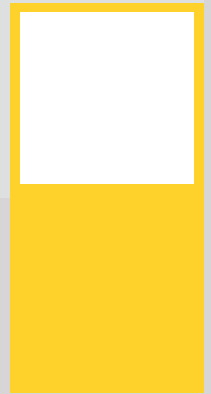




CLYDE TERMINAL CONVERSION PROJECT

APPENDIX I

GREENHOUSE GAS ASSESSMENT



Greenhouse Gas Assessment

Clyde Terminal Conversion Project Environmental Impact Statement

Greenhouse Gas Assessment

Clyde Terminal Conversion Project Environmental Impact Statement

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1.0 Introduction

AECOM Australia Pty Ltd (AECOM) was commissioned by the Shell Company of Australia Ltd (Shell) to undertake a Greenhouse Gas Assessment (GHG Assessment) for the Clyde Terminal Conversion Project (the Project). The Project involves conversion of Shell's Clyde Terminal for use solely as a finished fuel storage terminal. The Clyde Terminal is located at the confluence of Parramatta and Ducks Rivers in Rosehill, New South Wales (NSW), approximately 16 km west of Sydney's central business district. The terminal, which receives petroleum products from Shell's associated Gore Bay Terminal via 19 km of underground pipeline, is bounded to the north by Parramatta River, to the south and east by Duck River, and to the west by industrial complexes. The Project area falls wholly within the Parramatta Local Government Area and is zoned *IN3 Heavy Industrial* under the Parramatta Local Environment Plan 2011.

This GHG Assessment was prepared as part of an Environmental Impact Statement (EIS) in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979 (NSW)* (EP&A Act) to assess the potential impacts to GHG emissions associated with the conversion of the refinery into a finished fuel storage terminal.

2.0 Regulatory Framework

Greenhouse gases (GHGs) are gases found in the atmosphere that absorb outgoing heat that is reflected from the sun. The primary GHG is carbon dioxide (CO₂). Different GHGs have different heat absorbing capacities. In order to achieve a basic unit of measurement, each GHG is compared to the absorptive capacity of CO₂, and measurements and estimates of GHG levels are reported in terms of CO₂ equivalent emissions (CO₂-e).

Australia's National Greenhouse Gas Inventories are designed to provide estimates of Australia's net GHG emissions in accordance with the *Greenhouse Gas Protocol: Corporate Standard* (World Council for Sustainable Business Development and World Resources Institute, 2001) which provides internationally accepted methods of accounting for and reporting of GHG emissions. The National Greenhouse Gas Inventories also track Australia's progress towards its internationally-agreed GHG reduction targets. Australia has published annual national GHG inventories for each year from 1990 to 2010 inclusive. In 2010 (the latest available data), Australia's total GHG emissions were estimated to be 560.8 Mt CO₂-e (Department of Climate Change and Energy Efficiency, 2012c).

For organisations accounting and reporting their GHG emissions, regard must be had to the *National Greenhouse and Energy Reporting System, Technical Guidelines*, which are updated for each new financial year (DSEWPAC, 2012). Reported GHG emissions data are available for public viewing via the *Australian Greenhouse Emissions Information System* (Department of Climate Change and Energy Efficiency, 2012a).

3.0 Methodology

Estimation of the GHG emissions associated with the current Clyde Terminal operations was undertaken using the emission factors and methods outlined in the *Australian National Greenhouse Accounts - National Greenhouse Accounts Factors* (Department of Climate Change and Energy Efficiency, 2012b) (NGA Factors). The NGA Factors provide three types of assessment categories:

- **Scope 1**, which covers direct emissions from sources within the boundary of an organisation, such as fuel combustion and manufacturing processes;
- **Scope 2**, which covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation; and
- **Scope 3**, which includes all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation.

The emissions of end fuel use combustion were not included in the Scope 3 GHG assessment as the Clyde Terminal is an interim transfer point and is not the final distribution point of the fuels. Additionally, Shell does include the greenhouse gases emitted from product end use under its global greenhouse reporting protocols. The focus for this report was the emissions associated with the Clyde Terminal itself.

