

Pluto LNG Facility Greenhouse Gas Abatement Program

June 2021

Rev 3a

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Revision History

REVISION HISTORY						
Revision	Description	Date	Prepared by	Approved by		
0	Final for external issue	20/7/2007	JO	LDM		
1	Full re-draft, issued internally for comment	1/12/2010	JO	GG		
2	Final for external issue	20/6/2011	GG	LDM		
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3a	Table 5 amended. For Ministerial Approval	9/06/2021	cs	YM		

Acronyms, Abbreviations and Key Definitions

Acronym / Abbreviation	Definition			
ACCU	Australian Carbon Credit Unit			
ACR	Annual Compliance Report			
AGRU	Acid Gas Removal Unit			
aMDEA	Activated Methyl Diethanolamine			
BESS	Battery Energy Storage System			
Bio-sequestration	Refers to the removal of carbon dioxide from the atmosphere by sequestering (or storing) carbon in living biomass (such as trees), dead organic matter or soil			
BOD	Basis of Design			
BOG	Boil Off Gas			
BTEX	Benzene, toluene, ethyl-benzene and xylenes			
Climate change	A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed, largely, to the increased levels of atmospheric Greenhouse gas.			
СО	Carbon Monoxide			
CO ₂	Carbon Dioxide			
CO ₂ -e	Carbon Dioxide Equivalent			
СоР	ConocoPhillips Optimized Cascade SM Process			
C3MR	Propane Pre-Cool Mixed Refrigerant Process			
DER	Distributed Energy Resources			
Domgas	Domestic Gas			
EPA	Environmental Protection Authority			
ERAC	Emissions Reduction Assurance Committee			
ERF	Emission Reduction Fund			
FEED	Front End Engineering and Design			
GE	General Electric			
GGAP	Greenhouse Gas Abatement Program			
GHG	Greenhouse Gas (GHG) is a gas that absorbs and emits radiant energy within the thermal infrared range. Greenhouse gases cause the greenhouse effect on planets. The greenhouse gases that are reported under the NGER Scheme include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), sulphur hexafluoride (SF6) and specified kinds of hydro fluorocarbons and perfluorocarbons.			
HEPA	High Efficiency Particulate Air			
HIR	Human Induced Regeneration			
HRU	Heavies Removal Unit			
IAC	Inlet Air Chilling			
kt	Kilotonne			
LNG	Liquified Natural Gas			
MS	Ministerial Statement			

Acronym / Abbreviation	Definition
Mtpa	Million tonnes per annum
MW	Megawatt
NGER	National Greenhouse and Energy Reporting from the National Greenhouse and Energy Reporting Act 2007
NOx	Nitrogen Oxides
NRU	Nitrogen Rejection Unit
NWS	North West Shelf
Pluto LNG Facility	The facilities and infrastructure located at, or to be developed within, the Pluto LNG Park that are downstream of the Gas Receipt Point and which are used for processing feedstock gas and for the production, storage, handling and loading of LNG and other products, and includes the Storage Facilities and Loading Facilities
Pluto LNG Park	The facilities located on the land the subject of the leases with registration numbers K435291, K435292 and K545946 on the Burrup Peninsula, Western Australia
RcTO	Recuperative Thermal Oxidiser
Reservoir emissions	CO ₂ that exists within hydrocarbon gas in the reservoir which is removed from the product stream during processing (reservoir CO ₂).
Resource Owner	Any Person that has an interest in a reservoir, group of reservoirs, field or fields, of or from which hydrocarbons are produced and transported (as a single or commingled stream) to the Pluto LNG Facility for further processing
RTO	Regenerative Thermal Oxidiser
SGM	Safeguard Mechanism
Scope 1 GHG emissions	The emissions released to the atmosphere as a direct result of an activity, or series of activities at a facility level
Scope 2 GHG emissions	Indirect GHG emissions released to the atmosphere from the indirect consumption of an energy commodity.
Scope 3 GHG emissions	Indirect GHG emissions other than scope 2 emissions that are generated in the wider economy. They occur as a consequence of the activities of a facility, but from sources not owned or controlled by that facility's business.
TJ	Terajoules
UNFCCC	United Nations Framework Convention on Climate Change
VOC	Volatile Organic Compounds
WA	Western Australia
WHRU	Waste Heat Recovery Unit
Woodside	Woodside Energy Ltd as the proponent of Ministerial Statement 757, on behalf of Pluto LNG project participants and shareholders being Woodside Burrup, Kansai Electric and Tokyo Gas and on behalf of Woodside Burrup Train 2 participants

1. Introduction

Woodside Energy Ltd (Woodside) is the proponent of the Pluto Liquefied Natural Gas (LNG) Facility. The implementation authorisation (and conditions) for the Pluto LNG Facility was granted by the Commonwealth Department of Agriculture, Water and Environment (formerly the Department of Environment and Water Resources) by way of Approval Decision EPBC 2006/2968 and the Western Australian (WA) Minister for Environment by way of Ministerial Statement (MS) No. 757 and as amended by MS 850, Attachment 1, Attachment 2, Attachment 3, Attachment 4 and Attachment 5 (together MS 757).

MS 757 was granted for two trains to a capacity of 12 million tonnes per annum (Mtpa). The Pluto LNG Facility is currently a 4.9 Mtpa loadable-capacity single-train LNG plant (Pluto Train 1) processing gas from the Pluto and Xena gas fields. The first cargo was shipped in 2012, with domestic gas (domgas) production (at a capacity of 25 terajoules per day (TJ/day) commencing in 2018.

As the proponent, Woodside intends to construct Pluto Train 2 as per the approval, which includes the following scopes of work:

- Construction and operation of a second LNG train with nominal LNG production of 5.3 Mtpa (Pluto Train 2)
- Installation of an additional domgas facility with nominal production of 250 TJ/day
- Supporting utilities and general facilities.

This Pluto LNG Facility Greenhouse Gas Abatement Program (Pluto GGAP) has been updated to include the above scopes of work, in accordance with the requirements of MS 757. This revision of the Pluto GGAP also addresses the Western Australian Government's *Greenhouse Gas Emissions Policy for Major Projects* (State GHG Policy), as announced in August 2019 to guide Government decision-making for major projects assessed by the Environmental Protection Authority (EPA).

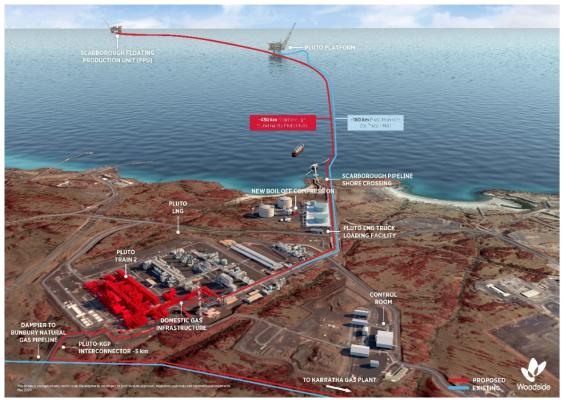


Figure 1: Proposed Scarborough to Pluto Train 2 development concept, including existing and proposed infrastructure.

Table 1 – Pluto LNG Facility Greenhouse Gas Abatement Program Summary Table

Title of Proposal	Pluto Liquefied Natural Gas (LNG) Facility				
Proponent Name	Woodside Energy Ltd				
Purpose of the Pluto GGAP	 The purpose of this Pluto GGAP is: to ensure that the plant is designed and operated in a manner that achieves reductions in greenhouse gas emissions as far as practicable to provide for ongoing greenhouse gas emission reductions over time to ensure that through the use of best practice, the total net greenhouse gas emissions and/or greenhouse gas emissions per unit of product from the project are minimised to manage greenhouse gas emissions in accordance with the Framework Convention on Climate Change 1992, and consistent with Australia's United Nations Framework Convention on Climate Change (UNFCCC) commitments under the Paris Agreement (formerly the National Greenhouse Strategy) to demonstrate Woodside's commitment to its Climate Change Policy (refer Appendix A) and alignment to the Western Australian Government's Greenhouse Gas Emissions Policy for Major Projects. 				
Key Environmental Factor/s and Objective/s	Key Environmental Factor: Greenhouse Gas Emissions EPA Objective: To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change (EPA, 2020)				
Key Provisions in the Greenhouse Gas Abatement Program	Refer to Section 8 of this document				
Ministerial Statement Conditions	Ministerial Statement 757 Condition 12-1 and 12-2				
Duration of this Pluto GGAP Revision	• 2021 to 2025				

1.1 Scope

The Pluto GGAP has been developed to meet MS 757 Condition 12-1 (below) and is being revised to include the construction and operation of Pluto Train 2.

Condition 12-1

Prior to the commencement of construction, the proponent shall develop a Greenhouse Gas Abatement Program:

- to ensure that the plant is designed and operated in a manner that achieves reductions in "greenhouse gas" emissions as far as practicable
- to provide for ongoing "greenhouse gas" emissions reductions over time
- to ensure that through the use of best practice, the total net "greenhouse gas" emissions and/or "greenhouse gas" emissions per unit of product from the project are minimised
- to manage "greenhouse gas emissions" in accordance with the Framework Convention on Climate Change 1992, and consistent with Australia's United Nations Framework Convention on Climate Change (UNFCCC) commitments under the Paris Agreement (formerly the National Greenhouse Strategy).

The relevant requirements of MS 757 are mapped to sections of this document in Table 2.

The Pluto GGAP also describes Woodside's approach to MS 757, Condition 12-2 that requires a greenhouse gas (GHG) offset package which, as a minimum, offsets the reservoir carbon dioxide released to the atmosphere, for the life of the project (Section 4).

Table 2 - Pluto GGAP inclusions required by MS 757 Condition 12-1

Reference No.	Component of MS 757 Condition 12	Relevant Section in Document
1	Calculation of the greenhouse gas emissions associated with the proposal as advised by the Environmental Protection Authority.	Section 3
2	Specific measures to minimise the total net greenhouse gas emissions and/or the greenhouse gas emissions per unit of product associated with the proposal using a combination of "no regrets" and "beyond no regrets" measures ⁽¹⁾ .	Sections 6 and 8
3	The implementation and ongoing review of greenhouse gas offset strategies with such offsets to remain in place for the life of the proposal.	Section 4
4	Estimation of the greenhouse gas efficiency of the project (per unit of product and/or other agreed performance indicators) and comparison with the efficiencies of other comparable projects producing a similar product, both within Australia and overseas.	Section 5
5	Implementation of thermal efficiency design and operating goals consistent with the Australian Greenhouse Office Technical Efficiency Guidelines in design and operational management.	Sections 6 and 8
6	Actions for the monitoring, regular auditing and annual reporting of greenhouse gas emissions and emission reduction strategies.	Section 7 and 8
7	A target set by the Proponent for the progressive reduction of total net greenhouse gas emissions and/ or greenhouse gas: emissions per unit of product and as a percentage of total emissions over time, and annual reporting of progress made in achieving this target. Consideration should be given to the use of renewable energy sources such as solar, wind or hydro power.	Section 7 Section 6.1.3
8	A program to achieve reduction in greenhouse gas emissions, consistent with the target referred to in (7) above;	Section 7
9	Entry, whether on a project-specific basis, company-wide arrangement or within an industrial grouping, as appropriate, into the Commonwealth government's "Greenhouse Challenge" voluntary cooperative agreement program.	Woodside was a member of the Greenhouse Challenge up until the cessation of the Program in July 2009.
10	Review of practices and available technology	Section 6
11	Continuous improvement approach so that advance in technology and potential operational improvements of plant performance are adopted.	Section 7.2.1

⁽¹⁾ Defined as per MS 757. "No regrets" measures are those which can be implemented by a proponent and which are effectively cost-neutral; and "beyond no regrets" measures are those which can be implemented by a proponent and which involve additional costs which are not expected to be recovered.

Further information on Woodside's response to the challenge of climate change can be found:

- On our website woodside.com.au
- In Woodside's Climate Change Policy (refer Appendix A) and
- In Woodside's ASX Announcement and supporting presentation material on 11 November 2020 concerning its corporate targets for direct carbon emission reductions (refer Appendix B)

2. Supporting Western Australia's Greenhouse Gas Emissions Policy for Major Projects

Woodside supplies LNG into global energy markets, and domestic gas to Western Australia. These energy supplies will contribute to lower atmospheric contributions of GHG than would otherwise be the case with higher carbon-intensive fuels (IEA, 2020). Woodside is committed to maximising this outcome by lowering our direct emissions through technology selection, plant design, efficient operations, and offsets.

Woodside shares the global Paris Agreement aspiration to limit global warming to well below two degrees Celsius. Woodside is working towards our own aspiration to be carbon-neutral for our operations in Western Australia by 2050, consistent with the State GHG Policy (refer Appendix A for Woodside's Climate Change Policy and Appendix B for Woodside's ASX Announcement on corporate targets for direct carbon emissions reduction).

This section describes how the Pluto LNG Facility supports the State's GHG Policy and broader Commonwealth and international efforts to reduce global GHG concentrations.

Central to the State's GHG Policy is the requirement for proponents to develop a GHG Management Plan which:

- Outlines strategies to avoid, reduce, mitigate and offset the project's direct (scope 1) emissions contributing towards the State's aspiration of net zero emissions by 2050
- Is unique to a proposal's specific circumstances
- Allows proponents to take account of opportunities at either facility level or across national operations
- Allows proponents to propose their own timeframes and interim targets
- Includes requirements for periodic public reporting against their targets
- Accounts for and aligns with Commonwealth requirements

2.1 How Woodside has approached the State's GHG Policy

Woodside recognises that addressing the State's GHG Policy aspiration to achieve net zero emissions by 2050 will require an economy-wide effort in two primary areas;

- Direct emission reductions
- Development of GHG offsets to balance remaining emissions

The following sections 2.1.1 to 2.1.8 outline Woodside's contribution to the State's aspiration of achieving net zero emissions by 2050 through the design and ongoing operation of the Pluto LNG Facility and alignment to the State's GHG Policy.

2.1.1 Strategies to Avoid, Reduce, Mitigate and Offset Emissions

As outlined below and throughout the Pluto GGAP, the Pluto LNG Facility has adopted technology, design and operational requirements which will result in a direct reduction in scope 1 GHG emissions and contribute towards to the State's aspiration of net zero emissions by 2050.

Avoid Emissions

Section 6 of this document outlines how current and future emissions from both Train 1 and 2 have been avoided by designing out emissions to as low as reasonably practical throughout the engineering and design phase. For example, Pluto Train 2 has adopted aero-derivative gas turbines for liquefaction, providing higher thermal efficiency and the lowest GHG emissions of the four alternatives considered. This technology is considered to be best practice for LNG developments in Australia. Further details on the efficiency and GHG emissions reduction initiatives adopted through the design phase are provided in section 6.1, resulting in a reduction

of approximately 1,000,000 t CO₂-e per annum of GHG emissions from Train 1 and a further 560,000 t CO₂-e per annum for Train 2, when compared to a 'business as usual' design case.

Reduce and Mitigate Emissions

Emissions reduction and minimisation is considered a process of continuous improvement and will be ongoing for the life of the Pluto LNG Facility.

Section 7.2 of this document demonstrates how emission reduction opportunities are identified and implemented for the Pluto LNG Facility, with substantial improvements in GHG intensity and consequently net emissions achieved since commencing operation of Train 1.

It is envisaged that, with these learnings, similar improvements will be identified and implemented in the early years of Train 2 operation to further reduce emissions.

Future improvements in technology and energy efficiency will be monitored and assessed for feasibility over the life of the Pluto LNG Facility. Such improvements will assist the Pluto LNG Facility achieve the interim and long-term targets described in section 2.1.4 and will be described in future revisions of this Pluto GGAP once implemented.

