Australian Gas Networks

Submission on Calculation of new Unaccounted for Gas Benchmarks

Victorian and Albury Networks

August 2017

Contents

1. About this Submission

1.1. Introduction and Executive Summary

Australian Gas Networks Limited (AGN) is one of the largest natural gas distributors in Australia. We deliver natural gas to around 650,000 customers connected to our Victorian and Albury networks.

We welcome the opportunity to make a submission to the Essential Services Commission (the Commission) on the "*Calculation of the new Unaccounted for Gas Benchmarks"*. We understand that the Commission will review submissions received and publish a draft decision by the end of September 2017.

In its Final Decision "*Review of Unaccounted for Gas Benchmarks, Final Decision - Methodology*" (FD - Methodology), we understand the Commission has determined the following methodology to calculate the Unaccounted for Gas (UAFG) benchmarks:

1 the use of the revealed cost approach with a multi-year average;

2 the use of actual UAFG data that has been settled by distributors and retailers to calculate the UAFG benchmarks;

3 not to account for possible reductions in UAFG resulting from the distributors' mains replacement programs;

4 not to account for possible increases in UAFG caused by the continued deterioration of the distributor networks;

5 consider whether there are any efficiencies that can be achieved by distributors, and may decide to adjust the forward benchmarks accordingly; and

6 to retain separate UAFG benchmarks for class A and class B customers.

AGN is generally supportive of most aspects of the Commission's overall approach. However, AGN has a number of concerns with the methodology and process. In particular, AGN does not support a requirement that the use of actual UAFG data that has been settled by distributors and retailers is required to calculate the UAFG benchmarks. There are a number of potential problems with the use of only settled data in the context of the calculation of benchmarks for the 2018 to 2022 period, including the following:

1 In AGN's submission, it is important for benchmarks to be based on the most recent data available in order to meet the objectives in sections 8 and 8A of the *Essential Services Commission Act 2001* (**ESC Act**). Using out of date data to set the benchmark for 2018 to 2022 is, among other things, unlikely to promote the long term interests of Victorian consumers and achieve the objectives of efficiency in the industry and incentives for long term investment.

2 The process for agreeing the required data can be lengthy and, in AGN's submission contrary to the FD – Methodology, there is little incentive for the party incurring a penalty to settle the data. Importantly, as is demonstrated in this submission, the settlement process does not result in any material change to total UAFG as advised by the distributors to the retailers. The changes, to the extent they occur, relate to the allocation of UAFG (and hence payments or penalties) between retailers.

3 AGN's settled data is currently only available up to 2013. AGN is working with retailers to finalise the data for 2014 and 2015. Under AEMO's "*Wholesale Market Distribution UAFG Procedures (Victoria) Version 3.0"*, retailers were required to reach agreement with AGN by 10 August 2017. However, despite repeated efforts on AGN's part, five retailers for 2014 and seven retailers for 2015 have not yet reached agreement as at the date of this submission. Whilst AEMO has the power to investigate a retailer's compliance with the "*Wholesale Market Distribution UAFG Procedures (Victoria)"* under the National Gas Law[1], AGN does not have any ability to do so and to otherwise enforce compliance.

4 The use of settled data up to and including 2013 is highly likely to result in a UAFG benchmark that is not reflective of the most recent conditions of AGN's network. This is because AGN experienced higher UAFG in 2014 and 2015 compared with earlier years. The impact on the benchmarks to be set for AGN is likely to be material.

5 Given the above, the most recent data should be used to calculate the UAFG benchmarks pursuant to the FD – Methodology. In AGN's case, not doing so could result in data that is 12 years old at the end of the 2018 to 2022 period being used. Such an outcome:

- unnecessarily relies on information that is no longer relevant and reflective of current network conditions, which problem was noted by the Commission in its DD – Methodology;
- is unwarranted given the data is not unreliable and does not materially change once issued by AGN;
- is inconsistent with the intended incentive properties of the benchmark;
- undermines confidence in the key benchmarks underpinning the Victorian regulatory regime;
- it follows that a benchmark based on this data will not be in the long term interest of consumers (and contrary to the requirements of the Essential Services Commission Act 2001).

6 AGN submits that the calculation of its 2018 to 2022 benchmarks should use 2013 to 2015 data based on:

- settled data for 2013; and
- in respect of 2014 and 2015, data agreed between AGN and retailers be used where available, with unsettled data used in respect of those retailers who have not complied with the *Wholesale Market Distribution UAFG Procedures (Victoria)*, by the date of the draft decision. In circumstances where AGN is unable to enforce compliance by the retailers with those procedures, AGN's proposed methodology will incentivize those retailers to settle the data in a timely fashion with AGN before a final decision is issued by the Commission.

The above methodology will result in a UAFG benchmark of 4.0% for class B to be applied over the 2018 to 2022 period. We are not proposing to change our class A Albury or Victoria benchmarks or our non-DTS benchmark for the 2018 to 2022 period.

[1] Refer National Gas Law, sections 91BM and 91BN.

1.2. Purpose of this submission

This submission on the calculation of the UAFG benchmarks includes:

- actual UAFG data that has been used to calculate UAFG benchmarks;
- a detailed assessment of the causes of UAFG to support our respective UAFG benchmark proposals;
- a detailed explanation of how we have efficiently sought to reduce UAFG levels during the 2013 to 2017 regulatory period; and
- a comprehensive strategy for how we will seek efficiencies to minimise UAFG levels during the 2018 to 2022 regulatory period.

The purpose of this submission is to provide the Commission with all the relevant information to set the UAFG benchmarks for the next (2018 to 2022) Access Arrangement (AA) period.

This submission also addresses the proposed amendment to clause 2.4(b) of the Gas Distribution System Code (GDSC).

1.3. Our Vision: To Be the Leading Natural Gas Distributor in Australia

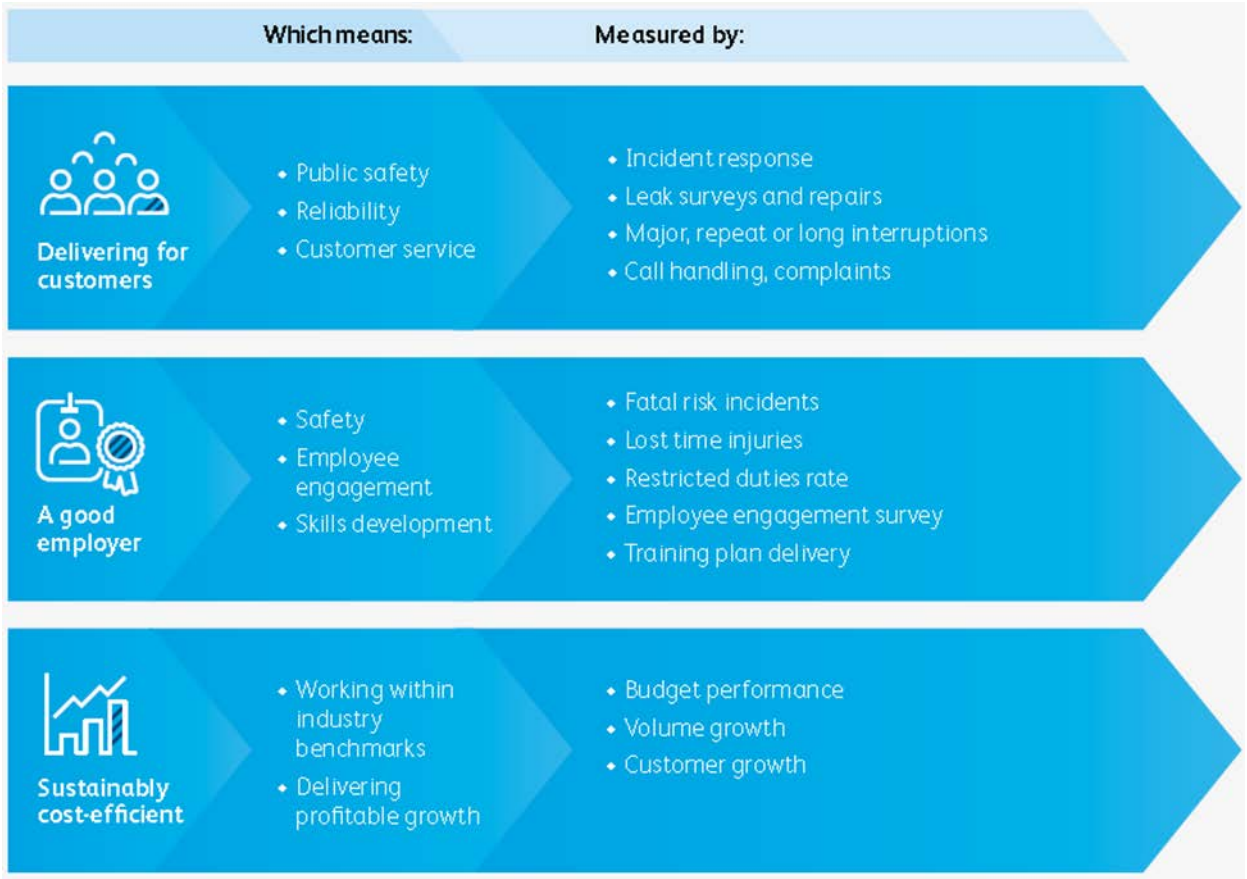
Our aim is to be the leading natural gas distributor in Australia. Our definition of leading is to achieve top quartile performance compared to other Australian natural gas distributors across all of our key targets. Our Vision sets out the following three key objectives that we consider are consistent with being the leading natural gas distributor in Australia:

- *Delivering for Customers* – which means ensuring public safety and the provision of high levels of network reliability and customer service;
- *A Good Employer* – which means ensuring the safety of our employees (including contractors), ensuring employees are motivated to achieve our Vision and receive appropriate training; and
- *Sustainably Cost-Efficient* – which means undertaking the required work within the allowances set by the Australian Energy Regulator (AER) while growing the network in a prudent and efficient manner.

We communicate our Vision to all key stakeholders, such as employees/contractors, governments, regulators, investors and our customers. Importantly, all of the objectives set out in our Vision are measured, including in most instances against the performance of our industry peers. We also publicly report on our performance under our Vision, most recently in our 2016 Annual Review, and use it to drive ongoing improvements in our performance.

Figure 1.1 details our Vision and how we measure our performance.

Figure 1.1: Our Vision Statement



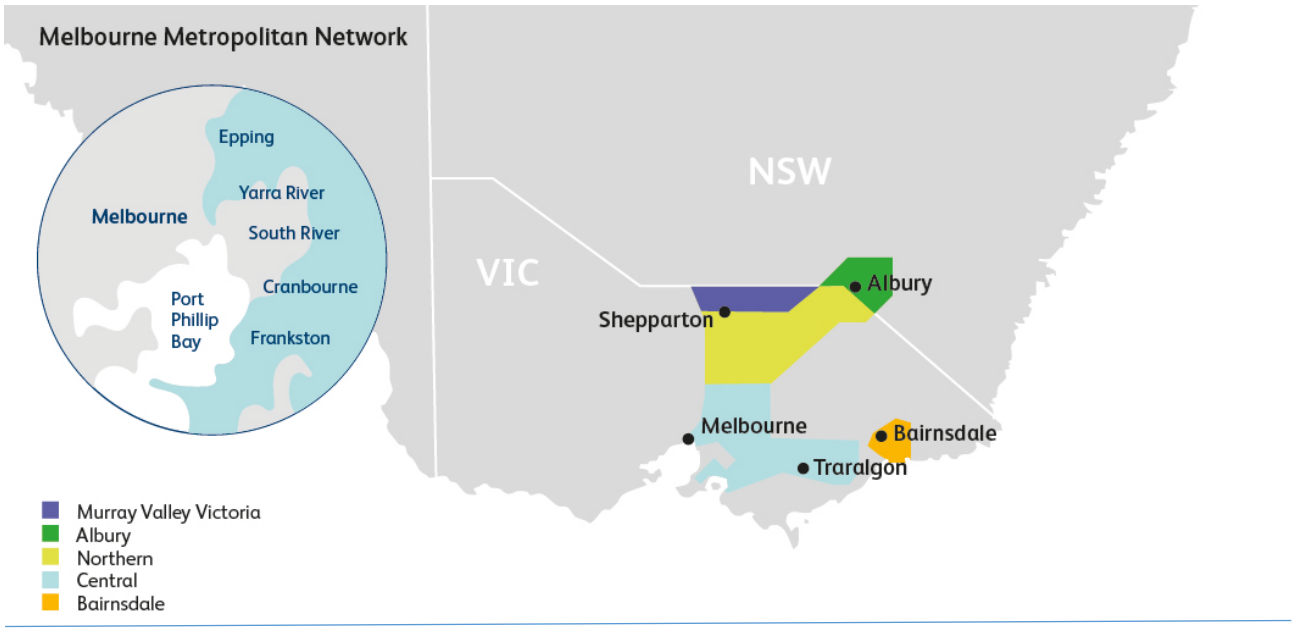
1.4. Description of the Networks

Figure 2.4 describes the location and key features of our Victorian and Albury networks. Our networks supply close to 650,000 customers through around 11,000 kilometres of predominantly distribution mains. Our networks are located in the city of Melbourne, inner and outer northern suburbs of Melbourne, outer eastern and southern areas of Melbourne, surrounding regional areas (including through to the Mornington Peninsula) and Albury (see Figure 1.2).

The two networks are interconnected, with the Albury network fed from the northern zone of the Victorian network.[2]

[2] Further information on our network can be found on our website at: www.australiangasnetworks.com.au.

Figure 1.2: Area Covered by our Victorian and Albury Networks



Note: Regulated networks only.

