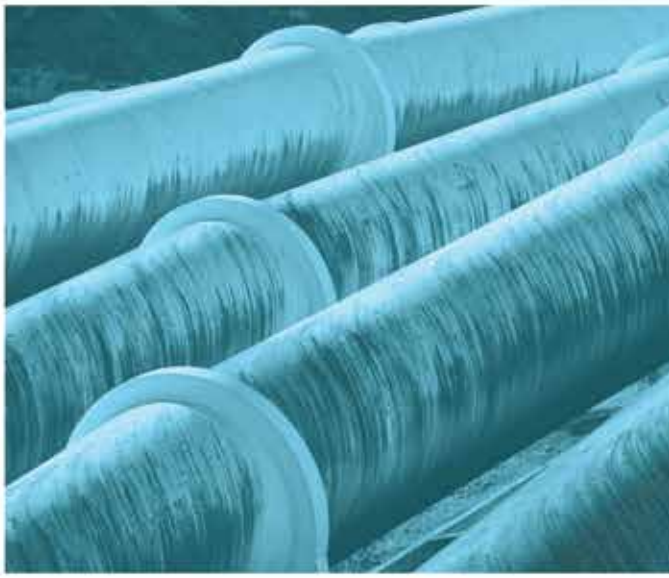



Hume Coal Project and Berrima Rail Project

Supplementary Greenhouse Gas emissions and mitigations/offset assessment in repsonse to recommendations R13 and R14 within the Independent Planning Commission Assessment Report dated 27 May 2019

Prepared for Hume Coal Pty Ltd
April 2020

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Summary of commitments

With regard to greenhouse gas (GHG) emissions from the proposed Hume Coal Project and the Berrima Rail Project (collectively, 'the Project'), Hume Coal Pty Limited (Hume Coal) commit to the following measures:

- Hume Coal will ensure all product coal are only sold to end users who are signatories to the Paris Agreement;
- Hume Coal commit to use as much renewable energy sources as possible to provide electricity to its operations;
- Hume Coal commit to establishing solar power cells and storage batteries to provide power to the Administration Block;
- Hume Coal will offset all fugitive gas emissions generated by the underground coal extraction operations through planting of an appropriate native species on its own land holdings;
- Hume Coal commit to ongoing investigations on methods and technologies to reduce the required diesel consumption of the Project;
- Hume Coal will support research initiatives for alternative means to reduce its overall emissions and footprint; and
- Hume Coal commit to preparing a comprehensive GHG mitigation and monitoring plan for the Project.

A summary of the life of project emissions from key GHG emission sources and the associated mitigation or offset measures of Hume Coal's commitments are documented in Table ES1. It can be seen that the commitments of Hume Coal will significantly reduce the Scope 1 and 2 emissions associated with the operation of the Project. Scope 3 emissions are accounted for by the commitment of Hume Coal to only sell product coal to Paris Agreement signatories.

Table ES1 Emission reduction measures and offset potential – Project GHG emissions

Emission type	Life of project emissions (t CO_2-e)	Mitigation or offset measure(s)	Emission offset/reduction
Scope 1 - ventilation gas	11,611	Tree planting commensurate to fugitive gas emission rate	Planned 100%
Scope 1 – diesel/petrol use	166,634	Alternative energy sources where practicable Fuel consumption reductions	Unknown, dependant on the availability of technology options
Scope 2 – purchased electricity	1,552,006	Sourcing of electricity from renewable generation sources Installation of solar power for onsite administration building requirements	Dependant on availability of renewable energy from power generator. Planned for as close to 100% use as possible. Offset will be equivalent to percentage of renewable energy use.
Scope 3 – end use of product coal	104,745,843	All product coal to be sold to Paris Agreement signatories only	Emissions to be accounted for within the emissions inventories of end user countries, with mitigation measures applied as necessary to meet NDC targets

Note: t CO_2-e = tonnes of carbon dioxide equivalent emissions

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1 Introduction

1.1 Overview

Hume Coal Pty Limited (Hume Coal) proposes to construct and operate an underground coal mine and associated mine infrastructure in the Southern Coalfield of New South Wales (NSW) (the Hume Coal Project). The mine will produce metallurgical coal with a secondary thermal coal product. Around 50 million tonnes (Mt) of run-of-mine coal will be extracted from the Wongawilli Seam via a non-caving mining system, resulting in approximately 39 Mt of saleable coal over a project life of about 23 years, including construction and rehabilitation. The Project area is located to the west of Moss Vale, in the Wingecarribee local government area (LGA).

Hume Coal is also seeking approval in a separate development application for the construction and operation of a new rail spur and loop, known as the Berrima Rail Project. Coal produced by the Hume Coal Project will be transported to port by rail for export or to domestic markets also by rail via this new rail spur and loop. The Hume Coal Project and the Berrima Rail Project together form 'the Project'.

A full description of the Hume Coal Project, including the location at a regional scale, the project areas and the indicative mine and surface infrastructure plans, is provided in the IPC response report (EMM 2020), to which this report is appended.

Approval for the Project is being sought under Part 4 Division 4.1 (State significant development) of the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act) and has been under assessment from 2015 to present. A detailed description of the environmental assessment process to date provided in Hume Coal's response to the IPC assessment report (EMM 2020), to which this supplementary GHG assessment is appended.

The Independent Planning Commission NSW (IPC) released the Independent Planning Commission (the IPC) Assessment Report in relation to the Hume Coal Project and Berrima Rail Project (collectively, the Project) on 27 May 2019 (the IPC Report).Titled *Independent Planning Assessment Report in relation to the Minister for Planning's request dated 4 December 2018 under Section 2.9(1)(d) of the Environmental Planning and Assessment Act 1979* (IPC 2019) and herein referred to as 'the IPC assessment report'.

The report contained 485 comments and 30 detailed recommendations within 18 themes, of which greenhouse gas (GHG) was included. The IPC Report presents the following two recommendations relating to the specific additional information that the IPC requires for the assessment of GHG emissions:

- R13 (GHG) - the Applicant should undertake a more rigorous and detailed assessment of Project Greenhouse Gas Emissions, including Scope 3 end use of product coal, and this should be assessed prior to the Department's Final Assessment.

- R14 (GHG) - the Applicant is to clearly define how it intends to mitigate/offset its greenhouse gas emissions through measures such as ensuring that all Project coal is only used within countries that are parties to the Paris Agreement.

1.2 Purpose of this report

The purpose of this supplementary GHG assessment is to respond directly to the IPC assessment report's, considerations, findings and recommendations.

Where necessary, this study also addresses items presented in the IPC assessment report that the applicant feels are erroneous, unsubstantiated or are otherwise worthy of response. This report presents a response to each of the IPC Report recommendations listed above.

The considerations, findings and recommendations specific to GHG emissions are contained in Table 1.1.

Table 1.1 Response to IPC findings/recommendations

Reference number	IPC's finding/recommendation	Location where addressed
249	The Commission in its assessment of merits of the Project has had regard to the predicted Project generated GHG emissions related impacts. The Commission has had regard to the Material before it and given consideration to the issues raised in public submissions. Relevant excerpts from submissions included:	
	• the proposed coal mine and its coal product would increase global total concentrations of greenhouse gases at a time when what is urgently needed in order to meet generally accepted climate targets is a rapid and deep decrease in those emissions;	Noted.
	• it is not clear what approval conditions the Department or the IPC could propose that would mitigate the increase in global local concentrations of greenhouse gases that this Project would produce;	Proposed mitigation measures (including offsets) are presented in Section 3.
	• excluding the impacts of Australian coal burnt offshore is ridiculous;	Discussion of Scope 1, 2 and 3 emissions and the regulatory framework for their calculation is presented in Section 2.3.
	• burning coals gives us global warming;	Noted.
	• the emissions needing to be considered include the more controversial downstream emissions, along with the direct and indirect emissions. And further, the public interest, which incorporates the principles of ecologically sustainable development, also mean that scope 3 emissions should be considered in the consideration of this mine's impacts; and	Discussion of Scope 1, 2 and 3 emissions and the regulatory framework for their calculation is presented in Section 2.3.
	• South Korea's POSCO declared plans to eventually halt carbon emissions by switching to a hydrogen-based steelmaking process from 2021.	Addressed in Annexure B.
250	During its meeting with the Commission on 11 February 2019, the Applicant indicated that such coal should not be confused with soft coking coal produced from mines in other parts of Australia. The Commission understands that 55% of the coal produced by the Hume Mine is semi-hard coking coal which is a premium product in producing metallurgical coke for the production of steel, which has different implications for the calculation of GHGE than the consumption of thermal coal.	Addressed in Section 2 and Annexure A.
251	During the public hearing the Applicant was asked by Counsel Assisting the Commission "would coal be sold to countries that are signatories to the Paris Climate Accord?" The Applicant took the question on notice and the Commission notes that a response to this question has not been received to date.	Addressed in Section 2.4.2.
252	Since the release of the Department's PAR, the decision of the Land and Environment Court on the Rocky Hill project has emphasised that a consent authority may be required to consider the impacts of a proposed mine on climate change (including by reason of downstream emissions) for a number of reasons including section 4.15(1)(a) of the EP&A Act – applicable environmental planning instruments such as the provisions of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP), section 4.5(1)(b) - the likely impacts of a development and section 4.15(1)(e)	Discussion of Scope 1, 2 and 3 emissions and the regulatory framework for their calculation in the context of the Rocky Hill decision is presented in Section 2.3.

Table 1.1 Response to IPC findings/recommendations

Reference number	IPC's finding/recommendation	Location where addressed
	the public interest, which includes the principles of ESD. The decision confirmed that indirect, downstream GHG emissions are a relevant consideration to take into account in determining applications for activities involving fossil fuel extraction. It concluded that the consideration of impacts on the environment and the public interest justify considering not only Scope 1 and Scope 2 emissions, but also Scope 3 emissions, and also noted that cl 14(2) of the Mining SEPP requires consideration of an assessment of the greenhouse gas emissions (including downstream emissions) of development for the purposes of mining.	
253	The Commission finds that the Applicant and Department have not appropriately considered or assessed the full impact of emissions as required by section 4.15 (1) of the EPA Act, including the provisions of the Mining SEPP. At this stage of its assessment the Commission finds that it is not satisfied with the information provided up to this point regarding GHG emission related impact, particularly Scope 3 emissions and confirmation of any proposed mitigation measures it has proposed to the Commission.	Discussion of Scope 1, 2 and 3 emissions and the regulatory framework for their calculation is presented in Section 2.3.
R13	The Applicant should undertake a more rigorous and detailed assessment of Project Greenhouse Gas Emissions, including Scope 3 end use of product coal, and this should be assessed prior to the Department's Final Assessment.	Addressed in Section 2 and Annexure A.
R14	The Applicant is to clearly define how it intends to mitigate/offset its greenhouse gas emissions through measures such as ensuring that all Project coal is only used within countries that are parties to the Paris Agreement.	Addressed in Section 3 and Annexure B.

2 Response to IPC recommendation R13

As stated, IPC recommendation R13 requested that a more rigorous and detailed assessment of Project Greenhouse Gas Emissions, including Scope 3 end use of product coal be undertaken.

2.1 GHG assessment history

By way of establishing the work that has been completed to date in relation to GHG emissions, the following points are noted:

- an assessment of GHG emissions from the Project was incorporated into the air quality impact assessment (AQIA) completed by Ramboll Environ Australia Pty Ltd dated 14 February 2017 (Appendix K of to the Environmental Impact Statement (EIS) for the Project); and

- a revision to the GHG calculations was undertaken by Ramboll Environ Australia Pty Ltd for the Response to Submissions (RTS) report prepared by EMM Consulting Pty Ltd dated 29 June 2018.

In both cases, the GHG emissions quantification was undertaken using the Department of the Environment and Energy (DoEE) National Greenhouse Accounts (NGA) Factors. The DoEE NGA Factors are designed for use by companies and individuals to estimate GHG emission from an operation.

For both assessments, Scope 1, 2 and 3 GHG emissions from all significant emission sources were quantified, considered and reported. Specifically, in response to IPC R13 relating to the inclusion of Scope 3 end use of product coal, such emissions were quantified and documented in both the EIS and RTS GHG assessments completed by Ramboll Environ Australia Pty Ltd.

The Department of Planning, Industry and Environment (DPIE, then Department of Planning and Environment) prepared an Assessment Report for the Project dated December 2018. In Section 6.5 of the DPIE Assessment Report states the following with regard to GHG emissions from the Project:

> The Department considers GHG emissions would be minimal and could be managed through the implementation of all reasonable and feasible measures to minimise the release of GHG emissions.

It is further noted that the submission from the NSW EPA to DPIE, dated 30 June 2017, relating to air quality and GHG assessments completed for the Project "*did not identify any issues that have the potential to alter the overall conclusions and outcomes of this assessment*".

It is repeated that IPC recommendation R13 requested that *a more rigorous and detailed assessment of Project Greenhouse Gas Emissions, including Scope 3 end use of product coal* be undertaken. The request from the IPC is in direct contrast to both the findings of the technical review completed by the NSW EPA and the review conclusions of DPIE.

It is considered on the basis of the above information that a rigorous quantification of GHG emissions from the Project has been undertaken. All significant emission sources of GHG emissions from the Project have been quantified following the DoEE NGA Factors, as specified by the DPIE assessment requirements. Given the Project is only proposed at this point in time, it is only possible to undertake the quantification of associated GHG emissions using these generic emission factors and estimates of annual energy consumption. The use of more precise, Project specific emission factors or energy consumption rates cannot be applied until to the commencement of actual Project operations.

It is however conceded that greater detail relating to the management of GHG emissions should be provided. In order to increase the robustness of the GHG assessment for the Project, the following additional steps have been undertaken:

- Hume Coal commissioned Coalbed Energy to undertake a stand-alone GHG assessment for the Project, focusing specifically on fugitive gas emissions (appended as Annexure A);
- further discussion on GHG mitigation measures, energy consumption reductions and offset strategies (further detail provided in Section 3.2); and
- review of all information previously prepared for the EIS and RTS GHG emissions inventories.

Finally, in Clause 249 the IPC lists various GHG-related issues that were raised in submissions. While these issues raised were addressed in Section 26 of the RTS report, some additional response is given below:

- detailed consideration of Scope 1, Scope 2 and Scope 3 emissions generated by the Project in relation to magnitude and relevance against state and federal policies is provided in the following sections of this report; and
- the GHG emissions statement of Hume Coal and parent company POSCO is presented in Annexure B.

2.2 Revised GHG emissions inventory

The Coalbed Energy assessment utilised in-situ gas values from Hume Coal's exploration boreholes to determine a more appropriate and site specific emission factor (0.00023 t CO_2-e/t ROM coal) than was used by Ramboll Environ for the EIS (0.00068 t CO_2-e/t ROM coal). The Coalbed Energy report identifies the site as being a 'low gas' situation and therefore the Scope 1 results are considered more realistic and are significantly reduced from those presented in the EIS and RTS.

The GHG emissions inventory for the Project has been revised from the totals presented in the RTS, with the following changes accounted for:

- recalculation of Scope 1 fugitive gas emissions from coal mining applying the site-specific emission factor derived by Coalbed Energy;
- annual ROM and Product coal was changed from a financial year breakdown to a calendar year breakdown for consistency with other technical studies prepared for the Project;
- associated revision to the annual fuel and energy consumption rates from financial year breakdown to a calendar year breakdown; and
- re-calculation of emissions accounting for the latest version of national GHG emission factors (NGA Factors 2019).

For comparison purposes, the total and annual average GHG emissions presented in the original AQIA for the EIS and the RTS report and the revised IPC inventory are summarised in Table 2.1.

