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apa

## Wiluna seal upgrade

December 15, 2023

# Business Case

# document control

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*Table 1.1: Revision Record*

| Version | Changes Made |
|---|---|
| *0.1* | *Initial draft* |
| *0.2* | *Feedback received from document review* |

*Table 1.2: Review and Distribution*

| Name | Role | Action | Sections |
|---|---|---|---|
| [redacted] | [redacted] | *Initial draft* | *All* |
| [redacted] | [redacted] | *Review and Input* | *All* |
| [redacted] | [redacted] | *Review and Input* | *Emissions* |
| [redacted] | [redacted] | *Review and Input* | *All* |
| [redacted] | [redacted] | *Review and Input* | *All* |
| [redacted] | [redacted] | *Review and Input* | *All* |

This document requires the following approvals. Approvals are inserted as an object in the table below (preferred) or stored with the approved document in electronic version on the Project Site in Project Server.

*Table 1.3: Approvals*

| Name | Role | Approval | Date Approved |
|---|---|---|---|
| [redacted] | [redacted] | *Approval* | *07 Dec 2023* |
| [redacted] | [redacted] | *Approval* | *15 Dec 2023* |

*Other project specific approvers can be added if required.*

Delegation Policy

# Contents

# 1. Executive Summary

## 1.1. Action Requested

This business case seeks to gain approval of $4 million (FY$2023) to upgrade the Wiluna turbine compressor from wet seals to dry gas seals. This upgrade will improve pipeline reliability and reduce emissions. In AA5 $4 million will be incurred and all costs will be allocated to the covered pipeline.[1]

The project is due to commence and be completed CY2025.

## 1.2. Options Considered

Option 1 – Status quo

Option 2 – Install dry gas seals (**Recommended Option)**

Option 3 – Install dry gas seals and blow-down and recovery system

## 1.3. Project Overview

Wiluna compressor station, commissioned in 2001, is the oldest turbine compressor on the GGP and the only one with wet seals and without an air power system.

Recently, failure of the wet seals system has led to oil in pipeline events which in turn has damaged a downstream compressor and led to a series of customer complaints.

Dry gas seals technology, now standard good industry practice, removes the risk of oil in pipelines. This technology also offers superior performance in terms of reliability, reduced maintenance, improved safety and lower emissions.

We have evaluated whether to install dry gas seals. We have also considered whether to also install a fugitive emissions recovery system at the same time.

We find that the reduction in risk from the removal of wet seals as well as the additional benefits of reduced emissions, means that installing dry gas seals is the preferred option. However, the additional cost to also install a fugitive gas recovery system at Wiluna exceeds the benefits. However, this may change in the future (depending on how Wiluna is being used, price of Australian Carbon Credits etc.) and will need to be reevaluated closer to delivery.

[1] As the compressor unit at Wiluna forms part of the covered pipeline 100% of the cost of expenditure at Wiluna is allocated to the covered pipeline.

# 2. Background

## 2.1 Wiluna compressor station

Since commissioning in 1996 the GGP has undergone several expansions resulting in a mix of rotating plant and equipment. The original compressor stations (Yarraloola and Ilgarari) were installed with reciprocating compressors.

The pipeline was expanded in 2001 with the construction of the Wiluna compressor station. Wiluna station features a [redacted] turbine compressor with a wet seal system and power gas (where gas is diverted from the high-pressure gas stream) for instrumentation control, valve actuation and to power the starter motor.

Subsequent expansions resulted in new compressor stations at Paraburdoo, Wyloo West, Neds Creek and Turee Creek and additional compression at Yarraloola and Paraburdoo. These expansions all resulted in the installation of turbine compressors with dry gas seals and air power systems.

## 2.2 Improvements in seal technology

Seals on the rotating shaft of centrifugal gas turbine compressors prevent gas from escaping the compressor casing.

Wet seals, a form of contacting mechanical seal, use high-pressure oil as a physical barrier to stop gas leakage. Wet seals require a supporting oil reservoir, pumps, and a pressurized circulation system. These systems require a relatively high degree of maintenance and are a leading cause of compressor down-time.

