Manildra Port Kembla Storage Facility

Greenhouse Gas Assessment

Manildra Group

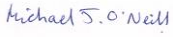
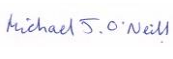
May 2022

→ **The Power of Commitment**

GHD Pty Ltd | | ABN 39 008 488 373
133 Castlereagh Street, Level 15
Sydney, New South Wales 2000, Australia
T +61 2 9239 7100 | **F** +61 2 9239 7199 | **E** sydmail@ghd.com | **ghd.com**

Printed date	10/05/2022 8:27:00 AM
Last saved date	10 May 2022
File name	https://projectsportal.ghd.com/sites/pp15_03/manildraportkemblast/ProjectDocs/GHG/12553198-Manildra PK GHG Report.docx
Author	Michelle Hirst and Pantju Nam
Project manager	Danny Craggs
Client name	Manildra Group
Project name	Manildra Port Kembla Storage Facility Air Quality Assessment
Document title	Manildra Port Kembla Storage Facility | Greenhouse Gas Assessment
Revision version	Rev 1
Project number	12551398

Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0	Michelle Hirst and Pantju Nam	Mike O'Neill		E Smith		27/04/2022
S4	1	Michelle Hirst and Pantju Nam	Mike O'Neill		E Smith		10/05/2022

Executive summary

As part of the Environmental Impact Statement (EIS) for the Manildra Port Kembla storage facility project, a greenhouse gas (GHG) emissions assessment during construction and operations phases was developed. The assessment is based on requirements set out in section 1.3.

In addition to information provided by the Manildra Group, the GHG assessment is based on data from the air quality study and a series of assumptions made on the projected quantities of materials used and the anticipated construction and operating processes (refer to section 2.5 for construction and section 2.7 for operations).

The quantity of emissions estimated to occur during construction are estimated as approximately 5,329 tCO_2-e comprising 1,591 tCO_2-e of Scope 1, 6 tCO_2-e Scope 2, and 3,733 tCO_2-e e Scope 3 during the entire construction period.

The annual quantity of emissions assumed to occur during operations are estimated as approximately 1,301 tCO_2-e comprising 22 tCO_2-e of Scope 1, 296 tCO_2-e Scope 2, and 1,008 tCO_2-e Scope 3 per annum.

The sources of the estimated emissions relating to the project are broken down in detail in sections 3.1 and 3.2, but summarised in Table ES-1 below.

Table ES-1 Estimate GHG emissions

Stage	Duration	GHG emissions			Total
		Scope 1	Scope 2	Scope 3	
Construction Phase	50 weeks	1,591	6	3,733	5,329
Operations Phase	Annual	22	296	1,008	1,301

Contents

Table index

Figure index

Glossary and abbreviations

Term	Definition
EF	Emission Factor
EIS	Environmental Impact Assessment
GHG	Greenhouse Gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
LPG	Liquefied petroleum gas
m	Metres
Manildra	The Manildra Group
ML	Mega litre
MPa	Megapascal
Mt	Megatonne
mm	millimetre
NGER	National Greenhouse and Energy Reporting Act
NSW	New South Wales
proposal	Bulk Liquids Facility project
SEARs	Secretary's Environmental Assessment Requirements
tCO_2-e	Tonnes Carbon Dioxide Equivalent
The site	Site B, Foreshore Road, Port Kembla

1. Introduction

1.1 Project description

Manildra Group (Manildra) operates a 300 Mega Litre (ML) per year beverage grade ethanol plant at its Bomaderry facility within the Shoalhaven local government area.

Manildra is proposing to develop a bulk liquids storage facility (the proposal) at Port Kembla to receive, store and export beverage grade ethanol. The proposal also includes two related pipelines from the facility location at Site B, Foreshore Road to the existing Berth 206 (the site). One pipeline is for sending product out, the second pipeline is a return line for flushing the system.