Offset Emissions

Section 4 of this document outlines how reservoir CO₂ emissions from the Pluto LNG Facility will be offset and retired over the life of the facility. Section 4 describes the process of acquiring and retiring eligible offset units to meet Woodside's requirements under MS 757 and additional voluntary offsets beyond reservoir CO₂ emissions, such as the interim and long-term emission reduction targets described in section 2.1.4.

2.1.2 Consideration of the Pluto LNG Facility's Specific Circumstances

The International Energy Agency (IEA) has highlighted the role of gas in enabling the energy transition to lower carbon intensive fuels, reporting that "global energy-related CO₂ emissions flattened in 2019 following two years of increases. This resulted mainly from a sharp decline in CO₂ emissions from the power sector in advanced economies, thanks to the expanding role of renewable sources (mainly wind and solar PV), fuel switching from coal to natural gas, and higher nuclear power output." This demonstrates the contribution gas is making to lowering global GHG emissions and net atmospheric concentrations by providing a dispatchable, transportable energy source to replace higher carbon-intensive fuels, such as coal, and supporting the development of renewables. As Chief Scientist Alan Finkel has noted, "natural gas is already making it possible for nations to transition to a reliable, and relatively low emissions, electricity supply."

Supply of domgas

In accordance with arrangements between Resource Owners and the State, a percentage of gas processed at the Pluto LNG Facility is, and will be, supplied into the Western Australian gas market.

It is therefore important to consider the availability of alternative energy sources to domestic gas supply from the Pluto LNG Facility. Today, these are renewables sources, alternative gas sources, or coal and oil.

Gas is transportable, dispatchable and available at scale today, and competes with other fuel sources with similar characteristics. It is however more expensive than some other sources of electricity, such as renewables, that are often quoted as the cheapest source of electricity in many of the world's energy markets.

Renewables are growing rapidly and are experiencing policy support from governments wishing to decarbonise and modernise their electricity system. Where installed, renewable electricity often dispatches at zero marginal cost.

There are, however, limits to the growth of renewables, both by physical space and by the need to ensure grid stability, as the State's current Distributed Energy Resources (DER) roadmap seeks to address. The response to this constraint can be supported by other dispatchable energy sources partnering to address their intermittency and enable deeper penetration of renewables into grid mixes.

Natural gas is therefore primarily expected to compete with other dispatchable energy sources in the portion of the grid not satisfied by renewables. Since it is the lowest carbon intensive fossil fuel, the use of natural gas in Western Australia will therefore lead to lower GHG emissions compared to the alternative of using other dispatchable energy sources.

2.1.3 Emission reduction opportunities beyond the Pluto LNG Facility

Woodside, in its corporate capacity, is implementing a number of GHG management measures which will contribute to reducing GHG emissions globally and meeting its carbon liabilities (refer Appendix B for Woodside's ASX Announcement on its corporate targets for direct carbon emissions reduction).

A summary of several of these corporate initiatives is provided below.

- A commitment to reduce Woodside's equity portfolio emissions by 15% (by 2025) and 30% (by 2030), below the annual average emissions over the period 2016 2020. This commitment subsumes the existing corporate commitment to offset equity reservoir CO₂ emissions from 2021, and to improve energy efficiency by 5% over 2021– 2025.
 - It is important to note that the Woodside equity portfolio commitment is across all Woodside projects globally, including non-operated projects. Woodside will pursue the best available opportunities across its portfolio, and as these may not necessarily be at the Pluto LNG Facility at a given time, it should not be assumed that Pluto emissions will decline at an even pace with the total portfolio.
- A target to improve energy efficiency against baseline from all producing assets by 5% over 2016 –2020 was successfully achieved in 2020, with a new target established to contribute to the new equity portfolio emission reduction targets.
- A collaborative partnership with Greening Australia to plant approximately 7.5 million native trees in 2020. The first seeds in WA's Great Southern Region were planted in May 2020 in a program that will see the planting of more than 3.6 million native trees and shrubs by July 2021. Two sites have been earmarked for planting in the Great Southern region of WA: a 1600ha site about 100km South of Lake Grace called Cowcher; and a 400ha site called Sukey Hill just east of Cranbrook. Woodside recently purchased an additional two properties in the Wheatbelt properties called Manalling Springs and Windy Lane, totalling 3694ha. These projects are being undertaken by Woodside independently of the Pluto LNG Facility and the resulting carbon credits will be applied to Woodside's portfolio as required.
- Supporting international efforts, as a signatory to the World Bank's Zero Routine Flaring by 2030 initiative, the Methane Guiding Principles for Reducing Methane Emissions Across the Natural Gas Value Chain, and the International Energy Trading Association's Markets for Natural Climate Solutions initiative.
- Membership with CO₂CRC (formerly the CO₂ Cooperative Research Council) and representation on the group's Board. The CO₂CRC conducts world-class research into carbon capture and storage (CCS) technology using pilot-scale projects in Victoria. The CO₂CRC is developing technology and expertise to support the long-term commercialisation of CCS.
- Diversifying our business into supplying lower and zero carbon energy sources for the future by:
 - Developing new markets for LNG supplied by the Woodside-operated Pluto LNG Truck Loading Facility and shipping as a lower-emissions fuel
 - Investigating the potential for hydrogen as a lower greenhouse gas intensive fuel
 - Exploring technologies that, at scale, consume carbon dioxide and convert it to a nongreenhouse gas impacting product, and
 - Establishing a carbon offset business to produce and acquire carbon offsets

Further detail regarding diversification is provided in Section 2.1.7.

2.1.4 Proposed Interim and Long-Term Emissions Reduction Targets for the Pluto LNG Facility

Interim Emissions Reduction Targets (2025 and 2030)

Interim emissions reduction targets have been set for the period of this Pluto GGAP (2021 - 2025) and beyond to 2030, specifically relating to the existing Train 1 operations and the early operational period of Train 2.

To date, significant GHG reduction and energy efficiency opportunities have been identified and implemented at the Pluto LNG Facility, as outlined in Table 10, since the commencement of Train 1 operations. Identification and implementation of further emission reduction opportunities for Train 1 will be inherently more challenging from a technical and/or commercial perspective, however Woodside will continue to implement the ongoing GHG Improvement Plan described in section 7.2, to achieve the following interim emission reduction targets by 2025:

- A 5% GHG intensity improvement, resulting in a cumulative carbon equivalent reduction of up to 250,000 t CO₂-e indicatively over the five years^{1, 2}
- Where sufficient GHG intensity improvements cannot be achieved onsite to reach this target, the shortfall will be voluntarily offset to achieve the equivalent carbon reduction from a 5% GHG intensity improvement. The resulting emissions reduction is shown in Figure 2 and is based on the forecast production rates
- Offsetting 100% of reservoir CO₂ emissions equating to abatement of approximately 2 million tonnes of CO₂-e² over the five years

Beyond 2025, the addition of Train 2 will see a corresponding increase in GHG emissions from the Pluto LNG Facility. Significant GHG emission reductions will be achieved with the incorporation of best available technology in the design of Train 2, as described in Section 6.1.2. The resulting reduction in emissions is approximately 500,000 tonnes of CO_2 -e per annum across the integrated Pluto LNG Facility (2 trains) below the original emissions estimate of 4.1 Mtpa CO_2 -e³.

Based on experience from Pluto Train 1, a period of process optimisation will follow the commissioning of Train 2 in order to realise the emission reductions avoided through design. Woodside has therefore adopted the following interim emissions reduction target for 2030:

- Realise the efficiencies in Train 2 design and reduce or abate emissions by 30%, based on the Pluto LNG Facility emissions estimate of 4.1 Mtpa CO₂-e³
- Where sufficient emissions reduction cannot be achieved onsite to reach this 2030 target, the shortfall will be voluntarily offset to achieve the equivalent of 30% emissions reduction

The emission reductions resulting from the 2025 and 2030 interim targets are shown in Figure 2 and 3 respectively and are subject to a number of variables as outlined in Appendix C.

Periodic public reporting of the Pluto LNG Facilities performance against these interim targets is described in section 2.1.5.

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¹ Determined as a 5% improvement in the average GHG intensity from the previous 5 year period (i.e. 2016 – 2020) using NGERs methodology outlined in Appendix C.

² Dependent on production volume and gas composition.

³ Pluto LNG Development Public Environmental Review (2006) emissions estimate of 4.1 Mtpa CO₂-e for two LNG trains.

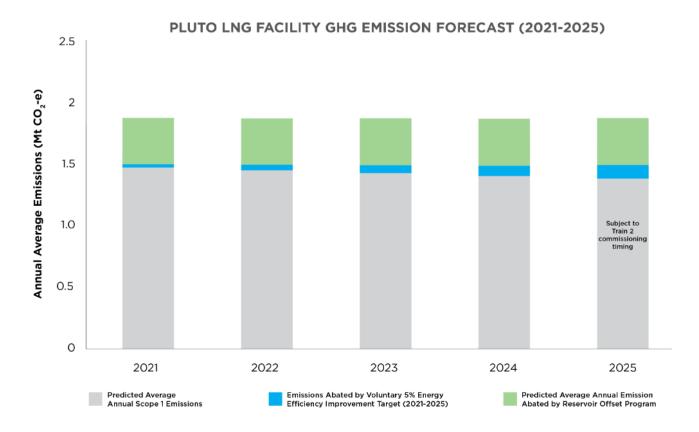


Figure 2: Pluto LNG Facility Train 1 – Interim Targets

This Pluto GGAP is reviewed and updated every five years (as a minimum). Subsequent interim targets incorporating emission reductions across both Train 1 and 2 will be outlined in future updates to this plan (e.g. 2031 – 2035 period), including details of how the emission reductions during that period are planned to be achieved.

Long-Term Emissions Reduction Targets

There remains some uncertainty over the most effective means to reduce emissions at the Pluto LNG Facility over the long term. Emission reductions will continue to be subject to a number of factors, including the advances or availability of technology that is practicable for retrofitting to existing plant; the outcomes of ongoing operational improvements; requirements under the Commonwealth Safeguard Mechanism (or other future Commonwealth legislation pertaining to GHG emissions); and the volume of existing and future gas reserves expected to be processed by the Pluto LNG Facility. Following the assessment of current technology under development, identified efficiency improvement opportunities, forecast offset availability and identified gas reserves, Woodside's long-term emissions reduction targets for the Pluto LNG Facility (based on two LNG trains), are to:

- Reduce or abate emissions by 35% by 2035;
- Reduce or abate emissions by 40% by 2040;
- Reduce or abate emissions by 65% by 2045; and
- Reduce or abate emissions by 100% by 2050.

These long-term emission targets, would result in 100% abatement of GHG emissions from the Pluto LNG Facility by 2050, as shown below in Figure 3. Note that the offset of reservoir CO₂ emissions, as required by MS 757, is included in these long-term targets.

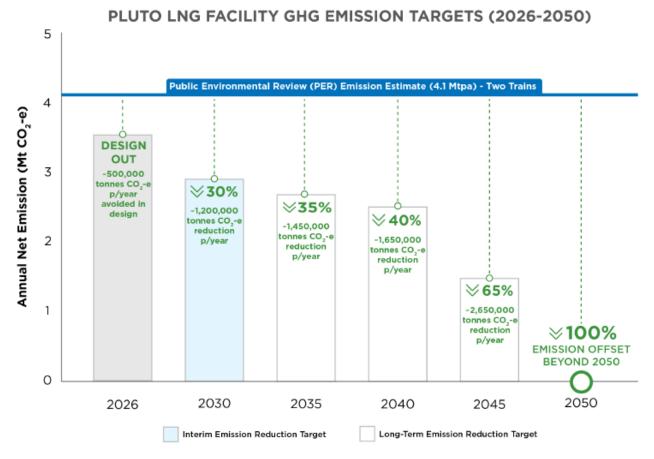


Figure 3: Pluto LNG Facility – Interim and Long-Term Targets

Based on previous emission reduction activities undertaken at the Pluto LNG Facility (Table 10) and carbon abatement measures implemented, or being progressed by Woodside in its corporate capacity (Section 2.1.3), the long-term emissions reduction targets are anticipated to be achieved by the implementation of a range of existing or potential future GHG abatement opportunities, existing examples of which are outlined in Table 2.1:

Table 2.1 – GHG Abatement Opportunities

GHG Abatement Opportunities	Existing examples ¹
Generating carbon offsets through native seeding	Woodside, in its corporate capacity, has partnered with Greening Australia to plant around 7.5 million native trees in 2020 and 2021. The first seeds were planted in WA's Great Southern Region in May 2020 on two properties: a 1600 hectare site about 100km South of Lake Grace called Cowcher; and a 400 hectare site called Sukey Hill just east of Cranbrook. Woodside purchased an additional two properties in the Wheatbelt, Manalling Springs and Windy Lane, totalling 3694 hectares. The work program has seen around 3.6 million native trees and shrubs planted utilising both a block planting and integrated farm system with further planting to be undertaken in 2021.
Generating carbon offsets through Human Induced Regeneration	Woodside, in its corporate capacity, is conducting a number of feasibility studies for carbon abatement in WA's Southern rangelands utilising the Human Induced Regeneration (HIR) method. HIR includes regeneration of native forest through activities such as: • the exclusion and/or management of livestock grazing;

	management of feral animals;				
	management of plants not native to the project area;				
	cessation of destruction or suppression of native growth.				
	The feasibility studies cover an area of over 640,000 hectares of pastoral lease land and 400,000 hectares of nature reserve.				
Acquiring quality carbon offsets	Woodside has funded the acquisition and retirement of 1.69 million eligible offset units for the purposes of offsetting Pluto reservoir emissions as detailed in Appendix E – Table E2 and Table E3. These offsets have been acquired on the voluntary market through renewable energy projects. A summary of the two voluntary market offset projects supported by Woodside is provided in section 4.3.3.				
Operational efficiency improvements	In 2019, Woodside upgraded the electrical load management system, which enabled the adoption of the 'GTG winter operating strategy' all year around on the Pluto LNG Facility. This operating strategy allowed one of four power generation turbines to be switched off, reducing fuel gas consumption and an estimated GHG emissions reduction of 1.7%.				
	Table 10 outlines further GHG emission reductions opportunities implemented at the Pluto LNG Facility, which have resulted in a GHG efficiency improvement of over 10%.				
Technological solutions	Developments in turbine filter medians resulted in Woodside adopting High Efficiency Particulate Air (HEPA) filters to replace standard turbine filters. The HEPA filters reduced fouling on gas turbines and reduced fuel gas consumption, resulting in an estimated GHG emissions reduction of 1.33%.				
	Section 7.2.2 outlines the Production Optimisation and Opportunity Management Procedure which identifies opportunities, such as those resulting from technological advancements, which are identified, ranked and assessed based on economic and environmental considerations.				

⁽¹⁾ Some of these carbon projects are being undertaken by Woodside independently of the Pluto LNG Facility and the resulting carbon credits will be applied to Woodside's portfolio as required.

Woodside's proposed long-term emissions reduction targets will be reviewed and updated (as appropriate) as part of the five-yearly review and update of this Pluto GGAP.

2.1.5 Periodic Public Reporting Against Targets

Monitoring, auditing and public reporting of GHG emissions from the Pluto LNG Facility is carried out in accordance with the requirements of the *National Greenhouse and Energy Reporting Act* 2007 (NGERS Act), or as otherwise required by law.

Compliance with the actions and requirements of this Pluto GGAP are reported through the Annual Compliance Reporting requirements specified in MS 757. Future Annual Compliance Reports will provide a summary of the most recent NGERS reporting period.

Further public reporting will be provided as part of the five-yearly revisions of this Pluto GGAP, which will be supported with a summary report detailing GHG emissions from the facility; further eligible offset units retired to meet the interim reduction targets in this document; emission reduction measures implemented; progress against interim emissions reduction targets; and performance against benchmarked facilities.

Section 9 of this document provides further information on reporting.