Additionally, although the seal itself does not leak, the oil absorbs gas, which is then purged by the oil system and vented, resulting in fugitive emissions.

Newer dry gas seals apply a non-contact sealing mechanism consisting of rotating and stationary rings. Hydrodynamic grooves etched into the surface of a rotating ring create a thin film of pressured gas. As the rings do not touch while the compressor is in operation, there is limited wear and no requirement for lubrication. However, dry gas seals require a source of clean dry gas, typically provided by an air power system.

Overall, dry gas seals have superior performance in terms of reliability, reduced maintenance, lower emissions, improved safety (reduced risk of a fire), and a reduced risk of oil in pipeline events. As a result, dry gas seals are now almost universally installed on new compressors and are considered good industry practice. In contrast, wet seals are considered legacy technology.

## 2.3 Oil in pipeline events

**Risks from oil in pipelines**

Wet seals increase the risk of oil leakage into the pipeline potentially leading to damage and operational downtime for downstream and customer infrastructure.

Accumulated oil can form slugs, which, due to their higher mass and density compared to gas, may exert greater force if moving at the same velocity as the gas stream. This can lead to pressure surges and increased mechanical stress.

Some pipelines are designed to manage the risk of liquids (employing coalescing elements, slug catchers, or specific design considerations around direction or elevation changes). However, the GGP was specifically designed for dry gas (with provision for the additional liquid collection and drainage facilities), based on the assumption that liquid presence is a negligible risk.

The presence of oil in gas pipelines also adversely affects other downstream infrastructure, such as compressors. Oil can cause mechanical failures, operational inefficiencies, safety hazard and contributes towards fouling and corrosion.

Oil in pipelines also poses risks to downstream appliances and customer plant equipment. Equipment like gas turbines, heating systems, and industrial burners, which are not designed for oil-contaminated gas, can experience clogging, reduced efficiency, and uneven combustion. In residential settings, this contamination can damage heating systems and present safety risks, potentially leading to long-term operational issues and increased maintenance and rectification costs.

**Recent events**

Over the last 6 years we have experienced two recent oil in pipeline events due to failures of the wet seal system at Wiluna:

- In around January 2017, the seal oil pressure regulator failed leaking an estimated 1,000 litres of oil.
- In around January 2021, the seal oil regulator diaphragm failed leaking an estimated 1,500 litres of oil.

These leaks have led to:

- A series of complaints from 4 different customers at 5 separate delivery points during 2022 and 2023.
- Contribution towards the failure of a slam shut valve at Yamarna Delivery station in May 2022.
- Significant damage to the dry gas seals [redacted] identified in September 2023 and which could have resulted in significant customer curtailment.

APA has also experienced a wet seal failure on an east coast asset in the last two years. These events highlight the ongoing risk inherent in operating wet seals.

## 2.4 Operational complexity

As Wiluna is the only wet seal system operated by APA on the West Coast[2] this introduces additional operational complexity. Not only in terms of the additional maintenance requirements, but the skills and capability which need to be maintained.

Notably the WA context is different to east coast operations where there is a greater use of wet seals (both within APA and in the Victorian gas industry) largely due to the respective age of the gas systems.

[2] We understand that the DBP uses dry gas seals across their compressors.

## 2.5 Emissions

**Estimated emissions from wet seals and blowdowns**

The GGP is responsible for emitting around 120,000 tonnes of carbon dioxide (tCO2e) each year, and as outlined in the Asset Performance and Lifecyle Plan, APA is committed to reducing emissions.

Around 80% of emissions relate to fuel gas usage for compression. Most of the remaining 20% relate to fugitive emissions across the pipeline. Fugitive emissions arise due to unintentional leaks (generally at flanges, valves, and seals etc.) as well as from intentional releases like venting and blowdowns. Blowdowns occur when a compressor unit moves into standby and undertakes a controlled release of gas to relieve pressure within the unit.

Although only a small amount of gas is lost to leaks and venting/blowdowns, the emissions factor is relatively high per unit of gas lost as methane is a more potent greenhouse gas than the byproducts of combustion (carbon dioxide and water vapour).

Emissions depend on the total run hours of a compressor as well as the number of starts and stops (which trigger a blowdown).

