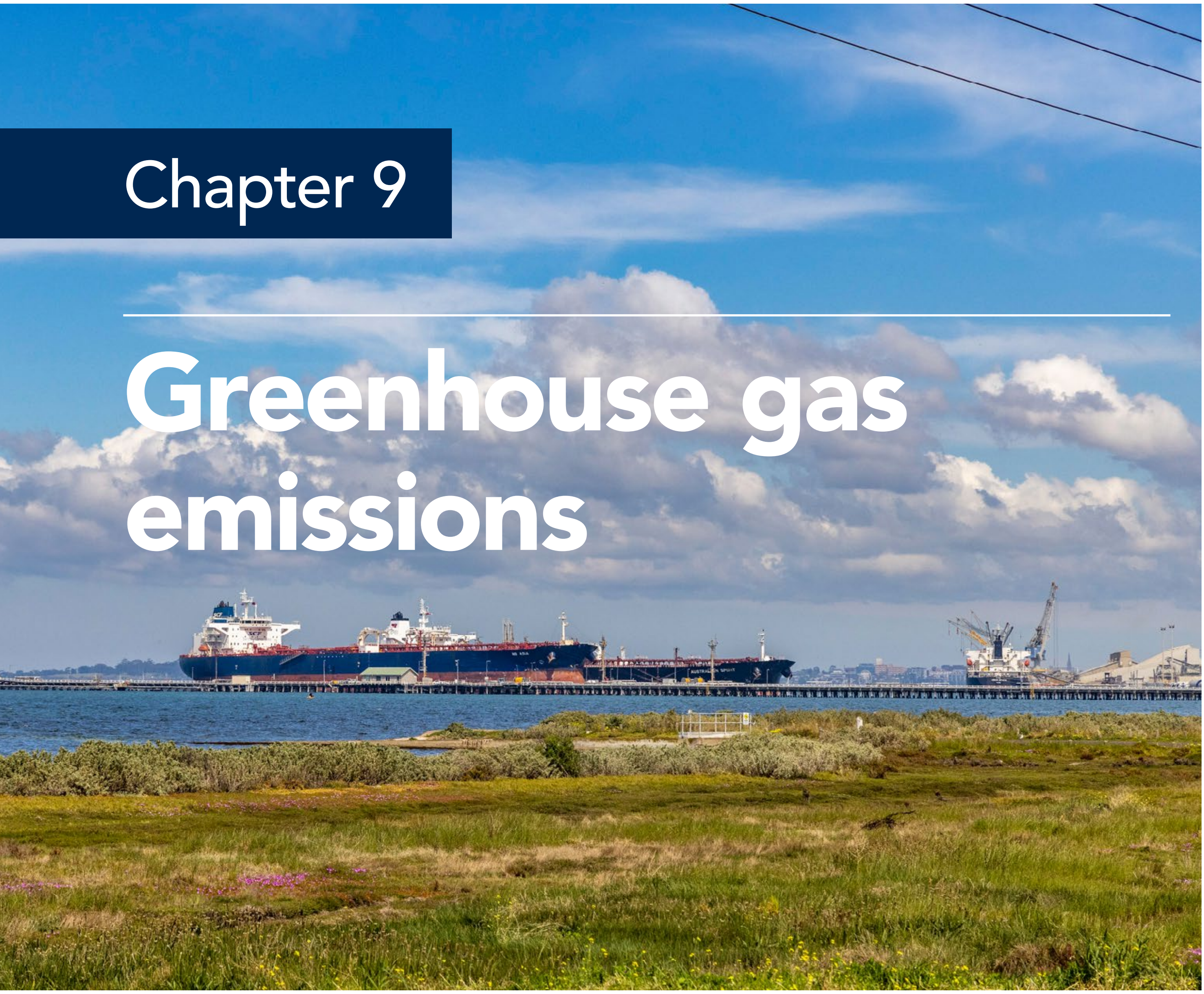

Chapter 9

Greenhouse gas emissions

This chapter provides an assessment of the greenhouse gas emissions associated with the construction and operation of the Viva Energy Gas Terminal Project (the project).

This chapter summarises the outcomes of Technical Report C: *Greenhouse gas impact assessment* prepared in support of the Environment Effects Statement (EES).

Overview

Australia's climate is changing, and greenhouse gas emissions are a key contributor to climate change. More intense and frequent storms, heatwaves, droughts, sea level rise, bushfires and other extreme weather events are impacting our natural and built environments. Climate impacts are already observable and there is broad scientific consensus that further changes will occur and that impacts are likely to increase. These changes in the climate system are due to the addition of greenhouse gases into the atmosphere, primarily from human activities such as the burning of fossil fuels and agricultural practices, however, natural processes such as bushfires also contribute to greenhouse gas concentrations.

Australia's 2015 Paris Agreement target is to reduce greenhouse gas emissions by 26-28% below 2005 levels by 2030. The *Climate Change Act 2017 (Vic)* sets the legislative foundation for managing climate change risks and driving Victoria's transition to net zero emissions by 2050. The Victorian government has set interim targets to reduce emissions by 28-33% below 2005 levels by 2025, and 45-50% by 2030. In line with this target, Viva Energy has recently announced that it plans to reach a net zero target for Scope 1 and 2 emissions for non-refining operations by 2030 and for all operations by 2050.

The project would produce greenhouse gas emissions through various activities, including burning fossil fuels in plant and vehicles during construction and operation, as well as dredging of seabed sediments and the manufacturing of materials used in construction. The total construction Scope 1, 2 and Scope 3 emissions within the project's operational boundary for the project is estimated to be 62,168 tonnes of carbon dioxide equivalent (t CO_2-e). Scope 1 and 2 emissions during the construction period is estimated to be 6,878 t CO_2-e. This equates to 0.01% of Victoria's annual greenhouse gas emissions which is considered to be a minor additional contribution to the State's greenhouse emissions.

