



Greenhouse Gas Assessment Report

Burrup Common User Transmission Infrastructure

4/11/2022



Executive Summary

Horizon Power is proposing to expand the North West Interconnected System (NWIS) electricity network, by constructing an approximately 7 kilometre (km) long 132 kilovolt (kV) overhead transmission line between the Dampier substation and the Burrup Strategic Industrial Area (SIA) (the Proposal). The Burrup SIA is not currently connected via transmission infrastructure to the NWIS.

The Proposal will provide common user transmission infrastructure, owned and operated by Horizon Power. As a result, the Proposal will also provide opportunities for tenants on the Burrup to access the higher efficiency generation portfolio, including proposed renewable energy resources available on the NWIS. The Proposal is considered the first step to providing enabling infrastructure to the Burrup SIA to support the transition towards State and Federal Government emission reduction targets. The Project is located in Murujuga (Burrup Peninsula) in Western Australia (WA). The location of the Proposal is approximately 1.5 km east of the Dampier township.

Horizon Power is referring the Proposal to the Western Australia (WA) Environmental Protection Authority (EPA) under Part IV (Section 38 [s38]) of the *Environmental Protection Act 1986* (EP Act), as the Proposal has the potential to have a significant impact on the environment.

The purpose of this report is to provide an estimate of scope 1, scope 2, and scope 3 GHG emissions resulting from the construction and operation (including maintenance) of the proposal. The estimated GHG emissions can also be used to assess the requirement for the development of a GHG management plan (GHGMP), as per the GHG Factor Guideline (EPA 2020). The emissions threshold for the requirement to prepare a GHGMP is currently set at 100,000 tons of operational carbon dioxide equivalent (t CO₂-e) emissions per annum under the EP Act.

The GHG emissions assessment includes estimates for scope 1, scope 2 and scope 3 emissions attributed to the construction and operation of the GSE, using the Transport Authorities Greenhouse Gas Group (TAGG) Carbon Gauge Tool (CGT) and custom GHG tools/models respectively. GHG emissions estimates relating to the decommissioning of the GSE were not within the scope of the GHG emissions assessment, as this rarely occurs for roads.

The proposal construction is expected to last 18 months, with total emission of **3,716 t CO₂-e** while annual operational (including maintenance) GHG emission was estimated to be **1,659t CO₂-e**.

Scope	Activity	Emissions [t CO ₂ -e]
Construction		
Scope 1	Diesel – Transport/stationary & lost carbon sink due to vegetation clearing	1,572
Scope 2	Not applicable	-
Scope 3	Fuel/Energy Related Activities, employee travel & construction materials embodied emissions	2,144
Total		3,716
Operation (annual GHG emissions)		
Scope 1	Diesel – Transport/Stationary, Petroleum based oils & synthetic GHG's	36



Scope	Activity	Emissions [t CO ₂ -e]
Scope 2	Transmission & distribution losses	1,595
Scope 3	Fuel/Energy Related Activities & Material Use	28
Total		1,659

These GHG emissions estimates place the proposal significantly below the 100,000 t CO₂-e per year threshold in terms of estimated total GHG emissions.

Acronyms

Acronym	Definition
ABS	Australian Bureau of Statistics
ATAP	Australian Transport Assessment and Planning
AR5	IPCC Fifth Assessment Report
CGT	Carbon Gauge Tool
CO ₂	Carbon Dioxide
CH ₄	Methane
DISER	Department of Industry, Science, Energy and Resources
DIRD	Department of Infrastructure and Regional Development
e.g.,	Example
EPA	Environmental Protection Authority
EP Act	<i>Environment Protection Act 1986</i>
GHG	Greenhouse Gas(es)
GHGMP	Greenhouse Gas Management Plan
GWP	Global Warming Potential
ha	Hectare
HFCs	Hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
kg	Kilogram
kL	Kilolitre
km	Kilometre
LV	Light Vehicle
kWh	Kilowatt per hour
NGA Factors	Australian National Greenhouse Accounts Factors 2021
N ₂ O	Nitrogen Dioxide
PBO	Petroleum based oil
PFCs	Perfluorocarbons
SF ₆	Sulphur Hexafluoride
TAGG	Transport Authorities Greenhouse Group
T CO ₂ -e	tonne of Carbon Dioxide equivalent
ULP	Unleaded Petrol
WA	Western Australia
%	Percentage

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1. Introduction

1.1 Background

Horizon Power is proposing to expand the North West Interconnected System (NWIS) electricity network, by constructing an approximately 7 kilometre (km) long 132 kilovolt (kV) overhead transmission line between the Dampier substation and the Burrup Strategic Industrial Area (SIA) (the Proposal). The Burrup SIA is not currently connected via transmission infrastructure to the NWIS.

