## Marine Ecology Studies

Onsite monitoring, sampling and modelling were carried out to understand how the construction and operation of the Project could affect the marine ecology of Corio Bay and nearby wetlands.

The impacts of 67 years of refinery operation on the marine environment was closely examined to assess ecosystem health.

The comprehensive studies show Corio Bay is healthy and marine life thriving.

Ecology studies and modelling of the terminal operation indicate that marine life would not be impacted.

With little change expected in the water discharge to the Bay, the studies show that the local marine environment won't be adversely affected by the addition of the new terminal.







## **Marine Ecology – Chlorine Impacts**

### The seawater discharge will not change significantly once the terminal is operating.

Studies of current operations show no measurable impact from chlorine after 67 years of continuous low-level discharge.

Local marine environment is healthy and thriving – including seagrass, sea urchins, fish and mussels.

The gas terminal will use seawater to warm up the LNG – then it will be sent into the refinery to be recycled and reused.

There will be no change in the amount of chlorine discharged to Corio Bay – it will continue to be less than the level of chlorine commonly found in tap water (and fully consistent with guidelines).



Sea urchins – sensitive to chlorine – are found thriving near the current refinery water outlet.





### Marine Ecology -**Seawater Temperature Impacts**

impacts from the new operation.

celsius warmer than ambient bay water temperature.

reused. A similar volume of water will be discharged back to the Bay as currently.

The water will be closer to ambient temperature as it goes back into the Bay (3–5 celsius average).



#### Modelling based on 67 years of data shows there will be no negative temperature

- Seawater is currently used for cooling in refinery operations. It is discharged to the Bay under an EPA licence at 8–9 degrees
- The gas terminal will use seawater to warm up the LNG the cooled water will be sent into the refinery to be recycled and
- Studies including data from historical testing show the water discharge has not had an adverse impact on marine ecology.



## **Dredging Impact Technical Study**

### **Key Findings**

Dredging has been a common activity in Corio Bay since the Port was created in 1854.

Physical sediment characteristics of the dredging area and disposal ground are very similar.

Point Wilson is a suitable destination for the dredged material, and its marine ecology will not be adversely impacted.

Contaminants are found at low levels throughout Corio Bay waters and sediments from years of industrial activity.

Analysis indicates very low potential for impacts to marine biota from dredging and spoil disposal.

### Extensive testing and sampling were carried out to understand existing conditions and inform a dredging plan to best minimize environmental impacts.





### **Gas Terminal Project Refinery Pier Works**

A proposed extension to the existing Refinery Pier and some localised dredging would be required to allow the LNG ships to safely berth and turn into position. The proposed dredge volume is about 490,000m<sup>3</sup>. The area to be dredged is about one percent of the Corio Bay Channel or five per-cent of the refinery footprint. This is relatively small in comparison to some other dredging projects.







### **Contaminants Assessment**

Testing including seabed sediment sampling was carried out at multiple points around the dredging area and the proposed spoil disposal site at Point Wilson to understand the existing levels of contaminants and help develop an appropriate dredging plan.

A very small number of sediment samples had contamination above guideline levels but testing concluded that these are not a risk to biota or humans.

Sediments within the area to be dredged reported slightly elevated levels of metals and some other contaminants, with similar levels found at the dredging site and elsewhere in Corio Bay.



Around refinery pier

**Outer Harbour** and Point Wilson







### **Dredging Area**





256m

#### LNG ships turn here

176m

224m

### Ramsar Wetlands Impact Assessment

A shoreline survey was one of the field studies and assessments carried out to understand how the construction and operation of the Project could impact on the sensitive wetlands and migratory birdlife.

Ramsar is located at a distance from the proposed terminal (1.3km at the closest point), and no project facilities will be constructed anywhere near the wetlands

Particular attention was paid to potential food chain impacts, including studies of plankton and larvae.

Surveys of known threatened species and migratory birds, including a shorebird survey showed the project would have no effect on habitat and food supply

Sediment plumes from dredging will not impact the Ramsar wetlands and will be of short duration. Dredging will occur outside of Spring which is the main breeding season.







## **Terrestrial Ecology Impact Assessment**

### Extensive ecological surveys were carried out to understand how the construction and operation of the Project could impact on the ecology of nearby areas.

- The study examined the area around the proposed construction zone including the pipeline, and potential impacts of removing around 0.1h.a. of native vegetation.
- The study area was found to be land disturbed by historical human activity (no pristine environments), with largely introduced species present.
- No native vegetation will be impacted within the Corio Native Grassland Reserve, no Coastal Saltmarsh impacted.
- No endangered or endemic species are threatened by the Project, with studies including an assessment of habitat for Golden Sun Moth, Swift Parrot and Grey-headed Flying-fox.
- The ecology of the Ramsar site will not be impacted.





## **Examples of Strategies to Avoid Risk** to Local Ecology

The Terrestrial Ecology study found that there would be no significant impacts from the construction and operation of the Project and highlighted strategies to avoid or minimise impacts.

