

# Appendix 2.5

Unaccounted for gas forecast

Prepared by Jemena for Evoenergy

Access arrangement information

ACT and Queanbeyan-Palerang gas  
network 2021–26

Submission to the Australian Energy Regulator

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# Evoenergy

## 2021-26 Access Arrangement Proposal

Attachment 2.5

Unaccounted for gas



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## Abbreviations

AA	Access Arrangement
AER	Australian Energy Regulator
CTM	Custody Transfer Meter
CTS	Custody Transfer Station
DAMS	Distribution Asset Management agreement
EGP	Eastern Gas Pipeline
HWGM	Howard Wright Gas Measurement Pty Ltd
I&C	Industrial and Commercial
JGN	Jemena Gas Networks
kPa	Kilopascals
KPMG	KPMG Australia Pty Ltd
NGR	National Gas Rules
Opex	Operating expenditure
SUG	System Use Gas
TJ	Terajoule
UAG	Unaccounted for Gas

## Overview

As part of its Access Arrangement (AA) proposal, Evoenergy is required to provide a forecast of its operating expenditure (opex). One of the elements of Evoenergy's opex, is the cost of Unaccounted for Gas (UAG). This document provides a summary of Evoenergy's UAG performance and provides an overview of how we report and manage UAG across the network. It also sets out Evoenergy's UAG proposal for the 2021-26 period.

UAG is the difference between the quantity of gas that is measured entering the network at custody transfer stations (receipts) and the quantity of gas that is measured leaving the network (deliveries). This difference is effectively "lost" or "unaccounted for". UAG is generally expressed as a percentage of receipts into the network and allows UAG levels to be viewed in terms of efficiency and appropriately benchmarked between various networks. Evoenergy is required to replace UAG under the terms of its Access Arrangement – effectively replacing gas that belonged to the Users of the network that has not been delivered to their customers.

Jemena manages the UAG as part of the services provided to Evoenergy under the Distribution Asset Management (DAMS) agreement. The underlying causes for UAG arise from gas measurement, calculation errors and physical losses. However, an important consideration when seeking to understand and manage UAG is the significant uncertainty around the estimates of the factors contributing to UAG as they cannot be directly measured and inferences about any particular source of UAG are difficult to make, despite best efforts to do so. This significant uncertainty is accepted in the gas industry.

Jemena Gas Networks (JGN) engaged an industry expert, Howard Wright Gas Measurement Pty Ltd (HWGM) to undertake an independent review of JGN's UAG performance which included a review of the methodology to calculate UAG, an opinion on UAG efficiency compared to other gas distribution networks and the processes for managing UAG. HWGM concluded that the methodology, approach and processes with UAG performance were in line with good industry practise. In turn, KPMG were also engaged to undertake an independent review of JGN's UAG data processing and UAG calculation within the enterprise reporting system, SAP. Based on its review, KPMG did not find any errors with JGN's UAG calculation. Both reviews by HWGM and KPMG on JGN's UAG performance and data processing can be inferred to Evoenergy's UAG performance and data processing.

Evoenergy's UAG level has increased from the prior Access Arrangement period from around 1.96 per cent to a four year average of 2.49 per cent. Analysis of UAG data demonstrates that Evoenergy's UAG is largely attributable to measurement related issues, rather than leakages on the network. This is supported by the effect of the balance of supply into the network between its two receipt points on the level of UAG.

Accordingly, the four year historical average of 2.49 per cent of gas receipts has been applied as the forecast for UAG for the 2021-2026 Access Arrangement Period. This approach is consistent with the requirement of Rule 91 of the National Gas Rules (NGR) that states, "*opex must be such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of delivering pipeline services*".

## 1. Introduction

As part of its Access Arrangement proposal, Evoenergy is required to provide a forecast of its operating expenditure (opex). One of the elements of Evoenergy's opex, is the cost of Unaccounted for Gas (UAG).

UAG is the difference between the quantity of gas that is measured entering the network at custody transfer stations (receipts) and the quantity of gas that is measured leaving the network (deliveries). This difference is effectively "lost" or "unaccounted for". UAG is generally expressed as a percentage of receipts into the network and allows UAG levels to be viewed in terms of efficiency and appropriately benchmarked between various networks.