Estimated emissions at Wiluna from wet seals and blowdowns are 2,475 and 401 tCO2e per year respectively. This estimate is based on the last three months of operation since the connection of the Northern Goldfields Interconnect (NGI). Prior to the connection of the NGI emissions were higher due to the greater need for compression at Wiluna. This estimate is subject to change if the Wiluna compressor is used for longer or undergoes more frequent start/stops.

The materiality of emissions from wet seals is a key reason why installing dry gas seals has been identified as a lesson learned from the United States Environmental Protection Agency Natural Gas Star program.[3]

**Measurement and recognition of emissions**

Currently fugitive emissions for the purposes of the National Greenhouse and Energy Reporting are calculated on a benchmark basis based on the length of pipeline.[4] Accordingly, the current measure does not reflect current pipeline assets and whether wet seals or dry gas seals are in use.

We intend on moving to a higher order method, which takes into account individual emission factors of various components, to calculate emission reductions in time. This will enable emissions reductions from the introduction of dry seals and other technologies to be recognised.

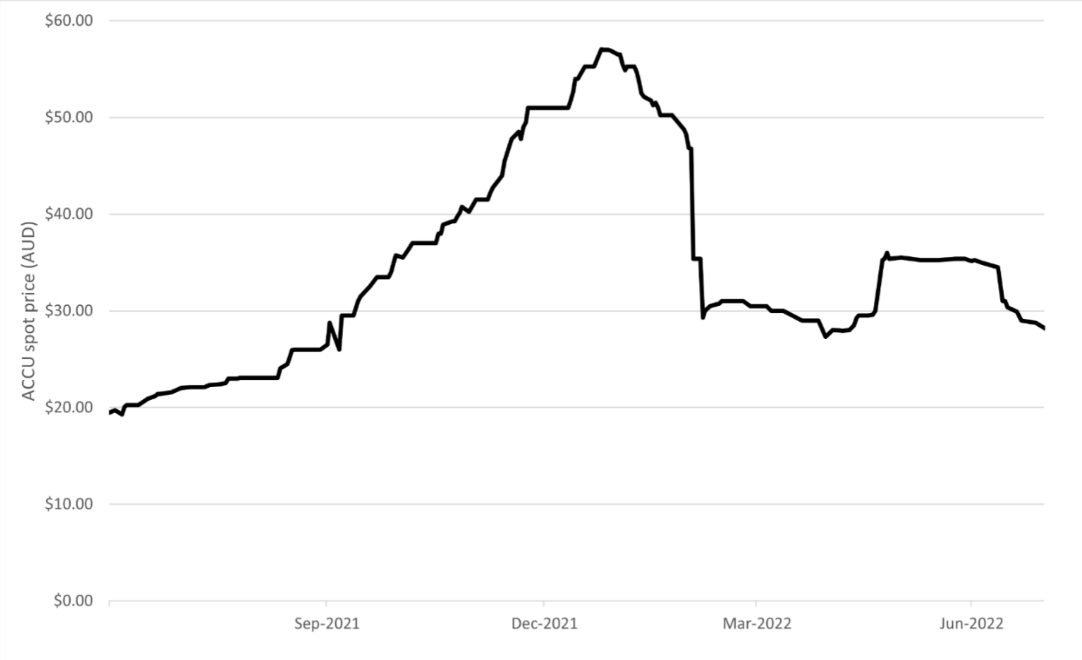
**Valuing emission reductions: reduce safeguard mechanism costs**

Lower emissions reduce the costs the GGP incurs under the safeguard mechanism, where emissions above a baseline must be offset through the purchase and surrender of Australian Carbon Credit Units (ACCUs).

[3] See here.
[4] Specifically method 1 outlines in section 3.76 of the National Greenhouse and Energy Reporting (Measurement) Determination 2008. Available here.

However, projecting the value of ACCU's is difficult. Prices have not been stable. Since their peak of $57 in January 2022[5] prices have since fallen to around $32.[6] It is also unclear how prices will move over time as the legislated limits on emissions reduce over time.