2.1.6 Commonwealth Requirements

The Emissions Reduction Fund (ERF) is the central component of the Commonwealth Government's Climate Solutions Package, which has a primary goal to deliver on Australia's

nationally determined contribution under the Paris Agreement, to 'reduce emissions by 26 – 28% below 2005 levels by 2030'. The ERF is enacted through the *Carbon Credits (Carbon Farming Initiative) Act 2011.* The ERF has three key elements: crediting, purchasing, and safeguarding emission reductions.

The Safeguard Mechanism (SGM) aims to ensure emission reductions paid for through the crediting and purchasing elements of the Emissions Reduction Fund are not displaced by significant increases in emissions above business-as-usual levels elsewhere in the economy. It does this by setting limits on large GHG-emitting facilities to ensure that net emissions are kept below a defined baseline in accordance with the *National Greenhouse and Energy Reporting* (Safeguard Mechanism) Rule 2015 (SGM) administered by the Clean Energy Regulator. The SGM applies to facilities with Scope 1 emissions (covered emissions) of more than 100,000 tonnes of CO₂e per year.

Baselines have been set by either taking the historical highpoint of emissions between FY 2009/10 to FY 2013/14 (for existing facilities) or by a site-specific emission factors based on production forecasts (for new facilities). Currently, the Pluto LNG Facility (defined as onshore and offshore platforms) has a baseline of 2.39 Mtpa CO_2 -e per financial year (SGM baseline). If emissions exceed this baseline, the Pluto LNG Facility can either use one of the compliance clauses within the SGM (if eligible) or purchase allowable offsets to bring net emissions below its baseline.

The SGM has been amended several times over the period of 2019 and 2020. Changes in March 2019 and February 2020 require all large emitters to re-apply for new baselines, subject to approval by the Clean Energy Regulator. A subsequent amendment in April 2020 has extended the baseline application deadline to October 2021.

The SGM allows for the Commonwealth regulator to allocate the given emissions reduction task where it is most efficiently discharged at the lowest aggregate cost to the economy. There are compelling policy reasons why the requirement for emissions reduction imposed on the LNG sector should be closer to the existing SGM baseline requirements set by the Commonwealth. These include the trade exposed nature of LNG; the net global reduction in atmospheric concentrations of GHG that LNG is expected to contribute over its lifecycle; and the jobs and revenue that the LNG sector can provide to support the economy through a period of restructuring and decarbonisation.

Consistent with the State GHG Policy's aim to complement, rather than duplicate, the Commonwealth Government's climate change policy framework, this Pluto GGAP proposes interim and long term emissions targets (section 2.1.4) that will be amended to complement rather than duplicate any future additional Commonwealth GHG requirements. Specifically, to the extent that additional Commonwealth GHG requirements are introduced, which overlap with the Pluto GGAP long-term emission targets, the Commonwealth requirements will take effect and the Pluto GGAP long-term emissions targets amended to avoid duplication of regulation.

2.1.7 Economic Development and Diversification

Woodside, in its corporate capacity, is progressing several initiatives that will develop Western Australian expertise, pilot new technologies, and support local communities in line with the State's GHG Policy.

Hydrogen

Our experience in producing and exporting LNG, underpinned by strong customer relationships, positions us well for complementary opportunities in large-scale hydrogen for industrial use. Currently, Woodside is investing in strategic opportunities for business development of hydrogen export in our target export markets.

In addition, Woodside possesses a number of the skills that are transferable to implement a hydrogen economy and are leveraging off other countries around the world that are well advanced in their hydrogen supply chain. Woodside believes a domestic hydrogen industry in Australia could generate cheaper and cleaner energy, as well as improve Australia's liquid fuel security.

Hydrogen has the potential to make a significant contribution to dispatchable renewable energy in Australia, which could help to support domestic manufacturing, deliver jobs and assist Western Australia and Australia in meeting its Paris Agreement emissions reduction targets and aspiration of net zero by 2050.

LNG for Transport, Power Generation and shipping

Woodside is working to create and expand markets where LNG substantially reduces emissions. This commenced in 2019 with the completion of the Woodside-operated Pluto LNG Truck Loading Facility. Displacing diesel and other liquid fossil fuels with LNG leads to significant cuts in GHG emissions and benefits for local air quality. On a lifecycle basis using trucked LNG in power generation instead of diesel reduces GHG emissions by 27%.

There are significant opportunities for LNG fuel use in the remote power generation, heavy transport and shipping sectors, particularly in the mining industry in Western Australia, to transition to LNG - a cleaner, cheaper, and locally produced fuel. Around three billion litres of diesel are currently imported into the Pilbara each year and more than two-thirds of that goes directly into mining operations, primarily iron ore. The ships that carry the mining export product from the Pilbara consume around five billion litres of heavy fuel oil each year, all purchased overseas. There are also potential opportunities to expand to commercial cruise liner ships that frequently visit the Western Australian coastline.

It is estimated that supply of LNG from the Pluto LNG Truck Loading Facility has the potential to displace up to approximately 100 kt CO₂-e per year from remote diesel fired power generation, providing a further contribution to the State aspiration of net zero emissions by 2050. The Pluto LNG Truck Loading Facility has the potential to contribute up to 200 kt CO₂-e per year if expanded to its full capacity. These opportunities, however, are subject to State policy settings that promote a reduction in the reliance on higher emission fuel sources and incentivisation of lower emissions power generation such as natural gas.

Carbon Offset Business

The Government of Western Australian recognises that activities which generate GHG gas emission offsets ('carbon offsets') can support regional diversification, Aboriginal employment and a range of environmental co-benefits. Woodside maintains a business to produce and acquire carbon offsets. Woodside has recently entered a collaborative partnership with Greening Australia for large-scale native tree planting projects to generate quality carbon offsets. The first phase involves planting up to 7.5 million native trees primarily in Western Australia. This builds upon the tree planting and carbon offsets already established for the Pluto LNG Facility through a partnership with CO₂ Australia.

In addition to these carbon offset projects, Woodside invested \$1.6 million in Seed Capability training, whereby five Noongar ranger teams completed paid, on-the-job, seed collection work over 18 months. The training involved completion of a number of units that contributed toward a Certificate II Conservation and Land Management, including collecting native seeds, recognising plants, and preparing and preserving plant specimens. Central to the objectives of the co-design model was that the on-country learning would provide opportunity for young rangers to work with senior cultural advisors, and thereby contribute to the already rich cultural relationships rangers have with country and community.

Research and Development

Research and development activities in hydrogen and carbon utilisation are undertaken through Woodside FutureLab partnerships.

In line with our Climate Change Policy principle of partnering with research organisations, relevant activities include:

- Investing A\$40 million in research to progress Australia's transition to a lower-carbon economy through the Woodside Monash Energy Partnership.
- Participating in Future Fuels CRC through Australian Pipeline and Gas Association together with two of the technical committees and as industry advisors for a number of projects.

 A significant shareholding in the Hydrogen Energy Network (HyNet) consortium that plans to build and operate 100 hydrogen refuelling stations in South Korea, amid growing interest in the fuel in key markets. This exposure to the market for hydrogen as a transport fuel will complement Woodside's support of hydrogen research through two Memoranda of Understanding signed in 2018 with the Korea Gas Corporation and Pusan National University.

2.1.8 Advocacy

Woodside advocates for stable policy frameworks that reduce carbon emissions and engage legislators and regulators in support of frameworks that can progress an orderly transition to a lower-carbon future. Current examples of this advocacy include:

- Support for the Paris Agreement, which establishes global targets, a framework for global emissions management and a mechanism for increasing ambition over time through successive Nationally Determined Contributions.
- Support for market mechanisms such as carbon pricing, together with targets based on science and measures to reduce the economic and social costs of transition so that frameworks endure.
- Encouraging development of effective domestic and international offset markets, which can reduce the cost of emission reductions or allow greater ambition for the same cost.

Woodside maintains memberships of relevant international climate-related business advocacy groups in order to contribute to the further evolution of global regulatory frameworks. Whilst these organisations will themselves change and develop over time, current Woodside memberships include:

- Global Carbon Capture and Storage Institute (GCCSI), which aims to accelerate the development, demonstration and deployment of the technology.
- International Emissions Trading Association (IETA), which advocates for GHG emission trading to decrease the costs of reducing emissions. In 2019, Woodside became a founding member of IETA's Markets for Natural Climate Solutions (NCS) initiative, which aims to support the development of global markets for carbon credits generated from NCS by enabling private investment at scale.
- International Petroleum Industry Environmental Conservation Association (IPIECA), the global oil and gas industry association for advancing environmental and social performance.
- Methane Guiding Principles, which includes a principle to advocate for sound policy and regulations on methane emissions.

3. GHG Emissions Profile

3.1 GHG Emissions Sources

Components of the Pluto LNG Facility that contribute to GHG emissions include:

- Liquefaction gas turbines
- Power generation gas turbines
- Acid gas removal unit (AGRU)
- Nitrogen rejection unit (NRU)
- Flaring
- Other fuel sources such as diesel for transport and machinery
- Fugitive emissions

3.2 Historic GHG Profile

The relative contribution of these sources and total GHG emissions based on operational data, by financial year is shown in Figure 4. During stable operation, the most significant contributor to GHG emissions is the combustion of fuel gas to operate compressors used in the refrigerant circuit for LNG liquefaction. Emissions from all sources vary according to plant status and production rate. Emissions due to flaring were elevated in the first two years of Pluto Train 1 operation due to the ongoing commissioning process. Reservoir CO₂ emissions are being offset over the life of the project (Section 4.1), in accordance with MS 757, Condition 12-2.

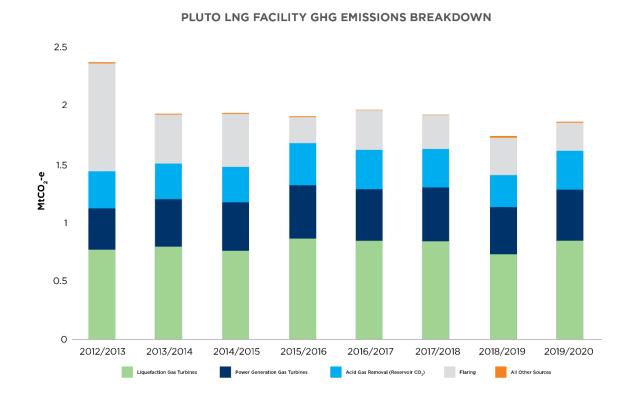


Figure 4 – Pluto LNG Facility GHG emissions plotted by source for each financial year.

3.3 Comparison of operational emissions with pre-operational estimates

Pre-operational estimates of GHG emissions from components of Pluto Train 1 were made in the Pluto GGAP (Revisions 1 and 2). The estimates were made in accordance with requirements of MS 757, Condition 12-1, and methodology is described in Appendix C.

The pre-operational estimates are compared with operational data averaged from the 2013/2014 financial year to 2017/18 in Table 3. Key variations between predicted and actual emissions were due to:

- Actual operational power demand being lower than estimated, and efficiencies identified allowing a turbine to be switched off in cooler months
- Higher emissions from the AGRU due to higher plant throughput resulting from debottlenecking
- Higher flaring emissions due to:
 - o higher plant throughput
 - original estimates were based on a multi-train LNG plant with alternate paths for gas during trips
 - o more flaring than predicted during the plant commissioning process.

Estimates for Pluto Train 2 GHG emissions (inclusive of domgas related emissions) are shown in Table 3.

The difference in AGRU CO₂ between Train 1 and Train 2 is attributable to the different feed gas composition that will be processed by each train. CO₂ concentration in the Scarborough development gas fields are approximately 0.01 - 0.1 mol% compared to the Pluto gas field concentrations of approximately 2 mol% CO₂, as a result, reservoir emissions are significantly lower.

Liquefaction emissions are estimated to be higher due to the difference in Pluto Train 2 LNG processing technology compared to that of Pluto Train 1, coupled with a larger design production capacity. Train 2 does not depend on additional motors where power is supplied by the power generation turbines like Train 1. Because of this, liquefaction emissions for Train 2 are higher, but power generation emissions for Train 2 are significantly lower.

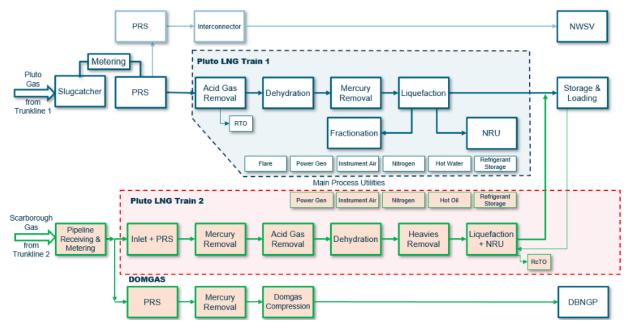


Figure 5 - Proposed Integrated Pluto LNG Facility Process Block Diagram.

The auxiliary power demand for Pluto Train 2 and domgas is small with only one gas turbine required for power generation. The Pluto LNG Facility power system will be managed as a facility-wide system and is optimised to ensure maximum energy efficiency and sparing across the facility.

Estimated emissions of Pluto Train 2 in Table 3 do not account for process start-ups and shutdowns.

Based on Pluto Train 1 operational experience and forecast production rates for both Train 1 and 2, the annual emission estimate for the Pluto LNG Facility are 3.6 Mtpa CO₂-e. This is below the annual estimated emissions rate of 4.1 Mtpa CO₂-e, indicated in the Pluto LNG Development Public Environmental Review (2006). Offshore emissions from the Scarborough development are excluded from this document and are dealt with by a separate Commonwealth approval process.

Table 3 - Comparison of pre-operational GHG emission estimates with operational data at the Pluto LNG Facility

Emission Source	Predicted Annual Emissions Pluto Train 1 (kt CO ₂ -e)	Actual Average Annual Emissions Pluto Train 1 (kt CO ₂ -e)	Predicted Annual Emissions Pluto Train 2 (kt CO ₂ -e)		
Liquefaction	804	821	1207		
Power Generation (LNG)	528	437	94		
AGRU (reservoir and fuel gas consumption)	242	326	24		
NRU thermal oxidiser (Pluto Train 2 only)	N/A	N/A	40		
Flaring	29	345	27		
All other sources (fugitives and domgas ⁽¹⁾)	39	9	73		
Total ⁽²⁾	1642	1935	1465		

⁽¹⁾ Power generation emissions associated with domgas are included under all other sources.

⁽²⁾ Totals subject to production and variables as detailed in Appendix C.

4. Reservoir Emission Offsets

4.1 MS 757 and Condition 12-2

In accordance with MS 757, Condition 12-2, a GHG offset package has been implemented to offset the reservoir carbon dioxide released to the atmosphere over the life of the project for the Pluto LNG Facility.

Under this revised Pluto GGAP, Woodside proposes to address the MS 757 condition 12-2 requirements for the Pluto LNG Facility by either:

- retiring offset units arising from the carbon stock sequestered in the Pluto Carbon Offset Project and/or
- retiring other Eligible Offset Units (as defined in Appendix A of the Climate Active Carbon Neutral Standard)

Reconciliation of reservoir emission volumes and the volume of retired Eligible Offset Units, for the purposes of Condition 12 of MS757, will occur on a five-yearly basis, as aligned with the revision period of the Pluto GGAP. Retirements will be detailed in the Pluto Annual Compliance Reports (ACR) following the retirement date.

4.2 Acquiring and Retiring Offsets

Given developments in carbon offset markets since the commencement of MS757 and contemporary expectations in relation to the retirement of accredited carbon offset units, Woodside will offset the Pluto reservoir emissions by *retiring* Eligible Offset Units on a five yearly basis having acquired them from a diverse range of sources. Diversity in offset source is an important means of managing risks to gaining sufficient volumes.