Table 2.1 Comparison of total and annual average GHG emissions by source – EIS, RTS and IPC inventories

Inventory version	GHG emissions (t CO_2-e) by scope										
	Scope 1					Scope 2	Scope 3				
	Diesel (on-site, mobile equipment)	Diesel (on-site, stationary equipment)	Diesel (Hume owned locomotives)	Petrol	Mine ventilation gas	Electricity	Diesel fuel	Electricity	Petrol	End use of coking coal	End use of thermal coal
Total Project life											
EIS	107,268	468	54,327	1,812	34,550	1,597,547	8,394	228,221	94	4,606,825	1,295,670
RTS	107,268	468	54,327	1,812	34,550	1,597,547	8,394	228,221	94	70,844,332	40,265,091
IPC	109,315	449	55,111	1,759	11,611	1,552,006	8,418	172,445	94	60,854,284	43,891,559
Annual average											
EIS	4,664	20	2,362	79	1,502	69,459	365	9,923	4	200,297	56,333
RTS	4,664	20	2,362	79	1,502	69,459	365	9,923	4	3,080,188	1,750,656
IPC	4,753	20	2,396	76	505	67,479	366	7,498	4	2,645,838	1,908,329

The following differences between the three presented GHG emission inventories are noted:

- Scope 1 emissions from mine ventilation gas emissions are lower for the IPC inventory due to the application of the site based and specific emission factor determined by Coalbed Energy, as discussed previously.
- Scope 3 emissions from product coal are significantly higher for the RTS and IPC GHG emission inventories relative to the EIS GHG inventory totals. The EIS GHG inventory only quantified Scope 3 emissions from the end use of product coal by applying the NGA Factors Scope 3 emission factor. The RTS and IPC GHG emission inventories were revised to include the combustion of product coal by end users by applying relevant Scope 1 emission factors.
- The RTS and IPC inventories totals for Scope 3 product coal end use emissions are different. While there is a difference in the coal production scheduled (ie financial year vs calendar year) and emission factors applied (ie NGA Factors 2016 vs NGA Factors 2019), the RTS totals could not be recreated for this report, indicating that there may have been a minor error in calculations for the RTS inventory.
- Minor differences between the various fuel and electricity consumption emissions for the IPC inventory relative to the EIS and RTS inventories. This is due to the application of the updated emission factors and the revised production schedule activity rates.

A summary of revised GHG emission totals by source type for the revised IPC GHG emissions inventory, incorporating Coalbed Energy calculations and revised factors and assumptions, is presented in Table 2.2. A summary of Scope 1, Scope 2, Scope 1 + 2 and Scope 3 GHG emissions by year is presented in Table 2.3.

Annual Scope 1 and 2 emissions from the Project are illustrated in Figure 2.2.

To provide context to the significance of the Project in relation to the coal mining industry in Australia, data for GHG emissions by industry was collated from the Australian Government Clean Energy Regulator. The most recent data available relates to the 2015-2016 year. The following points were noted from the analysis conducted:

- annual Scope 1 GHG emissions from the coal mining sector in 2015-2016[1] were 34,450,013 t CO_2-e, generated by 168 facilities;
- this equates to an Australian coal mining industry average of 205,060 t CO_2-e per facility;
- based on the data in Table 2.3, the maximum year Scope 1 emissions for the Project (11,741 t CO_2-e) equate to 5.7% of the Australian coal mining industry average; and
- without considering any mitigation measures the Project is therefore very low in Scope 1 emissions relative to the Australian coal mining industry.

To visualise the significance of Scope 1 emissions from the Project (maximum year and average year) relative to the Australian coal mining industry average, the three inventory totals are presented in Figure 2.1.

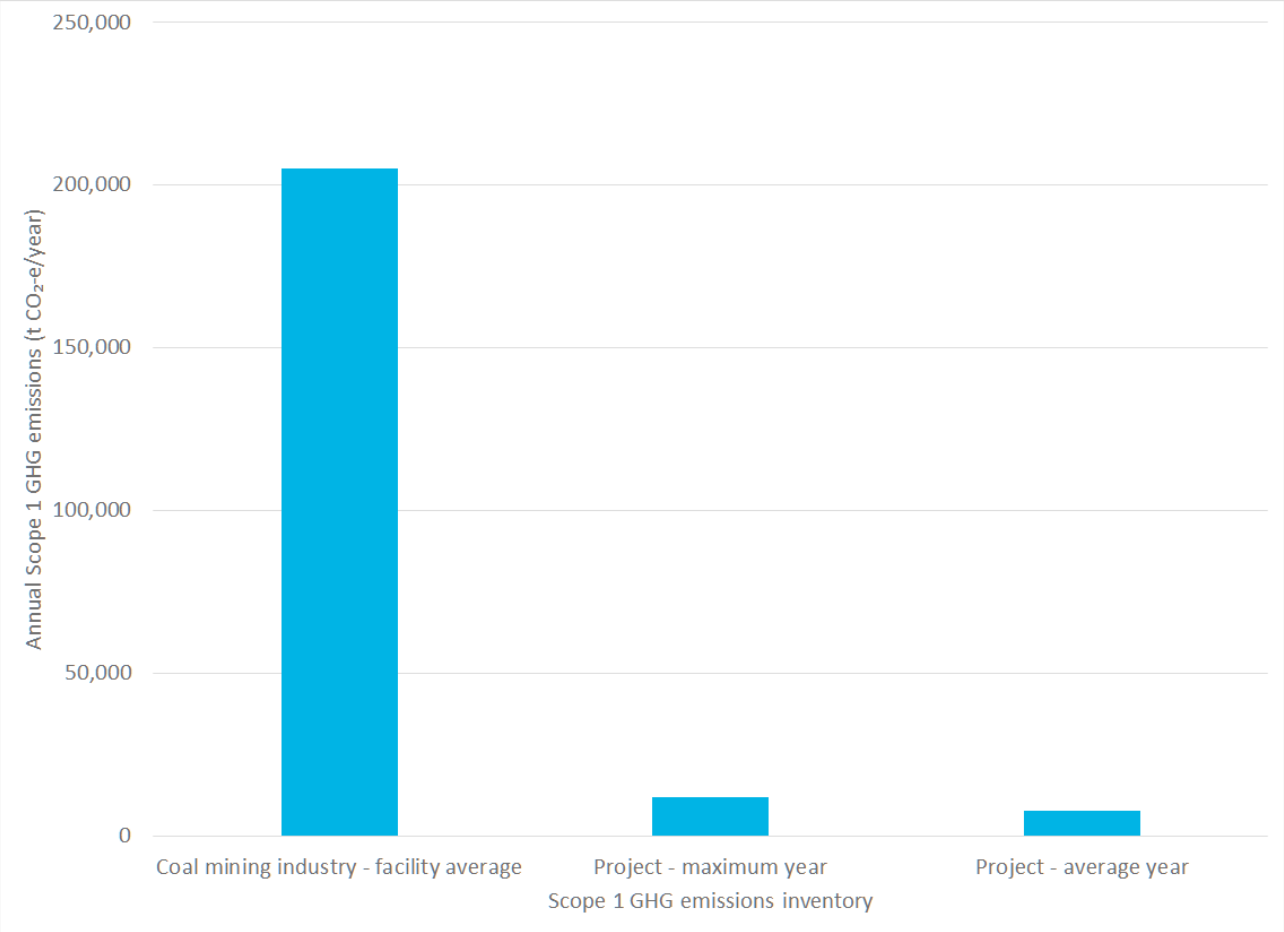

Figure 2.1 Comparison of Scope 1 GHG emissions – national coal mining facility average vs Project (maximum and average year emissions)

[1] http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/a-closer-look-at-emissions-and-energy-data/australia%E2%80%99s-scope-1-emissions-by-industry-for-nger-reporters

Table 2.2 Revised GHG emission estimates by source – the Project

Year	ROM (Mt)	Annual GHG emissions (t CO_2-e per year) by scope										
		Scope 1					Scope 2	Scope 3				
		Diesel (on-site, mobile equipment)	Diesel (on-site, stationary equipment)	Diesel (Hume owned locomotives)	Petrol	Mine ventilation gas	Electricity	Diesel fuel	Electricity	Petrol	End use of coking coal	End use of thermal coal
Construction Y1	-	11,443	-	-	305	-	3,043	584	338	16	-	-
Construction Y2	-	11,443	-	-	305	-	3,043	584	338	16	-	-
Operations Y1	0.38	480	3	435	4	88	11,635	47	1,293	0	480,057	346,244
Operations Y2	1.69	2,130	15	1,911	20	389	51,628	207	5,736	1	2,110,061	1,521,895
Operations Y3	2.82	3,548	25	3,251	33	648	85,991	348	9,555	2	3,590,048	2,589,346
Operations Y4	2.54	3,193	23	2,979	30	584	77,386	316	8,598	2	3,289,552	2,372,611
Operations Y5	2.82	3,554	25	3,174	33	649	86,137	345	9,571	2	3,505,113	2,528,087
Operations Y6	3.08	3,881	27	3,368	36	709	94,074	372	10,453	2	3,719,025	2,682,372
Operations Y7	3.15	3,960	28	3,400	37	724	95,989	377	10,665	2	3,754,393	2,707,881
Operations Y8	3.16	3,978	28	3,306	37	727	96,423	373	10,714	2	3,650,934	2,633,261
Operations Y9	3.31	4,171	29	3,558	39	762	101,092	396	11,232	2	3,929,205	2,833,965
Operations Y10	2.87	3,612	26	3,333	34	660	87,562	356	9,729	2	3,681,286	2,655,152
Operations Y11	2.73	3,431	24	3,045	32	627	83,154	332	9,239	2	3,362,449	2,425,189
Operations Y12	2.95	3,713	26	3,383	35	679	89,994	364	9,999	2	3,735,631	2,694,349
Operations Y13	3.28	4,131	29	3,597	39	755	100,122	396	11,125	2	3,972,822	2,865,424
Operations Y14	3.29	4,139	29	3,250	39	757	100,334	379	11,148	2	3,588,819	2,588,460
Operations Y15	3.04	3,827	27	2,622	36	700	92,773	331	10,308	2	2,895,861	2,088,659
Operations Y16	2.59	3,263	23	2,773	30	596	79,089	309	8,788	2	3,061,971	2,208,467
Operations Y17	3.08	3,877	27	3,543	36	709	93,967	380	10,441	2	3,912,732	2,822,084
Operations Y18	2.55	3,204	23	2,874	30	586	77,671	312	8,630	2	3,174,345	2,289,518
Operations Y19	1.14	1,436	10	1,304	13	263	34,814	140	3,868	1	1,439,979	1,038,595
Rehabilitation Y1	-	11,443	-	-	305	-	3,043	584	338	16	-	-
Rehabilitation Y2	-	11,443	-	-	305	-	3,043	584	338	16	-	-
Project total		**109,299**	**449**	**55,103**	**1,813**	**11,611**	**1,552,006**	**8,418**	**172,445**	**94**	**60,854,284**	**43,891,559**
Annual average		**4,752**	**20**	**2,396**	**79**	**505**	**67,479**	**366**	**7,498**	**4**	**2,645,838**	**1,908,329**

Table 2.3 Revised GHG emission estimates by scope – the Project

Project year	Annual GHG emissions (t CO_2-e per year)				
	Scope 1	Scope 2	Scope 3	Scope 1 and 2	Scope 1, 2 and 3
Construction Y1	11,741	3,043	938	14,783	15,721
Construction Y2	11,741	3,043	938	14,783	15,721
Operations Y1	1,010	11,635	827,641	12,645	840,286
Operations Y2	4,465	51,628	3,637,901	56,093	3,693,994
Operations Y3	7,505	85,991	6,189,299	93,496	6,282,795
Operations Y4	6,807	77,386	5,671,080	84,193	5,755,273
Operations Y5	7,435	86,137	6,043,117	93,572	6,136,689
Operations Y6	8,022	94,074	6,412,223	102,096	6,514,319
Operations Y7	8,148	95,989	6,473,319	104,137	6,577,456
Operations Y8	8,076	96,423	6,295,284	104,499	6,399,784
Operations Y9	8,559	101,092	6,774,801	109,651	6,884,452
Operations Y10	7,665	87,562	6,346,525	95,227	6,441,752
Operations Y11	7,158	83,154	5,797,211	90,312	5,887,524
Operations Y12	7,835	89,994	6,440,344	97,829	6,538,173
Operations Y13	8,551	100,122	6,849,769	108,673	6,958,442
Operations Y14	8,213	100,334	6,188,808	108,548	6,297,355
Operations Y15	7,212	92,773	4,995,161	99,985	5,095,146
Operations Y16	6,685	79,089	5,279,536	85,774	5,365,310
Operations Y17	8,192	93,967	6,745,639	102,159	6,847,798
Operations Y18	6,717	77,671	5,472,806	84,388	5,557,194
Operations Y19	3,026	34,814	2,482,583	37,840	2,520,423
Rehabilitation Y1	11,741	3,043	938	14,783	15,721
Rehabilitation Y2	11,741	3,043	938	14,783	15,721
Project total	**178,244**	**1,552,006**	**104,926,800**	**1,730,250**	**106,657,050**
Annual average	**7,750**	**67,479**	**4,562,035**	**75,228**	**4,637,263**

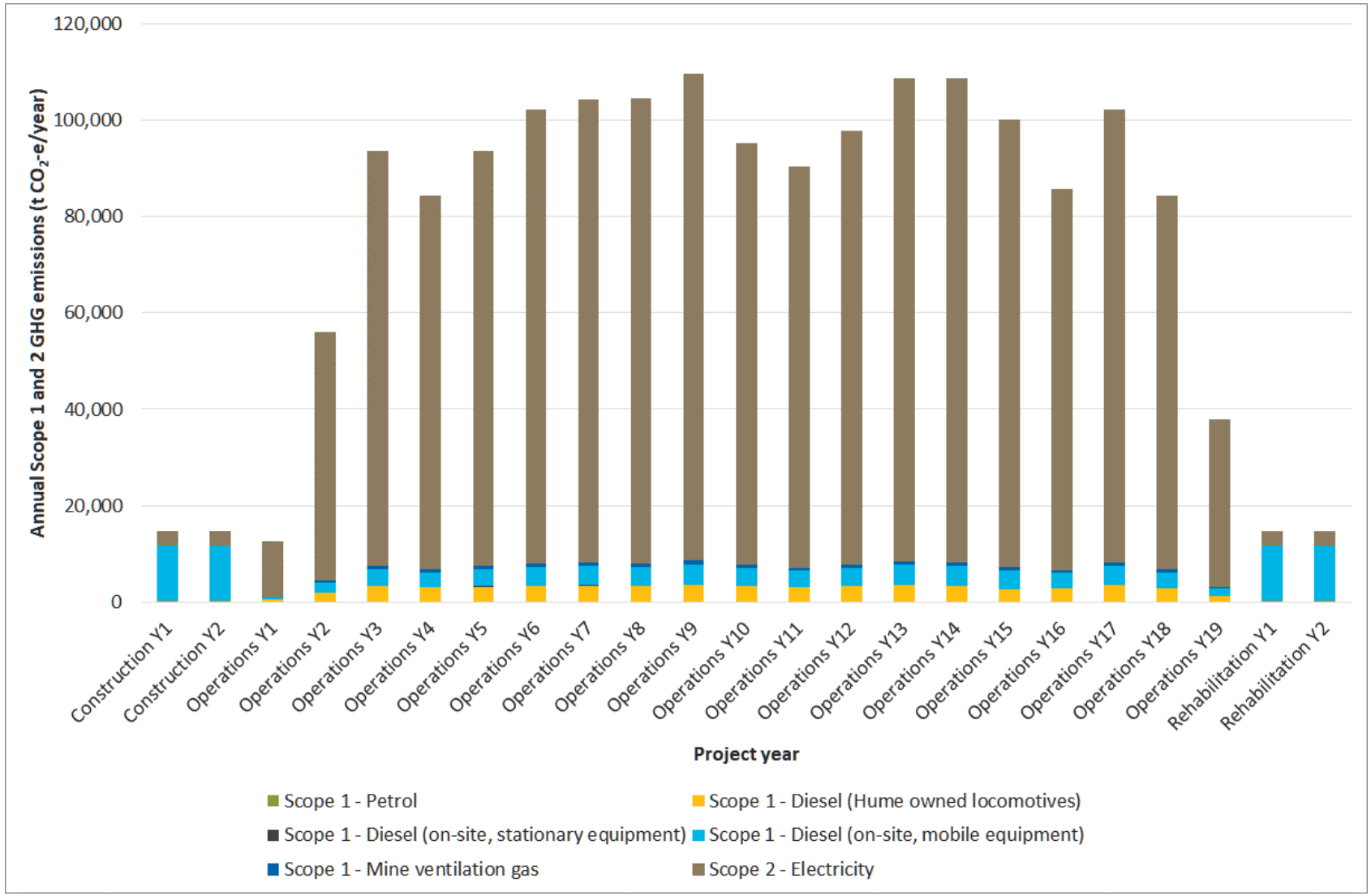

Figure 2.2 **Annual scope 1 and 2 GHG emissions by source type – the Project – revised inventory**

2.3 EP&A Act and Mining SEPP

Clause 252 of the IPC report states that the Rocky Hill Project decision in the NSW Land and Environment Court (LEC) highlighted that a consent authority may be required to consider the impacts of a proposed mine on climate change, including downstream Scope 3 emissions, for reasons included in section 4.15 (1) of the NSW Government *Environmental Planning and Assessment Act 1979* (EP&A Act). In particular, the IPC references the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) as an applicable environmental planning instrument that should be considered.

