

Chapter 15: Greenhouse gas

Environment Effects Statement



15 Greenhouse gas

15.1 Introduction

This chapter provides an assessment of the greenhouse gas (GHG) emissions associated with the construction, operation and decommissioning of the Victoria to New South Wales Interconnector (VNI) West (Victorian component) (the Project). This chapter describes how impacts will be avoided, minimised or managed and summarises the outcomes of *Technical Appendix H: Greenhouse gas*.

GHG emissions are a key contributor to climate change at a global scale. The *Climate Change Act 2017 (Vic)* and *Climate Change Act 2022* set the legislative foundation for managing climate change risks and driving Victoria's transition to net zero emissions by 2045. According to the Greenhouse Gas Protocol (GHG Protocol), GHG emissions are split into three categories, known as 'Scopes'.



The GHG Protocol identifies three GHG emissions scopes:

- **Scope 1** – Direct GHG emissions occur from sources that are owned or controlled by the company
- **Scope 2** – Indirect GHG emissions from the generation of purchased electricity consumed by the company
- **Scope 3** – An optional reporting category that allows for the treatment of all other indirect emissions that are a consequence of the activities of the company, but occur from sources not owned or controlled by the company

Direct Scope 1 emissions and indirect Scope 2 and Scope 3 emissions identified as material for the Project (in accordance with GHG Protocol criteria) and within the proponent's ability to control were considered for the proposed construction, operational, and decommissioning phases of the Project.



Key definition

CO₂-e – GHG is measured as tonnes (t), kilo tonnes (kt) or million tonnes (Mt) of carbon dioxide equivalent (CO₂-e).

This represents the combined effect of different greenhouse gases, converted to an equivalent amount of CO₂ based on their global warming potential (GWP), where CO₂ has a GWP of one.

The total emissions (Scope 1 and relevant Scope 3) for the Project are estimated to be 914,111 tonnes (t) CO₂-e, assuming no mitigation is applied. There are no expected material Scope 2 emissions for any phase of the Project. The breakdown of Scope emissions is outlined below:

- The total construction Scope 1 and 3 emissions for the Project are estimated to be 552,280 t CO₂-e. Scope 1 emissions during construction are estimated to be 115,663 t CO₂-e
- The total operation Scope 1 and 3 emissions over the expected lifespan of the Project are estimated to be 349,590 t CO₂-e. The total Scope 1 emissions from operations over the Project's expected life are estimated to be 44,397 t CO₂-e
- The total decommissioning Scope 1 and 3 emissions are estimated to be 12,241 t CO₂-e

The Project's annual Scope 1 and 2 emissions without the implementation of Environmental Performance Requirements (EPRs) were compared to Victoria and Australia's annual GHG emissions to enable assessment of these impacts in the context of existing conditions and the targets outlined in the Victorian *Climate Change Act 2017* and Australian *Climate Change Act 2022*. It was found that:

- The Project's annual Scope 1 and 2 emissions during construction are estimated to contribute approximately 0.05% of Victoria's annual GHG emissions. Operational emissions are estimated to contribute less than 0.01% per year and decommissioning emissions would contribute approximately 0.01%.
- The Project's annual Scope 1 and 2 emissions during construction, operation and decommissioning of the Project are estimated to each contribute less than 0.01% to Australia's annual GHG emissions.

The Project's total impact on existing conditions would be minor, with the largest impact occurring during the construction phase. As such, the Project would not have a material impact on Victoria's GHG emission reduction targets outlined in the *Climate Change Act 2017*.

Following the implementation of EPRs to avoid and minimise GHG emissions from Project construction and operation, residual GHG emissions would be quantified and offset to compensate for emissions produced.

15.2 Assessment scope

The scoping requirements provided by the Minister for Planning for the Project set out the specific environmental matters to be investigated and documented in this Environment Effects Statement (EES). The EES Scoping Requirements inform the extent and scope of each EES technical study. The issue identified in the EES Scoping Requirements to be addressed in this GHG assessment:

- Potential for emissions of greenhouse gases to result from the Project during its construction and operations, and implications of these emissions in the context of the targets outlined in the *Climate Change Act 2017*

Technical Appendix H: Greenhouse gas was prepared for this EES. The technical appendix provides more detailed information on the investigation and impact assessment conducted in response to the EES Scoping Requirements.

This chapter should be read in conjunction with other relevant EES chapters. EES chapters related to this impact assessment are listed in Table 15-1.

Table 15-1 Related EES chapters and relevance to GHG

EES Chapter	Relevance
<i>EES Chapter 13: Climate change</i>	The climate change chapter details the potential impacts of a changing climate on the construction, operation and decommissioning of the Project. This complements the greenhouse gas assessment, which considers the Project's contribution to climate change.
<i>EES Chapter 18: Traffic and transport</i>	The traffic and transport details Project-related transport activities during construction, operation and decommissioning. Transport movement data from this assessment has been used to estimate fuel use and associated greenhouse gas emissions for the Project.
<i>EES Chapter 26: Ecology</i>	The ecology chapter details potential ecological impacts associated with the construction, operation and decommissioning of the Project. Ecology data, including estimated native vegetation clearance, has been used to estimate greenhouse gas emissions associated with land use, land use change and forestry during construction.

15.3 Greenhouse gas scopes

This GHG impact assessment includes the impact of emissions from direct Project activities (e.g. fuel consumed by construction equipment at the Project location) and indirect Project activities (e.g. embodied emissions in construction materials used in the Project).

According to the Greenhouse Gas Protocol (GHG Protocol), GHG emissions are split into three categories, known as 'scopes', defined as:

- Scope 1 – Direct emissions of GHG from sources that are owned or controlled by the company (examples include combustion of fuel used in on-site plant and equipment).
 - Scope 2 – Indirect emissions associated with the import of energy from another source (examples include import of electricity from the grid).
 - Scope 3 – Other indirect emissions, other than energy imports (above) which are a direct result of the operations of the organisation, but from sources not owned or operated by them and due to upstream or downstream activities (examples include indirect upstream emissions associated with the extraction, production, and transport of purchased construction materials; and off-site transport).
- Note that Scope 3 emissions are an optional reporting category, included in this assessment to take a whole-of-life approach to understanding the Project's estimated GHG impacts. In line with Global Protocol guidance, Scope 3 emissions are not required to be compared to existing conditions as part of the EES process. As such, Scope 3 emissions are not discussed in Section 15.5.