The Proposal will provide common user transmission infrastructure, owned and operated by Horizon Power. As a result, the Proposal will also provide opportunities for tenants on the Burrup to access the higher efficiency generation portfolio, including proposed renewable energy resources available on the NWIS. The Proposal is considered the first step to providing enabling infrastructure to the Burrup SIA to support the transition towards State and Federal Government emission reduction targets.

The Project is located in Murujuga (Burrup Peninsula), in Western Australia (WA). The location of the Proposal is approximately 1.5 km east of the Dampier township. The project development envelope and proposed footprint is shown in Figure 1.

The Proposal includes:

- Construction, installation and operation of an approximate 7 km long, 132 kV single steel pole overhead transmission line
- 36 poles (base-case) with 40 m x 20 m pole pads along the transmission line route
- Construction and operation of the Burrup substation
- Cleared, unsealed access track along the route
- Construction and installation of associated electrical infrastructure such as ring main units and transformers.

Under section 15 of the EP Act, the EPA has the objective to use its best endeavours to protect the environment and to prevent, control and abate pollution and environmental harm. If the EPA assesses a proposal, section 44(1) of the EP Act requires the EPA to prepare a report on the outcome of its assessment of the proposal and give that report to the Minister for the Environment. Section 44(2) establishes that the report must set out what the EPA considers to be the key environmental factors identified during the assessment. The EPA has fourteen (14) environmental factors, organised into five themes: Sea, Land, Water, Air and People.

The EPA has identified an environmental objective for each environmental factor and has regard to these objectives when determining whether the environmental impact of a proposal or scheme may be significant. The environmental objectives are aimed towards ensuring the objects and principles of the EP Act are achieved.

1.1.1 Project Elements

A list of the identified elements of the proposal and the phases in which they occur are provided in Table 1.

Table 1 Identified project elements and phases

Project Element	Project Phase
Vegetation clearing	Construction
Vehicles and equipment (including stationary)	Construction & Operation/Maintenance
Transmission line	Construction & Operation/Maintenance
Substations	Construction & Operation/Maintenance
Access tracks	Construction & Operation/Maintenance
Earthworks (cut to fill, imported fill)	Construction

Project Element	Project Phase
Transmission and Distribution	Operation

1.2 Purpose of this report

The purpose of this report is to provide an estimate of scope 1, scope 2, and scope 3 GHG emissions resulting from the construction and operation (including maintenance) of the proposal.

The estimated GHG emissions can be used to assess the requirement for the development of a GHGMP, as per the *Environmental Factor Guideline Greenhouse Gas Emissions* (GHG Factor Guideline). The emissions threshold for the requirement to prepare a GHGMP is currently set at 100,000 t CO₂-e per annum under the EP Act.

An understanding of associated operational GHG emissions is also critical in enabling the Horizon Power to assess its operational climate related impacts and direct progress toward reducing their carbon footprint.

1.3 Scope of this report

The GHG emissions assessment includes estimates for scope 1, scope 2 and scope 3 emissions attributed to the construction and operation (including maintenance) of the proposal. For the operation elements, scope 2 and 3 emissions have been modelled showing annual predicted emissions.

The estimates include GHG emissions related to both direct (scope 1) and indirect (scope 2 and scope 3) emissions as defined in Table 2.

Table 2 GHG emissions scope definitions

Principle	Description
Scope 1	Direct emissions from owned or controlled sources resulting from the combustion/consumption of fuels (e.g., combustion of diesel in engines, transmission losses, use of synthetic gasses)
Scope 2	Indirect emissions from the generation of purchased energy (e.g., purchased electricity)
Scope 3	All indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions (e.g., purchase of goods and services)

Activities and potential emissions sources which have not been included in the emissions assessment have been detailed in section **Error! Reference source not found.**



Figure 1 Proposal Development Envelope and Footprint

2. Carbon Accounting and Reporting

Carbon accounting is the process of identifying and measuring the amount of GHG, measured in t CO₂-e, emitted by an entity or project. Carbon reporting is the process of reporting on that accounting.

2.1.1 GHG emissions

The carbon account is inclusive of the following GHG emissions covered by the United Nations Framework Convention on Climate Change (UNFCCC) Reporting Guidelines and in line with the GHG Factor Guideline:

- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous dioxide (N₂O)
- Sulphur hexafluoride (SF₆)
- Perfluorocarbons (PFCs)
- Hydrofluorocarbons (HFCs)

While all the above-mentioned GHG's have been considered, GHG's relating to infrastructure developments are primarily limited to CO₂, CH₄ and N₂O.

