CSBP Ammonia Expansion Project

Greenhouse Gas Management Plan

Rev.	Change Details	Author	Reviewer	Approver	Date
0	Issued for referral	M Alibhai	D Thompson	D Zacher	11 Nov 2022

Table of Contents

1. Summary

CSBP Limited (CSBP) is a major manufacturer and supplier of industrial chemicals, fertilisers and related services to the mining, mineral processing, industrial and agricultural sectors. CSBP, its subsidiaries and joint ventures, form the Chemicals and Fertilisers business units of Wesfarmers Chemicals, Energy & Fertilisers (WesCEF).

WesCEF's vision is to grow a portfolio of leading sustainable businesses. Core to this vision is its interim greenhouse gas[1] emissions reduction target of 30% by 2030 and net zero emissions by 2050. Furthermore, WesCEF requires all new projects to have a clear and credible path to net zero emissions by 2050.

CSBP produces ammonia at its facilities located within the Kwinana Industrial Area. The ammonia is used as a feedstock in downstream chemical and fertiliser production at the site, as well as being sold to third parties, primarily those involved in nickel processing. CSBP's production meets half of its demand, with the balance being imported in shipments via the Kwinana Bulk Jetty. CSBP is proposing to construct and operate a new 300,000 tonnes per annum (tpa) ammonia plant (Ammonia Plant 3 "AP3") on-site to displace its imports (the Proposal). The Proposal is being assessed by the Western Australian Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986* (EP Act). CSBP expects implementation of the Proposal to be subject to the conditions of a Ministerial Statement for AP3, including conditions with respect to greenhouse gas (GHG) emissions.

As such, this Greenhouse Gas Management Plan (GHGMP) has been prepared to support the assessment, approval and implementation of the Proposal under Part IV of the EP Act. The content and structure of this GHGMP has been prepared in accordance with the EPA's *How to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans: Instructions* (EPA 2021) and the EPA's *Environmental Factor Guideline – Greenhouse Gas Emissions* (EPA 2020)[2]. A summary of the key aspects of this GHGMP is provided in Table 1-1.

Table 1-1: Key aspects

Proposal name	Construction and operation of a new 300,000 tpa ammonia plant in the Kwinana Industrial Area
Proponent name	CSBP Limited
Ministerial Statement number/s (if applicable)	Not applicable (Proposal currently under assessment by the EPA)
Purpose of the GHGMP	To support the assessment, approval and implementation of the Proposal under Part IV of the EP Act, and to provide management and monitoring actions for GHG emissions resulting from the construction and operation of the Proposal that are aligned with WesCEF's Net Zero Roadmap, WesCEF's Climate Change Policy and the Western Australian Government Climate Policy.
Key environmental factor/s, outcome/s and/or objective/s	**EPA preliminary key environmental factor**: GHG emissions **EPA factor objective**: To reduce net GHG emissions in order to minimise the risk of environmental harm associated with climate change. **GHGMP outcome**: To avoid, reduce or mitigate 100% of Scope 1 GHG emissions from the operation of AP3 by 2050.
Condition clauses (if applicable)	Not applicable (Proposal currently under assessment by the EPA)

[1] Greenhouse gases are gases in the atmosphere such as carbon dioxide, methane and nitrous oxide that can absorb infrared radiation, trapping heat in the atmosphere

[2] A revised version of the GHG factor guideline was released as a draft for public review in July 2022.

Key components of the GHGMP	The long-term environmental outcome of this GHGMP is: • to avoid, reduce or mitigate 100% of Scope 1 GHG emissions from the operation of AP3 by 2050. This long-term outcome is supported by the following four interim progressive environmental outcomes: • to avoid, reduce or mitigate 30% of Scope 1 GHG emissions from the operation of AP3 by 2030 • to avoid, reduce or mitigate 40% of Scope 1 GHG emissions from the operation of AP3 by 2035 • to avoid, reduce or mitigate 70% of Scope 1 GHG emissions from the operation of AP3 by 2040 • to avoid, reduce or mitigate 80% of Scope 1 GHG emissions from the operation of AP3 by 2045. These environmental outcomes, and their associated indicators, response actions, monitoring and reporting requirements, are defined in table format within Section 5.
Proposed construction date	H2 2024 (subject to approvals)
EMP required pre-construction?	Yes ☐ No ☒

2. Context and Scope

2.1 Proposal

CSBP proposes constructing and operating a new 300,000 tpa ammonia plant within the existing CSBP site. The Proposal includes the construction and operation of an ammonia plant, integrated with hydrogen production from a 10MW electrolyser and supported with the following ancillary equipment and activities:

- water purification units,
- new pipe racks, pipe bridges and tie-ins to facilitate utility, raw material and finished product delivery,
- internal modifications to the existing central control room, and
- temporary construction facilities, including roads, laydown area, site offices, crib and ablution facilities.

The construction of AP3 will require additional site activities:

- relocation of the existing ammonium nitrate bag storage shelters, and
- demolition and relocation of the existing maintenance workshop, amenities and offices.

The construction and operation of AP3 will substantially reduce CSBP's reliance on ammonia imports. Ammonia is used internally (for the manufacture of ammonium nitrate, fertiliser, and sodium cyanide) and externally (being sold to customers such as nickel refineries). CSBP currently operates a single train ammonia plant (Ammonia Plant 2 "AP2") which manufactures half of the ammonia requirement. Internal and external ammonia demand is approximately 525,000 tpa, of which approximately 260,000 tpa is currently imported. The imported ammonia is delivered to CSBP in bulk shipments via the Kwinana Bulk Jetty.

CSBP commenced manufacturing and handling ammonia at Kwinana in 1967 following the construction of its Ammonia Plant 1 (AP1), which was decommissioned in the year 2000 after commissioning AP2.

Ammonia and its derivatives are not only critical inputs to the Western Australian mining and agriculture sectors but are also a future carrier of energy to support wider industry. By reducing reliance on imported ammonia through onshoring of manufacturing, CSBP is better placed to continue its reliable ammonia supply within the value chain. Further still, replacing imported ammonia with lower carbon manufactured ammonia enables critical mining, agriculture and mineral processing industries to have access to lower carbon intensity products.

2.2 Greenhouse gas emissions

Ammonia is generally produced using natural gas, steam and air. First, sulphur is removed from natural gas. Then, in a process known as primary reforming, the natural gas and steam are reacted at approximately 1,000 °C to produce carbon monoxide and hydrogen. The secondary reforming process sees the process gas mixed with air to produce more carbon monoxide and hydrogen gas. The air also provides nitrogen for the subsequent synthesis of ammonia. The carbon monoxide damages the downstream ammonia synthesis catalyst and has to be removed in subsequent steps. This is done by converting the carbon monoxide to carbon dioxide and then removing it from the process by absorbing it in an amine solution. Any remaining carbon oxides are converted to methane in a process known as methanation. Hydrogen and nitrogen are reacted over a catalyst to form ammonia. The ammonia gas is refrigerated and converted to liquid for storage.

The ammonia production process involves:

- the use of natural gas (predominantly methane), steam (water) and air (oxygen and nitrogen) as inputs, and
- the generation of ammonia and carbon dioxide as outputs (refer to Figure 2-1).

As such, the GHG carbon dioxide is produced during the ammonia manufacturing process when the carbon monoxide is converted to carbon dioxide. It is also created when methane is combusted to provide heat to the primary reforming process and create steam using the steam boiler. This GHGMP addresses all carbon dioxide formed in the reforming and heat generation processes.

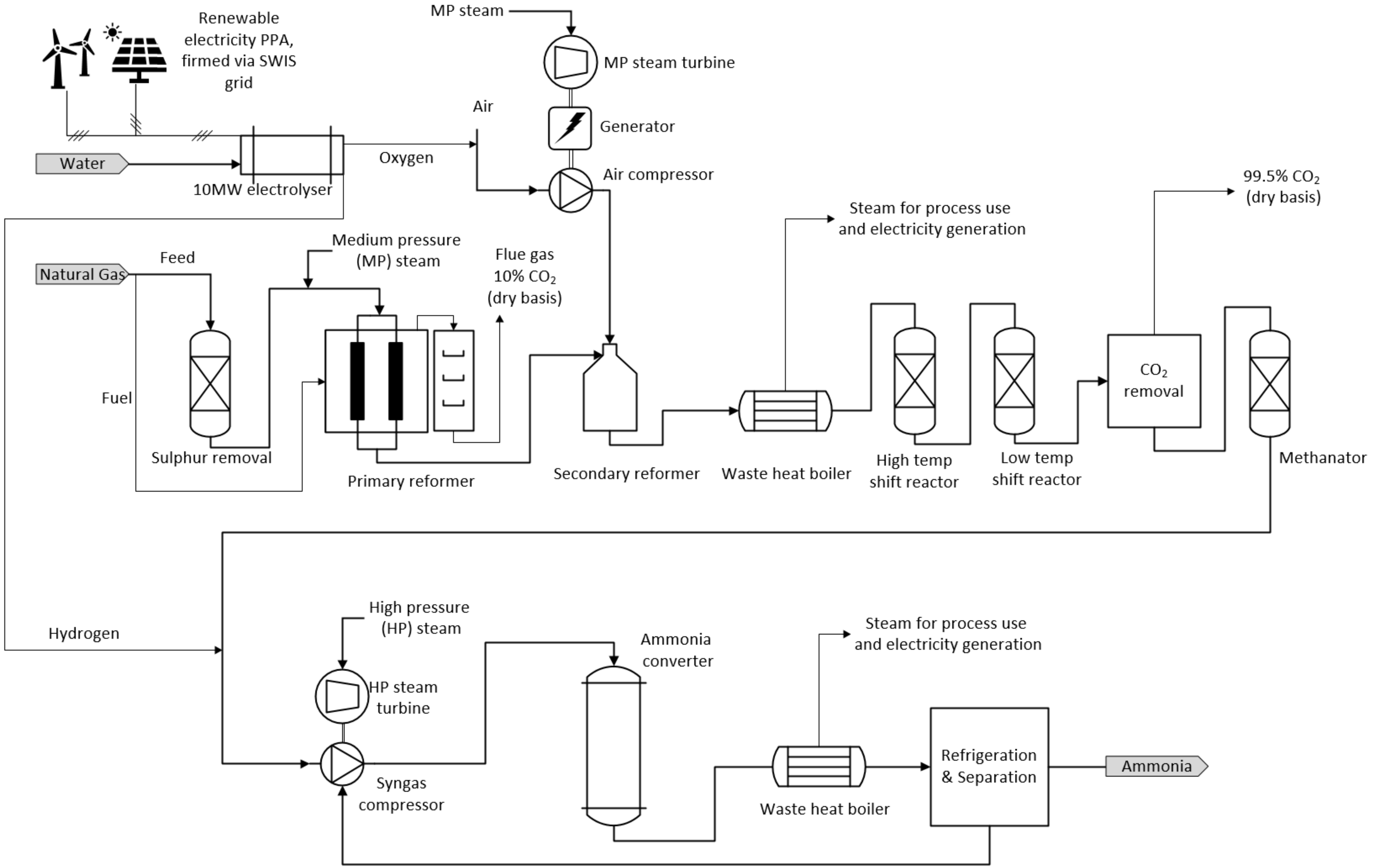

Figure 2-1: CSBP's AP3 process

2.3 Key environmental factor

AP3 is expected to have a nominal ammonia production capacity of 300,000 tpa. Based on this output, the Scope 1 GHG emissions from the operation of the plant have been estimated at 539,003 tpa CO_2 equivalent (CO_2-e). Scope 1 GHG emissions, often referred to as 'direct emissions', are the emissions released to the atmosphere as a direct result of an activity or series of activities at a facility level.

