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# Wheatstone LNG Plant Greenhouse Gas Management Plan

**Without prejudice draft for discussion purposes**

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## Wheatstone LNG Plant Greenhouse Gas Management Plan

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0.1	Draft GHG Management Plan for discussion purposes	22 Sept 2021	Hannah Brown	Graeme McKellar
0.2	Update completed to align with Contemporary GHG Management Plan requirements and to address comments received from the DWER	11 Nov 2022	Hannah Brown	Graeme McKellar

### Approvals

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## 1 Executive Summary

Proposal name	Wheatstone Development – Gas Processing, Export Facilities and Infrastructure
Proponent name	Chevron Australia Pty Ltd
Ministerial Statement number	873
Purpose of the EMP	Outline Chevron Australia’s plan for managing the GHG emissions for the Wheatstone LNG Plant’s planned contribution to the Western Australian Government’s current aspiration of achieving net zero emissions by 2050 (EPA, 2020)
Key environmental factor	Greenhouse Gas Emissions
Outcome	Net scope 1 GHG Emissions do not exceed established targets
Condition clauses	TBC

## 2 Introduction

### 2.1 Project Overview

Chevron Australia Pty Ltd (Chevron Australia) operates a multi-train liquefied natural gas (LNG) plant and a domestic gas (Domgas) plant near Onslow on the Pilbara coast, Western Australia (WA). The Wheatstone Development – Gas Processing, Export Facilities and Infrastructure (Wheatstone Development) processes gas from various offshore fields in the West Carnarvon Basin. The Ashburton North Strategic Industrial Area (ANSIA) is the approved site for the LNG and Domgas plants.

The Wheatstone Development comprises gas gathering, export, and processing facilities in Commonwealth and State waters and on land. The Wheatstone Development produces gas from Production Licences WA-46-L, WA-47-L, and WA-48-L, 145 km offshore from the mainland, approximately 100 km north of Barrow Island and 225 km north of Onslow, and also processes gas from Production Licence WA-49-L operated by Woodside Energy Group Ltd.

The ANSIA site is approximately 12 km south-west of Onslow along the Pilbara coast within the Shire of Ashburton. The foundation Wheatstone Development comprises two LNG processing trains, with a nominal combined capacity of 8.9 million tonnes per annum (MTPA). Environmental approval was granted for a 25 MTPA plant to allow for expected further expansions. The Domgas plant is a separate but co-located facility and forms part of the Wheatstone Development. The Domgas plant ties-in to the existing Dampier to Bunbury Natural Gas Pipeline infrastructure via the third-party Australian Gas Infrastructure Group Domgas pipeline.

### 2.2 Environmental Approvals

The Wheatstone Development was assessed through an Environmental Impact Statement / Environmental Review and Management Program (EIS/ERMP) assessment process under the *WA Environmental Protection Act 1986* (EP Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Ref. 1).

The Wheatstone Development was approved by the WA Minister for Environment; Water on 30 August 2011 by way of Ministerial Implementation Statement No. 873 (MS 873; Ref. 2) and as amended by Ministerial Implementation Statement No. 903 (MS 903; Ref. 3), Ministerial Implementation Statement No. 922 (MS 922; Ref. 4), Ministerial Implementation Statement No. 931 (MS 931; Ref. 5), Ministerial Implementation Statement No. 1130 (MS 1130; Ref. 6) and Attachments 1 to 4.

In anticipation of the introduction of the Commonwealth Government's carbon pricing legislation, Condition 19-9 of Ministerial Statement 873 contained a 'complementarity clause', providing that GHG conditions may be removed if the WA Minister for Environment determined that they were noncomplementary to national greenhouse gas (GHG) reduction legislation applicable to the Wheatstone Development.

On 11 January 2013, following a section 46 inquiry, the WA Minister for Environment; Water approved amendments to the GHG conditions within MS 873 on the grounds that they were considered noncomplementary to the national greenhouse gas reduction legislation at the time. The amendments set out in MS 922 repealed the original conditions relating to preparation and implementation of a GHG Abatement Program and implementation of a GHG offset package and

replaced them with a single condition requiring annual reporting. On 30 January 2013, the WA Minister for Environment; Water approved revised environmental protection outcomes under Condition 8.7 to allow for trunkline installation. On 22 April 2020, the WA Minister for Environment approved the deletion of Conditions 6.12, 9.1 to 9.5, and 12.1 to 12.8 by way of MS 1130.

The then Commonwealth Minister for Sustainability, Environment, Water, Population and Communities (SEWPaC; now Department of Climate Change, Energy, the Environment and Water [DCCEEW]), approved the Wheatstone Development on 22 September 2011 (EPBC 2008/4469; Ref. 7), with variations to EPBC 2008/4469 Conditions 2, 3, 5, 6, 8, 44, 45, 47, 54, 55, 56, 58, 66e, 71, 71A, and 71B made pursuant to section 143 of the EPBC Act.

### **2.3 Proponent**

Chevron Australia is the proponent, and the person taking the action for the Wheatstone Development on behalf of its current joint venture participants, pursuant to MS 873. The Wheatstone Development is a joint venture between Australian subsidiaries of:

- Chevron Corporation
- Kuwait Foreign Petroleum Exploration Company
- Woodside Energy Group Ltd
- Kyushu Electric Power Company
- PE Wheatstone Pty Ltd, part owned by JERA Co., Inc.

