

Appendix I Greenhouse Gas Management Plan



WEST ERREGULLA PROCESSING PLANT AND PIPELINE

Greenhouse Gas Management Plan

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1 Summary

AGI Operations Pty Limited (AGIO) propose to construct and operate a gas processing plant and pipeline near Dongara, Western Australia collectively referred to as the West Erregulla Gas Project (WER). The project includes the processing of gas from upstream wells (third party) and transport of the gas to the Dampier to Bunbury Natural Gas Pipeline (DBNGP). The Proposed Action includes:

- A gas processing facility (WEF), with a nominal design flow capacity of 87 terajoules per day (TJ/d);
- A 16.5 km interconnecting buried gas pipeline between the WEF and the DBNGP tie-in point at MLV 93(WEP);
- A custody transfer metering facility located at the DBNGP tie-in point (WEM);
- A pig launcher station; and
- Supporting infrastructure proposed to include but not limited to accommodation, power generation, flare system, water treatment package, back-up diesel system and communications.

This Greenhouse Gas Management Plan was prepared in accordance with the *Instructions on how to prepare Environmental Protection Act 1986 (WA) Part IV Environmental Management Plans* published by the Western Australian Environment Protection Authority (2020a).

The Greenhouse Gas Management Plan details the measures that are required to manage greenhouse gas emissions from the Proposal as summarised in Table 1-1.

Table 1-1: Greenhouse Gas Management Plan Summary

| Description | Summary |
|--|--|
| Title of Proposal | West Erregulla Gas Processing Plant and Pipeline |
| Proponent name | AGI Operations Pty Limited |
| Assessment number | TBC |
| Location | 30 kilometre south east of Dongara in Western Australia |
| Local Government Area | Shire of Irwin and Shire of Three Springs |
| Purpose of the management plan | This Greenhouse Gas Management Plan identifies management and mitigation measures to ensure impacts from greenhouse gas emissions associated with the Proposal are not greater than predicted. |
| Key environmental factor and objective | Greenhouse Gas Emissions |

| | |
|----------------|---|
| | EPA Objective: To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change (Environment Protection Authority 2020b). |
| Key provisions | <p>Management of the Proposal's contribution to global greenhouse gas concentrations from Proposal related Scope 1 and Scope 2 emissions through the implementation of the following key provisions:</p> <ul style="list-style-type: none">• Application of mitigation hierarchy and ALARP principles especially in design phase to eliminate emissions where possible• Establish an emissions profile based on design and upstream gas characteristics• Develop a baseline within the first two full years of operations (post commissioning) and monitor and report in accordance with NGER Act 2007 and any other approval reporting requirements set out in this plan.• Maintain emissions below baseline for the operating life of the plant• Establish ongoing monitoring, maintenance and reviews that aim to minimise all emissions of natural gas.• Ongoing improvements through the life of the plant to review feasibility of projects to further reduce (avoid, mitigate or offset) emissions. |

2 Context, Scope and Rationale

This Greenhouse Gas (GHG) Management Plan has been prepared by Ecological Australia (ELA) on behalf of the AGI Operations Pty Limited (AGIO) and is intended to support the assessment, approval and implementation of the Proposal under Part IV of the Western Australian *Environmental Protection Act 1986* (EP Act).

1.1 Proposal Description

AGIO proposes to construct and operate a pipeline and gas processing plant (the Proposal) on behalf of a joint venture between Strike Energy and Warrego Energy (the JV) in the mid-west region of Western Australia, approximately 350 kilometres (km) north east of Perth and approximately 30 km south east of Dongara (Figure 2-1). The Proposal will be associated with the development of the West Erregulla Facility (WEF) and the West Erregulla Lateral pipeline, located near Dongara in Western Australia (Figure 2-1).

The Proposal will consist of an approximate 30 metre (m) wide pipeline corridor, as well as a proposed 42 hectare (ha) plant site. The proposed 16.5 km pipeline will deliver gas from the new processing plant to the existing Dampier to Bunbury Natural Gas Pipeline.

The Proposal will involve the processing of gas delivered from upstream wells (outside of scope of this proposal) to the WEF. The sales quality gas will then be delivered via a 16.5 km pipeline to the nearby Dampier Bunbury Natural Gas Pipeline (DBNGP). The Proposal includes:

- A gas processing facility (the WEF), with a nominal design flow capacity of 87 terajoules per day (TJ/d)
- A 16.5 km interconnecting buried gas pipeline between the WEF gas plant and the DBNGP tie-in point.
- A custody transfer metering facility located at the DBNGP tie-in point (the West Erregulla Meter Station [WEM])
- A pig launcher station
- Supporting infrastructure including but not limited to power generation, flare system, water treatment package, back-up diesel system and communications.

At later stages of the Proposal, as the reservoir is depleted and the pressure into the facility declines, gas compression facilities may be installed at the WEF to maintain sufficient pressure to allow gas to be exported into the DBNGP. As the WEF requires a minimum inlet pressure to deliver the required flow to the export pipeline, the rate at which reservoir pressure declines will govern how long the free flow period will last.

The design life of the pipeline is 60 years and the plant is 20 years. Construction is proposed to commence in March 2021 with operations commencing late 2022 or early 2023.

The plant includes:

- Mercury removal equipment,
- Amine Gas Removal Unit - gas refining to remove carbon dioxide (also known as 'sweetening'),

- Waste gas incineration,
- Oxidisation process (heat control),
- Hydrocarbon dew-point control,
- Water content control,
- Sales gas metering,
- Condensate export system,
- Produced water treatment including a double lined evaporation pond, and
- Support utilities.