EPA Publication 2048 also adopts scopes as a method for understanding and estimating GHGs. Figure 15-1 illustrates various types of activities that are relevant to each of the Scope categories.

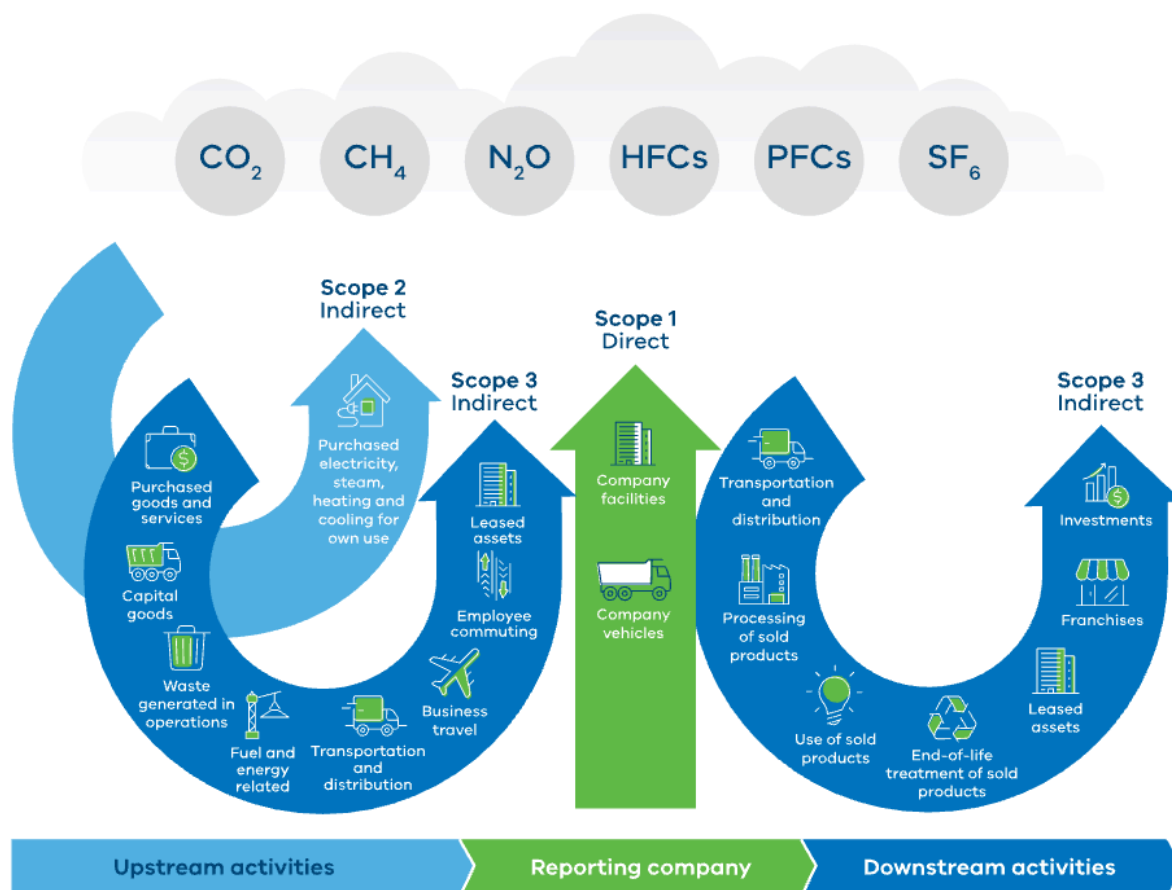


Figure 15-1 Direct and indirect emissions as defined by the GHG Protocol (Source: GHG Protocol, 2003)

For this assessment, Scope 1, Scope 2 and significant Scope 3 emissions have been determined for the assessed construction, operation and decommissioning phases of the Project. Scope 1 and Scope 2 direct and indirect emissions are required to be reported under both the National Greenhouse and Energy Reporting (NGER) and GHG Protocol reporting schemes. Significant Scope 3 emissions have also been included where they are expected to make a material contribution to the overall GHG inventory, including embodied emissions associated with construction materials, transport of employees and materials, and disposal of waste or soil. Other potential Scope 3 emissions were assessed and excluded where they were not expected to materially influence the assessment outcomes. This approach focuses the assessment on the main emission sources and supports practical identification of EPRs.

15.4 Greenhouse gas assessment boundary

The assessment boundary defines the sources and scope of GHGs included in this assessment, covering the expected lifetime of the Project's construction, operation, and decommissioning activities. The assessment extends to all direct (Scope 1) and indirect (Scope 2 and Scope 3) emissions within the proponent's ability to control them.

As set out in the GHG Protocol Corporate Standard, the proponent's ability to control or influence activity is a key criterion in determining the assessment boundary. Scope 3 emissions, such as those from embodied emissions relating to construction materials, transport of employees and materials, and the disposal of waste, are determined to be within the proponent's ability to control or influence. This approach is generally considered to be best practice and in line with previous EES submissions.

The construction phase, operation phase and decommissioning phase emissions sources within the assessment boundary are shown in Figure 15-2, Figure 15-3 and Figure 15-4 below. The included activities were based on information provided in *EES Chapter 4: Project description*, and consultation with the Project team, as of October 2025.

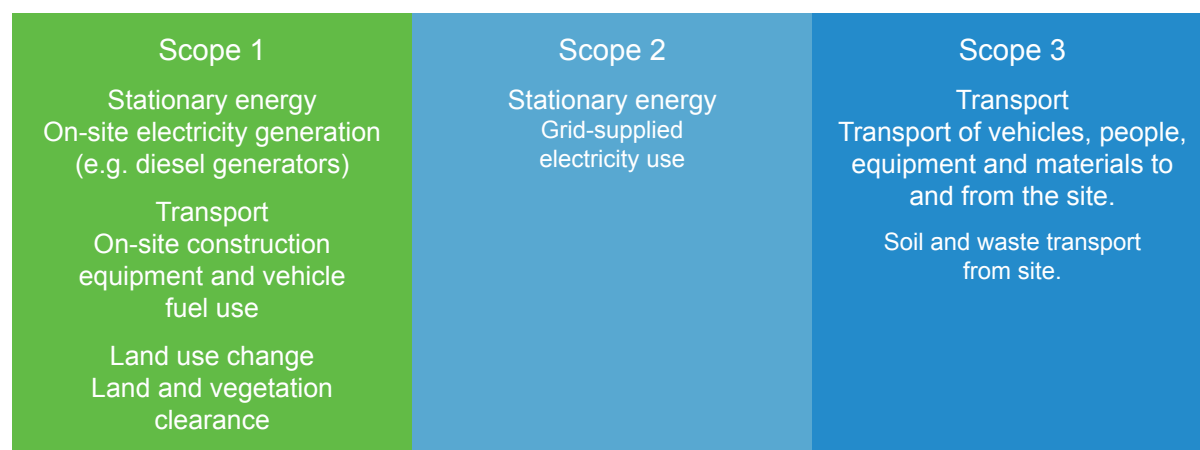


Figure 15-2 Construction phase emissions sources within the Project's assessment boundary