2.4 Location

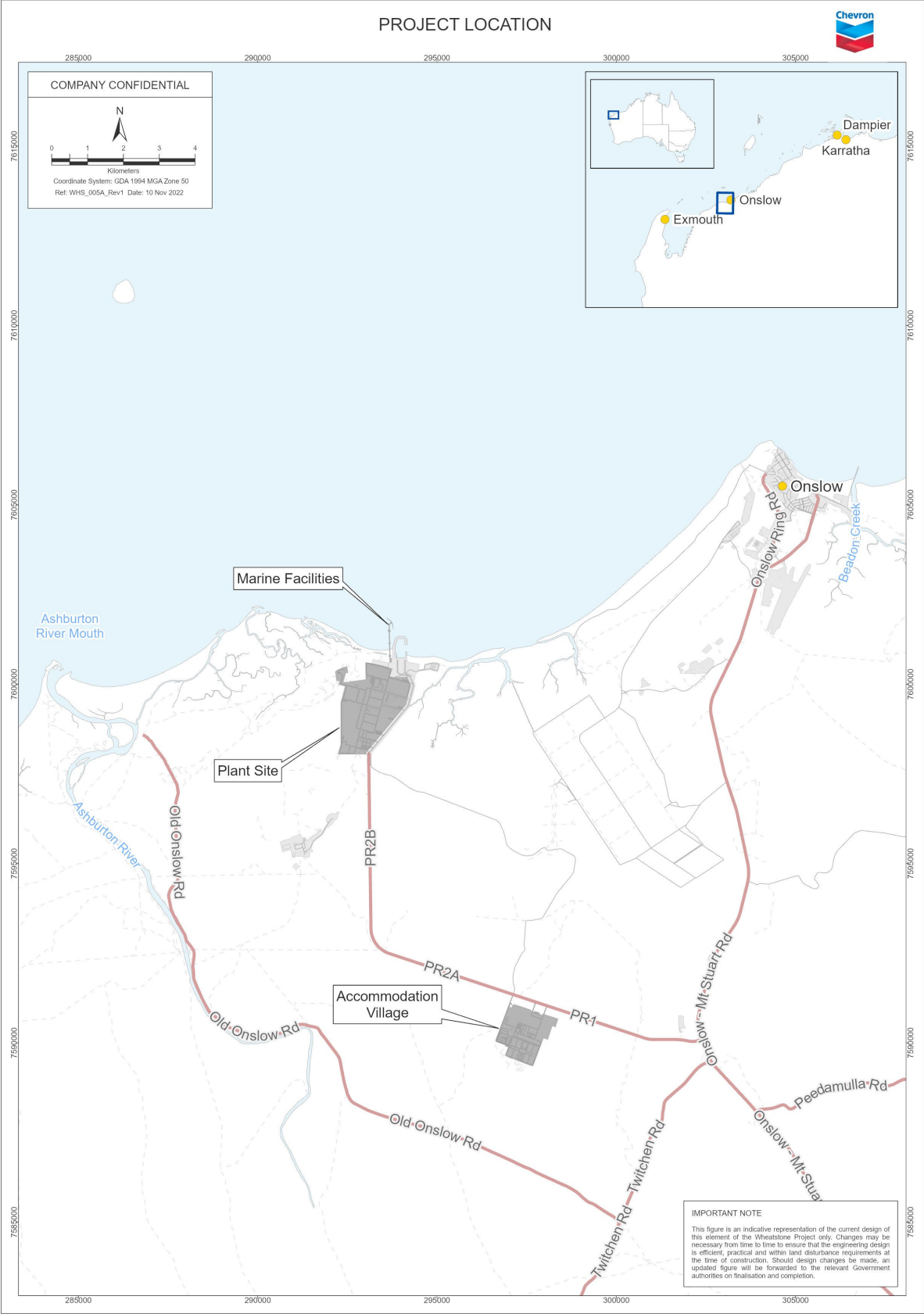


Figure 2-1: Project location



## 2.5 Scope

This plan is applicable to all scope 1 GHG emissions from the current operational Wheatstone Development facilities outlined in MS 873. This includes all scope 1 emissions from the Wheatstone LNG Plant Trains 1 and 2, Domgas Plant and associated accommodation facility. These facilities are described in further detail below in section 4.1. For clarity, the in-scope facilities will be referred to as the Wheatstone LNG Plant throughout this document.

There are currently no scope 2 emissions associated with the Wheatstone LNG Plant and this Plan also does not apply to:

- Scope 3 emissions such as emissions associated with final combustion and use of LNG, Domgas and condensate products by customers, as well as emissions from the transport of products to customers. Refer to Appendix A for an estimate of scope 3 emissions for the Wheatstone Development;
- Emissions from activities or facilities in Commonwealth waters; and
- Emissions from additional LNG Trains or associated facilities that are yet to be constructed (MS 873 provides approval for up to 6 LNG trains and up to 4 Domgas plants).

Assuming that further Ministerial conditions are set providing for net GHG emissions targets for the current operational facilities, an inquiry pursuant to section 46 of the *Environmental Protection Act 1986 (WA)* would be required to amend those targets to provide for any additional LNG Trains.

## 2.6 Purpose

In accordance with the requirements of the Environmental Protection Authority's (EPA) Environmental Factor Guideline (EFG) on Greenhouse Gas Emissions (Ref. 8), the purpose of this Wheatstone LNG Plant Greenhouse Gas Management Plan (GHGMP) is to outline Chevron Australia's plan for managing the GHG emissions for the Wheatstone LNG Plant's planned contribution to the Western Australian Government's current aspiration of achieving net zero emissions by 2050 (EPA, 2020).

The objective of this Plan is to outline:

- measures implemented through the design and early phase of operations to avoid or reduce GHG emissions;
- measures to avoid, reduce or offset scope 1 GHG emissions during operations over the life of the proposal; and
- interim and long-term aspirational emission reduction targets for scope 1 GHG emissions from the Wheatstone LNG Plant over the life of the proposal.

## 3 Internal and External Policy Frameworks

### 3.1 Commonwealth Policy and Requirements

In 2019, the Commonwealth Government published its Climate Solutions Package aimed at delivering on Australia's 2030 climate commitment to reduce emissions by 26 - 28% below 2005 levels (Ref 9). In October 2021, the Commonwealth Government released Australia's Long-Term Emissions Reduction Plan which outlined its plan to achieve net zero emissions by 2050 (Ref. 10). The Emissions Reduction Fund (ERF) incentivises businesses to cut the amount of GHGs they create and to undertake activities that store carbon. It has three key elements: crediting, purchasing, and safeguarding emission reductions. Chevron Australia participates in the ERF and the Wheatstone LNG Plant forms part of a larger facility that is registered as the 'Wheatstone Operations Facility' with the Clean Energy Regulator (CER). The ERF was established through the *Carbon Credits (Carbon Farming Initiative) Act 2011*.

The National Greenhouse and Energy Reporting (NGER) Scheme is a single national framework for reporting company information about GHG emissions, energy production and energy consumption and is administered through the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) and associated regulations (Ref. 11).

The Commonwealth Government's Safeguard Mechanism, which took effect in 2016, was also established as part of the ERF. The Safeguard Mechanism builds on the NGER Scheme's reporting and record keeping requirements. The Safeguard Mechanism is administered by the CER in accordance with the *National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015* (Safeguard Rule) (Ref. 12) and applies to all facilities with direct emissions over 100,000 tonnes per annum carbon dioxide equivalent.

The DCCEEW is currently consulting on options to reform the Safeguard Mechanism to help industry reduce emissions in line with Australia's climate targets. The Safeguard Mechanism currently requires Australia's largest GHG emitters to keep their net emissions below an emissions limit (a baseline). The Australian Government is currently consulting upon:

- gradually reducing baselines to help Australia reach net zero emissions by 2050
- introducing credits for facilities that emit less than their baseline
- providing tailored treatment to emissions-intensive, trade-exposed facilities so businesses are not disadvantaged compared to international competitors and emissions do not increase overseas.

Under the NGER and Safeguard Mechanism schemes, the scope of the 'Wheatstone Operations Facility' covers both the onshore Wheatstone LNG Plant, and any sources of emissions from activities or facilities in Commonwealth waters, including the Wheatstone offshore platform. The current Safeguard Mechanism baseline for the Wheatstone Operations Facility is 4.34 MTPA CO<sub>2</sub>-e per financial year. This current Wheatstone Operations Facility baseline commenced 1 July 2020 and is a calculated emissions baseline under the transitional calculated baseline criteria.

