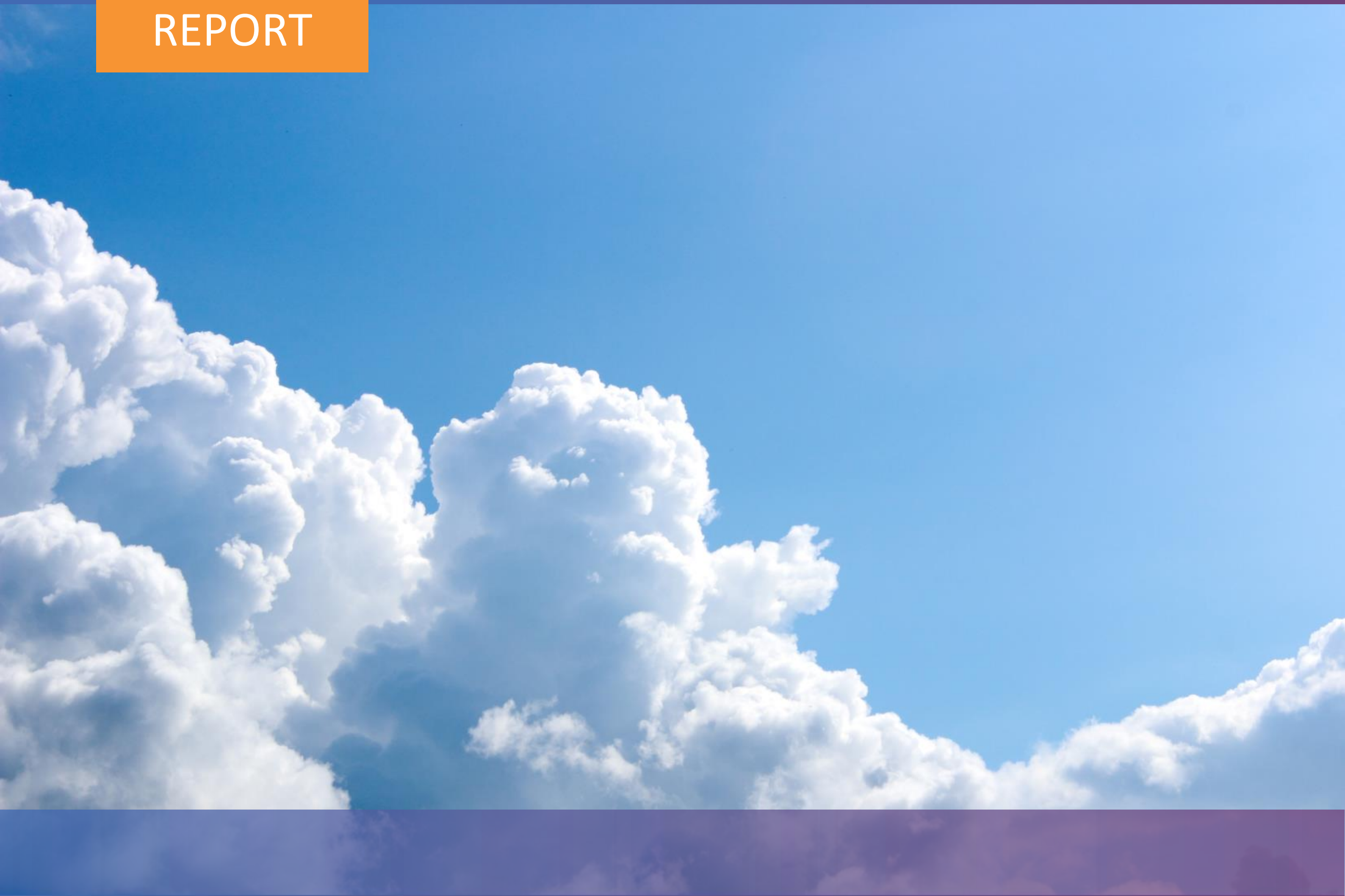
REPORT



SCNCP Projected Greenhouse Gas Assessment

for Rolleston Coal Holdings Pty Ltd

30/09/2023

COAL ASSETS AUSTRALIA
GLENCORE

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1 INTRODUCTION

Mining and Energy Technical Services (METServe) has been engaged by Rolleston Coal Holdings (RCH) to prepare a projected greenhouse gas emission assessment for the life of the Spring Creek North Continuation Project (SCNCP). This assessment will form part of the Queensland Government approvals process for the Rolleston Open Cut (ROC) SCNCP EA amendment, following a request for information by the Department of Environment and Science (DES). The purpose of this document is to inform the Department on predicted greenhouse gas emissions resulting from the SCNCP, and how the proposed project will contribute to the climate targets outlined in the Queensland Climate Action Plan 2020-2030.

1.1 Project Description

The ROC is an open cut, thermal coal operation located in the Bowen Basin, a major coal producing region in Central Queensland. The ROC is situated approximately 275 kilometres (km) west of Gladstone and approximately 16 km west of the town of Rolleston in the Central Highlands Regional Council area.

Current operations at the ROC utilise two BE 2570W draglines supported by three electric rope shovels (P&H 4100A, P&H 4100XPC and Cat7495), one hydraulic shovel (Hitachi EX5500), three hydraulic excavators (Cat6060), one front end loader (Komatsu WA1200), 42 rear dump trucks, 21 dozers, and various auxiliary equipment including graders, water trucks, service carts, drills. The support fleet principally move pre-strip material, post strip material and coal. All machinery operates on a seven-day per week roster.

There are currently four pits operating at the ROC. The 2024 LoM plan, based on current approvals, estimates production will continue until 2039 at a rate of up to 16 million tonnes per annum (mtpa). Production rates will decline from 2025 as strip ratios significantly increase. Discrete mining pits will commence and finish at various times throughout the mine life, with ongoing land reformation and rehabilitation planned as operational areas become available for progressive rehabilitation.

Pit areas are predominantly multi seam strip mining operations, with recovery of all coal meeting customer quality specifications. The mining strips are around 50 to 70 m wide, depending on depth and other constraints. Coal is loaded onto trains within ML70418 for transportation by rail to Gladstone, a total distance of 424 km via the 109 km connection to the Blackwater System. Trains are powered by diesel or electric locomotives and have a nominal capacity of 8,210 tonnes. ROC exports coal via the Port of Gladstone (RG Tanna and Wiggins Island Coal Terminals) as well as supplying domestic customers in Gladstone, including the Gladstone Power Station.

ROC seeks to extend the current operations with the Spring Creek North Continuation Project (SCNCP, the Project). The Project would extend the mining area of the existing ROC Operation by including mining north of the current Spring Creek pit on ML70307 and onto the northern section of ML70415.

The Project will not increase the mine's production rate or extend the life of the project. No change in the method of mining is proposed. Mining will continue to be conducted using the open cut methods described in **Section 2**. The proposed Spring Creek North pit will yield approximately 33.7Mt of ROM coal over the life of the Project.