The IPC report notes that the Rocky Hill Project decision concluded that:

- Scope 3 emissions, as well as Scope 1 and Scope 2 emissions, should be considered when assessing the potential climate change impacts of a project; and
- clause 14 (2) of the Mining SEPP requires consideration of an assessment of the greenhouse gas emissions (including downstream emissions) of the development for the purposes of mining.

Clause 253 of the IPC report expands further by stating the following:

> The Commission finds that the Applicant and Department have not appropriately considered or assessed the full impact of emissions as required by section 4.15 (1) of the EPA Act, including the provisions of the Mining SEPP. At this stage of its assessment the Commission finds that it is not satisfied with the information provided up to this point regarding GHG emission related impact, particularly Scope 3 emissions and confirmation of any proposed mitigation measures it has proposed to the Commission.

In order to provide context to the IPC Report comments and recommendations, the referenced clause 14 of the Mining SEPP is reproduced below:

> **14 Natural resource management and environmental management**
>
> (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following—
>
> c) that greenhouse gas emissions are minimised to the greatest extent practicable.
>
> (2) Without limiting subclause (1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.

With regard to 14(1)(c) of the Mining SEPP, proposed measures to minimise GHG emissions from the Project are detailed in Section 3.1.

Regarding 14(2), total GHG emissions from the Project, including downstream Scope 3 emissions, are presented in Table 2.2 and Table 2.3. Consideration of the applicable State or national policies, programs or guidelines concerning GHG emissions is provided in Section 2.4.

2.4 Federal and State GHG policies

Relevant national and state GHG policies, programs and guidelines are considered to include the following:

- National Greenhouse and Energy Reporting Act 2007 (NGER Act), Australian Government 2019;

- National Greenhouse and Energy Reporting Scheme (NGER Scheme);
- National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015;
- Australia's commitment to the UNFCCC Paris Agreement;
- NSW Climate Change Policy Framework, NSW Office of Environment and Heritage (OEH) 2016; and
- Net Zero Plan Stage 1: 2020-2030, NSW DPIE 2020.

2.4.1 Federal-level GHG policy and legislation

The object of the NGER Act is to introduce a single national framework for the reporting of GHG emissions and energy consumption, which provides the basis for the NGER Scheme. It is noted that under the NGER legislation, only Scope 1 and Scope 2 emissions from a facility are required to be reported.

As summarised in Table 2.3, the Project is estimated to generate:

- Scope 1 emissions – a maximum annual total of 11,741 t CO_2-e/year; and
- Scope 1 + Scope 2 emissions – a maximum annual total of 109,651 t CO_2-e/year.

The NGER Scheme reporting threshold for combined Scope 1 and 2 GHG emissions from a facility is 25,000 t CO_2-e/year. Based on the above data, the Project is estimated to exceed the NGER Scheme reporting threshold. Hume Coal would therefore be required to meet registration and ongoing reporting obligations to the Clean Energy Regulator.

The safeguard mechanism applies to facilities with Scope 1 emissions of more than 100,000 t CO_2-e/**year**, with these operations classified as the largest GHG emitters in the country. Based on the above data, annual scope 1 GHG emissions would not exceed the safeguard mechanism threshold at any time during the life of the Project (maximum annual total of 11,741 t CO_2-e/year). Therefore, the Project would not be classed as a large GHG emitting facility under the NGER Act.

2.4.2 Paris Agreement

At the 2015 United Nations Climate Change Conference (COP21) held in Paris in December 2015, Parties to the United Nations Framework Convention on Climate Change (UNFCCC) reached the Paris Agreement, a global climate change agreement aimed at reducing GHG emissions in order to limit global temperature rise this century to between 1.5-2°C above pre-industrial levels.

Under the Paris Agreement, all Parties are required to put forward GHG emission reduction targets through Nationally Determined Contributions (NDCs). All Parties are required to report on national emissions, with a review of targets set to occur every five years from 2020.

The UNFCCC provides the following description in relation to NDCs:

> NDCs are at the heart of the Paris Agreement and the achievement of these long-term goals. NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. The Paris Agreement (Article 4, paragraph 2) requires each Party to prepare, communicate and maintain successive NDCs that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.

The NDC for an individual country relates to the direct (Scope 1) GHG emissions generated by that country. Consequently, the NDC for Australia is relevant to:

- Direct (Scope 1) GHG emissions generated by the operation of the Project. This relates GHG emissions generated by fuel (diesel and petrol) consumption and fugitive mine ventilation emissions; and

- Indirect domestic GHG emissions associated with the Project. This relates to purchased electricity (Scope 2) from Australia power generators, upstream/downstream emissions from Project fuel use and the end use of thermal coal at Australian power stations. Under the Australian NDC, indirect domestic GHG emissions from the Project are actually direct emissions from the electricity producer.

With regard to direct (Scope 1) emissions, the Project is estimated to generate up to 11,741 t CO_2-e/year. Relative to the Australia NDC 2030 emissions target (441 to 453 Mt CO_2-e) for the Paris Agreement, the direct emissions from the Project equates to approximately 0.0027%. Accounting for the direct and indirect emissions from the Project generated within Australia, the emissions from the Project equate to between approximately 0.66% and 0.68% of the Australia NDC 2030 emissions target.

It is noted that in Clause 251, the IPC identified that *during the public hearing the Applicant was asked by Counsel Assisting the Commission "would coal be sold to countries that are signatories to the Paris Climate Accord?" The Applicant took the question on notice and the Commission notes that a response to this question has not been received to date.*

With regard to the offshore end-use of product coal, Hume Coal confirms a commitment to only sell its coal products to countries that are signatories to the Paris Agreement.

Indirect GHG emissions from the Project that originate internationally are applicable to the NDC of that country of end use. The downstream (domestic or offshore) Scope 3 emissions associated with the consumption of product coal from the Project would therefore be accounted for as Scope 1 emissions in the NDC of the end user countries (steel making or power generation).

At this time, the end user countries and the associated distribution percentage of produced coal have not been finalised. Coal export data from the Australian Government Department of Industry, Innovation and Science Office of the Chief Economist has been reviewed for the 2017-2018 financial year[2].

The breakdown of metallurgical/coking coal by end user country was reviewed. The data illustrated that in 2017-2018, 72% of exported coking coal was sent to India, Japan, China, South Korea and Brazil. At this point in time, Hume Coal do not have supply contracts in place in order to estimate the likely distribution of product coal. For the purpose of this response, the same export distribution by these five countries is assumed to apply to exported coking coal from the Project. The following end user distribution is therefore assumed for indicative purposes:

- Australia – 100% of total thermal product;

- India – 25.0% of total coking product;

- Japan – 21.1% of total coking product;

- China - 19.7% of total coking product[3];

- South Korea – 4.5% of total coking product; and

- Brazil – 1.9% of total coking product.

[2] https://publications.industry.gov.au/publications/resourcesandenergyquarterlyjune2019/index.html

[3] Includes Chinese Taipei exports.

To understand the significance of GHG emissions associated with coal from the Project to the relevant end user countries GHG emissions, the NDC 2030 targets for each of these potential end user markets for product coal (thermal and coking) from the Project were extracted and are summarised in Table 2.4 (column 2 and 3).

The coal export proportions to end user country listed above have been applied to the relevant maximum year GHG emissions from the Project as presented in Table 2.2, specifically:

- maximum project year total of 2,985,620 t CO_2-e for domestic Scope 1, Scope 2 and Scope 3 emissions (thermal coal, fuel and electricity consumption)[4]; and
- maximum project year total of 3,972,822 t CO_2-e for Scope 3 coking coal emissions only.

The proportion of Project GHG emissions by end user country (Table 2.4, column 4) was then compared against the relevant NDC 2030 target for each country to determine the significance of Project emissions (Table 2.4, column 5). For example, to quantify the significance of emissions generated by the consumption of Project product coal in India relative to the India NDC 2030 target level, the maximum project year total Scope 3 coking coal emissions (3,972,822 t CO_2-e) were combined with the adopted export percentage (25%).

It can be seen that the domestic GHG emissions correspond to less than 0.68% of Australia's NDC 2030 target and less than 0.091% of the NDC 2030 targets for any of the example export markets. Consequently, it is considered that the analysis conducted demonstrates that the GHG emissions associated with the Project, both within Australia and internationally, represent a small proportion of the applicable Paris Agreement NDC target commitments.

Table 2.4 Comparison of end user NDC 2030 targets and corresponding GHG emissions from the Project

Country	NDC 2030 target	NDC 2030 target emission level (Mt CO_2-e)	GHG emissions from the Project linked to country (Mt CO_2-e)	Relative percentage of corresponding HCP GHG emissions to applicable NDC target
Australia	Reduction by 26% to 28% below 2005 levels by 2030	441 to 453	2.99	0.66% to 0.68%
India	Reduction in emissions intensity of GDP by 33% to 35% below 2005 levels by 2030	6,034 to 6,203	0.99	0.0160% to 0.0165%
Japan	Reduction by 26% below 2013 levels by 2030	927	0.84	0.091%
China	Reduction by 60% to 65% below 2005 levels by 2030	2,613 to 2,986	0.78	0.026% to 0.030%
South Korea	Reduction by 37% below 2013 business as usual level by 2030	536	0.18	0.034%
Brazil	Reduction by 26% below 2013 levels by 2030	1,200	0.08	0.006%

Source of NDC data: https://www4.unfccc.int/sites/NDCStaging/Pages/All.aspx

2.4.3 State-level GHG policy and legislation

The NSW Climate Change Policy Framework outlines the NSW Government objective of net-zero emissions by 2050 and to increase climate change resilience in New South Wales. The NSW Climate Change Policy Framework provides

[4] Total is the maximum year total of summed Scope 1, Scope 2 and Scope 3 (thermal coal only) emissions presented in Table 2.2

a high-level overview of aspirational targets but does not provide any specific guidance or targets for the management or regulation of emissions from an individual facility.

Further to the NSW Climate Change Policy Framework, the NSW DPIE released the Net Zero Plan Stage 1: 2020-2030, dated 14 March 2020, which provides greater detail on initial strategies for the state to meet net zero emissions by 2050 by delivering a 35% cut in emissions by 2030 compared to 2005 levels. The plan outlines initiatives to balance economic growth, job creation and emission reduction.

A component of the plan relates to the NSW Government investment in a Coal Innovation Program. The plan acknowledges the importance of the NSW mining sector to the state economy and the need to address climate change without undermining the industry and the associated jobs and communities. The Coal Innovation Program would focus on providing:

- coal operators with direct, strategic incentives to capture and reuse methane released during mining; and
- research and industry partnerships with funding to commercialise emerging technologies to reduce emissions at hard to mitigate mine sites.

Given the Project is a low gas operation, the first component of the Coal Innovation Program is unlikely to be relevant. As illustrated in Section 2.2, the Project is a low emissions intensity mining operation relative to the Australian coal mines. Where opportunities arise, Hume Coal would seek to participate in Coal Innovation Program initiatives related to emission reduction opportunities (eg diesel combustion reductions).

2.5 Summary relating to IPC recommendation R13

The following points summarise the findings presented above in response to IPC recommendation R13:

- GHG emission calculations for the Project were revised from those presented in the RTS to incorporate revised emission factors, a site-specific fugitive gas release emission factor and adjusted product coal use information;
- emission calculations for Scope 1 and 2 GHG emissions from the Project illustrate that emissions associated with the consumption of purchased electricity are the most significant GHG emission source;
- the Project is very low in Scope 1 GHG emissions intensity relative to the Australian coal mining industry facility average;
- discussion is presented in relation to 14(1) and 14(2) of the Mining SEPP, in particular consideration of federal and state GHG emission policies;
- the combined Scope 1 and Scope 2 emissions from the Project are higher than the Federal NGER reporting threshold and would require ongoing reporting;
- the Scope 1 emissions from the Project are lower than the safeguard threshold mechanism and therefore the Project would not be classed as large GHG emitting facility under the federal NGER Act; and
- when compared to the relevant Paris Agreement NDC targets for potential end users of product coal from the Project, the associated Scope 3 emissions from the Project are less than 0.68% of Australia and less than 0.091% for potential international markets.

3 Response to IPC recommendation R14

3.1 GHG emission mitigation measures

IPC recommendation R14 requested that the Applicant is to clearly define how it intends to mitigate/offset its greenhouse gas emissions through measures such as ensuring that all Project coal is only used within countries that are parties to the Paris Agreement.

The primary GHG emission sources from the Project, as presented in Table 2.2, are as follows:

- fugitive gas emissions (Scope 1);
- diesel and petrol fuel combustion (Scope 1);
- consumption of purchased electricity (Scope 2); and
- downstream use of product coal (Scope 3).

Further discussion relating to the viability of mitigation and management practices proposed by Hume Coal for each of these GHG emission sources is presented in the following sections.

3.1.1 Scope 1 - fugitive gas emissions

While identified by Coalbed Energy (Annexure A) that the Project is a low gas mine, Scope 1 GHG emissions would nevertheless be generated by underground mining operations through the release of fugitive gas emissions.

As presented in Table 2.2, the fugitive emissions from coal extraction from the Project would generate between 8 t and 782 t of CO_2-e per year during the life of the project. In relation to NGER reporting requirements, GHG emissions from fugitive gas release equate to approximately 0.7% of total annual Scope 1 and Scope 2 emissions from the Project.

It is clear from these calculation results that fugitive gas release emissions from coal extraction are relatively insignificant in comparison to other Project GHG emission sources.

A typical method for the reduction of Scope 1 emissions from the fugitive gas release emissions is the capture of fugitive gas and subsequent combustion for electricity generation or destruction by flaring. Neither option is viable for the Project due to low levels of total gas present in the seam and the very low methane content of the seam gas.

Options for the mitigation of Scope 1 emissions from fugitive gas are therefore limited. Hume Coal propose to offset all fugitive GHG emissions through tree planting (see Section 3.2 for further detail). The proposed offset measures would account for all GHG emission generated the fugitive release of gas from the underground workings of the Project.

Hume Coal will undertake routine sampling of ventilation outlet emissions to accurately record Scope 1 fugitive gas emissions and establish the tree planting requirements for complete offset of Scope 1 fugitive emissions.

3.1.2 Scope 1 - diesel and petrol fuel combustion

Scope 1 GHG emissions would be generated by the combustion of diesel and petrol fuel by surface vehicles, mobile mining equipment, stationary engines and Hume-owned locomotives. In relation to NGER reporting requirements, Scope 1 emissions from diesel and petrol fuel combustion equate to between 5.3% to 7.7% of total annual Scope 1 and Scope 2 emissions from the Project during operational years.