The main operations associated with the generation of GHGs from the existing Clyde Refinery are:

- **Scope 1:**
 - Natural gas consumption;
 - Stationary energy consumption of liquid fuels; and
 - Transport energy consumption of liquid fuels.
- **Scope 2:**
 - Externally purchased electricity.
- **Scope 3:**
 - Externally purchased electricity;
 - Natural gas production, transmission and distribution;
 - Passenger vehicle movements of commuting staff and contractors (assumed to drive gasoline-powered cars with a conservative fuel consumption rate of 0.19 L/km (DSEWPAC, 2008) and commuting an average single trip distance of 20km five days per week);
 - Extraction, production and transport of consumed liquid fuels; and
 - Waste disposed to landfill.

4.0 Predicted Greenhouse Gas Emissions at the Converted Clyde Terminal

Existing facility GHG data provided below is as submitted for the 2010-11 National Greenhouse and Energy Reporting (NGER) requirements for fuels, electricity and process emissions. Existing facility waste data provided was sourced from Shell internally reported tonnages in 2011.

Shell has provided estimates for the changes to this baseline data for the current and proposed Clyde Terminal operations and for during the construction and demolition phases of the Project.

4.1 Scope 1 Emissions

Total Scope 1 GHG emissions for the Clyde Terminal are shown in **Table 1**. There are not anticipated to be changes to Scope 1 emissions throughout the duration of the Project or once the conversion works have been completed. The current operations would continue throughout the construction and demolition phase of the Project and would remain consistent once the works are completed. Scope 1 GHG emissions are estimated to remain at 501 tCO₂e per annum.

Table 1 Scope 1 GHG Emissions for the Current and Future Operations of the Clyde Terminal

Scope 1 Emissions					Current			Demolition and Modification (including concurrent operations)			Converted		
Activity	Energy Factor	Energy Factor Unit	Emission Factor	Emission Factor Unit	Value	Unit	tCO ₂ -e	Value	Unit	tCO ₂ -e	Value	Unit	tCO ₂ -e
Diesel Oil – non transport	38.6	GJ/kL	69.5	kgCO ₂ -e/GJ	48	kL	129	48	kL	129	48	kL	129
Gasoline – non transport	34.2	GJ/kL	67.1	kgCO ₂ -e/GJ	0.6	kL	1.4	0.6	kL	1.4	0.6	kL	1.4
Kerosene – non transport	37.5	GJ/kL	68.41	kgCO ₂ -e/GJ	5.5	kL	14	5.5	kL	14	5.5	kL	14
LPG – non transport	25.7	GJ/kL	59.9	kgCO ₂ -e/GJ	2.6	kL	4.0	2.6	kL	4.0	2.6	kL	4.0
Diesel Oil – transport	38.6	GJ/kL	69.9	kgCO ₂ -e/GJ	92	kL	248	92	kL	248	92	kL	248
Gasoline - transport	34.2	GJ/kL	69.6	kgCO ₂ -e/GJ	44	kL	105	44	kL	105	44	kL	105
Total Scope 1							501			501			501

4.2 Scope 2 Emissions

Scope 2 GHG emissions for the Clyde Terminal from the consumption of externally purchased electricity are shown in **Table 2**. There are not anticipated to be changes to Scope 2 emissions throughout the duration of the Project or once the conversion works have been completed when compared to current emissions. The current operations would continue throughout the construction and demolition phase of the Project and would remain consistent once the works are completed. Scope 2 GHG emissions are estimated to remain at 54,846 tCO₂e per annum.

Table 2 Scope 2 GHG Emissions for the Current and Future Operations of the Clyde Terminal

Scope 2 Emissions					Current			Demolition and Modification (including concurrent operations)			Converted		
Activity	Energy Factor	Energy Factor Unit	Emission Factor	Emission Factor Unit	Value	Unit	tCO ₂ -e	Value	Unit	tCO ₂ -e	Value	Unit	tCO ₂ -e
Electricity purchased from grid			0.88	kgCO ₂ -e/kWh	62,325	MWh	54,846	62,325	MWh	54,846	62,325	MWh	54,846
Total Scope 2								54,846			54,846		

4.3 Scope 3 Emissions

Scope 3 GHG emissions are shown in **Table 3**. Scope 3 GHG emissions are anticipated to increase by approximately 8% to 12,652 tCO₂-e per annum during the construction and demolition phase compared to current scope 3 GHG emissions at the Clyde Terminal. The increase of Scope 3 GHG emissions during the construction and demolition phase can be attributed to:

- Increased employee and contractor vehicle movements;
- Increased generation of municipal waste due to the greater number of employees and contractors onsite;
and
- Generation of construction and demolition waste.