The Project has been designed to utilise existing approved ROC infrastructure wherever practical. This approach reduces the Project disturbance footprint by utilising existing ancillary infrastructure such as electricity lines, water supply pipelines, coal handling facilities (CHF), train load out facilities (TLO), haul roads and rail infrastructure. Although the Project will be able to largely utilise existing infrastructure, some additional mine infrastructure, as well as upgrades to some existing mine infrastructure, will be required. This will include a new clean water drain at the western end of the project area to prevent clean water (overland flow) from entering operational areas, as well as the extension of the current Spring Creek pit dewatering pipeline, north into the proposed project area. A new 66 kV powerline will also supply power to the Project area.

1.2 Objectives

This Projected Greenhouse Gas Emissions Assessment (PGGEA) provides a breakdown of the major GHG emission sources, and an estimated greenhouse gas (GHG) emissions value for the life of the Spring Creek North Continuation Project (SCNCP). This value is assessed against Queensland, Australian and international GHG emissions estimates to provide a portion percentage and determination of the contribution of the SCNCP against state, national, and global GHG emissions.

1.3 Scope

To comply with the request for information received by RCH from the Department of Environment and Science (DES), this PGGEA determines the following:

- Total GHG emissions and major emission sources for the life of the SCNCP;
- Proportion of annual SCNCP generated emissions to annual state GHG emissions estimates;
- Proportion of annual SCNCP generated emissions to the latest annual national GHG emissions estimates;
- Proportion of annual SCNCP generated emissions to the latest annual global GHG emissions estimates;
- Detail the emissions management and mitigation strategies in place, at both corporate (Glencore), and site (ROC) levels.

1.4 Relevant Legislation

1.4.1 International Agreements

The United Nations Framework Convention on Climate Change (UNFCCC) provides the framework for intergovernmental action to combat climate change and its impacts on humanity and ecosystems. The UNFCCC has near-universal membership with 197 member states (Parties of the Convention). The ultimate objective of the convention and any related legal instruments that the Conference of Parties (COP) may adopt is to achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Under the convention all Parties are obliged to provide annual GHG inventory submissions, as well as a variety of reports, assessments, and technical reviews on GHG emissions reduction strategies. This transparent reporting system allows a unilateral understanding of the global progress on climate change and informs COP deliberation and guidance on these matters.

1.4.1.1 The Kyoto Protocol

The Kyoto protocol was formally adopted in 2005 and shares the ultimate objective of the Convention to stabilize atmospheric concentrations of GHG's at a level that will prevent dangerous interference with the climate system. Currently there are 192 parties to the Kyoto Protocol.

The Kyoto Protocol initially set binding emission reduction targets for the European Union and 37 other member states (including Australia). These targets amounted to an average 5% emission reduction compared to 1990 levels over the period 2008 – 2012 (the first commitment period).

A second commitment period (2013-2020) brought further greenhouse gas emission reduction targets, with member states committing to reduce GHG emissions by at least 18% below 1990 levels (UNFCCC).

Australia is estimated to have beaten it's Kyoto target by up to 430 million tonnes, or around 80% of a full year's emissions (Department of Industry, Science, Energy and Resources, 2020).

1.4.1.2 The Paris Agreement

The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 parties at COP 21 in Paris, on 12 December 2015, and entered into force on 4 November 2016.

Its goal is to limit global warming to well below 2 degrees Celsius, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. To achieve this long-term temperature goal, countries aim to reach a global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by mid-century (UNFCCC).

Nationally determined contributions (NDC's) are at the heart of the Paris Agreement and the achievement of these long-term goals. NDC's detail the efforts of each country to reduce national emissions and adapt to the impacts of climate change.

Australia's commitment under it's NDC is to reduce greenhouse gas emissions economy wide by 43% below 2005 levels by 2030.

1.4.2 Australian Legislation

The Clean Energy Regulator is the Government body responsible for administering legislation that will reduce carbon emissions and increase the use of clean energy in Australia.

The Clean Energy Regulator was established in 2012 as an independent statutory authority by the *Clean Energy Regulator Act 2011* and operates as part of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) portfolio.

The Australian National Greenhouse Accounts are a series of comprehensive reports and databases that estimate and account for Australia's GHG emissions from 1990 onwards. The Accounts contain the National Inventory Reports which fulfil Australia's commitments to the UNFCCC.

The National Greenhouse Accounts (NGA) Factors have been prepared by DCCEEW and are designed for use by companies and individuals to estimate greenhouse gas emissions. The default emission factors listed within the NGA Factors Workbook have been estimated by DCCEEW using the Australian Greenhouse Emissions System (AGEIS) and are determined simultaneously with the production of Australia's National Greenhouse Accounts. This promotes consistency between inventories at company or facility level, and the emission estimates presented in the National Greenhouse Accounts. Although the NGA Factors workbook draws on the National Greenhouse and Energy Reporting (NGER) Measurement Determination 2008 document, the NGA factors have a more general application and are used to estimate a broader range of greenhouse emissions.

The National Greenhouse Gas and Energy Reporting (NGER) Scheme, established by the *National Greenhouse and Energy Reporting Act 2007* (NGER Act), provides a national framework for reporting and disseminating company information about greenhouse gas emissions, energy production, energy consumption and other information specified under NGER legislation. The data reported in the NGER scheme forms an important input into the preparation of the National Greenhouse Accounts.

There are two thresholds that determine whether a company has a requirement to report under the NGER Act, facility, and corporate thresholds. The ROC as a facility exceeds the 25kt CO_2-e threshold, and so is required to submit annual NGER reports to DCCEEW.

1.4.3 Queensland State Initiatives

In 2017, the Queensland Government joined the international Under2 Coalition, a global community of state and regional governments committed to ambitious climate change in line with the Paris Agreement.

The coalition brings together 260 state or local governments, who represent 1.75 billion people and 50% of the global economy. Members are committed to keeping global temperature rises to well below 2 degrees Celsius, with efforts to reach 1.5 degrees Celsius. 35 states have committed to reaching net zero emissions by 2050 or earlier, of which Queensland is one.

To meet the target of net zero emissions by 2050, the Queensland Government have implemented the Queensland Climate Action Plan. The purpose of the Plan is to 'set bold but achievable targets for reducing emissions, while creating jobs' (DES).

Under the Plan, Queensland has committed to the following targets:

- 50% renewable energy target by 2030;
- 30% emission reduction below 2005 levels by 2030;
- 70% renewable energy by 2032;
- 80% renewable energy by 2035;
- Zero net emissions by 2050.

Information on Queensland greenhouse gas emissions is sourced from the National Greenhouse Gas inventory. The latest data available for total annual emissions across Queensland is for 2021 and currently sits at 139.7mt CO_2-e, which is 29% below the 2005 baseline.