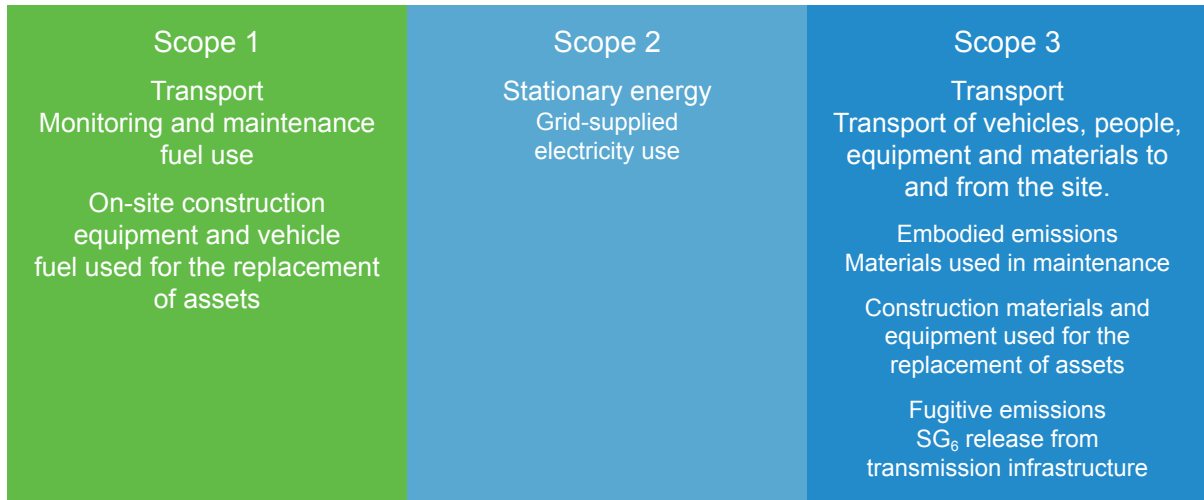


Figure 15-3 Operational phase emissions sources within the Project's assessment boundary

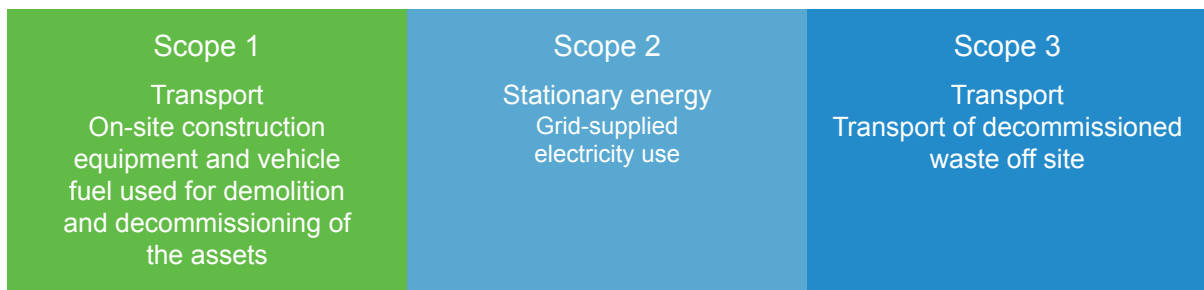


Figure 15-4 Decommissioning phase emissions sources within the Project's assessment boundary

15.5 Methodology

To respond to the scoping requirement outlined in Table 15-1 the GHG impact assessment undertook the following methodology:

- Establishing the scope of assessment for the construction, operation and decommissioning phases of the Project
- Characterisation of existing GHG emissions at a state and national level using the 2023 reporting reference year from the Australian National Greenhouse Accounts: State and Territory Greenhouse Gas Inventories
- Estimation of GHG emissions during construction, operation and decommissioning of the Project in accordance with the principles of the internationally accepted GHG Protocol
- Comparison of estimated GHG emissions to existing conditions and Victorian and national emission reduction targets
- Identification of EPRs where necessary to address potentially significant environmental impacts
- Evaluation of residual environmental impacts, taking into account the proposed EPRs and likely effectiveness

15.6 Existing conditions assessment

To determine the existing conditions, the most recent available data on Victoria's GHG emissions, the State and Territory Greenhouse Gas Inventories 2023 report, was considered. In 2023, Victoria's total GHG emissions were 84,200 kilo tonnes of carbon dioxide equivalent (kt CO₂-e).

Table 15-2 provides a breakdown of these emissions by sector. The operational Scope 1 and 2 emissions associated with the Project would primarily contribute to the electricity generation and transport categories presented in the table.

As noted in Section 15.2, Scope 3 emissions are an optional reporting category, included in this assessment to take a whole-of-life approach to understanding the Project's estimated GHG impacts. In line with Global Protocol guidance, Scope 3 emissions are not required to be compared to existing conditions as part of the EES process. As such, Scope 3 emissions are not discussed in this section.

Table 15-2 Victorian GHG emissions by source for 2021 (DEECA, 2023)

Emissions source and sink category	Annual net GHG emissions (kt CO ₂ -e)
Electricity generation	41,400
Fuel combustion	16,300
Transport	22,700
Fugitive emissions from fuels	1,700
Industrial processes and product use	3,900
Agriculture	16,400
Land use, Land use change and Forestry ¹	-21,100
Waste	2,700

15.7 Impact assessment

The following sections represent the GHG emissions associated with the construction, operation and decommissioning of the Project. The assessment considers the highest emitting Tragowel and Teddywaddy Proposed Easement options, to ensure a conservative approach. The Proposed Easement options are discussed further in Section 15.7.4.

The significance of the Project's GHG emissions impact has been assessed by comparing the total Scope 1 and 2 Project GHG emissions against annual state GHG emissions. In line with the EES Scoping Requirements, the Project's emissions are represented in the context of the *Victorian Climate Change Act 2017* target of net zero emissions by 2045. The ratings adapted to improve the understanding of residual impacts are shown in Table 15-3 below.

