emissions targets for developed countries. Under the Kyoto Protocol, industrialised countries are required to reduce the emissions of six greenhouse gases (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride) on average by 5.2 % below the 1990 levels during the first "commitment period" from 2008 to 2012. To date, 180 countries have ratified the Kyoto Protocol (UNFCCC website, 2008).

The Kyoto Protocol came into force in early 2005, as did a number of emissions trading schemes to support the Protocol. The emissions trading scheme with the greatest coverage is the European Union Emissions Trading Scheme (EUETS), which commenced in January 2005. Australia has recently announced plans to implement an emissions trading scheme in 2010, after ratifying the Kyoto Protocol in December 2007.

2.2. Australia's Response to Climate Change

Australia's national greenhouse gas emissions in 2006 totalled 576.0 million tonnes CO_2-e (Dept of Climate Change, 2008). A number of initiatives and programmes have been implemented or initiated in an effort to curb Australia's greenhouse gas emissions.

2.2.1. Mandatory Renewable Energy Target (MRET)

In 2001 the Australian Government introduced the MRET scheme, which aims to increase the uptake of renewable energy in Australia's electricity supply. In 2007 the Government committed to ensuring that 20 per cent of Australia's electricity supply comes from renewable energy sources by 2020.

2.2.2. Kyoto Protocol Ratification

On 3 December 2007, the Prime Minister signed the instrument of ratification of the Kyoto Protocol, and on 11 March 2008 Australia's ratification came into effect. Australia has committed to meeting its Kyoto Protocol target, and has set a target to reduce greenhouse gas emissions by 60 per cent on 2000 levels by 2050 (Australian Dept. of Climate Change).

2.2.3. National Greenhouse and Energy Reporting Scheme

The National Greenhouse and Energy Reporting Act 2007 was passed in September 2007 establishing a mandatory corporate reporting system for greenhouse gas emissions, energy consumption and production. The scheme is expected to:

- Provide robust data to underpin the proposed Carbon Pollution Reduction Scheme;
- Reduce the number of greenhouse and energy reports required across State, Territory and Australian Government programmes; and
- Provide corporate level information to the public on greenhouse and energy performance of Australian corporations for the first time.

The first reporting year for the scheme is 1 July 2008 – 30 June 2009. Corporations have until 31 August 2009 to register and until 31 October 2009 to submit their report under the Act.

Corporations will be required to register and report for the 2008-2009 financial year if:

- They have operational control of a facility that emits 25 kilotonnes or more of greenhouse gases (CO2 equivalent), or produce or consume 100 terajoules or more of energy; or
- Their corporate group emits 125 kilotonnes or more greenhouse gases (CO2 equivalent), or produces or consumes 500 terajoules or more of energy.

Lower thresholds for corporate groups will be phased in by 2010-11. The final thresholds will be 50 kilotonnes of greenhouse gases (CO2 equivalent) or 200 terajoules of energy.

(Source – Australian Department of Climate Change – NGERS Reporting and Technical Guidelines)

2.2.4. Carbon Pollution Reduction Scheme

The Australian Government has recently announced the proposed implementation of a Carbon Pollution Reduction Scheme by 2010. A Green Paper was released in July 2008 and a White Paper is expected by the end of 2008. The key mechanics of the scheme currently proposed include:

- The Government sets a cap on the total amount of carbon pollution allowed in the economy by covered sectors
- The Government will issue permits up to the annual cap each year
- Industries that generate carbon pollution will need to acquire a 'permit' for every tonne of greenhouse gas that they emit
- The quantity of carbon pollution produced by each firm will be monitored and verified
- At the end of each year, each liable firm would need to surrender a permit for every tonne of carbon pollution the firm produced in that year
- Firms compete in the market to purchase the number of permits that they require. Firms that value the permits most highly will be prepared to pay the most for them, either at auction, or on a secondary trading market. For some firms, it will be cheaper to reduce emissions than to buy permits
- As a transitional assistance measure, certain categories of firms might receive some emissions permits for free. These firms could use these permits or sell them.

The price of permits is not set by the Government - rather, it emerges from the market. If a firm can reduce carbon pollution more cheaply than the prevailing market price of permits, it will choose to reduce carbon pollution rather than buy permits. The scheme is therefore expected to provide a strong incentive for participants to reduce their own carbon pollution. By making this business decision around whether to reduce carbon pollution or trade in permits, it is anticipated that firms will operate within the overall cap at least cost. (Source – Dept of Climate Change, Carbon Pollution Reduction Scheme website)

Based on the information contained in the Green Paper, it is unlikely that the mining industry (other than coal mining) will classify for any free permits or compensation during the transition phase of the scheme. It is also likely that the acquisition and surrender of permits for emissions associated with diesel consumption are likely to be the responsibility of diesel suppliers. Therefore, the cost of these permits will be simply passed through to the customer.

2.2.5. Energy Efficiency Opportunities (EEO)

The Energy Efficiency Opportunities Act 2006 took effect on 1 July 2006 (with an amendment in March 2007). It aims to improve the identification and evaluation of energy efficiency opportunities by large energy using businesses and, as a result, to encourage implementation of cost effective energy efficiency opportunities.

The Act requires large energy using businesses to:

- Undertake an assessment of their energy efficiency opportunities to a minimum standard in order to improve the way in which opportunities are identified and evaluated; and
- Report publicly on the outcomes of that assessment in order to demonstrate to the community that those businesses are effectively managing their energy

(Source – Australian Dept of Resources, Energy and Tourism)

Participation in Energy Efficiency Opportunities is mandatory for corporations that use more than 0.5 petajoules (PJ) of energy per year.