Evoenergy is required to replace UAG under the terms of its Access Arrangement – effectively replacing gas that belonged to the Users of the network that has not been delivered to their customers.

Rule 91 of the NGR requires that, "*opex must be such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of delivering pipeline services*". In the case of UAG, Evoenergy may only include the cost of UAG that is prudent and efficient and will deliver the lowest sustainable cost.

Jemena manages UAG as part of the services provided to Evoenergy under the Distribution Asset Management (DAMS) agreement.

## 2. Background of UAG

### 2.1 Sources of UAG

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The efficiency of Evoenergy's UAG is best understood by considering what contributes to UAG. The causes for UAG can be grouped into gas measurement and calculation errors and physical losses:

- Measurement and calculation errors:
  - metering uncertainty<sup>1</sup> in receipt meters
  - metering uncertainty in delivery meters - both high and low capacity meters
  - degradation of meter accuracy
  - measurement uncertainty, due to heating value allocation
  - measurement uncertainty, in the calculation of the fixed factor(s) used for billing, including errors incurred due to atmospheric pressure and temperature changes
  - measurement period errors
  - billing estimation
- Physical losses:
  - leakage, due to:
    - integrity of materials
    - network damage
  - theft
  - unmeasured gas used for operational purposes.

Further explanation of each error or loss is provided below.

#### 2.1.1 Measurement error

##### Receipt meter uncertainty

- Receipt meters or Custody Transfer Meters (CTM) are installed at points where Evoenergy accepts gas into the network. The size and complexity of these meters varies subject to the volume of gas being receipted into the network (or network section). Typically, these meters operate in the range of +/- 0.5% (volumetric error) and are subject to validation checks on an annual basis.

##### Delivery meter uncertainty

- Low capacity meters – These are the meters that supply our volume market customers, which include residential, commercial and small industrial customers. These meters typically have an accuracy range of +/-1.5% to +/-2% (volumetric error).

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<sup>1</sup> Metering uncertainty is often called metering error because it is the difference between the amount measured and the true measurement which cannot be known.



- High capacity meters – These meters are used at large (demand market) customers. As these meters record larger volumes of gas, meters of a higher specifications are utilised providing more accuracy than the low capacity meters. Subject to their size and type, these meters generally operate in the range of +/- 0.5% to +/- 1% (volumetric error).

#### Degradation of meter accuracy

- The typical life of a customer meter ranges from 5 to 25 years. High capacity meters, such as turbine and rotary meters are used for large demand market customers, and are typically replaced after five (turbine meters) to 10 (rotary meters) years. While they generally remain within the accuracy requirements set by technical regulations<sup>2</sup>, aging does cause meter degradation. These meters tend to read 'slow' as they age. Diaphragm meters are used for volume market customers and are replaced after 15 to 25 years. As they degrade they may either read 'fast' or 'slow', although they have an inherent bias to read slow.

#### Measurement uncertainty (metrology errors)

- Heating value allocation uncertainty. The heating value is one of the key factors (alongside pressure and temperature) used to convert volumetric quantities into energy quantities<sup>3</sup>.
  - There are two different sources of gas entering the network and they have differing heating values. While the application of a single heating value to delivery meters is a practical approach to characterising the heating value of delivered gas, it has an inherent impact on the accuracy of measurement of gas deliveries, subject to the operational and seasonal requirements at each source.
- High capacity meters – high capacity meters incorporate temperature and pressure measurement equipment. The combination of the errors in each of the contributing measurements allows a high capacity meter to be accurate to within +/- 1.5% of the true quantity being measured.
- Low capacity meters – to convert the volume measured to an energy quantity for low capacity meters, a fixed factor is used to adjust for temperature and pressure (both the pressure delivered to the customer gas system and the effect of barometric pressure).
  - The element of the fixed factor relating to the delivery pressure is based upon the pressure set by the regulator device on the meter.
  - The element of the fixed factor relating to temperature and barometric pressure is based on published long-term averages from the Bureau of Meteorology.

While these corrections are essential for maximising the accuracy of gas measurement, they are imperfect representations of the conditions at each customer's meter, because actual monthly temperatures will vary from the historical average and the temperatures at a single location will be an imperfect proxy for the actual temperatures of gas passing through a customer's meter. The same is true of barometric pressure. As a result there is an inherent additional uncertainty in the measurement of gas being delivered from the network.