1.5 Definitions

The following definitions (**Table 1-1**) are taken from the UNFCCC and NGA Factors Workbook 2023:

Table 1-1 Definitions

Greenhouse Gases	The UNFCCC lists the following as reportable GHGs: Carbon Dioxide (CO_2) Methane (CH_4) Nitrous Oxide (N_2O) Perfluorocarbons (PFCs) Hydrofluorocarbons (HFCs) Sulphur Hexafluoride (SF_6) Nitrogen Trifluoride (NF_3)
Direct emissions (Scope 1)	Emissions produced from sources within the boundary of an organisation and as a result of that organisations activities
Indirect emissions	Emissions generated in the wider economy as a consequence of an organisations activities, but which are physically produced by the activities of another organisation.
Scope 2 emissions	Indirect emissions from the generation of electricity purchased and consumed by an organisation. Scope 2 emissions are physically produced by the burning of fuels (coal, natural gas, etc.) at the power station.
Scope 3 emissions	Indirect emissions which are not included in Scope 2, occurring within an organisations value chain.

2 COAL PRODUCT

2.1 Coal Type

The ROC is a thermal coal mine, with recovery of all coal meeting customer quality specifications. No Metallurgical coal or pulverised coal injection (PCI) product is mined at the ROC.

The **Table 2-1** below shows the ROC predicted extraction rates for the SCNCP, and the wider ROC inclusive of the proposed SCNCP, and presents the percentage of total ROC production that the SCNCP will contribute.

Table 2-1 ROC Production Rates

Production Year	ROC Production (t)	SCNCP Production (t)	% SCNCP of Total ROC
2026	15,193,568	149,071	0.98%
2027	12,262,848	3,446,025	28.10%
2028	11,673,760	3,317,638	28.42%
2029	10,529,096	2,603,226	24.72%
2030	11,184,761	3,042,350	27.20%
2031	11,146,018	2,600,524	23.33%
2032	11,889,911	1,998,231	16.81%
2033	10,506,606	2,792,742	26.58%
2034	9,721,113	2,617,896	26.93%
2035	9,363,086	2,729,724	29.15%
2036	10,870,475	3,006,903	27.66%
2037	12,005,279	2,083,405	17.35%
2038	10,318,523	1,666,174	16.15%
2039	9,576,526	1,685,594	17.60%
LOM	156,241,660	33,739,504	21.59%
Average Annual	11,160,119	2,409,965	21.59%

2.2 Coal Gas Content Characteristics

The coal seams targeted in this operation are the X, A, B, C and D seams in the Bandanna Formation. A total of 15 gas-sampling dedicated boreholes were drilled across Rolleston between April and August 2012 for the purpose of fugitive gas emissions and reporting.

The boreholes were drilled to sample all coal seams mined in ROC open pit areas including the strata 20m below the D-Seam as required by Section 3.22 of the NGER Determination 2008.

The results of this program were used to develop a gas distribution model for the annual fugitive emissions estimate for ROC. The sampling, testing and modelling at ROC for the purposes of fugitive estimation modelling was carried out according to Section 3.24 of the NGER Determination and Part 2 of the ACARP Guidelines.

Upon the analysis of the gas contents and methane composition in these 15 boreholes, the whole ROC extent was determined to fall into a low gas zone, due to ROC's very low gas content and negligible methane composition. For the ROC, the base of the low gas zone is the D-Seam floor (which is the pit shell floor for the SCNCP).

Following the sampling, testing, and modelling, a default emissions factor of 0.00023 t CO2-e was determined for all gas bearing strata (GBS) tonnes within the ROC footprint.

2.3 Emission Intensity Comparison

The fugitive emissions factor for the Project of 0.00023 t CO2-e / t ROM, when combined with total Scope 1 and 2 emissions projected from the project (**Section 4.5**), produces a total production emissions intensity value of 0.02 t CO_2-e per t ROM coal. This emissions intensity factor compares favourably with other approved and operating coal mining operations in the Bowen Basin, which have estimated greenhouse gas emissions intensities ranging from 0.036 to 0.13 (**Table 2-2**).

Table 2-2 Emission Intensity Comparison

Mining Operation	Total ROM Resource (Mt)	Total GHG Emissions (Scope 1 and 2) (Mt)	Emissions Intensity Factor (t CO_2-e / t ROM coal)
ROC[1]	33.7	0.68	0.02
Isaac Downs Mine[2]	35.4	2.15	0.06
Olive Downs Project[3]	644.5	71.91	0.12
Caval Ridge Mine[4]	-	11.14	0.036 – 0.043
Goonyella Riverside Mine[5]	750	39.25	0.05
Broadmeadow Underground Mine[5]	138	11.51	0.08
Red Hill Mine[5]	234	24.21	0.11 – 0.13
Central Queensland Coal Project[6]	64.1	3.45 (Scope 1 only)	0.05

Note: Values have been rounded.

[1] *Rolleston Coal Gas Assignment Report* (Xstrata Coal, 2012).

[2] *Air Quality and Greenhouse Gas Assessment for the Isaac Downs Project* (Katestone, 2020).

[3] *Air Quality and Greenhouse Gas Assessment for the Olive Downs Coking Coal Project* (Katestone, 2018).

[4] *Caval Ridge Environmental Impact Statement* (BHP Billiton Mitsubishi Alliance [BMA], 2009).

[5] *Red Hill Mining Lease Environmental Impact Statement* (BMA, 2013).

[6] *Central Queensland Coal Project Air Quality Assessment* (Vipac Engineers & Scientists, 2020).

3 EMISSIONS MANAGEMENT

3.1 Federal GHG Framework

ROC is a Safeguard facility under the Federal Safeguard Mechanism. The Safeguard Mechanism commenced on 1st July 2016 and applies to facilities that emit more than 100,000 tonnes of carbon dioxide equivalent (t CO_2-e) gas per financial year. This extends to businesses across a broad range of industry sectors, including mining. The Safeguard Mechanism is administered by the Australian Government's Department of Climate Change, Energy, Environment and Water (DCCEEW).

Together with the reporting obligations under the National Greenhouse and Energy Reporting Act 2007 (NGER Act), the Safeguard Mechanism provides a framework for Australia's largest emitters to measure, report, and manage their emissions.

The Safeguard Mechanism sets legislated limits, known as baselines, on the GHG emissions from qualifying facilities. The Safeguard Mechanism was reformed in 2023 with the aim of ensuring applicable facilities such as ROC contribute a proportionate share to Australia meeting its GHG emission reduction commitments to the UNFCCC. Australia's current commitment to the UNFCCC is to reduce GHG emissions to 43% below 2005 levels by 2030, and net zero by 2050.

3.1.1 Emissions Baseline

Under the Safeguard Mechanism, facilities such as ROC are given a baseline against which their Scope 1 emissions levels will be assessed. A facility is only required to be assigned a baseline under the Safeguard Mechanism if it exceeds the 100,000 t CO_2-e threshold. These are referred to as Safeguard facilities. A Safeguard facility must keep its net emissions levels at or below its baseline or face civil penalties.