As AP3 will have direct emissions of more than 100,000 tpa CO_2-e, the Proposal is subject to a key environmental impact assessment based on Greenhouse Gas Emissions factor guidelines (EPA 2020). The environmental objective of the EPA's Greenhouse Gas Emissions factor is 'to reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change' (EPA 2020).

An emissions inventory and further detail on the estimated Scope 1, Scope 2 and Scope 3 GHG emissions associated with the Proposal are provided in Section 3.4.

2.4 Condition requirements

Under Section 38 of the EP Act, CSBP has referred the Proposal to the EPA for assessment. As the Proposal has not yet been assessed, there are currently no conditions of a Ministerial Statement related to GHG emissions applicable to the Proposal.

3. Rationale and approach

WesCEF has an interim emissions reduction target of 30% by 2030 and a net zero target by 2050. It also requires projects to be consistent with those targets. Further, additional product volume growth initiatives must lower the emissions intensity of the relevant product when compared with the existing operations.

This GHGMP has been prepared with due consideration of the following:

- WesCEF's Net Zero Roadmap (Appendix A)
- WesCEF's Climate Change Policy (Appendix B)
- Western Australian Climate Policy (DWER 2020)
- Greenhouse Gas Emissions Policy for Major Projects (GoWA 2019)
- Environmental Factor Guideline – Greenhouse Gas Emissions (EPA 2020)
- National Greenhouse and Energy Reporting Act 2007 (NGER Act)
- Greenhouse Gas Protocol: Corporate Accounting and Reporting Standard (WRI and WBCSD 2013a), and
- Greenhouse Gas Protocol: Corporate Value Chain (Scope 3) Accounting and Reporting Standard (WRI and WBCSD 2013b).

In accordance with EPA requirements (EPA 2020), this GHGMP addresses reductions in Scope 1 emissions over the life of the Proposal.

The EPA's mitigation hierarchy has been applied to this GHGMP through the considered adoption of design, technology and/or management measures and proposes reasonable and practicable measures to avoid, reduce and/or mitigate, in particular, Scope 1 GHG emissions (refer to Section 3.6). This GHGMP also includes an adaptive management framework to respond to current uncertainties and future developments in regulatory policies, markets and/or technology (refer to Section 6).

3.1 Benchmarking

In accordance with the WesCEF Climate Change Policy (Appendix B), CSBP will only embark on new projects when the project delivers a lower emissions intensity of the relevant product. An emission intensity (also referred to as carbon intensity) is the emission rate of a given pollutant relative to the intensity of a specific activity, or an industrial production process, for example, grams of carbon dioxide released per megajoule of energy produced, or the ratio of greenhouse gas emissions produced to gross domestic product (GDP).

As an initial comparison, the emission intensity for AP3 was benchmarked against the existing ammonia plant and the Safeguard Mechanism default emission intensity prescribed by the Department of Industry, Science, Energy and Resources (DISER 2021).

The comparison (Table 3-1) shows that the emission intensity for AP3 is expected to be below that of both the existing plant and the default Safeguard Mechanism value.

Table 3-1: Emission intensity (t CO_2-e per t NH_3) for CSBP ammonia plants – Scope 1 and 2

Plant/Default	Steam methane reforming process (Scope 1 only)	Electricity and flare	Total
CSBP AP3	1.741	0.056 (scope 1)[3]	1.797
CSBP existing AP2[4]	1.827	0.119 (scope 1 and 2)	1.946
Safeguard Mechanism default emission intensity for ammonia plants	1.870	Not provided	Not provided

3.1.1 Comparison to plants with similar production capacity

CSBP engaged an independent consulting company, CRU, to determine how the AP3 forecast emission intensity compares with its peers (CRU 2021). While there is a global spread in ammonia production facilities chosen for the benchmarking, CRU has predominantly selected assets operating under similar laws and regulations to those in Australia (such as Europe and the United States). The emission intensities presented are based on CRU's database for the year 2020 and include Scope 1 and Scope 2 emissions.

Nine plants with similar ammonia production capacities to AP3 (ranging from 250,000 tpa to 331,000 tpa) were profiled to understand how AP3 will compare to its peers (refer to Figure 3-1). Of the nine plants selected, seven use natural gas as feedstock (the same feedstock as AP3), one uses heavy fuel oil (HFO), and one uses coal. The two plants using HFO and coal were included to highlight the differences in emissions stemming from the use of different feedstocks. The emission intensity from the coal-based ammonia plant is 1.8 to 2.1 times higher than the natural gas-based plants. Similarly, the plant using HFO as feedstock has an intensity 1.4 to 1.6 times higher than the natural gas-based plants. Of the seven natural gas feedstock plants, including a plant in Australia, the estimated emissions intensity for AP3 will be lower than its peers.

[3] Scope 2 emissions are not applicable for the normal operation of AP3 given any shortfall in electrical power will be met by purchasing renewable energy (refer to Section 3.4.2)

[4] Based on FY2020 data (includes 48,240 tonnes CO_2 exported to external customers)

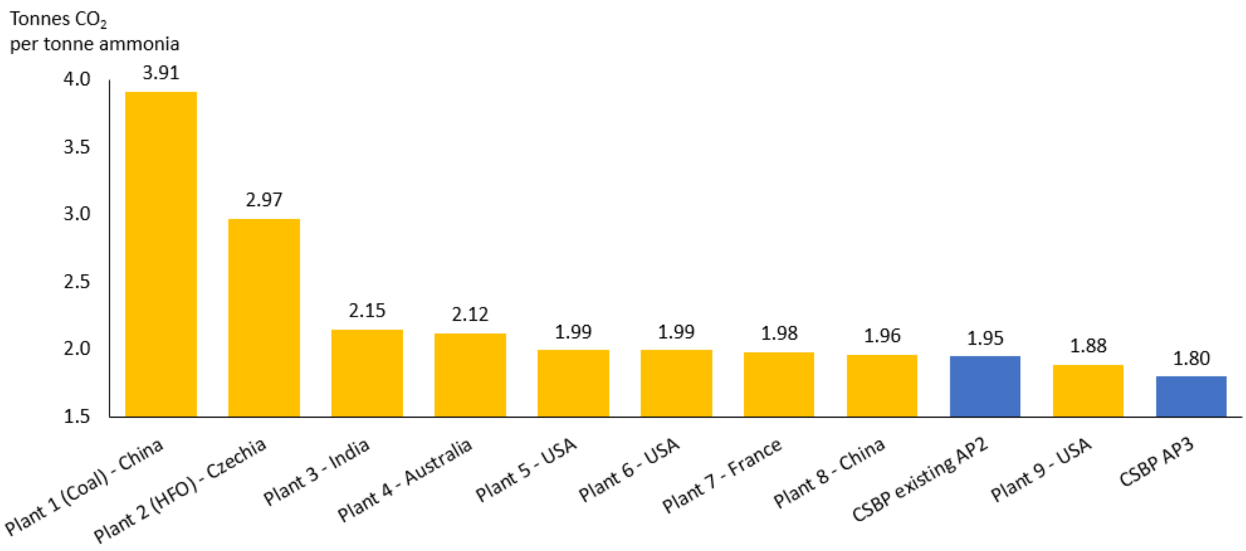

Figure 3-1: Benchmarking from 2020 emission intensities for assets with similar capacities to AP3

3.1.2 Global carbon dioxide emission intensity curve

A global carbon dioxide intensity curve was developed by estimating emissions on a plant-by-plant basis, covering 87% of global ammonia production capacity (refer to Figure 3-2). The model was developed by CRU using primary research and data sourced from its proprietary database. The data includes emissions produced from both the feedstock required for fuel and feed, as well as any additional electricity required in the production process, from either on-site or off-site sources. The emissions estimates do not account for the CO_2 released as part of the raw material hydrocarbon extraction process. To enable a fair comparison to be made between the global plants and AP3, the CO_2-e content per gigajoule (GJ) of natural gas was sourced from the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (51.47 kg CO_2-e per GJ) as country and region-specific feedstock emission factors for natural gas were not available. To ensure a like-for-like comparison of emission intensity, the comparison only considers gross emissions (that is, emissions are not reduced to account for subsequent sale or use of CO_2).

As highlighted in Figure 3-2, the expected emission intensity for CSBP's AP3 is in the lower decile. The ammonia plants with emission intensities below AP3 are predominantly mega-scale facilities that are inherently more efficient. CSBP's AP3 is a small-scale ammonia plant specifically designed to fulfil CSBP's internal and external ammonia requirements without relying on imported ammonia.

By collaborating with external consultants, equipment vendors and the technology licensor, CSBP has successfully enhanced the design of the existing plant to deliver an energy-efficient design for AP3 that will result in lower CO_2 emissions than global plants of similar scale. CSBP commits to continue reducing emissions over the life of the project by applying its continuous improvement ethos.

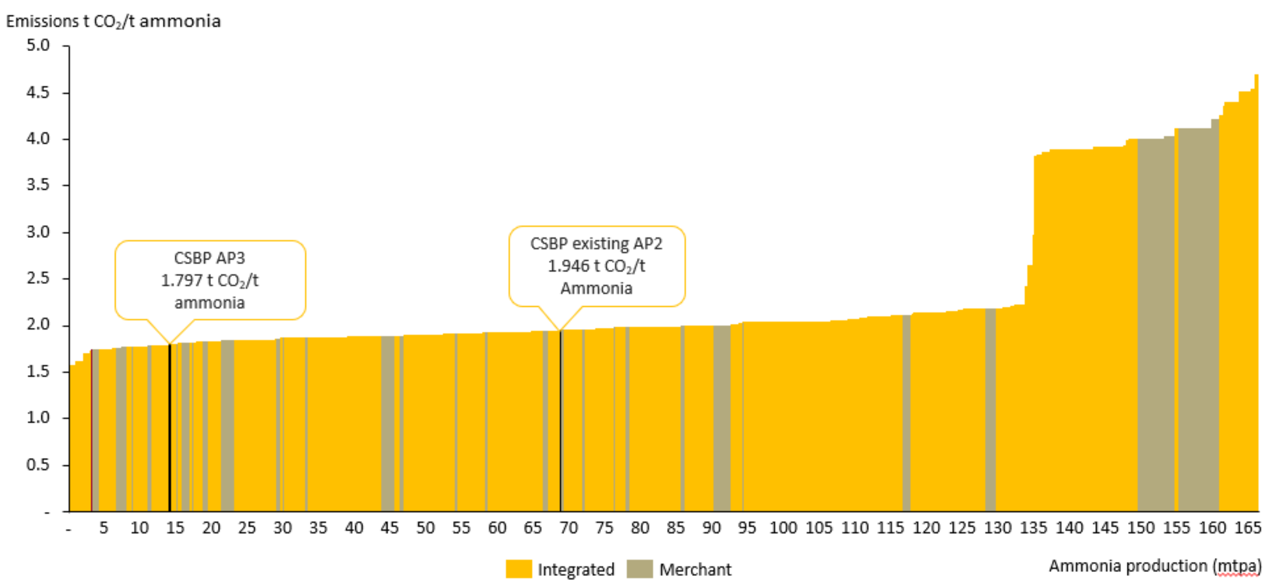

Figure 3-2: AP3 emission intensity position relative to global ammonia producers using 2020 data

The steep change in ammonia production and emission intensity shown in the global carbon curve is due to the different feedstocks used in the production process. The benchmarking study (CRU 2021) identified that ammonia producers using natural gas feedstock have an emission intensity ranging from approximately 1.5 to 2.2 t CO_2-e per tonne of ammonia.