In addition to emission offset strategies (see Section 3.2), Hume Coal propose the following mitigation measures for Scope 1 emissions related to diesel combustion:

- wherever practicable, Hume Coal will adopt the use of battery-electric powered vehicles for surface activities and underground personnel transportation;
- Hume Coal commit to the purchase of the most fuel-efficient locomotive engines currently available in the Australian market at the time of Project construction, including consideration of:
  - driver assistance systems;
  - idling reduction technologies;
  - aerodynamic improvements;
  - minimisation of acoustics emissions; and
  - balancing regulated emissions with GHG emissions;
- reducing engine idling times wherever practicable to reduce diesel use; and
- routine servicing of equipment to achieve manufacturer's emission specifications and efficiency.

3.1.3 Scope 2 – consumption of purchased electricity

The Project would result in the generation of Scope 2 GHG emissions associated with the consumption of purchased electricity. In relation to NGER reporting requirements, calculated Scope 2 emissions equate to between 91.5% and 94.5% of total Scope 1 and Scope 2 emissions during operational years of the Project. Consequently, GHG emissions associated with the consumption of purchased electricity emissions are the dominant source of Scope 1 and Scope 2 GHG emissions from the Project.

To manage Scope 2 emissions, Hume Coal will enter into arrangements with electrical suppliers to purchase as much of the Project power requirements from renewable energy sources as can be sourced. Hume Coal have advised that preliminary discussions with suppliers to ensure the feasibility of this proposal have been held and conformation received from suppliers that 100% of all power use can be acquired from renewable providers.

These measures would significantly reduce the calculated Scope 2 emissions from the GHG assessments completed for the Project. As an example, the Scope 2 emission factors for purchased electricity from NSW and Tasmania are 0.81 kg-CO_2-e/kWh[5] and 0.15 kg-CO_2-e/kWh respectively. By applying the Tasmanian emission factor to the GHG inventory presented in Table 2.2, the Scope 1 and 2 GHG emissions from operational years of the Project would reduce on average by 75%. The NGA Tasmanian Scope 2 emission factor accounts for some of its electricity generated by fossil fuels, consequently if electricity were to be sourced from 100% renewable generation, the reduction in Project Scope 1 and 2 emissions would be even greater.

As an additional measure, Hume Coal also commit to establishing solar power cells and storage batteries to provide power to the Administration Block.

[5] kWh – kilo watt hour

3.1.4 Scope 3 – consumption of product coal

As stated in the commitments section at the front of this report, Hume Coal commits to only sell its coal products to countries, (states or organisations) that are signatories to the Paris Agreement (2015). Any Scope 3 emissions associated with the consumption of product coal from the Project would therefore be accounted for in the NDC commitments for each respective country and not directly accountable to the Project. That is to say, domestic Scope 3 emissions would be accounted for in the Australia NDC target, while international Scope 3 emissions would be accounted for in the corresponding NDC target for the end user country.

It is also worthy of note that POSCO, Hume Coals' parent company is committed to reducing GHG emissions in its worldwide business activities. A description to the commitment by POSCO to the Paris Agreement is contained in Annexure B. Hume Coal commits to the future direction and focus on improving sustainability and the environment that POSCO has adopted.

3.1.5 Scope 3 – fuel and purchased electricity

The measures discussed above for the reduction of Scope 1 and Scope 2 GHG emissions generally relate to the reduction of required energy consumption (ie diesel, petrol or purchased electricity). Scope 3 emissions associated with the consumption of diesel, petrol and purchased electricity are calculated using emission factors linked to the rate of energy consumption (eg Scope 3 diesel emissions are calculated from an emissions factor in units kg CO_2-e/kL of diesel). Consequently, the measures proposed to reduce Scope 1 and 2 emissions from assorted energy (fuel and purchased electricity) consumption by the Project would also serve to reduce associated Scope 3 emissions.

3.2 Emission offsets

If the Project is approved, Hume Coal will undertake tree plantings on its own land. Planting would be conducted to offset fugitive gas emissions generated by the Project. The exact rate of planting per year would be determined based on the results of ongoing monitoring of fugitive mine gas from the operational ventilation outlet. By following actual monitored fugitive GHG emissions, the extent of required planting can be continually revised throughout the life of the Project.

Based on the information provided by Coalbed Energy (Appendix A) and the indicative tree planting emission offset factor, it is anticipated that a planting rate of between 1 to 2 ha per year would be required to completely offset Project Scope 1 fugitive GHG emissions. Hume Coal will conduct planting of an appropriate native species on their own land holdings. It is noted that since 2018, Hume Coal have planted approximately 4,000 trees on their own land.

Following approval of the Project, Hume Coal commit to undertaking a detailed tree planting assessment to identify the most appropriate areas of their land to undertake planting, the amount of planting required and the species of trees to plant.

The plantings will provide protection barriers around existing streams and water courses. The areas will be fenced off from livestock and the existing ecosystems will effectively be buffered which in turn will allow natural regeneration of native regrowth. In this way the plantings would serve to:

- benefit the local environment;
- boost the existing ecosystems; and
- offset site Scope 1 GHG emissions.

Hume Coal would also consider participation in future government carbon in soil or other initiatives, such as the Coal Innovation Program (see Section 2.4.3).

3.3 Ongoing mitigation and monitoring

Hume Coal commit to preparing a comprehensive GHG mitigation and monitoring plan for the Project. The plan would establish monitoring and reporting requirements, management commitments, site personnel responsibilities and plan review timeframes. Further, Hume Coal commit to ongoing reviews practical and cost-effective measures that will see the operation further proactively reduce its GHG footprint and any other relevant improvements including waste management.

Hume Coal would undertake routine sampling of ventilation outlet emissions to more accurately measure and record fugitive gas emissions from the underground mining operations. These monitoring results would be used to align the offset mitigation measures with the commitments presented above and to quantify annual emissions for reporting purposes in accordance with the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*.

Following the approval of the Project and during the first quarter of the life of the mine, Hume Coal will outline its commitment to Ecological Sustainable Development (ESD) for the life of the mine and transitioning to mine closure.

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Abbreviations

AQIA	Air quality impact assessment
CO_2-e	Carbon dioxide equivalent
DPIE	Department of Planning, Industry and Environment
DoEE	Department of the Environment and Energy
EPA	Environment Protection Authority
ESD	Ecologically sustainable development
GHG	Greenhouse gas
IPC	Independent Planning Commission
NDC	Nationally Determined Contributions
NGAF	National Greenhouse Accounts Factors
The Project	Hume Coal Project and Berrima Rail Project
ROM	Run-of-mine
RTS	Response to submissions
UNFCCC	United Nations Framework Convention on Climate Change

Annexure A

Coalbed Report

GREENHOUSE GAS EMISSIONS & MITIGATION STUDY

GHG STUDY FOR

Hume Coal Pty Limited

THE PROJECT

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GREENHOUSE GAS EMISSIONS AND MITIGATIONS STUDY

for

HUME COAL PTY LIMITED

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EXECUTIVE SUMMARY:

Hume Coal Pty Limited (Hume Coal) recently received feedback from the Independent Planning Commission (IPC) in their report dated 27 May 2019 to the effect that more detail is warranted to accurately quantify Greenhouse Gas (GHG) emissions from the proposed project. Further work was also required in the development of a strategy to mitigate the impact of likely project emissions.

This report is designed to address these issues from the following perspective:

a) providing a more robust review of Scope 1 emissions associated with mining the coal, and;

b) providing options regarding mitigation and offset alternatives that ameliorate the impact of Scope 2 and 3 emissions associated with the project.

Our work has established that an improved estimation of Scope 1 emissions can be achieved through the adoption of the Method 2 approach, detailed in the latest National Greenhouse Energy Reporting (NGER) Technical Guideline. This methodology assumes the provision of reliable, accurate, complete and transparent gas data inputs that may be used to estimate emissions over the Life of Mine (LOM). It is our view as Estimators that these conditions exist at Hume Coal.

Hume Coal is a non-gassy coal mining proposal and is not atypical of coal operations that are located along the western boundary of the Sydney Basin. As a result, our analysis has established a 'Low Gas Zone' (LGZ) that extends to at least 180m depth throughout the deposit. This depth exceeds the proposed workings maximum depth. An LGZ attracts a CO_2-e conversion factor of 0.00023 CO_2-e/t per tonne of coal mined. Subsequently, we calculate that total Scope 1 emissions *estimate* from the project related to mining the coal itself is **11,611 tonnes of CO_2-e**.

Key findings:

1. Hume Coal has sufficient reliable gas data for the calculation of Scope 1 emissions based on Method 2 analysis.
2. A Low Gas Zone (LGZ) can be assigned to the project to a depth of 180m.
3. Our Method 2 analysis has established an estimate of Scope 1 emissions of **11,611 CO_2-e tonnes** for the LOM.
4. Amelioration of Scope 1, 2 and 3 emissions may be best achieved through:
    a. The planting of trees as carbon offsets on Hume Coal land and via the acquisition of land elsewhere. Gains are anticipated to be modest but would offset Scope 1 fugitive emissions from the mine ventilation areas.
    b. Scope 2 emissions can be mitigated via sourcing energy from a renewable supplier rather than a NSW coal-based generator.

c. Scope 3 emissions will need to be supported by the company undertaking to not sell coal to non-Paris agreement signatory countries. It is our understanding that this is Hume Coal's policy.

1. INTRODUCTION

Hume Coal propose an underground coal mine southwest of Berrima in the Southern Highlands area of NSW (Figure 1).

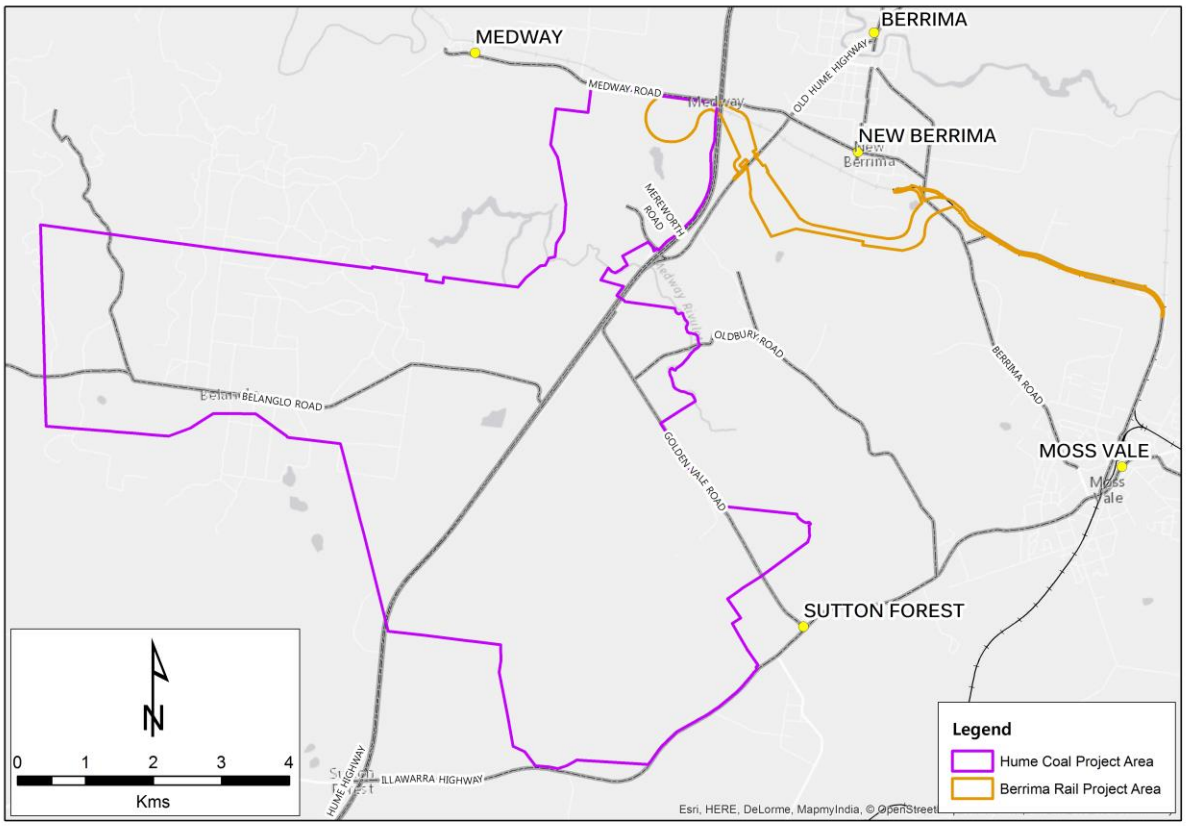

***Figure 1:* General location of the Hume Coal project area.**

Feedback from the Independent Planning Commission (IPC) 27 May 2019 Report suggested that more detail is warranted to accurately quantify Greenhouse Gas (GHG) emissions from the project. In addition, further work is required in the development of a strategy to mitigate the impact of those emissions.

This report is designed to address these issues, relevant to the following specific action items:

1. Address current Scope 1 fugitive emissions for National Greenhouse Energy Reporting (NGER)[1] compliance and provide a more rigorous and defendable estimate.

[1] *National Greenhouse and Energy Reporting Scheme Measurement – Technical Guidelines, October 2017.*

2. Investigate mitigation and offset alternatives that ameliorate the impact of Scope 1, 2 & 3 emissions associated with the project.

This review is specifically designed to address Scope 1 emissions associated with gas in the subsurface (i.e. potential mine ventilation gas) and does not include other emission sources associated with heavy machinery and vehicles (e.g. diesel equipment, vehicles, locomotives etc.).

CoalBed Energy Consultants Pty Limited (CoalBed) is experienced in greenhouse gas emission reporting and has been engaged in gas related consulting since 1998. CoalBed has been reporting Scope 1 emissions since 2008.

2. METHOD

The following methodology was used in this assessment:

1. Address Scope 1 Fugitive Emissions for Subsurface Gas in the Proposed Mining Area

1. **Review existing submissions** – Previous work was reviewed with a view to establishing the methodology used, and to determine whether further analytical work was necessary to achieve a more rigorous assessment of Scope 1 emissions from any gas that may be present in the proposed mining area.
2. **Quality check analytical data available -** This was achieved via reference to CoalBed's internal system for the investigation of data integrity, coupled with reference to existing Australian Standards and the National Greenhouse Energy Reporting (NGER) requirements. This included the screening of gas content data for N_2 contamination – particularly an issue in low gas content coals, reference of sample to position of water table, sorption rates, volatile matter, ash and moisture relationships, and the ratio of Q1:Q2:Q3 in the gas desorption reports.
3. **Investigate status of type and validation boreholes within the existing data set** – In order to achieve NGER compliance certain standards of sampling need to be met. The available gas data set was investigated and assessed for spatial and stratigraphic coverage.
4. **Characterise reservoir, stratigraphically and spatially -** Depth and stratigraphic relationships were investigated for the project and extrapolated into identified domains. A synthesis of gas characteristics (with due reference to lithology, gas content, gas composition, and saturation) and the geological drivers behind the variability was constructed in order to develop a 'gas model' for the project, which can be directly related to CO_2-e emissions over the life of mine. CoalBed has been involved in the investigation of

subsurface variability for fugitive emission purposes for many years (e.g. see public domain papers, Thomson et al, 2008[2], and Thomson, 2010[3], Thomson et al, 2014[4]).

5. **Provide formal report -** This was achieved with reference to the ACARP Guidelines for NGER Reporting[5] (Figure 2).

2: Investigate mitigation and offset alternatives that ameliorate the impact of Scope 1, 2 & 3 emissions

1. **Review existing submissions** – A review was undertaken of work completed to date for the project.
2. **Investigate alternative emission amelioration strategies** – Alternative approaches to mitigating / offsetting emissions were examined for the project and are reported herein.