On 16 June 2022, the Prime Minister and the Minister for Climate Change and Energy submitted a new Nationally Determined Contribution to the United Nations which formally committed Australia to reducing carbon emissions by 43% on 2005 levels (Ref. 13). The Australian Government introduced the *Climate Change Bill*

2022 in 2022 and the bill received assent on 13 September. The *Climate Change Act 2022* (Cth) (*Climate Act*) and the *Climate Change (Consequential Amendments) Act 2022* (Cth) (*Consequential Amendments Act*) came into effect on 14 September 2022. The Climate Act legislates emissions reduction targets for Australia of 43% from 2005 levels by 2030 and net zero emissions by 2050.

This Wheatstone LNG Plant GHGMP is intended to complement, rather than duplicate, Commonwealth GHG requirements. To the extent that additional Commonwealth GHG requirements are introduced, which overlap with the Wheatstone LNG Plant GHGMP emission targets, the Commonwealth requirements will take effect and this Wheatstone LNG Plant GHGMP will be amended to avoid inconsistency with, or duplication of, the regulation. This is consistent with the State GHG Policy's aim to complement, rather than duplicate, the Commonwealth Government's climate change policy framework.

### 3.2 State Policy

The Western Australian Climate Policy sets out the State Government's plan for a climate-resilient community and a prosperous low-carbon future (Ref 14). The policy underscores the Western Australian government's commitment to adapting to climate change and working to achieve net zero GHG emissions by 2050.

On 28 August 2019, the State Government released its GHG Emissions Policy for Major Projects assessed by the EPA (Ref. 15). This Policy requires new proposals or expansions undergoing environmental impact assessment under the *Environmental Protection Act 1986* (WA) to develop a GHGMP that sets interim and long-term emission reduction targets and outlines their contribution to the State's net zero aspiration.

The EPA released an EFG in April 2020 (Ref. 8) relating to GHG Emissions. The EFG outlines how and when the GHG Emissions factor is considered by the EPA in the environmental impact assessment process, including when assessing changes to proposals resulting in an increase in GHG emissions. The EFG states that when the EPA applies the guideline in assessing a proposal, the EPA will require proponents to develop a GHGMP as part of the assessment process that demonstrates their contribution towards the aspiration of net zero emissions by 2050. The EFG also states that, as a minimum a GHGMP should outline:

- intended reductions in scope 1 emissions over the life of the proposal;
- regular interim and long-term targets that reflect an incremental reduction in scope 1 emissions over the life of the proposal; and
- strategies which demonstrate that all reasonable and practicable measures have been applied to avoid, reduce and offset a proposal's scope 1 emissions over the life of the proposal.

This Plan was originally provided in response to the EPA's letter dated 10 June 2021 and has been revised in accordance with the EPA's letter dated 5 October 2022. The Wheatstone LNG Plant is not a new proposal or an expansion undergoing environmental impact assessment and therefore the requirement for the Plan was not triggered by the Greenhouse Gas Emissions Policy for Major Projects. Notwithstanding, the Plan aligns with the Policy by setting interim and long-term emission reduction targets and outlining Wheatstone LNG Plant's contribution to the State's net zero aspiration.

### 3.3 Corporate Context

As outlined in Chevron Corporation's Climate Change Resilience report (Ref. 16), Chevron supports the Paris Agreement and its goal of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels". Chevron's strategy employs a global approach in order to achieve the goals of the Paris Agreement as efficiently and cost-effectively as possible. Chevron believes that the optimal approach for society is to drive the most efficient and cost-effective reductions economywide, paired with natural and technological emissions removal. Chevron supports a price on carbon, applied as widely and broadly as possible, as the best approach to reduce emissions. To this end, Chevron supports international linkages (for example, through Article 6 of the Paris Agreement), with the goal of ultimately building up to a liquid and integrated global carbon market.

At Chevron, we believe the future of energy is lower carbon. We will accomplish our energy transition goals with our strong governance, risk management, business strategy and climate policy principles, coupled with actions and investments. Our primary objective is to deliver higher returns, lower carbon, and superior shareholder value in any business environment. Chevron's strategic planning process supports an ability to operate in a lower carbon policy environment. For example, we use carbon prices and derived carbon costs in business planning, investment decisions, impairment reviews, reserves calculations, and evaluation of carbon-reduction and new energy opportunities.

## 4 GHG Emissions Profile

### 4.1 Facility Description and GHG Sources

The facilities located at the ANSIA and referred to as the 'Wheatstone LNG Plant' include:

- two nominal 4.45 MTPA LNG processing trains utilising the Conoco-Phillips Optimised Cascade™ liquefaction technology
- one Domgas processing plant with a nominal capacity to supply approx. 205 TJ/day
- four 36 MW Aero Derivative gas turbine generators
- two LNG storage tanks
- two condensate storage tanks
- jetty for LNG and condensate loading into tankers
- operations and maintenance buildings
- associated infrastructure and support activities, including the accommodation facility.

Key sources of GHG emissions within the Wheatstone LNG Plant include:

- liquefaction gas turbines
- power generation gas turbines
- acid gas removal units (AGRU)
- nitrogen rejection units (NRU)
- fired heaters
- flaring
- other sources such as diesel for transport and machinery, tugs and pilot vessels and power generation at the accommodation facility, and fugitive emissions

### 4.2 Historical GHG Profile

The historical GHG profile for the Wheatstone LNG Plant is shown in Figure 4-1 and the corresponding data is provided in Table 4-1. Commissioning of the Wheatstone LNG and Domgas trains commenced in 2017 and continued through to March 2019. Hence the first two years of the Wheatstone LNG Plant's historical emissions profile reflect commissioning activities, rather than operations, which is evidenced by elevated flaring emissions. During operations, the most significant source of GHG emissions is the combustion of fuel gas in gas turbines which drive refrigerant compressors used for LNG liquefaction.

The CO<sub>2</sub> content of the reservoir gas entering the Wheatstone LNG Plant is shown in the Acid Gas Removal (Reservoir CO<sub>2</sub>) category in Figure 4-1 and Table 4-1. The CO<sub>2</sub> concentration of the feed gas has averaged approximately 2.0 – 2.5<sup>1</sup> mol% since operations commenced.

<sup>1</sup> Based on laboratory sample data 2019-2021

GHG emissions from the Wheatstone LNG Plant contribute approximately 4.4% of WA's overall GHG emissions, based on 2020 data<sup>2</sup>.

