NEW HOPE GROUP

10. Greenhouse Gas Emissions

Contents

10 Greenhouse Gas Emissions

10.1 Introduction

This Chapter assesses the potential greenhouse gas impacts and climate change vulnerability of the revised Project by:

- estimating the direct and indirect greenhouse gas emissions resulting from the revised Project;
- identifying mitigation measures to reduce greenhouse gas emissions; and
- undertaking a preliminary climate change risk assessment for the revised Project.

10.2 Regulatory Framework

10.2.1 Commonwealth Legislation

The following Commonwealth legislation is relevant for the reporting and management of greenhouse gas emissions in Australia:

- the *Energy Efficiency Opportunities Act 2006* (EEO Act) requires large energy-users to identify, evaluate and publicly report cost effective energy savings opportunities;
- the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) establishes a single, national system for reporting greenhouse gas emissions, abatement actions, and energy consumption and production by corporations; and
- the *Clean Energy Act 2011* establishes a pricing mechanism for greenhouse gas emissions and provides assistance for emissions-intensive trade-exposed industries and the coal-fired electricity generation sector.

10.3 Methodology

An inventory of greenhouse gas emissions for the revised Project has been prepared in accordance with AS ISO14064.1 (2006): Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.

Greenhouse gas emissions attributable to the revised Project have been considered in terms of two ‘scopes’ of emission categories:

- Scope 1: covers direct emissions from sources within the revised Project site; and
- Scope 2: covers indirect emissions from the consumption of purchased electricity, for activities within the revised Project site.

10.3.1 Inventory Principles

The greenhouse gas inventory has been developed to satisfy the principles outlined in AS ISO14064.1 as detailed in **Table 10-1**.

Table 10-1 Principles for the Greenhouse Gas Inventory

Principles	Requirements	Addressed
Relevance	Ensure the inventory appropriately reflects the emissions of the revised Project.	Greenhouse gas emissions have been estimated to meet the ToR for the EIS.
Completeness	Account for and report on all greenhouse gas emission sources and activities within the chosen inventory boundary. Disclose and justify any specific exclusions.	Inventory to cover Scope 1 and Scope 2 emissions from the Mining Lease. Greenhouse gas emissions from the following sources are not considered material and have not been estimated: ▪ petrol vehicles; ▪ fugitive emissions from wastewater treatment; and ▪ transport of coal to customers.
Consistency	Use consistent methodologies to allow for meaningful comparisons of emissions over time.	Emissions estimated using published emission factors outlined in **Section 10.2.3**. Future greenhouse gas emissions estimation and reporting under the NGER Act will be in line with the methodology used in this assessment.
Transparency	Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.	Emissions estimated using published emission factors outlined in **Section 10.3.3**. Assumptions and data are documented in **Section 10.4.2**.
Accuracy	Ensure that the quantification of greenhouse gas emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.	The accuracy of the emissions inventory is discussed in **Section 10.4.5**.

10.3.2 Global Warming Potential

Global Warming Potentials are used to compare the abilities of different greenhouse gases to trap heat in the atmosphere. Global Warming Potentials are based on the radiative efficiency (heat-absorbing ability) of each gas relative to that of carbon dioxide (CO_2). The Global Warming Potentials of relevance to this assessment are presented in **Table 10-2**.

Table 10-2 Global Warming Potentials

Greenhouse Gas	Chemical formula	Global Warming Potential
Carbon dioxide	(CO_2)	1
Methane	(CH_4)	21
Nitrous oxide	(N_2O)	310

Source: DCCEE, 2012

10.3.3 Emission Factors

Greenhouse gas emissions have been estimated using published emissions factors. The sources of published emission factors

- National Greenhouse Accounts (NGA) Factors (DCCEE, 2012);
- Guidelines for the Implementation Guidelines for the Implementation of NGER Method 2 or 3 for open cut coal mine fugitive GHG Emissions Reporting (ACARP, 2011); and
- IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Agriculture, Forestry and Other Land Use (IPCC, 2006).