2.1.2 Scopes of GHG emissions

The GHG Protocol defines three (3) scopes of emissions to ensure that single emission sources are not counted twice within the supply chain. Scope 1 and 2 emissions are required to be included in recognised GHG inventory reporting schemes and these emissions therefore should be included within any GHG assessment.

Scope 3 emissions are typically considered optional in most compliance reporting schemes. However, it is recognised that the inclusion of scope 3 emissions provides a more holistic view of a project's environmental impact. They also provide an opportunity to be innovative in GHG emissions management.

Figure 2 provides an overview of the relationship between the scopes and the activities that generate direct and indirect emissions along an entity's and/or projects value chain.

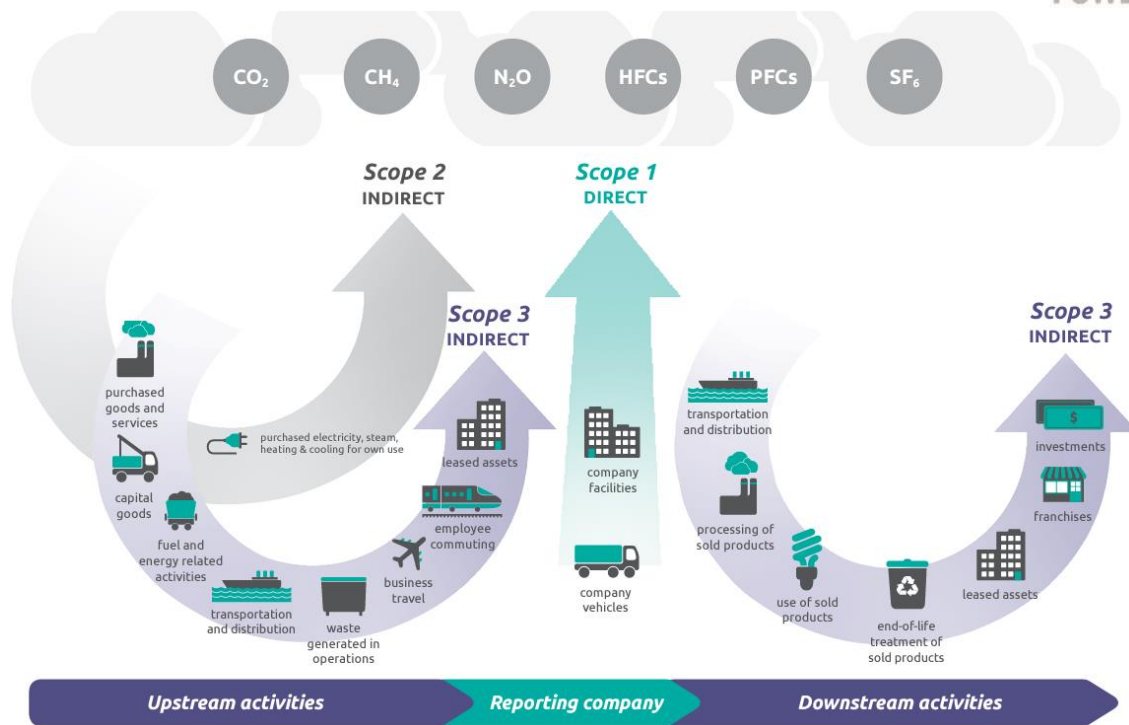


Figure 2 Overview of scopes and emissions across a value chain¹

2.1.3 GHG Assessment Boundaries

In estimating GHG emissions for the proposal, the assessment boundary has been considered to include all the emission sources that were deemed to potentially be impacted by decisions made by designers, constructors, managers, operators of the transmission line and associated infrastructure.

The identified project elements and phases which have been included in the assessment boundary are listed in Table 1.

2.1.4 Materiality

Materiality is a measure of the perceived effect that the inclusion or exclusion of an emission source or activity may have on the accuracy or validity of a GHG emission assessment. Different standards stipulate different definitions and thresholds for materiality. An organisation can determine materiality themselves, but if reporting under a specific scheme, then materiality is determined by the scheme's requirements and standards.

For the purposes of this GHG assessment all activities and project elements where data was available have been estimated. The activities and projects elements captured likely represent the most emissions intensive over the construction and operation phases.