3.1.3 Electricity consumption

Although fuel and feed are the main sources of GHG emissions for ammonia production plants, electricity consumption also plays a role, especially in respect to the partial oxidation process used for heavier hydrocarbon ammonia production. Additional electricity consumption for anthracite and bituminous coal-based plants adds around 1.2 t CO_2-e per tonne of ammonia. The increased electricity consumption can be compounded by a country's national grid, as countries that use significant quantities of heavier hydrocarbons in electricity generation have a higher emission intensity. Emissions from electricity in the partial oxidation process can rapidly increase when grid emission intensity is high. Ammonia production in China provides an example of this dual problem, as coal is the dominant hydrocarbon feedstock for both ammonia and electricity generation. The prevalence of coal as a feedstock means more partial oxidation and, therefore, greater electricity consumption, coupled with a carbon-intensive national electricity grid.

3.2 Environmental outcome

CSBP considers the use of an outcome-based GHGMP appropriate as GHG emissions can be, and are required to be, measured and/or quantified. Monitoring GHG emissions will enable CSBP to determine if interim and long-term environmental outcomes have been met.

In alignment with the WesCEF Net Zero Roadmap, WesCEF Climate Change Policy, the Western Australian Climate Policy (DWER 2020) and the requirements of the EPA's *Environmental Factor Guideline – Greenhouse Gas Emissions* (EPA 2020), the long-term environmental outcome for this GHGMP is 'to avoid, reduce or mitigate 100% of Scope 1 GHG emissions from the operation of AP3 by 1 January 2050' (refer to Table 3-2).

To support this long-term environmental outcome, four interim outcomes have also been defined for this GHGMP.

Table 3-2: Environmental outcomes for GHG emissions at AP3

Type	Environmental outcome
Long-term	To avoid, reduce or mitigate 100% of Scope 1 GHG emissions from the operation of AP3 by 2050
Interim 1	To avoid, reduce or mitigate 30% of Scope 1 GHG emissions from the operation of AP3 by 2030
Interim 2	To avoid, reduce or mitigate 40% of Scope 1 GHG emissions from the operation of AP3 by 2035
Interim 3	To avoid, reduce or mitigate 70% of Scope 1 GHG emissions from the operation of AP3 by 2040
Interim 4	To avoid, reduce or mitigate 80% of Scope 1 GHG emissions from the operation of AP3 by 2045

Figure 3-3 illustrates the annual emissions and cumulative emissions over the project life using interim and long-term Scope 1 GHG emissions reduction targets, and Section 4 outlines the rationale for the target setting.

On the basis that this GHGMP will be reviewed at least every five years (Section 6.3), the interim and long-term environmental outcomes are considered appropriate to meet the existing WesCEF and State Government targets to achieve net zero emissions by 2050. As part of the regular reviews of this GHGMP, CSBP will reassess the environmental outcomes and associated emissions reduction targets to ensure they reflect contemporary environmental guidance and legislation and consider the availability and practicability of implementing any new GHG emissions reduction opportunities.

Furthermore, as part of its annual corporate planning process, CSBP undertakes a detailed and systematic review of the economic viability of existing decarbonisation technologies and also seeks to identify new technologies.

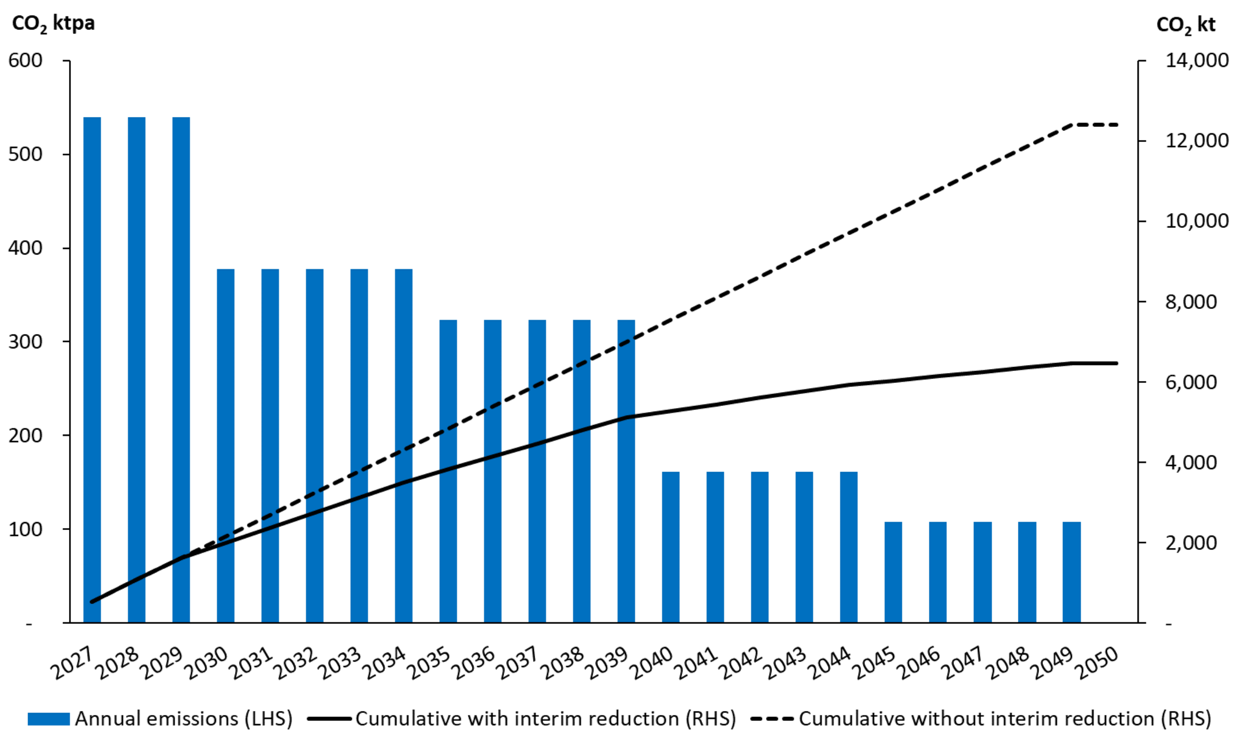

Figure 3-3: Estimated annual (bar) and cumulative (line) Scope 1 emissions from the operation of CSBP's AP3

3.3 Indicator of environmental impact

The GHGMP will be monitored and measured using specific indicators. Indicators are measurable or quantifiable characteristics selected for specific purposes to indicate the health or condition of that part of the environment (EPA 2021). The indicator selected for use in this GHGMP is Scope 1 GHG emissions. Scope 1 GHG emissions were selected for use for several reasons, including that:

- the emissions are a direct result of activities
- the emissions are measurable and/or quantifiable at the scale required (at the individual ammonia plant level)
- the emissions can be calculated and reported using methods from published data by National Greenhouse and Energy Reporting (NGER), and
- Scope 1 emissions are aligned with the target requirements of a GHGMP as described in the EPA's *Environmental Factor Guideline – Greenhouse Gas Emissions* (EPA 2020).

Emissions data is managed internally by CSBP using procedures for data collection and allocation (*NGER Source Data Collection Guide* and the *Natural Gas Allocation – Ammonia Plant Procedure*) and reporting (*CSBP NGER Act – Basis of Preparation Procedure*). The data is stored and managed within databases to enable high-quality and efficient reporting.

3.4 Estimated emissions during operations

CSBP has completed emissions inventory calculations based upon the NGER and GHG Protocol (WRI and WBCSD 2013b) methodologies. The outputs for Scope 1, Scope 2 and Scope 3 GHG emissions are detailed in the following sub-sections.

The factors used for calculating emissions are summarised in Table 3-3. CSBP recognises that GHG emissions estimates may change over the life of AP3 and, as such, these estimates will be reviewed as part of the five-yearly GHGMP review (refer to Section 6.3).

Table 3-3: Factors for calculating emissions

Type	Scope	Value	Units
Natural gas energy content	1 and 3	38,880	kJ per Nm^3
Emission intensity – primary reformer feed gas	1	51.40	kg CO_2-e per GJ
Emission intensity – primary reformer fuel gas	1	51.53	kg CO_2-e per GJ
Emission intensity – steam boiler and pilot flare fuel gas	1	51.53	kg CO_2-e per GJ
South West Interconnected System (SWIS) grid electricity emissions factor	2	0.68	kg CO_2-e per kWh
National Greenhouse Accounts (NGA) Factors for natural gas exploration, production, processing and transmission	3	0.0041	t CO_2-e per GJ
Emission intensity – imported ammonia displaced by AP3 manufactured ammonia	3	1.848	t CO_2-e per t NH_3
Emission intensity – associated with shipping ammonia from Dampier to Kwinana	3	0.03	t CO_2-e per t NH_3

3.4.1 Scope 1

Scope 1 emissions are 'direct emissions' from sources that are owned or controlled by the company.

The Scope 1 GHG emissions from the operation of the AP3 have been estimated at 539,003 tpa CO_2-e (refer Table 3-4). The main sources of Scope 1 GHG emissions are the:

- feed natural gas stream to the primary reformer (contributing approximately 69%)
- fuel natural gas stream to the primary reformer (contributing approximately 28%), and
- steam boiler and pilot flare (contributing approximately 3%)

With AP3 designed to operate for 30 years, the total estimated Scope 1 emissions, with emissions reduction actions, for the life of the Proposal is 6,468,031 t CO_2-e[5].

These estimated annual Scope 1 GHG emissions breakdown used for calculating the emission intensity for AP3 in Table 3-1 is provided below.

Table 3-4: Scope 1 emissions for the operation of AP3

Emission source	Estimated value (tpa)
CO_2 generated from primary reformer feed gas	372,090
CO_2 generated from primary reformer fuel gas	150,114
CO_2 generated from steam boiler	16,470
CO_2 generated from pilot flare	329
Total	**539,003**

3.4.2 Scope 2

Scope 2 emissions are the emissions released into the atmosphere from the use of purchased non-renewable energy. By optimising the process design and purchasing renewable energy to supplement any shortfalls, AP3 does not expect to generate any scope 2 emissions over the life of the Proposal (refer Table 3-5).

During initial plant start-up, an electricity source is required for approximately 72 hours. This initial electricity will be sourced either internally from the CSBP nitric acid and sodium cyanide manufacturing facilities or externally from the SWIS electricity grid.

When the plant is operating, electricity will be generated from the waste heat recovery system. Waste heat, which is a by-product from the ammonia plant, is used to heat water, creating steam that drives a turbine to generate electricity. Additionally, oxygen that is produced from the 10MW electrolyser will be used in the secondary reformer to increase steam generation. This additional steam will be used to generate approximately 0.7MW of additional electricity.

During normal operations, CSBP expects that the electricity generated by AP3 will meet circa 70% of the consumption requirements. This includes providing 4.4MW of carbon-free electricity from the waste heat recovery section to operate the 10MW electrolyser. The remaining 5.6MW will be sourced by either power purchase agreements (PPA) with renewable electricity providers or purchase of Large-scale Generation Certificates (LGCs). The firmed renewable electricity will be supplied through the SWIS electricity grid. CSBP will purchase sufficient annual renewable electricity generation certificates to enable a continuous supply of renewable electricity when the electrolyser is operating.