The Plant will operated 24 hours a day throughout the year except for planned and unplanned maintenance activities (Shutdowns).

Support Utilities include the following:

- Fuel gas system
- Electrical power generation (Gas Engine Alternators, Diesel back up)
- Instrument Air system
- Flare System
- Fire water system
- Utility water system, and
- Diesel system

1.1.1 Key avoidance measures

A number of key avoidance measures have been implemented as part of the design of the WEF which will assist in reducing GHG emissions. These include:

- Utilisation of the waste gas and flash gas from the amine package within the hot oil system
- Utilisation of produced condensate as a fuel source
- Installation of a flare as opposed to cold venting
- Fugitive emissions reduction
- Gas detection equipment.

There is also a recommendation for reducing GHG emissions associated with future inlet compression which would provide the ability to restart the inlet compressor from settle-out conditions. This would allow a faster restart which would minimise the flaring of gas, thus reducing GHG emissions.

These GHG reduction methods are described in further detail in Section 3.1.

AGIG is committed to a global effort to limit GHG gas emissions and this includes reducing through design, avoidance, mitigation and offsets the emissions from the operations of the WEF. With a focus on an energy source which generally generates less GHG emissions than other fossil fuels (e.g. coal and diesel)¹ AGIG supports the use of natural gas as a reduction in the use of more polluting fuel types to assist in lowering the overall carbon footprint of its operations and globally.

¹ Source: DCCCE 2010 Fuel Type Emission Factors

AGIG is a key player in trailing and introducing a hydrogen mix to natural gas distribution in Australia. The production of hydrogen greatly reduces emissions with an output of oxygen and water.

1.2 Key environmental factor – Greenhouse gases

This GHG Management Plan has been prepared in relation to the Environmental Protection Authority (EPA) key environmental factor Greenhouse Gas Emissions. The EPA's objective for the factor Greenhouse Gas Emissions is '*To reduce greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change*' (EPA 2020b).

The EPA GHG emissions guideline requires proponents of major greenhouse emitting projects (i.e. projects that exceed 100,000 tonnes CO₂e per year) to show how they can reasonably and practically avoid, reduce and offset emissions. While the proposed emissions are under this threshold, the requirements of the guideline have been considered in the preparation of this management plan.

Table 2-1 identifies where key requirements of the EPA Guideline have been addressed in this GHG Management Plan.

Table 2-1: GHG management plan and EPA guideline requirements

| GHG Guideline Requirement | GHG MP Section |
|--|----------------|
| Intended reductions in Scope 1 emissions over the life of the Proposal | Section 3 |
| Regular interim and long-term targets that reflect an incremental reduction in Scope 1 emissions over the life of the Proposal | Section 4 |
| Strategies which demonstrate that all reasonable and practicable measures have been applied to avoid, reduce and offset a proposal's Scope 1 emissions over the life of the Proposal | Section 4 |
| Identification of Scope 3 emissions: Third party owned or activities in relation to Scope 3 emissions | Section 2.1.6 |

1.3 Condition requirements

The Proposal has not yet been assessed under Part IV of the EP Act or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A referral was submitted under the EPBC Act in March 2021 (EPBC 2021-8907) and is currently in progress.

In anticipation of likely approval conditions under the WA EP Act, this GHG management plan outlines the management approach to GHG emissions of the Proposal to ensure environmental outcomes and objectives are achieved.

1.4 Regulation and policy

1.4.1 Commonwealth regulation and policy

The United Nations Framework Convention on Climate Change (UNFCCC) provides the framework for international cooperation to reduce global GHG emissions and limit temperature increases. The UNFCCC Paris Agreement entered into force on 4 November 2016, and Australia is currently committed to reducing GHG emissions by 26 to 28 per cent below 2005 levels by 2030 (Australian Government 2015).

A framework of national legislative policies, programs and guidelines has been established to support the commitment to meeting the climate change challenge. The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) establishes a framework for corporations to report GHG emissions and energy consumption and production from 1 July 2008.

Under the NGER Act, entities are required to register and report GHG emissions, energy production and energy consumption information if specific requirements are met (either at a facility or corporate group level).

The methods and criteria for calculating GHG emissions and energy data under the NGER Act are detailed in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*. The *National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015* (SGM) seeks to impose limits on large GHG-emitting facilities to ensure that net emissions are kept below a defined baseline. The SGM applies to facilities with Scope 1 emissions of more than 100,000 tonnes of CO₂-e per year.

1.4.2 State regulation and policy

The Western Australian Government's Greenhouse Gas Emissions Policy for Major Projects (the State GHG Policy) commits the State Government to work with all sectors of the Western Australian economy to achieve net-zero GHG emissions by 2050 and commits to working with the Commonwealth Government's interim target of emission reductions of 26 to 28 per cent by 2030 (Australian Government 2015).

The State GHG Policy is designed to guide Government decision making for major projects that are assessed by the EPA. In accordance with the policy, the Minister for Environment will consider the particular characteristics of each project and the advice and recommendations of the EPA. The Government may then consider whether it is appropriate to apply a condition that sets out the requirements for a plan detailing the Proponent's contribution towards achieving the Government's aspiration of net zero emissions by 2050.

The State GHG Policy supports the development of GHG Management Plans for proposals and provides recommended content. Table 2-2 details how this GHG Management Plan addresses the contents defined by the State GHG Policy.