2.2 Policy and Reference Documents

The following documents have been used for the purposes of defining appropriate methods for quantification of emissions from individual sources:

- TAGG Greenhouse Gas Assessment Workbook for Road Projects (2013)
- TAGG Supporting Document for Greenhouse Gas Assessment Workbook for Road Projects (2013)

¹ Source: <https://ghgprotocol.org/standards/scope-3-standard>

- Australian National Greenhouse Accounts (NGA) Factors 2021
- Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (GHG Protocol)
- Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard

3. Methodology

The calculation methodologies used to estimate the GHG emissions attributable to the construction, operation, and maintenance of the proposal are in alignment with GHG Protocol Corporate Accounting and Reporting Standard (GHG Protocol) and have been based on the principles outlined in Table 3.

Table 3 GHG accounting and reporting principles

Principle	Description
Relevance	Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of internal and external stakeholders
Completeness	Account for and report on all GHG emission sources and activities within the chosen inventory boundary, disclosing and justifying any specific exclusions from the emissions assessment
Consistency	Use consistent methodologies to allow for meaningful comparisons of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors
Transparency	Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used
Accuracy	Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information

Emissions estimated are represented in CO₂e using current global warming potential (GWP). The GWPs from the IPCC Fifth Assessment Report (AR5) have been used in this assessment and are listed in Table 4.

Table 4 Greenhouse gases and 100-year global warming potentials

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO ₂)	1
Methane (CH ₄)	28
Nitrous Oxide (N ₂ O)	265

The scope 1, scope 2, and scope 3 emission factors used in the estimation of GHG emissions have been taken from the National Greenhouse Accounts (NGA) Factors 2021.

3.1 Carbon Gauge Tool

The TAGG CGT provides the means for estimating GHG emissions for all activities and sources that are found to contribute significantly to the overall emissions arising from a project. Default assumptions are built into the CGT tool, which have been checked against the information collected to ensure they are relevant and representative.

The TAGG CGT has been used to determine the emissions associated with construction vegetation clearing, specifically the lost carbon sink associated with the removal of vegetation.

3.2 Custom Energy and Emissions Tool

A custom emissions estimation tool has been developed to calculate construction and operational emissions including maintenance activities over the life of the project. This methodology was selected to provide as accurate as possible estimates, taking into consideration the limitations of the CGT with regards to these aspects.

3.3 Assumptions

The assumptions used in the GHG emissions assessment are presented in Table 5. These assumptions have been developed from information available, default Carbon Gauge Tool assumptions and previous project experience.

Table 5 Assumptions used in the estimation of GHG emissions

Activity	Assumption
Vegetation clearing (construction)	<ul style="list-style-type: none"> – Vegetation removal will be conducted using conventional plant (i.e., graders and dozers) – Class 1 equivalent to 0-50 t dry matter/ha – The vegetation types selected were based on the ecological survey undertaken for the PDE. – The vegetation types identified were apportioned to the clearing area based on their occurrence within the PDE in its entirety (e.g., 10% of PDE vegetation identified as vegetation class D would result in 10% of cleared area assumed to be of vegetation class D)
Construction materials	<ul style="list-style-type: none"> – Construction material data was collected for steel, concrete and plastic and was estimated by Horizon Power based on similar project experience and dimensions – Estimated emissions are based on cradle-to-gate embodied emissions
Liquid fuel – transport & stationary (construction)	<ul style="list-style-type: none"> – Fuel consumption was estimated by Horizon Power based on similar project experience and dimensions – All construction related liquid fuel emissions were assumed to be from the consumption of diesel
Employee transport to site	<ul style="list-style-type: none"> – Emissions have been estimated on the most emissions intensive scenario of Fly in Fly out (FIFO). Assuming 2 flights from Perth to Karratha (1,247km one-way) occurring per month for the duration of the construction period – Employee workforce has been estimated at 52 for the entire duration of the construction period – Short-haul average passenger emissions factor (person.km) has been applied to estimate emissions
Liquid fuel – transport & stationary (operation and maintenance)	<ul style="list-style-type: none"> – Liquid fuel emissions have been based on vehicle/equipment type, fuel efficiency of each vehicle (0.124 L/km for mobile and 16.8 L/hr for stationary), hours of operation (8 hr per day) and estimated average vehicle speed (100km/hr) – Inspection frequency has been used to estimate the duration of vehicle/equipment use – Data based on Horizon Power estimates for vehicles used in inspections (4x4 for mobile and elevated work platform for stationary). – All operation (incl. maintenance) related liquid fuel emissions were assumed to be from the consumption of diesel
Transmission and distribution	<ul style="list-style-type: none"> – Transmission estimates have been based on design specifics for line losses (1% for line loss) – Other total losses (e.g., transformer losses etc.) are assumed to be equal to the line losses plus 25% contingency to account for any variation. – Transmission has been based on solar PV capacity of 25% for maximum generation of approximately 110GWh per annum. – Factors for electricity consumption based on National Greenhouse Accounts Factors 2021 for the NWIS – Although the electricity generation figure adopted is 100% renewable based, the NWIS factor has been adopted for the loss estimates as the transmission line will form part of the NWIS transmission network.
PBO consumption (operation)	<ul style="list-style-type: none"> – PBO consumption was estimated by Horizon Power based on similar project experience and project specific equipment capacities
Synthetic GHG	<ul style="list-style-type: none"> – Synthetic GHG (SF6) consumption was estimated by Horizon Power based on similar project experience and project specific equipment capacities