In the unlikely scenario renewable electricity not becoming available to AP3 and grid electricity is relied upon on a continuous basis, the estimated scope 2 emissions will be 33,735[6] tpa CO_2.

[5] Without interim target reduction measures, while maintaining a net zero by 2050 target, the Scope 1 emissions generated for the life of the Proposal is estimated at 12,397,060 t CO_2-e, or approximately 91.7% more emissions than currently projected.

[6] Using the grid carbon intensity of 0.68 tonne CO_2-e per MWh

Table 3-5: Electrical power and Scope 2 emissions for the operation of AP3

Electrical power generation and consumption	Estimated value (MW)
A – Electrical power generated from process waste heat and oxygen produced from electrolysis	11.8
B – Renewable electricity purchased	5.6
C – Electrical power consumption – 10MW electrolyser	10.0
D – Electrical power consumption – balance of AP3	7.4
Net AP3 non-renewable electrical power and Scope 2 emissions position (A+B-C-D)	**0**

3.4.3 Scope 3

Scope 3 emissions include all other indirect emissions that occur across the value chain and are outside of the company's direct control.

As the ammonia manufactured within AP3 will substitute CSBP's long-term projected import volume of approximately 300,000[7] tpa, no change in downstream Scope 3 emissions are expected, given the manufactured ammonia will not be used for additional downstream activities.

In reviewing Scope 3 emissions associated with upstream activities, as categorised within the GHG Protocol (WRI and WBCSD 2013b), CSBP has identified that 'fuel and energy-related activities' is the only applicable activity. As natural gas will be used as a feedstock and fuel within AP3, the estimated Scope 3 emissions (refer Table 3-6) covers emissions that stem from the exploration, production, processing and transmission of natural gas (upstream and mid-stream emissions).

While not formally part of an emissions inventory for AP3, the reduction in CSBP's overall Scope 3 emissions associated with the ability to produce ammonia from AP3 instead of sourcing from international markets is an important inherent benefit of the Proposal. Estimates of the Scope 3 emissions that CSBP will avoid are shown in Table 3-7. When taking into account this reduction and factoring in the natural gas upstream and mid-stream emissions, an overall net reduction in Scope 3 emissions of 563,210 tpa CO_2-e is expected.

Table 3-6: Scope 3 emissions generated by the operation of the AP3

Emission source	Estimated value (tpa)
Upstream and mid-stream fuel and energy-related activities from manufacturing ammonia	42,961
Total emissions generated	**42,961**

Table 3-7: Scope 3 emissions avoided by CSBP due to the availability of ammonia from the AP3

Emission source	Estimated value (tpa)
Emissions avoided by displacing 300,000 tpa ammonia imports	597,170
Shipping emissions avoided by displacing ammonia imports	9,000
Total import-related emissions avoided	**606,170**
Net Scope 3 emissions avoided after offsetting upstream and mid-stream energy-related activities in Table 3-6	**563,210**

[7] The projected ammonia import volume takes into account increased ammonia requirements from potential debottlenecking of CSBP chemical facilities, and long-term increase in offtake volumes by external customers

3.5 Estimated emissions during construction

The construction phase for CSBP's AP3 will take place over multiple years, with the GHG emissions stemming predominantly from diesel combustion by both stationary and non-stationary equipment. The estimated GHG emissions for the construction phase (Table 3-8) have been calculated using the NGER methodology.

It has been assumed that although electricity from the SWIS may be required, any Scope 2 emissions will simply displace the predicted Scope 1 emissions. Therefore, net Scope 1 and Scope 2 emissions from construction activities will be at or below the estimate provided in Table 3-8 (which has been calculated as Scope 1 only). The factors used for calculating emissions are summarised in Table 3-9.

Although Scope 3 construction emissions can be expected, there is a level of uncertainty as to what the potential emissions volumes may be. As such, Scope 3 emissions are excluded from the values in Table 3-8.

Table 3-8: Construction emissions inventory

Emission type	Estimated value (t CO_2-e)
Scope 1	19,505
Scope 2	0
Total	**19,505**

Table 3-9: Factors for calculating construction emissions

	Value	Unit
Diesel consumption over construction period	7,198	kilolitre (kL)
Diesel energy content	38.6	Gigajoule (GJ) per kL
Emission intensity	70.2	kg CO_2-e per GJ

3.6 Consideration of the mitigation hierarchy

In line with the EPA's mitigation hierarchy – avoid, reduce or mitigate/offset – and its own net zero target, CSBP has identified a range of emissions mitigation opportunities that are either available and/or being considered for AP3. These have been identified through engineering design considerations (refer to Sections 3.6.1 and 3.6.2), by the investigations of WesCEF's Business Development and Climate Opportunities teams (Section 3.6.3) and by identifying offset opportunities (Section 3.6.4). The application of these strategies will be subject to various studies to understand the benefits, feasibility and costs associated with the mitigations.

As detailed in Section 3.4, the primary emissions from the operation of AP3 are associated with the use of natural gas as feed and fuel. Therefore, opportunities for avoidance, reduction or mitigation are focussed on these sources.

The ammonia production process is inherently Scope 1 emissions-intensive, and opportunities to fully avoid and reduce such emissions are currently not financially viable. CSBP is, nevertheless, committed to actively participating in initiatives that will mitigate emissions.

3.6.1 Emissions avoidance

In order to avoid all Scope 1 GHG emissions, a major change to the plant operations would be required – with the supply of feedstock and fuel gas changing from natural gas to hydrogen produced by renewable energy. Renewable hydrogen can be produced by using an electrolyser which splits water into hydrogen and oxygen using renewable electricity.

There is currently no access to large quantities of renewable energy or hydrogen in the vicinity of the proposed AP3. To produce the volume of hydrogen necessary to make 300,000 tpa of ammonia:

- 1,120 MW electrolyser capacity is required, assuming the electrolysers are operated on solar energy at approximately 30% capacity factor[8]. The electricity requirement is equivalent to approximately 28% of the SWIS generation capacity[9]. In terms of land mass, this would require a solar farm land footprint of approximately 3,490 hectares which is 25 times the size of CSBP's Kwinana facility; and
- 750 MW electrolyser capacity is required, assuming the electrolysers are operated on wind energy at approximately 45% capacity factor[10]. The electricity requirement is equivalent to approximately 19% of the SWIS generation capacity. In terms of land mass, this would require a wind farm land footprint of approximately 11,290 hectares which is 82 times the size of CSBP's Kwinana facility.

Further, the cost of constructing and operating a facility capable of providing renewable hydrogen is significantly higher than the cost of methane-based ammonia production, making the project economically unviable at this time. No financially viable options to avoid all Scope 1 GHG emissions have been identified to date.

During the front-end engineering design (FEED) phase of the project, the focus has been on identifying emissions avoidance opportunities through design improvements. A workshop involving representatives from CSBP, the technology licensor and the FEED engineering consultant was held in May 2021 to generate emissions reduction ideas which were shortlisted for implementation. The following actions were determined:

- reduce natural gas used as feedstock in the primary reformer unit of the plant
- reduce natural gas used as fuel in the primary reformer unit of the plant
- improve heat recovery and increase steam production for electricity generation
- substitute gas-fired equipment with more efficient electric-powered equipment, and
- reduce energy losses to the surrounding environment.

The design of AP3 is based on the existing AP2, with the design team leveraging the operational successes of AP2 and incorporating carbon emission reduction measures into the design of AP3. The existing plant has been operational for 20 years, and during that time, it has been optimised. As a result, the design of AP3 is considered robust and technically proven.

A summary of the engineering improvements and design changes selected for implementation are outlined in Table 3-10. These design changes have resulted in AP3 achieving circa 8% lower emissions intensity compared to the existing plant (refer to Section 3.1.1). Further, AP3 falls within the lowest decile when compared globally (refer to Section 3.1.2).

The implementation of these design changes has contributed to a net avoidance in GHG emissions of approximately 59,980 tpa CO_2-e.

[8] Capacity factor equivalent to that of Merredin solar farm WA https://www.pv-magazine-australia.com/2022/01/24/western-australian-solar-farm-leads-way-in-performance-stakes/

[9] Based on 4,000 MW of SWIS non-synchronous generation which is expected to be exceeded by 2024-2025 (AEMO 2021)

[10] Capacity factor achievable by Badgingarra wind farm WA https://www.pv-magazine-australia.com/2022/01/24/western-australian-solar-farm-leads-way-in-performance-stakes/

Table 3-10: Emissions avoided from FEED phase engineering improvements

Improvements and design changes	Description	Estimated CO_{2}-e avoided per annum	Supporting details
Addition of a 10MW electrolyser (Scope 1)	A small-scale electrolyser is included in the design to produce circa 3.5% ammonia using renewable hydrogen. The electrolyser will use high purity water, renewable electricity and electricity from process waste heat to produce hydrogen and oxygen. The hydrogen will displace natural gas feed and fuel to the primary reformer.	~ 17,150 tonnes (Scope 1)	CSBP will install a small-scale electrolyser in the AP3 project to reduce its emissions intensity and gain valuable operational experience to transition to large-scale green hydrogen and ammonia production when it becomes commercially viable. The hydrogen generated by the electrolysis process will be injected upstream of the syngas compressor. The CSBP AP3 project will also use the electrolysis by-product oxygen (which is typically discharged to atmosphere) in a meaningful way to improve the process efficiency and GHG emissions. Oxygen will be injected into the secondary reformer to improve the efficiency of the secondary reformer, generate additional steam, which will generate circa 0.7MW electricity, and reduce the electricity consumption of the syngas compressor by lowering the methane content in the syngas. The electrical power for the electrolyser will be sourced from the waste heat recovery system in the ammonia plant and renewable electricity generation. The renewable electricity will be sourced by establishing PPAs with renewable electricity producers that are connected to the SWIS electricity grid. CSBP will procure sufficient PPAs annually to facilitate continuous operation of the electrolyser.
Optimised process flowsheet for heat recovery, steam generation and electricity generation (Scope 2)	The exothermic reactions in the ammonia process present a unique opportunity to harness large quantities of waste heat for conversion to high and medium-pressure steam. Steam is used to drive turbines for electricity generation to either be consumed within the plant or exported to the internal and external (SWIS) electricity grids. During the FEED phase, a targeted effort was made to improve the design in order to increase electricity generation to minimise the use of SWIS grid electricity. Grid electricity will only be needed for a short period during plant start-ups.	~ 22,600 tonnes (Scope 2)	The first version of the process flowsheet, which was based on the existing plant design, was optimised for heat recovery. The changes include: • The primary reformer waste heat recovery design was modified to accommodate additional steam superheating and boiler feed water coils. These changes will further enhance recovery by harnessing heat from the furnace flue gases before it is discharged to the atmosphere. The flue gas temperature is expected to fall by approximately 15% through the implementation of these changes. The additional steam generated will produce circa 2MW electricity. • Design improvements in the primary and secondary reformer are expected to generate approximately 11% additional high-pressure steam without an increase in natural gas consumption. The additional steam will be used to drive the steam turbine and generate circa 4MW of electricity. Design improvements and the selection of a high-efficiency process air compressor steam turbine, steam condenser and generator will allow the additional steam to be converted to electricity.