Greenhouse gas emissions generated from the project's operation would differ between the operational modes of the floating storage and regasification unit (FSRU) (refer to Chapter 4: *Project description* for details of the different FSRU operating modes). When gas demand is high, open loop mode (using seawater to heat the liquefied natural gas (LNG)) would result in 47,906 t CO2-e per annum, closed loop mode (using gas fired boilers to heat the LNG) would result in 178,985 t CO2-e per annum and combined loop mode would result in 65,280 t CO2-e per annum. For each of the three operating scenarios, these emissions would equate to 0.05% (open loop), 0.19% (closed loop) and 0.07% (combined loop) of Victoria's annual greenhouse gas emissions per annum.

As closed loop mode consumes natural gas in the regasification process, it emits approximately four times more greenhouse gas emissions than open loop mode to convert the same amount of LNG to natural gas. Therefore, the most significant opportunity to minimise greenhouse gas emissions from the project's operation would be, as is proposed, to adopt open loop as the usual operating mode for the FSRU, as this would emit four times less greenhouse gas emissions than closed loop.

Following the implementation of mitigation measures to avoid and minimise greenhouse emissions from project construction and operation, residual greenhouse emissions would be quantified and offset to compensate for emissions produced.

An energy management system would be implemented in accordance with the International Organisation for Standardisation (ISO) 50001 *Energy Management Systems* for the operation of the FSRU to improve energy performance and efficiency and reduce greenhouse gas emissions.

EES evaluation objective

The scoping requirements provided by the Minister for Planning for the project set out the specific environmental matters to be investigated and documented in the project's EES. The scoping requirements inform the extent and scope of the EES technical studies. The Minister identified greenhouse gas as a primary area of assessment for the EES as the project was considered to have the potential to contribute additional greenhouse gases in the context of the reduction targets outlined above.

The following EES evaluation objective is relevant to the greenhouse gas impact assessment:

Evaluation Objective
Waste management – To minimise generation of wastes by or resulting from the project during construction and operation, including dredging and accounting for direct and indirect greenhouse gas emissions.

Technical Report C: *Greenhouse gas impact assessment* prepared in support of the project EES provides more detailed information on the investigations and impact assessments conducted in response to the EES scoping requirements.

9.1 Methodology

To determine potential greenhouse gas emissions associated with the project, the following approach was adopted for the greenhouse gas impact assessment:

- Establishing the scope of assessment for construction and operation phases of the project
- Characterisation of existing greenhouse gas emissions at a state level using the 2019 reporting reference year from the Australian National Greenhouse Accounts: State and Territory Greenhouse Gas Inventories
- A risk screening at the outset of the project using the methodology outlined in Chapter 7: *Assessment framework* to identify potential risks associated with greenhouse gas emissions and inform the impact assessment and the level of investigation required
- Estimation of greenhouse gas emissions during construction and operation of the project in accordance with the principles of the internationally accepted Greenhouse Gas Protocol (GHG Protocol)
- Development of mitigation measures (MM) in response to identified potential impacts focused on elimination or avoidance of the potential impact where possible, or mitigation through measures incorporated into design, construction and operation
- Evaluation of the residual environmental impacts which are those remaining once mitigation has been implemented.

Greenhouse gas reporting

The National Greenhouse and *Energy Reporting Act 2007* ('NGER Act') outlines the national reporting framework for facilities required to report their energy use and greenhouse gas emissions. The NGER Reporting Scheme requires reporting of six greenhouse gas emissions: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), hydrofluorocarbons and perfluorocarbons. Under the NGER Act, if a facility consumes more than 100 terajoules (TJ) of energy annually or emits over 25,000 tonnes of carbon dioxide equivalence (CO_2-e) annually, the controlling corporation is required to report. Therefore, Viva Energy would be required to report energy use and greenhouse gas emissions under the NGER Act.

9.2 Study scope

Greenhouse gas emissions were estimated in accordance with the principles of the GHG Protocol. Within the GHG Protocol, greenhouse gas emissions are split into three categories, known as 'Scopes'. Scope 1, Scope 2, and Scope 3 are defined by the GHG Protocol as:

- Scope 1 – Direct emissions of greenhouse gas from sources that are owned or operated by a reporting organisation (examples include combustion of diesel in company-owned vehicles or 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, or heat)
- Scope 3 – Other indirect emissions, other than energy imports 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 business travel by ship, air or rail).

The study, in accordance with the scoping requirements, has considered both direct and indirect greenhouse gas emissions that would result from the project. Direct Scope 1, indirect Scope 2, and some Scope 3 emissions were considered for the construction and operation scenarios. All Scope 1 and Scope 2 emissions are required to be reported under both the National Greenhouse and Energy Reporting (NGER) and GHG Protocol reporting schemes. Some Scope 3 emissions have been included as they represent a material contribution to the overall greenhouse gas construction and operational footprints and are determined to be within the proponent's ability to control or influence.