Emission factors relevant to the revised Project are provided in **Table 10-3**.

Table 10-3 Greenhouse gas emission factors

Emissions source	Scope	Emission factor	Source
Diesel oil combustion	1	2.7 t CO_2-e/kL	DCCEE, 2012
Electricity consumption – Queensland	2	0.88 kg CO_2-e/kWh	DCCEE, 2012
Fugitive emissions from open cut coal mines – low gas zone	1	0.23 t CO_2-e/kt ROM coal	ACARP, 2011
Land clearing (woodland)	1	110.1 t CO_2-e/ha	IPCC, 2006
Land clearing (grassland)	1	10.5 t CO_2-e/ha	IPCC, 2006

Williams & Williams (2013) reported gas content analysis undertaken at the Mine in accordance with the ACARP (2011) guidelines. The analysis determined the Mine is in a low gas domain. The ACARP (2011) guidelines recommend an emission factor of 0.23 t CO_2-e/kt ROM coal to estimate fugitive emissions for mining operations located in a low gas zone.

10.4 Greenhouse Gas Emissions

10.4.1 Sources of Greenhouse Gas Emissions

The main sources of Scope 1 and Scope 2 greenhouse gas emissions for the revised Project are:

- direct CO_2 emissions from combustion of diesel in mining equipment and trucks;

- indirect CO_2 emissions due to consumption of electricity; and
- fugitive emissions from open cut coal mining.

10.4.2 Key Assumptions and Activity Data

The activity data used in the preparation of the greenhouse gas emissions inventory is presented in **Table 10-4**. The projected diesel usage for the revised Project has been forecast by NHG based on current operational data. NHG have estimated electricity demand based on the electrical loading requirements for the equipment at the CHPP, MHF and TLF.

Table 10-4 Source of construction and operation data used to estimate greenhouse gas emissions

Source	Operational Period	Value	Source
Diesel Usage	Current Operations	30,417 kL pa	NHG - current operational data
	Revised Project (2017 – 2029)	519,428 kL	NHG – refer to **Table 3-19**
		26,670 kL	NHG - refer to **Table 3-19**
		546,098 kL	
	Construction	3,000 kL	NHG estimate
Electricity Usage	Current Operations	50,344 MWh pa	NHG - current operational data
	Revised Project (2017 – 2029)	1,001,000 MWh	NHG - equipment load list for the revised Project
ROM Coal	Revised Project (2017 – 2029)	139,600 kt	NHG - refer to **Table 3-4**
Land clearing	Woodland	103 ha	SKM – spatial analysis
	Grassland (as pasture and native grasses)	1,927 ha	SKM – spatial analysis

10.4.3 Greenhouse Gas Emissions

Current Operations

Annual greenhouse gas emissions for the current operations of the Mine are estimated in **Table 10-5**.

Table 10-5 Annual Greenhouse gas emissions from current operations of the Mine

Emission source	Scope	Usage	GHG Emissions (t CO_{2-e})
Diesel oil combustion	1	30,417 kL	81,601
Electricity consumption	2	50,344 MWh	44,806
Fugitive methane emissions	1	9,600 kt ROM coal	2,208
TOTAL			128,615

Construction

The estimated greenhouse gas emissions from construction of the revised Project are presented in **Table 10-6** based on activity data in **Table 10-4**.

Table 10-6 Greenhouse gas emissions from construction of the revised Project

Emission source	Scope	Usage	GHG Emissions (t CO_{2-e})
Diesel oil combustion	1	3,000 kL	8,048
Land clearing - woodland	1	103 ha	11,340
Land clearing - grassland	1	1,927 ha	20,276
TOTAL			**39,664**

Operations of the revised Project

Estimates of diesel usage, electricity consumption and fugitive emissions for the operation of the revised Project are presented in **Table 10-7** based on activity data in **Table 10-4**. The corresponding Scope 1 and Scope 2 greenhouse gas emissions over the life of the revised Project are presented in **Table 10-7**. Cumulative greenhouse gas emissions for each year of operation are presented in **Figure 10-1**.