2.2.6. Greenhouse Challenge Plus (GCP)

The Greenhouse Challenge Plus programme requires participants to collect and report information annually on energy consumption, greenhouse gas emissions and actions to improve energy efficiency and/or reduce greenhouse gas emissions.

It is anticipated that the GCP programme will be subsumed by the NGER Scheme, however this is yet to be confirmed.

Businesses are required to be a GCP member in order to claim in excess of $3 million annually in fuel tax credits. Fuel tax credits are claimed through BAS submission to the Australian Taxation Office. The Australian Taxation Office will confirm with the Greenhouse Challenge Plus team that ABNs of claimants are covered by Greenhouse Challenge Plus agreements.

2.3. Western Australia's Climate Change Strategy

Greenhouse gas emissions were 70.4 million tonnes in Western Australia in 2006, which represents 12.2% of Australia's total emissions (Dept of Climate Change – State and Territory Greenhouse Gas Inventories, 2008).

On 6 May 2007, the Premier Hon. Alan Carpenter MLA released a major statement Climate Change: Making Decisions for the Future. The statement outlines a range of new policies and programs that the Government will be implementing to tackle climate change. The Office of Climate Change within the Department of Environment and Conservation was established to support the roles and responsibilities of the Minister for the Environment; Climate Change.

Key features of the Premier's Climate Change Action Statement include:

- a target to reduce emissions by at least 60 per cent below 2000 levels by 2050
- A $36.5 million Low Emission Energy Development Fund
- A target to increase renewable energy generation on the South West Interconnected System to 15 per cent by 2020 and 20 per cent by 2025
- A clean energy target of 50 per cent by 2010 and 60 per cent by 2020
- State Government purchase of 20 per cent renewable energy by 2010
- A mandatory energy efficiency program that will require large and medium energy users to invest in cost effective energy efficiency measures. In developing the scheme, the State Government will seek to ensure that it is consistent with schemes being implemented in other States and at a national level.
- Investing 8.625 million to help businesses and communities adapt to the impacts of climate change
- The development of new climate change legislation

- A commitment to establishment of a national emissions trading scheme.

The Western Australian Greenhouse Strategy was released in 2004 and is due for review in 2008. The strategy included requirements for major industrial emitters of greenhouse gases to report emissions and emission abatement activities to the government and the public. These elements of the strategy are largely covered by the new National Greenhouse and Energy Reporting Scheme and so are not required separately by the Western Australian government.

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"

3. Greenhouse Assessment Methods

An assessment of the greenhouse gas emissions associated with the Project was conducted by Kewan Bond Pty Ltd. The assessment involved:

- Identification of the likely sources of greenhouse gas emissions.
- Calculation and interpretation of the likely quantities of greenhouse gases from these sources.
- Identification of emission abatement measures currently planned.

Emissions of greenhouse gases were calculated in accordance with methods provided by the Australian Greenhouse Office (AGO) and Australian Department of Climate Change, which are generally in accordance with the WBCSD / WRI Greenhouse Gas Protocol.

3.1. Greenhouse Gases Included

Consistent with the Kyoto Protocol (Refer Section 2.1), efforts by industrialised countries to minimise greenhouse gas emissions have concentrated on six key greenhouse gases:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFC's)
- Perfluorocarbons (PFC's)
- Sulphur hexafluoride (SF_6)

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 it's '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 GWP's of the six Kyoto greenhouse gases are provided in **Table 2**.

Gas		Global Warming Potential
Carbon dioxide	**CO_2**	**1**
Methane	**CH_4**	**21**
Nitrous Oxide	**N_2O**	**310**
Hydrofluorocarbons	**HFC's**	**100 - 11,700**
Perfluorocarbons	**PFC's**	**6,500 – 9,200**
Sulphur hexafluoride	**SF_6**	**23,900**

Table 2 Global warming potential of greenhouse gases

Because of the variation in GWP between different gases, the emission factors used to calculate greenhouse gas emissions from the Project are stated in terms of carbon dioxide equivalents (CO_2-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 (Dept of Climate Change – NGA Factors, 2008). 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 (e.g. grid supply). Given that the Project will be generating its own electricity rather than sourcing from the grid, there will be no Scope 2 emissions.

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 and natural gas that is consumed on site.

3.2. Emission Sources

The following greenhouse gas emission sources were included in the assessment:

- Fuel consumption by mobile construction equipment
- Fuel consumption by mining equipment
- Fuel consumption by light vehicles
- Combustion of Ammonium Nitrate Fuel Oil (ANFO) for blasting
- Natural gas consumption by electricity generators
- Natural gas consumption by the pellet plant
- The use of limestone in the process
- The use of dolomite in the process
- Losses of synthetic gases used in refrigeration and electrical switchgear
- Deposition of solid waste to on-site landfill
- Waste water treatment

Minor emissions are also expected from the decomposition of cleared vegetation. However these emissions have not been included in the greenhouse gas assessment for the following reasons:

- The vegetation in the Project area is sparse and does not meet the Kyoto criteria for classification as a forest (i.e. a potential height of at least two metres and crown cover of at least 20 per cent). This criteria is also adopted by the Australian Department of Climate Change in determining whether emissions associated with land use change are included in the Australian National greenhouse accounts.
- The majority of disturbance associated with the Project will area will be revegetated to replicate current vegetation communities. This will, over time, sequester the majority of greenhouse gas emissions resulting from the original clearing.
- The National Carbon Accounting System does not currently contain soil or soil carbon information for the proposed location of the Project.