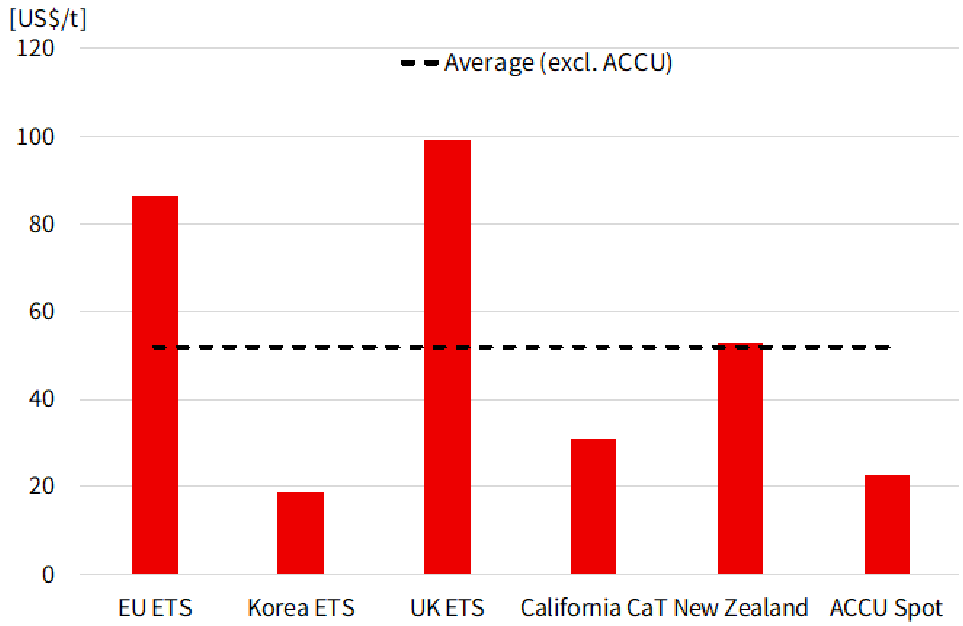
**Figure 1 Generic ACCU spot price (Clean Energy Regulator, June 2022 report)**




Earlier in 2023, several forecasters expected ACCU prices to significantly rise due to tightening legislated limits, increasing abatement costs, increasing adoption of net-zero targets and the relative price of carbon in Australia relative to comparable carbon markets.[7] Given this uncertainty we rely on external forecasts to project ACCU prices.

[5] See here.
[6] See here.
[7] See here, here and here for examples.

**Figure 2 NAB comparison of key carbon market prices in January 2023**




Source: World Bank (April 2022 nominal prices), National Australia Bank

**Valuing emission reductions: emission reductions**

Reducing emissions can also be valued based on their intrinsic value of supporting the achievement of Australia's and Western Australia's net-zero targets. This approach is consistent with the updated National Gas Objective, which will soon be adopted in WA.

To value this benefit we apply a figure developed by the NSW Treasury for use in cost benefit analysis. Due to the absence of a comprehensive Australia emissions market, it is derived based on the market price of carbon emission reductions in the EU emissions trading scheme (ETS). NSW Treasury noted that the EU ETS is the largest scheme in the world and has emission objectives which to a certain degree are comparable to Australia.[8]

This value is in the order of $130/tCO2e – which is higher than the current market price for an ACCU. This is not unsurprising given that, as shown in Figure 2, the ACCU prices are much less than prices seen in the EU ETS.

# 3. Options assessment

Three options have been considered:

- Option 1 – Status quo
- Option 2 – Install dry gas seals.
- Option 3 – Install dry gas seals and blow-down recovery system.

[8] Technical note to NSW Government Guide to Cost-Benefit Analysis TPG23-098 Carbon value in cost-benefit analysis. See here.

## 3.1. Option 1 – Status quo

The first option is to maintain the status quo and make no changes to the seals on the Wiluna compressor. In this option, the current risks relative to health and safety, operational capability, compliance and reputation and customer (as outlined in Table 3.1) will be maintained and no reductions in emissions will be achieved.