4.2.1 Eligible Offset Units

Where carbon offset units are purchased from existing projects to offset Pluto LNG Facility emissions, Woodside will only purchase Eligible Offset Units as defined in the *Climate Active Carbon Neutral Standard for Organisations*. Eligible Offset Units include both Australian Carbon Credit Units (**ACCU**s) and voluntary market units as described below.

ACCUs

ACCUs are generated by Government administered offset unit programs, such as the Commonwealth Government's Carbon Farming Initiative (see Section 4.3), and often used for compliance with Government emissions schemes, which may be accounted for in a nation's National Greenhouse Gas Inventory and Nationally Determined Contribution under the Paris Agreement (international protocol on Climate Change).

Voluntary Market Units

In addition to Government administered schemes, there are 'voluntary markets' which refer to offset unit programs overseen by independent non-government organisations (such as the Gold Standard which is supported by the World Wildlife Fund, ClimateWorks Australia and FairTrade International amongst others).

The voluntary market programs also meet offset integrity standards similar to those applied under the Australian Commonwealth program (refer section 4.3.2). A description of these offset integrity standards is set out in the *Climate Active Carbon Neutral Standard for Organisations*.

Retirement of Eligible Offset Units

The Eligible Offset Units will be retired expressly for the purposes of meeting the requirements of Condition 12 of MS757 and where practicable will be undertaken via publicly available registries (for examples of public registries see Gold Impact Registry and Verra Registry – Verified Carbon Standard). It is noted that at present the Australian National Registry of Emissions Units, which is used for ACCUs, does not have a publicly available real-time retirement register.

In addition to the above, Woodside will continue to report annual reservoir emission volumes and retired offset units (including serial numbers) in the Pluto Annual Compliance Reports, which are publicly available on Woodside's website. Periodic reconciliation of reservoir emission volumes and the volume of retired Eligible Offset Units, for the purposes of Condition 12 of MS757, will occur on a five-yearly basis, as aligned with the revision period of the Pluto GGAP.

Due diligence

When acquiring carbon offsets from third party projects, Woodside:

- verifies the identification and credentials of the offset unit vendor
- conducts analysis of the underlying project(s) from which the offsets are generated, including
 any potential risks and co-benefits (additional benefits such as employment or biodiversity),
 and
- ensures that its offsets meet the offset integrity principles of additionality, permanence, measurability, transparency, leakage deductions, independently audited and registration in a transparent registry.

4.3 Pluto Carbon Offsets

4.3.1 Pluto Carbon Offset Project (2008)

Woodside intended to achieve full offset of forecast reservoir emissions for the Pluto LNG Facility from the time of its final investment decision in 2008 by investing over A\$100 million in an extensive bio-sequestration project, planting over 25 million native Australian blue mallee trees on 27 properties (approximately 17,125 hectares) in Western Australia and New South Wales, implemented with CO₂ Australia Ltd through the Pluto Carbon Offset Project.

Subsequent to the commencement of the Pluto Carbon Offset Project, the Emissions Reduction Fund was introduced, and the Pluto Carbon Offset Project was registered as a Carbon Farming Initiative offset project (see Table 4).

Initial estimates of the Pluto reservoir emissions and the initial carbon sequestration forecasts together indicated that the Pluto Carbon Offset Project would sequester a greater volume of carbon dioxide than the volume of Pluto reservoir emissions over the life of Pluto LNG Facility.

Scientific measurement of the volume of carbon dioxide sequestered by the Pluto Carbon Offset Project to date (referred to as carbon stock), and revised carbon stock forecasts indicate that the volume of Pluto reservoir emissions has exceeded the volume of carbon dioxide sequestered by the Pluto Carbon Offset Project (see Table 4).

In addition, high reliability and debottlenecking of the plant have resulted in the Pluto LNG's Facility's annual production out-performing compared to forecast nameplate capacity. This has resulted in accelerated CO₂ emissions.

Table 4 – Pluto Carbon Offset Project

Emission, Sequestration and Offset Source	2012 – 2020 (total)
Reservoir emissions (t/CO ₂ -e)	2,579,292
Pluto carbon offset project (1)	1,159,795

⁽¹⁾ Forecast 2020 carbon stock level subject to confirmation measurement at periods prescribed under the Carbon Farming Initiative.

4.3.2 Currently Registered Projects

The Carbon Credits (Carbon Farming Initiative) Act 2011 (CFI Act) enables the crediting of greenhouse gas abatement from emissions reduction activities across the economy. Greenhouse

gas abatement is achieved either by reducing or avoiding emissions or by removing carbon from the atmosphere and storing it in soil or trees.

In 2014, the CFI Act was amended by the *Carbon Farming Initiative Amendment Act 2014* to establish the Emissions Reduction Fund (ERF) made up of three elements: crediting emission reductions, purchasing emission reductions, and safeguarding emission reductions.

Emissions reduction activities are undertaken as offsets projects. An offsets project must be covered by, and undertaken in accordance with, a methodology determination. The purpose of a methodology determination is to establish procedures for estimating abatement (emission reductions and sequestration) and rules for monitoring, record-keeping and reporting. These methodologies will ensure that emission reductions are genuine – that they are both real and additional to business as usual.

In deciding to make a methodology determination the Minister must have regard to the advice of the Emissions Reduction Assurance Committee (ERAC), an independent expert panel established to advise the Minister on proposals for methodology determinations. The ERAC must include in its advice to the Minister the Committee's opinion on whether a proposed determination complies with the offsets integrity standards set out in section 133 of the CFI Act.

The offsets integrity standards require that an eligible project should result in carbon abatement that is unlikely to occur in the ordinary course of events and is eligible carbon abatement under the Act. In summary, the offsets integrity standards also include that:

- amounts are measurable and capable of being verified
- the methods used are supported by clear and convincing evidence
- material emissions which are a direct consequence of the project are deducted, and
- estimates, assumptions or projections used in the determination should be conservative.

Offsets projects that are undertaken in accordance with a methodology determination and approved by the Clean Energy Regulator (the Regulator) can generate ACCUs representing emission reductions from the project.

ACCUs can be sourced through various commercial arrangements including:

- the direct development or funding of new ACCU generating projects
- purchase of existing ACCUs issued by the Clean Energy Regulator from market traders or offset-project developers
- offtake arrangements for ACCUs to be generated from new or existing projects, and
- spot purchase and long-term purchase agreements from market traders or project-developers.

As at January 2021 Woodside has six registered carbon farming offset projects in Australia (refer Appendix E, Table E1). Four of these registered offset projects relate to the original Pluto Carbon Offset Project and the other two are recently registered projects relating to biodiverse environmental planting (see Appendix E – Table E1).

The ACCUs generated from these projects may be used for Federal compliance purposes and not necessarily applied to offset Pluto reservoir emissions, because they may also be attributed to other Woodside portfolio emissions.

4.3.3 Retired Eligible Offset Units To Date

To date, Woodside has funded the retirement of 1.69 million eligible offset units for the purposes of offsetting Pluto reservoir emissions as detailed in Appendix E – Table E2 and Table E3. These offsets have been acquired on the voluntary market through renewable energy projects and the

offset units retired are identifiable through the registry serial numbers. A summary of the two voluntary market offset projects is provided below:

Wind Power Project in Tirupur District, India

Wind Power Project in Tirupur District - This project has enabled investment in, and use of, 33 Wind Energy Converters of 1.5 MW capacity each (total capacity of 49.5 MW) in the state of Tamil Nadu. The power generated by this project activity is supplied to Southern Grid in India. The project reduces the supply demand gap in the State and also helps in contributing reduction of GHG Emissions from a demonstrated baseline. In addition to regional employment and infrastructure benefits, two percent of the carbon credit revenue is applied toward local community development initiatives.

Tamil Nadu Spinning Mills Association Wind Power Project, India

Bundled Wind Power Project in Tamil Nadu, India, co-ordinated by Tamil Nadu Spinning Mills Association (TASMA-II). This project has enabled investment in, and use of, wind turbine generators to generate power for use by Spinning Mills (textile mills) with small individual power requirements. The wind turbine generators are micro-sited across a broad geographic area. The electricity generated is delivered via the Southern Grid under electricity tolling arrangements with Tamil Nadu Electricity Board. The project brings together a number of Spinning Mills to increase the collective bargaining capacity of the individual Spinning Mills with the wind turbine generators suppliers and the Tamil Nadu Electricity Board, and to provide financial support via carbon credit revenue. The combined Spinning Mills' wind turbine generators displaces the use of conventional energy generation for the Spinning Mills and delays or avoids the addition of grid capacity via conventional power plants. In addition to regional employment and infrastructure benefits, two percent of the carbon credit revenue is applied toward local community development initiatives.

5. GHG Intensity and Benchmarking

5.1 Pluto LNG Greenhouse Gas Intensity

Based on pre-operational estimates, the Pluto LNG Facility's GHG emissions intensity was forecast to be approximately $0.37\ t$ CO₂-e/t LNG.

Actual GHG intensity based on operational data is presented in Table 5.

Table 5 - GHG emissions intensity by financial year

	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
Emissions Intensity (t CO ₂ -e/tLNG)	0.58 (1)	0.45	0.46	0.38	0.41	0.39	0.42	0.36
Emissions intensity considering offsets ⁽²⁾ (t CO ₂ -e/tLNG)	0.50	0.38	0.39	0.31	0.34	0.32	0.35	0.30

⁽¹⁾ Higher due to high flare rates during Pluto Train 1 commissioning.

Post commissioning of Pluto Train 2, the combined Pluto LNG Facility intensity in steady-state operations is estimated to be 0.33 t CO₂-e/t LNG. The LNG intensity will vary depending on a number of factors, refer to Appendix D for further details.

5.2 Benchmarking GHG Intensity with Other Comparable Projects

Comparable benchmarking of an LNG processing plant is difficult to undertake due to the proprietary nature of data relating to plant performance and the difference in greenhouse gas efficiency that occurs due to local and site-specific factors. GHG emissions intensity can be influenced by a range of internal (technology) and external (environmental / policy) factors in design or operational phases, including:

- Relative proportions of gases (including CO₂) in reservoirs
- Ambient temperature at the location of the facility
- Major technology decisions, such as the use of air or water cooling which may be governed by factors other than GHG intensity
- Potential of integration with other facilities (i.e. the integration of utilities across Trains 1 and
 2)
- Capacity for external power generation, including the use of renewable sources

These factors are further explained in Appendix D. They are significant contributors to variation in the benchmarking data presented in this section. The data collated for comparative purposes has been sourced from publicly available documents. Although every effort has been made to provide a comprehensive and accurate comparison of LNG plants located within Australia and internationally, it does not include all LNG plants worldwide. The GHG emission intensities shown in Figure 6 are based on GHG emissions and the published LNG (or total product) production capacity of the plant. Figure 6 includes emissions related to onshore processing plants only and excludes upstream emissions.

The benchmarking shown in Figure 6 indicates that the performance of the Pluto LNG Facility is well positioned in relation to the LNG industry's current average GHG intensity, especially when the effect of reservoir CO₂ offsets is considered.

⁽²⁾ Emissions intensity considering offsets calculated on the basis all reservoir CO₂ emitted in each financial year will be offset.

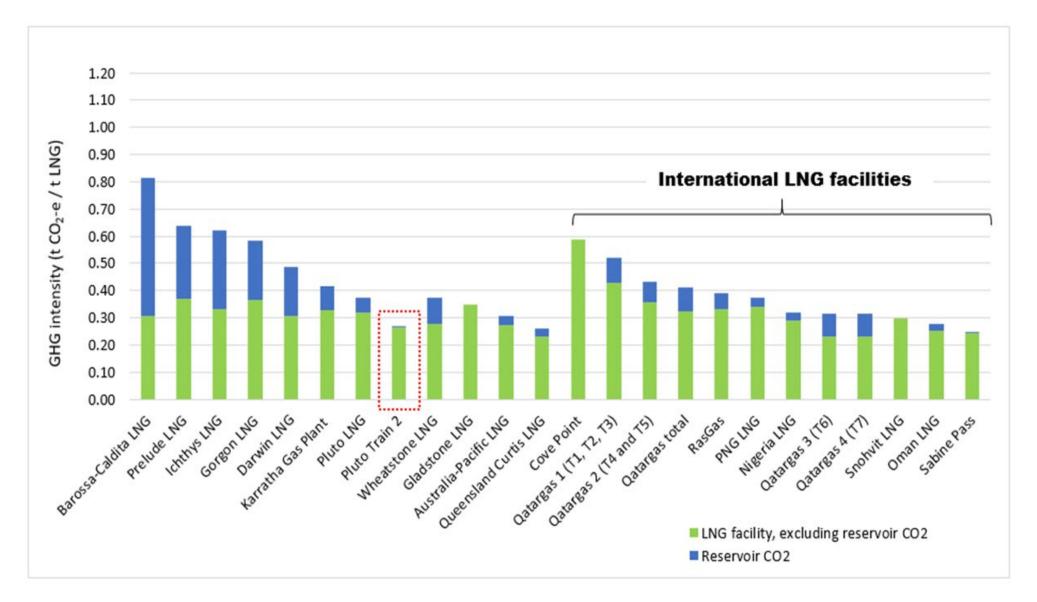


Figure 6 - Comparison of Pluto LNG Facility GHG emissions against other comparable projects.

6. GHG MITIGATION - DESIGN ACHIEVEMENTS

This section describes the mitigation measures that were adopted in the design and selection of technology for the Pluto LNG Facility. These measures represent either:

- No regret measures: those which can be implemented and are effectively cost-neutral or generate value (Section 6.1)
- **Beyond no regret measures**: measures are those which can be implemented and involve additional costs which are not expected to be recovered (Section 6.2)

The opportunity for GHG mitigation during the design phase provides the most significant opportunity to minimise emissions. Significant focus on GHG emissions was maintained during the Pluto LNG Facility Basis of Design (BOD) phase and the Front End Engineering and Design (FEED) phase.

As per Woodside's Climate Change Policy, the lowest cost abatement opportunities are sought, which can either be direct abatements (within design) or offsets (as per Section 3). Section 6.1 details direct abatement opportunities adopted by the Pluto LNG Facility. In some cases, as detailed in Section 6.1.3 a business case for direct abatement opportunities is not feasible.

6.1 No Regret Mitigation Measures

6.1.1 Pluto Train 1

Table 6 shows the 'No Regret' GHG reduction initiatives implemented for Pluto Train 1.

Table 6 - Summary of Main 'No Regret' GHG Abatement Initiatives for Pluto Train 1

Abatement Opportunity	GHG savings (t CO ₂ -e) p.a. ⁽¹⁾	GHG savings (tCO₂-e/tLNG)	Comments / Assumptions
Improved Gas Turbine Efficiency (Power Generation)	336,000	0.08	Based on evaluation of Frame 6 turbines against the base case of Frame 5 turbines, representing higher individual turbine costs but reduced turbine numbers and superior fuel efficiency economics.
aMDEA	384,000	0.09	Assessment assumed no cost difference between aMDEA and sulfinol system to install.
Flash Gas Recovery	129,000	0.03	Based on alternatively providing no flash gas recovery.
Regenerative Thermal Oxidiser	25,800	0.006	Based on provision of a regenerative thermal oxidizer over a traditional thermal combustion unit.
Waste Heat Recovery	86,000	0.02	Estimate based on alternative gas firing of process heat demands.
Optimising Nitrogen Content in fuel Gas	56,000	0.01	N ₂ available from Pluto reservoir gas and nitrogen rejection unit, allowing fuel gas leaning and efficiency improvement (fuel gas in vs power out).
Nitrogen Flare Purging	1,200	0.0003	Estimated based on 2006 flare gas study.
Main Cryogenic Heat Exchanger Redesign	0 – 73,000	0 – 0.017	Reduced risk of unplanned flaring events, however

Abatement Opportunity	GHG savings (t CO ₂ -e) p.a. ⁽¹⁾	GHG savings (tCO ₂ -e/tLNG)	Comments / Assumptions	
			magnitude not able to be quantified, as MCHE leakage is never 'planned'. Upper-end estimate based on complete elimination of leakages.	
Tandem Dry Gas Seals	0 - 39,460	0 - 0.009	Upper figures based on KGP Trains 1-3 wet seal emissions, scaled to capacity of Pluto Train 1. Zero estimate based on KGP Trains 4-5 comparable design.	
Total Reduction in Business as Usual	1,020,000 t CO₂-e p.a.	0.23 tCO₂-e/tLNG	Potential MCHE reductions not included in total, due to range uncertainty. No reduction for tandem dry gas seals included, as Pluto Train 1 design is in line with KGP Trains 4-5.	