3.3. Sensitivity and Accuracy of Results

The calculation of predicted greenhouse gas emissions is subject to various error factors and causes for potential variations in results. These include:

- Factors of error within standard emission factors adopted (e.g. rounding)
- Factors of error within standard calculation and modelling methods adopted
- Variations from assumed fuel and electricity consumption rates
- Variations from assumed efficiency of plant and equipment

The accuracy of the emission estimates within this study have been maximised through the inclusion of all known emission sources (except from vegetation clearing as discussed in Section 3.2) and the application of the latest emission calculation and modelling methods.

4. Greenhouse Gas Emissions

4.1. Diesel Consumption

Diesel fuel will be used by construction equipment during the Project construction and pre-strip phases. However, most diesel will be consumed by the mining equipment during operations. Light vehicles and standby generators will also consume diesel.

Estimates of annual diesel use by the equipment have been prepared by International Minerals as part of their feasibility study for the Project. Greenhouse gas emissions have been calculated using the emissions factors in Table 3. Emissions associated with the construction and pre-strip phases are shown in Table 4, while the operational emissions are provided in Table 5.

Fuel type	Energy Content (GJ/kL)	Scope 1 Emission Factor (kg CO_2-e/GJ)	Scope 3 Emission Factor (kg CO_2-e/GJ)	Full Fuel Cycle Emission Factor (kg CO_2-e/GJ)
Diesel (stationary)	38.6	69.5	5.3	74.8
Diesel (Mobile)	38.6	69.8	5.3	75.2

Table 3 Diesel Emission Factors

Source - Australian Department of Climate Change (2008), National Greenhouse Accounts Factors.

	Total Project Emissions (tonnes CO_2-e)	
	Scope 1	**Scope 3**
Construction Equipment	404,142	30,687
Mining Equipment (Pre-strip)	404,142	30,687

Table 4 Construction and Pre-Strip Emissions

	Maximum Annual Emissions During Operations (tonnes CO_2-e)		Total Project Emissions (tonnes CO_2-e)	
	Scope 1	**Scope 3**	**Scope 1**	**Scope 3**
Mining Equipment	323,314	24,550	8,082,840	613,740
Light Vehicles	53,886	4,092	1,347,140	102,290
Standby Generators	2,549	194	63,875	4,871

Table 5 Diesel Emissions

4.2. Natural Gas Consumption

Natural gas will be sourced from the nearby Mineralogy Central Block gas supply pipeline for electricity generation and for heating in the pellet plant.

The power station will consist of a series of combined cycle gas turbine power generators with heat recovery steam generators and steam turbines. The gas turbines will be equipped with low NOx burners, and the heat recovery system will convert heat energy from the gas turbine exhaust to steam and feed this to the steam turbines.

Natural gas will also be used in the pellet plant to fuel the induration process, where the concentrate mixed with limestone and dolomite is heated to 1200^{o} C.

Estimates of annual natural gas to be used in the power station and pellet plant have been prepared by International Minerals, while emission factors in Table 6 were used to calculate greenhouse gas emissions.

Fuel type	Scope 1 Emission Factor (kg CO_2^{-e}/GJ)	Scope 3 Emission Factor (kg CO_2^{-e}/GJ)	Full Fuel Cycle Emission Factor (kg CO_2^{-e}/GJ)
Natural Gas (stationary)	51.3	7.0	58.3

Table 6 Natural Gas Emission Factors

Source - Australian Department of Climate Change (2008), National Greenhouse Accounts Factors.

	Maximum Annual Emissions (tonnes CO_2-e)		Total Project Emissions (tonnes CO_2-e)	
	Scope 1	**Scope 3**	**Scope 1**	**Scope 3**
Electricity Generation	1,482,570	219,640	37,064,250	5,491,000
Pellet Plant	261,630	38,760	6,540,750	969,000

Table 7 Natural Gas Emissions

4.3. Explosives Use

The combustion of fossil fuels within explosives proposed to be used in the mining process will result in emissions of greenhouse gases. Emission factors for Ammonium Nitrate Fuel Oil (ANFO) from the Department of Climate Change have been applied to the quantity of ANFO predicted to be consumed for the Project. These emission factors and emissions are provided in Table 8.

	Scope 1 Emission Factor (t CO_2/t product)	Annual Emissions (t CO_2^{-e})	Project Emissions (t CO_2^{-e})
ANFO	0.17	13,430	344,250

Table 8 Explosives Emissions

4.4. Limestone and Dolomite Use

As explained in Section 1, the concentrate from the filter plant is mixed with approximately 7.5 kg/t of bentonite and 10 kg/t of ground limestone at the pellet plant, prior to being heated to 1200° C. When limestone is heated to high temperatures, the calcium carbonate in it breaks down into calcium oxide and carbon dioxide. This type of reaction is called thermal decomposition.

Emission factors for the use of limestone and dolomite (Table 9) were used to calculate greenhouse gas emissions based on the anticipated consumption of these materials. The calculated emissions are provided in Table 10.

Material type	Scope 1 Emission Factor (t CO_2^{-e}/t)
Limestone	0.396
Dolomite	0.453

Table 9 Limestone/Dolomite Emission Factors
Source - Australian Department of Climate Change (2008), National Greenhouse Accounts Factors.

	Maximum Annual Emissions (CO_2-e)	Total Project Emissions (CO_2-e)
Limestone Use	88,704	2,217,600
Dolomite Use	107,814	2,695,350

Table 10 Limestone/Dolomite Emissions

4.5. Waste Water Treatment and Waste Disposal

Sewage from the village and other on-site amenities will be treated in package treatment plants to Department of Health requirements and reticulated for irrigation of landscaping around the village and other areas.