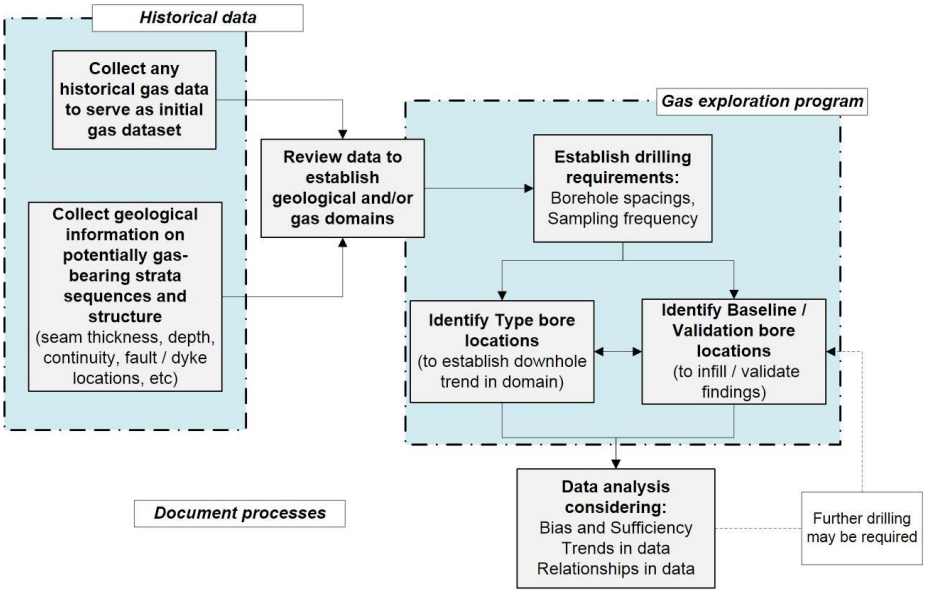

***Figure 2*: Summary of process for fugitive emission estimation (from ACARP Project C20005).**

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[3] *Thomson, S., 2010. Gas Layering in the Subsurface: Implications for Greenhouse Gas Emission, Bowen Basin Symposium Proceedings, Mackay, 2010.*

[4] *Thomson, S., Thomson, D., and Flood, P., 2014. Observations on the distribution of coal seam gas in the Sydney Basin and the development of a predictive model, Australian Journal of Earth Sciences, May 2014.*

[5] *Australian Coal Industry Research Project C20005, 'Guidelines for the Implementation of NGER Method 2 or 3 for Open Cut Coal Mine Fugitive GHG Emissions Reporting (C20005) and Technical Discussion of the Implementation of NGER Method 2 or 3 for Open Cut Coal Mine Fugitive GHG Emissions Reporting (C20005A), Burra, A. and Esterle, J., 2011.*

3. STATEMENT OF CURRENT POSITION

Scope 1 emissions have been previously reported in the Hume Coal Environmental Impact Statement (EIS), the Response to Submissions (RTS) and the Berrima Rail reports. Scope 1 emissions for the project are low, nonetheless the IPC has requested greater transparency in the calculation of Scope 1 emissions, and a more robust accounting methodology. This report is an attempt to address this issue specifically.

Previous work has stated that calculations follow a 'Method 1' approach, which should use a designated value[6] for a non-gassy coal, designated as 0.010 CO_2-e/t per tonne of coal (and 0.363 for gassy coals)[7], however it appears as if an 'average' value may have been used, derived from existing gas desorption data supplied by Hume Coal. The target coal seam of the project, the Wongawilli Seam (WWSM), is clearly a non-gassy coal (see Section 4 for justification).

A summary of the advice provided by the NGER Technical Guidelines follows:

- The Guidelines acknowledge that emissions are rarely measured through direct observation but are often estimated. Method 1 specifies the use of a designated emission factor in the estimation of emissions, by the means of default values.
- Method 1 is most suitable for emissions sources which are relatively homogeneous, whereas Method 2 is most useful for fuels which exhibit some variability in key qualities, such as carbon content. This is the case for coal in Australia. Method 2 allows for the calculation of emissions using industry sampling and Australian or international standards. Reliable sources of gas data such as coring information and desorption sampling from exploration boreholes fall into this category and therefore this applies to the project.
- Method 3 utilises a facility-specific method using Australian or international standards and is therefore much the same as Method 2 in terms of the provision of a robust estimate.
- Method 4 is simply an alternate approach to measuring emissions. Method 4 caters for direct monitoring of GHG emissions directly arising from an activity, such as existing underground mining operations (which is inapplicable currently to the project). It involves direct measurement of emissions within ventilation shafts and degasification systems.

In the case of the project, there is abundant exploration gas data of the required quality for emission estimation using Method 2. Method 2 is a reasonable, scientifically justifiable approach to quantifying Scope 1 fugitive emissions from a planned underground mine. This approach is standard procedure for open cut mining, which is what it was initially developed for.

[6] Based on national average factors determined by the Department of the Environment and Energy using the Australian Greenhouse Emissions Information System (AGEIS).
[7] National Greenhouse and Energy Reporting Scheme Measurement – Technical Guidelines, October 2017 (p. 204).

Therefore, an approach that utilises this independent laboratory data to provide an accurate estimation of future emissions is recommended.

4. METHOD 2 ANALYSIS

Requirements for Method 2 Analysis

- Data must be considered reliable. The measurement of gas content and gas composition in coals are the key input parameters in analysis.
- This data needs to be reviewed by a qualified independent Estimator[8] with the necessary experience to make inferences from the data provided.
- The information used in the estimation needs to be:
    - transparent — emission estimates must be documented and verifiable; (including sampling and testing procedures, interpretation and estimation methodology, and assumptions);
    - comparable — emission estimates using a particular method and produced by a registered corporation in an industry sector must be comparable with emission estimates produced by similar corporations in that industry sector using the same method and consistent with the emission estimates published by the Department in the National Greenhouse Accounts; (document procedures and guidelines for sampling, testing and reporting with particular reference to reporting bases for coal and gas);
    - accurate — having regard to the availability of reasonable resources by a registered corporation and the requirements of this Determination, uncertainties in emission estimates must be minimised and any estimates must be reported 'at the 95% confidence interval' (document datasets and methods used to make the estimates); and
    - complete — all identifiable emission sources must be accounted for (and demonstrate lack of bias, sample sufficiency and uncertainty).

It is our view as Estimators that the project database meets all of these criteria.

Analysis of gas data

The gas data of the project has been derived from two (2) independent laboratory sources, GeoGAS, and BHPB Labs. The latter shows evidence of internal inconsistency and does not fit well with the

[8] *CoalBed have been acting as Estimators for fugitive emission estimation since 2008. The Managing Director of CoalBed Energy Consultants, Mr. Scott Thomson holds a B.Sc., M.Sc., and M.B.A. (Tech. Man.), and has more than 40 years' experience in coal mining, and more than 20 years specifically in gas related consulting activities.*

trends evident from the GeoGAS data. The BHPB data is older than the GeoGAS data and there may have been issues with sampling and procedure. BHPB results are on average higher than GeoGAS and show a greater variability between sub samples. The problem was identified early by project Managers and:

a) led to a change of laboratory for all future reporting requirements, and
b) was the subject of an investigation in 2014[9].

Table 1: **Comparison BHPB and GeoGAS Testing (from 27.6.14 Memo).**

Laboratory	# Tests	Measured Gas Content Qm (m3/t)				CH4/CH4+CO2	
		Average	Std Dev	Min	Max	Average	Std Dev
BHP	10	1.04	0.84	0.55	3.10	0.35	0.33
GeoGAS	48	0.31	0.09	0.08	0.53	0.03	0.08

CoalBed internal QA / QC supports the findings of Williams (2014) that the BHPB results are problematic and should be discarded. This is not the case for the GeoGAS data. This is presented visually in Figure 3.

Issues with the BHPB data:

- Mismatches between Q1 and Qm results were noted for the same sample that do not make sense.
- IM (Inherent Moisture) was not reported on some samples.
- Density values reported in some cases appear biased towards low ash parts of the sample.
- There is a lack of consistency between samples.
- There is a lack of consistency between BHP and GeoGAS lab results. GeoGAS has much better internal consistency.
- There is inconsistency in calculations based on standard ash & moisture.
- BHPB data shows a poor relationship between RD and gas content.

[9] *Refer to Memorandum, R. J. Williams to R. Doyle, 27th June 2014, and Appendix I.*

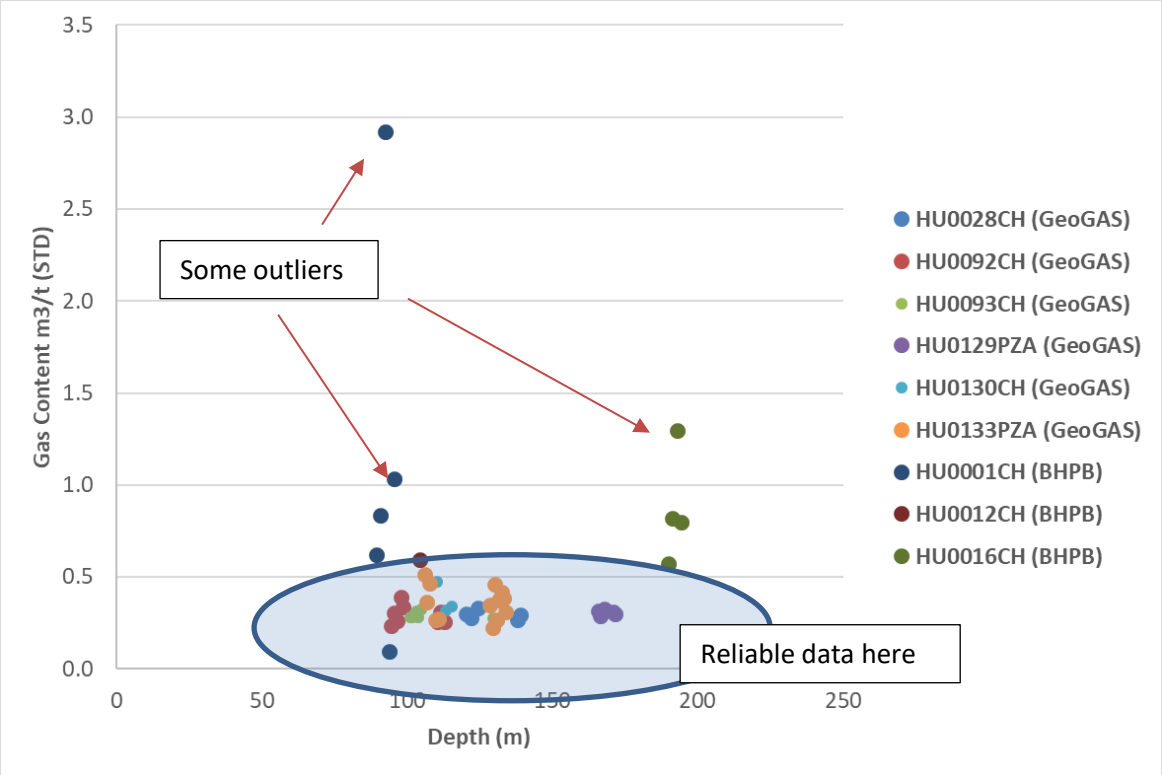

***Figure 3*: All gas content data for the project, note that all the outliers are BHPB data points.**

Figure 4 further illustrates the issues with the BHPB data. The GeoGAS data is represented as a cluster from ~100-170m depth, with gas content between 0-0.50 m^3/t. The BHPB data is far more inconsistent.

Results of Analysis

All the gas content information in the Hume Coal database (with the BHPB data excluded for the reasons mentioned in the previous section) has the following important characteristics:

- No four contiguous data points exceed a total gas content (Qm) of $0.5m^3/t$[10].
- No three contiguous data points are mainly methane (CH_4) (all GeoGAS data points are dominated by CO_2).

[10] *The definition from the Technical Guidelines to satisfy designation as a 'Low Gas Zone' is as follows: (a) the gas content values increase from below $0.5m^3/t$ to greater than $0.5m^3/t$ over more than 3 consecutive samples with increasing depth, or (b) the corresponding methane (CH_4) compositions switch from under 20% to greater than 50% over 3 consecutive samples. The base of the Low Gas Zone is the top of the coal seam intersected at this depth.*

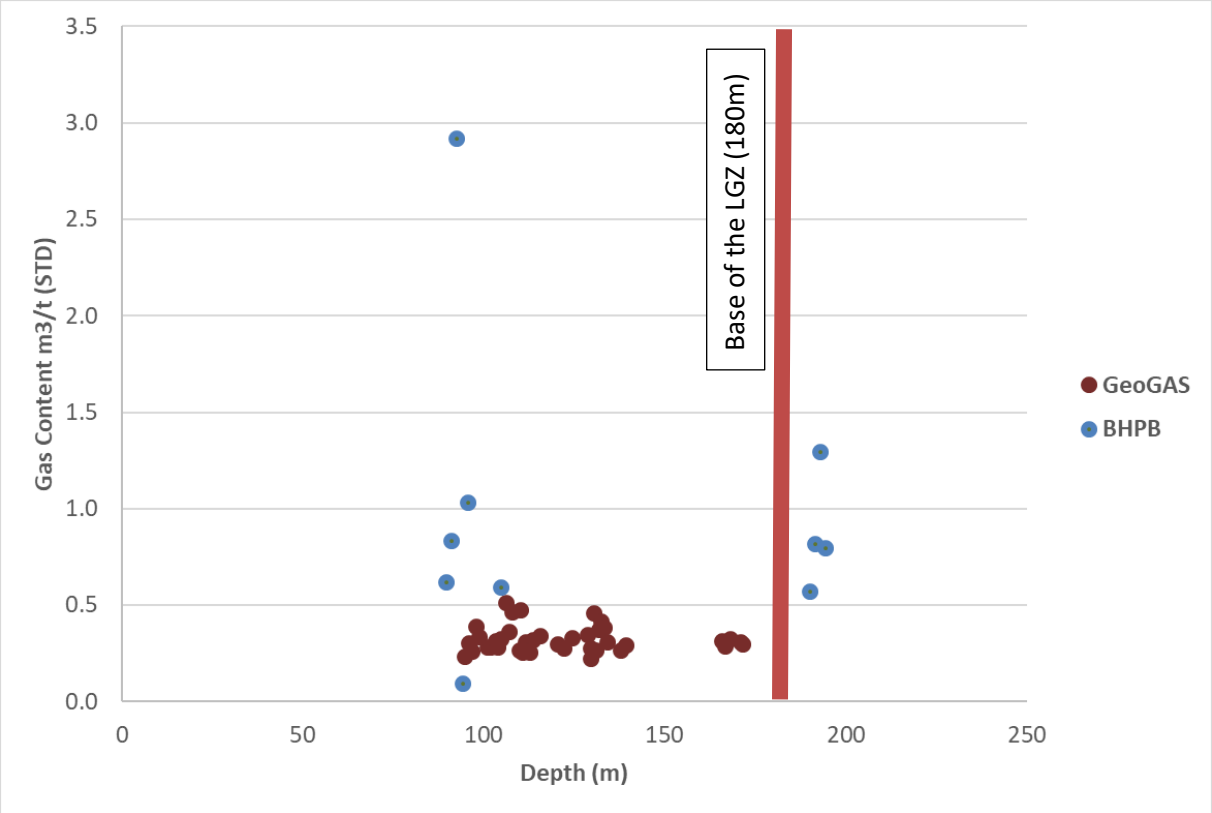

***Figure 4*: All gas content data for the project, showing the relative spread of BHPB data compared with GeoGAS.**

Thus, the project shows consistent properties with non-gassy coals from other parts of the Sydney Basin, and can be assigned to have a Low Gas Zone (LGZ)[11] to at least a depth of 171.6m[12], and in our best estimate, probably around 180m[13] (Figure 5). This kind of gas profile with depth is common along the western edge of the Sydney Basin (e.g. Lithgow, Ulan area) and in other geologically isolated coal areas (like the project area). The reasons for this include:

- Proximity of seam to subcrop enables gas that may have been in the coal to gradually escape over geological time.
- Possible flushing of the coal seam by natural flow of groundwater from the surface.
- Geological (structural) isolation provides no possible means of recharge from deeper coal seams elsewhere in the basin.