**Table 3.1 Risk Assessment – Status Quo**

| Risk | Threat | Likelihood | Impact | Residual risk |
|---|---|---|---|---|
| Health and Safety | Wet seal system failure leads to explosive mixtures in the oil reservoir due to absorbed flammable gases, leading to a significant fire or explosion. | Rare | Major | Low |
| Operational capability | Oil in pipeline leads to supply disruptions (either on the GGP or via damaging customer equipment) | Remote | Major | Moderate |
| Compliance | Oil in pipeline results in out of spec gas requiring negotiations with a customer | Minimal | Remote | Negligible |
| Reputation & Customer | Oil in pipeline leads to negative customer feedback | Unlikely | Significant | Moderate |

## 3.2. Option 2 – Install dry gas seals

In this second option the Wiluna compressor station is upgraded with the installation of dry gas seals and an air power system. This will also allow the compressor station to shift from gas powered to air powered instrumentation, actuation and to power the starter motor.

Removing the wet seal system will reduce all key risks (as outlined in Table 3.2) to negligible.

**Table 3.2 Risk Assessment – Install of dry gas seals**

| Risk | Threat | Likelihood | Impact | Residual risk |
|---|---|---|---|---|
| Health and Safety | Wet seal system failure leads to explosive mixtures in the oil reservoir due to absorbed flammable gases, leading to a significant fire or explosion. | Rare | Minimal | Negligible |
| Operational capability | Oil in pipeline leads to supply disruptions (either on the GGP or via damaging customer equipment) | Rare | Minimal | Negligible |
| Compliance | Oil in pipeline results in out of spec gas requiring negotiations with a customer | Rare | Minimal | Negligible |
| Reputation & Customer | Oil in pipeline leads to negative customer feedback | Rare | Minimal | Negligible |

Upgrading to a dry seal system and air power system will also reduce emissions.[9]

We estimate that the reduction will be around 2,475 tCO2e per year. This preliminary estimate is based on the current emissions of the wet seal system and assuming that the residual emissions from a dry gas seal (about 10%) are offset by the reduction in emissions from shifting from a gas power to air power system for instrument control etc. It does not include emissions from the increase electricity requirements for the air power system.

The present value of the emissions reduction (not including the value of any risk reduction) over a 15-year period is:

- $1.3 to $1.9 million, depending on the ACCU price forecast, if only the reduction in Safeguard Mechanism costs is considered.
- $3.5 million if the value of reducing emissions (based on the value estimated by the NSW Government) is applied.

This option costs $3.6 million in present value terms. Costs are based on an estimated cost of $4 million ($CY2023 incurred in CY2025) made up of a cost of $1 million for a new air system, $2 million to retrofit new dry gas seals, and $1 million for mobilisation, project management and installation (new pipework etc.). The upgrade of dry gas seals has a low deliverability risk (as vendors have retrofit packages available). However, the installation of the air power system introduces additional complexity and may require upgrades to the power system (such as to the busbar and motor control centre) which have not been included.

## 3.3. Option 3 – Install dry gas seals and gas recovery system

The third option to also install a fugitive gas recovery system along with the dry gas seals and air power system. This system captures fugitive gas emissions from both the dry gas seals and blowdowns, compresses the gas and injects it back into the gas stream.

[9] While emissions will be reduced, this will not be recognised until we move to a higher order method to more accurately calculate and report fugitive emissions.

Risks in this option are reduced to negligible, consistent with option 2 as the wet seals are removed. However, this option does increase operational complexity as these systems, while not new, are relatively recent developments in gas pipeline technology.

Compared to option 2, emissions will be reduced by an additional 648 $tCO_2e$ per year comprised of the capture of fugitive emissions from the dry gas seal (10% of 2,475 $tCO_2e$ ) and blow downs (401 $tCO_2e$). This estimate does not include the additional electricity requirements of the fugitive gas recovery system.

The present value of the emissions reduction (not including the value of any risk reduction) over a 15-year period is:

- $1.6 to $2.4 million, depending on the ACCU price forecast, if only the reduction in Safeguard Mechanism costs is considered.
- $4.35 million if the value of reducing emissions (based on the value estimated by the NSW Government) is applied.

The cost of this option is $5 million in present value terms [redacted] This cost is forecast to be incurred in 2025 in addition to the costs outlined in option 2.