#### Measurement period errors

- Meters in the network are read at different intervals. For example large network customers are read daily, whereas small domestic customers are read on a three monthly cycle. In order to calculate UAG, these periods need to be aligned and, in the case of the domestic customers, the readings need to be interpolated into smaller periods (ie months). This process includes a degree of estimation which introduces errors into the calculation.

#### Billing estimation

- Where meters are unable to be read, or are known to be faulty, the flow through the meter may be estimated and the bill created accordingly. Any estimation of gas consumption introduces errors into the UAG calculation.

<sup>2</sup> ACT General Gas Metering Code is the regulation governing metering.

<sup>3</sup> Gas is measured on a volumetric basis (that is, m<sup>3</sup>) but is converted to energy (that is, GJ) for billing purposes.

- The failure of meters can lead to them not registering flow. These are referred to as “non-registering meters”. A significant proportion of non-registering meters are identified and replaced after one or more billing cycles, although some may not be identified for some time.<sup>4</sup> Where a non-registering meter is identified, an estimate is applied to the gas consumption.

#### Unread consumption

- In a small number of instances, meters may be installed but not correctly recorded and hence not be part of the reading/billing cycle.

### 2.1.2 Physical losses

#### Leakage<sup>5</sup>

- Integrity of materials – the Evoenergy network commenced operation in 1982 and is constructed with modern steel and plastic technology and so has relatively low levels of leakage. The majority of leakage from modern plastic networks is from small above ground leaks around the deterioration of meters and corresponding fittings, which are relatively easily detected and rectified.
- Network damage - while Evoenergy’s network is designed to limit third party damage through participation in the ‘Dial before you dig’ service and patrols of its high pressure networks, third party impact can occur and contributes to UAG.
- Leakage from the high pressure pipelines is considered to be zero for practical purposes with the exception of some gas escape during maintenance. Small amounts of leakage may occur from above ground flanges and fittings, however, these are easily detected and rectified.

#### Theft

- Theft is considered to be uncommon, due to the inherent hazards of unskilled work with gas. This element is particularly hard to both detect and estimate. Theft is typically the bypassing or partial bypassing of a gas meter.

#### Operational usage

- Meter regulator venting. Meter regulators incorporated in both network pressure control equipment and customer pressure control equipment can vent during some operational circumstances (such as pressure surges or temperature effects). The gas released from such venting is generally only small in quantity and is unmeasured.
- Operational usage, such as venting. A small amount of gas is lost from the systems during maintenance and operational activities.
- System Use Gas (SUG) is used for operational purposes for water bath heaters within gas facility compounds. This is measured separately and is excluded from UAG.

## 2.2 UAG Calculation Uncertainty

An important consideration when seeking to understand and manage UAG is the significant uncertainty inherent in the calculation of UAG (as identified above). This is accepted in the gas industry.

With respect to the measurement related causes, these uncertainties are unavoidable because of limitations associated with any measurement process. Even the most accurate metering systems cannot provide an accuracy of better than +/- 1%. Typically the cost of improving the accuracy of any of these elements is far greater

<sup>4</sup> For example, some customers only use gas for heating, so it is not unusual to have no consumption for these meters over the warmer months. This means that it may take longer to identify a non-registering meter.

<sup>5</sup> Many of the items of leakage identified here are very small volumes and are generally not considered a safety risk. The use of odorant provides for most leaks to be detected well before a safety issue arises.

than any benefit. Industry practice has determined the efficient levels of accuracy for each of these elements over many years of gas industry operation.

Similarly, estimating gas losses from the network from leakage, operational use and theft involves from high levels of uncertainty. While there is some scope to estimate gas lost from leakage, purging and filling mains and when there is a third party hit, estimates will be only order of magnitude level estimates. The cost of improving the estimates would significantly outweigh any benefit, which can be expected to be small.

## 3. UAG Performance

### 3.1 Management of UAG

Jemena actively monitors and manages Evoenergy's UAG to ensure that it is maintained at an economic level. The management of UAG is multi-faceted and targeted at each of its sources. Management of UAG is overseen by a senior cross-functional management committee.