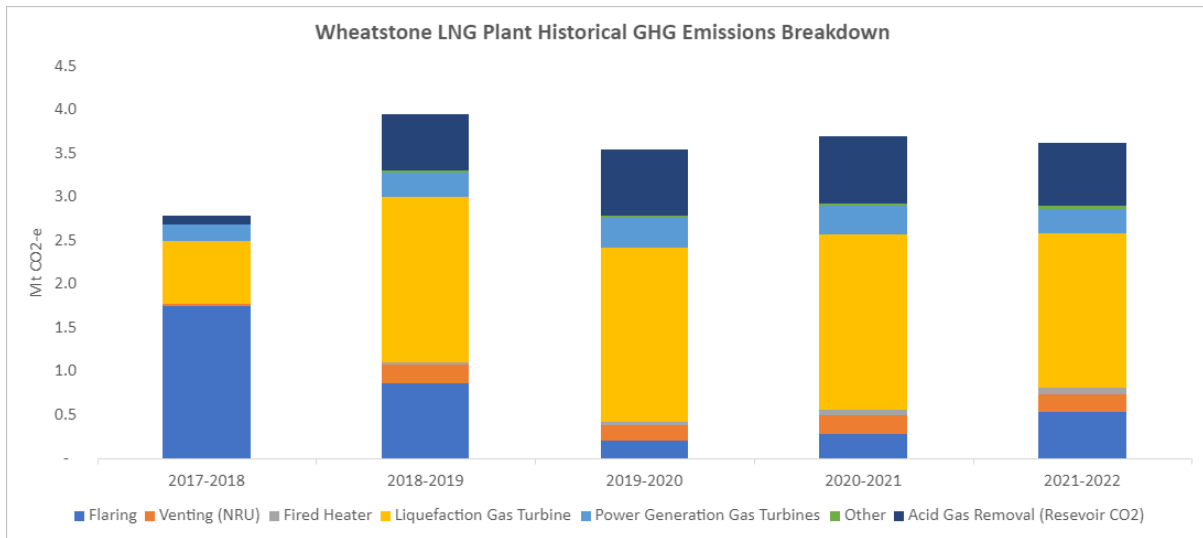


Figure 4-1 – Wheatstone LNG Plant historical GHG emissions by source

Table 4-1 Wheatstone LNG Plant historical GHG emissions (MtCO<sub>2</sub>e by source)

	FY2018	FY2019	FY2020	FY2021	FY2022
Flaring	1.75	0.86	0.20	0.28	0.54
Venting	0.03	0.22	0.19	0.22	0.20
Fired Heaters	-	0.02	0.04	0.06	0.07
Liquefaction Gas Turbines	0.73	1.89	2.00	2.02	1.77
Power Generation Gas Turbines	0.18	0.28	0.34	0.32	0.28
Other Sources	0.01	0.03	0.03	0.03	0.04
Acid Gas Removal (Reservoir CO <sub>2</sub> )	0.10	0.64	0.76	0.77	0.72
TOTAL	2.78	3.95	3.54	3.70	3.62

### 4.3 GHG Intensity and Benchmarking

The Draft EIS/ERMP for the Proposed Wheatstone Project (Ref. 17), submitted to the EPA in 2010 and approved by way of MS 873 in 2011 (Ref. 2), forecast a GHG emissions intensity for the Wheatstone Project of 0.37 t CO<sub>2</sub>-e/t LNG. This was a forecast intensity for the full 25 MTPA onshore facility, averaged over the life of the Project. Emissions estimations were based on an average of the anticipated steady

<sup>2</sup> State and Territory Greenhouse Gas Inventories 2020. Retrieved from <https://www.industry.gov.au/data-and-publications/national-greenhouse-accounts-2020/state-and-territory-greenhouse-gas-inventories2020-emission>

state operating scenarios and a single number was provided to represent the life of the Project. Therefore, this forecast emissions intensity was not intended to represent a two-train facility or initial years where the facility was still in commissioning or early stages of operation.

Actual GHG emissions intensities based on operational data to date are presented in Table 4-2. The emissions intensity for FY2018 and FY2019 are representative of the LNG Plant in commissioning and early operations phases. From FY2020 to FY2021, the average GHG emissions intensity has progressively decreased in line with the LNG Plant progressing towards steady state operations. The emission intensity for FY2022 was impacted by turnaround activities, which are associated with increased flaring activities and decreased production of products.

**Table 4-2 Wheatstone LNG Plant GHG emissions intensity by financial year**

Year (FY)	GHG Emissions Intensity (t CO <sub>2</sub> -e/TJ Products Produced) <sup>1,3</sup>	GHG Emissions Intensity (t CO <sub>2</sub> -e/tonnes of LNG) <sup>2,3</sup>
FY2018	17.5	0.99
FY2019	6.7	0.42
FY2020	5.9	0.36
FY2021	5.5	0.38
FY2022	6.0	0.41

*Note 1. GHG emissions intensity expressed as the total scope 1 GHG emissions (expressed as tonnes of CO<sub>2</sub>-e) divided by the terajoules of gas produced from the Wheatstone LNG Plant (determined in accordance with Item 30(1) of Schedule 2 to the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Cth)). This calculation method is aligned with contemporary GHG conditions set by EPA.*

*Note 2. GHG emissions intensity expressed as the total scope 1 GHG emissions (expressed as tonnes of CO<sub>2</sub>-e) divided by the amount of saleable LNG (expressed as tonnes of LNG). This calculation method is the method used to calculate the emissions intensity forecast in the Draft EIS/ERMP for the Proposed Wheatstone Project (Ref. 17).*

*Note 3. Emissions intensity value includes emissions associated with processing Domgas and condensate and providing all associated utilities and support services. Care should be exercised when comparing this metric with similar metrics from other facilities to ensure a like-for-like comparison.*

Benchmarking of the forecast GHG emissions intensity for the Wheatstone Development has previously been provided in the Draft EIS/ERMP for the Proposed Wheatstone Project (Ref. 17).

#### 4.4 Wheatstone LNG Plant GHG Baseline

The Draft EIS/ERMP for the Proposed Wheatstone Project (Ref. 17), outlined an emissions estimate of 9.9 MTPA of carbon dioxide for the onshore component of the Project, noting that this applied to the approved project with a throughput of up to 25 MTPA and up to 6 LNG trains.

A baseline that more appropriately reflects the emissions footprint for the current operational Wheatstone LNG Plant has been established using the methodologies outlined under the Safeguard Rule but constraining it to the scope of this GHGMP (i.e. the Wheatstone LNG Plant). Specifically, an emissions baseline of 4.15 MTPA CO<sub>2</sub>-e has been determined for the Wheatstone LNG Plant using the transitional calculated baseline criteria.

The methodologies used to calculate Safeguard Mechanism baseline for 'the Wheatstone Operations Facility' are subject to audit by a CER registered Greenhouse and Energy Auditor, per section 28 of the Safeguard Rule. These same methodologies have been applied to calculate the baseline for the Wheatstone LNG Plant.

An independent peer review was undertaken to evaluate the credibility of this baseline. The peer review concluded that "the proposed baseline is considered a reasonable forecast by considering all sources of emissions and generally supported by plant experience in the recent years" and that the basis for the applying the Safeguard Rule (constrained to the Wheatstone LNG Plant) is "considered reasonable to ensure consistency with Commonwealth GHG requirements" (Ref. 18).