Table 2-2: State GHG Policy management plan requirements

| State GHG Policy Considerations | GHG Management Plan response |
|---|--|
| <i>The Policy supports the development of Greenhouse Gas Management plans for proponents which:</i> | |
| <ul style="list-style-type: none"> Outline strategies to avoid, reduce, mitigate and offset the project's direct (Scope 1) emissions contributing towards the State's aspiration of net zero by 2050 | Strategies to avoid, reduce, and mitigate GHG emissions associated with the Proposal are described in Section 4. |
| <ul style="list-style-type: none"> Are unique to a proposal's specific circumstances | The GHG Management Plan is specific to activities associated with the Proposal. |
| <ul style="list-style-type: none"> Allow proponents to take account of opportunities at either facility level or across national operations | GHG Management Plan indicates that emissions will be avoided, mitigated or offset (or a combination). This may mean that offset or other processes may be used at a facility, local, regional or national level to ensure the targets for the proposal are met. This will be included in the annual reporting process and detail where and how emissions targets are being achieved. |
| <ul style="list-style-type: none"> Allow proponents to propose their own timeframes and interim targets | Management action timeframes and targets are described in Section 3. |
| <ul style="list-style-type: none"> Include requirements for periodic public reporting against their targets | Periodic public reporting of progress against the management actions is described in Section 4. |
| <ul style="list-style-type: none"> Account for and align with Commonwealth requirements. | The GHG Management Plan describes how emissions will be managed in accordance with Commonwealth requirements, including responsibilities under the NGER Act. |

1.5 Scope of the management plan

Reduction of GHG emissions have been considered in the selection and design of the Proposal, including infrastructure and site layout. This GHG Management Plan applies to Scope 1 and Scope 2 emissions from Proposal activities following design that are within the operational control of AGIO.

Proposal activities that will contribute GHG emissions include:

- Scope 1:
 - Removal of CO₂ from the gas stream through gas processing systems (Amine Gas Removal Unit (AGRU) and Oxidiser)
 - Combustion of natural gas fuel for the generation of electricity onsite (fuel gas)
 - Vessel push / pull
 - Flaring
 - Vessel or plant blow down (to flare)
 - Minor operation of mobile equipment and vehicles.

- Scope 2: as power generation occurs onsite, power generation is included in Scope 1 and therefore no Scope 2 emissions are identified on the project.

Estimates of the Scope 1 and Scope 2 emissions associated with the Proposal are:

- Scope 1 emissions: up to 96,319 tCO_{2e} per year

Potential impacts of GHG emissions are the contribution to global GHG concentrations from Scope 1 emissions.

Scope 2 emissions were not identified in relation to the project as no power generated is exported and no power is imported for consumption.

A number of options have been considered to improve energy efficiency and ensure that GHG emissions are minimised as far as practicable. These are described in further detail within this GHG Management Plan.

1.6 Rationale and approach

1.6.1 Key assumptions and uncertainties

This GHG Management Plan has been developed using all relevant and available information at the time of preparation. As the understanding of GHG management improves over time, this GHG Management Plan may require reviewing and updating (refer to Section 5.1).

1.6.2 Management approach

AGIO will implement management-based provisions for this GHG Management Plan. The management approach is based on the following objectives:

- Alignment with the State Government's commitment to working with the Commonwealth Government's target of reducing greenhouse gas emissions by 26 to 28% by 2030
- Alignment with the State Government's Greenhouse Gas Emissions Policy for Major Projects to contribute towards the State's aspiration of net zero emissions by 2050
- Alignment with EPA Guidance (EPA 2020), through applying the mitigation hierarchy (i.e. considering reasonable and practicable measures to mitigate GHG emissions)
- Adopting design, technology and management measures to mitigate GHG emissions, having regard to the as low as reasonably practicable principle
- Commitment in supporting the State Government in developing technical guidance to support greenhouse gas emission reduction within the gas industry
- Compliance with relevant State and Commonwealth GHG emission monitoring and reporting requirements, including NGER and the Safeguard Mechanism
- Adaptive management to respond to current uncertainties and future developments in Government policies, markets and technology.
- Assessment of emissions reducing technology in the design stage and feasibility assessment.

1.6.3 Rationale for choice of provisions

AGIO conducted a design review on the project as part of the overall Front End Engineering and Design (FEED) process. This included assessment of potential design options that improved the efficiency of the plant, ensured safe and effective operations and also the potential to reduce emissions. The following rationale have been included the proposed management provisions:

- The provisions and associated targets represent AGIO's alignment with National and State government targets;
- AGIO has utilised the mitigation hierarchy to assess potential management provisions and this includes assessing the overall feasibility to implement on the project;
- AGIO recognizes that there is the potential for changes to national and state policies, markets and technology over the life period of the plant and has included a management provision to periodically assess potential projects that can reduce the emissions of the plant;
- Additionally, ongoing monitoring and reporting of greenhouse gas emissions from the project will allow AGIO to minimise leaks, meet reporting requirements and identify key focus areas for improvement in the emissions profile.

2. Greenhouse gas inventory

2.1 Methodology

The assessment calculations of the WER emissions profile was completed in line with National Greenhouse Accounts Factors (Department of Environment and Energy pp11-12, 59, 70) and utilising the WEF heat and mass balance information.

The operational emissions profile accounted for an average of gas specification ranges from the upstream gas field of 6.35 mol % of CO₂ feed gas. With the output being to sales gas specifications of 3 mol % of CO₂.