At present, a total of six above-ground storage tanks are proposed within a single bunded area. The total volume of the storage tanks proposed is 24 ML of ethanol product (Class 3 PG II under the relevant ADG / AS1940 Classification), as illustrated in Figure 1.1, the proposed site layout.

The 300 millimetre (mm) diameter pipelines will be above-ground where possible but may be underground through the area where public access is permitted, and traverse approximately 950 metres (m) from the proposed facility location at Site B to an existing wharf structure at Berth 206.

1.2 Purpose of this report

GHD Pty Ltd (GHD) was engaged by Manildra to assess and prepare an inventory of the projected greenhouse gas emissions (GHG) associated with the construction and operational stages of the proposal as per the NSW Department Planning and Environment's Secretary's Environmental Assessment Requirements (SEARs). The purpose of this report is to document the findings of that assessment and the GHG inventory in line with the SEARs.

1.3 Scope Summary

NSW State legislation does not currently include any specific requirements in relation to how greenhouse gas assessments should be undertaken to meet the requirements of SEARs, unless stated in the project-specific SEARs.

The project-specific SEARs require:

– an assessment of the proposal's greenhouse gas emissions (reflecting the Government's goal of net zero emissions by 2050)

As the SEARs do not mandate a specific standard, protocol, or methodology for the greenhouse gas assessment Manildra agreed that the GHG assessment be undertaken in line with the National Greenhouse Energy Reporting (NGER) Measurement Determination.

– Assessment of the relevant projected GHG during construction and operation phases including:
  - The fuel and electricity consumption and vegetation removal during construction
  - Fugitive emissions during operation (processing leaks/ vents)
  - Electricity consumption during operation (from grid)
  - Wastes (used as fuel) combustion during operation
  - Fuel from mobile and stationary equipment
  - Transport of materials to the site
  - Employee commuting
  - Steel and Concrete used in construction
– Emission sources from the above activities attributed to Scope 1, 2 and 3 as appropriate
– Comparison of the annual (total and net) emissions against current state and national annual totals

– Identification of potential abatement measures including avoidance, and minimisation of GHG emissions and energy

1.4 Limitations

This report has been prepared by GHD for Manildra Group and may only be used and relied on by Manildra Group for the purpose agreed between GHD and Manildra Group as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Manildra Group arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 2 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Manildra Group and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