⁽¹⁾ Based upon LNG production of 4.3 MTPA

6.1.2 Pluto Train 2

The most significant 'No Regret' GHG reduction opportunities planned for Pluto Train 2 are summarised in Table 7. An estimate of annual GHG reductions is included. Given that the design of Train 2 is based on the design of an existing reference train, the starting basis was more progressed than a typical design. This is reflected in the lower starting intensity and supported by the number and magnitude of reduction opportunities that have arisen during the FEED phase. Further detail around each opportunity is provided in the following sub-sections.

Table 7 - Summary of Main 'No Regret' GHG Abatement Initiatives for Pluto Train 2

Abatement Opportunity	GHG savings (t CO ₂ -e) p.a.	GHG savings (t CO ₂ -e/tLNG)	Comments / Assumptions
Technology Choice	303,078	0.057	A carbon copy of Pluto Train 1 would require installation of an additional four GE Frame 6B heavy duty industrial gas turbine generators for auxiliary power generation, compared to the one generator planned utilising the ConocoPhillips (CoP) Optimised Cascade® Process. Power supply for the two trains will be integrated, allowing optimisation of power generation and supply, maximum energy efficiency and sparing. It allows Pluto Train 2 power supply to be met with a single gas turbine generator.
Selection of Aero- derivative GT design for Liquefaction compressors	127,259	0.024	LM 6000PF+ gas turbines for liquification have the highest thermal efficient and lowest GHG emissions of the four alternatives considered.
Inlet Air Chilling (IAC) for the GT's	38,026	0.007	~3% reduction in CO ₂ -e emission

Abatement Opportunity	GHG savings (t CO ₂ -e) p.a.	GHG savings (t CO₂-e/tLNG)	Comments / Assumptions
Optimisation of Acid Gas Removal Unit design	4,700	0.001	Recuperative thermal oxidiser (RcTO) will be fuelled primarily from flash gas from the AGRU process and only supplemented with fuel gas when required, to maximise efficiency and reduce fuel gas consumption.
Nitrogen Removal Unit Recuperative thermal oxidiser -	19,359	0.004	Provision of a RcTO compared to no thermal oxidiser.
Nitrogen Removal Unit Recuperative thermal oxidiser (RcTO) – Pre- heat coil	13,778	0.003	Estimated energy savings of 30.6 GJ/h by pre-heating the waste gas before introduction to the combustion chamber.
Inclusion of Waste Heat Recovery	50,430	0.01	Waste heat recovery has been implemented in the liquification process for supply of process heat through Pluto Train 2.
Optimisation of Heavies Removal Unit Design	4,052	0.001	Adoption of an Expander Compressor/ Heat Exchanger design and reducing pentane make-up as well as the need for additional rotating equipment.
Total Reduction in Business as Usual	560,682 t CO₂-e p.a.	0.107 t CO ₂ -e/tLNG	

Figure 7 illustrates the improvements that have been achieved from the 'Business as Usual' base case for Pluto Train 2 as greater efficiency has been built into design.

PLUTO TRAIN 2 DESIGN IMPROVEMENTS IN GREENHOUSE GAS INTENSITY

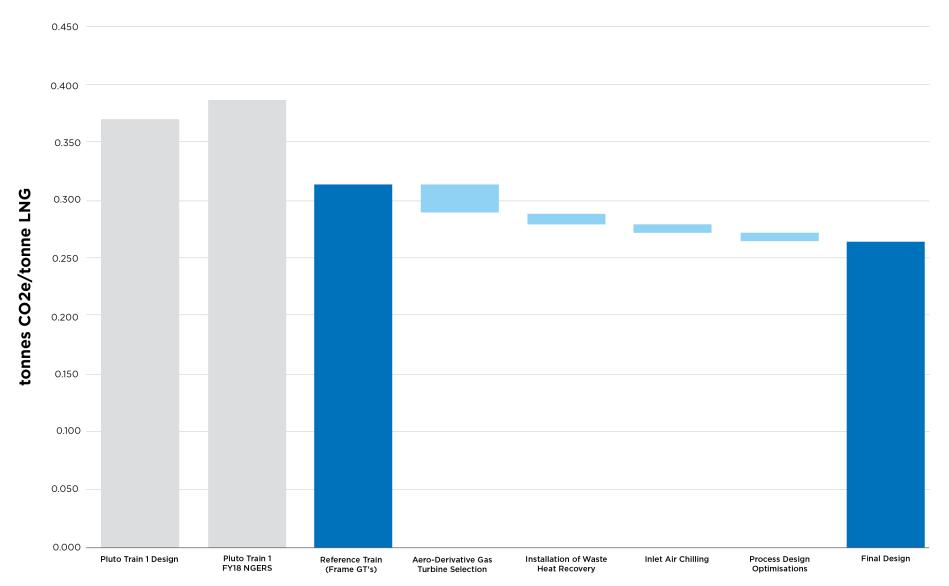


Figure 7 – Pluto LNG Facility GHG Emissions and Pluto Train 2 Efficiency Improvements

6.1.3 Power System Alternatives Assessed

A number of auxiliary power solutions were investigated as part of the planning for Pluto Train 2, with the decision being installation of an additional Frame 6B industrial gas turbine. A key consideration for Pluto Train 2 was that power generation could be integrated with the existing power system such that it could be optimised to ensure maximum energy efficiency and sparing across the facility, whilst maintaining availability and reliability. The alternative options assessed included:

- Battery Energy Storage System (BESS), and
- Power Import.

Currently, Pluto Train 1 has four GE Frame 6 heavy duty industrial gas turbine generators for auxiliary power generation, with a total installed capacity of 144 MW. Pluto Train 2 and the domgas unit auxiliary power demand is estimated to be approximately 30 - 40 MW. The existing Pluto Train 1 power system does not have sufficient capacity to support the additional load based on gas turbine availability and sparing.

MS 757, Condition 12-1 (7) requires the consideration of renewable power generating options for the Pluto LNG Facility.

The power requirement for Pluto Train 2 and domgas is reasonably stable year-round, therefore renewable energy solutions would need to be coupled with a suitable power generation source capable of delivering constant power demand. Woodside will continue to monitor the potential for import of renewable power to the Pluto LNG Facility.

6.1.3.1 Battery Storage

A Battery Energy Storage System (BESS) has the potential to provide back-up power capacity, known as spinning reserve. Batteries do not provide base load power that is required for stable operations. A BESS has the potential to minimise GHG and pollutant emissions as less fuel is consumed in order to maintain the required spinning reserve, to either:

- Provide short-term back-up in the event of power outage or shortage to enable systems issues to be resolved, or
- To enable smoothing of peaks in power demand.

An assessment was performed to understand whether additional power generation was required based on Pluto Train 2 power demand, or if a BESS could provide sufficient energy storage to maintain the minimum reliability and availability requirements for the plant to prevent significant trips.

The assessment concluded that in order to maintain the minimum reliability and availability requirements of the plant, additional power generation is required. The reasons for this are:

- The battery does not generate power, it stores energy. Large scale industrial batteries are
 not used for base load provision, they are used to smooth power demand peaks and provide
 short term stabilisation of the power system during upset to prevent a complete loss of power.
- Excess power is required to keep the battery charged. Based on the Pluto Train 1 power system and power demand profile throughout the year with Pluto Train 2, there is insufficient excess power to maintain a fully charged battery, without additional power generation being added.
- If a generator tripped, the battery would only supply approximately one hour of power to the Pluto LNG Facility, where a minimum of 18 hours of supply is required in the event no gas turbine sparing is available. With a small difference in power demand (<8 MW) in the event of a trip, the facility may be able to manage an extended gas turbine outage with a BESS through a small load shed, however given the Pluto Train 2 and domgas power demand of approximately 30 40 MW, the power difference is too large. This would lead to the requirement to load shed across the process. A process upset of this nature would lead to significant flaring and the potential to trip both trains. A larger battery does not assist in this

case as there is insufficient excess power in the existing system to maintain charge in the batteries, therefore additional power generation would need to be installed in order to keep the batteries charged.

The alternate reason for installing a BESS is to assist with smoothing of peaks in power demand, this is typically absorbed by the existing spinning reserve in power generation. At present, Pluto Train 1 utilises gas turbine generators to provide the spinning reserve. The power system has been optimised such that the spinning reserve demand decreases, fast load shedding can be enacted in the event of a trip, and the plant can be operated with three of the four installed turbines

A BESS has the potential to act as this spinning reserve with the benefit that it reduces emissions as gas-fired power generation typically operating in low load and inefficient operating modes can be turned off. This can only be achieved if there is sufficient excess power in the system to maintain charge in the batteries. Given the requirement to add power generation to the site in order to meet the minimum power demand, sufficient spinning reserve will be available in the power generation system. Therefore, a BESS is not required. As per current operations, the Pluto LNG Facility power generation system will be optimised to maximise the efficiency of the system.

6.1.3.2 Power Import

If insufficient onsite power is available, or if offsite power can be generated more efficiently, import of power is an option in order to meet the minimum power demands. At present, there is no power grid available for connection on the Burrup that can provide a stable power supply to the Pluto LNG Facility.

Woodside is continuing to assess potential options for importing power and optimising power generation onsite utilising imported power for the life of the project.

6.1.4 Liquefaction compressor driver selection

The LM6000PF+ aero-derivative gas turbine with IAC and dry low NO_X technology have been selected as the driver for the main refrigeration compressors. Aero-derivative drive units have been successfully integrated with the ConocoPhillips Optimised Cascade® Process and is considered best practice. Aero-derivative drive units have been integrated into four of the five most recent LNG developments in Australia.

If industrial frame gas turbines similar to that of Pluto Train 1 were to be adopted for the ConocoPhillips Optimised Cascade® Process³, a minimum of four Frame 6 refrigerant compressor turbines would be required in order to achieve the desired LNG production rate to ensure the projects commercial viability. The aero-derivatives proposed for Pluto Train 2 have a higher thermal efficiency, a lower turndown and greater operational flexibility, allowing the process to be optimised to ensure maximum energy efficiency and lower GHG emissions.

6.1.5 Inlet Air Chilling (IAC)

An IAC system is provided to chill the ambient air fed to each of the six liquefaction/refrigeration compressor gas turbine drivers. As the feed gas passes through a series of heat exchangers, it gives up heat to the successive refrigerants and cools. The IAC increases reliability of the gas turbines by maintaining the gas turbine compressor inlet air at a constant temperature and improves the heat rate (efficiency) of the gas turbine lowering emissions intensity per unit of LNG produced. Improving the reliability of the machine reduces the potential for gas turbine and plant restarts, thereby reducing potential for flaring.

The IAC has a low power duty of approximately 3.7 MW on the gas turbine generator, this duty will fluctuate throughout the year dependent on ambient temperature. The IAC allows the gas

³ Technology proposed by FEED Contractor

turbine to produce an additional 5 MW of power per gas turbine at a better heat rate, which increases the plant capacity and improves the overall emissions intensity.

Process simulations to understand the benefit of a 10°C decrease in inlet air temperature entering the train resulted in an approximate 11.6% increase in power output from LM6000PF + generators and decreased emission rates for CO₂ by 3%.

6.1.6 Optimisation of Pluto Train 2 AGRU design - Thermal Oxidiser

Gases vented from the AGRU contains traces of BTEX along with low levels of methane. Combustion of this waste stream is required in order to minimise CO₂-e emissions and destruct contaminants potentially harmful to human health.

Experience with the Regenerative Thermal Oxidiser unit on Pluto Train 1 and the expected process flows for Pluto Train 2 AGRU indicates selection of a Recuperative Thermal Oxidiser is preferred based on better performance for the destruction of vented methane. This is due to:

- Waste stream composition and VOC concentration
- Ability to handle larger variation in waste stream composition
- Destruction efficiency of at least 99%
- Higher availability.

Optimisation of the Pluto Train 2 AGRU design to reduce emissions has included:

- RcTO design: 4% improvement in destruction efficiency over Regenerative Thermal Oxidisers
- Heat integration of the Thermal Oxidiser and AGRU: preheat of feed streams using the exhaust gas, reducing fuel consumption and associated GHG emissions
- Low pressure operation and extended residence time: minimises hydrocarbon solubility and enhances removal of dissolved or entrained hydrocarbons from the circulating amine solvent, reducing the volume of hydrocarbon
- Flashed gas containing hydrocarbon is recovered for use as fuel gas, reducing fuel consumption.

6.1.7 Nitrogen Rejection Unit

A cryogenic Nitrogen Rejection Unit (NRU) is used in the LNG trains to remove excess Nitrogen. Nitrogen is cryogenically separated and concentrated, in the NRU, via a series of fractionation columns. The reference design for Pluto Train 2 had the NRU venting to the atmosphere.

The NRU vent stream may contain up to 1.6 mol% of methane, as such this stream is routed to an NRU Recuperative Thermal Oxidizer (RcTO) in order to combust residual methane prior to venting to atmosphere. This is done to convert remaining methane in the vent gas to carbon dioxide thus lowering the equivalent greenhouse gas emissions, as methane is a much more active greenhouse gas than carbon dioxide. Installation of a RcTO reduces methane and GHG emissions through combustion of the waste stream.

A preheat coil is provided in the combustion chamber of the NRU RcTO. The preheat coil heats waste gas before introducing it directly into the combustion chamber.

6.1.8 Waste Heat Recovery Units

Waste heat recovery units (WHRU) will be installed in exhaust ducts of each of the Ethylene refrigeration compressor GE LM6000PF+ gas turbines. A closed-loop, hot oil heating medium is used to transport heat from the WHRUs to supply major users, including condensate stabilisation facilities, AGRU regeneration and fractionation reboiler.

This system supplies sufficient process heating requirements for Pluto Train 2. These WHRUs also supply the heat to regenerate the molecular sieve dehydrators in Pluto Train 2. The WHRUs do not require any supplemental burners to meet plant heat demands.

6.1.9 Optimisation of Heavies Removal Unit

In order to prevent heavy hydrocarbon components freezing during the liquefaction process, they must be removed via a Heavies Removal Unit (HRU). The HRU essentially strips the heavy hydrocarbon components out of the feed gas. The initial design of the HRU would require an estimated continuous 2.2 m³/h of pentane makeup. By adding an additional Heat Exchanger to the HRU which eliminated the need for the Booster Compressor, pentane makeup was reduced to <0.05 m³/h. This removed 2.5 MW of power demand from the process, reduced flaring requirements due to the risk of Pluto Train 2 shutdowns and reduced pentane Truck Loading requirements to site from 33 fills to 1 fill per year.

6.1.10 Electric Drives

Although not selected for the larger refrigerant driver and power generation, electric drive has been adopted throughout the process for smaller compressors such as the regeneration, BOG, feed gas, instrument air and domgas.

6.1.11 Recovery of Boil Off Gas (BOG)

The Pluto Train 2 design includes recovery of LNG (primarily methane) vapours generated from a combination of the Pluto Train 2 rundown final flash into storage tank, rundown piping heat leak and Pluto Train 1 BOG header. The recovered vapours are then recycled back into Pluto Train 2 by the BOG blowers.