A range of emission profiles were calculated with the peak emissions outlined in Table 2-1. Additionally, AGIO reviewed impacts from changes to solar, solar with battery backup and a sales gas specification of 4 mol % as ways to reduce emissions onsite. AGIO will continue to review the feasibility of these reduction potential projects as part of the management actions on the project.

2.2 Assessment boundary

The boundary for assessment of the emissions from the project including the Midstream plant and gas pipeline. The upstream emissions (wellheads, flowlines and slugcatcher) are excluded from the emissions profile in Table 2-1.

Emissions from the DBNGP tie-in point will be included in the DBNGP gas accounting under the NGER Act.

The WEF assessment boundary utilises the NGER Act description in terms of defining a facility and operational control. Areas under AGIO operational control have been included in the emissions profile.

2.2.1 Assumptions

The following assumptions were made in determining the emissions profile for the project:

- Inlet compression was not present
- Overall FEED contingency was removed
- Hot oil package contingency removed
- Total Estimated Gas Flow 1.66 TJ/d (87TJ/d Net Export)
- Estimated Plant Yield = 97.5%
- GEA Fuel Gas consumption based on GHG Emission Factors of kgCO_{2e}/GJ (Fuel)
- Profile includes a facility blowdown occurring six times per year.

2.3 Greenhouse gas emissions profile

2.3.1 Scope 1 Emissions

GHG emissions related to reservoir sources of CO₂ that are removed through the AGRU will vary depending on the gas characteristics of each upstream well and the gas reservoir. This ranges from 5.77 to 6.93 mol % of CO₂. This has been averaged to 6.35 mol % of CO₂ for this assessment (Table 2-1).

All calculations have been made on full 'nameplate' capacity of the plant of 87 TJ / day with an estimated plant yield of 97.5 %. Emissions are likely to be lower as the estimated average delivery of gas from the plant is expected to be closer to 80 TJ / day.

Table 2-1: Emissions Profile

| | Activity | Location | Proponent | Predicted annual emissions tCO _{2e} |
|------------------------------------|---|-----------|-----------|---|
| Reservoir gas | Amine Gas Removal Unit (AGRU) (CO ₂) | Midstream | AGIO | 56,907 |
| Processing gas | Oxidiser burned gas (includes AGRU hydrocarbons in waste and flash gas) | Midstream | AGIO | 32,354 |
| Processing gas – Power consumption | Fuel Gas – GEA Power Generation | Midstream | AGIO | 6,076 |
| Processing gas | Flare | Midstream | AGIO | 39 |

| | | | | |
|----------------------------------|----------------------------------|-----------|------|---------------|
| Processing gas | Flare blowdown (maintenance) | Midstream | AGIO | 208 |
| Processing gas | Liquid circuit atmospheric vents | Midstream | AGIO | 71 |
| Fugitive gas | Pipeline | Midstream | AGIO | 172 |
| Other | Vessel push pull | Midstream | | 492 |
| TOTAL MIDSTREAM EMISSIONS | | | | 96,319 |
| Power Generation | Plant | Midstream | AGIO | 33,600 kWh |

Based on the above emissions profile, the plant has a proposed emissions intensity of 2.93 tCO_{2e} / TJ. This includes all processing, reservoir and other emissions but not including Fugitive gas in the pipeline as this makes comparison (Section 2.5) difficult as this is based on distance of pipeline and not efficient plant design and operations.

Emissions Intensity is based on the below calculations (Table 2-2).

Table 2-2: Emissions Intensity

| Production variable | Activity | Emission Type | Estimated GHG Emissions (per annum) | Emissions Intensity tCO _{2e} |
|---------------------|--|--|-------------------------------------|---------------------------------------|
| 30 | Processed natural gas | Non-reservoir emissions ² | 33,164 | 1.04 |
| 35 | Extraction of reservoir carbon dioxide in AGRU | Reservoir emissions (Emissions Intensity (EI) = 1 (minus any storage) ³ | 56,907 | 1.79 |
| 57 | Electricity Generation | Non-reservoir emissions (EI = 0.539 | 6,076 | 0.10 (per MWh) |

² National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015- Schedule 1, Division 5.

³ National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 – Schedule 1, Division 11