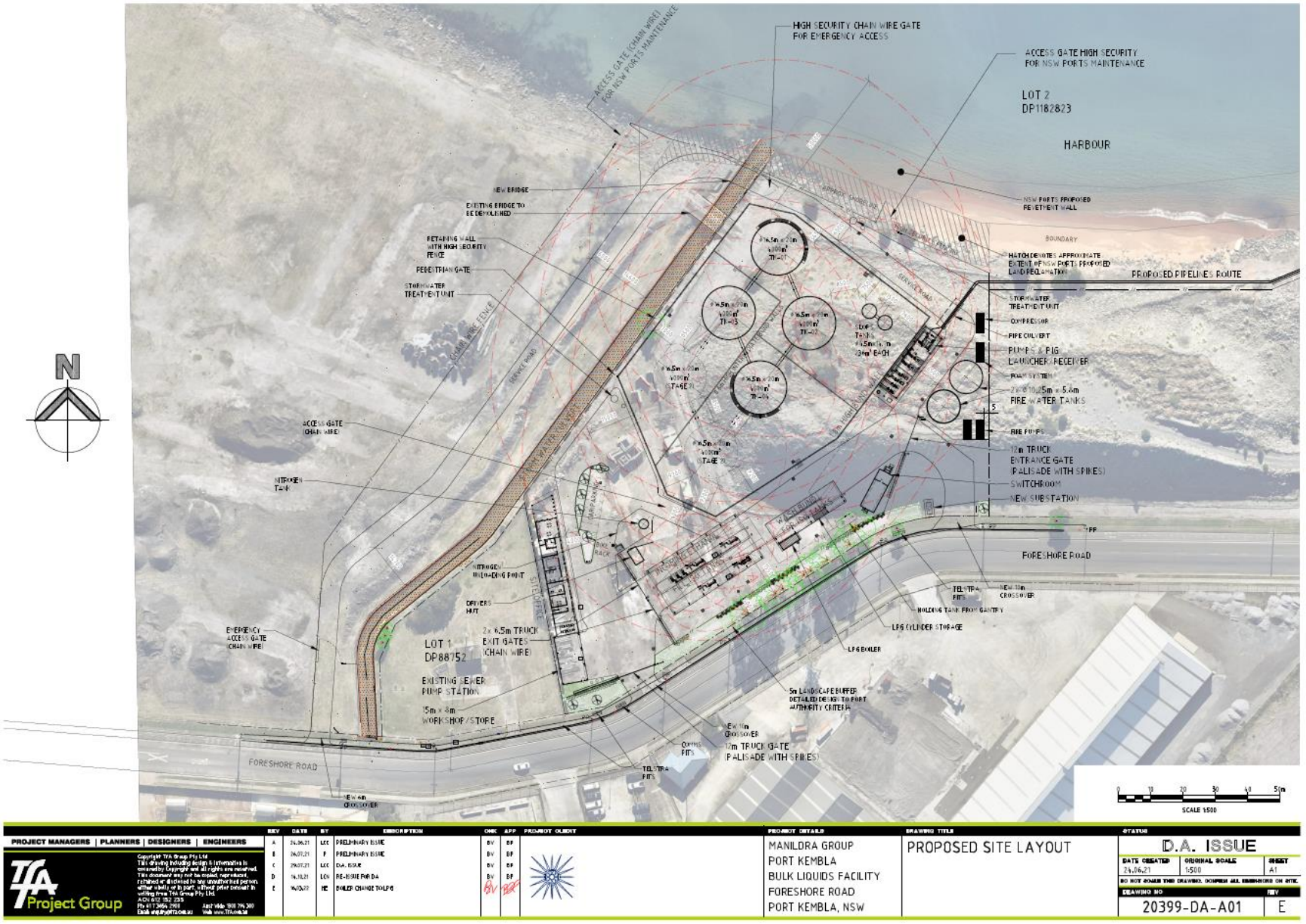


Figure 1.1 Proposed Site Layout

2. GHG Inventory

2.1 Overview

The following tasks were undertaken for the construction and operations stages:

– Identification of the likely GHG emission sources (for both construction and operations phases)
– Quantification of the projected fuel, electricity or other activity data for each emission source
– Identification of appropriate emission factors
– Calculated emission projections for each activity and each stage.

2.2 Policies, Guidelines and Plans

Relevant sections of the following documents were used for the purposes of defining appropriate methods for quantification of emissions from individual sources:

– National Greenhouse and Energy Reporting Act 2007 (NGER Act)
– National Greenhouse and Energy Reporting (Measurement) Determination 2008
– National Greenhouse and Energy Reporting Regulations 2008
– National Greenhouse Accounts Factors 2021
– ISO 14064-1:2006 Greenhouse gases - Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals
– Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (GHG Protocol) (World Business Council for Sustainable Development and World Resources Institute, 2015)
– Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (2014)

These policies, guidelines and plans are considered representative of good practice GHG accounting in Australia and are applicable to the proposal. A summary of what is covered by them is given in Table 2.1 below.