#### UAG Management Oversight

Jemena has a senior management committee whose scope is to review ongoing quantity and cost of UAG. The key objectives of the committee are to ensure that:

- the quantity of unaccounted for gas is minimised consistent with minimising total cost
- controls are in place to accurately capture, monitor and report UAG

The committee meets at least nine times per year and its membership is comprised of senior managers from across the business.

Monitoring and reporting of UAG is undertaken on a monthly basis, with investigations conducted as required to ensure UAG performance is maintained within acceptable thresholds.

#### 3.1.1 Activities to manage measurement errors

Jemena undertakes a range of activities and programs to manage measurement error.

##### Metering uncertainty (volumetric errors) and degradation of metering accuracy

- Meter testing to confirm accuracy – Jemena undertakes meter type and batch testing of meters and meter repairs to ensure compliance with applicable accuracy standards. Jemena applies meter sizing charts to ensure that the meter size is appropriately matched to customer loads in the network. All turbine and rotary meters are tested at 5 and 10 years respectively to confirm accuracy prior to refurbishment.
- Validation programs – Jemena undertakes validation program of Custody Transfer Station (CTS) meters by obtaining calibration results and witness testing third party CTS meter calibrations.
- Aged and planned meter replacement program:
  - Statistical meter testing program – samples of meters are removed for testing and results are analysed and are applied to populations by age, meter type and manufacturer.
  - Meters are replaced once they reach an age when there is insufficient confidence of meter accuracy. This may be up to 30 years where statistical analysis demonstrates that meters remain accurate.
  - Resizing of industrial and commercial (I&C) meter sets when the flow rates through the meters are either greater or less than the accurate range.
  - Replacement of I&C rotary and turbine meters is more frequent than for smaller meters to minimise metering error.
- Defective review and response – Defective meters are examined under the field failure program to identify any trends which would result in loss of accuracy or failure. Defective meter removal statistics are reviewed periodically to identify any failure or inaccuracy issues resulting from type failure.

### Measurement uncertainty (metrology errors)

- Pressure and temperature corrections are applied to large consumers. Jemena undertakes reconciliations of pressure correction factors recorded in the asset management system and metering/billing system to ensure there have been no administrative errors in billing consumption details.
- Jemena undertakes planned maintenance on meter sets operating 15kPa and above, including calibration of temperature and pressure transducers.
- Gas heating value for the network is measured at the two receipt points and a volume weighted value is applied across the networks as one heating value zone.
- Fixed factor billing is reviewed against Bureau of Meteorology data on a periodic basis.

### Billing estimation and profiling

- Meters that under-record consumption are detected in the billing system. In the first instance an estimate of consumption is applied and the meter is flagged for replacement.
- Ongoing review of large consumers - meter data is analysed on an individual meter basis to identify changes in consumption patterns that could result in UAG.
- Daily metered customer data is monitored to detect any indications of plant breakdown or incidence of faulty equipment.
- Contractors carrying out calibration and maintenance of daily metered sites are subject to audit, to ensure that they perform in accordance with required standards.
- Incorrect or missing data is substituted with estimated or recovered actual data, to ensure that the measurement of total UAG is as accurate as possible.

### 3.1.2 Activities to minimise losses

Key activities to minimise losses of natural gas from the network include:

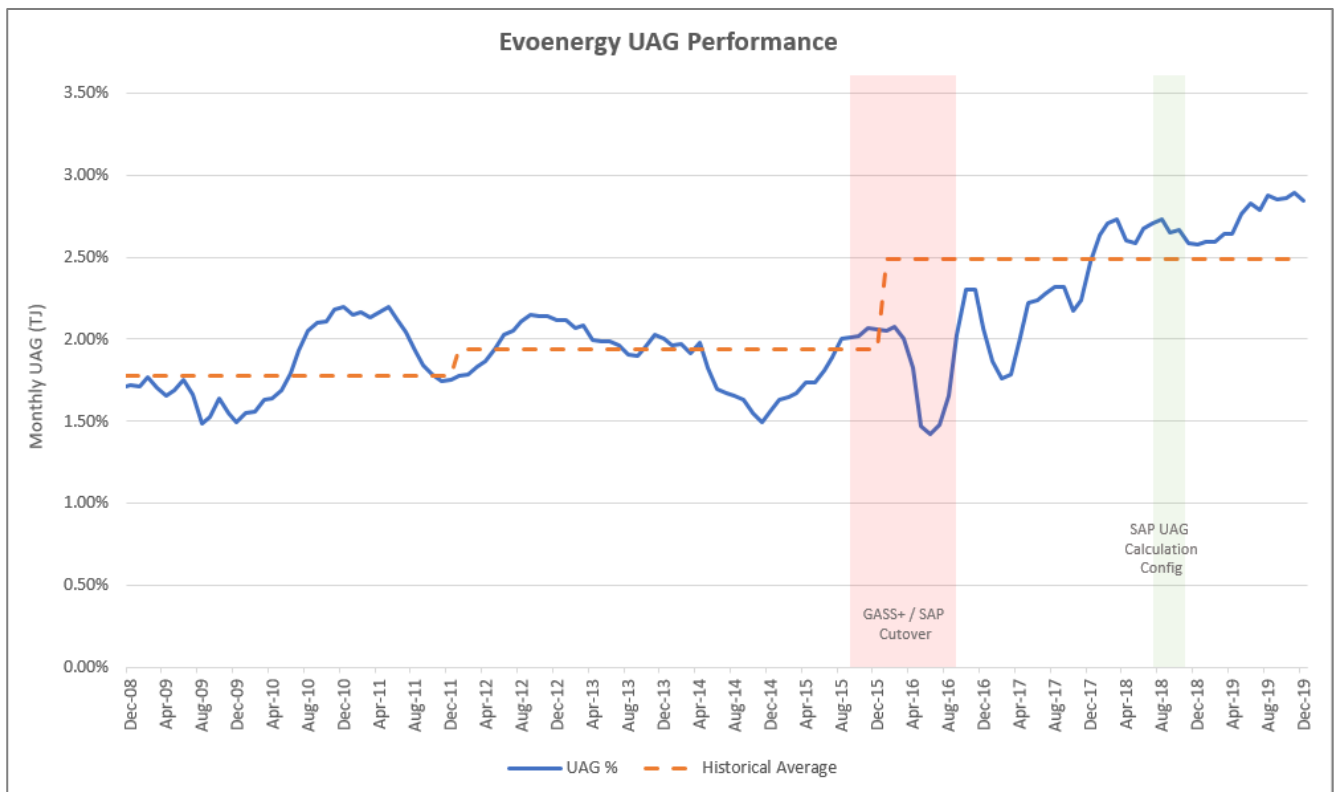
- Prompt responses to all gas escapes and undertake repairs immediately where gas leaks are found
- Replacement of customer meter regulators with minor leaks
- Five yearly leakage survey which is used to inform mains repair
- Quality construction (joining of steel and plastic) to ensure joints are leak tight
- Continuous monitoring of all meters purchased but not yet installed and flowing gas to ensure all installed meters are read and billed.

## 3.2 Historical pattern of UAG levels

Evoenergy's UAG performance reflects that it is a modern network with no cast iron or unprotected steel mains. Mains are constructed of cathodically protected welded steel mains for high pressures (ie: 1,050kPa and above) and fused plastic pipe operating at medium pressure (300kPa and below). The result is that leakage is a much smaller component of UAG than older networks that have cast iron and unprotected steel mains.

Figure 3–22 shows Evoenergy's historical pattern of UAG levels.

Up until December 2015, UAG was close to 1.96 per cent which was allowed by the AER for the current 2016-2021 Access Arrangement (AA) period. However, due to the impacts of an enterprise reporting system change and a calculation configuration within that system, there has been increasing volatility in the rate of UAG over the current AA period.



**Figure 3-2 : Evoenergy's UAG Performance**

Commencing in July 2015, Jemena transitioned from its GASS+ enterprise reporting system to a new SAP system. UAG reporting transferred from GASS+ to SAP at that time with the calculations for JGN and Evoenergy transferring. Cutover between the two systems took place in two stages, the second being in May 2016, after which GASS+ was decommissioned. Inaccuracies in UAG reporting within SAP were identified in mid-2016, and investigations to identify and correct reporting errors were carried out. Due to the complex nature of the UAG calculation methodology, multiple fixes to correct the errors in SAP were only finalised in late 2018. Once the SAP fixes were effected, there was a step change in reported UAG.