4. Greenhouse Gas Emissions Inventory

The GHG emission inventory included construction and operation activities, including maintenance works, to provide an overview of the impact of the proposal during its full life cycle. While majority of emissions are concentrated to the construction phase, the footprint of asset use, namely transmission of electricity, is insurmountable in comparison.

4.1 Construction

Emissions associated with construction have been broken down by various construction activities. The estimates have been based on 18 months of construction activities.

Table 6 Construction emissions breakdown by activity

Activity	Scope 1	Scope 2	Scope 3	Total [t CO ₂ -e]
Construction material	-	-	1,772	1,772
Liquid fuel (diesel) consumption	265	-	14	279
Vegetation clearing - lost sink	1,307	-	-	1,307
Employee travel to site	-	-	358	358
Total	1,572	-	2,144	3,716

Total GHG emission from construction for the proposal have been estimated to be **3,176 t CO₂-e**, with approximately 48% of total emissions being attributed to embodied emission in construction materials. Lost carbon sink from vegetation clearing and fuel consumption contributed to approximately 43% combined, with vegetation clearing accounting for an estimated 35% of the total construction related GHG emissions.

Table 6 and Figure 3 contain the construction emissions sources broken down by activity and emissions scope.

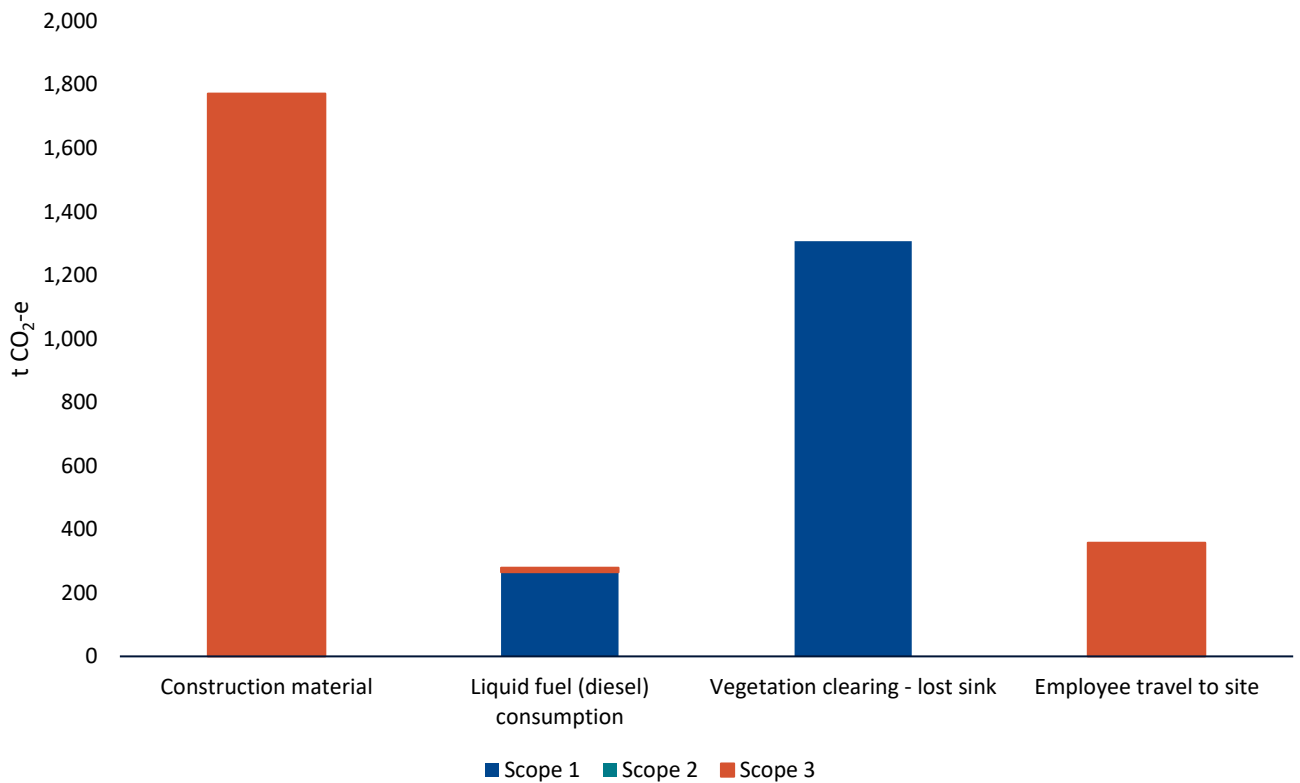


Figure 3 Construction emissions breakdown by activity

The overall construction emissions by emissions source are displayed in Table 7 and Figure 4.

Table 7 Construction emissions breakdown by emission source

Source	Scope 1	Scope 2	Scope 3	Total [t CO ₂ -e]
Steel	-	-	1,590	1,590
Concrete	-	-	66	66
Plastic	-	-	116	116
Mobile diesel	224	-	12	236
Stationary diesel	41	-	2	43
Vegetation clearing - lost sink	1,307	-	-	1,307
Employee travel to site	-	-	358	358
Total	1,572	-	2,144	3,716

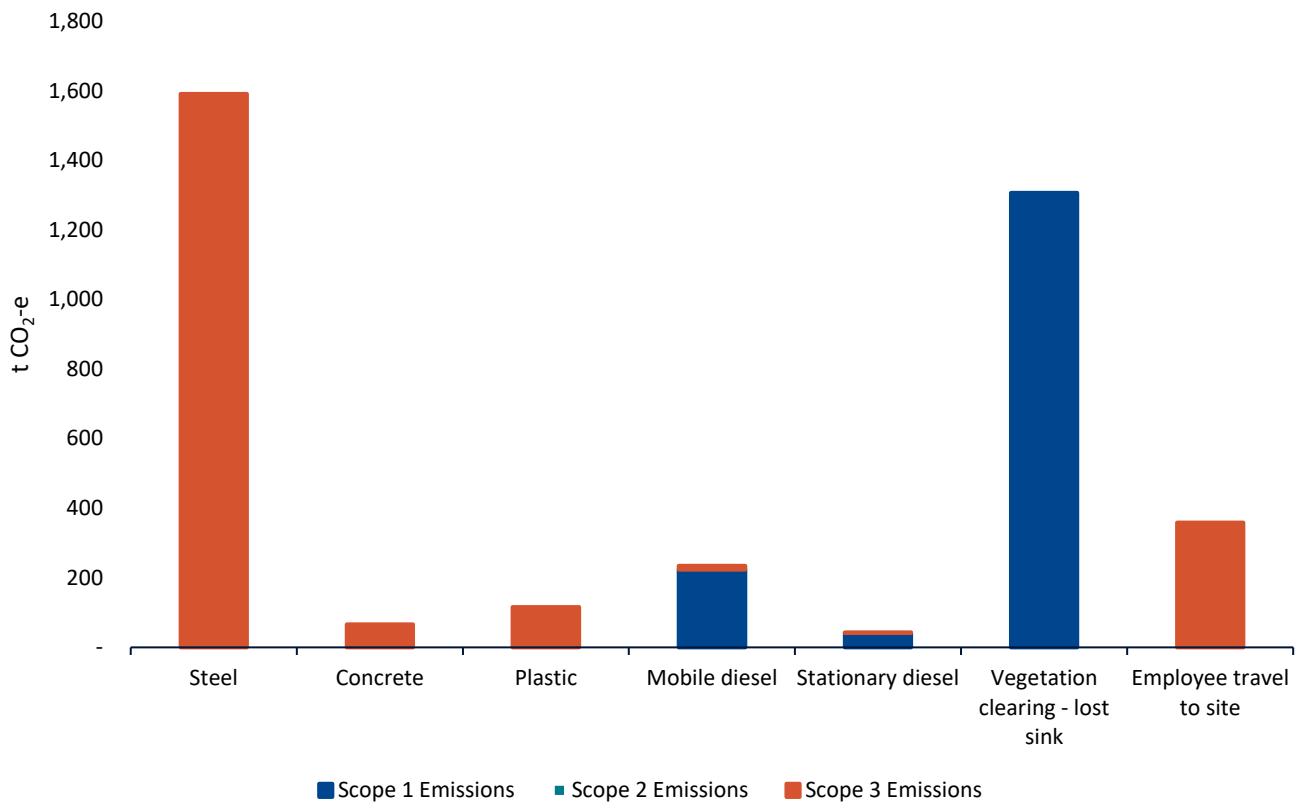


Figure 4 Construction emissions breakdown by emissions source

4.2 Operation

Total GHG emission from operation and maintenance for the proposal have been estimated to be **1,659 t CO₂-e**, with approximately 98% of total emissions being attributed to transmission and distribution losses. Annual emissions associated with operation, including maintenance, have been summarised by source and the annual totals presented in Table 8.