2. UAFG Performance and Proposed Benchmarks

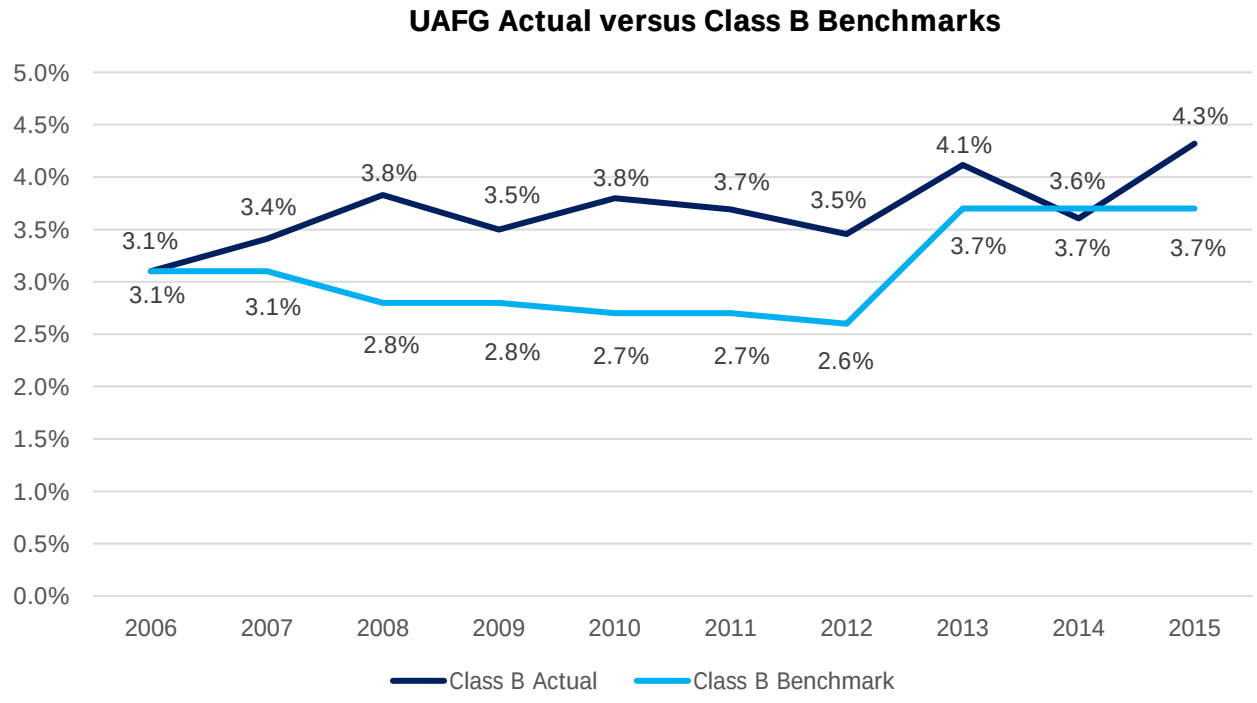
This section provides an overview of our historical UAFG performance and the proposed benchmarks for our Victorian and Albury networks.

2.1. Historical Performance

The current UAFG class B benchmark for the 2013 to 2017 period is 3.7% per annum. The Commission derived these benchmarks based on a three year average of our actual UAFG from 2008 to 2010. The Commission also made a downward adjustment of 0.04 percentage points to the forecast because it considered that we made a "windfall gain" by not replacing the approved volume of mains in the Commission's 2008 to 2012 Final Decision.[3]

Over the period from 2013 our actual UAFG has been above the 3.7% class B benchmark for two of the three years (see Figure 2.1). Of particular note, 2014 is the only year where our actual UAFG has been below the benchmark over the past 10 years. On average, our actual UAFG has been 21% above the UAFG benchmark over the last years. This is a significant difference over a long period of time, which trend needs to be addressed going forward by using the most recent available data.

Figure 2.1: Our actual UAFG performance and the Commission's class B benchmarks for Victoria and Albury since 2006



Note: the benchmark displayed is for our Victorian network, from 2008 to 2017 the Albury network benchmark is the same as our Victorian network.

[3] ESC 2013, *Gas Distribution System Code Review of Unaccounted for Gas Benchmarks Final Decision*, June 2013, page 3.

Class A customers are large customers with an annual consumption greater than 250 TJ per annum. As discussed in FD – Methodology they are serviced by field equipment that measures and adjusts for actual pressure and temperature of the gas volume compared to the standard pressure and temperature conditions[4] that are used for class B customers.

As reported to the Commission in response to its Draft Decision on the UAFG Benchmarks for the 2013 to 2017 period, there is no reporting of actual UAFG performance for our Victorian and Albury networks for class A. The distinction between class A and class B UAFG is purely arbitrary, and distributors simply allocate an amount of UAFG to class A that equates to the benchmark. Hence actual and benchmark UAFG for class A will always be equal.[5]

Our class A benchmark levels have been set at 0.3% for Victoria and 0.1% for Albury for the last 10 years (2006). Based on this historical practice we propose that the benchmark levels for the 2018 to 2022 period should remain unchanged at 0.3% for Victoria and 0.1% for Albury. The Commission did not alter class A benchmarks as part of the previous 2013 to 2017 review.[6]

Our historical performance for our non-Declared Transmission System (DTS) network has been highly variable over the last eight years (see Figure 2.3). Our non-DTS network is located in and around the Bairnsdale and Paynesville region. This part of our network is supplied from the Eastern Gas Pipeline, which is a separate gas supply to the remainder of our network.

The Bairnsdale and Paynesville network extensions were constructed over the period of 2005 to 2008 as part of the Victorian government's Energy for the Regions program. Any trends on our DTS network (the remainder of our network) cannot be used to predict future trends on the non-DTS network due to the newer composition of the non-DTS network (all high pressure) and the different gas source.

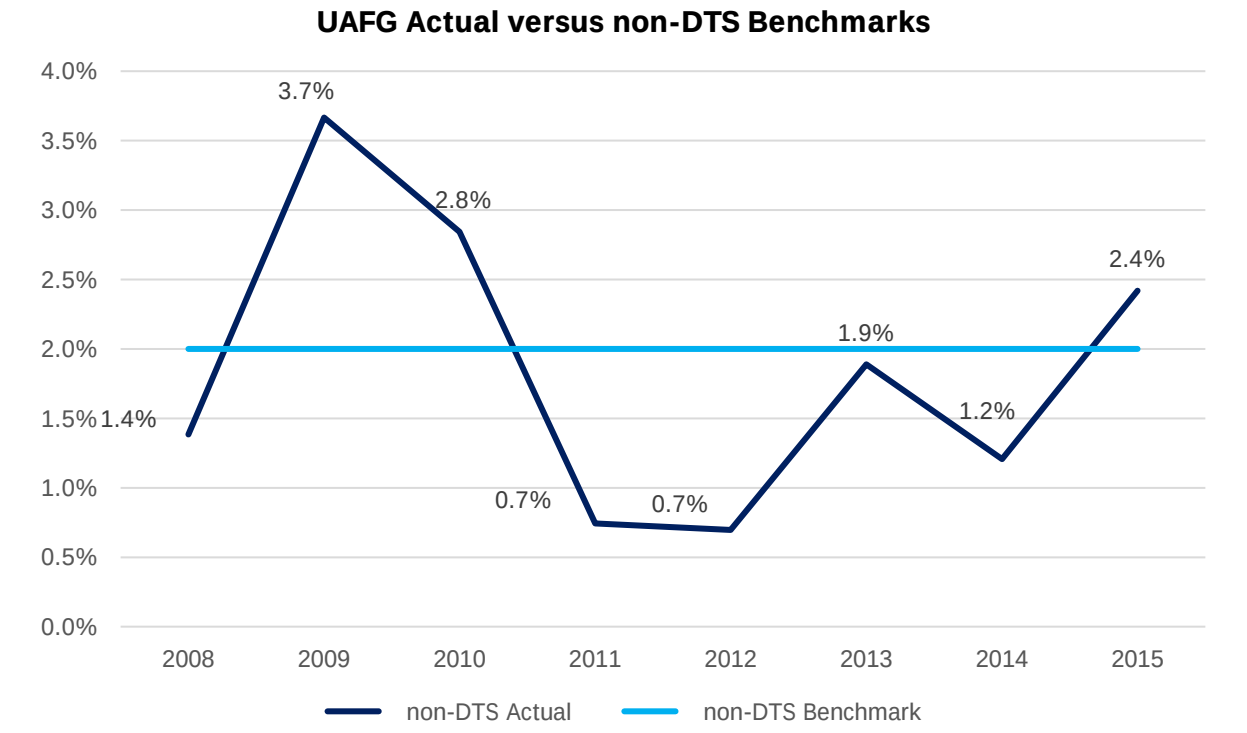
Due to the highly variable and low volume of gas injected (approximately 0.45% of the DTS volume of gas injected) we propose that the benchmark levels for the 2018 to 2022 period should remain unchanged at 2% for the non-DTS network.

4 ESC 2013, *Gas Distribution System Code Review of Unaccounted for Gas Benchmarks Final Decision*, June 2013.

5 Envestra, *Victoria & Albury Networks – Response to Draft Decision: UAFG Benchmarks 2013-17*, 10 May 2013, page 35.

6 *Ibid*, page 49.

Figure 2.3: Our actual UAFG performance and the Commission's non-DTS benchmarks since 2006



As part of this submission we have provided the Commission the requested UAFG data for our DTS network (class A and B) and our non-DTS network in the spreadsheet template sent to AGN on 31 July 2017 (see Attachment 1).

The requested populated template contains commercially sensitive information. This confidential information has been redacted from the public version of the spreadsheet. Importantly, confidential information has been provided to the Commission for its review. We have sought to minimise the amount of information that we claim confidentiality over to make our information as transparent to stakeholders as possible.

2.2. UAFG Reconciliation Process

The UAFG reconciliation process is summarised as follows:

1. retailers make available for injection an amount of gas into the network each day that equates to their customers' forecast requirements plus the relevant benchmark amount of UAFG as detailed in section 235 of the National Gas Rules (NGR);
2. if the amount of gas consumed on a day is higher than that forecast, the cost of the additional gas is initially borne by each distributor's "host" retailer (in AGN's case, Energy Australia). Retailers are therefore providing all the gas for the market, as required for the market and as required in order to satisfy all UAFG needs;
3. gas consumption data for a complete year must be agreed upon by the distributor and all retailers, not just the "host retailer";
4. the Australian Energy Market Operator (AEMO) then confirms the reconciliation amounts to be paid to and by each party, which includes all retailers and the gas distributor, consistent with the data agreed to by the parties; and

5 payment of reconciliation amounts.

Rule 317 of the National Gas Rules (NGR) sets out AEMO's obligation to produce a procedure for the calculation of UAFG in a declared distribution system. The "*Wholesale Market Distribution UAFG Procedures (Victoria)*" (UAFG Procedure) has been produced pursuant to this rule. This process is often referred to as the UAFG reconciliation process or "wash-up calculation" process.

In practice the UAFG reconciliation process is time-consuming and complicated. This is primarily because the UAFG Procedure (Points 3 to 5 above) requires both retailers and distributors to agree on consumption before the process can proceed as detailed in clause 2.3 of the UAFG Procedure.

We have experienced that agreement with retailers is often difficult because:

- all calculations must use the latest data published by AEMO for custody transfer meters (CTM) injections (sendout), net system load and interval metered sites (both residential, commercial and large industrial sites). AEMO publishes data on varying schedules including a "month plus 118 business day" schedule as well as occasional 'revisions'. These versions must be stored and tracked and agreement reached with retailers and AEMO as to the most recent version;
- basic meter reads must be reconciled back to invoices to retailers in order to minimise disputes;
- duplicate data in the case of large industrial sites that appear in both raw billing data and telemetry data needs to be stripped out;
- occasionally certain interval metered sites require an "off-market" settlement where a metering error has been detected outside the "month plus 118 business day" schedule cut-off. Both AEMO and the retailer must agree with an off-market settlement; and
- Net System Load (NSL) apportionment of basic meter reads, which straddle either the beginning or end of the calendar year, must be carried out. NSL data is not available until approximately two weeks after AEMO has issued the "month plus 118 business day" revisions for December (for example the data was available for 2016 by 7 July 2017).

The above steps are the largest bottleneck to the settling process. This is largely due to the volume of data to be agreed and the iterative nature of the process. Final agreement with all retailers cannot be achieved until each individual retailer has agreed with their consumption. Although one retailer may have agreed, this may be subject to changes because a subsequent retailer may have successfully disputed their consumption.

The mathematical process of profiling meter reads to periods is also very computationally intensive. For example, in 2015 4.9 million basic meter reads, together with 4,314 rows of interval data and 548 rows for the NSL profile were sent to retailers. Figure 1 of the UAFG Procedure clearly demonstrates the iterative nature of the process with 11 steps detailed just to obtain agreement from one retailer. We are required to undertake this process with 15 retailers for the 2015 year.

Clause 2.3.1 of the UAFG Procedure states "*Market Participants must review and agree on the consumption within 8 weeks.*"[7] It has been our experience that this timeframe is never met in practice. Our 2014 and 2015 settlement process is a good example of this. On 15 June 2017 we provided all the required data to 15 retailers, and at the end of the eight week period (10 August 2017) five retailers for 2014 data and seven retailers for 2015 data had not agreed despite repeated efforts by AGN. We have summarised in Table 2.1 our experience.

[7] AEMO, *Wholesale Market Distribution UAFG Procedures (Victoria),* 1 January 2016, Page 13.

Table 2.1: Settlement process for 2014 and 2015

	2014	Agreed data	2015	Agreed data
Retailer 1	Retailer required to pay AGN	Yes	Retailer required to pay AGN	Yes
Retailer 2	Retailer required to pay AGN	Yes	Retailer required to pay AGN	Yes
Retailer 3	Retailer required to pay AGN	Yes	Retailer required to pay AGN	Yes
Retailer 4	Retailer required to pay AGN	Yes	Retailer required to pay AGN	Yes
Retailer 5	N/A	No	AGN required to pay retailer	No
Retailer 6	Retailer required to pay AGN	No	Retailer required to pay AGN	No
Retailer 7	AGN required to pay retailer	No	AGN required to pay retailer	No
Retailer 8	N/A	Yes	N/A	Yes
Retailer 9	Retailer required to pay AGN	Yes	Retailer required to pay AGN	No
Retailer 10	Retailer required to pay AGN	Yes	Retailer required to pay AGN	Yes
Retailer 11	AGN required to pay retailer	Yes	Retailer required to pay AGN	Yes
Retailer 12	Retailer required to pay AGN	No	Retailer required to pay AGN	No
Retailer 13	Retailer required to pay AGN	Yes	Retailer required to pay AGN	No
Retailer 14	Retailer required to pay AGN	Yes	Retailer required to pay AGN	Yes
Retailer 15	N/A	No	N/A	No
Total	**Retailers to pay AGN**	**10 Agreed**	**AGN to pay retailers**	**8 Agreed**

Note: N/A means there was $0 reconciliation amounts

While AEMO has the power to investigate a retailer's compliance with the Wholesale Market Distribution UAFG Procedures (Victoria) under the National Gas Law[8], AGN does not have any ability to do so and to otherwise enforce compliance.

The Commission expressed a view in the FD – Methodology that whichever business is entitled to receive reconciliation payments is incentivised to expedite the settlement process in order to receive the payments more quickly due to the time value of money.[9] But if the counterparty has no incentive to settle, then no amount of "expediting" can enforce a settlement.

Furthermore, even where the counterparty should have an incentive to settle because they are due money, evidence indicates that long delays in settlement still occur. This is clear from Table 2.1, which shows that only one out of four retailers that will receive reconciliation payments from AGN has agreed on the data. The comments made by the Commission on the incentives to settle the data are therefore not supported by the evidence.

Consistent with our view expressed in our response to the Draft Decision Methodology (DD – Methodology) we believe that the 2014 and 2015 data should be used in the calculation of our class B benchmark as it reflects the most recent conditions for the network. AGN supports the Commission's following comments on the challenges of using old data:

> *"…the relevance of the data diminishes as the period used is extended because older data may not reflect the current circumstances faced by the distributors."*[10]

Using the most recent data will give rise to more accurate UAFG benchmarks which are necessary in order to meet the objective in section 8 of the ESC Act. The objective is to promote the long term interests of Victorian consumers having regard to the price, quality and reliability of essential services. In seeking to achieve the objective, the Commission must have regard to the following matters to the extent that they are relevant in any particular case:

- efficiency in the industry and incentives for long term investment;
- the financial viability of the industry;
- the degree of, and scope for, competition within the industry, including countervailing market power and information asymmetries;
- the relevant health, safety, environmental and social legislation applying to the industry;
- the benefits and costs of regulation (including externalities and the gains from competition and efficiency) for—
  - consumers and users of products or services (including low income and vulnerable consumers);
  - regulated entities;
- consistency in regulation between States and on a national basis; and
- any matters specified in the empowering instrument.