Table 15-3 Specific impact ratings for GHG used for understanding residual impacts

Rating	GHG residual impact
Negligible	Construction or operational Scope 1 and Scope 2 GHG emissions are less than 5,000 t CO ₂ -e per annum i.e. the Project is near to or on par with the 'no project' scenario.
Minor	Construction or operational Scope 1 and Scope 2 GHG emissions are below the NGER Scheme reporting threshold (25,000 t CO ₂ -e per annum).

¹ In 2021, Land use, Land use change and Forestry was a net negative source of emissions, and therefore a negative value is representative of emissions absorbed rather than emitted.

Rating	GHG residual impact
Moderate	Construction or operational Scope 1 and Scope 2 GHG emissions trigger the NGER Scheme reporting threshold (25,000 t CO ₂ -e per annum).
Major	Construction or operational Scope 1 and Scope 2 GHG emissions surpass the individual referral trigger under the <i>Environment Effects Act 1978</i> (200,000 t CO ₂ -e per annum).
Severe	Construction or operational Scope 1 and Scope 2 GHG emissions represent a non-negligible proportion of Victoria's total GHG emissions (> 1%).

The total emissions (Scope 1, 2 and relevant Scope 3) for the construction, operation and decommissioning of the Project are estimated to be 914,111 t CO₂-e.

Total Scope 1 emissions are estimated to be 171,990 t CO₂-e. The majority of these emissions are from fuel use by vehicles and equipment used for construction and transport. There are no expected material Scope 2 emissions for the Project. The highest source of emissions is from Scope 3 embodied emissions of the materials used during the construction phase and for asset replacement during the lifespan of the Project.

Table 15-4 and Table 15-5 present the total estimate of GHG emissions for each of the Project phases by emissions Scope and Project element. All emissions summaries have been rounded to the nearest 1 t CO₂-e. Due to rounding, there may be some differences between the sum of reported emissions and the reported totals.

Table 15-4 Summary of total Scope 1, 2 and 3 GHG emissions for the Project

Emissions	Total emissions (t CO ₂ -e)			
	Scope 1	Scope 2	Scope 3	Total
Construction	115,663	-	436,617	552,280
Operation	44,397	-	305,193	349,590
Decommissioning	11,929	-	312	12,241
Total	171,990	-	742,122	914,111

Table 15-5 Summary of total GHG emissions for each Project element

Emissions category	Total emissions (t CO ₂ -e)			
	Transmission lines	Tragowel Terminal Station	Bulgana Reactor Station	Total
Construction	377,179	143,659	31,443	552,280
Operation	155,524	160,597	33,468	349,590
Decommissioning	11,810	410	21	12,241
Total	544,513	304,666	64,932	914,111

15.7.1 Construction impact assessment

The following section represents the GHG emissions associated with the construction of the Project, assuming no mitigation is applied. For the purpose of this assessment, construction is expected to last from approximately mid-2027 to late 2030. EPRs are summarised in Section 15.8.

- The total construction Scope 1, 2 and 3 emissions within the study scope for the Project are estimated to be 552,280 t CO₂-e
- Scope 1 emissions during construction are estimated to be 115,663 t CO₂-e

A summary of the total GHG emissions for the construction of the Project is presented in Table 15-6 and Table 15-7 below.

Table 15-6 Summary of GHG emissions associated with the construction of the Project

Emissions category	Description	Total emissions (t CO ₂ -e)			
		Scope 1	Scope 2	Scope 3	Total
Stationary energy	The fuel or energy consumed by stationary (i.e. non-mobile) plant or equipment	9,225	-	-	9,225
Transport	The fuel or energy consumed by mobile plant, equipment, or other modes of transport	81,855	-	9,701	91,556
Embodied emissions	Scope 3 emissions generated and released during the manufacturing and processing of materials	-	-	426,916	426,916
Land use, Land use change and Forestry	Emissions related to the removal of vegetation for the construction of the Project	24,583	-	-	24,583
Total		115,663	-	436,617	552,280

Table 15-7 Summary of GHG emissions associated with the construction of the Project, by Project element

Project	Total emissions (t CO ₂ -e)			
	Scope 1	Scope 2	Scope 3	Total
Transmission lines	71,724	-	305,454	377,179
Tragowel Terminal Station	22,136	-	121,523	143,659
Bulgana Reactor Station	21,803	-	9,640	31,443
Total	115,663	-	436,617	552,280

Details on the total emissions and assumptions relevant to each emissions source are presented in *Technical Appendix H: Greenhouse gas*.

The largest source of construction emissions is Scope 3 embodied emissions from material use, such as concrete, steel and aluminium required to construct the transmission towers, foundations and conductors.

Transport is estimated to be the largest source of Scope 1 emissions for construction. Fuel consumed by vehicles, mobile equipment (e.g. mobile cranes), plant and stationary equipment during construction of the transmission lines, Tragowel Terminal Station and Bulgana Reactor Station are the key contributing activities to GHG emissions during this phase of the Project. Additionally, clearance of vegetation from the construction corridor also contributes to Scope 1 emissions.

Comparison to existing conditions

A comparison of the Project's annual construction Scope 1 and 2 emissions without the implementation of EPRs against Victoria's annual GHG emissions is shown in Table 15-6 below, enabling assessment of these impacts in the context of the targets outlined in the *Climate Change Act 2017*. Given that the construction would take approximately 3 years, the annual unmitigated Scope 1 and 2 emissions from the Project's construction would exceed 25,000 t CO₂-e per year, placing it in the 'moderate' significance rating as shown in Table 15-3.

The construction of the Project would account for approximately 0.05% of Victoria's Scope 1 and 2 emissions in 2023 and less than 0.01% of Australia's emissions in 2023.

Table 15-8 Comparison of the Project's construction GHG emissions to Victoria's annual emissions

Emissions source	Emissions (kt CO ₂ -e)	% of Victoria's annual net emissions total	% of Australia's annual net emissions total
Victoria net emissions 2023	84,200	100%	19%
Australia net emissions 2023	453,400	N/A	100%
Project annual construction emissions (Scope 1 and 2)	39	0.05%	<0.01%

EPRs

To reduce GHG emissions produced during construction, EPRs would be implemented to avoid, minimise and mitigate emissions where possible. EPRs would include minimising embodied and transport emissions of materials, material quality, and local sourcing of workforce and materials (e.g. concrete, aggregates and other construction materials may be sourced locally, referring to Victoria or neighbouring states in the context of the GHG assessment, where practicable), coordinating activities as much as possible, maximising plant and fuel efficiency, and avoiding waste (EPR-GG03). Further detail on these EPRs is presented in Section 15.8.