Table 10-7 Greenhouse gas emissions from operations of the revised Project

Emission source	Scope	Usage	GHG Emissions (t CO_{2-e})
Diesel oil combustion	1	546,098 kL	1,465,016
Electricity consumption	2	1,001,000 MWh	880,880
Fugitive methane emissions	1	139,600 kt ROM coal	32,108
TOTAL			**2,378,004**

The operation of the revised Project is estimated to result in approximately 2.4 Mt CO_2-e of greenhouse gases for the life of Project. Based on an operational period from 2017 to 2029 (13 years) the average annual greenhouse gas are expected to be 0.18 Mt CO_2-e. Average annual greenhouse gas emissions of 0.18 Mt CO_2-e from the revised Project represent an increase of 0.055 Mt CO_2-e when compared to current operations (refer to **Table 10-5**).

The major sources of greenhouse gas emissions from the revised Project are emissions for diesel combustion (61 per cent) and consumption of electricity (37 per cent).

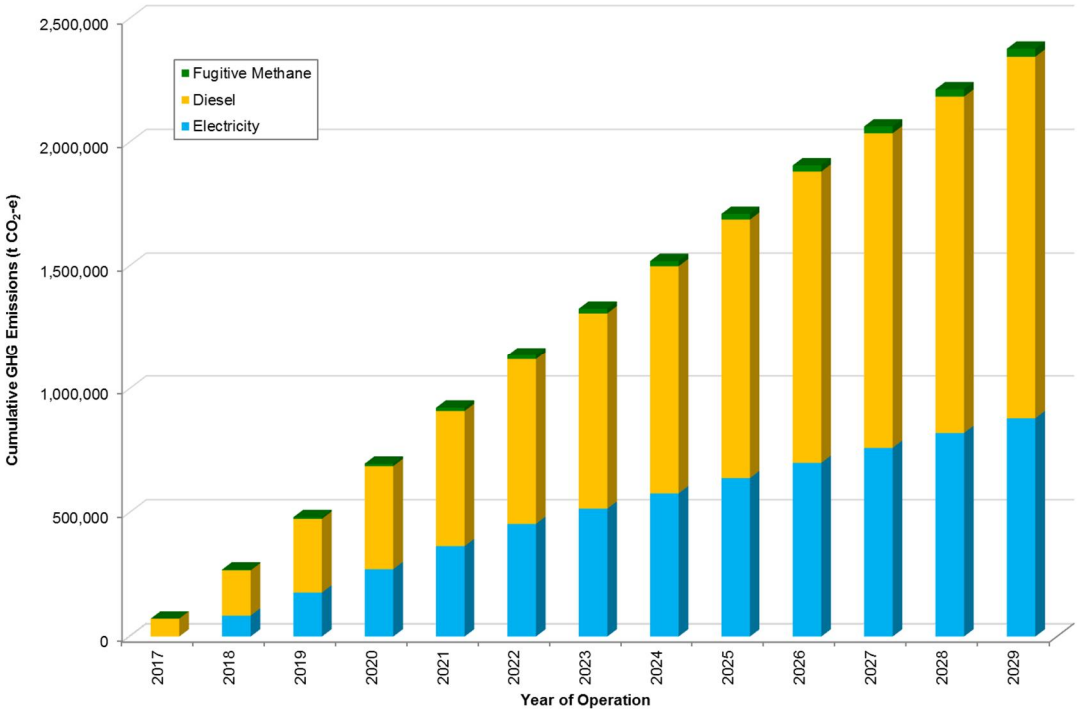

Figure 10-1 Cumulative greenhouse gas emissions during operation of the revised Project

10.4.4 Estimation of Uncertainty

The major sources of uncertainty associated with this greenhouse gas emissions inventory are associated with any uncertainty with activity data in estimating fugitive greenhouse gas emissions from mining operations. The uncertainty associated with activity data and emission factors is presented **Table 10-8**. The overall uncertainty has been calculated using the IPCC (2000) guidelines.