Installation of the BOG blowers reduces the need to flare the flows that are being recycled back into the process train. This reduces GHG emissions resulting from flaring of BOG vapours.

6.2 Beyond No Regret Mitigation Measures

'Beyond no regret' GHG reduction initiatives for Pluto Train 1 consist of reservoir emissions offsets, as outlined in Section 4. Table 8 summarises the main 'beyond no regret' GHG reduction initiatives implemented for Pluto Train 2.

Table 8 - Summary of "Beyond No Regret" GHG Abatement Initiatives for Pluto Train 2

Abatement Opportunity	GHG savings (tCO ₂ -e) p.a.	GHG savings (tCO₂-e/tLNG)	Comments / Assumptions
Market Offsets (Pluto Train 2)	16,000 (1)	0.003	Offset arrangements to be determined prior to Pluto Train 2 start up.

⁽¹⁾ Offset amount may vary as sequestration projects mature. Reservoir CO₂ volume varies annually with reservoir CO₂ concentration and LNG production rate.

7. GHG Mitigation - Operational Phase

7.1 Pluto GGAP Commitment Status

The pre-operation Pluto Train 1 GGAP included multiple commitments to reviews following commencement of operations.

These are summarised along with their findings in Table 9. Commitments applicable to Pluto Train 2 have been added.

Table 9 - Existing GGAP Commitments

Ref No.	Task	Purpose	Output	Timing	Findings
1	Monitor atmospheric emissions, energy consumption and LNG production	Validate existing emissions estimates, greenhouse predictions and design criteria or understand any variance	Establish baseline emissions estimates and greenhouse intensity	First year of steady state operations	Complete for Pluto Train 1. To be carried out for Pluto Train 2. The initial target GHG intensity for Train 1 (0.37 t CO ₂ -e/tLNG) has been achieved.
2	Undertake a leak detection and repair program	Minimise emission losses and maximise operational efficiency	Recommendations for minimising leaks	First year of steady state operations	Complete for Pluto Train 1. To be carried out for Pluto Train 2.
3	Undertake a flare gas recovery study	Maximise operational efficiency	Recommendations for gas recovery	Second year of steady state operations	Completed during operation of Pluto Train 1.
4	Undertake an energy efficiency review of the plant	Maximise operational efficiency and improving plant performance and emissions intensity	Establish a revised (reduction) target for greenhouse intensity and make recommendations for improving energy efficiency	Within 18 months of steady state operations	Woodside carries out regular reviews across its operations as standard operating practice to continually improve energy efficiency, reduce GHG emissions and optimise performance of its facilities. Under the Woodside Management System, energy efficiency is a key part of plant optimisation and as such is included alongside maximising value from assets. Ongoing opportunity management is described in section 7.2.2, and operational phase achievements are described in section 7.2.3.
5	Identify energy efficiency gains and improved greenhouse emissions intensity by integrating systems for future expansion	Maximise operational efficiency and improve emissions intensity	Revised cumulative emissions estimates and greenhouse intensity	In parallel with expansion of the Pluto LNG Facility	Planning for Pluto Train 2 includes integration of a power supply system across the Pluto LNG Facility, maximising efficiencies as part of the design for Pluto Train 2 and domgas. Refer to section 6.1.4 for details of the liquefaction compressor driver selection.

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Ref No.	Task	Purpose	Output	Timing	Findings
6	Continue to monitor market abatement opportunities	Maximise efficiency of global GHG reduction efforts for any additional Pluto offsets	Understanding of market offset opportunities for business evaluation	Within 18 months of steady state operations	Woodside continues to monitor market abatement opportunities and has established a carbon offset business to produce and acquire carbon offsets. Woodside has also established contractual partnerships with carbon abatement and greenhouse accounting expertise. The existing GHG offset package will continue to be reviewed to ensure compliance with MS 757, Condition 12-2.
7	Review GHG Improvement Plan and incorporate any identified actions	Maintain a "live" improvement plan	Annual review and incorporation of identified initiatives where appropriate	Around the anniversary of steady state operations, annually	Identification and management of further greenhouse related initiatives is undertaken on an ongoing basis. The ongoing GHG Improvement Plan, including operational phase achievements, is described in section 7.2.
8	Review and update the GHG Abatement Program	Maintain transparency over Woodside's GHG intensity performance on the Pluto LNG Facility	Updated GHG Abatement Plan.	5 years from steady state operations, or prior to commissioni ng of new trains	This update of the Pluto GGAP, prior to the implementation of Pluto Train 2, fulfils this requirement. Further review and update is described in section 10.

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7.2 Ongoing GHG Improvement Plan

Woodside has implemented an ongoing program of GHG intensity management during the operation of Pluto LNG Facility.

7.2.1 Annual Performance Targets

The interim and long-term emission reduction targets for the Pluto LNG Facility are described in section 2.1.4 of this Pluto GGAP.

In addition to the interim and long-term emissions reduction targets, Woodside implements annual GHG-related targets applicable to the Pluto LNG Facility. GHG-related targets are set at corporate, divisional and facility specific levels and include specific flaring and fuel intensity reduction targets for the Pluto LNG Facility. Performance against these targets is monitored and reported throughout the business to drive the operational behaviour and decision-making processes which support the implementation of energy efficiency improvements.

Based on operational experience at Pluto Train 1, the target for GHG intensity of the combined Pluto Train 1 and Pluto Train 2 is 0.33 t CO_2 -e/tLNG when in steady state operations (excluding offsets, commissioning and dependant on feed gas composition). In the event of any significant change in feed gas composition and the operational performance of Train 1 and 2, the target GHG intensity will be revised.

7.2.2 Opportunity Management

The existing ongoing program of GHG intensity management incorporates opportunities to optimise process. These opportunities may have an impact on production, fuel use, flaring or a combination of these factors. In accordance with the Production Optimisation and Opportunity Management Procedure (Woodside ID W0000PP10115808), Woodside is required to develop an Optimisation Reference Plan (ORP) for the Pluto LNG Facility which identifies and implements opportunities to improve production and energy efficiency whilst reducing emissions. The ORP recognises that any reduction in emissions is also identified as a production opportunity, as gas that can be diverted from fuel or flare streams can potentially be turned into a saleable product.

The ORP, prepared annually, delivers a ranked list of opportunities used to justify further study/implementation of each opportunity listed. Results are then incorporated into relevant plans to ensure consideration for funding / resourcing. A decision to progress and/or implement opportunities is based on a number of economic and environmental considerations:

- Opportunities are prioritised based on net present value (NPV), their contribution to Woodside corporate initiatives for GHG reduction, and the confidence of return (CoR) to ensure efficient capital allocation. The CoR is estimated based on maturity, complexity, technology novelty and ease of implementation.
- NPV and value / investment ratio (VIR) are calculated using an Economic Screening Portal, which is used to estimate the benefit for each opportunity.
- Production enhancing opportunities need to meet set criteria to be considered economic and reviewed for recommendation. Opportunities may not be recommended if economics are marginal and there is low probability of success, however opportunities that do not meet the economic criteria can still be recommended if there is environmental/strategic merit (e.g. emissions reduction benefit).

Operational phase GHG intensity achievements, identified and implemented via the ORP, will be reported in subsequent Pluto GGAPs and summary reports.

7.2.3 Operational Phase Achievements

Greenhouse gas and energy efficiency opportunities implemented through ongoing opportunity management and plant optimisation processes during Pluto Train 1 operations are described in Table 10. All benefits are estimates and subject to ongoing validation.

Table 10 - Operational phase greenhouse gas efficiency achievements

Opportunity MCHE internal	Description Implemented 2015 – Internal modification of main	Estimated greenhouse efficiency improvement 2%
modification	cryogenic heat exchanger to improve liquid flow and LNG production with no additional fuel use.	
GTG winter operating strategy	Implemented 2015 – Modification of standard operations, allowing one of four power generation gas turbines to be switched off during cooler months when efficiency is highest, reducing fuel gas consumption.	1.2%
Frame 7 speed increase	Implemented 2017 – Increase in maximum speed of refrigerant compressor turbines, increasing LNG production with proportionately less fuel gas consumption.	0.57%
AGRU high rate trial	Implemented 2017 – Trial to debottleneck front-end of LNG process, increasing maximum rates with proportionately less fuel gas consumption.	1.33%
Frame 7 HEPA filters	Implemented 2017 – Replacement of standard turbine air filters with High Efficiency Particulate Air filters to reduce fouling and fuel gas consumption.	1.05%
Increase BOG compressor motor current	Implemented 2017 – Modified maximum electrical current to boil off gas compressors, reducing flaring.	0.07%
MCHE C5+ limit adjustment	Implemented 2018 – modification to C5+ (heavy hydrocarbons) limit allows additional LNG production with no additional fuel gas consumption.	0.45%
MCHE improvements	2019 - Tube inserts installed to increase the efficiency of mixed refrigerant cooling, and installation of new vent valves addressed the issue of previous valves passing hydrocarbons to flare.	0.9%
Increased train operating pressure	2019 - This improvement enabled the operating pressure of the train to be increased as a result of control changes. This increased feed pressure results in additional cooling capacity, producing more LNG for no additional energy inputs.	0.4%
GTG all year round operating strategy	2019 – Upgrades to electrical load management system led to adoption of the "GTG winter operating strategy" all year round.	1.7%
K1410 APC improvements	2019 – Adjusting control margins within software used to optimise the LNG train increased the flowrate of mixed refrigerant and has resulted in more efficient LNG production.	0.1%
Helper motor power upgrades	2019 - upgrades to helper motors increased the available power from the mixed refrigerant, propane refrigerant, and end flash gas compressors.	0.8%
Increased K1430 performance	Adjusting a set point to maximise the number of online fin fans at the propane refrigerant compressor has increased cooling and resulted in more efficient LNG production.	0.1%
Removal of HMR and rundown flow constraints	Production previously constrained during cool conditions has now been unlocked by extending the limits of LNG rundown flow and heavy mixed refrigerant flow.	0.1%

8. Greenhouse Gas Abatement Program Provisions

This section describes the management based provisions of this Pluto GGAP to achieve the requirements of MS 757 condition 12-1.

Table 11 – Management-based Provisions

	Management Action	Target	Monitoring	Reporting
Condition Number	Component of MS 757 Condition 12			
12-1 (1)	Calculation of the "greenhouse gas" emissions associated with the proposal as advised by the Environmental Protection Authority.	Estimate GHG emissions related to the project. Refer to Section 3.	Ongoing with annual reporting as outlined in section 9.	Annual reporting of emissions is performed in accordance with the NGER Act. A summary of reservoir emissions, non-reservoir emissions and associated Pluto LNG Facility emissions intensity will be provided in the subsequent Pluto Annual Compliance Report as described in section 9.
12-1 (2)	Specific measures to minimise the total net "greenhouse gas" emissions and/or the "greenhouse gas" emissions per unit of product associated with the proposal using a combination of "no regrets" and "beyond no regrets" measures ⁽¹⁾ .	Quantify and document specific measures to minimise the total net greenhouse gas emissions with the project. Refer to Section 5 and 6.	Ongoing with five yearly reporting.	Specific measures implemented to minimise GHG emissions over the previous 5 years will be included in the subsequent Pluto GGAP revision and summary report as described in section 9.
12-1 (3)	The implementation and ongoing review of "greenhouse gas" offset strategies with such offsets to remain in place for the life of the proposal.	Implementation of this program.	Ongoing with five yearly reporting.	Retirement of all Eligible Offset Units in relation to the Pluto LNG Facility will occur on a minimum five yearly basis, as aligned with the revision period of the Pluto GGAP. Summary of purchased and retired Eligible Offset Units over the previous 5 years will be included in the subsequent Pluto GGAP and summary report. As described in section 9.

	Management Action	Target	Monitoring	Reporting
Condition Number	Component of MS 757 Condition 12			
12-1 (4)	Estimation of the "greenhouse gas" efficiency of the project (per unit of product and/or other agreed performance indicators) and comparison with the efficiencies of other comparable projects producing a similar product, both within Australia and overseas.	Benchmarking against comparable projects. Refer to Section 4.2.	No ongoing monitoring requirement.	No ongoing reporting requirement.
12-1 (5)	Implementation of thermal efficiency design and operating goals consistent with the Australian Greenhouse Office Technical Efficiency Guidelines in design and operational management.	Implementation of thermal efficiency design and operating goals. Refer to Section 5.	No ongoing monitoring requirement.	No ongoing reporting requirement.
12-1 (6)	Actions for the monitoring, regular auditing and annual reporting of "greenhouse gas" emissions and emission reduction strategies.	Direct GHG emissions (e.g. fuel, flare, fugitive and venting emissions) from operations will be measured and reported in accordance with the NGER Act.	Ongoing with annual reporting.	Annual reporting of emissions is performed in accordance with the NGER Act and section 9 of this Pluto GGAP.
12-1 (7)	A target set by the Proponent for the progressive reduction of total net "greenhouse gas" emissions and/ or "greenhouse gas": emissions per unit of product and as a percentage of total emissions over time, and annual reporting of progress made in achieving this target. Consideration should be given to the use of renewable energy sources such as solar, wind or hydro power.	2025 interim target of 5% GHG intensity improvement, as outlined in section 2.1.4. 2030 interim target of 30% emissions reduction from 4.1 Mtpa CO ₂ e, as outlined in section 2.1.4. Subsequent interim targets established in future revisions of this Pluto GGAP.	Ongoing with annual reporting of emissions and GHG intensity. Review of interim and long-term emission reduction targets on a five yearly interval (minimum).	Annual reporting of emissions is performed in accordance with the NGER Act and section 9 of this Pluto GGAP. A summary of progress against the interim targets will be provided in the Annual Compliance Report.

	Management Action	Target	Monitoring	Reporting
Condition Number	Component of MS 757 Condition 12			
12-1 (8)	A program to achieve reduction in "greenhouse gas" emissions, consistent with the target referred to in (7) above;	Optimisation and opportunity management processes are implemented to identify and prioritise enhancement opportunities including improving energy efficiency, reducing fuel use and intensity and minimising flaring.	Ongoing.	Identified opportunities tracked in the relevant optimisation reference plan. A summary of delivered opportunities will be presented in the five yearly summary report as described in section 9.
12-1 (9)	Entry, whether on a project-specific basis, company-wide arrangement or within an industrial grouping, as appropriate, into the Commonwealth government's "Greenhouse Challenge" voluntary cooperative agreement program.	Woodside was a member of the Green	thouse Challenge up until the cessation o	f the Program in July 2009.
12-1 (10)	Review of practices and available technology	Optimisation and opportunity management processes are implemented to identify and prioritise enhancement opportunities including improving energy efficiency, reducing fuel use and intensity and minimising flaring.	Ongoing.	Identified opportunities tracked in the relevant optimisation reference plan. A summary of delivered opportunities will be presented in the five yearly summary report as described in section 9.

	Management Action	Target	Monitoring	Reporting
Condition Number	Component of MS 757 Condition 12			
12-1 (11)	"Continuous improvement approach" so that advance in technology and potential operational improvements of plant performance are adopted.	Optimisation and opportunity management processes are implemented to identify and prioritise enhancement opportunities including improving energy efficiency, reducing fuel use and intensity and minimising flaring.	Ongoing.	Identified opportunities tracked in the relevant optimisation reference plan. A summary of delivered opportunities will be presented in the five yearly summary report as described in section 9.

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9. Monitoring and Reporting

Monitoring, auditing and reporting of emissions from the Pluto LNG Facility is carried out in accordance with the requirements of the *National Greenhouse and Energy Reporting Act 2007* (NGERS Act), or as otherwise required by law.