Using out of date data to set the benchmark for 2018 to 2022 is, among other things, unlikely to promote the long term interests of Victorian consumers and achieve the objectives of efficiency in the industry and incentives for long term investment.

The Commission is concerned that the use of unsettled data would mean that retailers are unable to comment on whether the data reliably represents UAFG levels. However, importantly, based on

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8 Refer National Gas Law, sections 91BM and 91BN.

9 ESC, *Review of Unaccounted for Gas Benchmarks – Final Decision – Methodology*, July 2017, page 30.

10 ESC, *Review of Unaccounted for Gas Benchmarks – Draft Decision – Methodology*, May 2017, page 14.

our past experience, the total UAFG data provided to retailers does not materially change from settled data.

To this end Table 2.2, shows six years of history on the variances of consumption data provided by AGN to retailers and the resulting agreed consumption data. On average, the variance is only 0.01% with a range of 0.15% to -0.13% over the six year period. This cannot be reasonably considered to represent a material difference that warrants the exclusion of the most recent data provided by AGN to retailers.

Agreement with the retailers is instead focused on the amount allocated to each individual retailer and not the total amount of UAFG, which is relevant for setting benchmarks going forward.

Table 2.2: Comparison of consumption data provided to retailers and the resulting agreed consumption data

	2008	2009	2010	2011	2012	2013	Total / Average
Consumption data provided by AGN to the retailers (TJ)	60,054	57,383	60,582	58,184	58,142	54,792	349,138
Consumption data agreed with retailers (TJ)	60,041	57,467	60,594	58,184	58,152	54,719	349,157
Variance (TJ)	-13.5	84.5	11.6	0	-10.2	-73.4	19.3
Variance (%)	**-0.02**	**0.15**	**0.02**	**0**	**0.02**	**-0.13**	**0.01**

In Multinet's submission on the DD – Methodology they detailed their experience for the recent 2014 settlement process. They have experienced similar delays to AGN with minimal variation to the total settled UAFG. This settlement process took approximately seven months to complete from first issuing the data to all parties agreeing. The UAFG varied from 4.97% to 4.95% (-0.4% change). [11]

In light of the difficulties explained above in the settlement process and the fact that there is no material change that arises from the settlement process, a balance needs to be struck in order to derive accurate and achievable UAFG benchmarks based on the most recently available and reliable data.

In the circumstances, we consider that the most recent available data should be used to establish UAFG benchmarks, given the alternative of using older data may result in unachievable or irrelevant UAFG benchmarks, which would work against the incentive properties of the regime.

The Commission in the FD – Methodology questioned the reliability of unsettled UAFG data as there is no way of checking the unsettled data before agreement is made with retailers. [12] As part of our Annual Regulatory Information Notices (RINs) process we are required to provide the AER independently audited financial accounts. UAFG is expensed or provided for in these audited accounts each year, whether the data is settled with retailers or not. Based on this audit requirement we believe that the unsettled UAFG data is sufficiently reliable.

[11] Multinet, June 2017, page. 4.

[12] ESC, *Review of Unaccounted for Gas Benchmarks – Final Decision – Methodology*, July 2017, page 30.

AGN therefore believes that the Commission should be relying on the most recent information available to set UAFG benchmarks over the next AA period. At present, and assuming no further progress is made in settling the data with retailers, the UAFG benchmarks would likely be based on an average of UAFG between 2011 to 2013. This information will be up to seven years old by the time the next AA period commences and 12 years old by the time the AA period ends.

A benchmark based on an average of UAFG between 2011 to 2013 cannot reasonably be considered to be consistent with setting a best estimate of UAFG over the next AA period. In particular, this outcome:

- unnecessarily relies on information that is no longer relevant and reflective of current network conditions, which problem was noted by the Commission in its DD – Methodology[13];
- is unwarranted given the data is not unreliable and does not materially change once issued by AGN;
- is inconsistent with the intended incentive properties of the benchmark;
- undermines confidence in the key benchmarks underpinning the Victorian regulatory regime;
- it follows that a benchmark based on this data will not be in the long term interest of consumers (and contrary to the requirements of the ESC Act 2001).

While we are aiming to have the data settled with retailers, we do not consider this to be required to calculate the UAFG benchmarks to apply over the next AA period.

We propose a three year average based on:

- settled data for 2013;
- in respect of 2014 and 2015, data agreed between AGN and retailers be used where available, with unsettled data used in respect of those retailers who have not complied with those procedures by the date of the draft decision. In circumstances where AGN is unable to enforce compliance by the retailers with the "*Wholesale Market Distribution UAFG Procedures (Victoria)*", AGN's proposed methodology will incentivize those retailers to settle the data in a timely fashion with AGN before a final decision is issued by the Commission.

Our proposed benchmarks are addressed in detail in the following section.

2.3. Proposed Benchmarks for 2018 to 2022 period

Consistent with the FD – Methodology[14], we are proposing to use a three multi-year average using 2013 to 2015 data, which is the most recent (and therefore relevant) information for setting our class B benchmark. As detailed in Section 2.1 we are not proposing to change our class A Albury or Victoria benchmark or our non–DTS benchmark. Our proposed benchmarks are detailed in Table 2.3.

[13] ESC, *Review of Unaccounted for Gas Benchmarks – Draft Decision – Methodology*, May 2017, page 14.

[14] ESC, *Review of Unaccounted for Gas Benchmarks – Final Decision – Methodology*, July 2017, page 15.

Table 2.3: Our proposed 2018 to 2022 UAFG class A, B and non–DTS benchmarks (%)

	2018	2019	2020	2021	2022
AGN Victoria and Albury Class B	4.0	4.0	4.0	4.0	4.0
AGN Victoria Class A	0.3	0.3	0.3	0.3	0.3
AGN Albury Class A	0.1	0.1	0.1	0.1	0.1
AGN non-DTS	2.0	2.0	2.0	2.0	2.0

Asset Integrity Australasia Pty Ltd (AIA) have reviewed our class B benchmark and *"consider this an appropriate benchmark for the 2018 to 2022 period."*[15]

The remainder of our submission demonstrates that:

- our UAFG management and policies are in line with best practice;
- we have prudently undertaken a comprehensive range of activities to minimize UAFG in the 2013 to 2017 period; and
- we have in place detailed plans to manage our assets, which are designed to cost effectively minimise UAFG in the 2018 to 2022 period. These plans have been reviewed and approved by the AER as part of our AA proposal for our Victorian and Albury networks for the 2018 to 2022 period.

[15] AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017.

3. Detailed assessment of the causes of UAFG

AGN supports the view of the Commission that there is some uncertainty regarding the extent and causes of UAFG.[16] In 2016, we commissioned AIA to assist AGN to undertake an assessment of the contributory elements of UAFG in the AGN Victorian and Albury networks. AIA recommended that UAFG is classified into two categories:

1 measurement based UAFG; and

2 fugitive emissions. [17]

Measurement based UAFG elements include:

- *Timing mismatch* – if data inputs do not relate to the same periods of time, network injections and deliveries will be mis-matched, resulting in either a positive or negative contribution to UAFG. The impact of this component is minimised by using longer (annual) time periods and ensuring appropriate data is used;
- *Administrative/Process errors* – incorrect records;
- *Purchase meters/CTM accuracy* – have an energy measurement uncertainty of up to +/- 3.0% of throughput when maintained correctly. For the large CTMs a small error can have a large impact on UAFG;
- *Pressure compensation* – the pressure of gas at most delivery points is not measured but regulated to be within certain limits. The difference between actual pressure and billing pressures results in a positive contribution to UAFG, as billing factors are designed to ensure that consumers are not disadvantaged;
- *Temperature compensation* – the temperature of gas at most delivery points is not measured but assumed to be at a certain temperature (we are required to use the standard temperature of 15^0C[18]). The difference between actual and assumed temperature results in a positive contribution to UAFG, as billing factors are designed to ensure that consumers are not disadvantaged;
- *Higher heating values (HHV) measurement* – we must use, under AEMO's rules, a state-wide heating value in calculating the energy delivered to each customer, whereas the actual heating value is known to be different, resulting in potentially reported higher levels of UAFG in the AGN network, versus what would be the case otherwise;
- *Metering accuracy* – all meters have an inherent tolerance, and can measure slightly above or below the actual volume of gas delivered;
- *Linepack changes* – as networks grow, gas is required to fill the new pipes, giving rise to relatively small increases in UAFG over time;
- *Company own use* – gas can be used to purge new mains and services, and to drive compressors, water bath heaters or other equipment; and
- *Meter Bypass and Theft* – the unlawfully removal of gas from the distribution network.

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16 ESC 2017, *Essential Services Commission Review of Unaccounted for Gas Benchmarks: Final Decision – Methodology*, July 2017, Page 5.

17 AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017.

18 AEMO, *Pressure Correction Factors* published documents – Document 239500 Date 28 August 2015.

Fugitive Emission UAFG elements include:

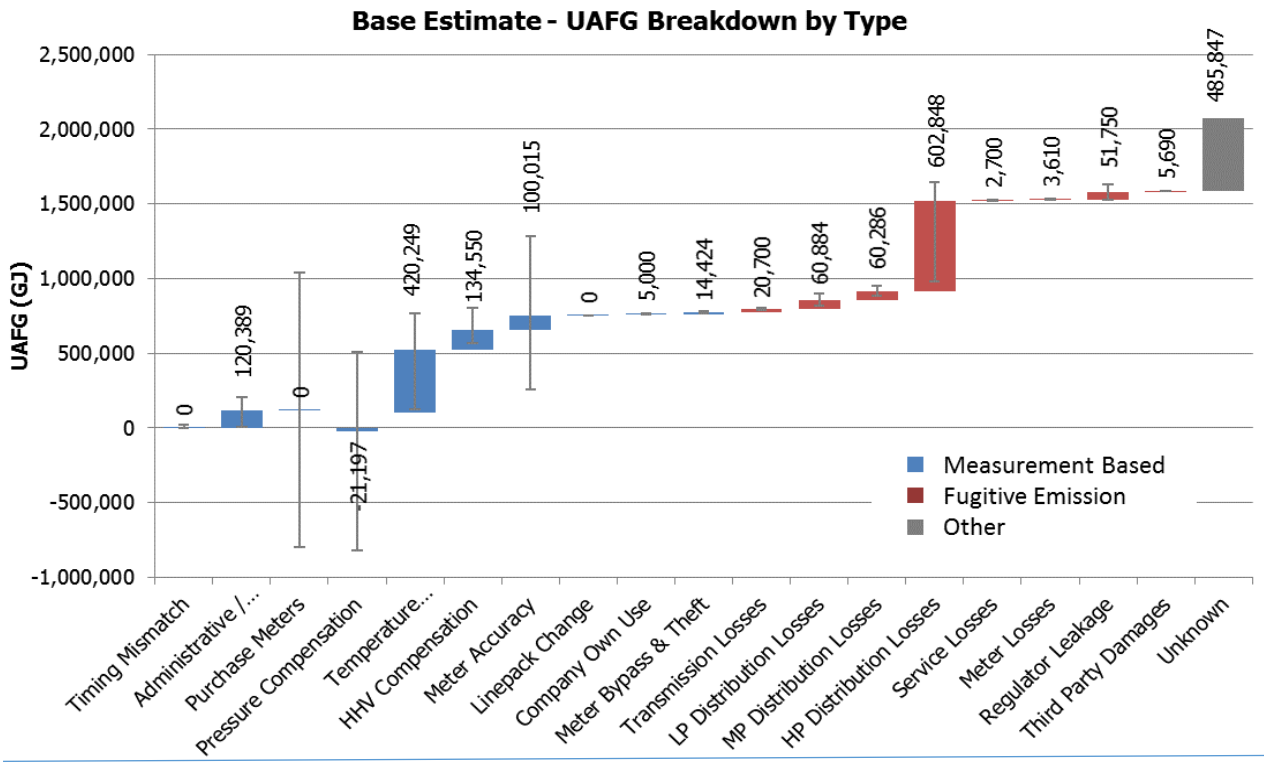
- *Losses from the Transmission pipelines* – leakage from pipe joints and fittings, this varies with material and pressure;
- *Losses from the Low Pressure (LP) pipelines* – leakage from pipe joints and fittings, this varies with material and pressure;
- *Losses from the Medium Pressure (MP) pipelines* – leakage from pipe joints and fittings, this varies with material and pressure;
- *Losses from the High Pressure (HP) pipelines* – leakage from pipe joints and fittings, this varies with material and pressure;
- *Losses from service lines* – leakage from pipe joints and fittings, this varies with material and pressure;
- *Meter Losses* – leakage from joints and fittings;
- *Regulator leakage* – control system bleeds to atmosphere;
- *Third Party Damage* – gas pipes are often damaged by other parties, resulting in gas lost to atmosphere

AIA used their model to assess the contribution to UAFG from each of the above elements for 2015, where the UAFG level was 2,070 TJ. The output of the model is shown in a stacked chart format to readily identify the relative contribution of each element, together with the level of uncertainty AIA attributes to that element (shown as a vertical line) (see Figure 3.1).

The total attributable UAFG for both measurement based and fugitive UAFG elements was assessed to be 1,585 TJ. This resulted in an unknown UAFG level of 485 TJ which is shown on the right hand side in grey that is not readily attributed to any individual UAFG element. [19]

[19] AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017.