[11] Refer to ACARP Project C20005, Guidelines for the Implementation of NGER Method 2 or 3 for Open Cut Mine Fugitive Emissions Reporting, December 2011.
[12] Figure derived from base of last GeoGAS sample.
[13] Inclusion of BHPB data shows gas composition changing to mainly methane from ~190m. Although the gas content data from BHPB has been discredited it is conceivable that gas composition could be correct, particularly in the deeper, higher gas content samples.

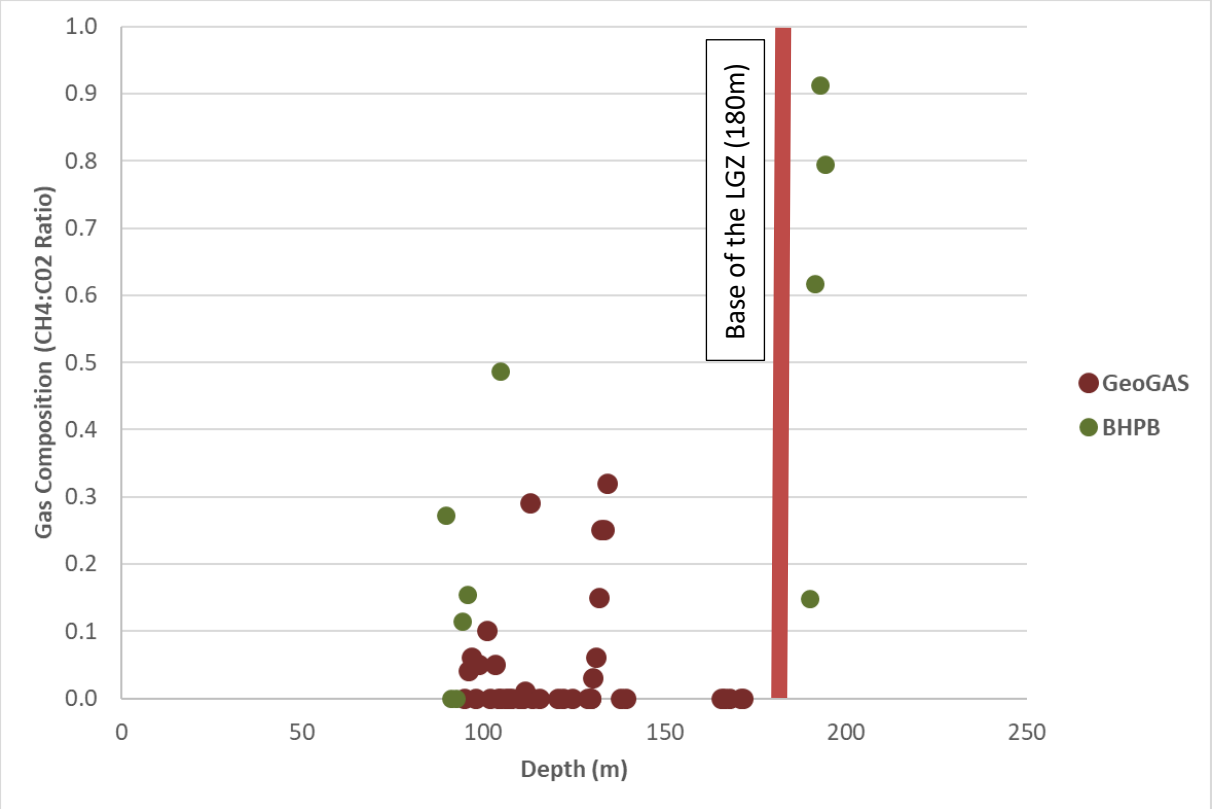

***Figure 5**: Gas composition data for the The project, showing that CO_2 remains the dominant gas to around 180m (at least).*

The project plans to mine using first workings, to a maximum depth of <180m. The depth to top of the seam relative to ground surface is presented in Figure 6. The gas in the proposed mining seam all report to the designated LGZ as per the NGER and ACARP Technical Guidelines.

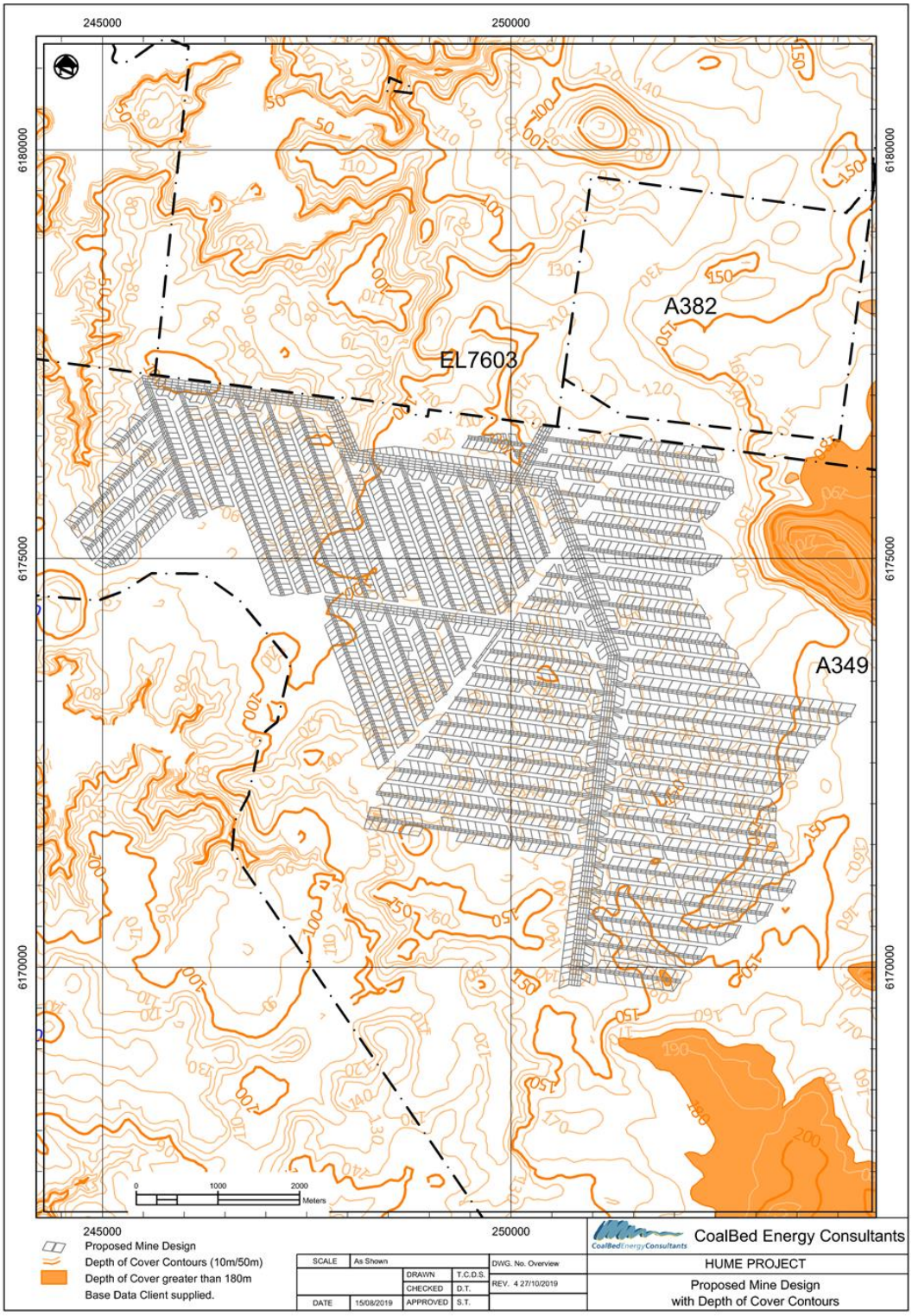

***Figure 6**: Hume Coal proposed workings relative to depth. Workings are <180m depth and report to the LGZ for Method 2 reporting purposes.*

Results from non-target seams

Data from non-target seams confirm the LGZ status of the project. Gas contents in the stratigraphically lower Tongarra Seam are no higher than the Wongawilli (Figure 7). Gas composition shows similar properties (Figure 8), (marginally greater methane in the Tongarra, but still dominated by CO_2).

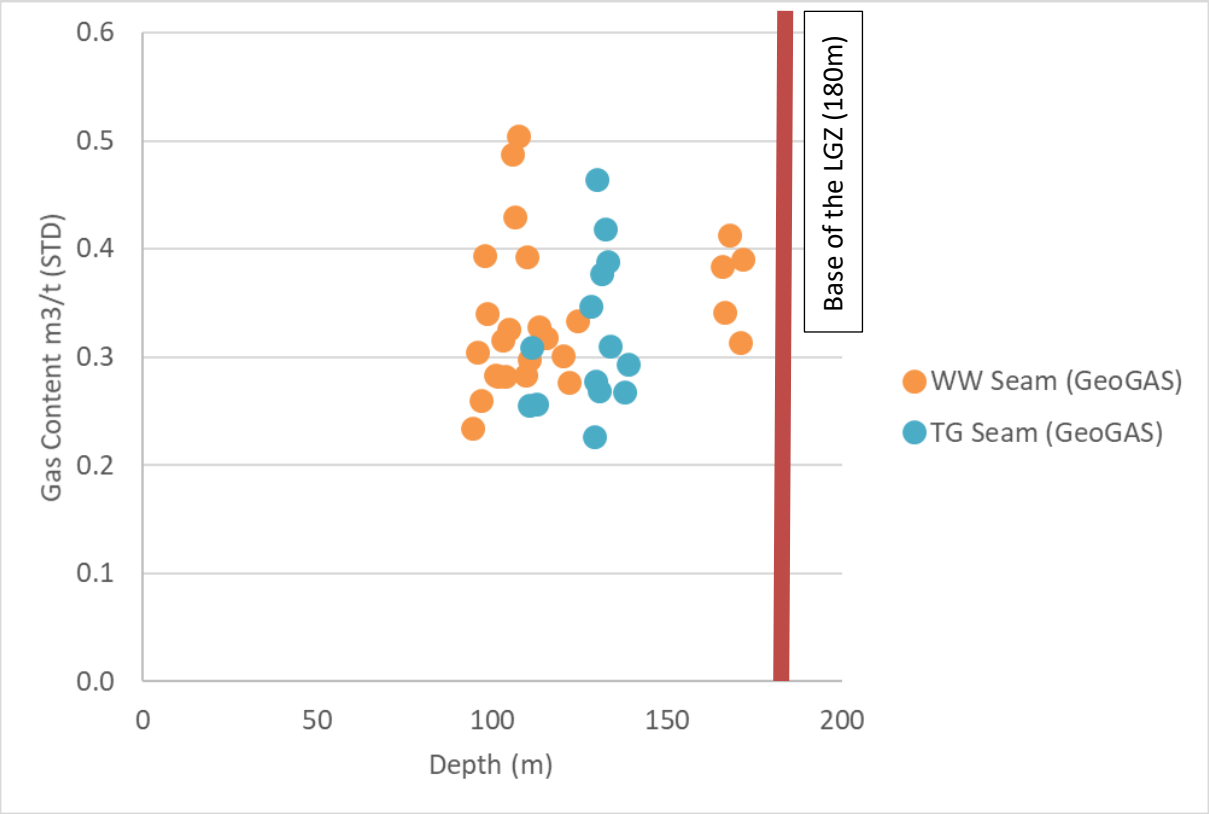

***Figure 7**: Gas content comparison of the Wongawilli (WW) and Tongarra (TG) seams show both conform to LGZ criteria.*

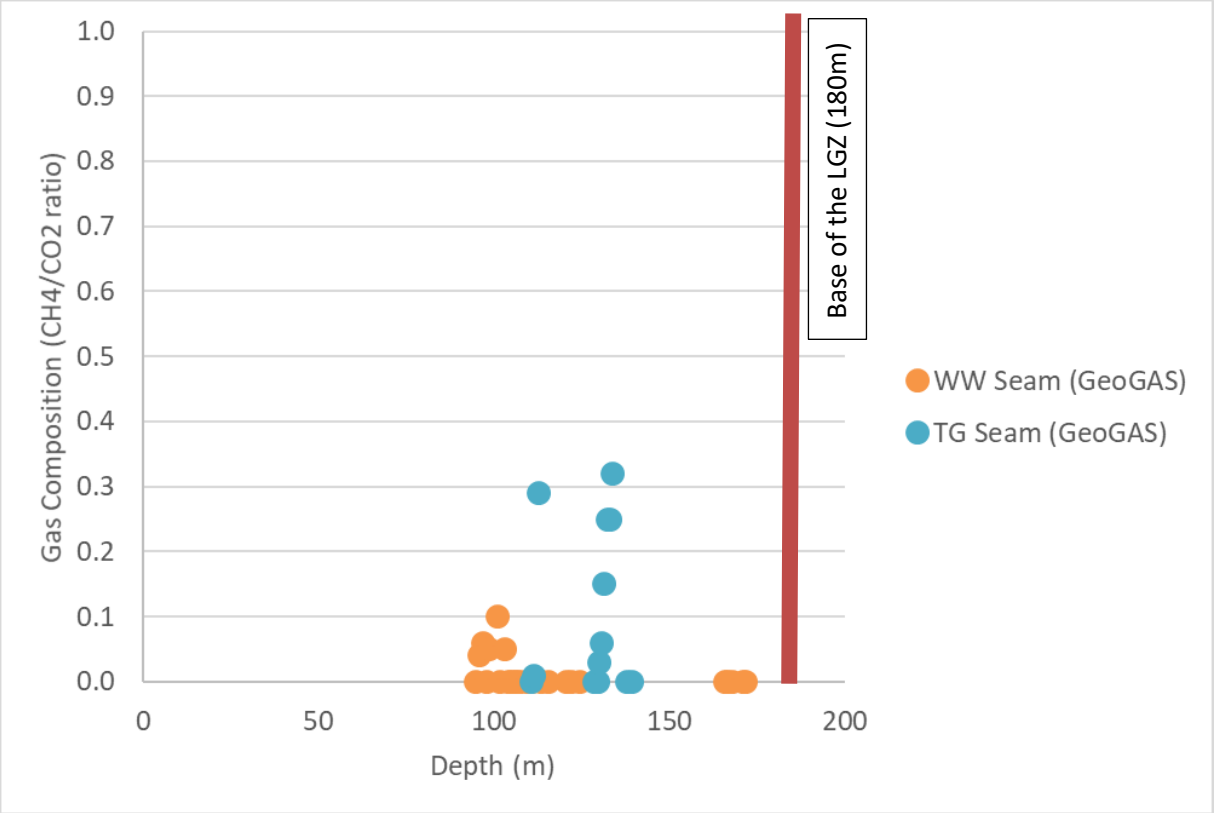

***Figure 8*: Gas composition comparison of the Wongawilli (WW) and Tongarra (TG) seams show both conform to LGZ criterion, with the Tongarra storing slightly more methane (up to 30%).**

5. DISCUSSION – SCOPE 1 EMISSIONS

Our analysis has established that a LGZ can be assigned to the project for the proposed working area. A LGZ is assigned a conversion factor of 0.00023 CO_2-e/t per tonne[14].

On the assumption that all the gas (100%) in the coal will be released during the mining process[15] we can estimate Scope 1 Emissions as presented in Appendix 2 and Figure 9. A total estimate of **11,611 CO_2-e tonnes** is expected to be produced by the project over the life of the operation.

[14] *Refer to NGER Technical Guidelines and associated ACARP Technical Guideline.*
[15] *We note that this is highly unlikely given the low desorption pressure of CO_2, inherently low initial gas contents, and the fact that the workings will be flooded soon after mining. The emissions estimation cited is thus considered to be conservatively high.*

It is our judgement as Estimators that only the target seam will contribute to overall emissions, largely due to the nature of the proposed mine plan and the absence of any gas in underlying coals. The overlying Hawkesbury sandstone is porous (10-25%), and likely water saturated[16].