Table 2.1 Policies, Guidelines and Plans

Policies, Guidelines & Plans	Description
NGER Act and Regulations	Provides for data accounting in relation to greenhouse gas emissions and energy consumption and production.
National Greenhouse and Energy Reporting (Measurement) Determination 2008	Provides methods and criteria for calculating greenhouse gas emissions and energy data under the NGER Act.
National Greenhouse Accounts	Provides methods, criteria and emissions factors for calculating greenhouse gas emissions, including Scope 3 emissions.
ISO 14064-1:2006 Greenhouse gases - Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals	Provides methods and criteria for setting boundaries and calculating greenhouse gas emissions
Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (GHG Protocol) (World Business Council for Sustainable Development and World Resources Institute, 2015)	Provides methods and criteria for setting boundaries and calculating greenhouse gas emissions
IPCC Fifth Assessment Report	Report adopted by the commonwealth government to assess scientific technical, and socio-economic information concerning climate change, its potential effects, and options for adaptation and mitigation

2.2.1 Net zero targets

The NSW Government and the Wollongong City Council have set goals to achieve net zero GHG emissions by 2050. As part of the NSW Government's action on climate change, it has set a significant milestone of 50% reduction in emissions in comparison to 2005 to be delivered by 2030. The Wollongong City Council have additional accelerated goals for their own operations to reach net zero emissions by 2030, with pledges to adopt best practice of energy efficiency measure across council and community facilities and set city-level renewable energy and emissions reduction targets.

Whilst the city-wide Wollongong City Council target has been agreed by the council, it is an "aspirational" target that council will "strive and do [its] best to meet", the emissions reduction target "isn't about penalising for non-compliance as maintaining business viability and local employment is also critical to creating a healthy and sustainable community".

2.3 Greenhouse gases and global warming potential

The greenhouse gases considered in this assessment and the corresponding global warming potential (GWP) for each gas are listed in Table . GWP is a metric used to quantify and communicate the relative contributions of different substances to climate change over a given time horizon. GWP accounts for the radiative efficiencies of various gases and their lifetimes in the atmosphere, allowing for the impacts of individual gases on global climate change to be compared relative to those for the reference gas carbon dioxide. In this assessment, the GWPs from the NGER Regulations 2008, updated from 1 July 2020, (which are the same as the IPCC Fifth Assessment Report) were used. These are reflective of radiative forcing over a 100-year time horizon.

Table 2.2 Select greenhouse gases and 100-year global warming potential

Greenhouse gas	Global Warming Potential
Carbon dioxide (CO_2)	1
Methane (CH_4)	28
Nitrous oxide (N_2O)	265

2.4 Construction phase emission sources

The following were included in the assessment boundary for the construction stage

2.4.1 Scope 1

Scope 1 emission sources considered include:

– Fuel consumption (including related infrastructure, civil works)
– Transportation of staff materials, and equipment around the construction site

2.4.2 Scope 2

Scope 2 emission sources considered include:

– Electricity consumption

2.4.3 Scope 3

Scope 3 emission sources considered include:

– Associated production (embodied) emissions of used concrete
– Associated production (embodied) emissions of used steel
– Transportation of materials and equipment to and from the construction site
– Commute of workers to and from the construction site

2.4.4 Exclusions

The following emission sources were excluded from the GHG inventory as they were deemed as outside the assessment boundary for the construction stage

– The cumulative emissions from neighbouring industries (existing or proposed)
– Scope 3 emissions not specified above
– Emissions which are likely to be negligible compared with other emissions from the proposal including:
  - Emissions associated with combustion of fuels in minor quantities such as LPG, gasoline, solvents, oils and greases
  - Emissions associated with construction waste removal and disposal
  - Emissions associated with vegetation removal and change of land use. These are negligible as site is cleared and land change will not be significant
  - Emissions associated with minor quantities of acetylene welding gases.

2.5 Assumptions

Assumptions used in estimating GHG emissions for the construction of the proposal are discussed in Table 2.3. The assessment was based on emission factors (EF) available at the time of the assessment as per NGER (Measurement) Determination and future changes in emission factors, GWP or the methodology were not considered.

Activity data used for the GHG assessment was provided by Manildra or other studies conducted as part of Environmental Impact Statement (EIS).