Improvements and design changes	Description	Estimated CO_2-e avoided per annum	Supporting details
Primary reformer optimisation (Scope 1)	Significant up-front investment will be made in the installation of additional features in the primary reformer to reduce overall heat flux and natural gas consumption. Best available technology has been applied, including digital and data capabilities, to augment the optimisation of the advanced process control system.	~ 18,400 tonnes (Scope 1)	From the initial (pre-FEED) design through to the FEED phase, extensive work has been carried out to reduce fuel and feed gas consumption within the primary reformer. This supported implementation of the following changes in the design of the primary reformer: • An additional 5% reformer tubes were added to reduce heat flux and natural gas consumption. • Reformer tube length was increased by 8% to reduce heat flux and natural gas consumption. • Reformer tube material was upgraded to allow a higher operating temperature, lower methane slip and improved hydrogen production efficiency. Lower methane slip has the additional benefit of reducing overall electricity consumption in the downstream synthesis gas compressor. • The reformer furnace has six rows of burners which are supplied with three sources of fuel – natural gas, flash gas and off-gases. Flash gases and off-gases are purge streams from downstream unit operations. These streams contain traces of hydrogen. A detailed options analysis was performed to design the most optimal distribution of fuel gas supply to the six rows of burners. The ability to use flash gases and off-gases optimally in the reformer burners will reduce the consumption of natural gas. • As the optimal performance of the reformer tubes is essential for maximising the conversion of natural gas to hydrogen, a proprietary primary reformer furnace manager and over-firing protection system will be implemented. The system is comprised of a series of thermal imaging cameras with data collection and analysis capability to monitor the condition and performance of the reformer tubes. • To reduce GHG emissions, the selection of efficient and best-in-class natural gas burners and a burner management system is a key design feature. A robust burner and management system are expected to enable AP3 to achieve superior and stable operation, lowering the associated natural gas use and GHG emissions.
Location selected to avoid flora disturbance (Scope 1)	The location of the development envelope was selected to avoid the need for vegetation clearing. This was achieved by optimising the use of land within the existing cleared location and	~ 1,150 tonnes (Scope 1)	The vast majority of the area developed for the project is already cleared. The location of the AP3 will be along the northern boundary of CSBP's Kwinana site and cover an area of 3.01 ha of compacted limestone and bituminised ground. By using this space, vegetation clearing will not be required. Given plants and trees facilitate the removal of CO_2 from the atmosphere, avoiding the disturbance of flora when executing the project is a positive outcome.

Improvements and design changes	Description	Estimated CO_2-e avoided per annum	Supporting details
	relocating existing facilities where practical to make way for the new facility.		A further 7.4 ha that was previously cleared will be used to support construction activities and the relocation of existing facilities to make space for the new plant. This area will be used for relocating amenities, temporary construction facilities, laydown areas and car parking. Proximity to natural gas supply from the Dampier to Bunbury Natural Gas Pipeline (DBNGP) is an added benefit of the selected location. CSBP collaborated with the natural gas pipeline operator (AGIG) to find the most suitable tie-in point and service corridor to extend the natural gas pipeline to AP3. The selected route will result in no vegetation being cleared from extending the pipeline.
Electrification (Scope 1 and Scope 2)	The gas-fired start-up heater design was replaced with an electric heater design. While gas-fired heaters are commonly used in ammonia plants, the safety and energy efficiency benefits of electric heaters over gas-fired heaters were selected.	380 tonnes net reduction in GHG emissions (decrease in Scope 1 and increase in Scope 2 emissions)	During the design phase, alternative options to the commonly used gas-fired start-up heaters in ammonia plants were investigated. The heater is used during the start-up phase for heating and activating the ammonia converter catalyst. During normal operation, the heater is turned off. The gas-fired design was replaced with an electric heater installed within the ammonia converter shell. This is a much more efficient design as it eliminates heat and energy losses to the surroundings. CSBP is in close proximity to the South West Interconnected Network (SWIN). It is expected that the mix of electricity generation sources within the SWIS will continue to decarbonise as the proportion of renewable energy generation increases. Over time, the SWIS emissions factor for the consumption of purchased electricity has reduced. As an example, the grid CO_2-e emissions intensity has reduced by 16% from 2009/2010 to 2020/2021 (a reduction from 0.81 kg of CO_2-e per kWh in 2009/2010 to 0.68 kg of CO_2-e per kWh in 2020/2021). Further, the announcement on 14 June 2022 by the WA government (GoWA 2022) to retire coal-fired power plants by 2030, and accelerate the transition to renewable energy generation, is expected to reduce the SWIS grid carbon intensity by 80% by 2030.

Improvements and design changes	Description	Estimated CO_{2}-e avoided per annum	Supporting details
Capitalising on CSBP's shared site assets and existing ammonia plant assets (Scope 1 and Scope 2)	CSBP's shared site is well-established and mature. Locating the AP3 at the shared site will allow the project to leverage existing production processes and equipment, avoiding the need to install additional new equipment which would increase the overall energy consumption	150 tonnes (Scope 1 and 2)	Examples of improvements include: • Eliminating the need for a hydrogen recycle compressor. Hydrogen is injected into the feed gas to remove sulphur from the natural gas. Sulphur, if not removed from the feed gas, can deactivate and reduce the efficiency of the downstream catalysts. During a plant start-up, as sufficient pressure is not available to inject the hydrogen from the downstream process, a standalone motor-driven hydrogen compressor is typically required. An opportunity to eliminate the need for the recycle compressor by installing a hydrogen interconnecting pipeline between the existing ammonia plant and new plant (AP3) was identified. The installation of the new pipeline will enable energy consumption and GHG emissions to be avoided. In addition, it will facilitate hydrogen injection into the feed gas sooner in the start-up timeline, helping maintain catalyst performance and plant energy efficiency. • Providing an interconnecting steam pipeline will facilitate transfer of steam from the existing ammonia plant boiler to AP3 and vice versa. This would effectively provide a duty-standby boiler arrangement and reduce the risk of a full ammonia plant shutdown in the event of a process upset occurring when the boiler in one plant is offline for maintenance. As part of the review, the option to share the boiler between the two ammonia plants was investigated and rejected. While this would eliminate installing a second boiler and avoiding the associated GHG emissions, it poses a risk to operations. Having a dedicated boiler for each plant which operates at minimum rates will safeguard the reliability of each plant and will prevent a full plant shutdown during a process upset occurring at both plants. A process upset simultaneously affecting both plants would typically occur due to external factors such as changes in natural gas supply pressure and composition, large and instant changes in ammonia customer offtake, instability in the electrical grid network or changes in wind conditions affecting draft to the primary reformer. The overall GHG emissions released to atmosphere due to a process upset causing a full plant shutdown are far greater than the emissions generated from keeping both boilers operating at minimum rates.

Improvements and design changes	Description	Estimated CO_2-e avoided per annum	Supporting details
Larger sulphur removal bed (Scope 1)	The size of the feed gas sulphur removal bed has been increased by 30% so the time between plant shutdowns can be extended.	150 tonnes (Scope 1)	Sulphur is removed from the feed gas by reacting it with a zinc oxide catalyst to form zinc sulphide. Once the zinc oxide, housed in the removal bed has been consumed, the plant is shut down so that the bed can be removed and replaced. By increasing the size of this bed, the plant run time between major shutdowns is increased. Full plant start-ups are inefficient events as gas is flared for several days without producing ammonia, while the steam boiler also operates on maximum firing for several days in order to supply steam during the start-up period. Over the long term, fewer start-ups will lower the CO_2 emissions per tonne of ammonia produced. The larger bed will also reduce plant pressure drops and lower the energy consumption by the synthesis gas compressor.

3.6.2 Emissions reduction

An extensive investigation into emissions reduction measures was carried out during the FEED phase of the project to drive improvements in the design, specification, and selection of process equipment, piping and electrical components. This approach will continue into the detailed engineering and procurement phases of the project.

The implementation of these emissions reduction measures has delivered an aggregate GHG reduction of 11,200 tpa. A summary of the improvements are detailed in Table 3-11.

Table 3-11: Emissions reduction measures identified and implemented during FEED

Improvements and design changes	Description	Estimated CO_2-e reduced per annum
Equipment and piping design focussed on reducing pressure drop as far as reasonably practicable	The synthesis gas compressor is a large energy user, consuming 10 MW of power during normal operation. The compressor is driven by a steam turbine, and any measures taken to reduce the compressor's power consumption will deliver a direct saving in steam consumption. The excess steam can subsequently generate more electricity using the 12 MW steam turbine-driven alternator. A targeted effort has been made to maximise the suction pressure to the synthesis gas compressor to reduce the energy consumption and GHG emissions from operating this unit. This will be achieved by increasing up-front investment in modifying the design of upstream processes and equipment to reduce overall pressure losses. Examples of changes that will reduce pressure losses and maximise the compressor suction pressure include: • Flow requirements informed the size of the natural gas supply pipeline from the tie-in point at DBNGP lateral to the inlet of the desulphurisation unit. While the engineering contractor determined an adequate line size, CSBP requested a 30% increase in size to lower pressure losses and increase the overall pressure on the front end of the ammonia plant. • The DBNGP operator (AGIG) designed a replacement natural gas metering and pressure control skid for the Mason Road yard in Kwinana. Following a review of the design, CSBP requested AGIG increase the size of the unit by 25% to reduce pressure losses within the system. • The secondary reformer burner design was changed from the conventional ring design to a proprietary design that substantially reduces pressure drop when process air is injected. Lowering the burner pressure drop at the burner will reduce power consumption by the process air compressor.	1,700 tonnes (Scope 1) 2,100 tonnes (Scope 2)
Reduce energy losses to the surrounding environment	Energy losses from process equipment and pipework have been designed out during the FEED phase as far as reasonably practicable. This has been achieved by adopting the latest and most effective insulation and refractory technology. As an example, insulation in the secondary reformer and waste heat boiler inlet channel will be upgraded from a two-layer design to a higher-cost and superior three-layer design to minimise heat losses to the surroundings. Additionally, opportunities for heat loss reduction will be maximised by specifying the use of the latest technology heat-insulating paint. This paint will be applied in areas where personnel protection is required and where a meshed cage would traditionally be used. While a meshed cage provides personnel safety protection, it does not prevent heat loss to the surroundings.	2,600 tonnes (Scope 1)

Improvements and design changes	Description	Estimated CO_2-e reduced per annum
Selection of low-energy and high-efficiency plant and equipment	The selection of low-energy and high-efficiency equipment was included in design, specifications and material requisitions prepared during the FEED phase. CSBP is committed to exploring opportunities as the project progresses into the detailed design phase. Examples of initiatives implemented include: • A larger steam turbine condenser was selected to allow recovery of the surplus steam without increasing the flow of cooling water to the condenser. Maintaining the cooling water flow will reduce the plant power consumption that would otherwise be needed for the additional pumping capacity. • A higher capacity cooling water tower has been specified which will deliver a lower cooling water temperature to the plant. This will improve overall energy efficiency and reduce electricity consumption within the cooling water pumps and tower fans. • Additional heat exchange capacity was included in the carbon dioxide removal process. The increased capacity will improve cooling in this part of the process and improve CO_2 removal. Efficient removal of CO_2 from the synthesis gas will reduce energy consumption within the synthesis loop, particularly within the synthesis gas compressor. • High and premium efficiency motors for large power-consuming electrical drives have been specified. • Light emitting diode (LED) lighting will be used throughout the plant.	1,200 tonnes (Scope 1) 3,200 tonnes (Scope 2)
Use of efficient packing in the towers	Carbon dioxide is removed from the synthesis gas by circulating an amine solution in packed bed towers. Any CO_2 not removed in the towers is converted to methane in the next process step to prevent damage to the downstream ammonia synthesis catalyst. The packing selected for use in AP3's towers is more efficient than that used within the existing plant and will increase amount of CO_2 removal. This, in turn, will lower the CO_2 slip which is converted back into methane in the downstream methanator. Reduced methane in the synthesis gas increases the efficiency of the synthesis loop, reducing energy consumption. Note: any methane that 'slips' into the synthesis loop is ultimately removed and directed to the fuel system where it is combusted to release CO_2.	400 tonnes (Scope 2)

3.6.3 Emissions mitigation

The WesCEF Climate Opportunities team was established in 2020 to proactively manage the risks to the company associated with climate change. The purpose of the WesCEF climate opportunities program is to identify, research, and develop reasonable and practicable measures to avoid, reduce and/or mitigate GHG emissions within WesCEF's businesses, including CSBP.