Residual impact

Residual impacts are those that remain after EPRs are implemented. For this assessment, residual impacts are presented without EPRs. This approach aims to prevent underestimating of residual GHG impacts. If EPRs are implemented, the remaining GHG emissions would likely be lower than initially estimated.

The largest source of construction emissions are Scope 3 embodied emissions from material use (e.g. steel and concrete). Embodied emissions receive a moderate impact rating, as emissions would be greater than 25,000 t CO₂-e per annum based on an approximate 3.5 year construction period. Applying a 25% potential reduction to the estimated embodied emissions, which reflects a typical observed decrease in GHG emissions in infrastructure projects, would reduce emissions but would still receive a moderate impact rating.

Transport is estimated to be the largest source of Scope 1 emissions in construction. Residual Scope 1 emissions would be between 5,000 t CO₂-e and 25,000 t CO₂-e per annum and would receive a minor rating.

Scope 1 emissions from other emission sources, for example, vegetation clearance, would fall below 5,000 t CO₂-e, and hence would receive a negligible rating. Following the application of relevant EPRs, impacts would be minor.

15.7.2 Operational impact assessment

The following section represents the GHG emissions associated with the operation of the Project, assuming no mitigation is applied. For the purpose of this assessment, the operational lifespan for the Project is estimated to be 50–100 years. EPRs are summarised in Section 15.8.

- The total operational Scope 1, 2 and relevant Scope 3 emissions over the expected life of the Project are estimated to be 349,590 t CO₂-e. The total Scope 1 emissions during operation are estimated to be 44,397 t CO₂-e.
- Annual Scope 1, 2 and relevant Scope 3 operation emissions are estimated to be 4,994 t CO₂-e per year. Annual Scope 1 operational emissions are estimated at 444 t CO₂-e per year.
- There are no expected material Scope 2 emissions for the Project.

A summary of the total GHG emissions for the operation of the Project is presented in Table 15-9 and Table 15-10.

Table 15-9 Summary of GHG emissions associated with the operation of the Project

Emissions category	Description	Total emissions (t CO ₂ -e)			
		Scope 1	Scope 2	Scope 3	Total
Transport	The fuel or energy consumed by mobile plant, equipment, or other modes of transport	44,397	-	-	44,397
Embodied emissions	Scope 3 emissions generated and released during the manufacturing and processing of materials	-	-	290,018	290,018
Fugitive	Fugitive emissions related to electricity transmission across the network were determined by multiplying the total mass of stored gas by a 0.001% per year leakage rate while in operation.	-	-	15,175	15,175
Total		44,397	-	305,193	349,590

Table 15-10 Summary of GHG emissions associated with the operation of the Project, by Project element

Project element	Total emissions (t CO ₂ -e)			
	Scope 1	Scope 2	Scope 3	Total
Transmission lines	2,002	-	153,523	155,524
Tragowel Terminal Station	21,207	-	139,390	160,597
Bulgana Reactor Station	21,188	-	12,280	33,468
Total	44,397	-	305,193	349,590

Details on the total emissions and assumptions relevant to each emissions source are presented in *Technical Appendix H: Greenhouse gas*.



Key definition

SF₆ – Sulphur hexafluoride is a colourless, odourless, non-flammable and non-toxic gas. It is one of six GHG emissions that requires reporting under the *National Greenhouse and Energy Reporting Act 2007* (NGER Act).

The majority of the Project's total operation emissions are Scope 3 embodied emissions due to the expected replacement of a significant amount of the installed infrastructure over the Project's lifespan. Additionally, there are estimated to be some Scope 3 fugitive emissions due to annual leakage of stored SF₆ from terminal station and reactor station infrastructure.

The only emissions classified as Scope 1 emissions during operation would be related to transport from survey and monitoring activities and transport emissions related to the expected replacement of a significant amount of the installed infrastructure over the Project's lifespan.

Comparison to existing conditions

A comparison of the Project's annual operation Scope 1 and 2 emissions without the implementation of EPRs and Victoria's annual GHG emissions is shown in Table 15-11 below, enabling assessment of these impacts in the context of the targets outlined in the *Climate Change Act 2017*. Since the annual, unmitigated Scope 1 and Scope 2 emissions from the Project's operation are less than 5,000 t CO₂-e, they would be categorised as negligible.

The Project's estimated Scope 1 and 2 emissions during operation would contribute less than 0.01% of Victoria's annual GHG emissions.

Table 15-11 Comparison of the Project's operation GHG emissions to Victoria's annual emissions

Emissions source	Emissions (kt CO ₂ -e)	% of Victoria's annual net emissions total	% of Australia's annual net emissions total
Victoria net emissions 2023	84,200	100%	19%
Australia net emissions 2023	453,400	N/A	100%
Project annual operation emissions (Scope 1 and 2)	0.4	<0.01%	<0.01%

EPRs

To reduce GHG emissions produced during operation, EPRs would be implemented to avoid, minimise and mitigate emissions where possible. This will include the development of a GHG Management Plan, incorporating GHG emissions considerations into asset management, consideration of certified carbon offsets and conducting monitoring to ensure there is no SF₆ leakage (EPR-GG01). Further detail on these EPRs is presented in Section 15.8.

Residual impact

Residual impacts are those that remain after EPRs are implemented. However, for this assessment, residual impacts are presented without EPRs. This approach aims to prevent underestimating of residual GHG impacts. If EPRs are implemented, the remaining GHG emissions would likely be lower than initially estimated.

Annual emissions during operation would mainly come from replacing assets at the end of their design life, with smaller contributions from vehicles used for inspection and maintenance activities and SF₆ leakage from circuit breakers. Taking a proactive approach to maintaining equipment, managing SF₆, and using low-emission or electric vehicles during inspections and maintenance would offer the best chance of minimising any remaining impacts and contribute to a moderate 25% reduction in operational emissions as part of industry practice emissions reduction. Applying a 25% reduction in operational emissions would reduce emissions, but they would still receive a negligible impact rating.

15.7.3 Decommissioning impact assessment

Decommissioning activities would be conducted in accordance with the relevant legislative requirements, industry standards and best practice relevant at the end point of the infrastructure lifespan and would be managed as part of a Decommissioning Management Plan (refer to *EES Chapter 28: Environmental management framework*).