Figure 3.1: Stacked Chart with Unknown UAFG Distributed for 2015[20]



In Figure 3.2 AIA has attributed the "unknown" 485 TJ of UAFG to individual UAFG elements in line with their individual uncertainty. This level of uncertainty is not an unusual occurrence and should not be viewed as inefficient management of UAFG. AIA states in their report:

> *"This emphasizes the uncertainty associated with UAFG, particularly relating to Purchase meters and Meter Accuracy that have relatively low directly attributed UAFG contributions and large uncertainty."*[21]

The total Fugitive Emissions of UAFG are calculated as 856 TJ, with the largest contributors to UAFG being the combined LP, MP and HP mains. The total Measurement UAFG increases to 1,214 TJ mainly due to the uncertainty associated with injection metering, withdrawal metering supplying gas at temperatures and HHV compensation. [22]

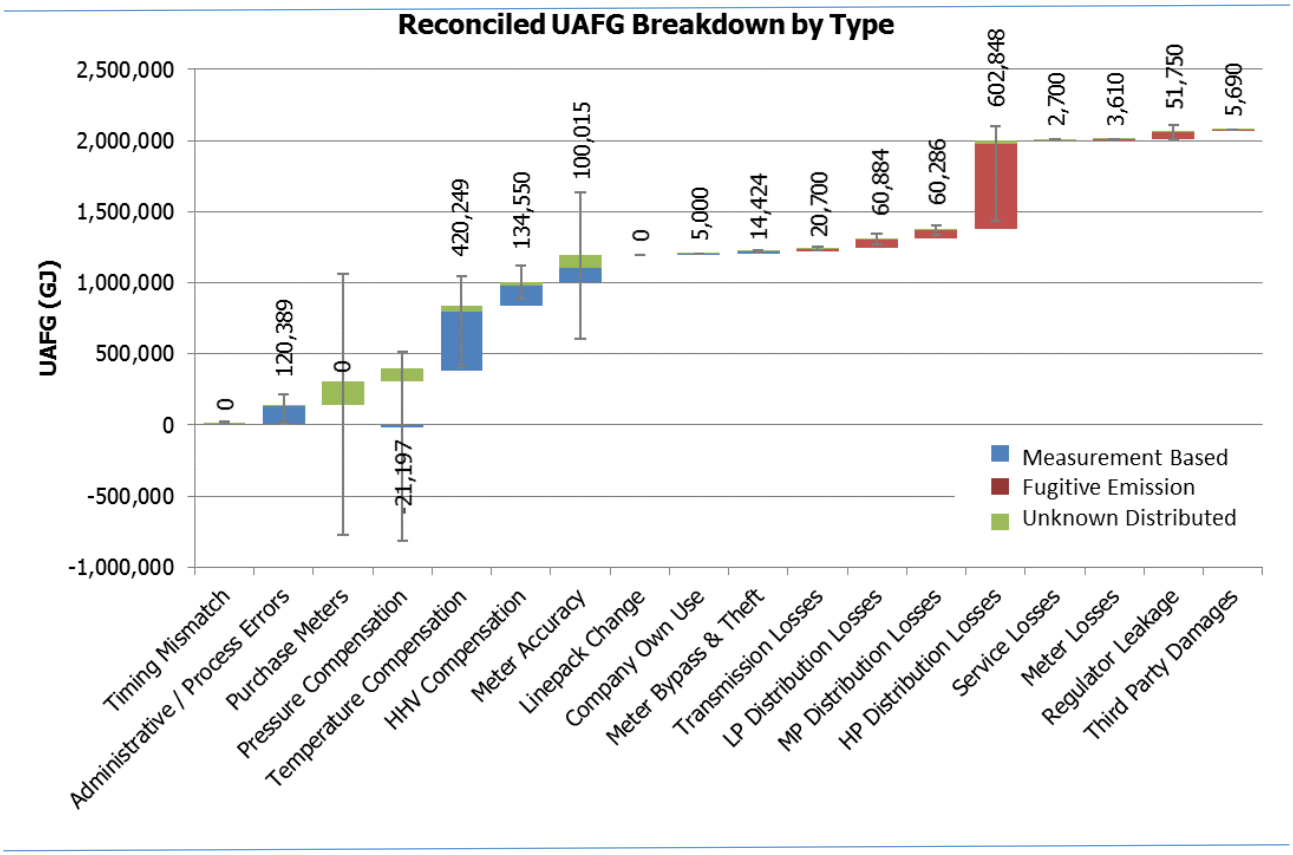
Further detail is available in AIA's report, provide as Attachment 2.

[20] AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017.

[21] *Ibid.*

[22] *Ibid.*

Figure 3.2: Stacked Chart with Unknown UAFG Distributed for 2015[23]



[23] AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017, page

4. Management of UAFG levels during 2013 to 2017

4.1. General

This section provides a detailed explanation of how we have efficiently sought to reduce UAFG levels during the 2013 to 2017 regulatory period.

As a national gas distributor, AGN places a significant emphasis on the analysis and mitigation of UAFG across each of its networks. UAFG is reviewed by AGN at both senior management and Board levels in recognition of the safety, cost and environmental impact this item has on our business and customers.

AGN has gas distribution networks in Victoria, South Australia, New South Wales, Queensland and the Northern Terriority. We therefore have a national perspective when considering UAFG and are able to leverage a "best practice" approach that incorporates outcomes across all of our networks. That is, the extensive number of networks owned by AGN across Australia means that the experience gained in addressing UAFG in one network can be leveraged to address a similar issue in another network elsewhere in Australia.

On a monthly basis, a UAFG report is prepared for all of AGN's networks, including the Victorian and Albury gas networks. This UAFG report compares the rolling moving annual total UAFG against the regulated benchmark position. The report contains, amongst other matters, the following components:

- a high level summary that reports current moving annual total UAFG and variances;
- tabulated volume and percentage statistics for the seven major zones in the Victorian distribution network;
- graphs of three-year history to highlight monthly and rolling annual UAFG data to identify and highlight trends; and
- summary data on progress of UAFG "wash-ups".

The report is compiled and analysed on a monthly basis. The report is reviewed by senior management, with particular attention paid to sub-networks where trends indicate anomalies, or the possibility of erroneous inputs, potential pipeline faults, theft, or other unusual factors. The results of this analysis are used to optimise execution of AGN's UAFG management strategy.

AIA's review found that "*UAFG has a high priority within the management of the AGN network*" and that *"meeting minutes indicate that any increases in UAFG are promptly investigated and action taken to remedy"*. [24]

The above detailed reviews drive actions to minimise UAFG. Examples of specific actions and outcomes are set out in the remainder of this section.

4.2. Recurrent Activities

In addition to the rigorous monthly analysis of UAFG results, AGN undertakes the following recurrent activities as part of its UAFG management strategy.

[24] AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017.

4.2.1. Mains Replacement

Our mains replacement program objective is to improve safety, with the additional benefit of improving supply reliability to gas customers by replacing ageing mains and services. This activity replaces the older cast iron, unprotected steel and PVC mains that have the highest leakage rates and therefore contribute to UAFG. Our Final Plan, provided to the AER on 23 December 2016, detailed that we are on schedule to deliver the approved replacement of 696 kilometres over the current (2013 to 2017) AA period.[25]

Table 4.1 below summarises progress to date and the forecast for 2017. We are required to report monthly to Energy Safe Victoria (ESV) on the delivery of the planned mains replacement program.

Table 4.1: Current AA Period Mains Replacement Performance (kilometres)[26]

	2013	2014	2015	2016	2017	Total
Allowance	195	172	148	91	90	**696**
Actual/Forecast	195	171	151	94	85	**696**
Annual Variance	0	(1)	3	3	(5)	**0**
Cumulative Variance	**0**	**(1)**	**2**	**5**	**0**	**0**

The mains replacement strategy is reviewed annually, and involves an analysis of trends on leaks and integrity related indicators, as demonstrated in our Distribution Mains & Services Integrity Plan (DMSIP), which formed part of our Final Plan to the AER. Recent analysis detailed in the DMSIP shows that the trend in UAFG of AGN's Melbourne network has been unresponsive to the mains replacement program over the 2010 to 2015 period, suggesting factors other than leakage on the low pressure network are key influences in the level of UAFG in the AGN network.

AIA reviewed our current period mains replacement performance confirming that the replacement levels are closely monitored on a monthly basis and that we are on target to replace 696 kilometres over the 2013 to 2017 period. [27]

4.2.2. Meter Management

We have a regulatory obligation to manage the integrity of meters and ensure they operate within a prescribed tolerance band for metering accuracy (i.e. +2% to -3% of the volume of gas delivered). Periodic Meter Changes (PMCs) are therefore carried out to:

- test the accuracy of meters; and
- replace meters when the accuracy of their measurements falls outside the prescribed band.

[25] Further information on our Final Plan is available on the AER's website: https://www.aer.gov.au/system/files/AGN%20-%20Final%20Plan%20-%20Access%20Arrangement%20Information%20for%20our%20Victorian%20and%20Albury%20natural%20gas%20distribution%20networks%202018-2022%20-%2020161222%20-%20Public.pdf.

[26] AGN, *Final Plan Attachment 8.2, Distribution Mains & Services Integrity Plan,* December 2016.

[27] AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017.

Failure to maintain the accuracy of meters to the required standards increases the likelihood of customers being charged the incorrect amount for gas usage, and for meters servicing larger customers, inaccuracy can have a significant effect on the level of unaccounted for gas. The AIA review found that actual meter replacement undertaken in the 2013 to 2017 period was in line with the planned replacement levels and was an increase from the 2008 to 2012 period by around 15%.[28]

4.2.3. Pressure Control Upgrade

A Supervisory Control and Data Acquisition (SCADA) system is used to provide surveillance of network pressures and active control of network pressures in the Melbourne and Mornington networks. Additional monitoring is provided through fixed and mobile data loggers and chart recorders. Network pressure data collected from these system is reviewed and analysed to diagnose pressure control equipment faults and network capacity problems.

AGN upgraded the SCADA system in 2014. AIA has reviewed our pressure control system and confirmed this has significantly improved the quality of pressure control and reduced the frequency of the system defaulting to high pressure. [29] In addition, our Asset Management Plan (AMP) details that remote SCADA monitoring to 30 gate stations will be completed by the end of this AA period.[30]

4.2.4. Leakage Management

AGN has a comprehensive leak survey and leakage response/repair strategy that ensures all detected and reported leaks are attended to in a timely manner. The basic purpose of the leak management program is to ensure the safety of customers and the public, by eliminating leaks that arise from time to time. This program has the ancillary benefit of reducing the leakage component of UAFG.

As noted earlier, responding to publicly reported leaks is an important Key Performance Indicator (KPI) for the business and therefore a key part of achieving our Vision. AIA have reviewed our leak management performance over the 2013 to 2017 period and confirmed:

- leak response times, leakage survey and the number of outstanding leaks are closely monitored and are high profile KPIs that are reported and actioned in internal management reports;
- overall AGN achieved the KPI target of over 95% of public reported leaks being responded to within a two-hour period. AGN has a process to tighten this target KPI over time. In 2015 it was 95%, in 2016 it was 96% and in 2017 it is 96.5%;
- 100% of leakage surveys were undertaken; and
- 98% of class 1 and 2 leaks were repaired within the target period, and any outstanding leaks are closely monitored and repaired. [31]

AIA concluded that our high level reporting and action by senior management, including the CEO, keeps a strong performance focus on this important activity. [32]

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28 AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017.

29 *Ibid.*

30 AGN, *Final Plan Attachment 8.1, Asset Management Plan,* December 2016.

31 *Ibid.*

32 *Ibid.*

4.2.5. Management of Third Party Damage

Third party incidents are when damage occurs on the network because of the actions of a third party (for example damage caused by builders using mechanical diggers). We monitor third party incidents to measure how such incidents contribute to leaks, as well as to identify opportunities to prevent incidents. Third party incidents are immediately reported to the CEO and discussed on a weekly basis by the Executive Management Team.

The primary activity aimed at reducing the number of incidents is the Dial Before You Dig (DBYD) program. The DBYD service provides information to the public and construction industry about the dangers and location of the gas distribution network when digging, particularly in public areas. Use of the DBYD service has increased year-on-year, and the decreasing levels of third party damage, despite high levels of construction activity in Melbourne, suggests the service has improved public awareness of these assets. Our AMP details the number of third party damages back to 2006.[33]

AIA reviewed our management in this area and found we had "*robust policies for incentivising third parties not to damage our network*" [34]. We invoice the third parties responsible for damage and where possible ensure the party signs to accept they damaged the network while AGN are on site undertaking the repair. In 2016, 758 invoices were issued with a value of $347,000. In AIA's opinion "*this is an additional effective deterrent to minimise damage and the consequential lost gas*". [35]

4.2.6. CTM Replacement and Refurbishment

Uncertainty in CTM measurement has the potential to be a major contributor to UAFG due to the high gas volumes flowing through a relatively small number of meters. Asset refurbishment or replacement is undertaken based on asset condition and performance. Where CTMs are found to be operating outside of their specified capacity range, they are required to be replaced to ensure the integrity of data recorded at these locations is not compromised.

A recent APA GasNet report indicates immediate or short term upgrades or replacements are required on 12 CTMs. AIA found that AGN, in conjunction with APA GasNet, are working collaboratively to complete these replacements and upgrades. [36]

4.2.7. Pressure Set Points

Only customers with a high gas consumption have meters that are corrected for the pressure and temperature of gas delivered. The vast majority of customers have assumed pressure and temperature at the meter.

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33 AGN, *Final Plan Attachment 8.1, Asset Management Plan,* December 2016.

34 AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017.

35 AGN, *Final Plan Attachment 8.1, Asset Management Plan,* December 2016.

36 *Ibid.*

Correction factors based on the assumed pressure and temperature are then applied to the meter volume to bill the customer. However the pressure supplied to the customer drops as demand increases (droop), and to enable the customer to have the required pressure at peak demand, when the demand reduces the pressure at the meter increases, effectively providing some free gas (UAFG) to the customer. This has the potential to be a significant source of UAFG, particularly with the Industrial and Commercial customers that do not have pressure correction at the meter.

AIA's review found that, in order to minimise this source of UAFG, AGN undertake regular checks on the set points to correct for any set point variation. [37]

4.2.8. Network Temperature

AIA noted that AGN initiated an analysis of network temperatures from the larger meters that have gas temperature correction. This demonstrated the reduction in network temperature can be more than anticipated, with the average flow weighted network temperature assessed to be in the region of 1.5^{0}C less than the 15^{0}C assumed for customer billing.

This work was further supported by the analysis of air temperatures across seven regions in the AGN Victorian and Albury network. This analysis demonstrated that between 2006 and 2015, the variation in average daily minimum temperature per month varied from 3^{0}C to 17^{0}C and within a month there is a 5^{0}C difference between Albury and Frankston.

This work is significant as temperature variations are an important influence on UAFG as it not only effects gas temperature but it also effects throughput and pressure in the network, both of which impact on UAFG. This analysis demonstrate that temperature variations from the 15^{0}C assumed for customer billing has the potential to be a significant contributor to UAFG. [38]

4.2.9. Billing Systems

The correct billing of customers relies upon accurate data in AGN's billing systems. This includes not only correct meter readings but the appropriate correction factor applied to customer billing.

During the current regulatory period, AGN has implemented both a national Enterprise Asset Management (Maximo) system and a national Customer Care and Billing (CCB) system. AIA confirmed these implementations have also included some optimisations to ensure that anomalies in basic metered consumption are identified and reviewed. [39]

4.2.10. Billing System Audits

Our metering and site billing department periodically undertake comparisons between Maximo and the CCB system to check that the appropriate correction factor is in the billing system. AIA found these reviews occasionally find a small number of incorrect correction factors, hence the reviews are undertaken regularly. [40]

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37 AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017.

38 *Ibid.*

39 *Ibid.*

40 *Ibid.*

In addition to these checks, AIA noted that our teams undertake various reviews including:

- business and residential – ensuring high consuming sites are set up correctly;
- meter Installation Registration Number (MIRN) reconciliation between Maximo and CCB;
- meter status reviews; and
- MIRN status discrepancies between Maximo and CCB. [41]

As a matter of practice we have included all sites with inlets/services only (i.e. no meter attached) on our meter reading routes. This provides an additional audit activity / control mechanism to detect illegal connections to a meter after disconnection, or if paperwork from a meter fix was mislaid or not delivered by a contractor. AIA found that AGN would identify such instances within the next meter read cycle (i.e. within two months). [42]

4.2.11. Ongoing Review of Large Consumers

Due to the size and potential impact on UAFG, interval-metered data (i.e. for large customers) is analysed on an individual meter basis to identify changes in consumption patterns that could result in UAFG.