For operational transmission and distribution emissions, an annual maximum transmission figure has been adopted to provide worst case scenario for electricity transmission. The transmission figure has been based on the assumed production capacity of the power station and the NWIS grid emission factor applied to the estimated annual losses. This approach has been taken as the common user transmission infrastructure will form part of the NWIS once operational.

Table 8 Annual operation emissions breakdown by source

Source	Scope 1	Scope 2	Scope 3	Total tCO ₂ -e
Transmission losses	-	1,595	28	1,623
Mobile diesel	5	-	0	6
Stationary diesel	3	-	0	3
Synthetic GHG	27	-	-	27
PBOG	1	-	0	1
Total	36	1,595	28	1,659

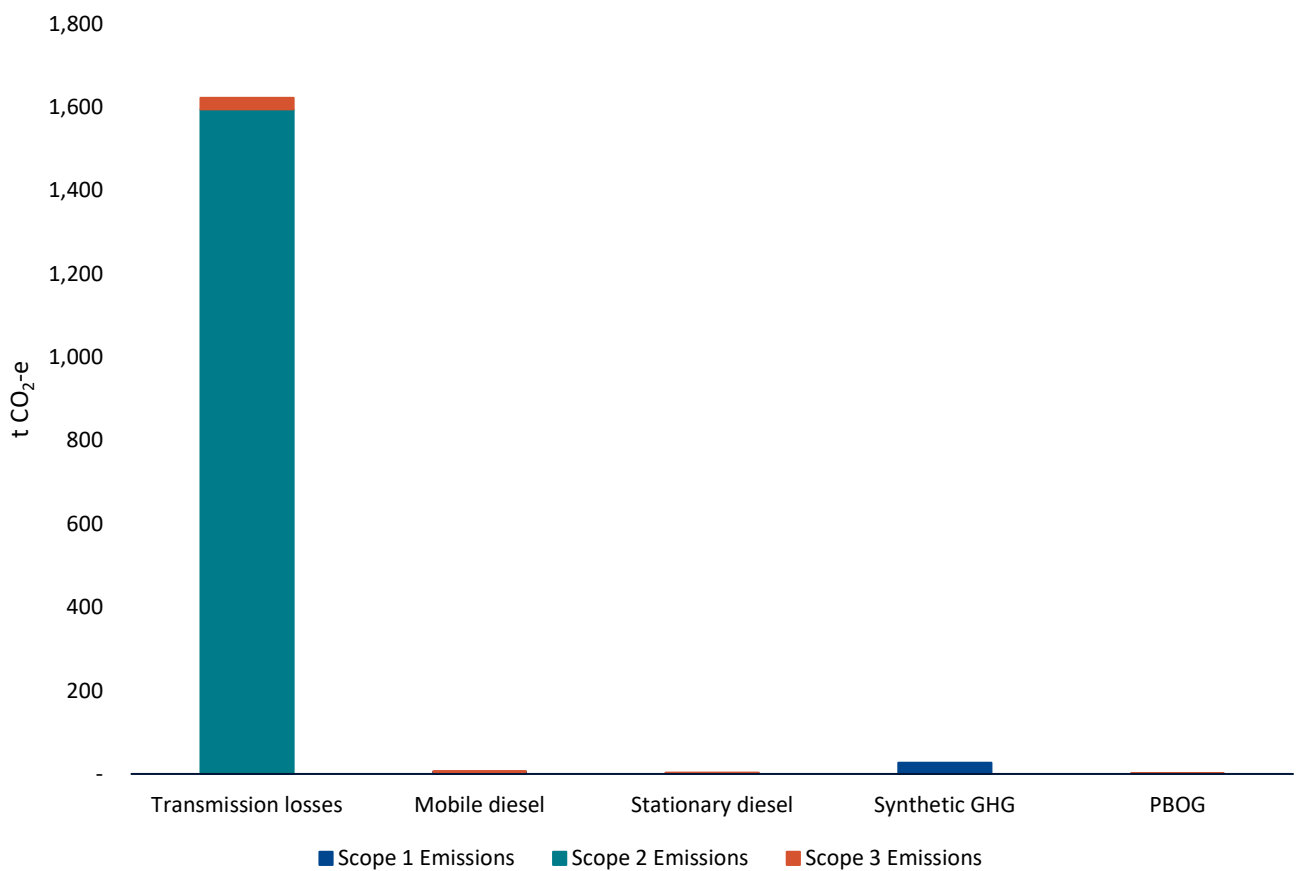


Figure 5 Annual operation emissions breakdown by source

Total worst-case annual GHG emission from operational activities relating to the proposal have been estimated to be **1,659 tCO₂-e**, with approximately 98% of total operational emissions being attributed to transmission and distribution losses.

5. Discussion and Conclusion

The proposal for the 132 kV overhead transmission line between the Dampier Substation and the proposed Burrup Substation project requires a GHG emissions assessment to support a referral to the Environmental Protection Authority (EPA) under section 38 (s38) of the EP Act. The GHG emissions assessment has been undertaken using the TAGG CGT and custom GHG tools to assess emissions associated with construction and operation, including maintenance aspects.

The proposal construction is expected to last 18 months with total emissions of **3,716 t CO₂-e** while annual operational (including maintenance) GHG emissions have been estimated to be **1,659 t CO₂-e**. Embodied emissions in construction material and lost carbon sink from vegetation clearing, were the biggest emission source during construction phase with a combined total of **3,079 t CO₂-e** (83%) of total emissions, while approximately 98% of total annual operational emissions was associated with transmission and distribution with **1,623 t CO₂-e**.

Scope 1 emissions were attributed to approximately 7% of total construction emissions while scope 3 contributed the remainder. Operational scope 1 and 2 emissions consisted of approximately 98% of total emissions, whereas scope 3 accounted for the remaining 2% of operational emissions.