The following section represents the GHG emissions associated with the decommissioning of the Project, assuming no mitigation is applied. EPRs are summarised in Section 15.8.

- The total decommissioning Scope 1, 2 and relevant Scope 3 emissions are estimated to be 12,241 t CO₂-e. Scope 1 emissions during decommissioning are estimated to be 11,929 t CO₂-e.

A summary of the total GHG emissions for the decommissioning of the Project is presented in Table 15-12. There are no expected material Scope 2 emissions for the Project.

Table 15-12 Summary of GHG emissions associated with the decommissioning of the Project

Emissions category	Description	Total emissions (t CO ₂ -e)			
		Scope 1	Scope 2	Scope 3	Total
Transport	The fuel or energy consumed by mobile plant, equipment, or other modes of transport	11,929	-	312	12,241
Total		11,929	-	312	12,241

Table 15-13 Summary of GHG emissions associated with the decommissioning of the Project-by-Project element

Project element	Total emissions (t CO ₂ -e)			
	Scope 1	Scope 2	Scope 3	Total
Transmission lines	11,607	-	204	11,810
Tragowel Terminal Station	303	-	107	410
Bulgana Reactor Station	20	-	1	21
Total	11,929	-	312	12,241

Transport emissions are the sole source of emissions during the decommissioning phase of the Project. This includes mobile plant and vehicles used in decommissioning activities and transport of materials away from the site to landfill, recycling or re-use. Once waste enters the recycling or landfill facility, it no longer falls under the Project's control.

Comparison to existing conditions

A comparison of the Project's decommissioning Scope 1 and 2 emissions without the implementation of EPRs and Victoria's annual GHG emissions is shown in Table 15-14 below, enabling assessment of these impacts in the context of the targets outlined in the *Climate Change Act 2017*. Since the unmitigated Scope 1 and Scope 2 emissions from the Project's decommissioning phase are between 5,000 t CO₂-e and 25,000 t CO₂-e per year, they would be categorised as minor.

The Project's estimated Scope 1 and 2 emissions during decommissioning would contribute 0.01% of Victoria's annual GHG emissions.

Table 15-14 Comparison of the Project's decommissioning GHG emissions to Victoria's annual emissions

Emissions source	Emissions (kt CO ₂ -e)	% of Victoria's annual net emissions total	% of Australia's annual net emissions total
Victoria net emissions 2023	84,200	100%	19%
Australia net emissions 2023	453,400	N/A	100%
Project total decommissioning emissions (Scope 1 and 2)	12	0.01%	<0.01%

EPRs

To reduce GHG emissions produced during decommissioning, EPRs would be implemented to avoid or minimise emissions where possible. Similar to the construction and operation phases, the selection of plant and equipment for the decommissioning phase would also consider fuel efficiency to reduce the consumption of fossil fuels. Additionally, a waste management plan that considers waste reduction, segregation of waste and disposal of waste to ensure that waste is correctly separated and diverted from landfill where appropriate will be developed (EPR-GG03).

Residual impact

Residual impacts are those that remain after EPRs are implemented. For this assessment, residual impacts are presented without EPRs. This approach aims to prevent underestimating of residual GHG impacts. If EPRs are implemented, the remaining GHG emissions would likely be lower than initially estimated.

Typical EPRs could result in a 25% decrease in emissions, but would still result in a minor rating.

15.7.4 Proposed Easement options

The Project has Proposed Easement options in Tragowel and Teddywaddy. The determining factor in GHG emissions due to a change in easement options is the number of towers required for each Proposed Easement option. As such, the embodied emissions of the towers are the main emissions source that could be affected by a change in easement options. For the purposes of the assessment, it was assumed that no other emissions sources would be significantly impacted by a change in easement options. Given they represent higher embodied emissions, this assessment uses the Tragowel eastern and Teddywaddy western easement options to calculate and report the Project's total GHG emissions. This presents the highest possible emissions estimated within the assessment. A comparison of the embodied emissions for each Proposed Easement option is provided in Table 15-15 below.

Table 15-15 Comparison of 500 kV transmission line tower embodied emissions for the easement options

Location	Total emissions (t CO ₂ -e)		
Tragowel	Western option	Eastern option	Reduction
500 kV transmission line embodied emissions	6,323	9,089	-2,766
Teddywaddy	Western option	Eastern option	Reduction
500 kV transmission line embodied emissions	6,022	5,754	-268
Total Project emissions with each option	914,111	911,077	-3,034

By switching from the highest-emitting options to the lowest, the Project has the potential to reduce its emissions by 3,034 t CO₂-e, equivalent to 0.3% of the Project's total emissions. The majority of this difference is in the Tragowel options, with only a minor emissions difference between the Teddywaddy options.

The determining factor in these results is the number of towers required for each Proposed Easement option. For example, for Tragowel, there are 35 towers in the eastern option and 23 towers in the western option, creating a 2,766 t CO₂-e reduction. This results in less concrete used in the foundations and steel in the towers, reducing Scope 3 emissions. The type and size of towers used also impact the number of materials used. Teddywaddy's western and eastern easement options have the same number of towers, yet the western option has twice the number of double-circuit heavy tension towers, which are larger and contribute to a higher emissions footprint.

Easement options that reduce the number or size of towers and their foundations, the length of conductors, and the extent of construction activities should be considered to reduce the Project's total GHG impacts.

15.7.5 Cumulative impact assessment

To understand the cumulative impacts of the Project in line with the EES Scoping Requirements, the Project's emissions are assessed within the broader context of Victoria and national annual emissions (i.e. the existing conditions), and the Victorian and national emission reduction targets set out in the *Climate Change Act 2017* and *Climate Change Act 2022* respectively. This approach acknowledges the global nature of atmospheric GHG contributions and the contribution of other emission sources in Victoria and nationally.

As noted in Section 15.6, the Project's annual Scope 1 and 2 emissions during construction are estimated to contribute approximately 0.05% of Victoria's annual GHG emissions. Operational emissions are estimated to contribute less than 0.01% per year and decommissioning emissions would contribute approximately 0.01%.

This shows that the Project's total impact on existing conditions is minor, with the largest impact during the construction phase. As such, this Project alone would not have a material impact on Victoria's GHG emission reduction targets outlined in the *Climate Change Act 2017*.