The Climate Opportunities team takes a cross-company approach to identify and research projects using a well-developed assessment framework to prioritise projects based on the technology's readiness level, potential scalability of the solution, likely costs of the solution, the carbon lifecycle impacts and other factors.

As a business, WesCEF has developed a roadmap for emissions reductions to meet its stated net zero by 2050 target. In hard-to-abate emissions industries such as ammonia production, production-ready and scalable technologies are not readily available at a cost that is acceptable to businesses and customers. WesCEF recognises this and has adopted a portfolio approach to balance the implementation of current commercially available solutions with early-stage opportunities, which may have the potential to become viable solutions. Many of these opportunities are at laboratory or pilot scale now, and through a partnership with WesCEF, the process can be accelerated and trialled on-site to facilitate early learning.

As part of WesCEF's net zero roadmap, a portfolio of projects has been identified for further investigation. Although these projects are only at the early conceptual or feasibility stage, a summary of the types of projects that may be used in the future to mitigate Scope 1 GHG emissions is detailed in Table 3-12. CSBP will continue to evaluate further opportunities to develop and implement reasonably practicable GHG emissions reduction methods such as these.

Table 3-12: WesCEF's GHG emissions mitigation project portfolio

Option	Description	Project stage
Carbon Capture and Storage (CCS)	WesCEF is investigating on-shore and off-shore geo-sequestration of pure CO_2. WesCEF is partnering with Mitsui E&P Australia (MEPAU) to develop depleted oil and gas reservoir and aquifer CCS options in the Perth Basin. Initial estimates suggest there is more than sufficient reservoir capacity to store the 6,468,031 tonnes of high purity CO_2 that will need to be sequestered over the life of the AP3 project to meet its emissions reduction targets in Table 4-1. WesCEF is also pursuing other on-shore CCS options in the Mid-West and off-shore options in Western Australia and the Northern Territory.	Feasibility
Carbon Capture and Utilisation (CCU)	WesCEF already provides approximately 50,000 tonnes of CO_2 per annum for end use in the food, beverage and metals refining industries and is actively looking at opportunities to grow the potential uses of its CO_2. CCU has three main streams, and WesCEF is evaluating early-stage opportunities across all three: • Mineral carbonation: WesCEF is already active in this area, providing 10,000 tonnes of CO_2 for sequestration into the aluminium refining process and is actively seeking ways to expand mineral carbonation opportunities. • Chemical conversion: WesCEF continues to conduct desktop research on chemical conversion processes and is holding preliminary discussions with companies with potentially viable technology in this area. • Biological conversion: The consumption of CO_2 by organic methods is being explored by WesCEF in conjunction with the patent holder.	Feasibility
Emerging technologies	At present, there is no commercially-viable alternative to producing ammonia at scale than the methods currently available. However, WesCEF acknowledges the tremendous amount of research and development being undertaken to find viable alternatives and is constantly evaluating and supporting research efforts by parties with relevant emerging technologies. WesCEF is co-funding a CRC-P project to scale up an electrolytic method for producing ammonia. This project will scale up from laboratory scale to pilot scale in partnership with Monash University, Jupiter Ionics, Fortescue Future Industries and SJDC Produce. If successful, this could be a viable method for producing emissions-free ammonia.	Conceptual

Option	Description	Project stage
Alternative locations	WesCEF is partnering with APA Group to complete a pre-feasibility study during 2022 to produce green hydrogen south of Perth for transport using APA's Parmelia Gas Pipeline to Kwinana. APA is converting this pipeline to 100% hydrogen as part of their Pathfinder project, partly funded by ARENA. If successful, the green hydrogen can be substituted with natural gas as a feedstock for producing ammonia in AP3. One of the challenges with producing green hydrogen at CSBP's Kwinana site is the lack of land mass for the scale of renewable electricity generation required to produce it. Working with APA to utilise its existing pipeline to transport hydrogen opens up an alternative manufacturing location	Feasibility

3.6.4 Emissions offsets

A carbon offset is the removal of GHG emissions in one location to compensate for GHG emissions of the same volume that are emitted from a different location. Offsetting requires the creation of a tradable unit created under GHG accounting rules and standards.

Following the EPA's mitigation hierarchy, the preference is to manage GHG emissions via avoidance or reduction measures. However, where further reductions are required, carbon offsets can be considered as a mitigation option and may include both Australian and international carbon offsets.

CSBP's preference is to use carbon offsets as a last resort after other practical avoidance, reduction and mitigation options have been exhausted. CSBP is aware of some of the recent concerns regarding the credibility of offsets and if it is required to use offsets will ensure only those of the highest standards are purchased.

Where and when required, CSBP will acquire carbon offsets that meet the contemporary Australian acceptability standards (for example, those that meet offset integrity principles and are based on clear, enforceable and accountable methods and approved by a recognised offset certification body such as Climate Active).

At the time of writing, acceptable carbon offsets include:

- Australian Carbon Credit Units (ACCUs) issued under the Commonwealth *Carbon Credits (Carbon Farming Initiative) Act 2011*, and
- eligible offsets under the *Climate Active Carbon Neutral Standard for Organisations* (Climate Active 2020).

Many offset projects also deliver social, economic or environmental outcomes in addition to emissions reductions (Climate Active 2019)

3.7 Key assumptions and uncertainties

Table 3-13 details the key assumptions and uncertainties that have been identified with respect to the proposed approach to managing GHG emissions at the AP3.

CSBP has proposed environmental outcomes, and associated monitoring and response actions, in consideration of the current state of GHG policies and available technical advice. An adaptive management approach has been proposed that allows for changes to this GHGMP (if required) in the future so that it remains aligned with contemporary policies and scientific advice.

Table 3-13: Assumptions and uncertainties

Type	Description
State and Commonwealth GHG policies	• The Western Australian EPA has begun a review of its GHG guidance (a revised environmental factor guideline has been released for public consultation in 2022). • State and Commonwealth Government policies and targets continue to evolve. • Methods available for calculating baselines under the Safeguard Mechanism have been revised for baselines that will commence after 2020/2021.
Market price carbon emissions	• At present , there is no uniformly applied (i.e. on unit of carbon emitted) market price for carbon emissions (i.e. a carbon levy) within Australia.
Cost and/or viability of new technology	• There is potential for substantial changes in GHG markets and technology, as well as regional energy infrastructure, to occur over the lifetime of the Proposal which may influence the reasonableness or practicability of GHG abatement measures. • The cost of renewables has changed significantly over the last 10 years and further changes are expected. • Multiple new technologies for emissions mitigation are currently in the research and development phase (as described in Table 3-12).

4. Emissions target rationale

The effects of the emissions reduction targets, as defined within the four interim and one long-term environmental outcomes, are shown Table 4-1. The rationale for the selection of the emissions reduction percentages is discussed below.

Table 4-1: GHGMP environmental outcome reduction targets for the operation of AP3

Timing	Estimated Scope 1 emissions (tpa CO_2-e)	Reduction from baseline (%)	Mitigation method
Start of operations to 2029	539,003	-	-
2030 to 2034 (Interim 1)	377,302	30	CCS, CCU and green hydrogen feed
2035 to 2039 (Interim 2)	323,402	40	CCS, CCU and green hydrogen feed
2040 to 2044 (Interim 3)	161,701	70	CCS, CCU and green hydrogen feed
2045 to 2049 (Interim 4)	107,801	80	CCS, CCU and green hydrogen feed + fuel
2050 onwards (Long-Term)	0	100	CCS, CCU and green hydrogen feed + fuel

The CSBP AP3 produces two types of emission streams:

a. **High purity:** CO_2 extracted from the steam methane reforming process that can be compressed, piped and injected into wells (CCS) or used in mineral carbonation, chemical and biological conversion (CCU). This stream contributes approximately 70% of the project's emissions.

b. **Low purity**: a hard to abate stream, typically 10 per cent CO_2 concentration, created by burning natural gas to produce process heat and steam, which contributes approximately 30% of the project's emissions.

The interim targets are structured to mitigate the high purity emissions first, followed by the low purity emissions.

4.1 Interim 1, 2 and 3 targets

As detailed in Section 3.4, approximately 70% of the emissions associated with the operation of AP3 are attributable to the use of natural gas as feedstock (high purity emissions stream). The key driving factor for the selection of the reduction targets in the Interim 1 (30% reduction by 2030), Interim 2 (40% reduction by 2035) and Interim 3 (70% reduction by 2040) environmental outcomes is the adoption of CCS and CCU mitigation options (refer Table 3-12) when they become practicable and commercially viable. By 2040, CSBP plans to have mitigated the full volume of high purity emissions.

CSBP believes that projects such as CCS will allow a significant portion, if not the entire volume, of high-purity CO_2 emissions to be mitigated. Complex projects, such as the development of CCS, require a large amount of planning, financial investment and testing to ensure they are proven, practicable and can be executed successfully. CSBP has reflected this development complexity by setting the interim targets in a way that enables the implementation of a phased CCS solution, starting at pilot-scale and developing progressively to a large-scale solution by 2040.

CSBP is committed to avoiding the generation of high purity emissions over time by substituting natural gas with green hydrogen as feedstock when it becomes commercially viable. The green hydrogen will be sourced through either additional investment in electrolysers and on-site hydrogen generation or pipeline supply from third parties.

4.2 Interim 4 and long-term targets

As detailed in Section 3.4, approximately 30% of the emissions from the project are attributable to the use of natural gas as fuel (low purity emissions stream). As such, the Interim 4 target (80% reduction by 2045) and long-term target (100% reduction by 2050) targets will be achieved by replacing natural gas fuel with green hydrogen.

Alternate options to mitigate the low purity emissions, such as purifying the CO_2 to make it useable for CCS and CCU, could also be applied if they become technically and commercially viable.

These targets represent a realistic reduction timetable and afford CSBP the best opportunity to successfully mitigate the emissions from AP3 while providing the most beneficial environmental outcomes.

CSBP is committed to continually assessing further initiatives and emerging technologies to implement as outline in Table 3-12.

5. Key Components of the GHGMP

CSBP have defined one long-term and four interim environmental outcomes for this GHGMP:

- **Long-term**: To avoid, reduce or mitigate 100% of Scope 1 GHG emissions from the operation of AP3 by 2050.
- **Interim 1**: To avoid, reduce or mitigate 30% of Scope 1 GHG emissions from the operation of AP3 by 2030.
- **Interim 2**: To avoid, reduce or mitigate 40% of Scope 1 GHG emissions from the operation of AP3 by 2035.
- **Interim 3**: To avoid, reduce or mitigate 70% of Scope 1 GHG emissions from the operation of AP3 by 2040.