The estimated operational GHG emissions place the 132 kV overhead transmission line between the Dampier Substation and the proposed Burrup Substation project significantly below the 100,000 t CO₂-e per year threshold. Therefore, it is not anticipated that a GHGMP will be required under the EPA referral conditions.

6. References

Australian Bureau of Statistics (ABS) (2020), Survey of Motor Vehicle Use. Retrieved from <https://www.abs.gov.au/statistics/industry/tourism-and-transport/survey-motor-vehicle-use-australia/latest-release#fuel-consumption>

Commonwealth Government of Australia (2007). National Greenhouse and Energy Reporting Act 2007 Retrieved from <https://www.legislation.gov.au/Details/C2007A00175>

Commonwealth Government of Australia. (2008). National Greenhouse and Energy Reporting (Measurement) Determination 2008. Retrieved from <https://www.legislation.gov.au/Details/F2017C00508>

DISER. (2021). National Greenhouse Accounts Factors. Retrieved from <https://www.industry.gov.au/data-and-publications/national-greenhouse-accounts-factors>

Environmental Protection Authority (EPA) 2020, Environmental Factor Guideline, Greenhouse Gas Emissions – Air, retrieved May 2021, from https://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/EFG%20-%20GHG%20Emissions%20-%2016.04.2020.pdf

GHG Protocol. (2015). A Corporate Accounting and Reporting Standard. Retrieved from <https://ghgprotocol.org/corporate-standard>

GHG Protocol. (2011). Corporate Value Chain (Scope 3) Accounting and Reporting Standard. Retrieved from <https://ghgprotocol.org/standards/scope-3-standard>

Transport Authorities Greenhouse Group (2013a), Carbon Gauge Tool, Transport Authorities Greenhouse Group Australia, and New Zealand (TAGG).

Transport Authorities Greenhouse Group (2013b), Greenhouse Gas Assessment Workbook for Road Projects, Transport Authorities Greenhouse Group Australia, and New Zealand (TAGG). Retrieved from <https://www.mainroads.wa.gov.au/globalassets/technical-commercial/technical-library/road-and-traffic-engineering/climate-change/carbon-gauge-workbook-2013.pdf>

Transport Authorities Greenhouse Group (2013c), Supporting Document for Greenhouse Gas Assessment Workbook for Road Projects, Transport Authorities Greenhouse Group Australia, and New Zealand (TAGG). Retrieved from <https://www.mainroads.wa.gov.au/globalassets/technical-commercial/technical-library/road-and-traffic-engineering/climate-change/supporting-document-for-greenhouse-assessment-workbook-for-road-projects-v6.pdf>