Table 2.3 GHG assessment assumptions - construction

Parameters	Assumptions
Diesel – Construction workers Commuting	Description of contractors vehicles for the construction phase was ‘cars/utes/small trucks’, these were assumed to use diesel.
Diesel – Transport of materials to the site	Concrete agitators, steel deliveries and other related heavy transport to the site during the construction phase were assumed to be completed using diesel fuel
Diesel – Equipment for site establishment	Activities such as earthmoving, excavators and cranes used were detailed with total hours and efficiency. The required fuel all was assumed diesel.
Steel – Emission Factors	Emission factors for the embodied emissions were adapted from the Infrastructure Sustainability Materials calculator from infrastructure sustainability Council (ISC). The following steel equivalent assumptions where used, assuming all steel was sourced from Australia; Welded beams and Columns Steel pipe and tube Hot rolled Coil – Alloyed Steel Reinforcing Mesh
Concrete – Emission Factors	Used the Holcim Ecopact EDP factor for normal class ready mix concrete.
Diesel oil (Stationary) emission factor	NGER (measurement) determination, Schedule 1 Part 3
Diesel oil (Post-2004)(Transport) emission factor	NGER (measurement) determination, Schedule 1 Part 4
Consumption of electricity purchased emission factor	NGER (measurement) determination, Schedule 1 Part 6

2.6 Operations phase emissions sources

The following emissions sources were included in the assessment boundary for the operations stage:

2.6.1 Scope 1

Scope 1 emission sources considered include:

– Fuel used during operations of the storage facility (Loading, transferring, inspections etc)

2.6.2 Scope 2

Scope 2 emission sources considered include

– Electricity consumption during operations of the facility (pumps, lighting, facility controls)

2.6.3 Scope 3

Scope 3 emission sources considered include

– Commute of workers travelling to and from the facility for general operations
– Transport of ethanol to the facility from Manildra ethanol plant

2.6.4 Exclusions

The following emission sources were excluded from the GHG inventory as they were deemed as outside the assessment boundary for the operation stage

– Emissions which are likely to be negligible compared with other emissions from the proposal, including:
  - Emissions associated with combustion of fuels used in minor quantities such as LPG, gasoline, solvents, oils and greases during other maintenance and inspection activities.
  - Emissions from sulphur hexafluoride or perfluorocarbons – these substances are not proposed to be used or stored as part of the proposal.
  - Emissions associated with waste removal and disposal.
  - Fugitive emissions of ethanol, from the vapour recovery unit scrubber stack and vessel vapour vent. Released ethanol to the atmosphere is not categorised as a GHG
– Transport of ethanol from the port Kembla facility to local and overseas destinations as these are consistent with current emissions

2.7 Assumptions

Assumptions used in estimating GHG emissions for the operation of the proposal are discussed in Table . The assessment was based on emission factors (EF) available at the time of the assessment as per NGER (Measurement) Determination and future changes in emission factors, GWP or the methodology were not considered.

The emissions of operations phases were assessed on what would be the annual operations of the proposal.

Activity data used for the GHG assessment was provided by Manildra or other studies conducted as part of Environmental Impact Statement (EIS).

Table 2.4 GHG assessment assumptions by source – operations phase

Parameter	Assumption
Fugitive emissions – Ethanol Quality	The two sources were specified to be of a minimum quality of 96% ethanol. Due to its already low rates of emission (145.2kg/year and 9,984kg/year) and high concentration of ethanol the assumption of 100% ethanol was accepted.
Fuel type - Employee commuting	The fuel type used in vehicle was specified as petrol/diesel, the Motor Vehicle census for Australia from 2020 (from the Australian bureau of statistics) was used to give the proportion of vehicles by fuel type. For Employee commute during operation the fuel type of vehicles used would be 74% petrol and 26%