Greenhouse gas emissions occur from the processes associated with waste water/sewage treatment. Emission calculations are based on the number of people on site, the type of waste water treatment on site and a number of default factors provided by the Department of Climate Change. The number of people on site will peak during the construction of phase 2 and operation of phase 1, during which time it is expected that there will be 4,000 people on site at one time. The site population during the majority of the operation phase is anticipated to be in the order of 1,500 people. Waste water treatment will be via a batch reactor process.

Emissions of methane also result from the decomposition of materials deposited in on-site landfill facilities. A landfill for all Project inert and putrescible waste will be incorporated as a special section of the waste disposal facilities (WDFs), and operated in accordance with Works Approval and Site Licence conditions. It will move as the WDFs develop. International Minerals commissioned a waste management contractor to provide a proposal for waste management services for the Project, which included an estimate of waste to be deposited to landfill. Emission factors per tonne of waste to landfill are presented in Table 11. It is assumed that the majority of recyclable and reusable materials will be removed from the waste stream prior to landfill as part of the waste management contract. It is therefore expected that the majority of paper, cardboard and wooden pallets will not enter landfill. These wastes are high contributors to greenhouse gas emissions from landfill facilities.

For the purposes of calculating greenhouse gas emissions, it has been assumed that wastes during the construction phase comprise mostly construction and demolition wastes, while waste generated during the operating phase comprise mostly commercial and industrial waste. As a result, the emission factor selected for the operation phase of the Project is likely to overstate the actual emissions. Waste stream monitoring during operations will allow a more accurate calculation of greenhouse gas emissions from landfill facilities.

Waste type	Scope 1 Emission Factor (t CO_2-e/t)
Construction and Demolition Waste	0.25
Commercial and Industrial Waste	1.66

Table 11 Landfill Waste Emission Factors

Source - Australian Department of Climate Change (2008), National Greenhouse Accounts Factors.

	Maximum Annual Emissions (tonnes CO_2-e)	Total Project Emissions (tonnes CO_2-e)
Waste Water Treatment	284	10,234
Waste to Landfill	6,544	187,593

Table 12 Waste Emissions

4.6. Synthetic Gases

Hydrofluorocarbon HFC143a will be used as a refrigerant gas for commercial refrigeration for the Project. Greenhouse gas emissions were calculated by applying a default annual loss rate and GWP from the Department of Climate Change (2008) to the estimated mass of HFC143a to be held on site.

Electrical switchgear on site will contain sulphur hexafluoride. A loss factor for this gas was also applied with the GWP for SF6 to calculate emissions in CO_2-e.

Gas type	Default Loss Factor*	Maximum Annual Emissions (tonnes CO_2-e)	Total Project Emissions (tonnes CO_2-e)
HFC143a	0.09	702	17,550
SF6	0.005	72	1,793

Table 13 Synthetic Gas Loss Factors and Emissions

** Source - Australian Department of Climate Change (2008), National Greenhouse Accounts Factors.*

5. Project Lifecycle Emissions

The Project is expected to generate annual emissions of 2,341,497 tonnes CO_2-e Scope 1 and 287,236 tonnes CO_2-e Scope 3 as shown in Table 14 and Figure 4. The breakdown of these emissions between the broad activities is shown in Table 14 and Figure 5.

Total Scope 1 emissions associated with the Project are estimated to be 59,381,509 tonnes CO_2-e over the 31 year life of the Project (including construction). Scope 3 emissions are estimated to be 7,242,275 tonnes CO_2-e over the life of the Project. Total lifecycle emissions are therefore estimated to be 66,621,991 tonnes CO_2-e. The majority of these emissions are associated with the consumption of natural gas for electricity generation and heating in the pellet plant and diesel consumption by the mining fleet, as indicated in Figure 5.

		Scope 1		Scope 3	
Source	Annual Energy (TJ)	Annual (t CO_2-e)	Project (t CO_2-e)	Annual (t CO_2-e)	Project (t CO_2-e)
Diesel - Construction	n/a[2]	n/a[2]	404,142	n/a[2]	30,687
Diesel - Pre-Strip	n/a[2]	n/a[2]	404,142	n/a[2]	30,687
Diesel - Mining	4,632	323,314	8,486,982	24,550	644,427
Diesel - LV's	772	53,886	1,347,140	4,092	102,290
Diesel - Generators	37	2,549	63,875	194	4,871
Nat. Gas - Elect Generation	28,900	1,482,570	37,064,250	219,640	5,491,000
Nat. Gas - Pellet Plant	5,100	261,630	6,540,750	38,760	969,000
ANFO	n/a	196,518	4,912,950	0	0
Limestone & Dolomite	n/a	13,430	344,250	0	0
Synthetic gases	n/a	774	19,343	0	0
Waste Water Treatment	n/a	284	10,234	0	0
Waste to Landfill	n/a	6,544	187,593	0	0
TOTAL	**39,441**	**2,341,497**	**59,381,509**	**287,236**	**7,242,275**

Table 14 Project Energy and Emissions

[2] Construction and pre-strip activities are not included in the aggregation of annual operational emissions as they occur prior to the operation phase.