3.1.2 Emissions Reduction & Baseline Decline Rate

Under the Safeguard reforms, which ROC is subject to, there is a requirement for net emissions across the Safeguard Mechanism to reduce by 4.9% annually from FY24 to FY30, then by ~3.3% from FY31 to reach net zero by 2050. These rates have been calculated to ensure that Australia remains on track with its GHG emission reduction targets to the UNFCCC and the ambition of net zero by 2050. The Federal Government has also scheduled a review during FY27 to evaluate performance against the reformed Scheme and to determine if baseline decline rates need to be revised. Post 2030, baselines will be decreased in 5-year blocks, to align with future updates and commitments to the UNFCCC. Baseline decline rates for the period 2030-31 through 2034-35 are scheduled to be set by 1st July 2027.

Additionally, total absolute emissions from Safeguard facilities are also required to decrease over time, measured over a 5-year rolling average. From 1st July 2025, the rolling average of Safeguard covered emissions over the previous 5-year period are required to be lower than the 5- year rolling average from 3 years earlier. From 1st July 2027, the 5-year rolling average of Safeguard covered emissions is required to be lower than the 5-year rolling average from 2 years earlier.

3.1.3 Managing Excess Emissions

Safeguard obligations rest with the person with operational control of the Safeguard facility. This person is referred to as the 'responsible emitter' and may be an individual, a body corporate, a trust, a corporation sole, a body politic or a local governing body. The responsible emitter is required to keep the Safeguard facility's net emissions at or below its emissions baseline.

Responsible emitters with a Safeguard facility that has, or is likely to, exceed its baseline have several options to manage the excess emissions situation:

- Pursue activities that would reduce the relevant emissions of the facility;
- Surrender prescribed carbon units to reduce the net-emissions of the facility - Australian Carbon Credit Units (ACCUs) and Safeguard Mechanism Credits (SMC) are currently the only prescribed units. Both Kyoto and non-Kyoto ACCUs can be used as offsets under the Safeguard Mechanism;

- Apply for a multi-year monitoring period that provides flexibility in how emissions are managed over a longer period;
- Apply for an exemption where excess emissions are due to exceptional circumstances such as a natural disaster or criminal activity.

3.2 State Approvals

Under the Queensland Government state approval process ROC were granted an Environmental Authority (EPML00370013) by the Department of Environment and Science (DES).

There are no specific conditions contained within the ROC EA relating to the management of GHG emissions.

There are also no specific conditions relating to GHGs within the *Environmental Protection Act 1994 (EP Act).*

3.3 Glencore Initiatives/Commitments

Glencore's Climate Change Strategy is to responsibly manage the decline of its global coal portfolio. As the world moves towards a low-carbon economy, Glencore is focused on supporting the energy needs of today whilst investing in our transition metals portfolio. The metals Glencore produces, sources and markets will support the global ambition to decarbonise.

Consistent with the commitment to responsibly manage the decline of its coal portfolio, Glencore has established total Scope 1, 2 and 3 emissions reduction targets, with a 15% reduction by the end of 2026 and a 50% reduction by the end of 2035 against a 2019 baseline, with a longer-term ambition of achieving net zero emissions by the end of 2050. These targets are aligned with the emission reduction objectives outlined in the QLD Climate Action Plan of:

- 30% emission reduction below 2005 levels by 2030;
- Zero net emissions by 2050.

Glencore is working actively towards achieving it targets and ambition, and has established seven actions with which it is aiming to do so:

1. Managing our operation footprint – reducing scope 1 and scope 2 emissions;
2. Reducing our scope 3 emissions;
3. Allocating capital to prioritise transition metals;
4. Collaborating with value chains to enable greater use of low carbon metals and support progress toward technological solutions to address climate change;
5. Supporting uptake and integration of abatement;
6. Using technology to improve resource use efficiency;
7. Transparency in regards to reporting on our progress and performance.

Glencore believes that only through collective global action can the world achieve the goals of the Paris Agreement and limit the impact of climate change. The UNFCCC and the Paris Agreement (Articles 2, 3(3) and 3(4), UNFCCC) provide that efforts to stabilise GHG concentrations should also enable economic development to proceed in a sustainable manner.

Glencore supports the UNFCCC's recognition of the critical importance of sustainable economic development and its acknowledgement that measures to protect the climate system against human-induced change should be appropriate for the specific conditions of each country and integrated with national development programmes.

Glencore supports the principle of equity set out in the Paris Agreement and acknowledges the common but differentiated responsibilities and capabilities of domestic economies (particularly those of emerging markets and developing economies) in the pursuit of climate objectives.

Glencore draws from this principle that the global response to climate change should pursue twin objectives: limiting temperatures in line with the goals of the Paris Agreement (Article 2(1)(a)), and supporting the United Nations Sustainable Development Goals, including sustained, inclusive, and sustainable economic growth, and universal access to clean, affordable energy.

The world requires a global transformation of energy, industrial and land-use systems to achieve these goals. Glencore believes this transition is a key part of the global response to managing energy security and the increasing risks posed by climate change.

In response to the ongoing decarbonisation of energy and the electrification of key sectors, including mobility and its associated infrastructure, Glencore expects demand to grow exponentially for renewable energy technologies, and the metals and minerals required to build them.

The business enables Glencore to support the delivery of these goals by producing, recycling, marketing, and supplying transition metals and minerals that are essential to the shift to a low-carbon economy and to meeting the needs of everyday life.

3.4 ROC Initiatives/Commitments

ROC is a low emission intensity operation in comparison to other coal mining operations (**Section 2.3**), driven by its gas content and composition, and low electricity consumption:

- Due to low gas content and negligible methane composition, ROC is a low fugitive emission intensity operation. Fugitive emissions represent ~1-2% of ROC's Scope 1 emissions (0.03% of Queensland's estimated annual emissions).
- Fossil fuel emissions form the considerable portion of Scope 1 emissions.
- Additionally, as ROC produces a thermal coal product with minimal coal processing, electricity consumption for processing activities is negligible and this results in ROC being a low Scope 2 emission intensity operation (0.01% of Queensland's estimated annual emissions).

ROC's plan to continue mining incorporates measures to maximise energy efficiency and minimise GHG emissions.

The high-quality thermal coal produced at ROC is suitable for high efficiency power generation. If it is not available, markets may turn to lower quality thermal coal or brown coal which produces higher GHG emissions.

As described in earlier sections ROC is subject to the requirements of the Federal Government's Safeguard Mechanism, which has recently undergone significant reform. The Safeguard Mechanism reform is part of the Government's measures to achieve the national emission reduction target of 43% by 2030. Production from Spring Creek North (as part of the Life of Mine plan) will be included in the site's Safeguard Baseline assessments.