Parameter	Assumption
	diesel. An assumption was used that 20km is driven each day by commuters to site.
Diesel use – Transport of ethanol	Ethanol is transported to the proposed facility from Manildra's ethanol plant in Shoalhaven. This was assumed to be either in a double or b double truck, at a fuel consumption rate of articulated trucks, given by the Australian bureau of statistics. The assumed rate to the facility being via Princes Highway (A1), and therefore approximately 70km one way.
General operation	48 weeks of operation per year
Diesel oil (Post-2004) (Transport) emission factor	NGA Factors
Liquefied petroleum gas (Post-2004) (Transport)	NGA Factors
Consumption of electricity purchased emission factor	NGA Factors
Liquefied petroleum gas (Stationary)	NGA Factors
Water Supply and Treatment	UK Government GHG Conversion Factors for Company Reporting, "water supply" and "Water Treatment"

3. Impact assessment

3.1 Construction

A summary of estimated Scope 1, 2, and 3 GHG emissions occurring as a result of construction activities for the proposal is presented in Table 3.1 below. This represents emissions across the entire construction period of 50 weeks.

Scope 1 emissions are estimated to be 1,591 tCO_2-e during the construction period. The source of the Scope 1 emissions being from the diesel consumption of equipment during construction, which accounts for approximately 30% of projected GHG construction emissions.

Scope 2 emissions are estimated to be 6 tCO_2-e during the construction period, which is negligible.

Scope 3 emissions are forecast to be 3,733 tCO_2-e during the construction period. The majority of the Scope 3 emissions will be from embodied emissions in steel which accounts for approximately 84% of Scope 3 emissions (59% of total construction emissions). Embodied emissions from cement accounts for 7% of Scope 3 emissions, with the rest due to staff commuting to site and transport of materials.

Table 3.1 Summary of emissions – construction phase

Activity	Activity Data	Units	Scope 1 GHG Emissions (tCO_2-e)	Scope 2 GHG Emissions (tCO_2-e)	Scope 3 GHG Emissions (tCO_2-e)	Total (tCO_2-e)
Diesel Consumption – on site	587	kL	1,591	-	82	
Electricity - consumed from Grid	8	MWh	-	6	1	
Diesel Consumption -Staff commuting to site	63	kL	-	-	171	
Diesel Consumption - Transport of material to site	13	kL	-	-	36	
Steel	1,192	T	-	-	3,084	
Concrete	1,700	M^3	-	-	359	
Total Scope 1, 2 & 3			1591	6	3733	5,330

3.2 Operations

A summary of estimated Scope 1, 2, and 3 GHG emissions occurring as a result of operations for the proposal is presented in Table 3.2 below. Scope 1 emissions are from Liquid Petroleum Gas used for the boiler and are approximately 22 tCO_2-e annually. Scope 2 annual emissions, as electricity consumed from the grid, are estimated to be approximately 296 tCO_2-e, this accounts for 23% of all operations phase emissions.

Scope 3 emission are estimated to be 1008 tCO_2-e per year of operation. The majority of which is the transport of ethanol to the site by truck.

Table 3.2 Summary of emissions – operations phase

Activity	Activity Data	Units	Scope 1 GHG Emissions (tCO_2-e)	Scope 2 GHG Emissions (tCO_2-e)	Scope 3 GHG Emissions (tCO_2-e)	Total (tCO_2-e)
LPG Consumption – on site	14	kL	22	-	1	
Electricity - consumed from Grid	380	MWh	-	296	27	
Diesel Consumption – Ethanol Transport to site	351	kL	-	-	953	
Petrol Consumption – Employee Commute	11	kL	-	-	17	
Diesel Consumption – Employee Commute	4	kL	-	-	10	
Water – network emissions	3,120	kL	-	-	1	
Total Scope 1, 2 & 3			22	296	1008	1,301

3.3 Impact of emissions

The quantity of Scope 1 and 2 emissions estimated to occur during construction and yearly operations phases are estimated as approximately 1,597 tCO_2-e and 318 tCO_2-e.

Scope 1 and 2 emissions associated with the construction of the proposal are below the threshold of 25,000 tCO_2-e per annum for facility level reporting under the NGER Act so will not require annual reporting under the NGER scheme.