These reviews have resulted in a number of instances of on-market and off-market adjustments to increase recorded customer consumption (and therefore reduce UAFG).

41 AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017.

42 *Ibid.*

5. Strategies to minimise UAFG levels during 2018 to 2022

This section provides a comprehensive strategy as to how AGN will seek efficiencies to minimise UAFG levels during the 2018 to 2022 regulatory period.

The key document that describes our approach to asset management over the next five to six years is our AMP. This document details how our plans are used to drive asset management strategies that are consistent with good industry practice. The AMP should be read in conjunction with other key documents such as the DMSIP and Meter Replacement Management Plan (MRP). All these documents were submitted to the AER together with our Final Plan on 22 December 2016.

Our asset management objectives are:

- *Ensuring network safety* – to maintain and operate assets so that the risks to employees, contractors and the public, are maintained as low as reasonably practicable;
- *Providing high quality service* – to provide customer service that is in the top quartile of gas distributor performance across the industry (e.g. reliability of gas supply);
- *Prudent and efficient operation and investment* – to ensure costs are prudent, efficient, consistent with accepted industry practices and necessary to achieve the lowest sustainable cost of providing gas distribution services in the long-term interest of customers;
- *Regulatory compliance* – to meet all regulatory requirements associated with the Gas Distribution Licence, Gas Reticulator Authorisation, Gas Act 1997 (Victoria), Gas Supply Act 1996 (New South Wales), National Gas Law, and other regulatory instruments; and
- *Environmental management* – to maintain and operate assets so that the risks to the environment are kept as low as reasonably practicable.

These objectives help ensure the ongoing investment in and operation of our networks is in the best interest of customers. Each of these objectives is factored into AGN's investment governance processes and decision making framework.

By achieving these objectives, AGN provides the following benefits to customers:

- a safe and reliable natural gas network;
- an affordable natural gas supply;
- confidence that natural gas remains a sustainable energy option; and
- minimal impact on the environment and community.

Key strategies for minimising UAFG are detailed in the following sections.

5.1. Mains Replacement

The provision of a safe and reliable supply of natural gas is fundamental to the business. An integral part of ensuring public safety is our DMSIP, which sets out the strategy for the replacement of ageing/deteriorating mains on our network. This is a key driver in the minimisation of the leakage component of UAFG.

Our long-term mains replacement program, which commenced in 2003, involves the removal of low-and-medium-pressure cast iron (CI), unprotected steel (UPS) and polyvinyl (PVC) mains from our networks. As detailed in section 4.2.1 we have demonstrated a strong commitment to delivering this program, including through the planned completion of the full 696 kilometres of mains replacement allowed for in the current AA period.

Over the next AA period we are planning to complete our low-pressure mains replacement program and to replace other mains determined to be at risk. This work was strongly supported by stakeholders and was considered to be the highest priority initiative at our customer workshops. Importantly, and consistent with stakeholder feedback, we have engaged with the safety regulator, ESV, on our DMSIP. The ESV noted in a letter to AGN that they have:

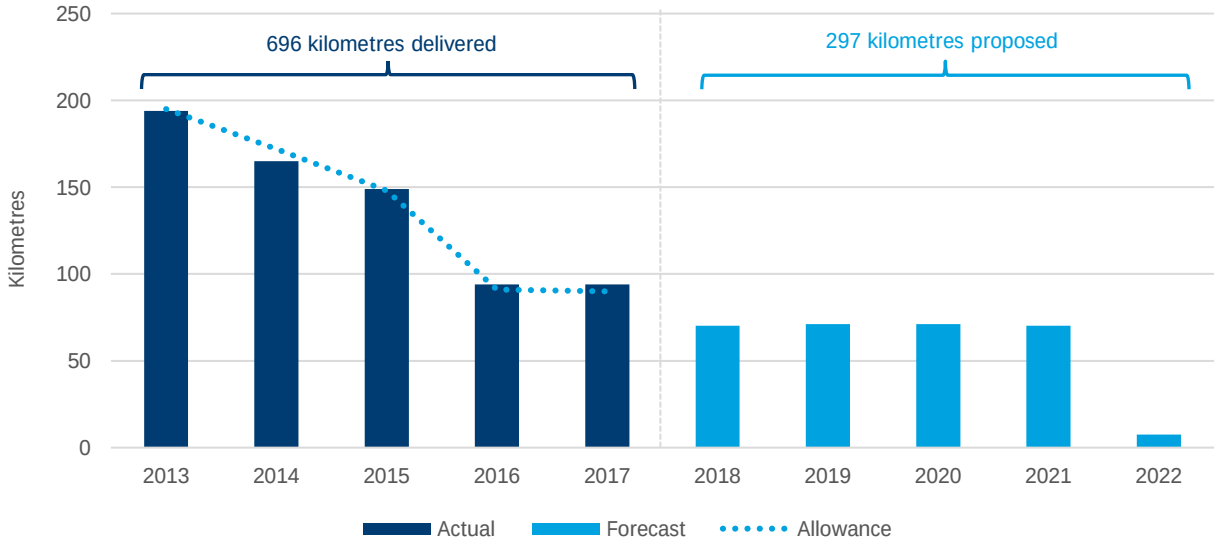
> *"... reviewed the DMSIP as a basis for managing the integrity of distribution mains and services in AGN's Victorian gas distribution network. The DMSIP outlines the timing, scope and cost of proposed risk mitigation strategies, including mains and services replacement."*[43]

The ESV has endorsed our proposed mains replacement program, noting that:

> *"... ESV supports the proposed mains and services replacement program outlined in AGN's DMSIP, being the replacement of 297km of CI, UPS, PVC and HDPE [High Density Polyethylene] mains."* [44]

Consistent with this, we are forecasting to replace 297 kilometres of mains over the next AA period (see Figure 5.1). Note that this will complete the mains replacement program. Further detail on our mains replacement plan can be found in the DMSIP submitted to the AER as part of our Final Plan.

Figure 5.1: Mains Replacement Program Volumes[45]



As part of the AER's Draft Decision they have reviewed our mains replacement program and accepted the program in full, finding that our mains replacement program:

[43] ESV, *Letter to Australian Gas Networks*, 21 December 2016. Provided at Attachment 8.9 to the Final Plan submitted to the AER.

[44] *Ibid.*

[46] AER 2017, *Attachment 6 – Capital expenditure | Draft decision - AGN Victoria and Albury gas access arrangement 2018–22*, July 2017, page 6-15.

> *"is justified on the grounds that it is necessary to maintain and improve the safety of services and for maintaining the integrity of services"*[46]

The AER also found it was conforming capex as:

> *"that which would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services"*[47]

The AER's technical expert, Zincara also reviewed our risk analysis and leakage performance for each mains category. They determined AGN's methodology appropriately identified mains requiring replacement.[48] Zincara advised the AER that our proposed approach to replace all 'high' risk mains and its scenarios are reasonable. [49]

The AER concluded:

> *"we are satisfied that AGN's forecast mains replacement volume is arrived at on a reasonable basis and represents the best forecast possible in the circumstances."* [50]

5.2. Meter Replacement Program

As detailed in Section 4.2.2 we are required to manage the integrity of meters and ensure they operate within a prescribed tolerance band for metering accuracy. Ongoing meter replacement also ensures the accuracy of meters for customer billing and to minimise this source of UAFG.

The meter replacement strategy for 2018 to 2022 is detailed in our MRP. In summary this strategy includes:

- replacement of domestic and commercial meters driven by their age profile and life extension testing forecasting high volatility in annual replacement ranging from 17,760 to 52,725 for domestic and 508 to 2,147 for commercial meters; and
- over the next AA period, we plan to replace 152,621 domestic meters, which is 6% higher than those replaced in the current AA. This increase is largely due to the growth in domestic meters in the 2003 to 2007 period (now approaching their 15 year life), and the higher life extension failure rate evident in newer meters;
- there are 7,055 commercial meters planned for replacement in the next AA period which is almost double that replaced in the current AA period . This is primarily due to the growth of commercial meters in the 2003 to 2007 period now approaching the end of their serviceable life; and
- life extension testing will continue throughout the 2018 to 2022 period as required by the National Standard AS4944 2006.

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46 AER 2017, *Attachment 6 – Capital expenditure | Draft decision - AGN Victoria and Albury gas access arrangement 2018–22*, July 2017, page 6-15.

47 *Ibid.*

48 Zincara, *AER Access Arrangement 2017 – AGN*, June 2017, page. 48.

49 *Ibid*.

50 AER 2017, *Attachment 6 – Capital expenditure | Draft decision - AGN Victoria and Albury gas access arrangement 2018–22*, July 2017, page 6-17.

As part of the AER's Draft Decision, they again had their technical expert, Zincara also reviewed our meter replacement program. Zincara advised the AER that our proposed meter replacement methodology is based on good industry practice and its forecast estimates are well developed. The AER accepted our program in full.[51]

5.3. SCADA

As part of our Final Plan to the AER we have proposed to more effectively manage monthly meter reading of large customer sites and to extend the SCADA network to regional towns and certain fringe points of the network. This will allow for the real-time monitoring of network conditions and, in some cases, for the remote control of gas flows and pressures to optimise system performance and maximise safety. We believe this will assist in managing UAFG.

As part of the AER's Draft Decision, Zincara found the expenditure was prudent. The AER accepted our program in full. [52]

5.4. Leak Management

As detailed in section 4.1 we will continue our strategy to closely monitor leakage response and leak repair times. These important risk mitigation measures assist to minimise UAFG. Our AMP sets out our strategy for these activities for the 2018 to 2022 period.

The strategy maintains stringent response times for public reported escapes, the times for repairing class 1 and 2 leaks, and the completion of the leakage survey programme. These targets are reviewed annually based on past performance and other gas networks performance, to ensure we are meeting our Vision objective of being a leading natural gas distributor in Australia.

The robust monitoring of leakage survey completion and the response time and repair time KPIs that are reported monthly to senior management ensure that actions are taken to remedy any performance that does not meet the required targets, as evident by our performance in the current AA period.

5.5. Other UAFG Actions in the 2018 - 2022 Period

In addition to the above, we have planned numerous actions and initiatives to reduce and further understand UAFG. These are outlined below:

- replacement or refurbishment of 12 CTM sites – Zincara as part of the AER's Draft Decision has reviewed a number of the CTM upgrades and found the projects prudent and efficient; 53
- continue with the robust invoicing of third parties causing damage to the network;
- planning to install domestic meters with pressure and temperature correction at strategic locations around the network to ascertain the impact on UAFG from the current billing assumptions of gas pressure and temperature. This data will feed into a study on the cost effectiveness of extending pressure and temperature correction to commercial and domestic meters;

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51 AER 2017, *Attachment 6 – Capital expenditure | Draft decision - AGN Victoria and Albury gas access arrangement 2018–22*, July 2017, page 6-29.

52 *Ibid*, page 6-29.

53 Zincara, *AER Access Arrangement 2017 – AGN*, June 2017.

- continue with billing system audits to ensure critical customer billing data is correct and consistent between the customer billing system and asset management system; and
- continue with the focus on UAFG monitoring and actions at the Monthly Operational Meetings.

5.6. Review of our UAFG Strategies

As detailed previously we engaged AIA to undertake an assessment of our strategies to manage UAFG levels during the 2018 to 2022 period. AIA consider our strategies to be robust and prudent in managing UAFG. [54]

[54] AIA 2017, *Assessment of Contributory Elements of UAFG for AGN's Victorian Networks*, August 2017.

6. Proposed amendment to clause 2.4(b) of the GDSC

We raised the issue that clause 2.4(b) of the GDSC should be either deleted or amended in our submission on the DD – Methodology. Clause 2.4(b) of the GDSC provides that a distributor must give written notice to AEMO by 30 April each year of the volume of gas withdrawn by the distributor for a customer. We welcome the opportunity by the Commission to amend the date in clause 2.4(b).

As detailed in our submission, AEMO is not in a position to provide injections, net system load and pricing data to distributors until 118 business days after the end of December. The UAFG reconciliation process is detailed Section 2.2 of this submission.

We support Multinet Gas proposal from their submission on the DD – Methodology, that clause 2.4(b) should be amended to refer to 30 April of the following year i.e. t-2.[55] We echo the experiences of Multinet that reconciling data with all parties can take extended periods and are not surprised that it took seven months for final settlement and for all parties to agree. [56]

The Commission expressed the view in the FD – Methodology that whichever business is entitled to receive reconciliation payments is iincentivised to expedite the settlement process in order to receive the payments more quickly due to the time value of money.[57] As detailed in Section 2.2, evidence indicates that long delays in settlement still occur. The Commission notes:

> "*if a distributor outperforms its benchmark by the same percentage, the distributor is entitled to receive reconciliation payments of an equal amount from retailers*". [58]

In this case there is no incentive or requirement on the retailer to reconcile data with the distributor.

Alternatively:

> "*if a distributor underperforms its benchmark by a certain percentage, retailers are entitled to receive reconciliation payments from the distributor"* [59]

Distributors are still required under clause 2.4 (b) to reconcile the data and provide the information to AEMO in the timeframe set in the GDSC even if we are required to pay the retailer. We request the Commission consider that the incentives to settle are not symmetrical and this should be taken into considerations when making the determination on the date to amend clause 2.4(b) of GDSC.

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55 Multinet, June 2017, page. 4.

56 *Ibid*, page. 2.

57 ESC, *Review of Unaccounted for Gas Benchmarks – Final Decision – Methodology*, July 2017, page 30.

58 *Ibid*, page 30.

59 *Ibid*, page 30.

RPC 0099

REVIEW OF UAFG IN AGN'S VICTORIAN AND ALBURY NETWORKS

AUGUST 2017

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ASSESSMENT OF THE CONTRIBUTORY ELEMENTS OF UAFG IN AGN'S VICTORIAN NETWORKS

1 EXECUTIVE SUMMARY

1.1 BACKGROUND

Australian Gas Networks Limited (AGN) commissioned Asset Integrity Australasia Pty Ltd (AIA) to:

- Undertake an assessment of the contributory elements of the Unaccounted for Gas (UAFG) in the AGN Victorian and Albury networks;
- Undertake an assessment of how AGN have efficiently sought to reduce UAFG levels during the 2013 to 17 regulatory period;
- Undertake an assessment on AGN's strategy to seek efficiencies to minimise UAFG levels during the 2018 to 2022 regulatory period; and
- Recommend UAFG benchmarks for the 2018 to 2022 regulatory period.

AIA have previously undertaken UAFG reports for all the Victorian gas networks in their submissions to the Essential Services Commission (ESC), and have developed a detailed understanding of the elements that contribute to the overall UAFG level.