ROC will continue to investigate means of improving its current low emission intensity operations by maintaining current practices for fossil fuel minimisation, and investigating emerging technologies and further efficiencies, such as:

- Continue to implement operational control efficiencies such as minimising haul distances, and optimising ramp gradients, payload management and scheduling activities to optimise equipment use.
- Continue to report GHG emissions under the National Greenhouse and Energy Reporting Act 2007 as well as other government initiatives to manage emissions at a national level.
- Continue to assess technologies to improve efficiencies and reduce emissions including fuel switching, fleet electrification, and electricity from renewable sources that are economically feasible and practical.

4 IMPACT ASSESSMENT

4.1 Assessment Tools

To effectively and reliably estimate the projected greenhouse gas emissions for the SCNCP, and apply the proportion of SCNCP generated emissions against total ROC, State, national and global GHG estimates, the following tools will be applied:

4.1.1 National Greenhouse Accounts Factors

Scope 1, 2, and 3 emissions will be projected using the National Greenhouse Accounts (NGA) Factors (DCCEEW 2023). The NGA factors contain GHG emission factors for a variety of industrial activities. The NGA Factors include methods of estimating the fugitive gas emissions from open cut mines, emissions produced from electricity production, emissions produced from the combustion of solid fuels such as coal, liquid fuels such as diesel, and emissions produced by a variety of transport methods.

The following proposed activities at the SCNCP fall within the factors included in the NGA factors document:

- Fugitive Emissions,
- Diesel use,
- Consumption of petroleum-based oils and greases,
- Product transport,
- Product use,
- Waste produced.

All values within the *NGA Factors* are standardised and expressed as a carbon dioxide equivalent (CO_2-e). This is achieved by multiplying the individual gas emission factor by the respective gas global warming potential (GWP). A list of all Greenhouse gases and their GWP are included in **Appendix A**.

4.1.2 Greenhouse Gas Protocol Emissions Calculation Tool

The Greenhouse Gas Protocol (GHG Protocol) provides the world's most widely used GHG emission accounting standards, utilised by a number of corporations and governments to measure and manage GHG emissions from private and public sector operations. The GHG protocol has also developed calculation tools to allow companies to determine their GHG emissions from a variety of inputs.

4.1.3 National Greenhouse Gas Inventory

Estimates against the Queensland State and Australian National GHG projections are to be undertaken using the latest National Greenhouse Gas Inventory – Paris Agreement Inventory data as per the DCCEEW website (National Inventory Report 2021, April 2023). This will produce the proportion of estimated SCNCP generated GHG emissions against the latest Queensland and Australian GHG emissions calculations.

4.1.4 Climate Data Explorer (CAIT)

Assessment against the global annual GHG emissions estimates will be undertaken using the 2020 WRI CAIT Climate Data Explorer (CAIT) dataset. This will produce the proportion of estimated SCNCP generated GHG emissions against the total global GHG emissions predictions.

4.2 Methodology

4.2.1 Scope 1 Emissions

Scope 1 emissions include all emissions directly attributable to the SCNCP. This includes fugitive emissions from the extraction of coal, emissions from equipment used in the production of coal, emissions from vehicles used for transport and haulage, and emissions used from the use of petroleum-based grease and oils. These emissions will be estimated using the following methods.

4.2.1.1 Fugitive Emissions

Fugitive emissions were estimated using the National Greenhouse Accounts (NGA) Factors (DCCEEW 2023). The NGA Factors 2023 defer to the National Green house and Energy Reporting (Measurement) Determination 2008 for methodologies regarding estimation of fugitive emissions.

As per section 2.2, as gas content data is available for the seams to be mined at the ROC, Method 2 within section 3.21 of the National Greenhouse and Energy Reporting (Measurement) Determination 2008 was utilised.

This is determined using the following equation:

$Ej = \gamma j \ \sum z \ (Sj,z)$

The emissions value for the ROC was calculated using Method 2 for open cut coal mines as outlined above. As per section 2.2, Xstrata Coal (now Glencore) undertook a gas sampling program across the ROC in 2013 (Appendix A) as part of the RCEP approval Project. The emission factor for gas bearing strata tonnes at the ROC is stated as 0.00023 (tonnes CO_2-e/ gas bearing strata tonne). This calculation was used to provide the fugitive emissions factor for all coal mined over the life of the ROC.

Typically at ROC, gas bearing strata (GBS) tonnes are around 12% higher than ROM tonnes. This accounts for GBS within overburden and interburden. As such a 12% escalation has been applied to the emissions estimates for fugitive emissions from ROM tonnes provided within **Section 4.5**.

4.2.1.2 Liquid Fuels

For the purposes of estimating GHG emissions on ROC, liquid fuel usage can be separated into three parts, stationary diesel (production equipment), petroleum-based oils (PBO’s) and petroleum-based greases (PBG’s).

To estimate GHG emissions produced by the SCNCP, ROC has provided projected diesel and petroleum-based oil and grease usage for the life of mine, these are taken from the latest 2024 Life of Mine (LoM) projections. These volumes were projected for the ROC as a whole, so in order to determine the portion attributable to the SCNCP, the percentage of SCNCP to ROC ROM (**Table 1.1**) has been used to estimate the consumption of each fuel type specific to the SCNCP. The GHG emissions from combustion of these liquid fuels was then estimated using the formulas stated in the NGA Factors (DCCEEW 2023).

Section 2.1.3 of the NGA Factors provides the methodology for the estimation of emissions for stationary combustion.

The formula is for liquid fuel GHG emission estimates is:

Emissions type = quantity of fuel x energy content of fuel x emission factor for each gas type.

This figure is produced in kg CO_2-e, which is then divided by 1000 to give t CO_2-e.

4.2.2 Scope 2 Emissions

The NGA Factors (2023) state that ”Scope 2 emissions are physically produced by the burning of fuels (coal, natural gas, etc.) at the power station to create electricity”.

In order to capture emissions from upstream and downstream in the electricity supply chain, a Scope 3 emission factor is also included for power generation within the total Scope 2 value provided for the SCNCP.

Section 2.2 of the NGA Factors provides the methodology for the estimation of emissions from stationary energy sources.

The formula for estimating emissions from consumption of purchased electricity from a grid is:

Emissions total = quantity of electricity purchased and consumed in kilowatt hours x (Scope 2 emission factor (0.73 for Queensland) + Scope 3 emission factor (0.15 for Queensland)).

This figure is produced in kg CO_2-e, which is then divided by 1000 to give t CO_2-e.

Under the Queensland Climate Action Plan 2020-2030, the Queensland Government have set renewable energy targets for grid supplied electricity of:

- 50% renewable energy by 2030;
- 70% renewable energy by 2032;
- 80% renewable energy by 2035.

The draft 2023 Queensland Renewable Energy Zone Roadmap (the Roadmap), provides details on the four Renewable Energy Zone (REZ) facilities planned for Central Queensland to meet these targets. These four REZ facilities are anticipated to generate up to 8,200 MW of renewable energy across the region between 2023 and 2028.