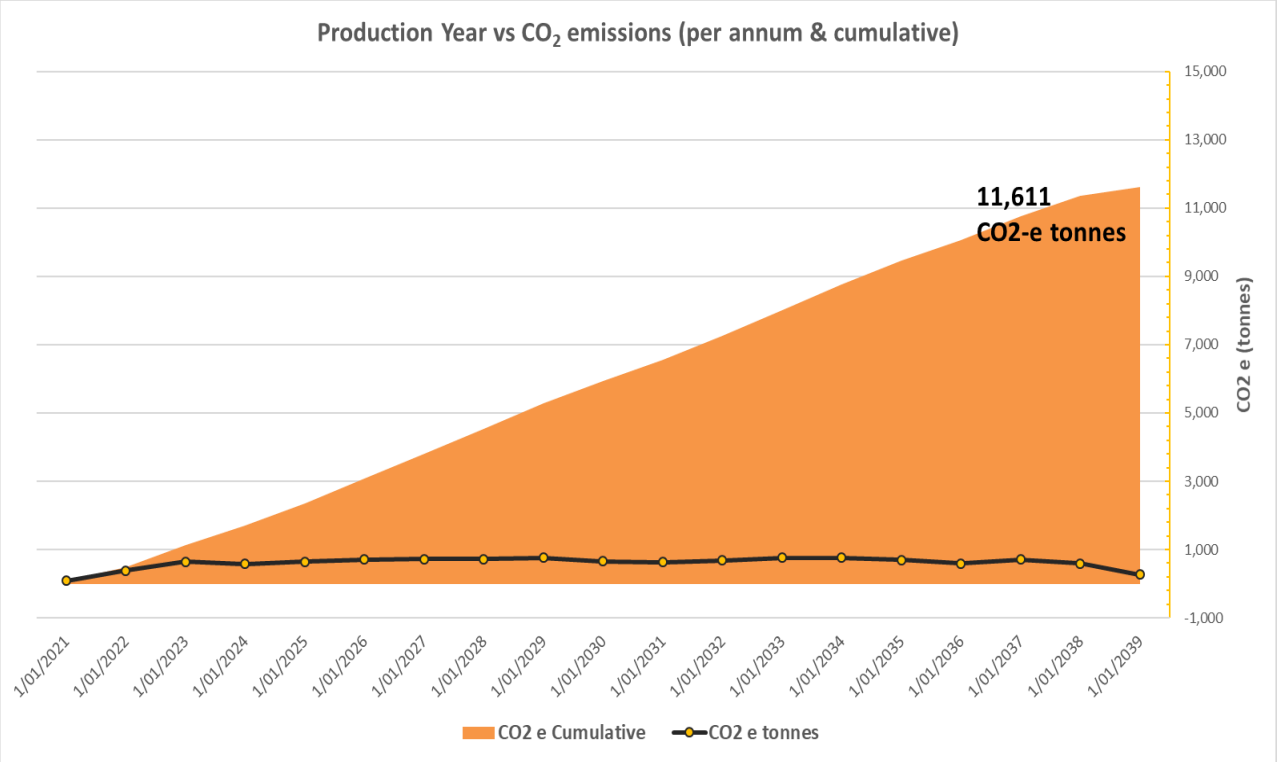

***Figure 9*: Scope 1 fugitive emission CO2-e tonnes produced during the life of mine estimate.**

6. DISCUSSION - SCOPE 2 and 3 EMISSIONS

Background

Source data used in previous work reporting emissions for the project appears to have been sourced from National Greenhouse Accounts Factor Workbook (NGAF 2016, Appendix K, Chapter 11.5, p92). Project GHG estimates are contained in Table 26.1 (p603) and Table 26.2 (p604) of the Response to Submissions (RTS) document (Publication # J12055RP2).

[16] Refer to independent geophysical logging study of Hume data by CoalBed Energy (2020).

Presented in the RTS is a summary document that states a total emission estimate of 1,597,543 t CO2-e for Scope 2 and 111,346,132 t CO2-e for Scope 3. Based on this, Scope 3 emissions account for 98.4% of the total Scope 1, 2 and 3 emissions (113,142,097 t CO2-e (i.e. 113Mt)) for the project.

Scope 3 is based on **39 Mt product coal** over LOM (23 years), where Export Coking (~55%) is ~71 Mt CO_2-e and Thermal (~45%) is 40 Mt CO_2-e[17]. Note that Scope 3 emission factors for coking coal are significantly greater than that of bituminous coal[18].

By implication, the project has therefore a carbon multiplier of **113/39** = **2.9.** Note, this is largely dominated by Scope 3 emissions (98.4%).

Options for offsets

One option for offsets is using Hume Coal's land assets to grow trees and create a carbon sink. Hume Coal has total land ownership of in excess of 1300 Ha, of which it has identified some 155Ha that would be suitable for mitigation measures[19]. CSIRO modelling[20] states that:

- 7.4 t CO_2 / Ha / year of mitigation is possible under Australian conditions;
- This would create an Offset estimate of **~300 t** CO_2-e **per hectare** (over 40 years). In Hume Coal's 155Ha of potential revegetation = **~46,500 t CO_2-e.**

It is therefore feasible that tree planting could easily offset Scope 1 estimates from mining coal (**11,611 t CO2-e**), and some of Scope 2 or 3, *with the following caveats,*

- Calculations assumes 100% of land coverage, tree longevity and 100% success rate (i.e. zero loss, and this may be optimistic);
- It may be an alternative to acquire land in other areas to maximise carbon offset tree planting;
- It may be an alternative to consider funding and sponsoring Carbon in Soil (CIS) initiatives in other areas. CIS development work on broad acre cultivation indicates a dual benefit of carbon storage and increasingly productive soil and overall produce productivity, based on multi-crop rotation. This would be perceived as an enhanced benefit beyond simple tree planting.

[17] Hume Coal officials have confirmed that expected Hume Coal thermal product would be a High Ash Middlings (~22% ash) product –typical for NSW domestic power station supply.
[18] 6.4 kg CO2-e/GJ compared to 3.0 kg CO2-e/GJ, refer to National Greenhouse Accounts Factors, August 2016, Table 37, p63. Relates to carbon content of the fuel and the degree to which the fuel is fully combusted (p9).
[19] Figures supplied by Hume Coal.
[20] Polglase et al, 2011. Opportunities for Carbon Forestry in Australia; Economic Assessment and Constraints to Implementation, CSIRO Publication.

A key point is that tree planting offsets of ~0.046 Mt relative to 113 Mt CO_2-e is – in the overall scheme of things - insignificant, but in conjunction with other Carbon initiatives could be expanded, supported and funded.

Further discussion

Scope 1 – our analysis (see Section 3, 4 and 5 contained herein) suggests an excellent case for using Method 2 (direct measurement), rather than Method 1, or an averaging methodology, which would importantly include the identification of a Low Gas Zone (previously overlooked), and therefore lead to a direct reduction in the current GHG estimate.

Scope 2 – is mainly Purchased Electricity, and this presumably assumes that it is derived from a coal-fired NSW based generator (Table 41 of NGAF of **0.265 t CO_2-e**). We contend that Hume Coal should consider negotiating Long Term Retail Electricity Contracts with Hydro Tasmania (or other renewable supplier) which will result in a significantly lower (100% renewable) electricity emission factor of only some **0.037 CO_2-e**[21]**.** For example, if Hume Coal can access 100% renewable energy, then based on the 0.037 multiplier the saving would be 86% for Scope 2 emissions, reduced from 1,597,543 (refer to Table 26.2 'Response to Submissions' document) to 223,053 t CO2-e.

Scope 3 – as now detailed in the Independent Planning Commission NSW (IPC) Report on United Wambo Open Cut Mine Project, it will be most likely incumbent on Hume Coal (POSCO) to use its best endeavours (at date of export) to ensure that the overseas coal buyers are signatories to the Paris Agreement. Hume Coal will commit to the supply of coal only to those countries who are signatories to the Paris Agreement.

7. CONCLUSIONS AND RECOMMENDATIONS

Work completed has resulted in a more robust and defendable estimate of Scope 1 fugitive emissions. Undertaking this work has resulted in a reduction of Scope 1 fugitive emissions relative to the default value used in previous calculations.

Key findings:

1. Hume Coal has sufficient reliable gas data for the calculation of Scope 1 fugitive emissions based on Method 2 analysis.
2. A Low Gas Zone (LGZ) can be assigned to the project to a depth of 180m.
3. Our Method 2 analysis has established an estimate of Scope 1 fugitive emissions of **11,611 CO_2-e tonnes** for the LOM.

[21] *Refer to National Greenhouse Accounts Factors, August 2016 - Electricity Emission factors for end users - Tasmania p.69 that quotes the 'latest estimate" at 37 kg CO2e/GJ & 0.13 kg CO2e/kWh (they are interchangeable factors).*

4. Amelioration of Scope 1, 2 and 3 emissions may be best achieved through:
    a. The planting of trees as carbon offsets on Hume Coal land and via the acquisition of land elsewhere. Gains are anticipated to be modest but would offset Scope 1 fugitive emissions from the mine ventilation areas.
    b. Scope 2 emissions can be mitigated via sourcing energy from a renewable supplier rather than a NSW coal-based generator.
    c. Scope 3 emissions will need to be supported by the company undertaking to not sell coal to non-Paris agreement signatory countries. It is our understanding that this is Hume Coal's policy.

It is recommended that the detailed Scope 1 emissions detailed herein are incorporated into Hume Coal's broader GHG submission to the IPC. Further work on the production of tangible agreements regarding Scope 2 renewable energy supply and a commitment to only supply coal to countries that are signatories to the Paris Agreement is recommended.

Scott Thomson
Managing Director
CoalBed Energy Consultants Pty Limited

APPENDIX I

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MEMORANDUM

Attention:	Rod Doyle, Exploration Manager, Hume Coal Pty. Ltd.
From:	Ray Williams, GeoGAS Pty. Ltd.
Copy To:	Shoba Keys, Guy Mitchell GeoGAS Pty. Ltd.
Date:	27th June 2014
Subject:	Hume Coal Gas Content Database

This memorandum follows the meeting on 27th June 2014 between Rod Doyle of Hume Coal and Ray Williams/Shoba Keys of GeoGAS Pty. Ltd.

The basic query covers the mismatch between older BHP laboratory tested gas content samples and more recent (2011-2013) GeoGAS gas content tests. Nine gas content test boreholes have been drilled (Figure 1).

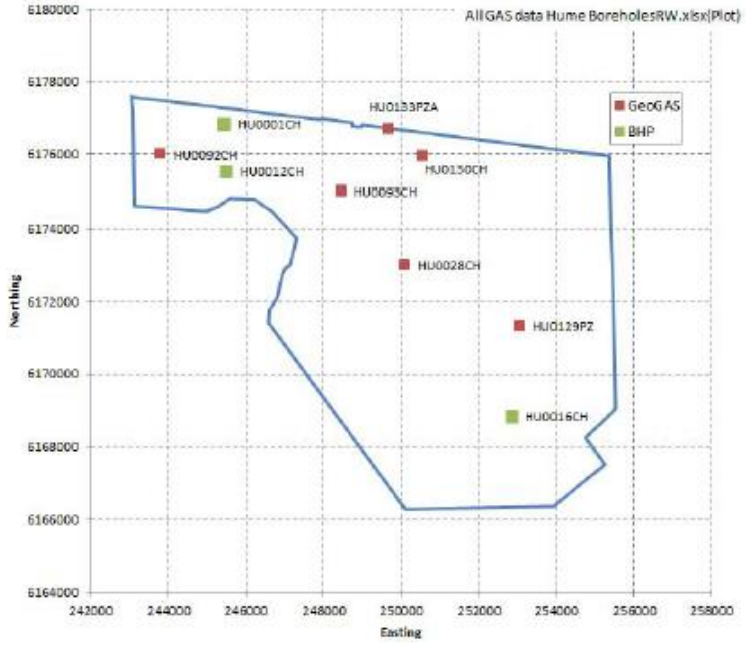

Figure 1 Gas Content Test Borehole Locations

The BHP tested results are on average much higher than GeoGAS tests with a greater variability between sub samples (Table 1).

Table 1 Comparison BHP and GeoGAS Testing

Laboratory	# Tests	Measured Gas Content Qm (m3/t)				CH4/CH4+CO2	
		Average	Std Dev	Min	Max	Average	Std Dev
BHP	10	1.04	0.84	0.55	3.10	0.35	0.33
GeoGAS	48	0.31	0.09	0.08	0.53	0.03	0.08

BHP tested samples are also higher in CH_4 and show greater variability (Table 1).

From the data provided, the cause of the greater variability between BHP and GeoGAS is unknown. The relatively poor consistency between sub samples for the Wongawilli seam suggests errors in BHP's testing and/or reporting. The deepest tested borehole is HU0016CH (BHP) at ~190 m (Wongawilli seam). The presence of CH_4 in the Q3 gas could be real. The deepest GeoGAS tested borehole is HU0129PZ at ~170 m, and it is devoid of CH_4. For GeoGAS testing, CH_4 is primarily found in minor concentrations, in the Tongarra seam. The gas contents are so low though, that the seam gas concentration in the analysed samples are mostly less than 0.5% (ie air or inert gas of 99.5%, 0.5% seam gas), resulting in a magnification of error for air free calculation.

The low gas content GeoGAS tests utilised a 250 ml burette in the Q3 stage and this gives a more accurate measure of gas content than standard equipment for higher gas contents. That said, the actual values measured are close to the minimum detection limit using GeoGAS equipment. Crushing of non coal samples using this equipment results in a consistent zero error of +0.22 m^3/t. This means the gas contents are in effect very close to zero (~0.1 m^3/t, 0.31-0.22) and almost all CO_2).

Given the lack of coverage over the lower third of the lease, consideration should be given to reviewing the actual BHP test data for borehole HU0016CH, or drill another test borehole nearby and test at GeoGAS. There is some likelihood that the gas content and CH_4 concentration are higher, but probably not in any material way.

It is recommended that in applying the gas content database, the BHP tests be set aside.

Ray Williams

Executive Consultant, GeoGAS

APPENDIX II

Scope 1 fugitive emissions from mine ventilation gas

		ROM Tonnages	CO_2 e tonnes
	Total/Average	**50,481,367**	**11,611**
Calendar Year	**Year Start Date**		
CY21	1/01/2021	381,433	88
CY22	1/01/2022	1,692,557	389
CY23	1/01/2023	2,819,098	648
CY24	1/01/2024	2,536,996	584
CY25	1/01/2025	2,823,875	649
CY26	1/01/2026	3,084,090	709
CY27	1/01/2027	3,146,861	724
CY28	1/01/2028	3,161,103	727
CY29	1/01/2029	3,314,168	762
CY30	1/01/2030	2,870,590	660
CY31	1/01/2031	2,726,088	627
CY32	1/01/2032	2,950,325	679
CY33	1/01/2033	3,282,361	755
CY34	1/01/2034	3,289,321	757
CY35	1/01/2035	3,041,431	700
CY36	1/01/2036	2,592,817	596
CY37	1/01/2037	3,080,589	709
CY38	1/01/2038	2,546,337	586
CY39	1/01/2039	1,141,323	263
Conversion Factor			0.00023

Annexure B

POSCO and Hume Coal GHG emissions statment

POSITION STATEMENT

Scope 3 Greenhouse Gas (GHG) Emissions
Hume Coal and POSCO Perspective

> *"Climate change is a mega trend that is shifting the paradigm of each sector of society. A majority of global companies proactively respond to this issue and strive to secure a competitive advantage. With the understanding that climate change is a critical risk factor, POSCO acknowledges that it is a strategic opportunity to enhance corporate competitiveness"*
>
> *POSCO Corporate Citizenship Report 2018*

Overview

Hume Coal and its parent company, POSCO, has undertaken to only sell product coal to nations that are signatories to the Paris Agreement for the reduction of GHG internationally and to ensure that Scope 3 emissions are accounted for in accordance with Australian and international carbon obligations.