The current workforce at the site is approximately 83 personnel. The workforce would increase to approximately 254 personnel during the peak of the demolition and construction/modification phase and would then reduce to 58 personnel once the conversion works are completed.

Once the Project works are completed, Scope 3 GHG emissions are anticipated to decrease slightly below current Scope 3 GHG emissions to 11,583 tCO₂-e per annum, which represents a reduction of approximately 1% compared to current Scope 3 GHG emissions. The slight decrease in Scope 3 GHG emissions can be attributed to a decrease in the total workforce resulting in a reduction in emissions relating to vehicle movements and municipal waste generation when compared to the current emissions.

Ongoing emissions associated with the extraction, production and transport of other consumed liquid fuels (gasoline, kerosene and LPG) are expected to remain unchanged.

Table 3 Scope 3 GHG Emissions for the Clyde Terminal Current and Future Operations

Scope 1 Emissions					Current			Interim			Converted		
Activity	Energy Factor	Energy Factor Unit	Emission Factor	Emission Factor Unit	Value	Unit	tCO ₂ -e	Value	Unit	tCO ₂ -e	Value	Unit	tCO ₂ -e
Electricity Purchased for Grid			0.18	kgCO ₂ -e/GJ	62,325	MWh	11,219	62,325	MWh	11,219	62,325	MWh	11,219
Employee & Contractor passenger vehicles	34.2	GJ/kL	69.6	kgCO ₂ -e/GJ	151	kL	360	462	kL	1100	106	kL	251
Extraction, Production & Transport of Consumed Liquid Fuels													
Diesel Oil	38.6	GJ/kL	5.3	kgCO ₂ -e/GJ	140	kL	29	140	kL	29	140	kL	29
Gasoline	34.2	GJ/kL	5.3	kgCO ₂ -e/GJ	45	kL	8.2	45	kL	8.2	45	kL	8.2
Kerosene	37.5	GJ/kL	5.3	kgCO ₂ -e/GJ	5.5	kL	1.1	5.5	kL	1.1	5.5	kL	1.1
LPG	25.7	GJ/kL	5.0	kgCO ₂ -e/GJ	2.6	kL	0.3	2.6	kL	0.3	2.6	kL	0.3
Waste Disposal to Landfill													
Municipal solid waste			1.2	tCO ₂ -e/tonne	75	t	90	229	t	277	52	t	63
Industrial waste			1.14	tCO ₂ -e/tonne	10	t	11	10	t	11	10	t	11
Construction and demolition waste			0.2	tCO ₂ -e/tonne				32	t	6.4			
Total Scope 3							11,719			12,652			11,583

5.0 Conclusion

The GHG assessment of the proposed conversion of the current Clyde Terminal has considered Scope 1, 2 and 3 emissions. The overall total GHG emissions are estimated to reduce on a per annum basis from 67,066 tCO₂-e per annum to 66,930 tCO₂-e per annum, representing a reduction of approximately 1 percent.

There would be a temporary increase in GHG emissions during the construction and demolition phase to 67,999 tCO₂-e per annum due to emissions associated with a temporary increase in workforce and the generation of construction and demolition waste.

The majority (98.7 percent) of ongoing GHG emissions are attributed to emissions associated with external electricity purchases (Scope 2 and 3) with only 501 tCO₂-e or 0.75 percent of GHG emissions from direct Scope 1 sources.

The relationship between GHG concentrations and climate change is very complex and nonlinear. As such, the effect that the reduction in GHG emissions associated with this project may have on the environment or climate change have not been estimated as part of this GHG Assessment. The Clyde Terminal produces only a small fraction of the total Australian GHG emissions (i.e. 0.012% of the total Australian emissions) and this is expected to remain consistent once the modifications to the terminal are completed.

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