Current figures from the Queensland Government's Department of Energy and Public Works show 26% of Queensland's energy production is sourced from renewables. The target of 50% renewable energy generation across the state by 2030 will require a 3.43% increase on 2023 levels over the 7 years to 2030.

As the Scope 2 values for the SCNCP contained within this report are projected across the period during which these targets are anticipated to be met, a greening factor for Scope 2 emissions resulting from gird purchased power utilised by the ROC has been applied. This greening factor has been calculated using the 2023 renewable energy data supplied by the Department of Energy and Public Works (26% renewable energy utilisation) and has applied the 3.43% increase from 2023 levels to 2030, until the 50% renewable energy target is met in 2030. The periods between the targets of 70% renewables by 2032 and 80% renewables by 2035 has been calculated by assuming an equal year on year increase in renewable energy generation to the target. For example, 2030 targets 50% renewable energy utilisation across the QLD grid network, and 2032 targets 70% renewables, and so 2031 has been projected at 60% renewables (**Table 4-1**).

This greening factor has been applied to the projected electricity usage values provided for the SCNCP, with values provided in **Section 4.5** reflecting the percentage of energy projected to be sourced from non-renewable sources.

Table 4-1 Projected Percentage of Renewable Energy for Grid Purchased Electricity

SCNCP Production Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Projected Renewable Percentage (%)	36.29	39.72	43.15	46.58	50	60	70	73.33	76.66	80	80	80	80

4.2.3 Scope 3 Emissions

Scope 3 emissions include all emissions indirectly attributable to the SCNCP. This includes the combustion of coal products by the final end user, and product transport to the final end user including rail and shipping. These emissions will be estimated using the methods discussed in the following sections.

4.2.3.1 Product Coal Combustion

Product coal combusted for the purposes of energy production were estimated using the NGA Factors 2023, Table 3, which presents the factors to be utilised for combustion of solid fuels for energy production. The coal produced across the ROC is classed as bituminous.

Using the SCNCP production data provided by ROC and the emissions factors given in Table 3 of the NGA Factors 2023, a GHG emissions estimate can be produced using the following formula:

Emissions type = quantity of fuel x energy content of fuel x Scope 3 emission factor (3)

This figure is produced in kg CO_2-e, which is then divided by 1000 to give t CO_2-e.

4.2.3.2 Product Transport

In order to calculate the downstream (Scope 3) transportation emissions for the SCNCP's product coal the GHG Protocol Transport Tool (V2) was used. This allows an estimated GHG emissions total to be calculated using method of transport, distance travelled, and volume of freight. As this portion of the transportation is not managed by Glencore and precise data regarding fuel consumption isn't readily available, this was considered to be the most accurate approach.

As the final destination of ROC's coal product includes customers across the globe, including South Korea, Taiwan, Japan, Vietnam, Singapore, India, Switzerland, Hong Kong, Argentina, China and Bataan Port (Philippines), the latter (Bataan) was chosen as the destination for shipping. The GHG Protocol Technical Guidance for Calculating Scope 3 Emissions states that if an actual distance is unavailable, companies may use the shortest theoretical distance.

4.3 Assessment Boundary

The GHG Protocol Corporate Accounting and Reporting Standard states that a credible GHG calculations report presents relevant information that is complete, consistent, accurate, and transparent. As such this PGGEA has been developed to include all significant Scope 1, 2 and 3 emissions from the SCNCP.

4.3.1 Emission Sources

The ROC has several potential emissions sources attributed to both direct and indirect processes. These are set out in **Table 4-2** below:

Table 4-2 SCNCP Emission Sources

Emissions Source	Scope	Description
Fugitive emissions	1	GHG's released during the mining process due to the removal of overburden and disruption of coal seams
Stationary diesel use	1	Diesel usage on site, main sources are for production purposes (heavy equipment)
Oils and greases	1	The use of petroleum-based oils and greases on ROC
Grid purchased Electricity	2	Electricity purchased form a third party provider and supplied via the QLD power grid
Product transport	3	Transport of ROM coal off site to final end-users
Product use	3	Use of coal by end-user. Specifically, the combustion of coal in electricity generation

4.3.2 Assessment Exclusions

As the SCNCP is designed to utilise existing ROC infrastructure to the fullest extent possible, with no increase in numbers of staff required across the ROC attributable to the SCNCP, and no increase in production expected, the emissions sources listed below have been excluded from the PGGEA. All omitted emission sources relate to relatively small volumes of emissions which are not anticipated to influence the SCNCP projected GHG footprint in any meaningful way.

All emission sources listed below combined, as applicable to the SCNCP specifically, when compared to total Scope 1 emissions, are anticipated fall within the 5.7% uncertainty level which was applied to the 2021 National Inventory Report the Australian Government submitted to the UNFCCC in 2023. (See **Table 4-3**).

Table 4-3 Assessment Exclusions

Emissions Source	Scope	Description
Workforce Travel	1	As the SCNCP will utilise the existing ROC workforce, no change is proposed to workforce travel as a result of the Project
Supply deliveries	1	As the SCNCP will utilise existing ROC infrastructure where possible, meaning no supply deliveries, or an accurate portion of each delivery, is directly attributable to the SCNCP
Wastewater treatment	1	As the SCNCP will utilise the existing ROC workforce, no change is anticipated in terms of wastewater volumes and treatment methods as a result of the Project
Business travel	1	Infrequent interstate travel relates to the ROC as a whole. No additional business travel is anticipated as a result of the Project
Sulphur Hexafluoride (SF_6)	1	As the SCNCP will utilise existing ROC infrastructure where possible, no significant increase in electrical infrastructure is anticipated.
Waste to Landfill	3	As the SCNCP will utilise the existing ROC workforce and infrastructure, no significant change is anticipated in terms of waste volumes reporting to landfill as a result of the Project

4.4 Data Sources

The values contained within this report and the total emissions figures stated are based on supporting documentation for the ROC state and federal approvals, along with projected production and fuel consumption values based on the 2024 ROC Life of Mine plan provided by the ROC.

4.5 Greenhouse Gas Emissions

The information in the following **Table 4-4** to **Table 4-18** have been produced using the methodology outlined in **Section 4.2** and the data provided by ROC in **Section 4.4**.