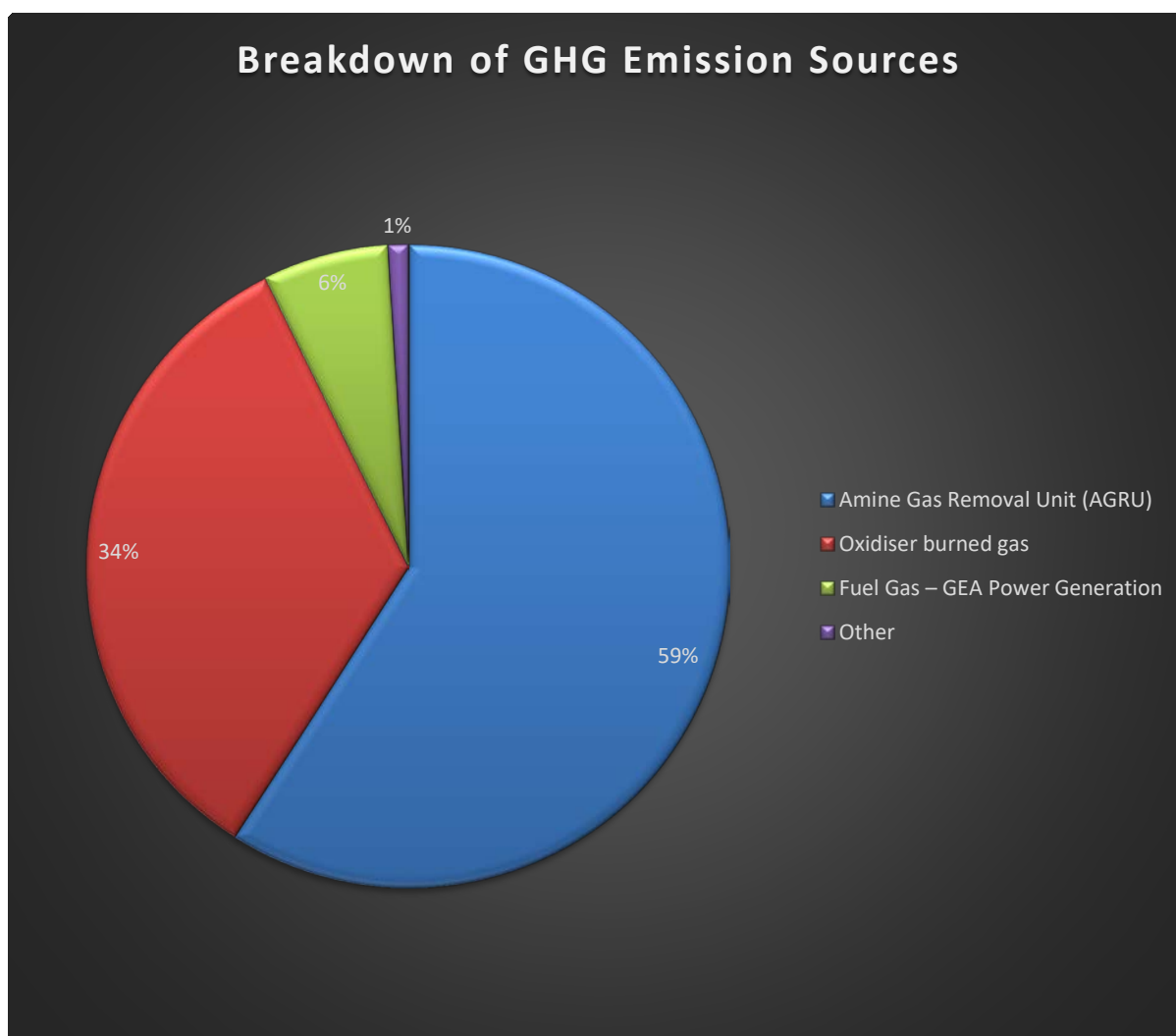


Figure 1 Breakdown of GHG emissions sources

2.3.2 Scope 2 emissions

There are no Scope 2 emissions identified as no electricity is imported or exported.

2.3.3 Scope 3 emissions

AGIO is not the owner of the processed gas. The gas is owned by the Upstream Joint Venture (JV) consisting of Strike Energy and Warrego Energy and the sales agreement for downstream use is a third party process.

Information supplied by the JV, outlines that Scope 3 emissions are based on full use in non-metro activities (i.e. industrial process). Noting that this impact is outside of the scope of the processing plant, an outline of the potential Scope 3 emissions for the full West Erregulla upstream project by the JV partners is detailed below:

Scope 3 gas consumption figures detailed as outlined in NGA Factors 2020⁴. Assumes peak plant production of 87 TJ / day. Total Scope 3 emissions per day is 348 tonnes of CO_{2e} per day (Table 2-3). This equates to 127,020 tCO_{2e} per year.

Table 2-3 Scope 3 emission calculations

| End Use | Emission Factor kg CO _{2e} / GJ | Approximate quantity breakdown (GJ) | Total daily emissions (approximate) tCO _{2e} |
|---|---|---|---|
| Metro WA | 4.1 | 0 | 0 |
| Non-metro (industrial) WA including export gas | 4.0 | 87,000 | 348 |

2.4 Benchmarking – Reservoir

In terms of reservoir quality, this is out of scope for this project as AGI is not the upstream producer (extraction) of gas. Based however on the gas specifications provided the average CO₂ reservoir content is 6.35 mol % of CO₂ with a range from 5.77 to 6.95 mol % of CO₂. This equates to the nearby Waitsia Gas Field (4.5-7.5) and is lower than most other gas fields in WA with the exception of Macedon, John Brookes (Santos), Janz (Chevron) and Reindeer (Santos) fields⁵.

2.5 Benchmarking – Gas Processing

AGI Operations will utilise the first two years of full operations to set the baseline emissions profile for the project. This will allow for commissioning processes to be completed for all equipment and a period of time to ensure efficient running of the WEF. This will provide additional capability to assess the actual percentage range of mol % of CO₂ feed gas and provide the ability to average this over the first two years as the upstream well use normalises to a sustainable volume.

AGIO has been able to assess the plant emissions and emission intensity against existing and proposed plants within WA. Both of these are larger in size but detail the emissions expected and actually released from the plants.

2.5.1 Macedon (BHP)

The BHP operated Macedon Gas Plant only has trace amounts of carbon dioxide within the upstream gas field and minimal to no processing is required to remove this from the gas flow to meet sales gas specification. Therefore Macedon emissions are based more on the gas plant operating equipment (gas production) rather than reservoir gas. Public documentation available as part of the approvals of Macedon include an emissions output of 115,000 tCO_{2e}

⁴ National Greenhouse Accounts Factors 2020 (Appendix 4, Table 41) Scope 3 emission factors – natural gas for a project that is not ethane (inclusive of coal seam gas).