Compliance with the actions and requirements of this GGAP are reported through the Pluto Annual Compliance Reporting (Pluto ACR) requirements specified in MS 757, Condition 4-1. The Pluto ACR will provide a summary of the most recent NGERs reporting period, including:

- Total emissions (reservoir and non-reservoir emissions)
- Total emission intensity and non-reservoir emission intensity
- Volume of gas processed at the facility

Periodic public reporting will also be undertaken as part of the five-yearly revisions of this GGAP, which will be supported with a summary report detailing information from the preceding five years, including:

- The quantity of total GHG emissions and net GHG emissions from the facility
- The type, quantity, identification or serial number, and date of retirement or cancellation of any authorised offset which have been retired or cancelled and which have been used to calculate net GHG emissions
- GHG emission reduction measures that have been implemented to avoid and reduce GHG emissions
- A graphical comparison of emission reduction commitments with actual emissions for compliance periods
- Performance against benchmarked facilities
- · GHG emissions intensity of the facility
- A statement whether interim targets have been achieved

Pluto ACRs, the approved revision of the Pluto GGAP and supporting summary report will be made publicly available on the Woodside website <u>woodside.com.au.</u>

9.1 Voluntary Reporting

Woodside supports transparent greenhouse reporting and seeks to participate in voluntary reporting schemes that align with business objectives. At the time of writing, Woodside reports greenhouse gas performance as part of the:

- Taskforce for Climate-related Financial Disclosure (TCFD), through our Annual Report available at woodside.com.au
- Dow Jones Sustainability Index
- International Association of Oil and Gas Producers Environmental Indicators
- Annual Sustainable Development Report, available at woodside.com.au

10. Stakeholder Consultation

This document has been made publicly available on the Woodside website since 2011 in accordance with MS757 Condition 12-4.

Consultation activities conducted for Pluto Train 2 builds upon Woodside's extensive and ongoing stakeholder consultation for its petroleum activities in the region. Woodside has been a part of

the regional north-west WA communities for more than 30 years and during this time it has promoted and encouraged stakeholder input and feedback.

Woodside has undertaken consultation with a number of regulators and other stakeholders specific to Pluto Train 2. A summary of relevant consultation is shown in Appendix F.

Further stakeholder consultation associated with Pluto Train 2 will be ongoing and undertaken as required.

11. Review and Update

This GGAP will be reviewed and updated every five years as a minimum. Revision 3 (this document) fulfils the requirement of an update to the GGAP prior to the construction and commissioning of an additional LNG train at Pluto LNG Facility and is developed for the five-year period from 2021 to 2025.

Where either the five yearly review cycle or additional infrastructure review cycle is triggered, a revised Pluto GGAP will be submitted to the DWER in accordance with MS 757.

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Appendix A: Woodside's Climate Change Policy

WOODSIDE POLICY



Climate Change Policy

OBJECTIVE

Woodside recognises the scientific consensus on climate change and the challenge of providing safe, clean, affordable and reliable energy whilst reducing emissions. Woodside is committed to being part of the solution.

We believe hydrocarbons will continue to be vital in meeting the world's energy needs and that the benefits of natural gas, in particular, will see it play an increasingly important role globally both in the energy mix and in reducing greenhouse gas emissions.

PRINCIPLES

Woodside will achieve the objective by:

- Promoting natural gas in the global energy mix as a means to reduce greenhouse gas emissions, support renewable energy and improve local air quality
- Promoting and pursuing a culture of energy efficiency and improved resource use in designs and operations
- Supporting our host countries in their endeavours to set emission reduction targets in accordance with internationally accepted science and to achieve these targets using efficient and stable policies
- Supporting lowest cost abatement through global carbon pricing
- Evaluating the resilience of our portfolio and investment decisions to potential changes in global climate policy
- Setting and publishing targets to encourage innovation and drive reductions in our carbon footprint and energy use
- Pursuing greenhouse gas emission reduction technologies with our peers and scientific institutions

APPLICABILITY

Responsibility for the application of this policy rests with all Woodside employees, contractors and joint venturers engaged in activities under Woodside operational control. Woodside managers are also responsible for promotion of this policy in non-operated joint ventures.

This policy will be reviewed regularly and updated as required.

Reviewed in December 2019

Appendix B: Woodside ASX Announcement

Woodside released the following ASX Announcement and supporting presentation material concerning its corporate targets for direct carbon emission reductions on 11 November 2020.

ASX Announcement

Wednesday, 11 November 2020

ASX: WPL OTC: WOPEY



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INVESTOR BRIEFING DAY 2020

Woodside has risen to the challenges of 2020, delivering exceptional operating performance and demonstrating prudent financial decision-making to protect value for shareholders, CEO Peter Coleman said at the company's annual Investor Briefing Day.

"Despite the constraints imposed by the pandemic, throughout this year our teams have met the highest standards of safety, reliability and production, allowing us to narrow our full-year output guidance to 99 to 101 million barrels of oil equivalent.

"We've made excellent progress at Sangomar Field Development Phase 1 offshore Senegal and expect to complete our acquisition of Cairn's interest in the joint venture before year-end. Sangomar is an attractive, de-risked asset and, as previously flagged, we are looking to sell down our equity to the right partner at the right price over the course of 2021.

"The deferral in March this year of final investment decisions on Scarborough and Pluto Train 2 allowed the project teams to seize the day, extracting additional value by potentially increasing the offshore capacity and optimising the development schedule.

"Scarborough is a globally competitive development which has the potential to be a game-changer for Woodside, producing net cash flow of around \$35 billion over its field life.

"We estimate the targeted 20% increase in Scarborough's upstream capacity can be achieved at a very modest capex, with virtually no cost impact on the downstream.

"In terms of both contractor availability and the external LNG market, we expect the timing to be right for final investment decisions on Scarborough and Pluto Train 2 in the second half of 2021. The Scarborough Joint Venture is aligned on this schedule, which would put us on track for first LNG in 2026.

"We also remain aligned with our joint venture partners on the development of Browse as backfill to the North West Shelf. Work is continuing to move Browse towards the front-end engineering design phase, with a final investment decision targeted from 2023.

"This year we are also setting new targets for direct carbon emission reductions in support of our goal to be net zero by 2050. We are now aiming for reductions of 15% by 2025 and 30% by 2030 in our net equity Scope 1 and 2 emissions compared with the 2016-2020 period.

"We plan to achieve these targets using a range of levers: designing out emissions in new and existing facilities, potentially including carbon capture and storage; limiting emissions through efficient operations; and using high-quality offsets.

"Woodside is a resilient hydrocarbon business and our investments in technology and offsets, along with our early-mover activities in hydrogen, build on our existing capabilities in LNG and position us to provide value through the energy transition.

"We continue to provide enhanced transparency into our business, and have recently published a review of the policy positions of industry associations we belong to for alignment with our climate change policy positions," he said.

To access the live webcast of the Investor Briefing Day, please follow the link at www.woodside.com.au. The webcast will commence at 0930 AWST/1230 AEDT.

A copy of Woodside's Investor Briefing Day 2020 slide pack is attached.

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This ASX announcement was approved and authorised for release by Woodside's Disclosure Committee.

CLIMATE

Clear targets for decarbonising our production

Delivered	Near-	Medium-	Long-
Delivered	term	term	term
Over 2.7Mt			
CO ₂ -e offset	15% below	30% below	Net zero
or avoided	baseline by	baseline by	aspiration for
to date ¹	2025 ^{2,3}	2030 ³	2050 or soone

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Woodside operated. Avoided through energy efficiencies, voluntary offsets acquired and surrendered and ACCUs generated and retained/surrendered.
 Equivalent to previously disclosed equity reservoir offset target.
 Baseline is set as the average equity Scope 1 and 2 emissions over 2016-2020 and may be adjusted (up or down) for potential equity changes in producing or sanctioned assets, with an FID prior to 2021.

APPENDIX C: Greenhouse Emission Estimate Methodology

For the purposes of estimating GHG emissions the following key documents were utilised as guidance material:

- NGER Method-2 has been used for estimating GHG emissions
- National Greenhouse and Energy Reporting Scheme Measurement Technical Guidelines for the estimation of emissions by facilities in Australia
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Table 2.6.
- U.S. EPA AP-42, Compilation of Air Emissions Factors, Volume I: Stationary Point and Area Sources
- Historical operational GHG emissions and engineering design GHG emissions estimates within the GGAP have been calculated using emission factors based on Global Warming Potentials (GWPs) for converting non-carbon dioxide gases into carbon dioxide equivalent values to align with the National Greenhouse and Energy Reporting (Measurement) Determination 2008 at the time of calculation (prior to 1 July 2020) and the Australian Government's implementation of the Paris Agreement.

Emission estimates were based upon functions of the following key data inputs:

- Stream characteristics and compositions
- Stream flow rates
- Molar flow rates and mass
- · Heat mass balance
- Production profile for the life of the LNG plant
- Fuel consumption profile for the life of the LNG plant

Where technical data was not sufficient to predict greenhouse emissions, emission factors were used

APPENDIX D: Factors Influencing LNG Plant Energy Intensity

The below points detail factors that influence LNG plant energy intensity.

- The proportion of CO₂, N₂ and other inert gases that naturally occur in the reservoir gases that supply the LNG plant. Feed gas composition has a potential impact on the efficiency of the liquification process. Inert gas contained in the feed gas stream (from the reservoir) must largely be removed prior to, or during, the liquefaction process. CO₂ and other inerts removed are usually vented to atmosphere. Venting of CO₂ directly influences the greenhouse footprint of an LNG plant and the removal process also requires energy, thus impacting the energy efficiency of the process and thus the greenhouse footprint. This can only be reduced through geo-sequestration, however the process of geo-sequestration itself has an impact on energy efficiency and is not cost effective.
- The ambient temperature of the surrounding environment at the location of the LNG plant (lower temperatures enhance air cooling of LNG and turbine efficiency). The cooling efficiency of the refrigeration loop is improved when cooling takes place in areas of lower ambient temperatures as compared to warmer temperatures. Ambient temperatures also influence the efficiency of gas turbine operation (compressor efficiency is favoured by cooler temperatures). Therefore, cooler temperatures result in greater efficiency and less greenhouse emissions for the same power output compared to a gas turbine operating in a warmer climate.
- The technology, process and policy factors that influence greenhouse intensity include choice of liquefaction technology, power generation – choice of turbines and configuration, waste heat recovery, the use of air or water for processing cooling, acid gas removal process and market-based offsets.
- The level of integration with other gas processing facilities such as domestic supply, LPG
 extraction and condensate production. A larger site typically has a smoother electrical
 demand and allow greater flexibility for power generation plant. Integration with other
 facilities including domestic gas supply, LPG extraction and condensate production, also
 provides greater opportunity for waste heat utilisation thereby increasing overall energy
 efficiency of the facility.
- The capacity for local electricity generation infrastructure to supply electrical power. This enables generation plant to be operated more efficiently as the grid can be used for sparing capacity and larger scale power generation has greater capacity for efficiency for the same price per megawatt output. In a reporting sense, greenhouse emissions from the consumption of grid power is included and are reportable as Scope 2 emissions, however the greenhouse emissions from the production of electricity for the grid is accounted for by the supplier (refer to National Greenhouse and Energy Reporting Guidelines).

Appendix E: Offsets Projects and Retired Units

Table E1 – Woodside's Registered Carbon Farming Offset Projects in Australia

Project Proponent	Project Name	Reference	Methodology
Woodside Burrup	Woodside Pluto Carbon Offset	ERF101451	Reforestation and
Pty. Ltd.	Project - Stage 4		Afforestation - 1.2
Woodside Burrup	Woodside Pluto Carbon Offset	EOP100818	Reforestation and
Pty. Ltd.	Project - Stage 3		Afforestation - 1.2
Woodside Burrup	Woodside Pluto Carbon Offset	EOP100654	Reforestation and
Pty. Ltd.	Project - Stage 2		Afforestation - 1.2
Woodside Burrup	Woodside Pluto Carbon Offset	EOP100203	Reforestation and
Pty. Ltd.	Project - Stage 1		Afforestation - 1.2
Woodside Energy Ltd.	Woodside Native Reforestation Project – Phase 2	ERF158901	Reforestation by Environmental or Mallee Plantings - FullCAM
Woodside Energy Ltd.	Woodside Native Reforestation Project - Phase 1	ERF143796	Reforestation by Environmental or Mallee Plantings - FullCAM

Table E2 - Retired Eligible Offset Units, Wind Power Project in Tirupur District, India

Serial Numbers	Units	Project ID
7147-374253826-374339160-VCU-050-APX-IN-1-	85,335	VCS1163
1163-08032014-31122014-0		1001100
7328-385123084-385137110-VCU-050-APX-IN-1- 1163-08032014-31122014-0	14,027	VCS1163
7152-374925555-375007826-VCU-050-APX-IN-1- 1163-01012015-31122015-0	82,272	VCS1163
7150-374531763-374539495-VCU-050-APX-IN-1- 1163-01012016-31122016-0	7,733	VCS1163
7150-374539496-374561710-VCU-050-APX-IN-1- 1163-01012016-31122016-0	22,215	VCS1163
6884-356383015-356386527-VCU-050-APX-IN-1- 1163-01012017-31122017-0	3,513	VCS1163
6884-356386528-356403545-VCU-050-APX-IN-1- 1163-01012017-31122017-0	17,018	VCS1163
7149-374354161-374428249-VCU-050-APX-IN-1- 1163-01012018-07012019-0	74,089	VCS1163

Table E3 – Retired Eligible Offset Units, Tamil Nadu Spinning Mills Association Wind Power Project, India

Serial Numbers	Units	Project ID
221,767,266 - 223,072,717	1,305,452	CER-IN-4760
223,072,718 - 223,151,063	78,346	CER-IN-4760

Appendix F: Stakeholder Consultation

Date	Activity	Stakeholders Involved	Summary of Engagement
9 March 2018	Karratha	Attended by City of Karratha,	Regular quarterly meeting, provided an
	Community	LandCorp and Pilbara	overview of the Burrup Hub including
	Liaison Group	Development	Pluto Train 2.
26 April 2018	Quarterly Karratha heritage meeting	Ngarluma Aboriginal Corporation, Yindjibarndi Aboriginal Corporation, Yaburara and Coastal Mardudhnuera Aboriginal Corporation,	Regular quarterly meeting with Traditional Owner groups. Provided an update on approvals pathways and schedule for Burrup Hub projects including Pluto Train 2.
8 June 2018	Karratha Community Liaison Group	Wong-Goo-Tt-Oo Attended by City of Karratha, Karratha Districts Chamber of Commerce and Industry, Pilbara Ports Authority, Department of Environment, Ngarluma Yindjibarndi Foundation Ltd, Department of Local Government, Arts, Culture and Sport and WA Police.	Regular quarterly meeting, provided an update on the Burrup Hub, including Pluto Train 2.
6 September 2018	Quarterly Karratha heritage meeting	Ngarluma Aboriginal Corporation, Yindjibarndi Aboriginal Corporation, Yaburara and Coastal Mardudhnuera Aboriginal Corporation, Wong-Goo-Tt-Oo	Regular quarterly meeting with Traditional Owner groups. Provided an update on approvals pathways and schedule for Burrup Hub projects including Pluto Train 2.
6 September 2018	Burrup Hub	Environmental Protection	Provided an overview of the Burrup
7 September 2018	meeting Karratha Community Liaison Group	Authority Attended by City of Karratha, WA Police, Karratha Community Association, Department of Education, Horizon Power, Pilbara Ports Authority, Pilbara Development Commission, Department of Sport and Recreation, Karratha Districts Chamber of Commerce and Industry	Hub, including Pluto Train 2. Provided an overview of the Burrup Hub activities and key environmental approvals required, including Pluto Train 2.
11 September 2018	Burrup Hub update meeting including Pluto Train 2	Murujuga Aboriginal Corporation	Provided an update on the Burrup Hub, including Pluto Train 2, approvals pathways, schedule and proposed engagement approach.
11 September 2018	Burrup Hub meeting including Pluto Train 2	Environmental Protection Authority	Provided an update on the Burrup Hub, including Pluto Train 2. Discussion on environmental approvals and schedule.
19 September 2018	Burrup Hub update meeting including Pluto Train 2	Office of the WA Minister for Environment	Provided an update on the Burrup Hub, including Pluto Train 2, approvals pathways and schedule.
19 September 2018	Burrup Hub update meeting	Office of the WA Premier and Minister for State Development	Provided an update on the Burrup Hub, including Pluto Train 2.