## 3.4. Preferred option

The preferred option is to install dry gas seals at Wiluna with no gas recovery system (option 2) primarily due to reduction in risks from the removal of wet seals with additional benefits of reducing safeguard mechanisms costs and helping achieve Australia's emission reduction targets.

The reduction in emissions is difficult to value. It depends on whether you consider the intrinsic value of reducing emissions or solely the reduction in safeguard mechanism compliance costs. With the latter the value also depends on the forecast of ACCU prices. However, the range of values presented in Table 3.5 indicates that the value from reducing emissions is substantial.

As in both option 2 and option 3 wet seals (and their associated risks) are removed, the decision comes down to the marginal value the reduction in risk and cost of installing a fugitive emission recovery system. At this stage the costs exceed the benefits so option 2 is preferred. This may change in the future if operational factors mean that emissions increase, the costs of the technology fall as they mature of the ACCU prices rise.

**Table 3.3 Cost comparison ($millions, $2023)**

| Option and Description | Cost estimate | Present value of costs[10] |
|---|---|---|
| 1. Status quo | - | - |
| 2. Install dry gas seals | 4.0 | 3.62 |
| 3. Install dry gas seals and gas recovery system | 5.5 | 4.97 |

[10] 5.18% WACC discounted the capex incurred in CY25 back to CY23.

**Table 3.4 Risk comparison ($millions)**

| Option and Description | Health and safety | Operational capability | Compliance | Reputation and customer |
|---|---|---|---|---|
| 1. Status quo | Low | Moderate | Negligible | Moderate |
| 2. Install dry gas seals | Negligible | Negligible | Negligible | Negligible |
| 3. Install dry gas seals and gas recovery system | Negligible | Negligible | Negligible | Negligible |

**Table 3.5 Present value of emission reductions 15-year timeframe ($millions, $2023)**

| Option | Annual emission reductions (tCO2e) | Present value of emission reduction | Value in the reduction of safeguard costs | | |
|---|---|---|---|---|---|
| | | | Low ACCU | Central ACCU | High ACCU |
| 1. Status quo | - | - | - | - | - |
| 2. Install dry gas seals | 2,475 | 3.45 | 1.30 | 1.59 | 1.88 |
| 3. Install dry gas seals and gas recovery system | 3,123 | 4.35 | 1.64 | 2.01 | 2.34 |

## 3.5. Consistency with the National Gas Rules

The preferred option meets the requirements of Rule 79 and is conforming capital expenditure.[11]

**Prudent and good industry practice**

Installing dry gas seals is accepted good industry practice and, together with the realisation of emissions reductions benefits (and lower safeguard mechanisms costs) achieves the lowest sustainable cost of providing services.[12]

The removal of wet seals will improve the safety of services[13] and improve the reliability of services (through lower gas in pipeline events) thereby helping maintain the integrity of the pipeline as well as capacity to meet the current levels of demand for services.[14]

The reduction in emissions will also deliver economic value to consumers, through the reduction in opex (from lower safeguard costs) and in terms of helping reduce emissions to achieve Australia's carbon reduction targets. While the value from reducing emissions does not exceed the cost of the project the overall value is positive when the reduction in risk is also taken into account.[15]

[11] The allocation of costs between the notional covered and uncovered GGP pipelines is addressed separately.
[12] Rule 79(1)(a)
[13] Rule 79(2)(c)(i)
[14] Rule 79(2)(c)(ii) and (iv)
[15] Rule 79(2)(a)

**Efficient**

GGT/APA tenders the provision of compressor station works on a competitive basis. The works will be subject to APA procurement policies. The works will be carried out by external contractors who demonstrate specific expertise in completing the installation of the facilities in a safe and cost-effective manner. The expenditure can therefore be considered consistent with the expenditure that a prudent service provider acting efficiently would incur.

**To achieve the lowest sustainable cost of delivering pipeline services**

Installing dry gas seals is a cost-effective solution that will reduce oil in gas risks, reducing costs to customers and the GGP. It will also reduce emissions and in turn the cost of purchasing ACCU's under the safeguard mechanism.