⁵ Mitsui E & P Australia – Waitsia Gas Project Stage 2 – Greenhouse Gas Management Plan 2020

per annum (EPA, 2010). This was also referenced in the recent Waitsia documentation where emissions intensity was calculated as being $3.15 \text{ tCO}_{2e} / \text{TJ}$ (Mitsui, 2010).

However based on the $3.15 \text{ tCO}_{2e} / \text{TJ}$ being wholly for production and not including reservoir gas the emissions intensity for West Erregulla for gas production (non-reservoir gas) is $1.04 \text{ tCO}_{2e} / \text{TJ}$ which is a reduction in intensity level of ~67%.

2.5.2 Waitsia (Mitsui)

Waitsia's Greenhouse Gas Management Plan (Revision 5) (Mitsui E&P, 2020) outlines the emissions profile, intensity and overall targets for emission reductions for the 250 TJ / day processing facility. Emissions intensity figures are comparable with the total intensity difference in line with the smaller West Erregulla plant size. With overall emissions predicted at 300,000 tCO_{2e} this equates very similar to the West Erregulla size and emissions profile.

Waitsia outlines it's proposed emissions intensity at $3.29 \text{ tCO}_{2e} / \text{TJ}$ which is slightly higher than the $2.93 \text{ tCO}_{2e} / \text{TJ}$ calculated for West Erregulla. As per above, this equates similarly to Waitsia but with improvements in intensity to the emissions profile for the project.

3. Greenhouse gas management plan provisions

This section outlines management-based provisions and key requirements under this GHG Management Plan. When implemented, it is expected that these provisions will achieve the objective of the Air Quality (greenhouse gas emissions) environmental factor and minimise emissions so that environmental values are protected.

AGIO will implement management provisions, detailed in Table 3-1, consistent with the rationale and approach presented in Section 1.6.

Table 3-1: Management based provisions

| Management action | Management target | Monitoring | Reporting |
|-------------------|--|--|--|
| 1 | Demonstrate and implement design efficiencies as part of emissions mitigation for project design including quantification of mitigation as outlined in the project GHG MP | Included in GHGMP and quantified via calculations Initial approach plus new technology or plant design monitored annually. | Initial Annual Compliance Assessment Report (ACAR) |
| 2 | Review ongoing abatement opportunities as part of annual compliance assessment report, with a review of emission reduction targets every 5 years. This includes a review of the GHGMP. | Emissions monitoring, Review of abatement opportunities and graded against feasibility criteria Annual Report Quarterly Emissions report 5 yearly review of plan | NGER report, ACAR |
| 3 | Maintain emissions below baseline and report annually as required (Scope 1 emissions). Baseline to be set in first two years of operations and reported to the Clean Energy Regulator (Section 2.1.5) | Emissions monitoring quarterly with annual reporting | NGER report, ACAR |
| 4 | All reservoir emissions (~60% of total emissions) avoided, mitigated or offset from commencement of operations. | Emissions monitoring, baseline data, offset reporting | ACAR |
| 5 | Avoid, mitigate or offset as per the Emissions Reduction Targets (Section 3.1) For the period ending June 2028 reduce emissions by 60% from the baseline emission profile from the commencement of operations; For the period ending June 2038 reduce emissions by a further 5%; and A further 5% reduction post June 2038 and subsequently aligning with the Trajectory to Zero targets. | Emissions monitoring | NGER report, ACAR |

| | | | |
|---|---|---|-------------------|
| 6 | Demonstrate that all reasonable and practicable measures have been reviewed and undertaken to reduce emissions | Emissions monitoring, Feasibility Review | ACAR |
| 7 | Preventative maintenance program implemented for leak detection and repair including: 1) Monitoring pressure relief instances and develop a target number for reduction every 5 years 2) Monitor and report on fugitive emissions including the pipeline 3) Develop procedures to address plant non-conformances | Emissions monitoring, PSV release information, leak detection records, event reports, Work orders (preventative and corrective maintenance system). | NGER report, ACAR |

3.1 MA1 - Design Avoidance

The development of the processing plant design included a target to maximize efficient gas use based on the specifications provided for the upstream gas. AGIO conducted a design review to assess reasonable and feasible opportunities to ensure efficient use and this included emission reduction capabilities. This process was in line with EPA's GHG Environmental Factor Guideline to outline and demonstrate that design measures have been applied to avoid or reduce emissions for the proposal.

Those deemed feasible for the project have been adopted and are outlined in Table 3-2.

Without these designs being built into the processing plant, initial emissions for the proposal would have been ~119,000 tCO_{2e} per annum. Due to the design factors this was reduced by approximately 22,600 tCO_{2e}.

Management Action 1 outlines the characteristics included to avoid emissions as part of the design phase of the project.