Table 10-8 Greenhouse gas emissions from operations of the revised Project

Emissions Source	Activity Data Uncertainty	Emission Factor Uncertainty	Overall Uncertainty
Electricity Consumption	20%	7%	± 20%
Diesel usage	20%	4%	
Fugitive emissions	20%	50%	

10.4.5 Comparison with Australian Emissions

Australia's total greenhouse gas emissions (including land use, land use change and forestry) in 2012 were 568.4 Mt CO_2-e (DIICCSRTE, 2013).

Average annual greenhouse gas emissions from the operation of the revised Project represent 0.03 per cent of Australia's greenhouse gas emissions. The increase in greenhouse gas emissions above current operations of the Mine represents 0.01 per cent of Australia's greenhouse gas emissions.

10.4.6 Comparison with other mining operations

Fugitive methane emissions generally make up almost 50% of the greenhouse gas emissions from open-cut coal mines in Queensland. Gas sampling undertaken at the Mine has determined the coal resource is located in a low gas domain resulting in lower fugitive methane emissions. Greenhouse gas emissions from the revised Project are expected to be lower than other mining operations in Queensland.

10.5 Mitigation Measures

There are a range of mitigation and management measures for greenhouse gas emissions, which will be implemented or continued by the revised Project. These management measures are aligned with other operators in the black coal industry. The measures can be broadly categorised as:

- reduce fuel usage from operations (improving operational efficiency);
- reduce electricity usage from operations;
- research and contributions to industry bodies; and
- reporting and analysis;
- carbon sequestration;

- carbon trading; and
- research and contributions to industry bodies.

The proposed management measures to reduce greenhouse gas emissions from the revised Project are consistent with other mining operations in Queensland.

Reduce fuel usage from operations

NAC is continuously evaluating methods to reduce fuel usage. NAC are committed to undertaking the following actions to reduce fuel usage from mining operations for the revised Project:

- mine planning to reduce haulage distances
- improving efficiency of payload management (e.g. run-of-mine coal haulage);
- considering fuel efficiency of mining equipment and haul trucks during procurement;
- maintaining mining equipment and haul trucks in good working order so fuel efficiency of equipment is maximised;
- modifying operational procedures to improve the fuel use of selected machines (for example, minimising unnecessary idling of mobile equipment); and
- implementing an operator education program to promote more fuel efficient operation of machines.

A significant reduction in fuel use can be achieved by improved mining pit design. With optimised haul road and dump design, haulage distances can be reduced with substantial savings in fuel (and therefore greenhouse gas emissions).

Reduce electricity usage from operations

NAC are committed to undertaking the following actions to reduce electricity usage from mining operations for the revised Project:

- using power factor correction equipment at the CHPP to improve electricity consumption efficiency; and
- using LED lighting where practical for general access and safety lighting, e.g. around personnel access walkways and doors and conveyor walkways, which can result in a reduction of electricity consumption.

Use of Alternate Fuels

NAC has evaluated the potential use of alternative fuels, such as compressed natural gas (CNG) and liquefied natural gas (LNG) for its on-site mining fleet, and in consultation with its trucking contractor, for the haulage of product. Larger sized diesel engines used by mining equipment are not commonly converted to CNG or LNG usage. Cost and fuel storage issues (e.g. sizing) are the main factors that precluded conversion to these alternative fuel technologies.

NAC will continue to periodically explore the potential use of alternative fuel options, and expects that major advances will be made in this area in the future, particularly when the economic drivers for change improve.