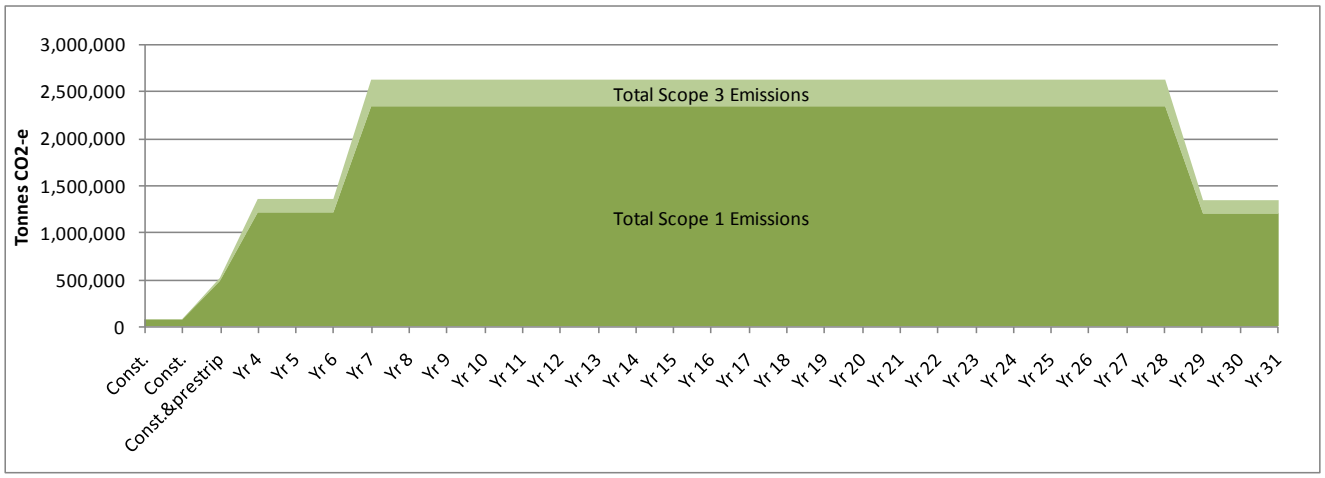

Figure 4 Project Lifecycle Emissions

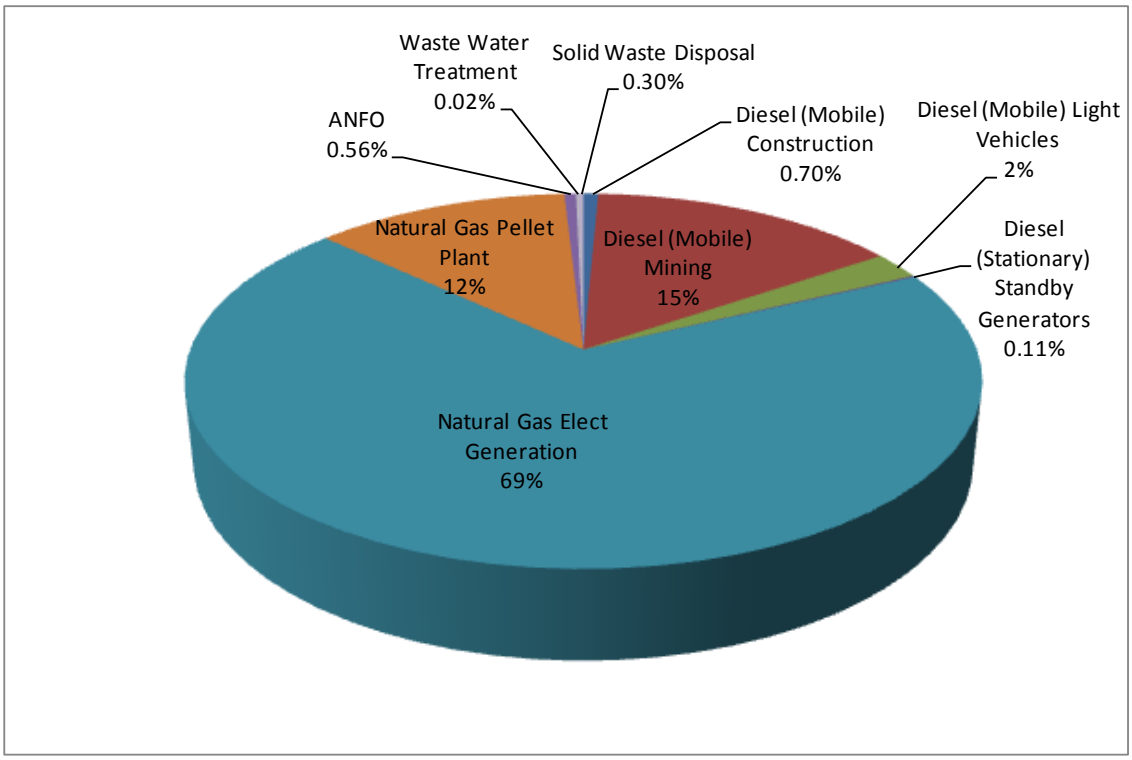

Figure 5 Emissions Breakdown

6. Emission Mitigation Initiatives and Considerations

The Project will be a significant user of energy. As such, particular attention has been paid during the planning and design phases to maximise energy efficiency. The proposed introduction of the Carbon Pollution Reduction Scheme in 2010, has added further justification to maximising efficiency, reducing greenhouse gas emissions.

6.1. Combined Cycle Gas Turbine Generation

The majority of energy and emissions will result from the generation of electricity. International Minerals have therefore adopted industry best practice technology to maximise efficiency and reduce greenhouse gas emissions from this activity. It is proposed to install a combined-cycle utility class gas turbine power station with a 600 MW capacity, which should produce an estimated 3.8 million MWh per annum. Natural gas will be sourced from the Mineralogy Central Block gas supply pipeline.