Date	Activity	Stakeholders Involved	Summary of Engagement
	including Pluto Train 2		
20 September 2018	Burrup Hub update meeting including Pluto Train 2	Department of Industry, Innovation and Science	Provided an update on the Burrup Hub, including Pluto Train 2.
20 September 2018	Burrup Hub update meeting including Pluto Train 2	Office of the Shadow Minister for Environment	Provided an update on the Burrup Hub, including Pluto Train 2.
27 September 2018	Burrup Hub update meeting including Pluto Train 2	Office of the Leader of the Opposition, Public Sector Management, State Development, Jobs and Trade and Federal-State Relations	Provided an update on the Burrup Hub, including Pluto Train 2.
28 September 2018	Burrup Hub update meeting Pluto Train 2	Department of the Environment and Energy	Provided an update on approvals for Burrup Hub projects, including Pluto Train 2.
28 September 2018	Burrup Hub update meeting including Pluto Train 2	Office of the Federal Minister for Resources and Northern Australia	Provided an update on approvals for Burrup Hub projects, including Pluto Train 2.
2 October 2018	Burrup Hub update meeting including Pluto Train 2	Office of the WA Treasurer, Minister for Finance, Energy and Aboriginal Affairs	Provided an update on the Burrup Hub, including Pluto Train 2.
2 October 2018	Burrup Hub update meeting including Pluto Train 2	Office of the WA Minister for Transport, Planning and Lands	Provided an update on the Burrup Hub, including Pluto Train 2.
10 October 2018	Burrup Hub update meeting including Train 2	Environmental Protection Authority	Provided an update on the Burrup Hub, including Pluto Train 2, approvals pathway and schedule.
12 October 2018	Burrup Hub update meeting including Pluto Train 2	Shadow Minister for Northern Australia	Provide update on approvals for Burrup Hub projects including Pluto Train 2.
12 October 2018	Burrup Hub update meeting including Pluto Train 2	Senator for WA Patrick Dodson	Provided update on approvals for Burrup Hub projects including Pluto Train 2.
12 October 2018	Burrup Hub update meeting including Pluto Train 2	Kimberley Land Council	Provided update on approvals for Burrup Hub projects including Pluto Train 2.
18 October 2018	Burrup Hub update meeting	Member for Kimberley Josie Farrer	Provide update on approvals pathways and schedule for Burrup Hub projects including Pluto Train 2.

Date	Activity	Stakeholders Involved	Summary of Engagement
	including Pluto Train 2		
19 October 2018	Burrup Hub update meeting including Pluto Train 2	Office of the WA Minister for Regional Development	Provided update on approvals for Burrup Hub projects including Pluto Train 2.
19 October 2018	Burrup Hub update meeting including Pluto Train 2	Environmental Protection Authority	Discuss Burrup Hub environmental approvals, including Pluto Train 2.
1 November 2018	Site tour	Environmental Protection Authority	Pluto LNG site tour.
9 November 2018	Burrup Hub update meeting including Pluto Train 2	Ngarluma Yindjibarndi Foundation	Provided update on approvals for Burrup Hub projects including Pluto Train 2.
14 November 2018	Burrup Hub meeting including Pluto Train 2	Friends of Australian Rock Art	Burrup Hub environmental approvals briefing including Pluto Train 2.
19 November 2018	Burrup Hub update meeting including Pluto Train 2	Chamber of Minerals and Energy of Western Australia Inc	Provided update on approvals for Burrup Hub projects including Pluto Train 2.
21 November 2018	Regular Burrup Hub meeting	Environmental Protection Authority	Update on Burrup Hub projects, including Pluto Train 2 environmental approvals/management plans.
23 November 2018	Burrup Hub update meeting including Pluto Train 2	Member of the Legislative Council - Mining and Pastoral Region	Provide update on approvals for Burrup Hub projects including Pluto Train 2.
29 November 2018	Quarterly Karratha heritage meeting	Ngarluma Aboriginal Corporation, Yindjibarndi Aboriginal Corporation, Yaburara and Coastal Mardudhnuera Aboriginal Corporation, Wong-Goo-Tt-Oo	Regular quarterly meeting with Traditional Owner groups. Provided an update on approvals pathways and schedule for Burrup Hub projects including Pluto Train 2.
29 November 2018	Burrup Hub meeting including Pluto Train 2	Environmental Protection Authority	Discussion on Burrup Hub environmental approvals, including Pluto Train 2.
9 January 2019	Burrup Hub meeting including Pluto Train 2	Murujuga Aboriginal Corporation	Ongoing engagement and progress update on Woodside's Burrup Hub, including Pluto Train 2.
22 January 2019	Burrup Hub Update Meeting including Pluto Train 2	Department of the Environment and Energy	Provide update on approvals for Burrup Hub projects (including Pluto Train 2) and referral of activities.
22 January 2019	Burrup Hub meeting including Pluto Train 2	Department of Industry, Innovation and Science	Provided an update on the Burrup Hub projects, including Pluto Train 2, schedule and environmental approvals.

Date	Activity	Stakeholders Involved	Summary of Engagement
24 January 2019	Burrup Hub meeting including Pluto Train 2	Murujuga Aboriginal Corporation	Meeting to discuss ongoing engagement on the Burrup Hub, including Pluto Train 2.
29 January 2019	Burrup Hub meeting Pluto Train 2	Department of Primary Industries and Regional Development	Provided an overview of the Scarborough and Pluto Train 2 projects, including environmental approvals and stakeholder engagement moving forward.
5 February 2019	Burrup Hub meeting including Pluto Train 2	Department of Transport	Provided an overview of the Burrup Hub, including Pluto Train 2.
7 February 2019	Burrup Hub meeting including Pluto Train 2	City of Karratha	Provided an update on Burrup Hub projects, including Pluto Train 2, and environmental approvals.
21 February 2019	Meeting to discuss and cultural heritage	Department of the Environment and Energy	Discussion on environmental approvals and cultural heritage matters.
8 March 2019	Karratha Community Liaison Group	Attended by Ngarluma Yindjibarndi Foundation Ltd, City of Karratha, Landcorp, WA Police, Dept Local Govt and Communities, Pilbara Ports, Karratha Districts Chamber of Commerce and Industry, Regional Development Australia, Pilbara Development Commission and Dampier Community Association	Provided a briefing on the environmental approvals process and highlighted opportunities for public comment.
12 March 2019	Quarterly meeting	City of Karratha	Discussion on Burrup Hub activities including Pluto Train 2.
13 March 2019	Burrup Hub meeting including Pluto Train 2	Environmental Protection Authority	Monthly update of Burrup Hub developments provided, including Pluto Train 2.
18 March 2019	Burrup Hub meeting including Pluto Train 2	Department of the Environment and Energy	Discussion on Burrup Hub matters, including assessment levels.
19 March 2019	Burrup Hub meeting including Pluto Train 2	Department of the Environment and Energy	Discussion on Burrup Hub approvals, Heritage Management and Conservation Agreement.
9 April 2019	Burrup Hub social impact assessment	Pilbara Port Authority	Discussion on preliminary social impacts and opportunities assessment for the Burrup Hub, including Pluto Train 2.
9 April 2019	Burrup Hub social impact assessment	City of Karratha	Discussion on preliminary social impacts and opportunities assessment for the Burrup Hub, including Pluto Train 2.
24 April 2019	Regular Burrup Hub meeting	Environmental Protection Authority	Discussion on Burrup Hub matters, including Pluto Train 2 environmental approvals.
7 May 2019	Burrup Hub meeting	Murujuga Aboriginal Corporation	Discussion on Burrup Hub matters, including and Pluto Train 2, approach

Date	Activity	Stakeholders Involved	Summary of Engagement
			to emissions, engagement and environmental approvals.
13 May 2019	Burrup Hub full council briefing	City of Karratha councillors	Provided an update on Woodside's Burrup Hub developments, including Pluto Train 2.
15 – 16 May 2019	Burrup Hub public information sessions in Karratha and Roebourne	Various Karratha and Roebourne community members	Five public information sessions in Karratha and Roebourne, providing opportunities for local community stakeholders to engage with the project team, learn more about Scarborough and Pluto Train 2 and provide their general feedback. Of the 50 attendees, two comments were received on environmental approvals which were closed out during the relevant session. Public information sessions were advertised through the local community newspaper the Pilbara News, social media, community noticeboards and targeted communications.
6 June 2019	Quarterly Karratha heritage meeting	Attended by Ngarluma Aboriginal Corporation, Yaburara and Coastal Mardudhnuera Aboriginal Corporation and Wong-Goo- Tt-Oo Aboriginal Corporation	Update on Scarborough project and environmental approvals, including proposed Pluto Train 2 Works Approval submissions.
7 June 2019	Karratha Community Liaison Group meeting	Attended by City of Karratha; Pilbara Development Commission; LandCorp; Regional Development Australia; and Pilbara Port Authority	Update on Scarborough project including environmental approvals, including proposed Pluto Train 2 Works Approval submissions.
12 June 2019	Pluto Train 2 meeting	Department of Water and Environmental Regulation	Overview of Pluto Train 2 and discussion on licencing and works approvals.
25 June 2019	Quarterly meeting	WA Minister for Environment	Update on Burrup Hub projects, including Pluto Train 2 environmental approvals/management plans.
4 July 2019	Scarborough meeting	University of Western Australia	Overview of the proposed Scarborough to Pluto Train 2 development.
9 July 2019	Regular Burrup Hub meeting	Environmental Protection Authority	Update on Burrup Hub projects, including Pluto Train 2 environmental approvals/management plans.
25 July 2019	Regular Burrup Hub meeting	Environmental Protection Authority	Update on Burrup Hub projects, including Pluto Train 2 environmental approvals/management plans.
6 August 2019	Scarborough project meeting	Member for the Pilbara	Overview of the Burrup Hub, including Pluto Train 2.
16 August 2019	Regular Burrup Hub meeting	Environmental Protection Authority	Update on Burrup Hub projects, including Pluto Train 2 environmental approvals/management plans.
19 August 2019	Site visit	Department of Environment and Energy, Environmental Protection Authority and Murujuga Aboriginal Corporation	Tour of Woodside-operated facilities on the Burrup Peninsula.
6 September 2019	Karratha Community	Attended by the City of Karratha, Horizon Power,	Regular quarterly community meeting. Provided an update on Burrup Hub

Date	Activity	Stakeholders Involved	Summary of Engagement
	Liaison Group meeting	Karratha Health Network, Pilbara Port Authority, Pilbara Development Commission, WA Police, Landcorp, Yara Pilbara Fertiliser, Karratha District	developments and environmental approvals, including Pluto Train 2.
		Chamber of Commerce and Industry and Bechtel	
9 September 2019	Regular Burrup Hub meeting	Environmental Protection Authority	Update on Burrup Hub projects, including Pluto Train 2 environmental approvals/management plans.
26 September 2019	Regular Burrup Hub meeting	Environmental Protection Authority	Update on Burrup Hub projects, including Pluto Train 2 environmental approvals/management plans.
3 October 2019	Quarterly meeting	WA Minister for Environment and Environmental Protection Authority	Update on Burrup Hub projects, including Pluto Train 2 environmental approvals/management plans.
16 December 2019	Quarterly meeting	WA Minister for Environment	Update on Burrup Hub projects, including Pluto Train 2 environmental approvals/management plans.
21 January 2020	Pluto Train 2 and GGAP meeting	Environmental Protection Authority	Discuss Environmental Approval status and EPA responses to the Pluto Greenhouse Gas Abatement Program
17 April 2020	Burrup Hub meeting	Environmental Protection Authority	Update on Burrup Hub projects, including Pluto Train 2 and the Pluto Greenhouse Gas Abatement Program.
22 April 2020	Quarterly meeting	WA Minister for Environment	Update on Burrup Hub projects and discussion on relevant regulatory approvals including Pluto Greenhouse Gas Abatement Program.
23 April 2020	Burrup Hub meeting	Office of WA Premier and Minister for State Development	Update on Burrup Hub projects and discussion on relevant regulatory approvals including Pluto Greenhouse Gas Abatement Program.
11 June 2020	Quarterly Karratha Heritage meeting	Attended by representatives of Wong-Goo-TT-OO, Ngarluma Aboriginal Corporation and Yaburara and Coastal Mardudhenera Aboriginal Corporation	Regular quarterly heritage meeting. Provided an update on Burrup Hub developments and environmental approvals, including Pluto Train 2 and the Pluto Greenhouse Gas Abatement Program.
12 June 2020	Karratha Community Liaison Group meeting	Attended by representatives of Horizon Power, Pilbara Port Authority, Yara Fertilisers, WA Police, Pilbara Development Commission, Dampier Community Association, Karratha and District Chamber of Commerce and Industry and Regional Development Australia	Regular quarterly community meeting. Provided an update on Burrup Hub developments and environmental approvals, including Pluto Train 2 and the Pluto Greenhouse Gas Abatement Program.
16 June 2020	Pluto GGAP meeting	Office of the WA Premier and Minister for State Development	Briefing on amendments to the Pluto Greenhouse Gas Abatement Program.
11 August 2020	Pluto GGAP meeting	Department of Agriculture, Water and Environment and Environmental Protection Authority	Clarification of EPA comments on the Pluto Greenhouse Gas Abatement Plan and proposed response.
25 September 2020	Corporate meeting	Office of the WA Premier and Minister for State Development	Discussion on Woodside's corporate approach to greenhouse gas management.

Date	Activity	Stakeholders Involved	Summary of Engagement
13 October 2020	Corporate meeting	WA Minister for Mines and Petroleum	Discussion on Woodside's corporate approach to greenhouse gas management.
19 October 2020	Corporate meeting	Department of Water and Environmental Regulation and Environmental Protection Authority	Discussion on Woodside's corporate approach to greenhouse gas management.
21 October 2020	Burrup Hub Meeting	WA Minister for Environment	Discussion on relevant regulatory approvals, climate policy and greenhouse gas management.
26 October 2020	Corporate meeting	Department of Jobs, Tourism, Science and Innovation	Discussion on Woodside's corporate approach to greenhouse gas management.
5 November 2020	Pluto GGAP meeting	Department of Water and Environmental Regulation and Environmental Protection Authority	Briefing on proposed amendments to Pluto Greenhouse Gas Abatement Plan prior to re-submission.
27 November 2020	Corporate meeting	Conservation Council WA	Briefing and discussion on Woodside's corporate approach to greenhouse gas management.
1 December 2020	Corporate and Pluto GGAP meeting	Office of WA Minister for Environment, Department of Water and Environmental Regulation and Environmental Protection Authority	Briefing on Woodside corporate approach and targets for emissions reduction and proposed amendments to the Pluto Greenhouse Gas Abatement Plan.
3 December 2020	Corporate meeting	Office of WA Premier and Minister for State Development	Briefing on Woodside's corporate approach to greenhouse gas management.
4 December 2020	Corporate meeting	Office of WA Minister for Mines and Petroleum	Briefing on Woodside's corporate approach to greenhouse gas management.
12 January 2021	Pluto GGAP meeting	Department of Water and Environmental Regulation and Environmental Protection Authority	Discussion on amendments to the Pluto Greenhouse Gas Abatement Plan.
4 March 2021	Pluto GGAP meeting	Department of Water and Environmental Regulation and Environmental Protection Authority	Discussion on amendments to the Pluto Greenhouse Gas Abatement Plan.

Pluto LNG Facility Greenhouse Gas Abatement Program

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