The Hume Coal project EIS was prepared on the default position that all coal would be exported and utilised in the steel and energy plants operated by POSCO in the Republic of Korea and, therefore, any Scope 3 emissions would be accommodated within the *National Determined Contribution (NDC)* of Korea.

However, since the display of the EIS, Hume Coal has received interest from the local steel and power generation industry and to make the product coal available to the Australian market. It is apparent that the supply of competitively sourced coal for local industry to meet domestic steel and power generation requirements during the Hume Coal operational period through to nominally 2045.

In 2017 the Australian Consumer and Competition Commission (ACCC) conducted an analysis of the Southern Coalfield, and its importance in supplying the Australian steel industry with competitive supplies of metallurgical (coking) coal. The ACCC declared the Southern Coalfield to be in its own market and supplying suitable coal from other mines in Australia would impose significant additional costs on steelmakers for higher prices for coking coal, additional infrastructure for seaborne inputs and higher transportation costs from the inefficiencies of local cabotage requirements. Hume Coal appreciates the need for local industry to have access to competitively priced coal suitable for blending to support domestic steel production.

Hume Coal and POSCO undertook to the ACCC to make product coal available to the domestic market on appropriate commercial terms. Any locally sold product coal and used domestically would be accounted within the Australian NDC as required by the *Paris Agreement.*

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In 2019 several Land and Environment Court (LEC) cases [*Gloucester Resources Limited v Minister for Planning (2019) NSWLEC* 'Rocky Hill' and *Australian Coal Alliance Inc v Wyong Coal Pty Ltd (2019) NSWLEC* 'Wallarah 2' examined the role of Scope 3 GHG emissions and made certain determinations.

This led to the Independent Planning Commission (IPC) requiring coal mine applicants to consider Scope 3 emissions in the assessment of the development applications for new coal mines or extensions to existing mines. In the United Collieries/Wambo application the framework of Australia's GHG obligations were addressed in detail in a separate submission by the legal firm Ashurst. This can be found at:

https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2018/11/united-wambo-open-cut-coal-mine-project-ssd-7142/information-from-applicant/submission-2--united-wambo-jv--submission-to-ipc-on-climate-change-and-ghg-matters.pdf

Hume Coal and POSCO takes its obligations under the Australian and Korean GHG framework seriously and, besides making an enforceable commitment only to sell product coal to *Paris Agreement* nations, it is further committed to reducing or mitigating Scope 1 and 2 emissions within its direct control and, where coal is exported to the Republic of Korea, ensure its use is within the Scope 3 obligations of Korea's NDC.

The *Paris Agreement* is one of the key instruments in the international climate change legal framework. Central to the GHG reduction framework is the use of *Nationally Determined Contributions (NDC's)*, being high-level plans setting out the approach of each nation to reduce emissions to meet a goal of limiting global warming to below 2^0.

Should planning authorities seek to inject themselves into making assessments and determinations on Scope 3 emissions, outside the accepted international framework, there is a risk of 'contaminating' international protocols and yet undecided mechanisms for further GHG reductions. In dealing with Scope 3 emissions, the following points are relevant:

1. In determining GHG accounting, care needs to be taken to avoid "double counting" of GHG emissions, including a calculation of a nation's GHG emissions and benchmarked against the benchmark of the relevant NDC. This mechanism is central to the local and international framework for addressing climate change through GHG reductions.

2. There is no Australian law or policy prohibiting the development of new coal mines or the expansion of existing coal mines nor is there any such mechanism within the *Paris Agreement* imposing unilateral emission obligations or an individual industry sector. Equally, nor is there any mechanism within the *Paris Agreement* as to the methodology by which the allocation of or sharing of global mitigation of GHG takes place, excepting the ability of 'developing countries' to increase emissions to 2030.

3. Hume Coal and POSCO endorses the *Paris Agreement* that is predicated on the basis that Scope 3 emissions are accounted for within the framework NDC's applicable to each signatory. This is consistent with our international obligations and those of the nation's where the product coal is combusted, and where emissions are accounted for with the relevant national NDC.

4. To impose legal obligations on producers requiring offsets for Scope 3 emissions and/or to ensure product customers are meeting emission reduction 'targets' would be contrary to modus operandi of the *Paris Agreement* and practically impossible to implement. In addition, any obligation on a planning authority to enforce obligations for Scope 3 emissions is fraught with administrative and legal danger.

POSCO Supports GHG Reductions and the NDL Determined by Republic of Korea

The Republic of Korea has finalised its 2030 target of reducing greenhouse gas emissions by 37 percent from business-as-usual (BAU) levels, higher than its earlier plan for a 15-30 percent cut. In 2009, Korea voluntarily set to cut greenhouse gas emissions in 2020 to 30 percent below BAU.

In June 2018, the Korean Government released a draft 2030 'roadmap' for achieving its Nationally Determined Contribution (NDC) of a 37 percent greenhouse gas emissions (GHG) reduction below 2030 business-as-usual level (850.8 $MtCO_2e$) by 2030. The share of domestic reductions has increased from 25.7% to 32.5%. The Korean government aims to achieve this through deeper cuts across all sectors.

Increased domestic reduction measures would result in Korea requiring fewer international reduction credits to achieve their NDC target. Up to 4.5 percent of the 37 percent reduction is now expected to be covered by international offset credits. This figure may be further reduced if the target is to be reached using forest carbon sinks. This is pending the finalisation of international rules under UNFCCC negotiations, as well as other international instruments.
In July 2018, the Korean Cabinet approved the 2030 greenhouse gas 'roadmap' and the allocation plan for the second phase (2018-2020) of the national emissions trading system (ETS).

Both are key elements of the Republic of Korea's strategy to achieve their Nationally Determined Contribution (NDC) goal for 2030 under the *Paris Agreement*.
The 'roadmap' establishes the protocol achieving Korea's Nationally Determined Contribution (NDC) of a 37 percent reduction in greenhouse gas emissions below the BAU case.

The 'roadmap' provides details at three-year intervals of the indicative emissions levels required for the country to achieve its reduction target (536 MtCO2e in 2030), as well as sector-specific reduction targets compared to 2030 BAU emissions. National emissions are expected to peak around 2020.

The 'roadmap' also reduces the scope for international offsets, increasing the share of domestic mitigation necessary to reach their NDC target.

GHG Emissions from POSCO Production Processes

Carbon dioxide constitutes the majority of GHG emissions generated from POSCO Pohang Works and Gwangyang Works. In 2018, GHG emission volume amounted to 72.49 million tons, while CO2 emissions per ton of crude steel produced was 1.92 t- CO2 /t-S.
Ongoing energy saving efforts, has resulted in POSCO's CO2 emissions intensity remains below the voluntary reduction target of 2.00 t-CO2/t-S.

In addition to GHG mitigation measures, Korea is undertaking a substantial programme to convert its existing coal powered electricity generation fleet to High Energy Low Emission (HELE) power plants. As of December 2018, 83% of South Korea's coal-fuelled generation capacity was HELE and at least 90% of planned and under construction capacity are HELE units. In the years to 2023, at least 7 GW of HELE generating capacity is expected to come online in South Korea.

Should Hume product coal be destined for POSCO's Korean operations, its combustion would be accounted for within the Korean NDC.

Overview of POSCO's Carbon Risk and Opportunity Management

POSCO recognises that responding to the climate change issue and conducting carbon management activities pose both risks and opportunities for its businesses. Accordingly, the company is focused on establishing a strategy that will minimise the business risks and implement carbon reduction strategies as a positive business opportunity.

POSCO's GHG Risk Management System

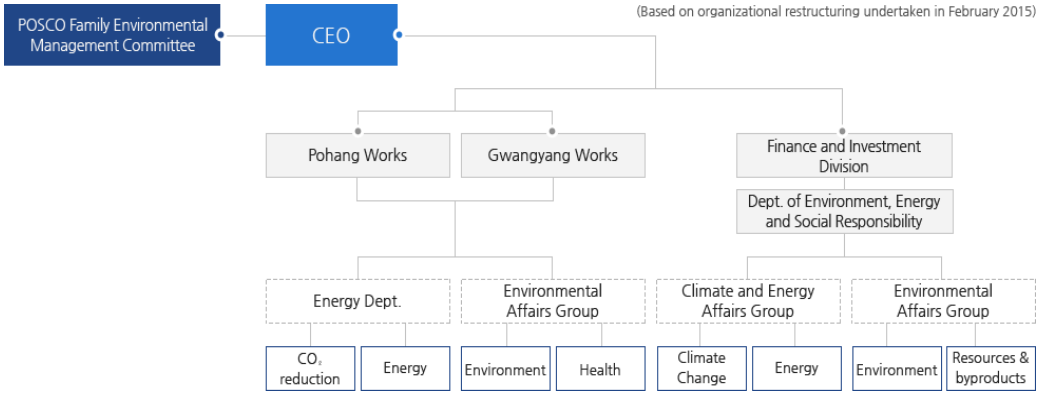
POSCO has built an internal system for identifying, assessing and analysing the risk and opportunity factors associated with climate change.

POSCO's investment management rules provide that if a business plan could result in environmental risk, such as increased GHG emissions, personnel must consult with a relevant department specialising in the area.

Climate change response activities are reported through the annual POSCO Family Environmental Management Committee meeting chaired by the CEO. The enterprise-wide CO2 and energy indices are shared through the monthly Management Meeting.

Information about POSCO's efforts in carbon-related risk and opportunity management are transparently disclosed to the public through a third party-verified Sustainability Report, business reports and public notices.

POSCO Climate Change Governance Structure



Climate Change Opportunities

Opportunities associated with climate change and carbon management activities are determined by technological and domestic and international GHG.

Increased energy use, due to changing natural environment and severe weather such as heat waves and unseasonal cold conditions, can also lead to new business opportunities.

POSCO is undertaking the sea forest restoration project using Triton, a product made from steel slag, to restore coastal areas affected by bleaching caused by rising sea temperatures. In 2014, Triton was authorised by the Ministry of Oceans and Fisheries to be used in the

artificial fish reef projects and other projects authorised by the central and municipal governments.

POSCO has adopted a ‘Green Building’ strategy, which employs more than a hundred ecological based technologies, as a model for energy conservation building.

Low carbon technologies and efforts to reduce indirect greenhouse gas emissions provides business opportunities. High-strength, lighter steel sheets reduces vehicle weight, and blast furnace slag that reduces the amount of cement are already new sources of corporate revenue.

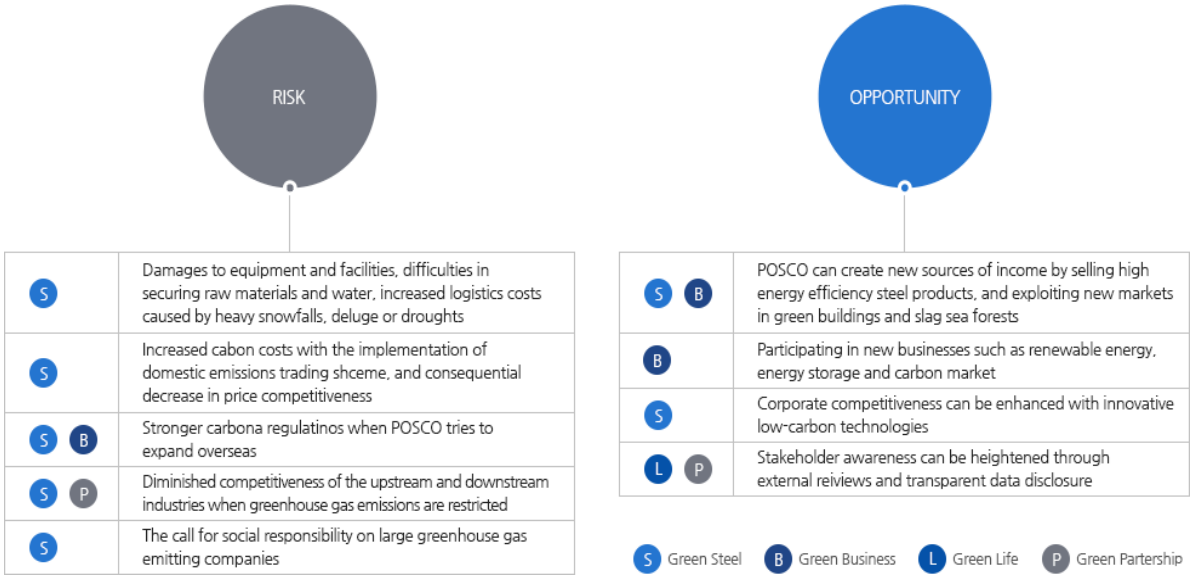
In addition, owing to stricter environmental regulations in China, some steelmaking companies have purchased FINEX, POSCO's unique steel making technology reducing emissions normally associated with traditional means.

Meanwhile, other companies continue to benchmark POSCO's environmental management activities, and POSCO expects there will be demand for environmental and energy conservation technology in the future

In other areas, under the Korean government's projects for enhancing energy efficiency and expanding renewable energy, POSCO is continuing to expand the Smart Industry[i] demonstration project, fuel cells and solar power business, ESS[ii] and Microgrid[iii] business.

Risk & Opportunity Management Process for Carbon Management

Risk & Opportunity Factors in POSCO's Carbon Management



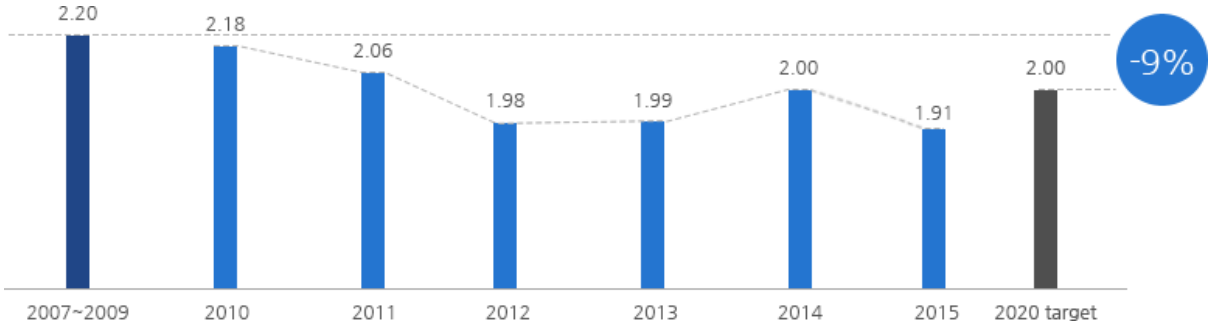
POSCO's Voluntary Reduction Target (2020)

The Korean government adopted a GHG Emissions Trading Scheme trading in 2015, POSCO changed its carbon target and performance to accord with government methodologies.

POSCO announced its greenhouse gas reduction target to be reached by 2020 at the Seventh Green Growth Committee meeting chaired by the President of the Republic of Korea in February 2010.

The target was to reduce the CO2 emission intensity per ton of steel produced in 2020 by 9% of the average emission intensity between 2007~2009.

POSCO's CO2 Emission Intensity Target



In order to reach this voluntary reduction target, POSCO has taken measures to reduce coal usage and enhance energy efficiency, while also putting efforts into developing innovative CO_2 reduction technologies.

Aside from implementing GHG reduction efforts at its business sites, POSCO is committed to reducing greenhouse gases from the use of the products it manufactures, such developing and supplying high-strength automotive steel, electrical steel that increases energy efficiency of motors and transformers and use of blast furnace slag substitute for cement.

POSCO is now committed to implementing the Korean government's GHG 'roadmap' for a 37 percent reduction in GHG emissions over BAU.

[i] Smart Industry: The goal of Smart Industry is to increase energy efficiency, reduce production cost and stabilize facilities by combining various energy sources at the steel mill with advanced information technology.

[ii] ESS (Energy Storage System): An ESS stores surplus energy produced at the power plant to be supplied during temporary power outages

[iii] Microgrid: An independent power grid that enables a small area to be self-sufficient. It is a next-generation electrical system that fuses and combines renewable energy and ESS.