- **Interim 4**: To avoid, reduce or mitigate 80% of Scope 1 GHG emissions from the operation of AP3 by 2045.

The long-term target for this GHGMP is aligned with the WesCEF Net Zero Roadmap, WesCEF Climate Change Policy's target of 'net zero GHG emissions by 2050' and the Western Australian Climate Policy of 'net zero emissions for Western Australia by 2050' (DWER 2020). The four interim targets, set at five-yearly intervals post 2030, have been developed to show CSBP's commitment to regular incremental reductions in emissions. These also set a realistic reduction timetable that does not compromise research and investment in future mitigation technologies (refer Section 3.6.3).

Table 5-1 to Table 5-5 identify the indicators (selected for monitoring to assess potential environmental impacts), trigger criteria (to provide early warning of potential impacts), threshold criteria (to determine the limit of acceptable impact), response actions, monitoring, and reporting requirements associated with each of the interim and long-term environmental outcomes for this GHGMP.

Table 5-1: Interim 1 environmental outcome

<table>
<tr><td colspan="2">EPA factor</td><td colspan="4">GHG emissions</td></tr>
<tr><td colspan="2">EPA factor objective</td><td colspan="4">To reduce net GHG emissions to minimise the risk of environmental harm associated with climate change</td></tr>
<tr><td colspan="2">GHGMP outcome</td><td colspan="4">Interim 1: To avoid, reduce or mitigate 30% of Scope 1 GHG emissions by 2030 from the operation of AP3</td></tr>
<tr><td colspan="2">Key impacts and risks</td><td colspan="4">Contribution to Western Australia’s GHG emissions, contribution to climate change and the risks to the environment from climate change</td></tr>
<tr><td>ID</td><td>Criteria</td><td>Response action</td><td>Monitoring</td><td>Timing and frequency</td><td>Reporting</td></tr>
<tr><td>#1</td><td>Trigger criterion:
Annual Scope 1 GHG emissions from the operation of AP3 are above the estimated baseline emissions (>539,003 tpa CO_2-e)</td><td>Trigger criterion action:
If annual Scope 1 GHG emissions are above the estimated baseline emissions, then an investigation into the cause of the increased emissions will be undertaken and completed within the subsequent 12-month period, and corrective actions will be implemented</td><td rowspan="2">Indicator:
Scope 1 GHG emissions
Method:
GHG emissions for AP3 will be monitored via internal CSBP and WesCEF databases and meet the annual NGER requirements</td><td rowspan="2">Scope 1 GHG emissions will be monitored annually (based on a financial year schedule) during operations</td><td rowspan="2">Facility emissions data will be reported annually in accordance with NGER requirements

In the event a trigger or threshold criteria is exceeded, this will be documented in the Ministerial Statement Annual Compliance Assessment Report</td></tr>
<tr><td>#2</td><td>Threshold criterion:
Annual Scope 1 GHG emissions from the operation of AP3 are not 30% below the estimated baseline emissions (≤377,302 tpa CO_2-e) by 2030</td><td>Threshold criterion action:
If annual Scope 1 GHG emissions are not 30% below the estimated baseline emissions by 2030, then:
• within the subsequent 6-month period, net emissions for the AP3 facility will be decreased by the purchase of appropriate offsets to reduce Scope 1 emissions to be at or below 70% of the estimated baseline emissions
• net emissions for the facility will be maintained at or below 70% of the estimated baseline emissions (by reductions or offset purchases) until 2034</td></tr>
</table>

Table 5-2: Interim 2 environmental outcome

EPA factor	GHG emissions
EPA factor objective	To reduce net GHG emissions to minimise the risk of environmental harm associated with climate change
GHGMP outcome	**Interim 2:** To avoid, reduce or mitigate 40% of Scope 1 GHG emissions by 2035 from the operation of AP3
Key impacts and risks	Contribution to Western Australia's GHG emissions, contribution to climate change and the risks to the environment from climate change

ID	Criteria	Response action	Monitoring	Timing and frequency	Reporting
#3	**Trigger criterion:** Annual Scope 1 GHG emissions from the operation of AP3 are above the measured emissions from 2030	**Trigger criterion action:** If annual Scope 1 GHG emissions are above the measured emissions from 2030, then an investigation into the cause of the increased emissions will be undertaken and completed within the subsequent 12-month period, and corrective actions will be implemented	**Indicator:** Scope 1 GHG emissions **Method:** GHG emissions for AP3 will be monitored via internal CSBP and WesCEF databases and meet the annual NGER requirements	Scope 1 GHG emissions will be monitored annually (based on a financial year schedule) during operations	Facility emissions data will be reported annually in accordance with NGER requirements In the event a trigger or threshold criteria is exceeded, this will be documented in the Ministerial Statement Annual Compliance Assessment Report
#4	**Threshold criterion:** Annual Scope 1 GHG emissions from the operation of AP3 are not 40% below the estimated baseline emissions (≤323,402 tpa CO_2-e) by 2035	**Threshold criterion action:** If annual Scope 1 GHG emissions are not 40% below the estimated baseline emissions by 2035, then: • within the subsequent 6-month period, net emissions for the AP3 facility will be decreased by the purchase of appropriate offsets to reduce Scope 1 emissions to be at or below 60% of the estimated baseline emissions • net emissions for the facility will be maintained at or below 60% of the estimated baseline emissions (by reductions or offset purchases) until 2039			

Table 5-3: Interim 3 environmental outcome

<table>
<tr><td colspan="2">EPA factor</td><td colspan="4">GHG emissions</td></tr>
<tr><td colspan="2">EPA factor objective</td><td colspan="4">To reduce net GHG emissions to minimise the risk of environmental harm associated with climate change</td></tr>
<tr><td colspan="2">GHGMP outcome</td><td colspan="4">Interim 3: To avoid, reduce or mitigate 70% of Scope 1 GHG emissions by 2040 from the operation of AP3</td></tr>
<tr><td colspan="2">Key impacts and risks</td><td colspan="4">Contribution to Western Australia’s GHG emissions, contribution to climate change and the risks to the environment from climate change</td></tr>
<tr><th>ID</th><th>Criteria</th><th>Response action</th><th>Monitoring</th><th>Timing and frequency</th><th>Reporting</th></tr>
<tr><td>#5</td><td>Trigger criterion:
Annual Scope 1 GHG emissions from the operation of AP3 are above the measured emissions from 2035</td><td>Trigger criterion action:
If annual Scope 1 GHG emissions are above the measured emissions from 2035, then an investigation into the cause of the increased emissions will be undertaken and completed within the subsequent 12-month period, and corrective actions will be implemented</td><td rowspan="2">Indicator:
Scope 1 GHG emissions
Method:
GHG emissions for AP3 will be monitored via internal CSBP and WesCEF databases and meet the annual NGER requirements</td><td rowspan="2">Scope 1 GHG emissions will be monitored annually (based on a financial year schedule) during operations</td><td rowspan="2">Facility emissions data will be reported annually in accordance with NGER requirements

In the event a trigger or threshold criteria is exceeded, this will be documented in the Ministerial Statement Annual Compliance Assessment Report</td></tr>
<tr><td>#6</td><td>Threshold criterion:
Annual Scope 1 GHG emissions from the operation of AP3 are not 70% below the estimated baseline emissions (≤161,701 tpa CO_2-e) by 2040</td><td>Threshold criterion action:
If annual Scope 1 GHG emissions are not 70% below the estimated baseline emissions by 2040, then:
• within the subsequent 6-month period, net emissions for the AP3 facility will be decreased by the purchase of appropriate offsets to reduce Scope 1 emissions to be at or below 30% of the estimated baseline emissions
• net emissions for the facility will be maintained at or below 30% of the estimated baseline emissions (by reductions or offset purchases) until 2044</td></tr>
</table>

Table 5-4: Interim 4 environmental outcome

EPA factor	GHG emissions
EPA factor objective	To reduce net GHG emissions to minimise the risk of environmental harm associated with climate change
GHGMP outcome	**Interim 4:** To avoid, reduce or mitigate 80% of Scope 1 GHG emissions by 2045 from the operation of AP3
Key impacts and risks	Contribution to Western Australia's GHG emissions, contribution to climate change and the risks to the environment from climate change

ID	Criteria	Response action	Monitoring	Timing and frequency	Reporting
#7	**Trigger criterion:** Annual Scope 1 GHG emissions from the operation of AP3 are above the measured emissions from 2040	**Trigger criterion action:** If annual Scope 1 GHG emissions are above the measured emissions from 2040, then an investigation into the cause of the increased emissions will be undertaken and completed within the subsequent 12-month period, and corrective actions will be implemented	**Indicator:** Scope 1 GHG emissions **Method:** GHG emissions for AP3 will be monitored via internal CSBP and WesCEF databases and meet the annual NGER requirements	Scope 1 GHG emissions will be monitored annually (based on a financial year schedule) during operations	Facility emissions data will be reported annually in accordance with NGER requirements In the event a trigger or threshold criteria is exceeded, this will be documented in the Ministerial Statement Annual Compliance Assessment Report
#8	**Threshold criterion:** Annual Scope 1 GHG emissions from the operation of AP3 are not 80% below the estimated baseline emissions (≤107,801 tpa CO_2-e) by 2045	**Threshold criterion action:** If annual Scope 1 GHG emissions are not 80% below the estimated baseline emissions by 2045, then: • within the subsequent 6-month period, net emissions for the AP3 facility will be decreased by the purchase of appropriate offsets to reduce Scope 1 emissions to be at or below 20% of the estimated baseline emissions • net emissions for the facility will be maintained at or below 20% of the estimated baseline emissions (by reductions or offset purchases) until 2049			

Table 5-5: Long-term environmental outcome

EPA factor	GHG emissions
EPA factor objective	To reduce net GHG emissions to minimise the risk of environmental harm associated with climate change
GHGMP outcome	**Long-term:** To avoid, reduce or mitigate 100% of Scope 1 GHG emissions from the operation of AP3 by 2050
Key impacts and risks	Contribution to Western Australia's GHG emissions, contribution to climate change and the risks to the environment from climate change

ID	Criteria	Response action	Monitoring	Timing and frequency	Reporting
#9	**Trigger criterion:** Annual Scope 1 GHG emissions from the operation of AP3 are above the measured emissions from 2045	**Trigger criterion action:** If annual Scope 1 GHG emissions are above the measured emissions from 2045, then an investigation into the cause of the increased emissions will be undertaken and completed within the subsequent 12-month period, and corrective actions will be implemented	**Indicator:** Scope 1 GHG emissions **Method:** GHG emissions from AP3 will be monitored via internal CSBP and WesCEF databases and meet the annual NGER requirements	Scope 1 GHG emissions will be monitored annually (based on a financial year schedule) during operations	Facility emissions data will be reported annually in accordance with NGER requirements In the event a trigger or threshold criteria is exceeded, this will be documented in the Ministerial Statement Annual Compliance Assessment Report
#10	**Threshold criterion:** Annual Scope 1 GHG emissions from the operation of AP3 are not 100% below the estimated baseline emissions (0 tpa CO_2-e) by 2050	**Threshold criterion action:** If annual Scope 1 GHG emissions are not 100% below the estimated baseline emissions by 2050, then: • within the subsequent 6-month period, net emissions for the AP3 facility will be decreased by the purchase of appropriate offsets to reduce Scope 1 emissions to be at or below 0 tpa CO_2-e • net emissions for AP3 will be maintained at 0 tpa CO_2-e (by reductions or offset purchases) for the operational life of the facility			

6. Adaptive Management and Review

6.1 Adaptive management

To foster continuous improvement over the life of AP3, CSBP will apply adaptive management processes to this GHGMP (refer to Figure 6-1). Adaptative management allows progressive learnings from implementing the GHGMP to be incorporated, as required, to ensure that best practices (including consideration of revised regulatory policies, new technologies, increased knowledge of the climate system, and so forth) can be incorporated to improve environmental outcomes.