While individual projects such as this Project may only contribute minor emissions at the state or national context, the combined effect of multiple projects can be significant, potentially jeopardising Victoria's and Australia's emission reduction targets.

However, there are opportunities for projects in Victoria to set a positive practical example and help drive emissions reductions for Victoria and Australia. These projects can adopt practical EPRs, such as those described in Section 15.8. By embedding these practices from the outset, this and other similar projects can not only reduce their own emissions but also influence industry practice to support state and national emissions reduction targets.

In addition, the Project proposes to boost renewable energy uptake by improving the connectivity of renewable sources in Western Victoria to the wider electricity grid. This aligns with the requirements of the Victorian *Climate Change Act 2017* and Australian *Climate Change Act 2022* targets.

15.8 EPRs, monitoring and contingency measures

15.8.1 EPRs

Table 15-16 outlines the EPRs developed to avoid and minimise potential impacts during construction, operation and decommissioning of the Project.

Key recommended opportunities to mitigate GHG emissions from this Project are listed below with an indicator of the potential impact. These opportunities would be evaluated during the detailed design of the Project to determine if they are practical for incorporation:

- Concrete: Use of low-carbon concrete for foundations and footings.
 - Low-carbon concrete could reduce emissions from this source by up to 45%. Low-carbon concrete is widely available in Australia and can be used in the energy sector when longer curing times are scheduled, sometimes at no price premium.
- Steel: Use of low-carbon steel. The assessment assumes structural steel for towers sourced from China.
 - Low-carbon steel could reduce emissions from this source by up to 43%. Lower carbon steel than assumed for this assessment is available in Australia.

- Fuel efficiencies: Implementing measures to reduce the liquid fuel requirements for vehicles, plant and equipment (focusing on the fuel efficiency of vehicles, plant and equipment, and a training, monitoring and reduction plan to reduce wasteful fuel consumption).
 - Mitigating on-site construction fuel through training alone could reduce emissions from this source by 7–8.5%
- Asset replacement: Designing to reduce the need or frequency of asset replacement during the Project lifetime. Particularly for the towers, conductors and station equipment.
 - Extending the asset life of conductors and primary station equipment to cover the whole Project life could mitigate the majority of the emissions related to replacement of assets.
- Easement options: Consideration of the Teddywaddy and Tragowel Proposed Easement options to reduce the Project's total GHG impacts.
 - Given that they represent higher embodied emissions, this assessment uses the Tragowel eastern and Teddywaddy western easement options to calculate and report the Project's total GHG emissions.
 - By switching from the highest emitting options to the lowest, the Project has the potential to reduce its emissions by 3,034 t CO₂-e.

Table 15-16 EPRs relevant to the Greenhouse Gas Assessment

EPR ID	EPRs	Project phase
GG01	Greenhouse Gas Management Plan (GHGMP) VicGrid VNI West will develop and implement a GHGMP for the Project to provide a framework for identifying, reducing, monitoring and managing greenhouse gas emissions across the Project lifecycle. The GHGMP will: • Provide a clear framework for identifying, reducing, monitoring, reporting and managing emissions across the Project lifecycle, particularly during design and procurement • Embed greenhouse gas emissions considerations into design and delivery • Include emission reduction targets • Identify roles, responsibilities, reporting requirements and review processes for greenhouse gas management • Document how design, procurement, construction, operation and decommissioning greenhouse gas reduction measures required under GG02 and GG03 will be implemented, monitored and reported • Set out the process by which the purchasing of certified carbon offsets to compensate for emissions during construction and operation will be achieved following the application of the design and operational greenhouse gas reduction requirements set out in GG02 and GG03.	Design Construction Operation Decommissioning

EPR ID	EPRs	Project phase
	Offsets will only be used as a last resort for residual emissions that cannot reasonably be avoided or minimised. Any offsets purchased for the Project will be certified carbon offsets aligned with recognised offset standards.	
GG02	Environmentally Sustainable Design During the design phase, VicGrid VNI West will integrate sustainable design practices into the design process to minimise, to the extent practicable, greenhouse gas emissions arising from the construction, operation and decommissioning of the Project. These practices will consider: • Choice of easement options such that where options exist for the easement alignment, ensure that the potential GHG emissions of each option are considered in the decision-making process, together with other relevant factors. • The use of low embodied carbon materials and locally sourced materials, where practicable. • The criteria for the minimum proportion of supplementary cementitious material content which will be used in concrete. • The use of recycled steel, and recycled aggregates. • The location from which materials are being sourced in order to minimise associated transport emissions. • Use of low maintenance and durable materials where practicable to avoid unnecessary replacement. • Sustainable procurement and resource management practices, in accordance with <i>ISO 20400:2017 Sustainable procurement</i>, to avoid the inefficient use of materials, fossil fuels and electricity. • Energy efficiency performance standards for the tendering of works associated with plant and equipment. • Design refinement which will reduce the total quantum of materials and incorporate reuse of materials during construction and operation of the Project • Opportunities to align sustainable design and procurement outcomes with relevant business, local procurement and social procurement EPRs. The Greenhouse Gas Management Plan required under GG01 will document how these sustainable design practices have been considered and implemented, including relevant design decisions, procurement criteria, emissions reduction opportunities, reasons where opportunities are not adopted, and reporting requirements.	Design
GG03	Reduction of greenhouse gas emissions during construction, operation and decommissioning	Construction Operation Decommissioning

EPR ID	EPRs	Project phase
	The Principal Contractor, TNSP and Principal Contractor for decommissioning will minimise greenhouse gas emissions during construction, operation and decommissioning to the extent practicable, in accordance with the GHGMP. This will include, where practicable: • Inspecting the quality of key materials before supplying them to site to avoid additional transport and handling of materials. • The use of locally sourced plant and equipment (i.e. within Victoria) where practicable to reduce transport-related emissions associated with transport. • Include sourcing of local plant and equipment where practicable in the selection criteria for tendering of works associated with plant and equipment. • Coordinating construction activities, where practicable, to reduce unnecessarily extending the construction period and to avoid inefficient use of equipment. • Engaging local workforce, where practicable and minimising interstate and international travel. • Completing a transport plan to detail how fuel emissions from employee transport will be minimised. This will include a training program to upskill the local workforce. • Selecting plant and equipment with regard to fuel efficiency to reduce the consumption of fossil fuels, including the use of electric vehicles, where practicable. • Developing a waste management plan, in accordance with GS06 that considers waste reduction, segregation of waste, and disposal of waste to ensure that waste is correctly separated and diverted from landfill where appropriate. • Implementing safety controls and emergency management practices in the case of unplanned activities, incidents and emergencies to minimise the release of fugitive GHG emissions. • Procedures to reduce GHG emissions as a result of asset management through the incorporation new technologies, reducing replacement through maintenance, and utilising future lower-emission materials and construction methods for maintenance and replacement • Recording and reporting implementation of greenhouse gas reduction measures in accordance with the Greenhouse Gas Management Plan • Identifying opportunities to align construction, operation and decommissioning emission reduction measures with relevant business, local procurement and social procurement EPRs.	