#### **4.5 Proposed Interim and Long-Term Aspirational Emissions Reduction Targets for the Wheatstone LNG Plant**

As required by the EPA Environmental Factor Guideline (Ref. 8), this section sets out interim and long-term targets for reductions in scope 1 emissions over the life of the proposal.

Based on current understanding of existing technology, planned emissions reduction projects and availability of offsets, Chevron Australia's interim emissions reduction targets for the Wheatstone LNG Plant are to:

- Avoid, reduce or offset the amount of CO<sub>2</sub>-e, equivalent to 100% of Reservoir CO<sub>2</sub> from the date of condition change to 30 June 2030;
- Avoid, reduce or offset emissions by 30% for the period between 1 July 2030 and 30 June 2034;

from the Wheatstone LNG Plant baseline emissions estimate of 4.15 MTPA CO<sub>2</sub>-e.

Where sufficient emissions avoidance or reduction cannot be achieved to reach these targets, the shortfall will be offset to achieve the equivalent emissions reduction.

Chevron Australia's long-term aspirational emission reduction targets are to:

- Avoid, reduce or offset emissions by 47% for the period between 1 January 2035 and 31 December 2039;
- Avoid, reduce or offset emissions by 65% for the period between 1 January 2040 and 31 December 2044;
- Avoid, reduce or offset emissions by 82% for the period between 1 January 2045 and 31 December 2049; and
- Avoid, reduce or offset emissions by 100% for the period from 1 July 2050;

from the Wheatstone LNG Plant baseline emissions estimate of 4.15 MTPA CO<sub>2</sub>-e.

Information on the potential mitigation actions proposed for 2023 – 2030 are set out in Section 6 below. Information on the potential mitigation actions proposed for the post-2030 periods will be outlined in future updates of this Plan and will reflect strategies and measures reasonably practicable at the time, noting the expectation that potential mitigations will develop over time, and more effective mitigation alternatives may become available, as technological development progresses.

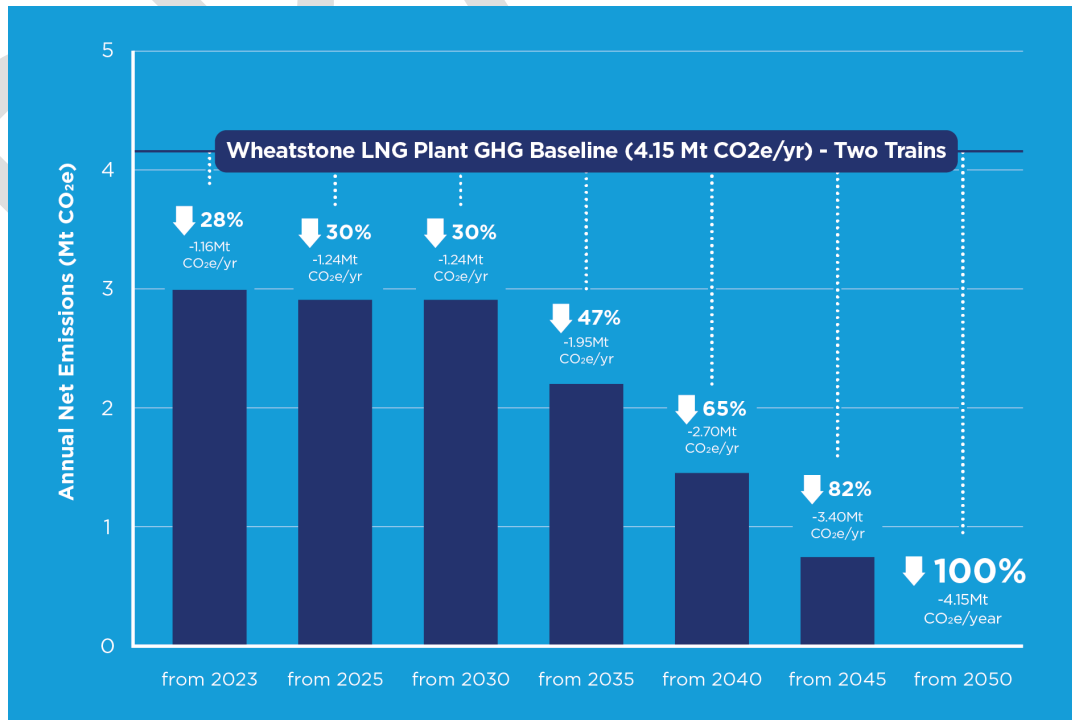


Table 4-3 and Figure 4-2 below outline the net emissions for the Wheatstone LNG Plant, based on the interim emissions reduction targets and long-term aspirational emissions reduction targets outlined above.

**Table 4-3 Net emissions estimates based on the proposed Wheatstone LNG Plant interim and long-term aspirational emissions reduction targets.**

Target	Period	Net Emission Estimates
<b>Interim Emissions Reduction Targets</b>		
Avoid, reduce or offset the amount of CO <sub>2</sub> e, equivalent to 100% of Reservoir CO <sub>2</sub> <sup>^</sup>	From date of condition change to 30 June 2030	
Avoid, reduce or offset emissions by 30% by 2030	1 July 2030 and 30 June 2035	14.52 MTPA CO <sub>2</sub> -e
<b>Long-term Aspirational Emissions Reduction Targets</b>		
Avoid, reduce or offset emissions by 47% by 2035	1 July 2035 and 30 June 2040	10.99 MTPA CO <sub>2</sub> -e
Avoid, reduce or offset emissions by 65% by 2040	1 July 2040 and 30 June 2045	7.26 MTPA CO <sub>2</sub> -e
Avoid, reduce or offset emissions by 82% by 2045	1 July 2045 and 30 June 2050	3.73 MTPA CO <sub>2</sub> -e
Avoid, reduce or offset emissions by 100% by 2050	every five (5) year period from 1 July 2050 onwards	zero (0) MTPA CO <sub>2</sub> -e

<sup>^</sup> Avoiding, reducing or offsetting 100% of Reservoir CO<sub>2</sub> is forecast to equate to approximately a 28-30% reduction in emissions from Wheatstone LNG Plant baseline emissions estimate of 4.15 MTPA CO<sub>2</sub>-e. The actual volume of 100% Reservoir CO<sub>2</sub>, and therefore the resulting net emissions, will depend on operational factors and the nature of the gas being processed in the specific period.



**Figure 4-2 – Net emissions estimates based on the proposed Wheatstone LNG Plant interim and long-term aspirational emissions reduction targets.**

## 5 GHG Mitigation Actions in Design

### 5.1 Philosophy

GHG emissions minimisation was integrated into the design basis of the Wheatstone Foundation Project and considered within the emissions estimate included within the Draft EIS/ERMP for the Proposed Wheatstone Project (Ref. 17). This GHGMP can be distinguished from recent Plans provided by other proponents as both the design mitigation selection process and subsequent construction of the facility is complete. The following section describes the facilities and practices that were adopted to avoid and minimise emissions as far as practicable through best practice design. Alternative technologies were also considered during the initial design. These are discussed in Chapter 3 of the Draft EIS/ERMP for the Proposed Wheatstone Project (Ref. 17).