Australia's national GHG emissions, by sector, for the year to June 2020 and year 2018 are presented in Table 3.3 below. Total emissions for the year to June 2020 are 498.9 $MtCO_2$-e, and 537.4 $MtCO_2$-e for year 2018. Emissions from construction of the proposal would account for approximately 0.0003% of Australia's annual emissions while also only being a short term issue, this is negligible.

The most recently published state-based emissions inventory is for 2018. NSW GHG emissions, by sector, for the 2018 year are also presented in Table 3.3 below. Total annual emissions for NSW are 131.7 $MtCO_2$-e. Emissions from construction of the proposal would account for approximately 0.001% of NSW's annual emissions, which is negligible.

The quantity of Scope 1 and 2 emissions estimated to occur during operations are estimated as approximately 322 tCO_2-e per annum, representing 0.0001% of the total Australia emissions, and 0.00024% of NSW emissions, which are both negligible.

Scope 1 and 2 emissions associated with the operations of the proposed project are below the threshold of 25,000 tCO_2-e per annum for facility level reporting under the NGER Act so will not require annual reporting under the NGER scheme.

Table 3.3 National and NSW GHG emissions

Emission Source	Australia Emissions Year to June 2021 (Mt CO_2-e)	2018 Australia Emissions ($MtCO_2$-e)	2018 NSW Emissions ($MtCO_2$-e)
Energy – Electricity	163.9	183.2	52.1
Energy – Stationary energy excluding electricity	99.4	97.1	15.3
Energy – Transport	91.2	100.8	28.7
Energy Fugitive emissions	48.7	54.4	13
Industrial processes and product use	31.1	34.2	13.7
Agriculture	75	75.6	18
Waste	14	12.7	4.3
Land use, Land Use change and Forestry	-24.4	-20.6	-13.3
Total	**498.9**	**537.4**	**131.7**
Source: Quarterly Update of Australia's National Greenhouse Gas inventory: June 2021, Department of Industry, Science, Energy and Resources State and Territory Greenhouse Gas Inventories 2018, Department of the Environment and Energy			

This project was completed as a lower carbon alternative to the current situation of transportation in which ethanol was transported directly from the Nowra facility to Port Botany to be shipped out. A desktop review of this proposed development at Port Kembla against the direct transport of the direct transport of the ethanol to Port Botany by road was undertaken to estimate this reduction, and is noted in Table 3.4. This was completed under the assumption that differences from the emissions related to shipping were of negligible difference between both options.

The development of this project presents the opportunity to achieve an approximately a 770 t CO_2-e, 45% reduction for the transportation of the ethanol.

Table 3.4 Case Study Results

Scenario	Development of Port Kembla	Direct to Port Botany	Reduction
Total Transport Distance (km pa)	336600	608400	45%
Emissions (t-$CO_{2\text{-}e}$)	955	1725	-770 t-$CO_{2\text{-}e}$ (45%)

*The emissions of the operation of the Port Kembla facility are accounted for in this comparison as these would be additional to the transportation operation, whereas Port Botany facility will operate in both scenarios.

3.3.1 Impact on net zero emission targets

As noted above the impact of this proposal either at construction or operations phase will have an insignificant impact on NSW emissions, and therefore will have virtually no impact on the net zero plans of NSW.

The Wollongong City Council Local Government Area (LGA) emissions in FY17 were approximately 3.1Mt CO_2-e, so once again the impact of this proposal at construction and operations phase at 0.2% (one year only) and 0.03% of annual LGA emissions respectively, will also be a very insignificant impact on the achievement of that target.