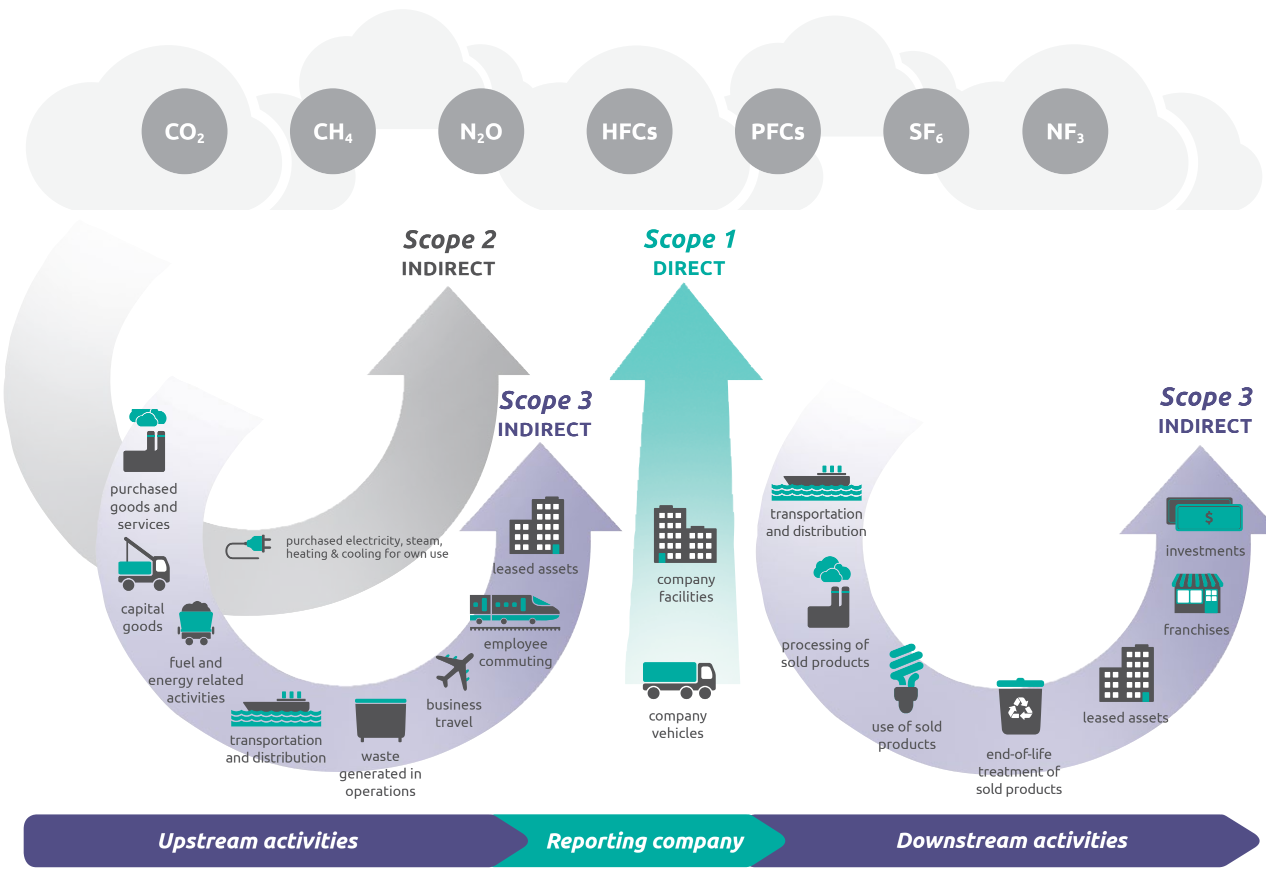

Figure 9-1 Illustrates various types of activities that are relevant to each of the Scope categories.

As outlined in the scoping requirements, the EES should quantify anticipated greenhouse gas emissions from the project relative to time including Scope 1 and Scope 2 emissions, as well as provide an estimate of potential fugitive emissions through infrastructure spills or leakages. While the scoping requirements do not require Scope 3 emissions to be quantified and included in the impact assessment, those significant Scope 3 emissions that Viva Energy has the ability to control, or influence have been included in Technical Report C: *Greenhouse gas impact assessment* and are presented in this chapter for completeness. Key Scope 3 emissions which have been included are those from the consumption of fuel in the transport of the FSRU, employees and material to Geelong and embodied emissions related to construction materials. An operational boundary describes the scope of activities (during both construction and operation) that are within the proponent's ability to control. The operational boundary during construction is shown in Figure 9-2. The study scope for the construction phase of the project included all direct (Scope 1), and indirect (Scope 2 and Scope 3) greenhouse gas emissions within the proponent's ability to control, associated with the following activities:

- Localised dredging of seabed sediments at Refinery Pier
- Construction of the temporary loadout facility at Lascelles Wharf
- Transportation of the FSRU to Refinery Pier
- Construction of the new pier arm and berthing infrastructure, and aboveground pipeline along Refinery Pier and through the refinery
- Construction of the treatment facility on a laydown area at the northern boundary of the refinery site
- Construction of the underground pipeline and the tie-in point to the SWP at Lara.