The gas turbines will be equipped with a heat recovery system, which will convert heat energy from the gas turbine exhaust to steam and feed this to steam turbines. This generation arrangement is expected to achieve a thermal efficiency of between 51% and 56%, depending on the particular machines selected.

The selection of this technology involved detailed consideration of alternative technologies such as:

- open cycle aero-derivative
- open cycle frame
- open cycle utility class
- open cycle – inlet air cooled.

A comparison of the efficiencies between the selected combined cycle technology and other electricity supplies is provided in Section 7.

The power station is also proposed to include a power plant management system to control, monitor and optimise fuel efficiency. The system will monitor and control inlet air temperature, inlet air evaporative cooling, turbine inlet guide vanes, heat recovery steam generator exhaust temperature pinch point, mechanical draft cooling tower and other systems that impact on the overall plant efficiency

6.2. Process Plant Waste Heat Capture

The process includes a cooling section, where heat is recovered from the fired pellets of concentrate, limestone and dolomite. In an effort to minimise heat losses, the plant is set up so that hot gases from the cooling zone are used to provide preheated air to the burners in the firing zone, and then the off-gases are transferred from the firing zone to the drying zone.

6.3. Geothermal Energy

There are two geothermal power stations in Australia. These plants are based on using geothermal aquifer technology and geothermal hot dry rock technology. A 150 kW geothermal plant is currently in operation at Birdsville in South East Queensland (Ergon Energy) and a demonstration plant is currently being constructed in the Cooper Basin in South Australia (Geodynamics). Geodynamics have also recently been provided government funding for development of a commercial geothermal plant in the Hunter Valley in New South Wales.

It is understood that some geological hot rocks exist in the Pilbara and may be considered in the future for generation of electricity. However, given that the source of the hot rocks area is remote from the Project site, geothermal energy is currently not considered as a commercially viable option for the Project.

6.4. Solar Energy

Present solar technology is not considered suitable for base load operations. Barring cloud cover, solar electricity production peaks during the day and is zero at night, such that approximately 5.5 to 6 hours of full electricity production per day could be expected (Worley Parsons, 2007). Although solar energy may offset gas generation and reduce greenhouse gas emissions, it is still necessary to install full capacity gas generation infrastructure to ensure sufficient supply when solar energy is not available. Operation of the gas gensets at reduced capacity (when being partially offset by solar energy) would also impact on the thermal efficiency of those gensets.

For the Project, solar energy infrastructure would also be susceptible damage during cyclone events.

Present commercially available solar hot water heaters are subject to overheating in the Pilbara environment and present a safety hazard to personnel. Solar heating of camp accommodation may be possible if a safe designed unit becomes available on the market. Consideration has also been given to the use of solar lighting.

6.5. Wind Energy

The cost range for a wind energy installation is typically between $1,600 / kW and $2,200 / kW of installed capacity for relatively large installations. In order for wind energy to be financially viable a minimum average wind speed of 7 metres per second is generally required (Worley Parsons, 2007). As with solar energy, gas generation capacity to meet full demand will still be required for times when wind energy is not available and the infrastructure would be susceptible to cyclone damage.

6.6. Biofuels

Consideration has been given to the use of bio diesel as an alternative to natural gas. Currently there is not adequate product available to meet demands and would otherwise still represent a 250% increase in energy costs compared to natural gas.

6.7. Renewable Energy Certificates

The Mandatory Renewable Energy Target (MRET) is implemented trough Federal Government legislation and is designed to increase the amount of electricity generated from eligible renewable energy sources. Renewable Energy Certificates (RECs) are an electronic form of currency initiated by the Renewable Energy (Electricity) Act 2000. Under the scheme, accredited power generators are eligible to create RECs which can be sold or traded with liable parties. It is likely that opportunities exist for International Minerals to gain some subsidy on the cost of renewable energy through the sale of REC's and this should be included in any future consideration of renewable energy options.

6.8. Emissions Trading

The Australian Government's proposed implementation of the Carbon Pollution Reduction Scheme in 2010 will theoretically ensure the most efficient allocation of resources towards greenhouse gas mitigation measures. The scheme should allow resources to be allocated to mitigation measure where the marginal costs of carbon abatement are the lowest.

Once the scheme commences, International Minerals will have the option to either acquire and relinquish 100% of the necessary carbon permits, or to offset these permits with actual reductions in emissions. It is recommended in Section 8 that International Minerals continue to compile the details of the various emission mitigation measures available to them (irrespective of current feasibility) and develop an understanding of their marginal cost of carbon abatement. This will facilitate decision making on these projects as carbon prices fluctuate. For example, if carbon reaches a particular price, a project that is not currently financially viable may become viable.

6.9. Progressive Revegetation

The emissions from vegetation clearing at the Project are expected to be minimal due to the sparseness of the existing vegetation. Most of these emissions are however expected to be eventually offset through the carbon sequestration by the proposed progressive revegetation activities.

6.10. Solid Waste Management

Greenhouse gas emissions are generated from the decomposition of waste materials in landfill facilities. Waste materials with the highest emission factors are paper and cardboard, wood and straw (Department of Climate Change, 2008). A total waste management programme has been developed with an external waste contractor for implementation at the Project. The programme involves extensive recycling and reuse of materials and is expected to result in significant reductions in the quantity of waste to landfill that would otherwise decompose and generate greenhouse gases.