- Collaborative process with design and construction.
- Underground pipeline works along part of MacGregor Court designed to avoid patches of Plains Grassland which can be habitat for Golden Sun Moth.
- Reductions in laydown areas at Lara City Gate avoids patches of Plains Grassland and Chilean Needle-grass habitat for Golden Sun Moth.
- Use of existing right-of-ways and pipeline easements further reduces potential impacts to native vegetation.
- Reductions in laydown areas in the 'Paddocks' avoids planted trees; foraging habitat for Swift Parrot and Grey-headed Flying-fox.





## Study Summary: Safety, Hazard and Risk Assessment

Before the terminal can start up, we have to demonstrate to safety regulators that it can and will be operated safely.

A range of studies, analysis and assessments are being completed by safety and risk experts as part of the project planning and design.

This analysis is an important part of our application for a licence to operate, and will be ongoing through the design and planning phase of the Project, in conjunction with regulators like Ports Victoria.

The studies and reviews will look at all viable events that could lead to a major incident.

Opportunities to reduce and mitigate risk have been identified and recommended for inclusion in terminal design and plans for operation.

The safety, hazard and risk assessments carried out to date show that the gas terminal including LNG shipping operations, can be operated safely.





## LNG Shipping Safety

a major incident or loss of cargo in over 60 years.

- The liquid LNG is carried in an inner steel tank, inside the steel hull ('double hull').
- Specialised, modern carriers: high-tech navigation systems.
- Ships vetted to ensure only safe and high-quality carriers with experienced, well-trained crews are used.
- Fire, gas and leak detection, automatic response/ shutdown on board.
- Port safety tugboat escorts, speed limits, experienced and licenced local marine pilots.
- Regulator oversight including Ports Victoria.
- Dynamic under-keel clearance system (DUKC) to monitor conditions in real time, including water depth and draft.
- Security assessments and ongoing monitoring.



## LNG ships operate safely around the world every day – 135,000 voyages without





## Safety and the Floating Gas Terminal

LNG receiving terminals currently operate worldwide in over 35 countries and these facilities have proven to be a safe and efficient means of supplying gas into local markets.

### **Safety features**

- LNG stored in an interior tank protected by a double hull.
- Automated monitoring and shutdown systems - fire, gas and leak detection.
- LNG held as a liquid no gas storage tanks - and not stored under pressure. As such, it is flammable or explosive on board the vessel.

### Careful planning

- Detailed risk assessments looking at a wide rational statements and the ratio of the statement of scenarios.
- Risk assessments inform planning and design mitigation of risk factors for safest possible of
- Ports Victoria engagement.
- Waterside restriction zone at the pier.

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### **Highly regulated**

- Safety Cases. MHF licence (WorkSafe), pipeline licence (Energy Safe Victoria), strict operating parameters imposed.
- Maritime Security Plan (Federal approval).
- Up front and ongoing oversight, assessment and reporting including Ports Victoria and AMSA.
- Experienced hazard facility operator including Port operations.

#### **Emergency response preparation**

- Fire fighting capability on board, on the jetty and in Port (tugs).
- Trained responders onsite at the Refinery 24/7.
- Geelong Port and Ports Victoria liaison and training.
- Ships crew on board the FSRU at all times.



### **Social and Business Impacts Assessment**

Viva Energy is committed to minimising the impact of the terminal on the local community, and finding ways to optimise economic and social benefits. A social and business impact assessment was undertaken to inform planning for terminal construction and operation.

#### Who was involved?

A team of independent experts engaged directly with local stakeholders, including neighbours, community and business organisations. Surveys and interviews were conducted (28 individuals) to understand views and concerns. Issues raised in the wider consultation program were also considered.

Local employment – jobs and local businesses boost to household income and skills development.

Access to the social infrastructure and community services will not be impacted by the proposal due to the siting of the project.

Communications and consultation with the local community will continue to be a focus as we move forward with planning and the EES process.

#### **Findings – local benefits**

#### **Understanding the issues**

Those interviewed identified their primary issues including greenhouse gas emissions, marine environment, safe operations, as well as local amenity impacts during construction such as traffic and noise.



## Sustainability in Project Design

The terminal will operate primarily in 'open loop' mode, using seawater to warm up and re-gasify the LNG rather than heaters which burn fuel. As a result, greenhouse gas emissions will be about four times less than the alternative 'closed loop' scenario.

The terminal will re-use and recycle seawater used in its operation through the refinery. This delivers a unique environmental outcome, with the temperature and chlorine levels of the water discharged largely unchanged from current refinery operations

An internationally-recognised energy management system will be implemented to improve energy efficiency and reduce greenhouse gas emissions.

To further reduce the environmental footprint, Viva Energy has committed to fully offset emissions (Scope 1 and Scope 2) from the proposed gas terminal.

### Sustainability has been at the core of project design, right from the start. A number of changes to the gas terminal plans have been made to reduce its environmental impact.







## **Greenhouse Gas Emissions Study**

Viva Energy will make every effort to minimise emissions from the proposed gas terminal, and will further reduce its footprint by offsetting actual Scope 1 and Scope 2 carbon emissions.