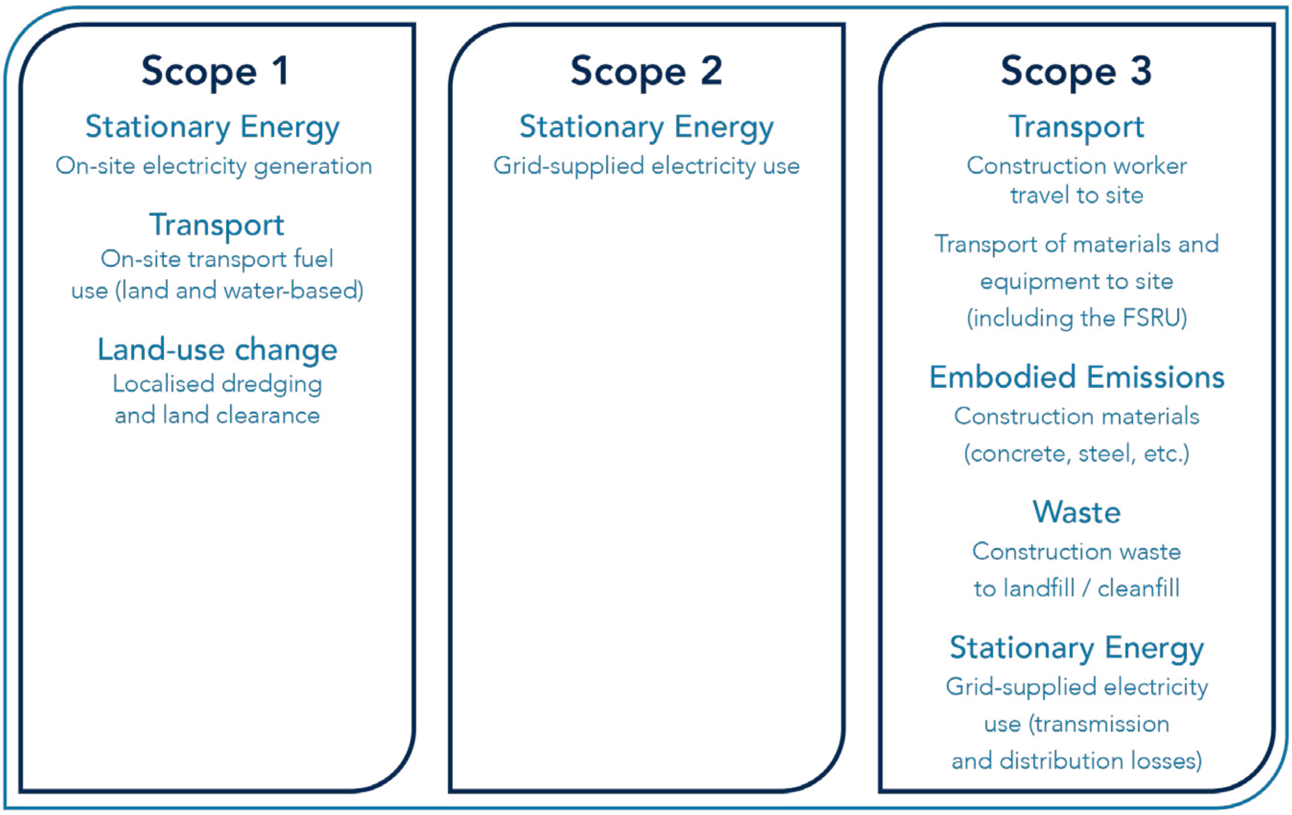

Figure 9-2 Construction phase emissions sources within the project's operational boundary

The operational boundary during operation is shown in **Figure 9-3**. The operational boundary was determined based on Viva Energy's ability to control or influence the activity.

Upstream emissions associated with the production of LNG were not included as these would represent Scope 1 emissions for the company that undertakes the production activities, and the project has no control or influence over these activities. It has been assumed that the extraction, and liquefaction of gas which would generate emissions would occur irrespective of the project. The decisions around the sourcing of LNG cargoes would be made by the customers of the terminal and not by Viva Energy as the operator, therefore the upstream emissions associated with transport of the LNG to the terminal were also not included in the study.

Downstream emissions associated with the consumption of the gas are not included in the study as consumption of gas in the Victorian Transmission System (VTS) (by domestic, commercial and industrial end users) is outside the influence of Viva Energy. In addition, the emissions associated with the consumption of this gas would represent Scope 1 emissions for the entity that consumes the gas and including them in this inventory would lead to double counting of these emissions. The objective of the project is to meet an expected shortfall in natural gas availability in Victoria rather than create a higher demand. It is assumed that end-use consumption of gas in the VTS would occur irrespective of the project as if the project does not proceed it is anticipated that another gas provider would fill the forecast gas shortfall in Victoria by the mid-2020s.

An estimate of Scope 3 emissions outside of the project's operational boundary are presented for context in Appendix A of Technical Report C: *Greenhouse gas impact assessment*.