6.11. Building Design

International Minerals have indicated a commitment to the following design features for the accommodation village and other buildings (e.g. offices, crib rooms):

- Use of energy efficient light globes where possible
- Use of heat pump 5-star plus energy efficient water heaters
- Use of 5-star WELS rated water fixtures to reduce water and power consumption
- Use of best practice energy efficient housing materials as defined in the Building Code of Australia to reduce heating and cooling requirements in the village

7. Benchmarking

Approximately 96% of Australia's iron ore production is associated with high-grade hematite ore (Direct Shipping Ore), which involves a relatively simple crushing and screening process before being exported for use in steel mills. Magnetite ore however has lower iron content and must be upgraded (i.e. processed to concentrate and/or pellet form) to make it suitable for steelmaking.

A number of magnetite projects are proposed in Western Australia. These include:

- Karara Iron Ore Project (Gindalbie Metals / Anshan Iron & Steel Group)
- Southdown Project (Grange Resources)
- Sino Project (CITIC Pacific Mining)
- Balmoral Project (CITIC Pacific Mining)
- Balla-Balla Project (Aurox Resources)

Of these projects, only Gindalbie Metals and Grange Resources have published their predicted greenhouse gas emissions.

Located 225 km east of Geraldton the Karara Iron Ore Project includes magnetite and hematite resources. Production of 12 million tonnes of concentrate per annum is scheduled for 2010.

The Southdown Magnetite Deposit is located approximately 90 km east, north-east of the City of Albany. This project involves open pit mining and processing at a rate of 18-20 Mtpa to produce approximately 6.6 Mtpa of magnetite concentrate. The magnetite ore will be crushed, magnetically separated, screened and mixed with water to form the concentrate slurry. The slurry will be transported by pipeline over 100 km to the Port of Albany, dewatered, stockpiled and loaded onto capesize vessels for transport to Malaysia.

Proposed greenhouse gas emissions from the Karara and Southdown projects have been compared against the proposed emissions from the Balmoral South Project in Table 15.

Operation	Concentrate Production	Annual Emissions (Tonnes CO_2-e)*	Emission Intensity (t CO_2/t con)	Comments
Balmoral South	24 MT	1,976,408**	0.08	Grinding to 28 µm, therefore requires more grinding energy
Karara (Gindalbie)	12 MT	1,261,317	0.11	Grinding to 45 µm WA grid (SWIS) supply
Southdown	6.6 MT	750,000***	0.11	Grinding to 100 µm, WA grid (SWIS) supply

Table 15 Magnetite Project Comparison

** Full fuel cycle emissions (i.e. Scope 1, 2 and 3)*

*** Excludes emissions associated with waste management and refrigerants to be consistent with Gindalbie and Southdown calculations. Other exclusions in order to reflect emissions associated with concentrate production only (not pellet production):*

- *Emissions from using limestone and dolomite in pellet process*
- *Emissions from natural gas consumption by pellet plant*
- *Emissions from 300,000 MWh per annum for pellet process*

**** Includes sourcing electricity from WA grid (SWIS).*

A comparison of the efficiency and greenhouse gas intensity of the proposed electricity source for the Project against potential alternatives has also been conducted. Results of this comparison are provided in Table 16 and Figure 6 and show that the proposed combined cycle configuration results in Project greenhouse gas reductions of 24% compared to open cycle and 42% compared to the Western Australian grid (South West Interconnected System).

Electricity Source	Generation Efficiency*	Emissions (t CO_2^{-e}/MWh)	Project Emissions
Combined Cycle Natural Gas	53%	0.45	66,621,991
Open Cycle Natural Gas	36%	0.67	87,571,810
WA Grid (SWIS)	n/a	0.98	115,417,259

Table 16 Comparison with Electricity Options

* Manufacturer specifications based on new equipment, optimum conditions, full capacity and ambient temperature of 43°C. Actual efficiency will be lower due to derating. Emission estimates have been based on the derated efficiency of approximately 47% for combined cycle configuration.

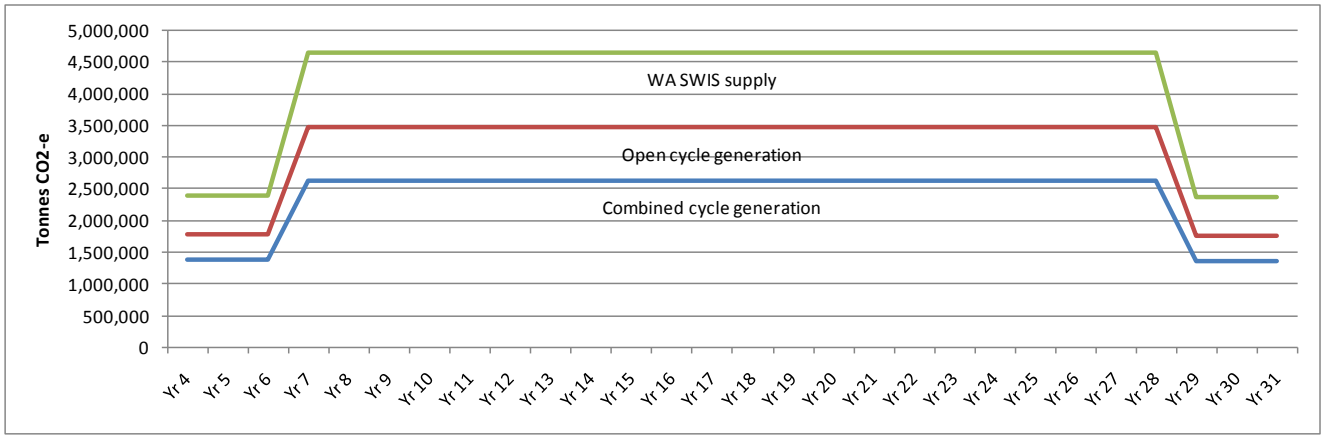

Figure 6 Comparison with Electricity Options

8. Recommendations

The proposed Project is expected to be a significant energy user and emitter of greenhouse gas emissions. It is therefore appropriate that International Minerals have conducted detailed investigations into the energy efficiency of proposed and alternative plant and equipment and the greenhouse intensity of various energy sources.