3.4 Greenhouse gas reduction measures

3.4.1 Construction

The following measures can be undertaken to minimise/reduce greenhouse gas emissions and energy during construction:

- Sustainable procurement practices will be adopted where feasible
- Construction materials will be sourced locally where possible
- Investigate the use of biodiesel for trucks and equipment, where suitable
- Investigate the use of low carbon concrete, including higher proportions of fly ash in concrete to reduce cement proportion (and hence reduce the Scope 3 'embodied emissions' from use of cement)
- All plant and equipment used during the construction works shall be regularly maintained to reduce emissions and comply with the relevant exhaust emissions guidelines
- Plant and equipment will be switched off when not in constant use and not left idling
- Plant and equipment brought onsite will be regularly serviced and energy efficient vehicles or equipment will be selected where available
- Any plant and equipment that is not working efficiently will be removed from site and replaced as soon as possible
- Construction works will be planned to ensure minimal movement of plant and equipment
- Opportunities for the beneficial reuse of the carbon removed in vegetation, such as mulching and composting, will be included in construction management plans, where feasible
- Opportunities for the reuse/recycling of construction waste materials will be investigated and included in construction management plans, where feasible.

3.4.2 Operations

Since the greenhouse gas emissions related to operations are mainly related to the electricity from the grid, the following actions that can be undertaken to minimise/reduce greenhouse gas emissions and energy during operations are:

- Purchase from renewable energy sources when feasible, as there is no land available space on site to propose/provide options for renewable energy sources.
- The site is connected to main power grid, and therefore the associated carbon emissions from this source are impacted by the NSW government's drive to introduce a greater amount of zero emissions energy sources to reduce NSW electricity grid emissions intensity. The decarbonisation of the state energy grid will reduce the emissions related to this facility. This is out of control of Manildra and would be a government matter to manage.
- Staff and worker commute is associated with the accessibility of low carbon vehicles to the public by improved access to electric and hydrogen vehicles and the associated infrastructure. This is out of Manildra control and would be a government matter to manage.
- The consideration of hydrogen or electric fleet of tanker trucks. However, given the scale of the transport operations related to this project, the capacity of hydrogen or electric tanker trucks are less suitable at this time in comparison to the combustion engine counterparts. It is recommended that this option is considered more seriously as the technology develops further. Reduction/minimisation of greenhouse gas emissions from the other sources during operations would be negligible.

4. Conclusions

The quantity of emissions estimated to occur during construction are estimated as approximately 5,247 tCO_2-e comprising 1,591 tCO_2-e of Scope 1, 6 tCO_2-e Scope 2, and 3,733 tCO_2-e Scope 3 during the entire construction period. These emissions are negligible compared to annual emissions in NSW and Australia.

The quantity of emissions estimated to occur during operations are estimated as approximately 1,301 tCO_2-e per annum, comprising 22 tCO_2-e Scope 1, 296 tCO_2-e Scope 2, and 1,008 tCO_2-e Scope 3 per annum. These direct emissions from the facility, scope 1 and scope 2 emissions, are negligible compared to annual emissions in NSW and Australia.

Measures can be implemented to minimise and reduce greenhouse gas emissions and energy consumption during the construction and operations period.

5. References

Australia Bureau of Statistics “Motor Vehicle Census”, 31st January 2021

Commonwealth of Australia “National Greenhouse and Energy Reporting (Measurement) Determination 2008”, Compilation No. 13, 1 July 2021

Department for Environment Food & Rural affairs, Department for Business, Energy & Industrial strategy, “UK Government GHG Conversion Factors for Company Reporting”, version 2.0, 7/31/2021.

Department for Environment Food & Rural affairs, Department for Business, Energy & Industrial strategy, “UK Government GHG Conversion Factors for Company Reporting”, version 2.0, 31 July 2021.

Holcim Pty Ltd “ECOPACT – Low Carbon Concrete made Easy”

Infrastructure Sustainability Council (ISC) “Infrastructure Sustainability Materials Calculator”, Version 2.0

State and Territory Greenhouse Gas Inventories 2018, Department of the Environment and Energy

Quarterly Update of Australia’s National Greenhouse Gas inventory: June 2021, Department of Industry, Science, Energy and Resources

Wollongong City Council “Emissions Reduction Target”
https://our.wollongong.nsw.gov.au/emissionsreductiontarget/widgets/263047/faqs Accessed 3/3/22

ghd.com

The Power of Commitment