#### 5.1.1 Non-Routine Flaring

The Wheatstone LNG Plant has been designed to operate without routine gas flaring and such that flaring during abnormal operations is limited to only that essential for emergencies, process upsets, maintenance activities, plant start-up and shutdowns either to meet safety requirements or where the alternative would result in increased GHG emissions.

#### 5.1.2 Aero-derivative Gas Turbines

Incorporation of aero-derivative gas turbines into the design of the Wheatstone LNG Plant is estimated to have reduced GHG emissions for the Foundation Project by approximately 0.55 MTPA compared to use of industrial gas turbines, primarily due to the increased thermal efficiency

#### 5.1.3 Inlet Air Humidification on Gas Turbines

To further optimise the overall efficiency during high ambient temperature conditions, the gas turbine drivers in the liquefaction trains were designed with Inlet Air Humidification (IAH). This system uses evaporation of water to cool and humidify the combustion air supply, improving the power output and efficiency of the gas turbine.

#### 5.1.4 Waste Heat Recovery Units (WHRU) on Gas Turbines

It was determined that all the routine process heat requirements for the inlet facilities, and LNG trains 1 & 2 could be met through the use of waste heat recovery units (WHRUs) that capture waste heat from the exhaust gases from the gas turbines driving the refrigeration compressors. The use of WHRUs precludes the need for the routine use of fired heaters or boilers to provide process heat for the LNG trains, and thus their inclusion in the design is estimated to have reduced the GHG emissions of the Foundation Project by approximately 0.5 MTPA CO<sub>2</sub>-e.

In addition to the use of a waste-heat based hot oil system for process heating, selected WHRUs on the compressor gas turbine drivers in each liquefaction train were fitted with separate heating coils to heat a slipstream of the treated gas stream which is then used to regenerate the molecular sieve beds in the dehydration units of each train.

### **5.1.5 Recuperative Thermal Oxidiser**

The key function of the AGRU is to remove acid gas from the feed gas stream. Several acid gas disposal design options were evaluated during the design phase in order to dispose of acid gas and minimise emissions of volatile organic compounds (VOCs) and hydrogen sulphide (H<sub>2</sub>S). The assessment process identified the Recuperative Thermal Oxidiser to be the most suitable acid gas disposal option, providing the best balance between energy efficiency, reliability and destruction efficiency of VOCs and H<sub>2</sub>S. The provision of waste heat recovery to recover energy in order to preheat feed gas to the thermal oxidiser reduces the fuel requirement over direct fired thermal combustion units.

### **5.1.6 Turbo Expander – Power generation (pressure let down system)**

A Turbo Expander/Generator was incorporated in the LNG train 1 & 2 process configuration on the feed stream to the Heavy Hydrocarbon Removal system. The turbo expander converts energy contained in the process stream, that would otherwise be lost to electricity. This improves the thermal efficiency of the LNG production process and is estimated to recover approximately 7 MW of electricity per LNG train, resulting in lower load on the gas turbine power generators and associated emissions. For the Foundation Project, this is estimated to have achieved a 15% reduction of the total Gas Turbine Generator (GTG) power load.

## 6 GHG Mitigation Actions in Operation

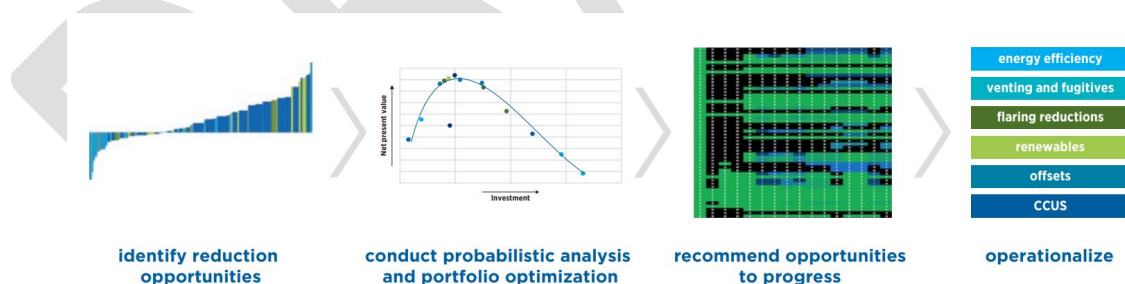
Following on from the design stage, Chevron Australia recognises the importance of innovation and continuing to apply mitigations through the subsequent steps of the mitigation hierarchy as critical to the success of achieving its interim and long-term aspirational emissions reduction targets. This includes continuous improvement to reduce emissions over the life of the project through Chevron's GHG Optimisation Process and by offsetting emissions through the implementation of a GHG emissions offset package.

### 6.1 GHG Optimisation Process

To help lower carbon intensity cost efficiently, Chevron uses a lower carbon portfolio optimization process. This process uses the Marginal Abatement Cost Curve (MACC) tool to identify, prioritize and fund opportunities to reduce GHG emissions that enable Chevron to make progress towards its GHG reduction targets.

The MACC tool is used to visualise a portfolio of carbon reduction opportunities by cost and by magnitude of emission reductions which enables an asset or business unit to prioritize the most cost-efficient reductions. At Chevron, MACC also refers to the internal enterprise process for optimized selection of the most efficient carbon reduction projects for corporate funding. Funding for carbon reduction projects is allocated to the business units during the annual business planning process, with the aim of supporting projects that most cost efficiently reduce carbon intensity across the enterprise.

A high-level overview of the process is outlined in Figure 6-1 below. The initial phase includes routine assessments where subject matter experts (SMEs) identify potential abatement opportunities and quantify potential emissions reductions. Abatement opportunities that are technically feasible then undergo further assessment and screening to enable development of a qualitative MACC. The MACC is then used to recommend opportunities that should be further progressed and eventually operationalised.



**Figure 6-1: Chevron GHG optimisation process**

Chevron Australia has already started implementing this GHG optimisation process for the Wheatstone asset, noting that the Wheatstone LNG Plant is still in early operations, with commissioning of the LNG trains only completed in March 2019. In 2020, as part of an electrical power generation system optimization project, the number of normally operating GTGs was reduced from four to three, and significant improvements were made in the tuning of each machine's combustion parameters to further reduce emissions. The project realized annual reductions in GHGs of more than 23,000 tCO<sub>2</sub>-e associated with reduced fuel gas consumption.

Whilst a range of carbon reduction projects, such as process optimisation projects, renewable projects, and low emissions technology projects, have been and will

continue to be considered within the Chevron MACC tool, there remains significant uncertainty over the most effective means to substantially reduce emissions at the Wheatstone LNG Plant over the long-term. Chevron Australia is evaluating technology feasibility at the Wheatstone LNG plant; in the context of a complex brownfield facility, any significant carbon reduction projects are likely to be a major capital project that will take multiple years to plan and execute. As such, information on specific mitigation measures, including potential timeframes for implementation and potential magnitude of emissions reduction, is not currently available. This GHGMP will be updated at least every five years to identify and describe options for future advances in technology and operational processes that may potentially be implemented to avoid, reduce and/or offset GHG emissions and/or reduce GHG emissions intensity.