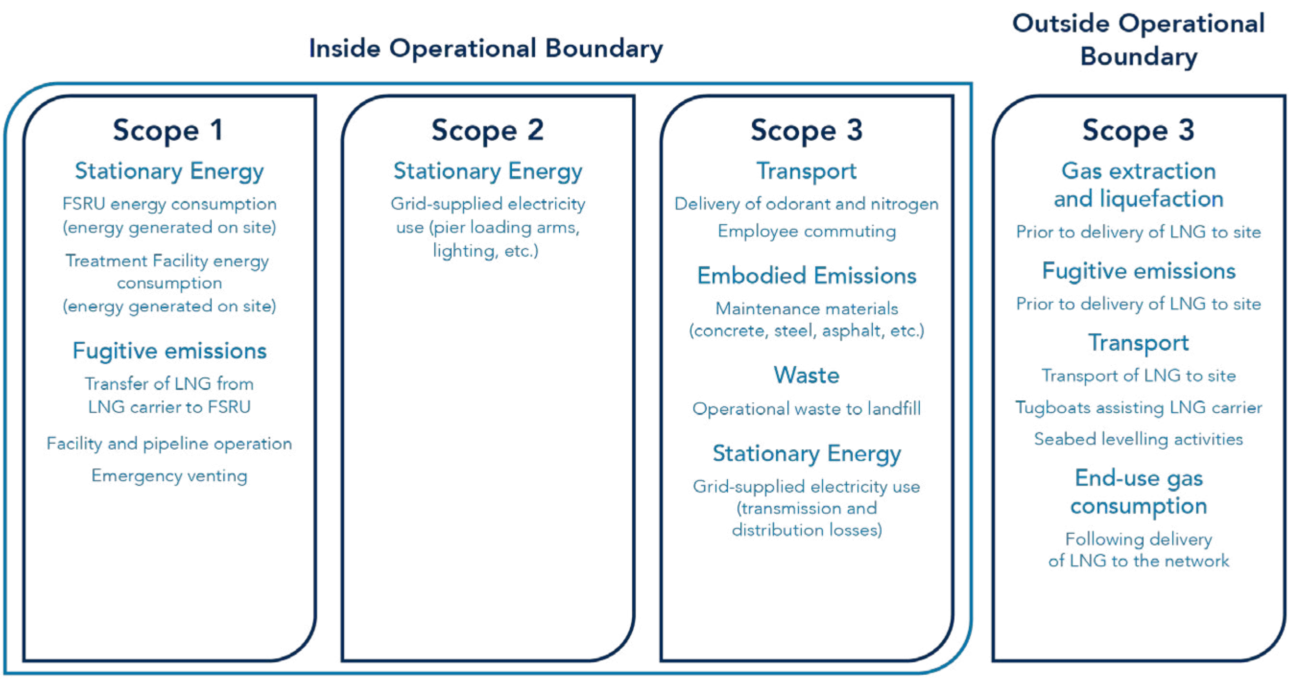

Figure 9-3 Operation phase emissions sources within the project's operational boundary

9.3 Existing conditions

The existing conditions assessment considered the most recent available data on Victoria's greenhouse gas emissions, which is the *State and Territory Greenhouse Gas Inventories 2019* report. In 2019, Victoria's total greenhouse gas emissions were 91 million-tonnes of carbon dioxide equivalent (Mt CO_2-e).

Table 9-1 provides a breakdown of these emissions by category. The greenhouse gas emissions associated with the operation of the project would primarily contribute to the energy industries and transport categories presented in the table.

How are greenhouse gases measured?

Greenhouse gases are measured as tonnes, kilo tonnes or million- tonnes of carbon dioxide equivalent (CO_2-e). This represents the amount of greenhouse gases emitted as an equivalent amount of CO_2 which has a global warming potential of one. For example, one tonne of CH_4 released into the atmosphere will cause the same amount of global warming as 25 tonnes of CO_2. Therefore, one tonne of CH_4 is expressed as 25 t CO_2-e (Clean Energy Regulator, 2021).

Table 9-1 Victorian greenhouse gas emissions by source for 2019 (Commonwealth of Australia, 2021)

Emissions source and sink category	Annual greenhouse gas emissions (Mt CO_2-e)	Percentage (%)
Energy industries	46.88	51
Manufacturing	4.77	5
Transport	22.69	25
Other energy sectors	9.68	11
Fugitive emissions from fuels	2.97	3
Industrial processes and product use	3.34	4
Agriculture	15.57	17
Land use, land use change, and forestry	-17.40[1]	-19
Waste	2.83	3
Total	91.33	100

1 *Land use, land use change and forestry in this reporting year is a net-emissions sink, and therefore a negative value is representative of emissions absorbed rather than emitted.*

9.4 Construction impacts

This section presents the greenhouse gas emissions associated with construction of the project. The total construction Scope 1, 2 and Scope 3 emissions within the project's operational boundary for the project is estimated to be 62,168 t CO_2-e. Scope 1 and 2 emissions during the construction period is estimated to be 6,878 t CO_2-e.

A summary of the total greenhouse gas emissions for the construction of the project is presented in **Table 9-2**.

Table 9-2 Summary of greenhouse gas emissions associated with the construction of the project

Emissions category	Project activity	Total emissions (t CO_2-e)		
		Scope 1	Scope 2	Scope 3
Stationary energy	• Fuel and electricity consumed by plant/ equipment during construction of Refinery Pier, treatment facility and the pipeline	537	391	71
Transport fuel (Note: Scope 3 emissions represent fuel consumed in the transport of the FSRU to Geelong)	• Fuel consumed by vessels/equipment during construction of Refinery Pier, treatment facility, the pipeline and dredging activities • Fuel consumed by transport of materials, equipment and employee travel to the project site • Fuel consumed for transport of FSRU to Geelong	3,466	-	19,879
Embodied emissions	• Embodied carbon in concrete and steel for Refinery Pier and pipeline infrastructure	-	-	35,264
Waste	• Fuel consumed for transport of waste from project construction • Waste from project construction	-	-	76
Land use, land use change and forestry	• Carbon sequestration lost due to cleared vegetation • Emissions associated sediment removal during localised dredging and trenching	2,484	-	-
Total		**6,487**	**391**	**55,290**

Detail on the total emissions and assumptions relevant to each emissions source are presented in Technical Report C: *Greenhouse gas impact assessment*. The majority of total Scope 1 and Scope 2 emissions for construction are those associated with transport fuel. Diesel fuel consumed by vehicles, vessels and plant and equipment during construction of the Refinery Pier extension, treatment facility and pipeline, as well as dredging activities are the key contributing activities to greenhouse gas emissions during the construction phase. While the use of plant and equipment is unavoidable, environmental management measures will be implemented including the consideration of fuel-efficient plant and equipment where appropriate (refer to mitigation measure MM-GG07).

Removal of vegetation in the pipeline construction corridor also contributes to Scope 1 emissions. It was assessed that the pipeline construction corridor contained approximately 0.09 hectares (ha) of native vegetation and approximately 10.11ha of non-native vegetation. The majority of the cleared vegetation would be exotic grassland. Following installation of the pipeline, the construction corridor would be revegetated and rehabilitated to its pre-existing condition. The majority of the Scope 3 emissions are associated with fuel consumed for the transport of the FSRU to Geelong and the embodied emissions in concrete and steel for Refinery Pier and pipeline infrastructure.