Capturing or Flaring Coal Seam Gas

Gas content analysis undertaken has determined the Mine is in a low gas domain. The revised Project site is expected to have similar gas content to the Mine. Fugitive emissions represent approximately 1 per cent of greenhouse gas emissions from the revised Project. Capturing or combusting coal seam methane is not considered a feasible option for achieving significant reductions in greenhouse gas emissions from the revised Project.

Reporting and Analysis

Based on the revised Project's estimated annual greenhouse gas emissions the following actions will be undertaken to fulfil legislative requirements:

- report annual greenhouse gas emissions under the National Greenhouse and Energy Reporting System under the NGER Act (facility threshold is 25,000 t CO_2-e / year); and
- identify, evaluate and publicly report cost effective energy savings opportunities under the EEO Act (facility threshold is 0.5 PJ energy consumed / year).

Under the EEO Act, NAC are committed to investigating energy efficiency and other opportunities with a view to reducing its carbon footprint. Initiatives such as a solar power and tree screening and planting are examples of options currently being considered.

Carbon sequestration

A carbon sequestration program near the revised Project site is considered to have a relatively low potential to offset greenhouse gas emissions. The reduction in greenhouse gas emissions provided by a carbon sequestration program is not expected to outweigh the costs of implementing the program.

Carbon Trading

Under the Clean Energy Act 2011, NHG are required to pay a carbon price for Scope 1 greenhouse gas emissions from their operations that exceed 25,000 kt CO_2-e. The carbon price is currently fixed but will transition to a fully flexible price under an emissions trading scheme market.

The transition to an emissions trading scheme will provide opportunities to offset emissions through carbon trading. NHG will investigate opportunities to offset greenhouse gas emissions from the revised Project through the trading scheme under the *Clean Energy Act 2011*.

Research and contributions to industry bodies

NAC are also a foundation member of the COAL 21 fund, a voluntary industry fund dedicated to greenhouse abatement measures in the Black Coal industry. As of April 2013, approximately $250 million has been committed to demonstration projects as well as a national research program managed by Australian National Low Emissions Coal Research (ANLEC) Ltd.

10.6 Vulnerability to Climate Change

The vulnerability of the revised Project to climate change has been determined through a climate change risk assessment.

10.6.1 Predicted Change in Climate

The preliminary climate change risk assessment is based on climate change scenario for the Eastern Downs region which includes Toowoomba Regional Council. The climate change scenario for 2030 is presented in **Table 10-9**.

Table 10-9 2030 Climate Change Scenario for Eastern Downs relative to 1990

Feature	Season	Current historical mean	2030
Temperature (°C)	Annual	18.3 °C	+1 °C
	Summer	24.1 °C	+1 °C
	Autumn	18.9 °C	+1 °C
	Winter	11.7 °C	+1 °C
	Spring	18.8 °C	+1.1 °C
Rainfall (%)	Annual	694 mm	-3 mm
	Summer	262 mm	-1 mm
	Autumn	149 mm	-3 mm
	Winter	99 mm	-6 mm
	Spring	178 mm	-6 mm
Potential Evaporation	Annual	1737 mm	+3 mm
	Summer	617 mm	+3 mm
	Autumn	387 mm	+4 mm
	Winter	235 mm	+4 mm
	Spring	502 mm	+3 mm
Number of hot (>35 °C) days	Annual	31 days	46 days
Extreme weather	More intense and long-lived cyclones have a greater chance of impacting on inland regions such as the region, from the decay of cyclones into rain bearing depressions or the cyclones themselves tracking further inland.		

Source: Office of Climate Change, 2009

10.6.2 Change Climate Risk Assessment

The potential risk to the revised Project posed by each climate change parameter has been assessed and mitigation measures, where appropriate, have been proposed and presented in **Table 10-10**.