## 6.2 Offsets

Offsets will complement other efforts to reduce Wheatstone's GHG emissions. Where sufficient emissions avoidance and/or reductions to reach the targets outlined in section 4.5 cannot be achieved through operational measures or emission reduction projects, the shortfall will be offset.

Offset will involve the acquisition and surrender of carbon offsets that meet integrity principles and are based on clear, enforceable, and accountable methods. Types of offsets include, but may not be limited to:

- **Australian Carbon Credit Units (ACCUs)** issued under the Carbon Credits (Carbon Farming Initiative) Act 2011 (Cth) and administered by the Australian government;
- **Verified Emission Reductions (VERs)** issued under the Gold Standard independent non-government program;
- **Verified Carbon Units (VCUs)** issued under the Verified Carbon Standard independent non-government program; or
- Other offset units that meet integrity principles and are based on clear, enforceable and accountable methods.

This diversity in offset types is an important means of managing the risks associated with obtaining sufficient volumes, given the varied and dynamic nature of current offset markets.

Where required, offsets will be surrendered expressly for the purposes of net emissions reduction at Wheatstone. Net emissions are considered the total scope 1 emissions less any carbon offsets acquired and surrendered in respect of Wheatstone LNG Plant emissions, including but not limited to those surrendered in respect of obligations under the SGM or other Australian legislative obligations.

Reconciliation of any emissions reduction shortfall and the volume of surrendered offsets will occur on a five-yearly basis, aligned with the target periods, and will be reported to DWER at the end of each period.

Chevron has been active in offset procurement globally for nearly two decades and across multiple jurisdictions and will leverage this capability to address any offset requirements for the Wheatstone LNG Plant. Chevron has also recently established a new business unit, Chevron New Energies, which is focused on developing scalable, low carbon business opportunities, including offset project opportunities, around the world.

## 7 Monitoring and Reporting

Monitoring, auditing and public reporting of GHG emissions from the Wheatstone Operations facility is carried out in accordance with the requirements of the NGER Act, or as otherwise required by law. The GHG emissions from the Wheatstone LNG Plant are a subset of those from the Wheatstone Operations facility and therefore the same monitoring, auditing and reporting processes will apply, including public reporting of GHG emissions on an annual basis.

A five-yearly report will be submitted to the CEO of the DWER and published on Chevron Australia's website outlining:

- GHG emissions and net GHG emissions from the Wheatstone LNG Plant;
- eligible offset units retired to calculate net GHG emissions;
- progress towards meeting interim and long-term aspirational emissions reduction targets; and
- emission reduction measures implemented.

A summary document comprising of a summary plan and progress statement outlining key information from the GHGMP (and reports to that time) will be submitted to the CEO and published on Chevron Australia's website every time a revised GHGMP is submitted to the DWER. The summary document will outline key information from the GHGMP in an accessible form which can be easily reviewed by third parties for transparency, including:

- a graphical comparison of emission reduction commitments in the GHGMP with 'actual' emissions for compliance periods;
- proposal performance against benchmarking for comparable facilities;
- emissions intensity;
- a summary of emission reduction measures undertaken by the proponent; and
- a clear statement as to whether interim targets have been achieved.

In addition, annual compliance reporting, in accordance with Condition 4 of MS 873, will be undertaken in relation to the requirements of this Plan.

## 8 Stakeholder Consultation

Regular consultation with stakeholders has been undertaken by Chevron Australia throughout the development of the environmental impact assessment management documentation for the Wheatstone Project. This stakeholder consultation included engagement with the community, government departments, industry operators, and contractors to Chevron Australia via planning workshops, risk assessments, meetings, teleconferences, and the EIS/ERMP formal approval processes.

A draft version of this Wheatstone GHGMP was submitted to the DWER on 30 September 2021 to inform the Section 46 inquiry into amending the implementation conditions of Ministerial Statement 873 (MS 873) for the Wheatstone Development – Gas Processing, Export Facilities and Infrastructure proposal relating to the emission of GHG. Review comments received from the DWER have been addressed in the finalization of this Plan.

The approved Wheatstone GHGMP will be made publicly available on Chevron Australia's website.

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## 9 Adaptive Management & Plan Revision

Chevron Australia is committed to conducting activities in an environmentally responsible manner and aims to implement reviews of its environmental management actions as part of a programme of continuous improvement. This commitment to continuous improvement means that the Proponent will apply an adaptive management approach by routinely monitoring matters such as GHG emissions, GHG emission intensity, technological developments, availability of offsets, changes in environmental risks and changes in business conditions in order to determine the need for adjustments to management measures, monitoring and update to the GHGMP.

In addition to any updates as a result of adaptive management reviews outlined above, the GHG MP will be reviewed and updated every five years as a minimum or as required by MS 873 (as amended from time to time). The revised GHGMP will be submitted to the CEO of the DWER in accordance with MS 873.

As outlined in Section 4.5, information on the potential mitigation actions proposed to achieve the long-term aspirational emission reduction targets will be outlined in future updates of this Plan and will reflect strategies and measures reasonably practicable at the time, noting the expectation that potential mitigations will develop over time and more effective mitigation alternatives may become available.



## 10 Acronyms and Abbreviations

Table 10-1 defines the acronyms and abbreviations used in this document.

**Table 10-1: Acronyms and abbreviations**

Acronym/ Abbreviation	Definition
~	Approximately
µg	Microgram
ABU	Australasian Business Unit
ACCU	Australian Carbon Credit Unit
AGRU	Acid Gas Removal Unit
ANREU	Australian National Registry of Emissions Units
ANSIA	Ashburton North Strategic Industrial Area
CAPL	Chevron Australia Pty Ltd
CER	Clean Energy Regulator
CO <sub>2</sub> -e	Carbon Dioxide Equivalent
Cth	Commonwealth
DAWE	Department of Agriculture, Water and the Environment
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DISER	Department of Industry, Science, Energy and Resources
Domgas	Domestic Gas
DWER	Department of Water and Environmental Regulation
EFG	Environmental Factor Guideline
EIS	Environmental Impact Statement
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Environmental Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERF	Emissions Reduction Fund
ERMP	Environmental Review and Management Plan
GHG	Greenhouse Gas
GHGMP	Greenhouse Gas Management Plan
GTG	Gas Turbine Generator
GWP	Global Warming Potential
H <sub>2</sub> S	Hydrogen Sulphide
IAH	Inlet Air Humidification
km	Kilometre
LNG	Liquefied Natural Gas
MACC	Marginal Abatement Cost Curve
MS	Ministerial Statement

Acronym/ Abbreviation	Definition
MTPA	Million tonnes per annum
MW	Megawatt
NGER	National Greenhouse Energy Reporting
NGER Act	<i>National Greenhouse and Energy Reporting Act 2007</i>
NRU	Nitrogen Rejection Unit
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
SME	Subject Matter Expert
TJ	Terajoules
VCU	Verified Carbon Units
VER	Verified Emission Reductions
VOC	Volatile Organic Compound
WA	Western Australia
WHRU	Waste Heat Recovery Unit

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## 11 References

The following documentation is either directly referenced in this document or is a recommended source of background information.