Without mitigation measures, the total construction Scope 1, 2 and Scope 3 emissions within the project's operational boundary for the project is estimated to be 65,930 t CO_2-e. The total Scope 1 and 2 emissions during the construction period is estimated to be 10,642 t CO_2-e, which equates to 0.01% of Victoria's annual greenhouse gas emissions. This is considered to be a minor additional contribution to the State's greenhouse gas emissions.

To reduce greenhouse gas emissions produced during construction, mitigation measures would be implemented to avoid or minimise emissions where possible. Mitigation measures would include utilising low embodied energy and locally sourced materials where practicable to minimise embodied and transport emissions (refer to MM-GG01). To enable the best emissions outcome, the project would develop criteria that considers the proportion of supplementary cementitious material content in concrete, recycled steel, and recycled aggregates, the location materials are being sourced from, and maintenance requirements of materials (refer to MM-GG01 and MM-GG02). To further reduce transport emissions, the project would engage a local workforce where possible (refer to MM-GG06) and source local plant and equipment to avoid long distance or interstate travel (refer to MM-GG03).

Additionally, construction activities would be coordinated to reduce unnecessarily extending the construction period and to avoid inefficient use of equipment (refer to MM-GG04). The selection of plant and equipment would also consider fuel/energy efficiency. Together, this would reduce plant and equipment stationary and transport emissions associated with construction. The proponent would develop a waste management plan that addresses waste reduction, segregation of waste, and disposal of waste to ensure that waste is correctly separated and diverted from landfill where appropriate (refer to MM-GG08).

To ensure sustainable procurement and resource management practices, the proponent would refer to ISO 20400:2017 Sustainable procurement, which provides guidance on integrating sustainability within procurement (refer to MM-GG05). Energy efficiency performance standards and transport distances would also be considered in the selection criteria for tendering of works associated with plant and equipment (refer to MM-GG07 and MM-GG03).

Following implementation of mitigation measures, the project would quantify and offset residual Scope 1 and 2 emissions (refer to MM-GG11).

9.5 Operation impacts

This section presents the greenhouse gas emissions associated with operation of the project. Greenhouse gas emissions for the FSRU, as the main greenhouse gas contributor during operation, have been assessed based on the three operational scenarios: open loop, closed loop and a combined loop mode. An overview of these operating scenarios is provided in Chapter 4: *Project description.*

The usual operating mode for the FSRU is open loop, but closed loop has also been assessed on the basis that it represents the 'worst case' scenario for greenhouse gas emissions as it utilises gas fired boilers to generate steam for the regasification process. Closed loop would be used in very limited instances where discharge water is unable to be transferred to the refinery.

The open and closed loop scenarios assumed the following supply of natural gas per year:

- 250 terajoules per day (TJ/day) during summer (90 days per year)
- 350 TJ/day during spring and autumn (183 days per year)
- 500 TJ/day during the winter (86 days per year)
- 620 TJ/day during peak demand days in winter (6 days per year).

This would deliver a total of up to 45 cargoes of LNG into the VTS. This equates to approximately 160 petajoules (PJ) of natural gas delivery per annum.

A combined loop regasification process involving a combination of modes to heat the seawater could potentially be used if the ambient seawater temperature is too low for open loop regasification to operate effectively. For the purposes of this assessment, it has been assumed that this would be 30 days per year. Should combined loop mode be required, it would lead to a further 17,374 t CO_2-e per annum in addition to the emissions associated with open loop mode.

During operation, fuel consumed by the FSRU would be the primary source of greenhouse emissions accounting for the majority of the Scope 1 emissions outlined below. In addition to the FSRU, other project components and activities would also contribute to the overall greenhouse emissions produced during operation, including electricity consumed at Refinery Pier and within the treatment facility. Fugitive emissions (e.g., gas leaking from pipes or valves,) have also been considered for key project components including the treatment facility and the pipeline, emergency venting as well as the transfer of LNG from LNG carriers to the FSRU.

The total annual Scope 1, 2 and Scope 3 operational emissions within the project's operational boundary for the project would be as follows:

- Open loop – 47,906 t CO_2-e
- Closed loop – 178,985 t CO_2-e
- Combined system – 65,280 t CO_2-e

A summary of the total annual greenhouse gas emissions for the operation of the project is provided in **Table 9-3**. Scope 3 emissions have been included for completeness, however, are not considered in this impact assessment.

Table 9-3 Summary of annual operational greenhouse gas emissions for the project

Emissions category	Project activity	Total annual emissions (t CO_2-e)		
		Scope 1	Scope 2	Scope 3
Open loop				
Stationary energy	• Gaseous fuel consumed by the FSRU during open loop operation • Electricity consumed at Refinery Pier and the treatment facility	41,235	3,268	359
Transport fuel	• Fuel consumed by: • Operators and staff travel to and from site • Supply delivery vehicles to the treatment facility	-	-	1,600