The close proximity of a natural gas source is a significant advantage to the Project in terms of energy efficiency and greenhouse intensity. The selection of combined cycle gas turbine technology for electricity generation is considered industry best practice and will result in significant emission reductions compared with most other fossil fuel generation technologies.

Although large scale renewable energy is not considered viable at this stage, rapid advances in technology warrant ongoing monitoring of these options for future consideration.

Recommendation – continue monitoring of renewable energy technologies, government subsidy programmes to determine future viability.

The most significant opportunities for International Minerals to reduce its greenhouse footprint are expected to exist in the area of maximising energy efficiency of the proposed plant, equipment and processes. Apart from the business and financial benefits, the ongoing review of operations and pursuit of improved energy efficiency aligns with the legal obligations under the Federal Government's Energy Efficiency Opportunities (EEO) programme.

The Project is expected to trigger thresholds for reporting as part of the National Greenhouse and Energy Reporting Scheme (NGERS) and participating in the EEO programme. Both these programmes require accurate and detailed monitoring and accounting of energy consumption and NGERS involves also calculating and reporting greenhouse gas emissions.

Recommendation – establish comprehensive monitoring, calculation and reporting systems to satisfy the requirements of the NGERS and EEO programmes.

The EEO programme also contains a number of key requirements to facilitate the ongoing identification, assessment and implementation of energy efficiency projects.

Recommendation – allocate sufficient resources and establish internal procedures and processes to satisfy the requirements of the EEO programme.

The NGERS will be the basis for the government's proposed Carbon Pollution Reduction Scheme. Based on the current Green Paper, International Minerals are likely to be liable for the purchase and relinquishment of carbon permits associated with emissions from their natural gas consumption. Given that the price of permits will fluctuate and will be determined by the market, International Minerals would benefit from understanding its marginal cost of carbon abatement.

<u>Recommendation</u> – establish the range of carbon abatement options available to International Minerals and determine the costs of each option. This will enable an understanding of the marginal cost of carbon abatement that can be referenced as carbon prices fluctuate.

9. Glossary

AGO - Australian Greenhouse Office

ANFO – Ammonium Nitrate Fuel Oil

CH_4 – methane

CO_2 - carbon dioxide

CO_2-e – carbon dioxide equivalent

CPRS - Carbon Pollution Reduction Scheme

EEO - Energy Efficiency Opportunities

EUETS - European Union Emissions Trading Scheme

GCP - Greenhouse Challenge Plus

GLpa – gigalitres per annum

GWP – Global Warming Potential

HFC's - hydrofluorocarbons

IPCC - Intergovernmental Panel on Climate Change

MRET - Mandatory Renewable Energy Target

Mtpa – Million tonnes per annum

MWh – Megawatt hour

N_2O - nitrous oxide

NGERS - National Greenhouse and Energy Reporting Scheme

PFC's - perfluorocarbons

RECs - Renewable Energy Certificates

SF_6 - sulphur hexafluoride

SWIS – South West Interconnected System

UNFCCC - United Nations Framework Convention on Climate Change

WDF – waste disposal facility

WELS – Water Efficiency Labelling and Standards

WBCSD – World Business Council for Sustainable Development

WRI – World Resources Institute

10. References

Australian Department of Climate Change (2008) – National Greenhouse and Energy Reporting Guidelines

Australian Department of Climate Change (2008) – National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2008 v1.0

Australian Department of Climate Change (2008), National Greenhouse Accounts (NGA) Factors – January 2008

Australian Department of Climate Change, National Greenhouse and Energy Reporting Scheme website - http://www.climatechange.gov.au/reporting/index.html

Australian Department of the Environment, Water, Heritage and the Arts, Greenhouse Challenge Plus website - http://www.environment.gov.au/settlements/challenge/

Australian Department of Resources Energy and Tourism, Energy Efficiency Opportunities website - http://www.energyefficiencyopportunities.gov.au/

Intergovernmental Panel on Climate Change (2007), Climate Change 2007: Synthesis Report, Summary for Policymakers - Summary of the IPCC's Fourth Assessment Report (AR4)

United Nations Framework Convention on Climate Change (UNFCCC) website (accessed November 2008) - http://unfccc.int/essential_background/kyoto_protocol/items/2830.php

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.

Western Australian Government (2007) Making Decisions for the Future: Climate Change – The Premier's Climate Change Action Statement, May 2007

Western Australian Government (2004), Western Australian Greenhouse Strategy – September 2004.

World Business Council for Sustainable Development / World Resources Institute (2004), *The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard*, Revised edition.

Gindalbie Metals Ltd (2008), Gindalbie Metals Ltd. Response to the Carbon Pollution Reduction Scheme Green Paper, July 2008

Grange Resources Ltd (2007), Albany Iron Ore Project, Public Environmental Review – Southdown Mangnetite Proposal, February 2007

International Minerals Pty. Ltd.

Level 4, 5 Mill Street

Perth WA 6000