This study has been undertaken by AIA for AGN's Victorian and Albury assets. This Report details the findings of the UAFG Study. Currently, AGN has a regulatory allowance for UAFG based on the actual level prior to the last regulatory review in 2013. This was set at 0.3% for Class A customers Victoria, 0.1% for Class A customers Albury and 3.7% for the Class B customers (Albury and Victoria) on the distribution network. Under the current arrangements, if for each retailer the actual UAFG is greater than the regulatory allowance, then AGN pays the retailer; if the actual UAFG is below the allowance the retailer pays AGN.

In recent years AGN has been at or slightly exceeding this allowance. This AIA report is intended to support the AGN's submission to the ESC on the calculation of UAFG benchmarks for the years 2018 to 2022.

UAFG is defined by the Victorian Wholesale Market Guide as, the difference between metered injected gas supply and allocated gas at delivery points.

UAFG comprises of gas losses, metering uncertainty, deviation from assumed pressure and temperature for billing, actual heating value difference from than the State declared value and other factors.

UAFG is difficult to break into component parts due to the inherent uncertainty (compared to electricity) of metering a compressible fluid and the lack of data associated with determining physical unmetered losses. UAFG is of increased importance worldwide, particularly in deregulated markets where the cost impacts have to be allocated between shippers and transporters.

1.2 Summary of Findings

- AIA has undertaken a bottom up assessment of the contributory elements of the Unaccounted for Gas (UAFG) in the AGN Victorian and Albury networks (Sections 4 and 5). This identified leakage from the distribution system, variations in pressures and temperatures assumed at customer billing and meter accuracy as being the major contributors of UAFG.
- A review of AGN's policies, procedures, plans, asset activities and management meeting minutes (Section 6) demonstrated that AGN have prudently planned and undertaken a comprehensive range of activities to minimize UAFG. Hence, in our opinion, AGN has maintained UAFG at efficient levels over the 2013 to 2017 period.
- AGN's have developed strategic plans on managing their assets that have been submitted to the AER and are designed to cost effectively minimise UAFG in the 2018 to 2022 period. These are outlined in Section 7 of this report. These include the total removal of cast iron and unprotected steel from the distribution network. AIA consider these robust and prudent in managing UAFG in the 2018 to 2022 period.
- AGN have used the "Revealed Cost" methodology to establish the UAFG benchmark. The multi-year average for years 2013 to 2015 produces a Class B UAFG benchmark of 4.0%. AIA consider this an appropriate benchmark for the 2018 to 2022 period.

1.3 AIA's UAFG Analysis

AIA recommends that UAFG is classified into two categories:

1. Measurement Based UAFG
2. Fugitive Emissions

This separation allows the UAFG due to leakage (i.e. fugitive emissions) to be assessed separately. Note that in some environmental reports fugitive emissions are referred to as the UAFG, but this is incorrect as the UAFG also includes measurement based UAFG.

To understand the complexity of UAFG and focus on those areas that have the greatest impact, further definition of UAFG sources has been determined by AIA within the above categories based on AIA industry knowledge and historic classifications. Assessment of UAFG has been made against each of the categories and calculation made of the contribution to UAFG. Figure 1 shows AIA's assessment of the expected UAFG contribution for each category for 2015. Further analysis has been undertaken to assess the uncertainty surrounding each of these values, with each of the categories having consistently different uncertainty based on the assumptions for each calculation.

The estimation of UAFG to each category results in around 23% of the 2,070 TJ of measured UAFG in 2015 not attributed to any category. This emphasizes the uncertainty associated with UAFG, particularly relating to Purchase meters and Meter Accuracy that have relatively low directly attributed UAFG contributions and large uncertainty. In the Figure 1 below the 'unknown' UAFG has been redistributed to categories based on their uncertainty. It is evident that there is significantly less distribution of the non-attributed UAFG to fugitive emissions as the understanding of this leakage source relates to the physical assets and previous leakage studies which gives more confidence to the fugitive emissions assessment than, for example, the potential for systematic uncertainty in the relatively small number of purchase meters (CTM's).

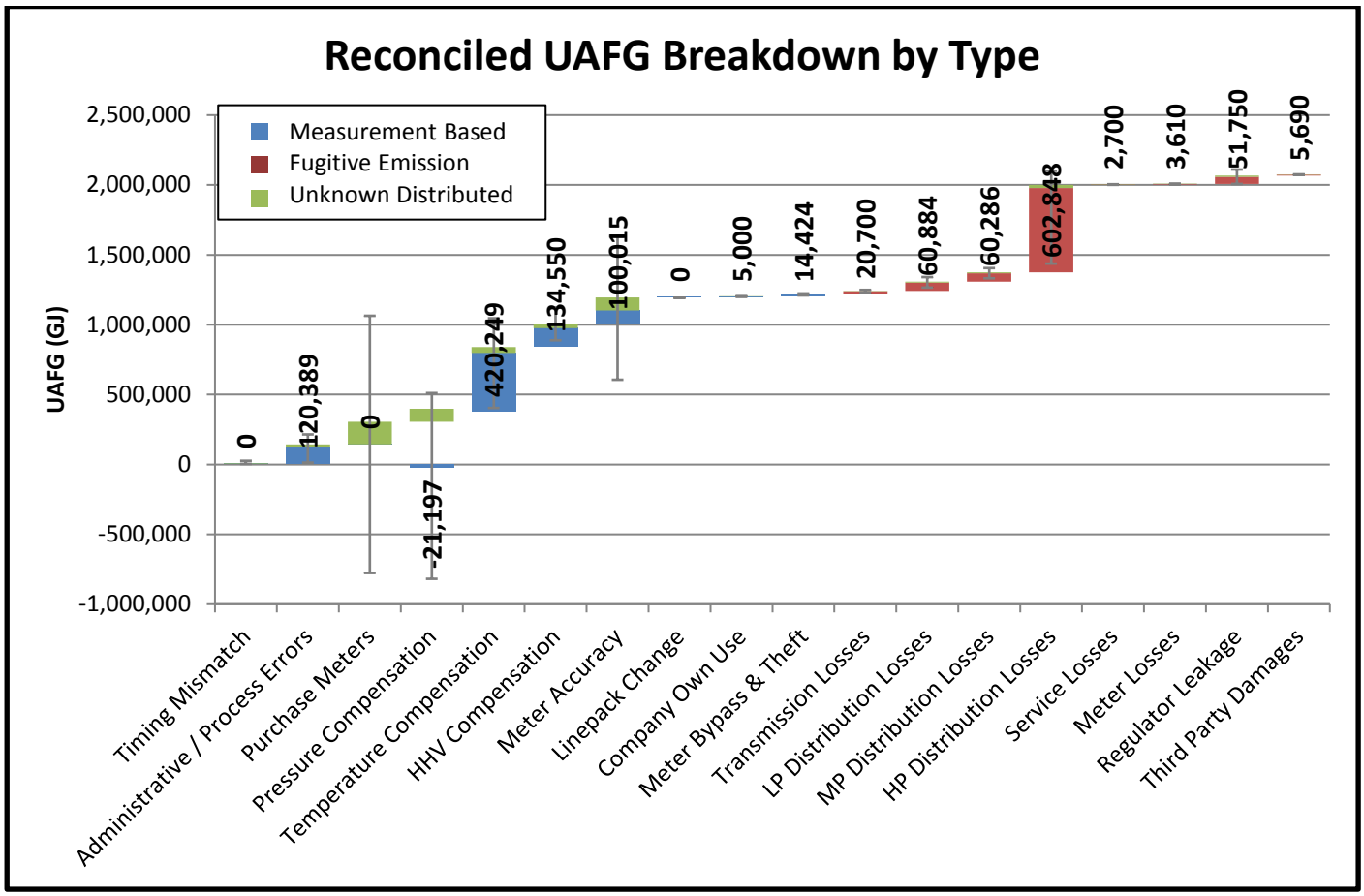

FIGURE 1 – ANNUAL RECONCILED 2015 UAFG BREAKDOWN

We have identified a number of UAFG issues (set out below) that are worthy of further investigation in the forthcoming regulatory period. Some of these matters could assist in managing UAFG, subject to undertaking the necessary analysis in conjunction with the AEMO Industry Reference Group, and completing business cases to justify the associated expenditure. It should also be noted that the impact of any initiative to reduce UAFG will lag behind the investment. Some of the matters set out below also illustrate the inherent uncertainty in measuring and managing UAFG.

1. **Purchase Meters (CTMs) Metering Accuracy**

   CTM's currently do not contribute to the UAFG calculation, but have an energy measurement uncertainty of up to +/- 3.0% of throughput1 when maintained correctly. For the large CTMs a small error can have a large impact on uncertainty on UAFG. A systematic 1.0% error in CTM readings would contribute approximately 33% of all of AGN's UAFG. Concerns in the uncertainty of some CTM's have led to the planned replacement of some of these meters.

   The Victorian Market Rules set out the requirements for CTM accuracy and the requirements for CTM calibration. The CTM's to the AGN territory are owned, operated and calibrated by APA GasNet. APA GasNet is obligated to carry out calibration in accordance with the market rules via an obligation in the connection agreement between APA GasNet and AGN. APA GasNet look to maintain uncertainty within +/- 1.0% and when uncertainty is found outside this range then remedial action is recommended to bring the uncertainty back to +/- 1.0%. A recent APA GasNet report indicated immediate or short term upgrades or replacement are required on 12 CTMs. The main reasons are lifecycle replacement after 20 years of operation together with 4 of the meters regularly operating at 120% of design capacity (one at 200%) hence operating at an unknown measurement uncertainty.

2. **Large Tariff D Customer uncertainty**

   As with CTM accuracy, metering tolerances here can have a large effect on the total level of UAFG due the high volumes involved.

   General meter accuracy limits are set out in the Gas Distribution System Code and Australian Standard AS 4944. AGN meter replacement programs are compliant with these requirements.

3. **Temperature Compensation**

   Temperature assumption for basic meter customers introduces an error that will increase UAFG when the temperature of gas passing through the meter is below 15 degrees C, especially in winter and on networks downstream of large PRS's where the pressure cut reduces the gas temperature. One important element of this error is that it is more pronounced for customers on HP networks where a further pressure cut is immediately upstream of the meter. Therefore the addition of customers to HP networks (including due to mains replacement) is increasing UAFG gradually on an annual basis.

4. **Classification of Class A Meters**

   The classification of meters as Class A or Class B for those customers near the 250,000 GJ p.a. threshold results in changes in the UAFG weighted benchmark. This does not impact actual UAFG but can impact the UAFG settlement. However the allocation of customers to

[1] AEMO "Wholesale market Metering Uncertainty Limits and Calibration Requirements Procedures (Victoria)"

either Class A or B must be carried out in accordance with the market rules. Actual customer consumption may vary such that the customer may turn out to be misclassified for the year in question, however it is not possible to retrospectively correct the customer allocation.

One interesting point on Class A customers in AGN is that the vast majority (over 85% of these customers equating to 65% of throughput) are connected to the HP network, and due the significant contribution to UAFG of HP leakage, meter uncertainty and HHV losses the actual UAFG for 65% of the Class A throughput is closer to the 3.7% Class B benchmark than the 0.3% Class A benchmark. Calculated on the basis of only 35% of the Class A having a realistic benchmark of 0.3%, then the "effective" Class B UAFG for AGN reduces from 4.1% to 3.6%.

5. HHV

The differential in average HHV between AGN and State-wide networks increased and then stabilised over the last few years with the increasing supply of higher HHV gas into the AGN network. This change coincided with the upward trend in AGN's Class B UAFG from 3.7% to 4.1% up to 2015 (estimated). The current average impact on UAFG is 136 TJ per year. The generation of data on HHV values in AGN over the coming years should feed into the AEMO Industry Reference Group to review the current methodology prior to future GAAR reviews.

6. I&C Pressure Set Point

An assessment of a sample of 8 I&C customers in AGN indicated the average pressure set point was higher than that assumed in billing. This caused an average 1.7% decrease in the energy billed. If the sample base is assumed to be reflective of the broader I&C population then applied to all non-pressure corrected Tariff V I&C customers the UAFG is assessed to be 117 TJ in 2015.

7. Fugitive Emissions

With the ongoing replacement of the LP assets reducing the population down to 463 km and only 90 km of MP assets, the largest individual contributor continues to be the HP mains. Even though the UAFG estimate for HP mains is driven by a low level of leakage rates for both the PE and protected steel, the relatively long lengths (over 10, 500km)and higher pressures of the HP network is increasing the fugitive emissions from these assets. As this is based on a low unit leakage level over many km this leakage source has not been included as a major cost driver for UAFG reduction. The continued replacement of cast iron and PVC in the LP and MP networks, as planned by AGN, should continue to be the focus for replacement, however, as shown in Figure 1, with most of this material replaced, the contribution from these networks is only a relatively small component of UAFG.

Although the replacement of these distribution mains will reduce the fugitive emissions from the network, these reductions are counterbalanced by increases in UAFG from two sources:

a) The majority of mains replaced are from the LP network, and are usually replaced by a HP supply. This HP supply has to be reduced in pressure just before the meter, and

the Joule Thomson effect from this pressure reduction causes cooling of the gas by approximately 2 degree C. This cooled gas delivered to the meter increases the UAFG by around 27 GJ /Km (based on a 2 degrees C less than standard temperature and 68 customers per km of network).

b) The remaining LP / MP network is subject to continuous deterioration with age. This can be demonstrated by the trends in PRE's Km LP Network / Leaks per km MP Network / Breaks per Km Cast Iron.

Importantly, in terms of AGN's current performance, AIA considers that AGN's UAFG management and policies are in line with best practice. AIA examined a suite of documents and held discussions with various APA personnel to assess the processes and diligence applied by AGN in analyzing UAFG movements and taking action where appropriate to minimize UAFG. The listing of UAFG documents reviewed by AIA and a summary of their impact on managing and reducing UAFG are included in Appendix 1. In our opinion, AGN applies significant resources in this area and has taken all reasonable and prudent measures in minimizing UAFG. Consequently we conclude that AGN has maintained UAFG at efficient levels over the 2013 to 2017 period.

The observed minor increase in Class B UAFG over the period since 2013 is, in our opinion, not the result of inefficiency. A number of factors have influenced the recent increases in Class B UAFG up to 4.3% (for 2015), such as systematic uncertainty of the CTM's (some are being replaced), the higher average HHV in AGN's network than the declared statewide average, the ongoing connection of customers to the HP network (resulting from the lower temperature effect of new customer connections and connection of existing customers to HP following the replacement of LP mains). One important factor in 2015 is the particularly cold winter which resulted in the weighted average temperature of gas in the distribution network to be assessed at 13.5 C (using temperature monitoring at large I&C sites).

AIA agree with the views of ESC in their March 2013 Draft Decision on UAFG Benchmarks in that many factors, which pull in opposite directions, affect the current levels of UAFG. It is considered by AIA that there are no additional cost effective actions available to AGN that would effectively reduce the current effective Class B UAFG level.

AIA also acknowledges that the Victorian Distribution Businesses, as is the case in other jurisdictions, need to ensure that any investment in reducing UAFG needs to be cost effective as any investment that does not prove to be prudent can be disallowed by the AER.