Emissions category	Project activity	Total annual emissions (t CO_2-e)		
		Scope 1	Scope 2	Scope 3
Fugitive emissions	• Fugitive emissions from: • Transfer of LNG from the LNG carrier to the FSRU • The treatment facility • The pipeline • Emergency venting	1,442	-	-
Waste	• Operational wastewater	-	-	3
Total – open loop		**42,676**	**3,268**	**1,962**
Closed loop				
Stationary energy	• Gaseous fuel consumed by the FSRU during closed loop operation • Electricity consumed at Refinery Pier and the treatment facility	172,313	3,268	359
Transport fuel	• Fuel consumed by: • Operators and staff travel to and from site • Supply delivery vehicles to the treatment facility	-	-	1,600
Fugitive emissions	• Fugitive emissions from: • Transfer of LNG from the LNG carrier to the FSRU • The treatment facility • The pipeline • Emergency venting	1,442	-	-
Waste	• Operational wastewater	-	-	3
Total – closed loop		**173,755**	**3,268**	**1,962**
Combined loop				
Stationary energy	• Gaseous fuel consumed by the FSRU during closed loop operation • Electricity consumed at Refinery Pier and the treatment facility	58,608	3,268	359
Transport fuel	• Fuel consumed by: • Operators and staff travel to and from site • Supply delivery vehicles to the treatment facility	-	-	1,600
Fugitive emissions	• Fugitive emissions from: • Transfer of LNG from the LNG carrier to the FSRU • The treatment facility • The pipeline • Emergency venting	1,442	-	-
Waste	• Operational wastewater	-	-	3
Total – combined loop		**60,050**	**3,268**	**1,962**

The stationary energy used during operation of the project varies between the three different operational scenarios. The change in Scope 1 emissions produced is related to the volume of gaseous fuel consumed by the FSRU during the different operational scenarios, with a much higher level of stationary energy emissions associated with closed loop. As closed loop mode consumes natural gas in the regasification process, it emits more Scope 1 greenhouse gas emissions than open loop mode to convert the same amount of LNG to natural gas.

The closed loop operational mode would trigger requirements under the *National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015* as direct (Scope 1) greenhouse gas emissions are expected to be greater than 100,000 t (CO_2-e a year). Viva Energy would be required to apply for a calculated-emissions baseline determination to be approved by the Clean Energy Regulator.

Table 9-4 provides a comparison of the project's annual operational emissions to Victoria's annual greenhouse gas emissions. The project's estimated Scope 1 and Scope 2 emissions during operation are estimated to contribute the equivalent of 0.05% (open loop), 0.19% (closed loop) and 0.07% (combined loop) of Victoria's total annual greenhouse gas emissions per annum.

Table 9-4 Comparison of the project's operational greenhouse gas emissions to Victoria's annual emissions

Emissions source	Total annual greenhouse gas emissions (kt CO_2-e)	% of Victoria's annual total greenhouse gas emissions
Victoria 2019 (Scope 1 + 2)	**91,330**	**100**
Open loop (Scope 1 + 2)	47	0.05
Closed loop (Scope 1 + 2)	179	0.19
Combined loop (Scope 1 + 2)	65	0.07

To reduce greenhouse gas emissions produced during operation, mitigation measures would be implemented to avoid or minimise emissions where possible. The most significant opportunity to minimise greenhouse gas emissions during the project's operation would be, as is proposed, to adopt open loop as the usual mode of operation for the FSRU (refer Chapter 4: *Project description*). The main benefit of the open loop regasification mode is that seawater from Corio Bay can be used to heat the LNG via an intermediate heating medium in a heat exchanger. This is an efficient and readily available means of heating the LNG without using additional fuel to generate heat for LNG vaporisation. Furthermore, for this project the potential impact of discharging the seawater from the FSRU heat exchangers is able to be mitigated by transferring the seawater to the refinery for reuse as cooling water (see Chapter 4: *Project description*). As shown in **Table 9-4**, estimated greenhouse gas emissions at peak production when gas demand is high would be approximately four times less in the preferred open loop operating mode compared to closed loop.

To further reduce emissions, plant and equipment for the project's operation would be selected with consideration of fuel efficiency to reduce the consumption of fossil fuels. Engaging a local workforce where possible would reduce transport emissions associated with transport and air travel (refer to MM-GG06). Safety controls and emergency management practices would be put in place in the case of unplanned activities, incidents, and emergencies (i.e., unplanned maintenance or venting) to reduce the likelihood of releasing fugitive greenhouse gas emissions (refer to MM-GG10).

Following implementation of mitigation measures, the project would quantify and offset residual Scope 1 and 2 emissions (refer to MM-GG11).

Viva Energy would incorporate energy use and greenhouse gas emissions associated with the operation of the gas terminal into existing reporting requirements under the NGER Act. An energy management system would be implemented in accordance with the International Organisation for Standardisation (ISO) 50001 Energy Management Systems (ISO 50001) for the operation of the FSRU (refer to MM-GG09). The ISO 50001 provides a framework for organisations to take a systematic approach to achieve continual improvement of energy performance and efficiency and reductions in greenhouse gas emissions. This framework is considered global best practice, and involves:

- Developing energy use baselines
- Developing energy management plans
- Identifying performance indicators
- Setting targets for improvement.

Progress would be regularly monitored, reported and reviewed. Implementation of this system would also involve external certification by ISO-accredited auditors (typically on a three-year cycle) in which both compliance with the ISO standard and performance improvement would need to be demonstrated to maintain certification.

9.6 Mitigation measures

The mitigation measures to avoid, minimise and manage potential greenhouse gas emissions associated with the project are outlined in Table 9-5.