4.5.1 Scope 1 Emissions

Table 4-4 Fugitive Emissions

Fugitive Emissions						
ROM (t)	Life of SCNCP (Years)	Emissions Factor (t CO_2-e/ t gas bearing strata)	CO_2	CH_4	N_2O	Including GBS Factor of 12% (t CO_2-e)
33,739,504	14	0.00023	7,760	0	0	8691.2
Total SCNCP LOM Fugitive GHG Emissions (t CO_2-e)					7,760	8691.2
Annual Average SCNCP Fugitive GHG Emissions (t CO_2-e)					554	620.8

Table 4-5 Production (Stationary Diesel)

Production (Stationary Diesel)				
	Diesel Combusted	CO_2	CH_4	N_2O
Emission Factor	38.6 GJ/kL	69.9 kg CO_2-e/GJ	0.1 kg CO_2-e/GJ	0.2 kg CO_2-e/GJ
Volume	209,884.56 kL	566,297.93 t CO_2-e	810.15 t CO_2-e	1,620.31 t CO_2-e
Total SCNCP LOM Production GHG Emissions (t CO_2-e)				568,728.39
Annual Average SCNCP Fugitive GHG Emissions (t CO_2-e)				40,623.46

Table 4-6 Petroleum Based Oils (PBO)

Petroleum Based Oils (PBO)				
	Diesel Combusted	CO_2	CH_4	N_2O
Emission Factor	38.8 GJ/kL	13.9 kg CO_2-e/GJ	0.0 kg CO_2-e/GJ	0.0 kg CO_2-e/GJ
Volume	4,151.58kL	2,239.03 t CO_2-e	0 t CO_2-e	0 t CO_2-e
Total SCNCP LOM PBO Combustion GHG Emissions (t CO_2-e)				2,239.03
Annual Average SCNCP Fugitive GHG Emissions (t CO_2-e)				159.93

Table 4-7 Petroleum Based Greases (PBG)

Petroleum Based Greases (PBG)				
	Diesel Combusted	CO_2	CH_4	N_2O
Emission Factor	38.8 GJ/kL	3.5 kg CO_2-e/GJ	0.0 kg CO_2-e/GJ	0.0 kg CO_2-e/GJ
Volume	715.25 kL	97.13 t CO_2-e	0 t CO_2-e	0 t CO_2-e
Total SCNCP LOM PBG Combustion GHG Emissions (t CO_2-e)				97.13
Annual Average SCNCP Fugitive GHG Emissions (t CO_2-e)				6.94

4.5.2 Scope 2 Emissions

Table 4-8 Scope 2 Emissions

Purchased Electricity from a Grid			
Based on:	Emission Scope	Scope 2	Scope 3
Non-renewable electricity consumed across life of SCNCP of:	Emission Factor	0.73 kg CO_2-e/kWh	0.15 kg CO_2-e/kWh
	GHG Emissions (t CO_2-e)	80,425.16 t CO_2-e	16,525.72 t CO_2-e
	Total SCNCP LOM PBG Combustion GHG Emissions (t CO_2-e)		96,950.88
110,171,452.72 kWh	Annual Average SCNCP Fugitive GHG Emissions (t CO_2-e)		6,925.06

4.5.3 Scope 3 Emissions

Table 4-9 Total Product Coal – Thermal (Bituminous)

Total Product Coal – Thermal (Bituminous)		
	Product Coal	Emissions Factor
Emission Factor	27.0 GJ/t	3 kg CO_2-e/GJ
Volume	33,739,503.53 t	2,732,900
Total SCNCP LOM Combustion GHG Emissions (t CO_2-e)		2,732,900
Annual Average SCNCP Fugitive GHG Emissions (t CO_2-e)		195,207

Table 4-10 Product Transport (Rail)

Product Transport (Rail)				
Based on: Product: 33,739,504 t Distance: 424km (ROC to Gladstone)		CO_2	CH_4	N_2O
	GHG Emissions (t CO_2-e)	246922.38	19.6	5.88
	Total SCNCP Shipping GHG Emissions (t CO_2-e) As per GHG Protocol Transport Tool v2			249,029.06
	Annual SCNCP Shipping GHG Emissions (t CO_2-e)			17,787.79

Table 4-11 Product Transport (Shipping)

Product Transport (Shipping)				
Based on: Product: 33,739,504 t Distance: 3707 3637 Nautical Miles (Gladstone to Port of Pagbilao, Quezon, Philippines)		CO_2	CH_4	N_2O
	GHG Emissions (t CO_2-e)	6,492,732.09	554.59	189.37
	Total SCNCP Shipping GHG Emissions (t CO_2-e) As per GHG Protocol Transport Tool v2			6,558,443.9
	Annual SCNCP Shipping GHG Emissions (t CO_2-e)			468,460.3

4.5.4 Total SCNCP GHG Emissions

Table 4-12 Total SCNCP Generated GHG Emissions (Scope 1 and 2)

Total SCNCP Generated Emissions (t CO_2 – e)		
Scope 1 Emissions	Scope 2 Emissions	Total LOM Emissions
579,755.75	96,950.88	676,706.63

Table 4-13 Total SCNCP GHG Emissions (Scope 1, 2 & 3)

Total SCNCP Emissions (t CO_2 – e)			
Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions	Total LOM Emissions
579,755.75	96,950.88	9,540,372.96	10,217,079.59

4.5.5 Average Annual SCNCP GHG Emissions

Table 4-14 Average Annual SCNCP generated GHG Emissions (Scope 1 and 2)

Average Annual SCNCP Generated Emissions (t CO_2 – e)		
Scope 1 Emissions	Scope 2 Emissions	Average Annual Emissions
41,411.13	6,925.06	48,336.19

Table 4-15 Average Annual SCNCP GHG Emissions (Scope 1, 2 & 3)

Average Annual Emissions (t CO_2 – e)			
Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions	Average Annual Emissions
41,411.13	6,925.06	681,455.21	729,791.40

4.6 Greenhouse Gas Proportions

Using the projected GHG emissions data determined in **Section 4.5** and referencing them against the National Greenhouse Inventory data, we can present a value for the projected annual average SCNCP generated GHG emissions against the Queensland and Australian National GHG annual emissions estimate. The latest annual submission to the UNPCCC is the National Inventory Report 2021, which was submitted in April 2023. This data set states an estimated emission value for Queensland of 139,665,100 t CO_2-e and an estimated emission value for Australia of 464,770,700 t CO_2-e.

Taking the SCNCP's projected life of mine GHG emissions and dividing them by the LoM (14 years) produces an average annual emissions value for the SCNCP (Scope 1 & 2) of 48,336.19 t CO_2-e pa. This value equates to 0.035% of Queensland's annual (2021) GHG emissions, and 0.01% of Australia's annual (2021) GHG emissions (NIR 2023).

The majority of Scope 3 emissions will be created downstream of the SCNCP, where product coal is combusted for steam production offshore, where these Scope 3 emissions will be included in the Scope 1 and 2 emission reporting by the end user for the relevant countries. As such, a more accurate representation of the total SCNCP GHG value (Scope 1, 2 & 3 emissions) of 729,791.40 t CO_2-e pa is to compare it against global GHG emissions estimates.

Using the 2020 WRI CAIT Climate Data Explorer (CAIT) dataset provides the most recent available value for global GHG emissions at 47,513,150,000 t CO_2-e pa. The 729,791.40 t CO_2-e pa value for total upstream and downstream average annual SCNCP GHG emissions gives a proportion of 0.00154% of global GHG emissions for the entire extraction to consumption lifespan of coal produced at the proposed SCNCP. The RCH controlled emissions (Scope 1 and 2) amount to 0.00001% of estimated annual global GHG emissions.