Routine shutdowns of AP3 (typically every five years during steady-state operations) will provide CSBP with a regular opportunity to implement equipment and/or process changes that have been identified and proven to be viable and practicable emissions reduction options. The frequency of planned shutdowns is considered a practicable frequency to enable sufficient time to plan, design, procure and implement abatement opportunities.

CSBP acknowledges that where a change to the GHGMP (for example, to outcomes, indicators or monitoring requirements) is proposed, formal approval from the regulator is required prior to the changes being implemented.

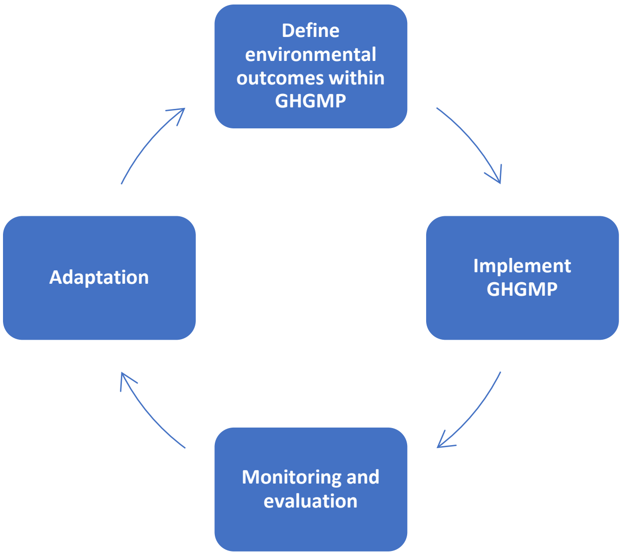

Figure 6-1: Adaptive management cycle

6.2 Periodic reporting

CSBP will provide a performance assessment of CSBP's AP3 operations against the environmental outcomes defined in this GHGMP in accordance with the requirements detailed in the Ministerial Statement for the Proposal.

CSBP also acknowledge that it is required to report GHG emissions under the Commonwealth NGER Act, and that emissions will be subject to a default emission intensity baseline in accordance with the *National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015*.

6.3 GHGMP review

This GHGMP will be formally reviewed by CSBP every five years during the operational life of AP3. In addition, the GHGMP may also be reviewed before the five-year interval on an as-needs basis (for example, if required due to the adaptive management process; refer to Section 6.1).

As part of the GHGMP reviews, CSBP will reassess the environmental outcomes and associated emissions reduction targets to ensure they reflect contemporary environmental guidance and legislation and consider the availability and practicability of implementing any new GHG emissions reduction opportunities.

Based on the outcomes of the review, if a revision to the GHGMP is required, this will be prepared and submitted to the EPA in accordance with Section 8.

7. Stakeholder Consultation

Consistent with the EPA's expectations for this GHGMP, and to align with the principles of environmental impact assessment, CSBP consulted with stakeholders, including but not limited to the Department of Water and Environmental Regulation (DWER), during the development of the EPA Section 38 referral for the Proposal and this GHGMP.

A summary of the stakeholder engagement carried out is provided in the *Section 38 Environmental Referral Supporting Report*.

8. Changes to this GHGMP

All changes to this GHGMP (post-assessment) will be provided separately to compliance reports and will be submitted to the registrar@dwer.wa.gov.au.

CSBP will provide a summary table of changes, which will clearly indicate which section of the document has been updated and the reason/s for the change/s (as per the format shown in Table 8-1). A tracked-change version of the revised GHGMP will also be provided where possible, indicating all minor, non-structural changes to the document.

Table 8-1: GHGMP Summary of changes

<table>
<tr><th>Complexity of changes</th><td colspan="2">Minor revision ☐</td><td colspan="2">Moderate revision ☐</td><td>Major revision ☐</td></tr>
<tr><th>Number of key environmental factors</th><td colspan="2">1 ☐</td><td colspan="2">2-3 ☐</td><td>>3 ☐</td></tr>
<tr><th>Date revision submitted to EPA</th><td colspan="5">DD/MM/YYYY</td></tr>
<tr><th>Proponent's operational requirement timeframe for approval of revision</th><td><1 month ☐</td><td colspan="2"><6 months ☐</td><td>>6 months ☐</td><td>None ☐</td></tr>
<tr><th>Reason for timeframe</th><td colspan="5"></td></tr>
<tr><th>Item</th><th>GHGMP section no.</th><th>GHGMP page no.</th><th>Summary of change</th><th>Item</th><th>GHGMP section no.</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

9. References and Appendices

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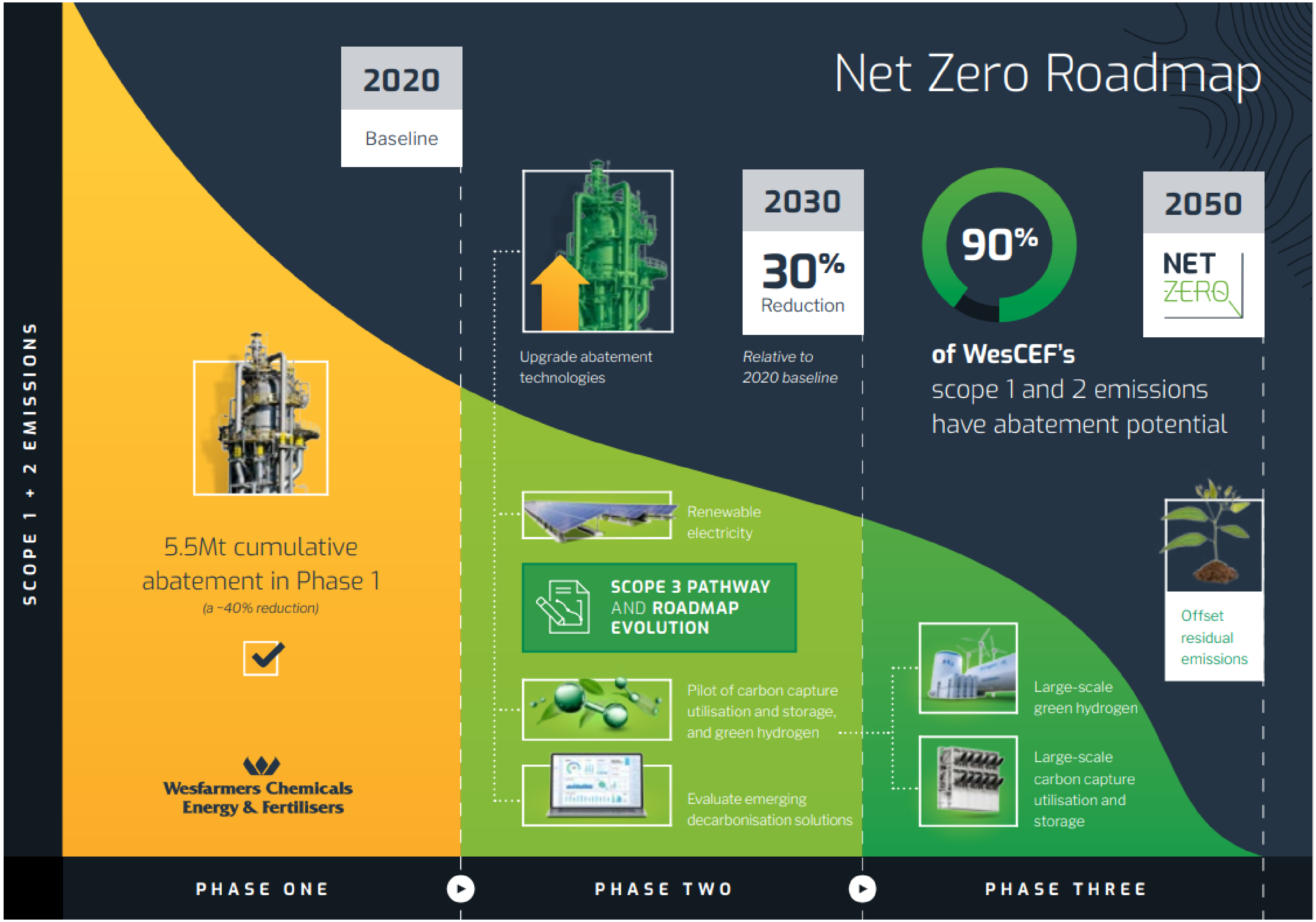
Appendix A: WesCEF Net Zero Roadmap



Appendix B: WesCEF Climate Change Policy

Wesfarmers Chemicals, Energy & Fertilisers

Climate Change Policy

Wesfarmers Chemicals, Energy & Fertilisers (WesCEF) operates chemical, energy and fertiliser businesses that service a range of sectors in both domestic and international markets. WesCEF has a strategy to continually improve environmental performance, and hence strengthen its reputation for environmental management.

We recognise that business has an important role to play in addressing climate change, and its actions can deliver economic, social and environmental benefits over the long term.

WesCEF is committed to proactively managing the risks and realising business opportunities associated with climate change. This policy applies to all businesses controlled by WesCEF.

WesCEF is predominately a Scope 1 emitter due to its manufacturing processes, which are widely recognised as being 'hard to abate'. This means that for some of its processes there are no known technological solutions to abate emissions, and for others the emerging technical solutions are many years away from being viable at scale.

We are committed to addressing these challenges and managing our activities in an environmentally responsible manner. This commitment is reflected in its interim emissions reduction target of 30 per cent by 2030 (relative to an FY2020 baseline) and its target of net zero greenhouse gas emissions by 2050 (for both Scope 1 and Scope 2 emissions).

WesCEF will achieve its targets by:

- Creating a team dedicated to identifying and evaluating emissions reductions opportunities and driving a carbon aware culture.
- Actively seeking and adopting technology improvements as they become available and reasonably practicable to apply.
- Identifying and prioritising opportunities to leverage existing proven technology in renewable energy to reduce carbon emissions from power consumption.
- Identifying opportunities to reduce Scope 1, 2 and 3 emissions through investments in research and technology, alternate energy sources, transport efficiency and process optimisation. We will undertake these investments via collaboration with universities and other research organisations, as well as with our suppliers and customers.
- Exploring opportunities to minimise our consumption and contribution to waste.
- Reviewing our net zero roadmap annually and increasing our level of ambition as new technologies become commercially viable.
- With respect to growth, WesCEF will only undertake major investments if they have a clear and credible path to net zero by 2050, and material product volume growth will only be undertaken if it reduces the emissions intensity of that product over the investment horizon.
- Continuing to enhance our emissions disclosure and transparency to facilitate constructive dialogue with our customers and suppliers regarding emissions reduction opportunities across the value chains in which we operate.

WesCEF will strive to protect the environment and create sustainable businesses for future generations.

Ian Hansen
Managing Director
Wesfarmers Chemicals, Energy & Fertilisers

September 2022