Table 9-5 Greenhouse gas mitigation measures

MM ID	Mitigation measure	Project phase
MM-GG01	**Minimise embodied and transport emissions of materials** Low embodied energy and locally sourced materials will be considered and used where practicable to minimise embodied and transport emissions. The proponent will develop criteria for a minimum proportion of supplementary cementitious material content in concrete, recycled steel, and recycled aggregates. The criteria will consider the location where materials are being sourced from to minimise associated transport emissions.	Construction
MM-GG02	**Managing quality of materials** Materials that are low maintenance and durable will be selected to avoid unnecessary replacement. The quality of key materials (i.e., pipe and mooring infrastructure) will be inspected before supplying to site to avoid additional transport and handling of materials.	Construction
MM-GG03	**Source local materials and equipment** Locally sourced plant and equipment (i.e., within Victoria) will be considered and used where practicable to reduce emissions associated with transport. Sourcing local plant and equipment where practicable will be included in the selection criteria for tendering of works associated with plant and equipment.	Construction
MM-GG04	**Coordination of construction activities** Construction activities will be coordinated to reduce unnecessarily extending the construction period and to avoid inefficient use of equipment.	Construction
MM-GG05	**Sustainable procurement and resource management practices** Sustainable procurement and resource management practices will be adopted to avoid the inefficient use of materials, fossil fuels, and electricity. The proponent will refer to ISO 20400:2017 Sustainable procurement which provides guidance on integrating sustainability within procurement.	Construction

MM ID	Mitigation measure	Project phase
MM-GG06	**Local workforce** Local workforce will be engaged where possible. Interstate and international travel will be minimised and where appropriate replaced by virtual engagement. The proponent will complete a transport plan to detail how fuel emissions from employee transport would be minimised.	Construction and operation
MM-GG07	**Plant and equipment fuel efficiency and quality** Selection of plant and equipment will incorporate consideration of fuel efficiency to reduce the consumption of fossil fuels.	Construction and operation
MM-GG08	**Waste – avoid, reduce, reuse** Design will reduce the total quantum of materials required through design refinement and incorporate reuse materials during construction and operation of the project. The proponent will develop 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.	Design, construction and operation
MM-GG09	**Implementation of Energy Management Systems** An energy management system will be implemented in accordance with the International Organisation for Standardisation (ISO) 50001 Energy Management Systems (ISO 50001) for the operation of the FSRU. The ISO 50001 provides a framework for organisations to take a systematic approach to achieve continual improvement of energy performance and efficiency and reductions in greenhouse gas emissions. This framework is considered global best practice, and involves: • Developing energy use baselines • Developing energy management plans • Identifying performance indicators • Setting targets for improvement. Progress will be regularly monitored, reported, and reviewed. Greenhouse gas emissions reporting will include public reporting under the NGER scheme and Viva Energy's corporate Sustainability reporting. Implementation of this system will also involve external certification by ISO-accredited auditors (typically on a three year cycle) in which both compliance with the ISO standard and performance improvement will need to be demonstrated to maintain certification.	Operation
MM-GG10	**Emergency management procedures** Safety controls and emergency management practices will be put in place in the case of unplanned activities, incidents, and emergencies (i.e., unplanned maintenance or venting) to minimise the release of fugitive greenhouse gas emissions.	Operation
MM-GG11	**Certified carbon offsets** Scope 1 and 2 emissions associated with the project will be quantified and offset to compensate for emissions produced during construction and annual emissions produced during operation. Note that offsets will only be considered for project emissions after measures that aim to avoid or minimise emissions have been adopted.	Construction and operation

9.7 Residual impacts

Implementation of mitigation measures would minimise greenhouse gas emissions during construction and operation of the project, however, at this stage it is not confirmed to what extent emissions would be reduced.

The most significant opportunity to minimise greenhouse gas emissions from the project's operation would be, as is proposed, to adopt open loop as the usual mode of operation of the FSRU. Operating at peak demand in open loop mode would result in approximately four times less greenhouse gas emissions than under a closed loop operating scenario.

Following the implementation of mitigation measures to avoid and minimise greenhouse emissions from project construction and operation, residual Scope 1 and Scope 2 greenhouse emissions would be quantified and offset to compensate for emissions produced. A more detailed comparison between open loop, closed loop and combined loop and the rationale for the preferred regasification mode is presented in Chapter 3: *Project alternatives and development* and Chapter 4: *Project description*.

9.8 Conclusion

The project would produce greenhouse gas emissions through various activities associated with both the construction and operation phases, however, emissions would primarily result from operation of the FSRU.

Scope 1 and Scope 2 emissions associated with the construction phase of the project would equate to 0.01% of Victoria's annual greenhouse gas emissions, which is considered to be a minor additional contribution to the State's greenhouse emissions. Mitigation measures would be implemented to avoid or minimise emissions where possible during the construction phase, such as using locally sourced materials and engaging with a local workforce to reduce emissions associated with travel. Construction activities would be coordinated to reduce unnecessarily extending the construction period and to avoid inefficient use of equipment, as well as selecting plant and equipment with consideration of fuel efficiency.

The project's estimated annual Scope 1 and Scope 2 emissions during operation are estimated to contribute the equivalent of 0.05% (FSRU open loop operation), 0.19% (FSRU closed loop operation), and 0.07% (FSRU combined loop operation) of Victoria's greenhouse gas emissions per annum. The most significant opportunity to minimise greenhouse gas emissions during the project's operation would be, as is proposed, to adopt open loop as the usual mode of operation of the FSRU (refer to Chapter 4: *Project description*). Estimated greenhouse gas emissions would be approximately four times less in the preferred open loop operating mode compared to closed loop.

Following the implementation of mitigation measures to avoid and minimise greenhouse emissions from project construction and operation, residual Scope 1 and Scope 2 greenhouse emissions would be quantified and offset to compensate for emissions produced.

An energy management system would be implemented in accordance with the International Organisation for Standardisation (ISO) 50001 Energy Management Systems for the operation of the FSRU to improve energy performance and efficiency and reduce greenhouse gas emissions.

In response to the EES evaluation objective, greenhouse gas emissions from construction and operation of the project have been assessed and mitigation measures have been identified to avoid and minimise emissions where possible.

PAGE INTENTIONALLY LEFT BLANK