To ensure the methodology, processes, and current UAG levels were comparable to other Australian gas distribution networks, JGN engaged an industry expert, HWGM, to undertake an independent review of JGN's UAG performance and management, but also engaged KPMG to review UAG data collection, data processing and calculations within our enterprise reporting system, SAP.

HWGM's review<sup>6</sup> concluded that :

- JGN's methodology and approach to calculating and reporting UAG is appropriate and in line with good industry practise; and
- JGN's processes for managing the various factors that may influence UAG are appropriate and in line with good industry practise.

HWGM's review also included JGN's UAG comparison with other Australian gas distribution networks. Refer to Figure 5 of HWGM's review<sup>7</sup>, where Network 'H' represents Evoenergy's UAG % from Energy Networks Australia's (ENA) benchmarking analysis (2019). Despite the increase Evoenergy's UAG, it is still within the expected range and is comparable to other distribution networks<sup>8</sup> (normal range of 1.5% to 4% for Australian gas networks).

<sup>6</sup> See Attachment 6.8 of HWGM's review of Jemena's UAG for the 2020-2025 Access Arrangement proposal.

<sup>7</sup> See Figure 5 of Attachment 6.8 of HWGM's review of Jemena's UAG for the 2020-2025 Access Arrangement proposal.

<sup>8</sup> See Figure 5 of Attachment 6.8 of HWGM's review of Jemena's UAG for the 2020-2025 Access Arrangement proposal.

KPMG's review<sup>9</sup> concluded that :

- JGN's daily quantity consumption figures (grouped by month) agreed with KPMG's calculations (0.002% variance);
- JGN's UAG percentage by month and rolling 12 month period calculations agreed with KPMG's calculations (0.003% & 0.004% variance); and
- JGN's normalisation of raw data into standardised energy content agreed to KPMG's calculations (0.1% variance).

We also updated Evoenergy's approach for UAG data to the most recent available data up to December 2019 utilising the calendar year and not regulatory year. This approach is consistent the approach taken by Frontier Economics to derive the UAG targets for JGN's Access Arrangement proposal.

Hence, with two independent reviews of JGN's UAG calculation (as above) following a major system change, this supports and confirms that the UAG data flows, data processing, methodology, calculations and comparability with other Australian gas networks is correct and in line with god industry practise. The same data flows, methodology, calculations are utilised for Evoenergy's UAG calculation which is also shown to be comparable to other Australian gas networks. Importantly, the UAG is primarily attributable to measurement errors, rather than physical losses from the network and therefore it is reasonable that our proposed UAG levels are included in our operating expenditure allowance.

### 3.3 Evoenergy's UAG is largely measurement driven

UAG as a result of leakage, operational use or theft is unrelated to the level of network throughput. Therefore, any correlation between throughput and UAG is generally a product of uncertainty in measurement. The following Figure 3-3 Evoenergy's Monthly UAG vs Monthly Total Receipts, shows the relationship between UAG quantities (ie: in TJ's, not as a percentage of receipts) and total network receipts. Clearly, there is a very strong relationship between the quantity of UAG and network throughput with the quantity of UAG closely following the quantity of gas receipts.

<sup>9</sup> See Attachment 6.11 of KPMG's report of Jemena's UAG for the 2020-2025 Access Arrangement proposal.