Table 10-10 Potential impacts of climate change on the revised Project and proposed mitigation measures

Climate change parameter	Potential impact on the revised Project	Mitigation measures
Increase in annual average temperature	Average temperature increase is unlikely to affect reliability of infrastructure or equipment.	Not applicable
Decrease in annual average and seasonal rainfall	Reduced yield from onsite water storages.	Recycled water will be supplied from Toowoomba's WWRF to provide a consistent and reliable source of water to the Project.
	Increased difficulty in achieving rehabilitation success criteria due to slower growth rates for plants. This may increase the risk of erosion from rehabilitated areas.	Ongoing monitoring of rehabilitation areas and implement control measures, if required. For example, via the use of more drought tolerant species and cultivars and the development of detailed rehabilitation plans highly focussed on ground preparation, seasonal weather conditions, etc.
Increase in annual average potential evaporation	Reduce the yield from onsite water storages.	Recycled water will be supplied from Toowoomba's WWRF to provide a consistent and reliable source of water to the Project.
	Increased dust emissions due to drier surface conditions, may increase water demand for dust suppression.	Progressive rehabilitation will be undertaken as soon as practical to reduce exposed areas.
Increase in annual number of hot days	Increased potential for heat stress to affect mine workforce	Health and Safety Management Systems to incorporate appropriate safety training and awareness sessions.
	Unlikely to affect reliability of infrastructure or equipment.	Not applicable
Increase risk of extreme weather	Increased impacts from flood events result in overtopping of sediment dams.	Responsive water management system to deal with severe storm events. For example, via the use of more conservative (risk averse) design parameters for water management structures.
	Increased impacts from flood events result in the pit filling with water.	Responsive water management system to deal with severe storm events. For example, via the development of strategies to allow preferential use of excess pit water for operational purposes.
	Increased risk of erosion especially from exposed areas.	Progressive rehabilitation will be undertaken as soon as practical to minimise risk.

Climate change parameter	Potential impact on the revised Project	Mitigation measures
	Severe storms or cyclones may create bottlenecks at ports.	No mitigation measures available.

10.7 Conclusions

Greenhouse gas emissions were estimated based on published emissions factors. The operation of the revised Project is estimated to result in approximately 0.18 Mt CO_2-e on an annual basis. These emissions represent an increase of 0.055 Mt CO_2-e in greenhouse gas emissions when compared to current operations of the Mine. The increase in greenhouse gas emissions above current operations of the Mine represents 0.01 per cent of Australia's annual greenhouse gas emissions.

The project is considered to have a low vulnerability to climate change.

10.8 Summary of Mitigation Measures and Commitments

Table 10-11 Summary of mitigation measures and commitments

Economic risk	Mitigation strategy
Greenhouse Gas Reduction	■ Mine planning to reduce haulage distances ■ Improving efficiency of payload management (e.g. run-of-mine coal haulage) ■ Consider fuel efficiency of mining equipment and haul trucks during procurement ■ Maintaining mining equipment and haul trucks in good working order so fuel efficiency of equipment is maximised ■ Modifying operational procedures to improve the fuel use of selected machines (for example, minimising unnecessary idling of mobile equipment); ■ Implementing an operator education program to promote more fuel efficient operation of machines ■ Using power factor correction equipment at the CHPP to improve electricity consumption efficiency ■ Using LED lighting for general access and safety lighting, e.g. around personnel access walkways and doors and conveyor walkways can result in a reduction of electricity consumption ■ Report annual greenhouse gas emissions under NGERS ■ Identify, evaluate and publicly report cost effective energy savings opportunities under the EEO Act. ■ Investigate opportunities to offset greenhouse gas emissions through carbon trading scheme under the *Clean Energy Act 2011*
Climate Change	■ Recycled water will be supplied from Toowoomba's WWRF to provide a consistent and reliable source of water to the Project ■ Ongoing monitoring of rehabilitation areas and implement control measures, if required, to achieve rehabilitation success criteria ■ Responsive water management system to deal with severe storm events ■ Progressive rehabilitation will be undertaken as soon as practical to minimise risk of erosion from exposed areas