### Key Findings – **Scope 1 and Scope 2 Emissions**

During operation of the floating gas terminal greenhouse gas emissions are estimated at 45.4kt CO2-e p.a. (around 0.05% of Victoria's annual total).

Emissions during the construction period are an additional 7.1kt CO2-e.

#### **Emissions Sources – Construction**

- Transport fuel (diesel) 60%.
- Manufacturing processes (steel and cement).

#### **Emissions Sources – Operations**

- Use of fossil fuels mainly LNG to run the FSRU (97%).
- Fugitive emissions (2%).

#### What changes have been made to reduce emissions?

- 'Open loop' operating mode is planned, which uses seawater to regasify the LNG rather than heaters fuelled by fossil fuels, and results in around 4 times less emissions than the alternative.
- Any surplus vapour from the LNG tanks will be captured and used in the terminal or the refinery rather than being burned off.
- Minimise waste and excess materials and incorporate reuse/recycled materials where possible.
- Use low embodied energy materials (e.g. substituting concrete mixes) where practicable.
- Sustainable procurement and resource management practices.



### **Committed to a Low-carbon Future**

### We are committed to being part of a low-carbon future while recognising that traditional fuels will play an important role in providing energy security in the energy transition.

#### New energies and technologies



Partnering with Waga Energy, the European leader in bio methane natural gas recovery from landfill waste.

Pilot trial with Nestle and others to recycle soft plastics to create Kit Kat wrappers.

Exploring opportunities in hydrogen and electrical vehicles.

### Reducing emissions



Ambition of net zero by 2050. Targeting net zero for our nonrefining operations and 10% reduction in our Refinery emissions intensity by 2030.

Renewable energy: Solar farm, wind farm Power Purchase Agreement

Refinery Energy Master Plan.

Offset (Scope 1 and 2) Gas Terminal emissions.

### Supporting **customers**



New carbon neutral jet fuel

Carbon solutions team established to support customers to reach their decarbonisation goals.





### product, Carbon Neutral Jet A-1.

## **A Future Vision: Geelong Energy Hub**

We are exploring projects that will support the evolving energy needs of Victoria and southeast Australia.

The broader Energy Hub vision includes a gas terminal and a solar energy farm, projects to support alternative energies such as renewables and hydrogen, and the development of strategic storage to improve fuel supply security.

The Energy Hub will support our Geelong Refinery, which already supplies around 50 percent of Victoria's fuel needs and employs over 700 people.





### Powered by the Sun

### Viva Energy is exploring opportunities to install a solar farm next to Geelong Refinery.



Initially we are looking at a capacity of about 15MW. That is 3,000 times bigger than the average 5kW home solar installation.

Panels will slowly rotate over the course of the day to follow the sun, enabling maximum site generation efficiency.

Over the course of a year it would be capable of meeting almost 10% of the current refinery's power needs.

It will provides an on-site source of renewable generation.







In 2019, Viva Energy entered into a long term Power Purchase Agreement (PPA) with Acciona to supply the refinery from the Mt Gellibrand Wind Farm. This is one of Victoria's largest wind farms located near Colac, 65km west of Geelong.

Wind power now meets around a third of Geelong Refinery's annual electricity needs.

With the agreement, Viva Energy is directly supporting the growth of renewable energy generation in Western Victoria, home to over 30% of all wind farm generation in Australia.

![](_page_19_Picture_5.jpeg)

## Future Transport Fuels: Hydrogen

vehicles.

Hydrogen is the most abundant element on earth.

As standard temperature and pressure, hydrogen is nontoxic, non metallic, odourless, colourless and tasteless.

Energy can be stored in hydrogen and kept to be used later.

It can be used in a fuel cell to create electricity.

A fuel cell vehicle is an electric vehicle.

Driving a fuel cell vehicle is very similar to combustion engine vehicles – the refuelling experience is similar, and it has a similar range to petrol or diesel.

### Viva Energy is exploring opportunities to develop hydrogen re-fuelling for heavy

![](_page_20_Picture_9.jpeg)

![](_page_20_Picture_10.jpeg)

# **Strategic Storage: Fuel Security for the Nation**

As part of the Australian Government's 'Boosting Australia's Diesel Storage Program', Viva Energy is proposing to build additional diesel storage within the grounds of its Geelong Refinery.

Three diesel storage tanks of 30 million litres usable capacity each are proposed to be located in the north west corner of the Refinery site.

The tanks will be designed and managed in accordance with best engineering practice and strict regulatory requirements.

Safety measures of the tank include bunds, firefighting protection and alarms.

Studies undertaken include environmental emissions modelling, vegetation, noise, geotechnical traffic management, bushfire management and fire safety.

Currently undertaking City of Greater Geelong planning and EPA Works Approvals.

Construction due to commence in 2022.

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![](_page_21_Picture_9.jpeg)

![](_page_21_Picture_10.jpeg)

![](_page_21_Picture_11.jpeg)