15.8.2 Monitoring and contingency measures

The monitoring measures relevant to GHG are listed in Table 15-17.

Table 15-17 Monitoring measures relevant to the Greenhouse Gas Assessment

Relevant EPR	Monitoring	Location	Frequency	Project phase	Assigned responsibility
GG01	Monitor progress against greenhouse gas reduction targets and implementation of the GHGMP	Project-wide	Periodic, as specified in the GHGMP	Design Construction Operation Decommissioning	VicGrid VNI West Principal Contractor TNSP Principal Contractor for decommissioning
GG03	Monitor SF ₆ leakage and maintenance performance of relevant equipment during operation	Relevant operational electrical equipment	Routine, in accordance with maintenance schedule and leak detection requirements	Operation	TNSP

15.8.3 Offsetting emissions

Where residual impacts remain after the implementation of the EPRs described in Section 15.8, the Project will consider purchasing certified carbon offset units to compensate for residual emissions produced during construction and annual emissions produced during the operation of the Project. Note that offsets would only be considered for Project emissions after measures that aim to avoid or minimise emissions have been adopted. A GHG Management Plan will be developed and implemented for the Project, which will set out the process by which purchasing of certified carbon offsets will be achieved to compensate for residual GHG emissions due to construction and operation (EPR-GG01).



Key definition

Carbon neutrality – Balancing the amount of carbon dioxide released into the atmosphere with an equivalent amount removed or offset, resulting in a net-zero carbon footprint.

The National Carbon Offset Standards and Carbon Neutral Program was launched by the Australian Government in 2010 and rebranded under the Climate Active name in 2019. The standard(s) provide a credible framework for managing emissions and achieving carbon neutrality.

The Climate Active Standard(s) provide a list of eligible offset units that have been assessed using a decision framework based on offset integrity principles outlined in the standard(s). These principles are designed to ensure that eligible offset units represent genuine and credible emission reductions.

Eligible offset options include:

- Australian Carbon Credit Units issued by the Clean Energy Regulator
- Certified Emissions Reductions under the Kyoto Protocol's Clean Development Mechanism
- Verified Emissions Reductions issued by the Gold Standard
- Verified Carbon Units issued by the Verified Carbon Standard
- GreenPower®

15.9 Conclusion

The purpose of this chapter was to identify and assess the GHG emissions associated with the construction, operation and decommissioning of the Project to inform the preparation of the EES, and the implications of these emissions in the context of the targets outlined in the *Climate Change Act 2017*. The scope of the GHG emissions assessment for the Project's construction, operation and decommissioning activities includes all direct (Scope 1) and indirect (Scope 2 and relevant Scope 3) emissions which the proponent can control.

Impacts were assessed in the context of Victorian and Australian annual emissions and in regard to the targets outlined in the *Climate Change Act 2017* and *Climate Change Act 2022*. EPRs have been proposed to reduce the Project's GHG emissions impacts, with residual emissions assessed following their application.

Estimated GHG emissions for the Project

The total emissions (Scope 1, 2, and relevant Scope 3) for the Project are estimated to be 914,111 t CO₂-e. The largest source of emissions is from the Scope 3 embodied emissions of the materials used during the construction phase and for asset replacement throughout the Project's lifetime.

Total Scope 1 emissions are estimated to be 171,990 t CO₂-e. The majority of these emissions originate from the use of fuel by vehicles and equipment used for construction and transportation. There are no expected material Scope 2 emissions for the Project.

Impact rating and residual impacts

Residual impacts are those that remain after EPRs are implemented. For this assessment, residual impacts are presented without EPRs. This approach aims to prevent underestimating of residual GHG impacts. If EPRs are implemented, the remaining GHG emissions would likely be lower than initially estimated.

- The annual, unmitigated Scope 1 and Scope 2 emissions from the Project's construction would exceed 25,000 t CO₂-e per year, placing it in the moderate impact significance rating.
- The annual, unmitigated Scope 1 and Scope 2 emissions from the Project's operation would be less than 5,000 t CO₂-e, placing it in the negligible impact significance rating.
- The annual, unmitigated Scope 1 and Scope 2 emissions from the Project's decommissioning phase would be between 5,000 t CO₂-e and 25,000 t CO₂-e per year, placing it in the minor impact significance rating.

Typical EPRs could result in a 25% decrease in emissions and would reduce the impact but still result in the impact ratings outlined above.

GHG emissions impact in relation to existing conditions and emission reduction targets

The Project's total impact on existing conditions is expected to be minor, with the largest impact occurring during the construction phase, with annual construction emissions representing 0.05% of Victoria's annual emissions. As such, this Project alone would not have a material impact on Victoria's GHG emission reduction targets outlined in the *Climate Change Act 2017*.

Key opportunities to mitigate GHG emissions from this Project are:

- Asset replacement: Designing to reduce the need or frequency of asset replacement during the Project lifetime. Particularly for the towers, conductors, and station equipment.

- Fuel efficiencies: Implementing measures to reduce the liquid fuel requirements for vehicles, plant and equipment (focusing on the fuel efficiency of vehicles, plant, and equipment, and a training, monitoring and reduction plan to reduce wasteful fuel consumption).
- Concrete: Use of low-carbon concrete for foundations and footings.
- Steel: Use of lower carbon steel. The assessment assumes that structural steel for towers is purchased from China. China is a common source of structural steel and is assumed to be representative of the source that may be used in construction. Lower carbon steel than assumed for this assessment is available in Australia.
- Proposed Easement option selection: The Tragowel western and Teddywaddy eastern easement options represent the lowest GHG emissions options.

These EPRs are expected to provide a significant and achievable reduction in the Project's GHG impact if implemented effectively. The Project would utilise the mitigation hierarchy to first avoid and then minimise emissions produced during construction, operation, and decommissioning, before considering offsets for residual emissions. Given the ongoing impacts of climate, all practicable opportunities to reduce emissions should be considered.



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