Table 3-2 Design opportunities adopted to minimise emissions

| Aspect | Detail | Quantification (emissions avoided annually) tCO _{2e} |
|--|--|--|
| Utilisation of the Waste gas and Flash Gas from the Amine Package in Thermal Oxidiser / Hot Oil Package | In many natural gas processing plants, the waste gas from the amine regeneration column and flash gas from the amine flash drum is cold vented locally (normally at the highest point of the facility). Instead of following a similar method, the design of the West Erregulla Facility utilises the waste gas and flash gas from the amine package within the hot oil / thermal oxidiser package. By doing so, the fuel gas consumption within the hot oil | 3,092 |

| | | |
|--|---|--|
| | package is reduced which increases the overall facility yield and decreases the GHG emissions. An additional impact of the thermal oxidiser is that pollutants that are contained within the waste gas, flash gas and fuel gas are destroyed completely, for the expected gas composition these pollutants are H ₂ S and BTEX. | |
| Utilisation of Produced Condensate as a Fuel Source in Thermal Oxidiser / Hot Oil Package | Produced condensate is often flared or trucked off site for disposal elsewhere in natural gas processing plants. For the WEF, the condensate will be utilised as a fuel source for the hot oil / thermal oxidiser package. By utilising produced condensate, the total fuel gas requirements for this package are decreased which increases the facility yield and decreases the GHG emissions. | 485 |
| Installation of a Flare | The use of a flare to burn any gas that would otherwise have been cold vented is a method of greenhouse gas reduction. This is far better than cold venting natural gas which has a larger impact on the environment as methane has a global warming potential (GWP) of 28 compared to the CO ₂ generated from combustion. | 18,850 |
| Fugitive Emissions Reduction | To minimise fugitive emissions, manual valves, instrumentation and control valves, isolation valves, piping and equipment, be designed, tested, supplied and installed as per the appropriate codes, standards and company install procedures. By doing this, the likelihood of fugitive emissions from leaking flanges, valve bodies etc. will be reduced. | NA |
| Gas Detection Equipment | The WEF will include line of sight (LOS) gas detectors. If a gas leakage occurs the LOS gas detectors will initiate an Emergency Shutdown (ESD) and shut in the facility to reduce the available inventory for leakage and complete a facility blowdown. By completing the facility blowdown a large inventory of gas will be flared but without the LOS detectors, if a leak is to occur the leak will be continuous for an extended period of time which will result in a higher rate of GHG emissions. | 15.4 (per hour on an assumed leak rate) NOTE: not included in total |
| Compressor Restart from Settle-Out Conditions (FUTURE) | Reciprocating compressor start-up procedures involve the depressurisation of the compressor casing prior to operation. The WEF inlet compressor has been selected as a centrifugal compressor driven by a gas turbine which has the capability to start from settle-out pressure conditions (no depressurisation required during startup). This will allow a faster restart and will minimise the flaring of gas thus reducing GHG emissions. | 233 |

As part of the review of opportunities to reduce emissions, solar and solar with battery backup (BESS) was reviewed as an alternative power source for the plant. This reduction in emissions was minor (equating to ~1,327 tCO_{2e} per annum) and therefore while this remains an option, the cost involved outweighed the minor reduction in emissions across the total emissions of the plant. This equates to less than 1.5 % reduction in emissions overall.

AGIO will continue to assess the feasibility of BESS as this reduction is warranted once the cost of a BESS reduces, which is likely in the future.

3.2 MA2 - Ongoing opportunities

AGIO will annually review the potential for new technology, design, plant efficiency and emissions capture to assess feasible options for reducing emissions.

This will form part of the ongoing targets to reduce emissions through the plant life. Reductions will link to Management Action 5 in terms of meeting emission targets for the life of the proposal.

3.3 MA3 – Baseline assessment

The *National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015* requires the establishment of an emissions baseline. For this project, AGIO proposes to establish a production-adjusted baseline determination to allow for production variability within the first two years of operations to accurately set the baseline based on efficient operations.

The Rule also includes a benchmark intensity index in relation to the emission of a production variable. Table 2-2 sets out the emissions intensity and production variables identified for the project. Once benchmarking has been completed, the emissions intensity will be reviewed for processed natural gas to establish a site based emissions intensity figure.

Baseline emissions, once set shall be the maximum allowed emissions from the site as per the MA2 target requirement. As this baseline will be production-adjusted baseline the overall emissions (prior to mitigation or offset) shall not be exceeded.

Annual reporting under the NGER Act will be completed as well as annual reporting to DWER and DMIRS as required in line with the CEMP and approval conditions. Quarterly emissions monitoring will be completed to understand changes during the year.

3.4 MA4 and MA5 – Emissions Reduction Targets

As outlined in Table 3-1, the emissions reductions over time shall increase as the project life continues. The profile and target reductions are outlined in Figure 3.

AGIO has developed these targets to meet the West Australian Government and Australian Government commitments to reduce greenhouse gas emissions. These targets include a reduction from 2005 by 2030 of 26% - 28% at a national level.

AGIO also is committed through a wider business model approach to working towards the State's aspirational 2050 target of no net emissions.

To align with the above, AGIO has committed to offsetting the full scope of Reservoir Gas emitted from the plant from the commencement of operations. This is ~60% of the full plant emissions (all reservoir emissions) and will continue through the life of the proposal. Accordingly, AGIO will continue to review potential further reductions through the life of the project and commits to a further reduction in emissions (to 65%) in 2028 and a further 5% in 2038. From 2038 onwards, the proposal will continue to reduce its overall emissions profile (through avoidance, mitigation or offsetting) to align with Trajectory to Zero targets outlined in Figure 3.