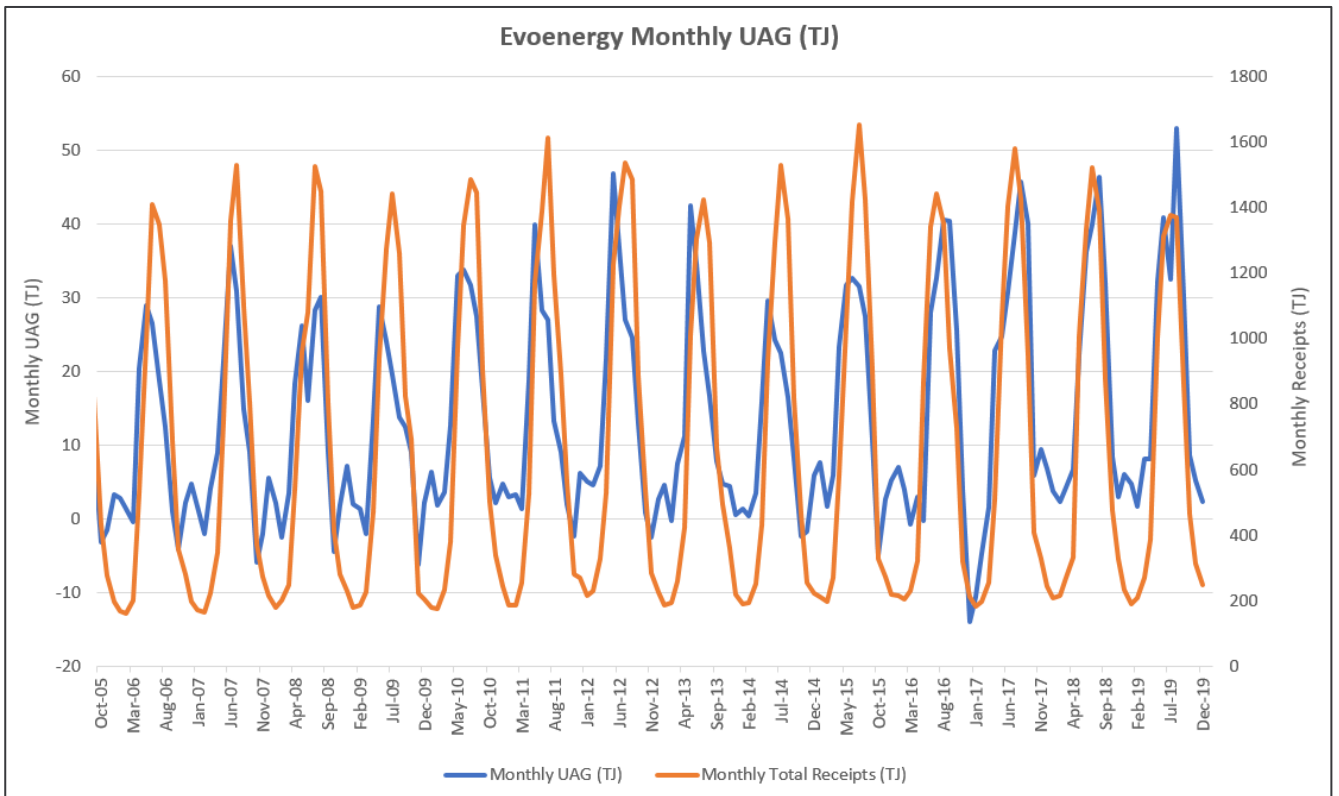


Figure 3-3 : Evoenergy’s Monthly UAG vs Monthly Total Receipts



## 4. Proposed UAG Level for the 2021-26 Period

An important consideration when seeking to understand and manage UAG is the significant uncertainty around the estimates of the factors contributing to UAG as they cannot be directly measured and inferences about any particular source of UAG are difficult to make, despite best efforts to do so.

JGN, as part of their 2020-2025 Access Arrangement proposal recently engaged HWGM<sup>10</sup> and KPMG<sup>11</sup> to undertake an independent review of their UAG data processing, methodology, calculation and reporting within the enterprise reporting system, SAP. Based on its review, HWGM and KPMG concluded that they did not find any errors with JGN's UAG calculation, methodology and approach, and is appropriate in keeping good industry practice. The same review can be inferred to Evoenergy's UAG calculations, data processing and reporting.

Evoenergy's UAG level has increased from the prior Access Arrangement period from around 1.96 per cent to a four year average of 2.49 per cent. Analysis of UAG data demonstrates that Evoenergy's UAG is largely attributable to measurement related issues, rather than leakages on the network. This is supported by the effect of the balance of supply into the network between its two receipt points on the level of UAG.

Jemena on behalf of Evoenergy, propose that the four year historical average of 2.49 per cent of gas receipts be applied as the forecast for UAG for the 2021-2026 Access Arrangement Period. The 2016-2021 allowance was forecast using historical UAG rates over the 2010-2014 period.

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<sup>10</sup> See Attachment 6.8 of HWGM's review of Jemena's UAG for the 2020-2025 Access Arrangement proposal

<sup>11</sup> See Attachment 6.11 of KPMG's review of Jemena's UAG for the 2020-2025 Access Arrangement proposal