2 INFORMATION PROVIDED

In order to undertake the assessment AIA requested and was provided extensive information on the networks, including:-

- The length and diameter of all pipelines and mains by pressure tier and material
- The UAFG level for 2013 to 2015
- The injections and withdrawals for 2015
- Tariff V and D withdrawals
- Customer numbers by tariff type
- Tariff D customer volumes with and without pressure and temperature correction
- Network Temperature data
- Network pressure data
- Network HHV data
- Number of services by material and pressure tier
- Levels of 3rd party damage for both mains and services
- Number of customers connected to each pressure tier
- Number of theft of gas detections
- Details on Own Use Gas
- Average Elevation and barometric pressure
- Previous UAFG and relevant reports

3 AIA UAFG ASSESSMENT

3.1 HISTORICAL UAFG PERFORMANCE

The trend in Class B UAFG in the Victorian and Albury Network has broadly been increasing from 2003 to 2013, and in 2013 to 2015 appears to be varying at or above the current Class B benchmark of 3.7% as shown in Figure 2 below.

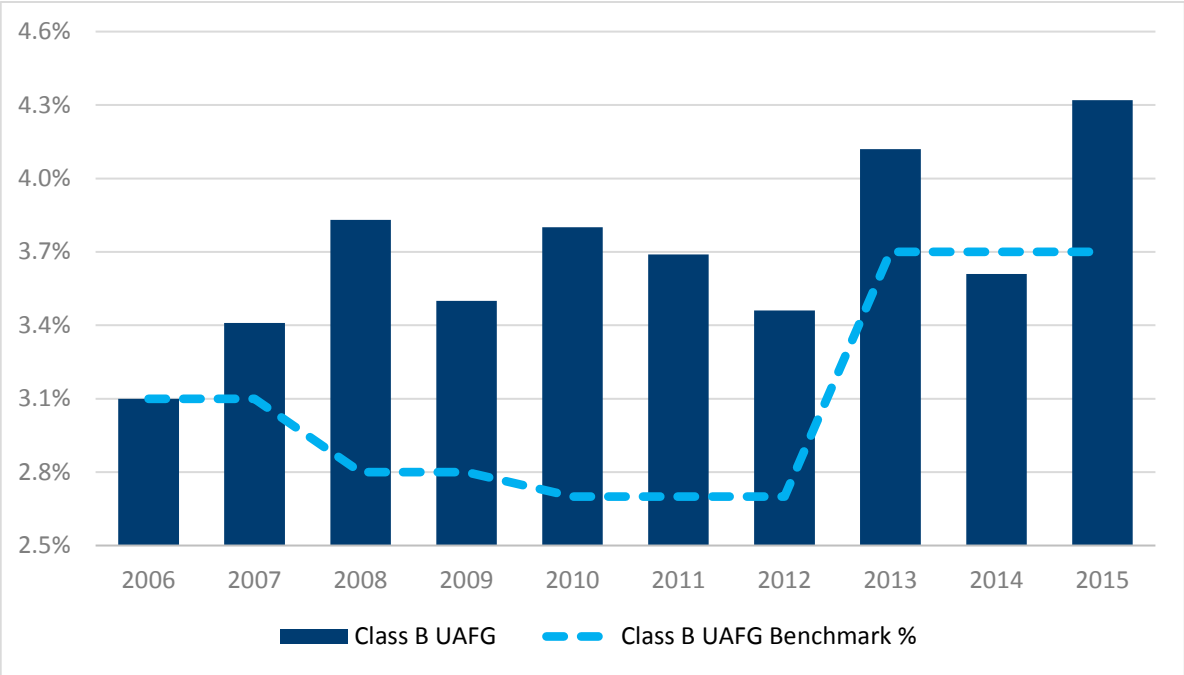

FIGURE 2 – CLASS B UAFG PERFORMANCE SINCE 2006

AGN's Class B UAFG comparison with the other DB's in Victoria up to 2015 is shown below in Figure 3. Although AGN is on a generally rising trend it is consistently lower than the other DB's.

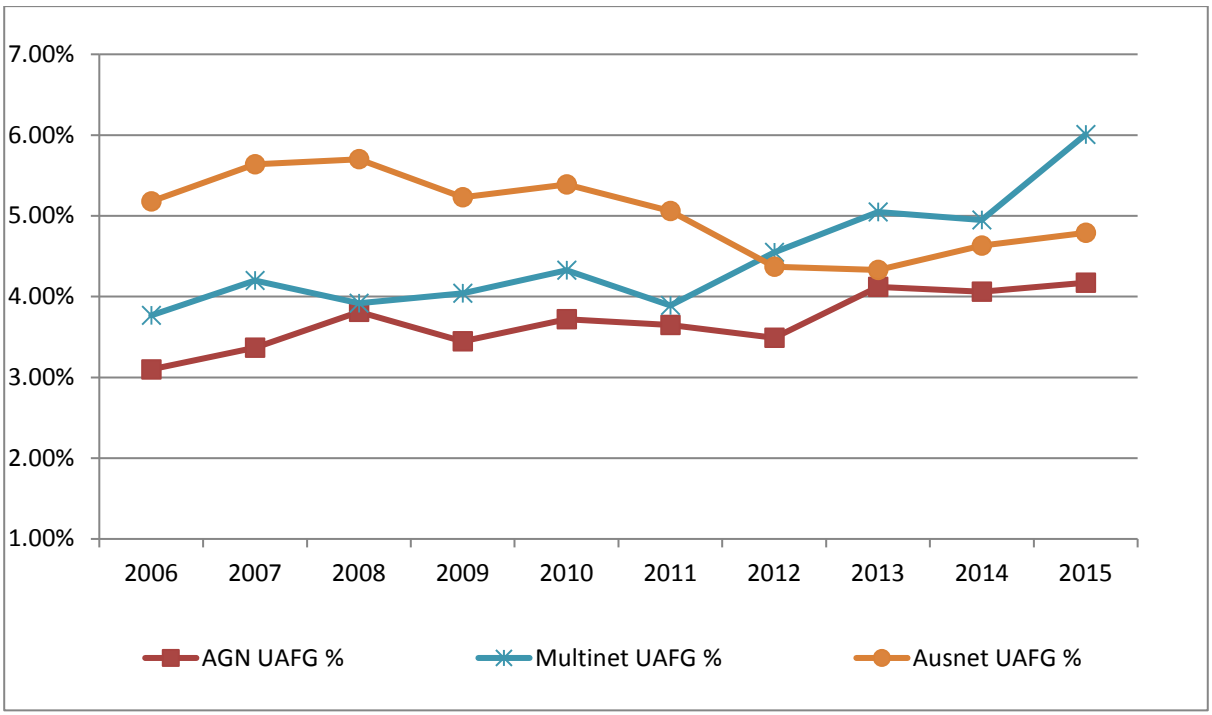

FIGURE 3 - CLASS B UAFG (%) COMPARISON BETWEEN OTHER VICTORIAN DB'S

3.2 Component Analysis of AGN UAFG

AIA assessed the contributory elements of UAFG in AGN's Victorian and Albury networks based on the same principles as previous AIA reports for clients to support their submissions to the ESC and the AER.

The contributory elements to UAFG are classified as either Measurement UAFG or Fugitive Emission UAFG.

Fugitive Emission UAFG elements include:

- Losses from the LP, MP, HP mains and Transmission pipelines – varies with material and pressure
- Losses from service lines – varies with material and pressure
- Regulator leakage – control system bleeds to atmosphere
- Third Party Damage – losses to atmosphere
- Meter Losses – joint leakage

Measurement UAFG elements include:

- Pressure measurement – gas delivered at variation to Standard Conditions
- Temperature measurement -gas delivered at variation to Standard Conditions
- HHV measurement – gas delivered at variation to declared HHV
- CTM measurement – uncertainty in metered volumes
- Meter Accuracy - uncertainty in metered volumes

- Linepack Changes – Linepack volume varies each year end date
- Administrative errors – incorrect records
- Own Use Gas – gas used for operational reasons
- Theft

AIA has a model that assesses the UAFG contribution to UAFG from each of the above elements. The output of the model is shown in a stacked chart format to readily identify the relative contribution of each element.

Inevitably the assessed level of UAFG does not match the total UAFG level measured and there will generally be an "unknown" amount of UAFG that is not readily attributed. In this case the AIA model can attribute this unknown amount in accordance with the level of uncertainty that AIA consider appropriate for each element. For example the CTM measurements of injections into a network usually have a UAFG assessment of zero (unless data shows otherwise). However each meter has an uncertainty of +/- 3%, and as a group of meters the total uncertainty is potentially around +/- 1.0%. As the CTM's measure total injections, any systematic bias will have a major impact on UAFG, and hence has a relatively high level of uncertainty in its contribution to UAFG. On the other hand, assessment of the uncertainty of some UAFG elements, such as leakage from the transmission network, will be relatively low due to the high integrity of these assets.

AIA used the information provided to assess the contributory elements of UAFG for 2015 where the UAFG level was 2,070 TJ.

4 ASSESSMENT OF UAFG ELEMENTS

The following chart indicates the assessed level of UAFG for each contributory element of the total 2,070TJ for 2015.

The UAFG level in GJ is shown for each element, together with the level of uncertainty AIA attributes to that element (shown as a vertical line). Some elements such as Pressure Compensation may have the effect of reducing UAFG as the altitude effect can result in gas being supplied to customers being at a lower pressure than that assumed for customer billing. This "negative" UAFG is shown reducing the cumulative UAFG on the stacked chart. The total attributable UAFG was assessed to be 1,585 TJ. This resulted in an unknown UAFG level of 485 TJ which is shown on the right hand side in grey that is not readily attributed to any individual UAFG element.

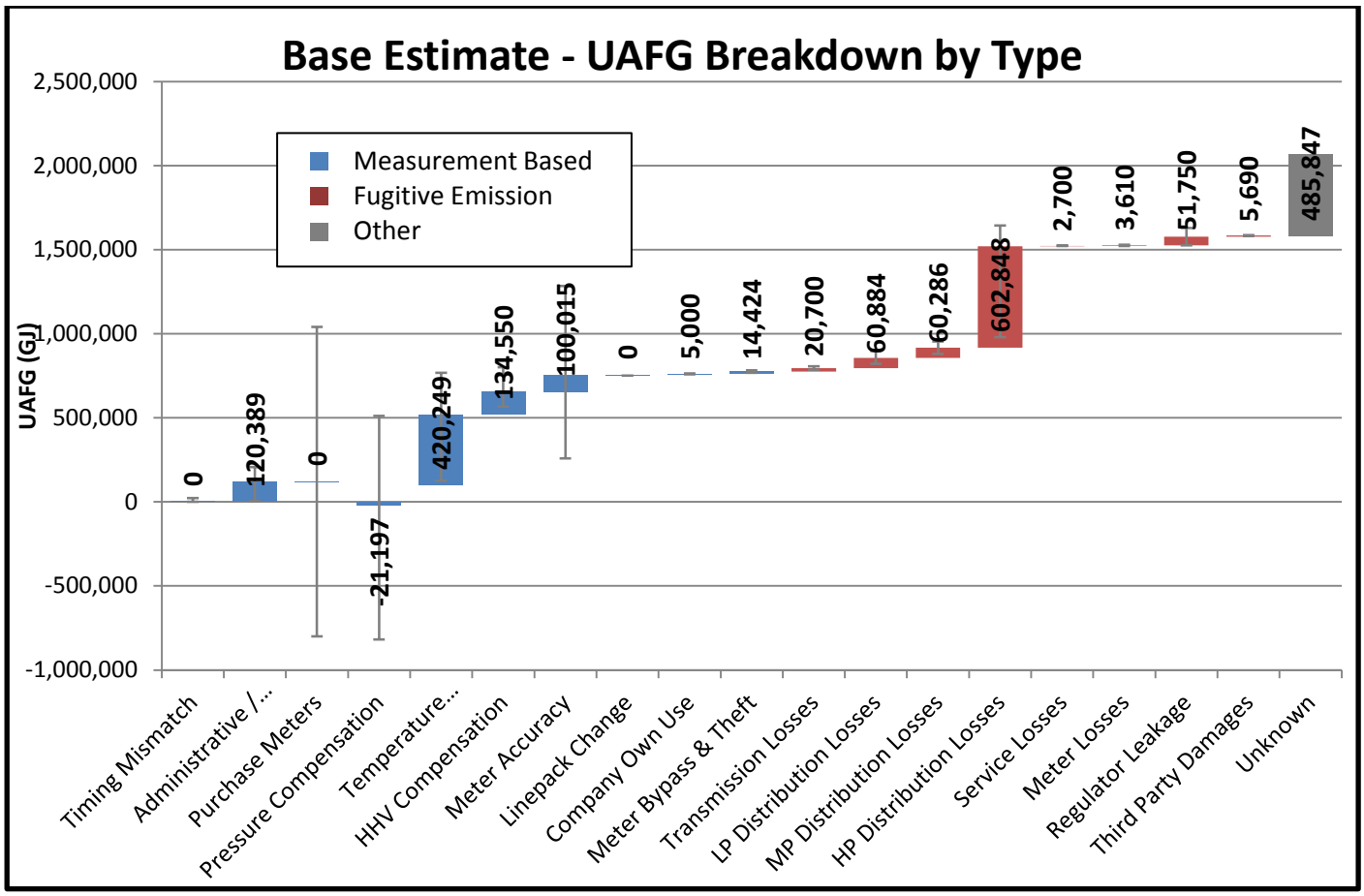

FIGURE 4 – STACKED CHART BY COMPONENT FOR 2015 UAFG

With the continued replacement policy reducing the remaining lengths of LP and MP assets to 463 km and 90 km respectively, the largest individual contributor continues to be the HP mains. Even though the UAFG estimate for HP mains is driven by a low level of leakage rates for the PE and protected steel, the relatively long lengths (over 10,500 km) and higher pressures of the HP network is increasing the fugitive emissions from these assets. As this is based on a low unit leakage level over many km this leakage source has not been included as a major cost driver for UAFG reduction. The continued replacement of cast iron and PVC in the LP and MP networks should, as planned by AGN, continue to be the focus for replacement as they have high leakage rates per kilometer. The other fugitive emission elements are relatively low and are at a level expected in similar networks.

Total Fugitive Emissions UAFG is assessed to be 808 TJ.

For Measurement UAFG a major contributor is gas being delivered to Tariff V customers on the LP network at a lower temperature than assumed in the gas bill (assessed from temperature data during 2015 from 15 sites across the AGN network that have pressure and temperature monitoring to have a flow weighted average temperature over the year to be 1.5 C less than standard temperature). This is particularly the case where Tariff V customers are supplied from the HP gas network where the pressure is further reduced just before the meter. This pressure reduction cools the gas and has been measured at peak times in the winter months (on Tariff D customers) to be delivered up to 12 degrees centigrade below the temperature assumed for billing. Supply to Tariff

V customers at these low temperatures tends to be at times of greatest demand hence increasing the effect. These customers are therefore delivered more energy than they pay for and hence are a major contributor to temperature related UAFG which is assessed to be 420 TJ of UAFG per year based on an average pressure drop of 300 kPa at the meter. However, in order to more accurately assess this temperature effect on UAFG it is recommended that a number of electronic meters are installed at residential tariff V customer properties to enable a more accurate tariff V annual temperature profile to be established based on measured temperature data throughout the networks.