**Table 11-1: References**

Ref. No.	Description	Document ID
1.	Chevron Australia Pty Ltd, 2010. Final Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Wheatstone Project. Chevron Australia Pty Ltd.	
2.	Government of Western Australia, Minister for Environment; Water, Hon Bill Marmion MLA. 2011. Statement that a Proposal may be Implemented – Wheatstone Development – Gas Processing, Export Facilities and Infrastructure (Ministerial Statement No. 873), 30 August 2011. Perth, Western Australia.	
3.	Government of Western Australia, Minister for Environment; Water, Hon Bill Marmion MLA. 2012. Statement to Amend Conditions Applying to a Proposal – Wheatstone Development – Gas Processing, Export Facilities and Infrastructure (Ministerial Statement No. 903), 6 July 2012. Perth, Western Australia.	
4.	Government of Western Australia, Minister for Environment; Water, Hon Bill Marmion MLA. 2013. Statement to Amend Conditions Applying to a Proposal – Wheatstone Development – Gas Processing, Export Facilities and Infrastructure (Ministerial Statement No. 922), 11 January 2013. Perth, Western Australia.	
5.	Government of Western Australia, Minister for Environment; Water, Hon Bill Marmion MLA. 2013. Statement to Amend Conditions Applying to a Proposal – Wheatstone Development – Gas Processing, Export Facilities and Infrastructure (Ministerial Statement No. 931), 30 January 2013. Perth, Western Australia.	
6.	Government of Western Australia, Minister for Environment, Hon Stephen Dawson MLA. 2020. Statement to Change the Implementation Conditions Applying to a Proposal – Wheatstone Development – Gas Processing, Export Facilities and Infrastructure (Ministerial Statement No. 1130), 23 April 2020. Perth, Western Australia.	
7.	Commonwealth of Australia, Minister for Sustainability, Environment, Water, Population and Communities, Hon Tony Burke MP. 2011. Approval Construction and Operation of LNG and Domestic Gas Plant and Onshore and Offshore Facilities, State & Commonwealth Waters, Pilbara Coast, WA (EPBC Reference: 2008/4469), 22 September 2011. Canberra, Australian Capital Territory	
8.	Environment Protection Authority (EPA), 2020, Environmental Factor Guideline: Greenhouse Gas Emissions, Environmental Protection Authority, Perth, Western Australia. Available from: <a href="#">Environmental Factor Guideline – Greenhouse Gas Emissions</a> [Accessed Oct 2022]	
9.	Commonwealth of Australia, <i>Climate Solutions Package (2019)</i> , Available from: <a href="#">Climate Solutions Package (environment.gov.au)</a> [Accessed Sept 2021]	
10.	Commonwealth of Australia, Australia's Long-Term Emissions Reduction Plan (2021), Available from: Australia's Long-Term Emissions Reduction Plan (environment.gov.au) [Accessed Feb 2022]	
11.	Office of Parliamentary Counsel. <i>National Greenhouse and Energy Reporting Act 2007</i> . Federal Register of Legislation, Government of Australia, Canberra ACT. Available from: <a href="#">Federal Register of Legislation - Australian Government</a> [Accessed Sept 2021]	

Ref. No.	Description	Document ID
12.	Office of Parliamentary Counsel. <i>National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015</i> . Federal Register of Legislation, Government of Australia, Canberra ACT. Available from: <a href="#">Federal Register of Legislation - Australian Government</a> [Accessed Sept 2021]	
13.	Commonwealth of Australia, Assistant minister for Climate Change and Energy, Hon Jenny McAllister, 2022. Stronger Action on Climate Change Media Release , Available from: <a href="#">Senator the Hon Jenny McAllister Media Releases (minister.industry.gov.au)</a> [Accessed Oct 2022]	
14.	Government of Western Australia, <i>Western Australian Climate Policy (November 2020)</i> . Available from: <a href="#">Western_Australian_Climate_Policy.pdf (www.wa.gov.au)</a> [Accessed Sept 2021]	
15.	Department of Environment Regulations (DER), <i>Greenhouse Gas Emissions Policy for Major Projects (2019)</i> . Perth, Western Australia, Available from: <a href="#">Approved By Cabinet - Greenhouse Emissions Gas Policy for Major Projects 150819 (002).pdf (der.wa.gov.au)</a> [Accessed Sept 2021]	
16.	Chevron Corporation, 2021. <i>Climate Change Resilience Report</i> . Chevron Corporation, San Ramon CA. Available from: <a href="#">www.chevron.com</a> [Accessed March 2022]	
17.	Chevron Australia Pty Ltd, 2010. Draft Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Wheatstone Project (Draft EIS/ERMP). Chevron Australia Pty Ltd.	
18.	Xodus Group, 2022. Baseline Credibility Assessment for Wheatstone GHG Management Plan, Xodus Group, Perth, Western Australia.	
19.	International Maritime Organisation (IMO), 2014. Guideline on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for New Ships (Adopted 4 April 2014).	
20.	IPEICA, Estimating Petroleum Industry Value Chain (Scope 3) Greenhouse Gas Emissions (2016), Available from: <a href="#">www.ipeica.org/resources</a> [Accessed March 2022]	
21.	API, Compendium of Greenhouse Gas Emissions Methodologies for the Natural Gas and Oil Industry (2021). Available from: <a href="#">www.api.org</a> [Accessed March 2022]	
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## appendix a Scope 3 Emissions Estimate

Estimates of scope 3 GHG emissions associated with the Wheatstone Development have previously been provided in the Draft EIS/ERMP for the Proposed Wheatstone Project (Ref. 17).

The current estimate of the Wheatstone Development's scope 3 GHG emissions, associated with transport and third-party end use of products, applying contemporary guidance on estimating these emissions, is 36.8 Mtpa CO<sub>2</sub>e-.

For the purposes of estimating scope 3 GHG emissions the following key documents and inputs were used:

- Emissions factors sourced from IMO Resolution MEPC.245(66) (Ref. 19) and IPCC AR5 100-year global warming potentials (GWP);
- Emissions from third party use of products were calculated in alignment with methods in Category 11 of IPIECA's Estimating Petroleum Industry Value Chain (Scope 3) Greenhouse Gas Emissions, including product quantity and fuel specific higher heating values, and the CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O combustion emissions factors for each fuel type (Ref 20);
- Evaluation based upon production data from a representative year (9.8 MT net LNG), applying API compendium methodologies and factors (Ref. 21, Ref. 22), and IPCC AR5 100-year GWP;
- Transport emissions estimated from shipping fuel consumption scaled for a representative year of production.