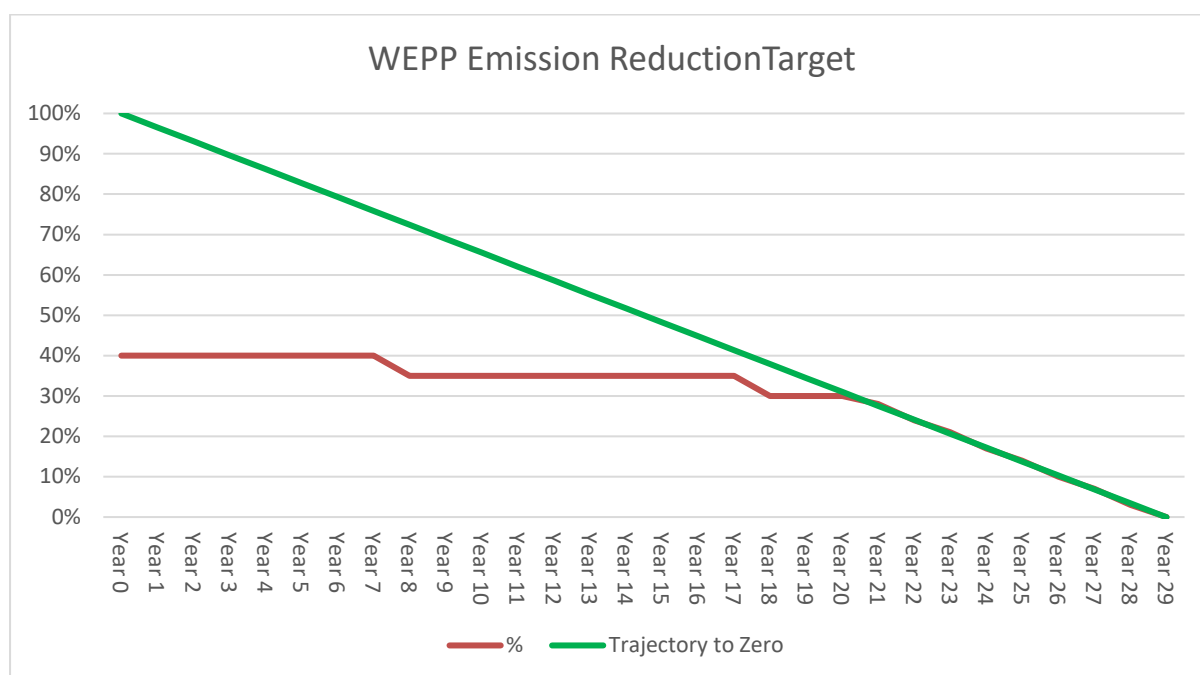


Figure 2 Emissions Reduction Target

3.5 MA6 – Practicable emission reduction works

As outlined with MA3 and MA5, AGIO is committed to identifying, reviewing and implementing where feasible (reasonable and practicable) emissions reduction technology, systems or designs to minimise emissions from the proposal. Work towards this, including feasibility reviews will be conducted annually and be reported on as part of the annual report (Table 3-1).

3.6 MA7 – Preventative maintenance and leak identification

AGIO processes and procedures will be developed and implemented to ensure emissions from plant operations and design will be minimised and actioned through consistent and constant monitoring, leak detection capability and frequent site inspections.

These processes will include (but not limited to) the following:

- Personnel profile (roster and onsite/offsite operations and response timeframes);
- Leak monitoring
- Leak detection devices
- Response procedure
- Critical spares inventory
- Gas chromatographs (gas quality / specifications)
- Flare monitoring (gas flow)
- Pressure Safety / Pressure Relief Valves (PSV or PRV) release monitoring
- Custody transfer monitoring (upstream, midstream, downstream)

The proposal is designed and will be constructed and operated in line with Australian and International Standards (e.g. AS2885, ASME B31.3).

AGIO will continue to build on the long term success of AGIG in the management of the DBNGP and other transmission, distribution and gas storage projects all of which have a high quality environmental record and focus on the safe and effective handling and storage of gas.

A component of this management action will be targeting ongoing improvements (reductions) in the amount of PSV/PRV releases to minimise emissions for these sources.

4. Adaptive management and review

4.1 Management plan review

This GHG Management Plan will be reviewed, evaluated and updated as required or in response to the following triggers:

- Introduction of a new process or activity that could introduce new or amend existing GHG emissions
- Outcomes of relevant technical studies and investigations into new GHG emission reduction opportunities or new energy efficiency technologies or techniques
- Changes in relevant State or Commonwealth legislation
- Comments from the EPA during the environmental assessment process.

An internal review of the monitoring and reporting procedures will be carried out annually to ensure accuracy and compliance with relevant legislation. The annual reviews will include checking that:

- All requirements have been adequately reported
- Inventory boundaries have been set correctly
- Correct calculation methods have been used to quantify GHG emissions
- Correct energy production and consumption reporting factors and methods have been applied
- Energy efficiency opportunities have been reported
- Reporting procedures show relevance, completeness, consistency, transparency, and accuracy
- Quarterly reporting to DMIRS matches NGER Act reporting requirements; and
- Timeframes have been met for outputs and deliverables.

Independent verification of the GHG inventory will be conducted as required for quality assurance purposes and to provide feedback on managing data collection and inventory quality.

After a review is triggered, any updates to the GHG Management Plan (other than administrative changes) will be submitted to the EPA and published when approved.

4.2 Review of mitigation measures

AGIO shall review all measures to avoid, reduce and offset emissions through an ongoing basis and in line with targets set out in Table 3-1. This includes meeting the timeline for overall reduction in line with 'Target Zero by 2050'.

4.3 Stakeholder consultation

AGIO has detailed the Stakeholder Consultation for the project within the project CEMP.

5. References

Australian Government 2015. *Australia's 2030 Emission Reduction Target: Summary Report*.

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Environmental Protection Authority (EPA) 2020a. *Instructions on how to prepare Environmental Protection Act 1986 (WA) (EP Act) Part IV Environmental Management Plans*. Environmental Protection Authority, Perth WA.

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