Table 4-16 Projected SCNCP Emissions V Queensland GHG Emissions

Projected SCNCP Emissions vs Queensland Estimated GHG Emissions (2022)			
Emissions Type	Projected Annual SCNCP Emissions (t CO_2-e pa)	Estimated Queensland GHG Emissions (2021) (t CO_2-e pa)	SCNCP Contribution to Queensland Emissions (%)
Scope 1	41,411.13	139,665,100	0.02965
Scope 2	6,925.06		0.00496
Total SCNCP Generated (Scope 1 & 2) GHG Emissions	48,336.19		0.03461

Table 4-17 Projected SCNCP Emissions V Australian National GHG Emissions

Projected SCNCP Emissions vs Australian Estimated GHG Emissions (2022)			
Emissions Type	Projected Annual SCNCP Emissions (t CO_2-e pa)	Estimated Australian GHG Emissions (2021) (t CO_2-e pa)	SCNCP Contribution to Australian Emissions (%)
Scope 1	41,411.13	464,770,700	0.00891
Scope 2	6,925.06		0.00149
Total SCNCP Generated (Scope 1 & 2) GHG Emissions	48,336.19		0.0104

Table 4-18 Projected SCNCP Emissions V Global GHG Emissions

Projected SCNCP Emissions vs Estimated Global GHG Emissions (2020)			
Emissions Type	Projected Annual SCNCP Emissions (t CO_2-e pa)	Estimated Global GHG Emissions (2020) (t CO_2-e pa)	SCNCP Contribution to Global Emissions (%)
Scope 1	41,411.13	47,513,150,000	0.00009
Scope 2	6,925.06		0.00001
SCNCP Generated (Scope 1 & 2)	48,336.19		0.0001
Scope 3	681,455.21		0.00143
Total GHG Emissions	729,791.40		0.00154

5 CONCLUSION

The SCNCP will generate an estimated 676,706.63 t CO_2-e of Scope 1 and 2 emissions related to the extraction and processing of ROM coal and the progressive rehabilitation of the SCNCP over the 14 year life of the Project. Fugitive emissions will contribute 1.5% of the SCNCP Scope 1 and 2 LOM emissions. The annual SCNCP contribution to Scope 1 and 2 GHG emissions amounts to 0.035% of Queensland's estimated annual emissions, 0.01% of the total Australian estimated annual emissions (NIR 2023), and 0.0001% of annual global emission estimates (CAIT WRI).

For Queensland to meet the climate targets outlined in the Queensland Climate Action Plan 2020-2030 the following must be met:

- 50% renewable energy target by 2030;
- 30% emission reduction below 2005 levels by 2030;
- 70% renewable energy by 2032;
- 80% renewable energy by 2035;
- Zero net emissions by 2050.

Queensland's renewable energy targets are not considered to be impacted by the SCNCP. Currently the ROC supplies Gladstone power station within Queensland, however this contract expires in 2026, when the SCNCP comes online, and the plant itself is scheduled to close in 2030. As such all product coal from the SCNCP will be exported to offshore end users.

Information on Queensland greenhouse gas emissions is sourced from the National Greenhouse Gas inventory. The latest data available for total annual emissions across Queensland is for 2021 and currently sits at 139.7mt CO_2-e, which is 29% below the 2005 baseline, as such it is not anticipated that the 0.035% SCNCP contribution to Queensland's Scope 1 and 2 emissions would have a material impact on meeting these targets.

The SCNCP life of project is scheduled for 14 years under the current 2024 LoM Plan, starting from 2026. Last coal from the project is expected in 2039, and so the project will have no impact on the Queensland target of net zero emissions by 2050.

For Australia to meet its obligations under its Nationally Determined Contributions (NDC), a reduction of GHG emissions by 43% economy wide based on the 2005 baseline is required. The 2005 baseline figure stands at 616,293,200 t CO_2-e pa, with the latest National Inventory data giving a current emissions estimate of 464,770,700 t CO_2-e pa (NIR 2023). This represents a reduction of 28% to date from the 2005 baseline. A total reduction of 265,006,076 t CO_2-e pa from the 2005 baseline is required by 2030. Within this context the 48,336.19 t CO_2-e pa (0.01%) of annual national emissions contributed by the SCNCP are unlikely to have any measurable impact on Australia meeting the conditions of its NDC by 2030.

The SCNCP is also projected to be associated with 9,540,372.96 t CO_2-e of Scope 3 emissions over the 14 year life of the project. The majority of these emissions will be outside of the control of RCH, and will be generated by offshore customers where product coal is combusted for electricity generation. The total emissions generated by processes associated with the SCNCP, including Scope 3 emissions, are estimated to contribute 0.00154% of annual global GHG emissions during this period. Emission reduction strategies regarding Scope 3 emissions are the consideration of the respective countries that demand thermal coal.

6 REFERENCES

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Appendix A

List of GHG's and Global Warming Potential (GWP)

LIST OF GHG'S AND GLOBAL WARMING POTENTIAL (GWP)

Gas	Chemical formula	Global Warming Potential
Carbon dioxide	CO_2	1
Methane	CH_4	28
Nitrous oxide	N_2O	265
Sulphur hexafluoride	SF_6	23,500
Hydrofluorocarbons HFCs		
HFC-23	CHF_3	12,400
HFC-32	CH_2F_2	677
HFC-41	CH_3F	116
HFC-43-10mee	$C_5H_2F_{10}$	1,650
HFC-125	C_2HF_5	3,170
HFC-134	$C_2H_2F_4$ (CHF_2CHF_2)	1,120
HFC-134a	$C_2H_2F_4$ (CH_2FCF_3)	1,300
HFC-143	$C_2H_3F_3$ (CHF_2CH_2F)	328
HFC-143a	$C_2H_3F_3$ (CF_3CH_3)	4,800
HFC-152a	$C_2H_4F_2$ (CH_3CHF_2)	138
HFC-227ea	C_3HF_7	3,350
HFC-236fa	$C_3H_2F_6$	8,060
HFC-245ca	$C_3H_3F_5$	716
HFC-245fa	$CHF_2CH_2CF_3$	858
HFC-365mfc	$CH_3CF_2CH_2CF_3$	804
Perfluorocarbons PFCs		
Perfluoromethane (tetrafluoromethane)	CF_4	6,630
Perfluoroethane (hexafluoroethane)	C_2F_6	11,100
Perfluoropropane	C_3F_8	8,900
Perfluorobutane	C_4F_{10}	9,200
Perfluorocyclobutane	$c\text{-}C_4F_8$	9,540
Perfluoropentane	C_5F_{12}	8,550
Perfluorohexane	C_6F_{14}	7,910

Source: Australian Government (DCCEEW): NGA Factors 2023

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