An assessment of 8 I&C supplies in AGN indicated the average pressure set point was higher than that assumed in billing. This caused an average 1.7% decrease in the energy billed. Applied to all non-pressure corrected Tariff V I&C customers the UAFG is assessed to be 117 TJ in 2015. In the chart this is included in Administrative and Process UAFG.

CTM measurement is assessed to be zero UAFG as there is no evidence indicating otherwise. However, individual CTM's have an uncertainty of +/- 3% of energy throughput, and as a total group this uncertainty is in the order of up to +/- 1.0% of total throughput. Hence a high level of uncertainty can be attributed to CTM measurement as any systematic bias can contribute significantly to UAFG.

Meter accuracy is assessed to contribute 100 TJ to UAFG, generally as a consequence meters operating at or over design capacity as meters tend to under-read at this level. Meter accuracy also has similar uncertainty levels as the CTM's mentioned above.

The elevation of the network can have a negative contribution to UAFG as high elevations will reduce the pressure at the meter. For the AGN network the average elevation of 44 metres has been applied, which results in a relatively small reduction in UAFG of 21 TJ as shown in Figure 2.

Based on reports provided by AGN on previous AEMO studies, the HHV contribution is assumed to be 135 TJ, and the impact of linepack and timing errors in meter readings are assumed to be minimal. These assumed levels of UAFG are consistent with previous studies undertaken by AIA.

The other Measurement elements of UAFG have a relatively small contribution and are in line with levels expected in similar networks.

The total net Measurement UAFG has been assessed to be 776 TJ.

5 DISTRIBUTION OF UNKNOWN UAFG

In figure 5 the "unknown" 485 TJ of UAFG has been attributed to individual UAFG elements in line with their individual uncertainty.

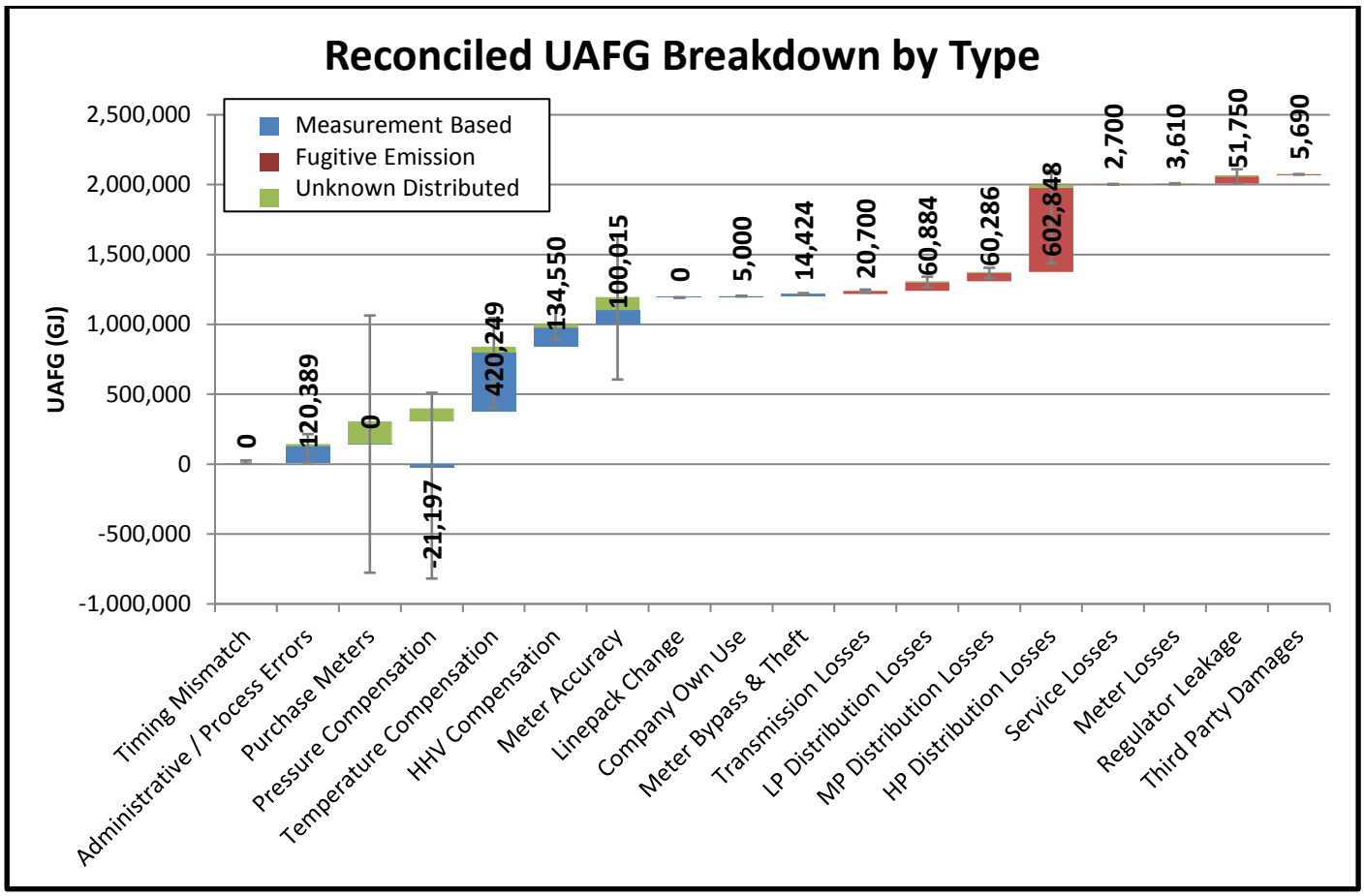

FIGURE 5 – STACKED CHART WITH UNKNOWN UAFG DISTRIBUTED FOR 2015

This results in the largest contributors to UAFG being the combined LP, MP and HP mains at 760 TJ, with total Fugitive Emissions UAFG increasing from 808 TJto 856 TJ.

The major individual contributors to UAFG per kilometre are the LP and MP mains at 68 TJ and 67 TJ respectively mainly due to the contribution from cast iron, unprotected steel and PVC mains. These should be target areas to reduce UAFG.

The CTM measurement UAFG increases from zero to 161 TJ and meter accuracy increases from 100 TJ to 193 TJ. Concerns in the uncertainty of some CTM's have led to the planned replacement of some of these meters. The Victorian Market Rules set out the requirements for CTM accuracy and the requirements for CTM calibration. The CTM's to the AGN territory are owned, operated and calibrated by APA GasNet. APA GasNet is obligated to carry out calibration in accordance with the market rules via an obligation in the connection agreement between APA GasNet and AGN. APA GasNet look to maintain uncertainty within +/- 1.0% and when uncertainty is found outside this range then remedial action is recommended to bring the uncertainty back to +/- 1.0%. A recent APA GasNet report indicated immediate or short term upgrades or replacement are required on 12

CTMs. The main reasons are lifecycle replacement after 20 years of operation together with 4 of the meters regularly operating at 120% of design capacity (one at 200%) hence operating at an unknown measurement uncertainty

The uncertainty associated with the delivery of gas to Tariff V customers at temperatures that are below standard temperature is a significant contributor to UAFG, especially to those customers supplied from the HP network, and in total is assessed to be 464 TJ. This assessment can be more accurately measured with the installation of a number of electronic meters that can log the customer delivery temperatures throughout the pressure tiers.

Having the state-wide HHV declared at a lower average HHV than that supplied to the AGN network, due to increasing supplies of higher HHV gas, can increase UAFG of up to 160 TJ.

The variation in pressure set point on I&C supplies from that assumed in billing has the potential to contribute up to 130 TJ of UAFG, but based on a relatively small sample.

The other Measurement UAFG elements have relatively low contributions, and the total Measurement UAFG increases from 776 TJto 1214 TJ mainly due to the uncertainty associated with injection and withdrawal metering and supplying gas at temperatures and pressures that vary from that assumed in billing.

The summary of directly attributed UAFG and directly attributed with distributed UAFG is shown in Figure 6 below.

[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]
[C-I-C]		[C-I-C]	[C-I-C]	[C-I-C]
[C-I-C]		[C-I-C]	[C-I-C]	[C-I-C]
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]

FIGURE 6 SUMMARY OF DIRECTLY ATTRIBUTED AND DISTRIBUTED UAFG

5.1 Changes in UAFG drivers' since 2008 and 2012 review

Since AGN's UAFG report to the ESC in 2013, (which AIA did not undertake but provided a methodology review) AIA does not consider there has been any new UAFG drivers, however, the data reviewed in the current report indicates there is additional weighting to some drivers as follows:

- Cold temperature effect – 2015 data indicated that average temperatures were 1.5°C less than the assumed 15°C in billing. In the winter months during high gas demand the gas temperatures were measured as low as 5°C.
- Pressure supplied to I&C customers has been assessed from a sample of 8 I&C sites to be providing 1.7% more energy than billed due to compensation for regulator droop. This level of UAFG has likely always been there, but until the detailed work was done it was assumed to be much less.
- Recent audits have indicated that 12 of the CTM's supplying the AGN network require replacement due to exceeding design capacity or reaching their service life. This supports the potential high level of UAFG that is attributed to these large meters.

6 MANAGEMENT OF UAFG 2013 TO 2017

In undertaking this report AIA reviewed AGN reports on activities undertaken in 2013 to 2017 to actively manage and cost effectively minimise UAFG levels in the network.

AIA can confirm the following actions are undertaken by AGN to reduce UAFG, and are evidenced in reports referenced in Appendix 1

6.1 MAINS REPLACEMENT

This activity replaces the older cast iron, unprotected steel and PVC mains that have the highest leakage rates and are a significant contributor to UAFG. The level of replacement for this period was agreed with the AER and the achievement of these replacement levels are closely monitored on a monthly basis within the business as demonstrated by the APA AGN O&M Monthly Reports. AIA confirms that the AER agreed replacement level is on target to replace 696 km over the 2013 to 2017 period.

6.2 METER REPLACEMENT

The meter replacement programme is designed to ensure all the meters in the AGN network meet the required accuracy standard.

This activity is driven by the National Standard AS 4944 2006 that sets out sample testing of meter families to determine if their accuracy performance enables their operational lives to be extended. Hence meter replacement is driven by the age profile of meters within the network and the results of the meter testing programme. Ensuring that all the meters in the network achieve the prescribed accuracy both provides accurate bills for customers and minimises UAFG.

In the 2013 to 2017 period around 28,000 replacement meters per year were installed . This is in line with the planned replacement levels and is an increase from the 2008 to 2012 period by around 15%.

One interesting feature of the meter testing programme is that it is evident that the newer meters are not achieving the life extension levels of the older meters. This is increasing the number of meter replacements required in the 2018 to 2022 period.

6.3 PRESSURE CONTROL UPGRADE

The AGN SCADA system actively manages the pressure in the networks to minimise average network pressure and hence reduce leakage and UAFG. A review of the average pressures in the AGN network over the 2013 to 2017 period indicates a 16% reduction in network pressures in both 2014 and 2015 compared to 2013. This is due to the upgrade in the SCADA system in 2014 that significantly improved the quality of pressure control and reduced the frequency of the system defaulting to high pressure.

6.4 LEAKAGE MANAGEMENT

The prompt response and repair of network leaks is a critical activity for both public safety and minimising network leakage. AGN have robust procedures (AGN APA Asset Management Plan December 2016) to control, monitor and report this activity. The overall leak rate for mains and services has remained relatively static at about 0.33 leaks per kilometer per year. A reduction in cast iron and unprotected steel mains leaks, as result of mains replacement over the last few years, has been offset by an increase in PE and protected steel service leaks.

AIA have reviewed the performance of AGN over the 2013 to 2017 period to date and confirm:-

- Leak response times, leakage survey and the number of outstanding leaks are closely monitored and are high profile KPI's that are reported and actioned at the APA Group Monthly Operating and Management Report for AGN.
- Overall AGN achieved the increasing KPI target of over 95% public reported leaks being responded to within the 2 hour period. AGN has a process to tighten this target KPI over time. In 2015 it was 95%, in 2016 it was 96% and in 2017 it's 96.5%.
- 100% of leakage Survey were undertaken
- 98% of Class 1 and 2 leaks are repaired within the target period, and any outstanding leaks are closely monitored and repaired.

This high level reporting and action by top level management keeps a strong performance focus on this important activity.

6.5 MANAGEMENT OF 3RD PARTY DAMAGE

AGN have a robust policies for incentivising 3rd parties not to damage their network when excavating in the vicinity of the AGN network. In addition to the Dial Before You Dig activities, AGN invoice the parties responsible for damage and normally ensure the party signs to accept they damaged the network while AGN are on site undertaking the repair. In 2016, 758 invoices were issued with a value of $347,000. In AIA's opinion this is an additional effective deterrent to minimise damage and the consequential lost gas.

6.6 CTM REPLACEMENT AND REFURBISHMENT.

Uncertainty in CTM measurement has the potential to be major contributors to UAFG due to the high gas volumes flowing through a relatively small number of meters. A recent APA GasNet report indicates immediate or short term upgrades or replacements are required on 12 CTMs. The main reasons are lifecycle replacement after 20 years of operation together with 4 of the meters regularly operating at 120% of design capacity (one at 200%) hence operating at an unknown measurement uncertainty. AGN in conjunction with APA GasNet, have further refined this report in order for AGN to gain financial approval to undertake these replacements and upgrades.

6.7 Pressure Set Points

Only customers with a high gas consumption have meters that are corrected for the pressure and temperature of gas delivered. The vast majority of customers have assumed pressure and temperature at the meter. Correction factors based on the assumed pressure and temperature are then applied to the meter volume to bill the customer. However the pressure supplied to the customer drops as its demand increases (droop), and to enable the customer to have the required pressure at peak demand, when the demand reduces the pressure at the meter increases effectively providing some free gas (UAFG) to the customer. This has the potential to be a significant source of UAFG, particularly with the I&C customers that do not have pressure correction at the meter.

In order to minimise this source of UAFG, AGN undertake regular checks on the set points to correct for any set point variation. These procedures are included in Appendix 1 (APA Group Document – I&C Meter Station Maintenance Procedure March 2017).

6.8 Network temperatures

As indicated in 6.7 above, variations from the assumed billing pressure or temperature can be a significant source of UAFG.

In the 2013 to 2017 period, in order to assess its impact on UAFG, AGN initiated an analysis of network temperatures from the larger meters that have gas temperature correction. This proved the reduction in network temperature be more than anticipated with the average flow weighted network temperature was assessed to be in the region of 1.5C less than the 15C assumed for customer billing.

This was further supported by the analysis of air temperatures across 7 regions in the AGN Victorian and Albury network. This analysis in the Figure 7 below demonstrated between 2006 and 2015 a variation in average daily minimum temperature per month varied from 3C to 17C and within a month there is a 5C difference between Albury and Frankston.

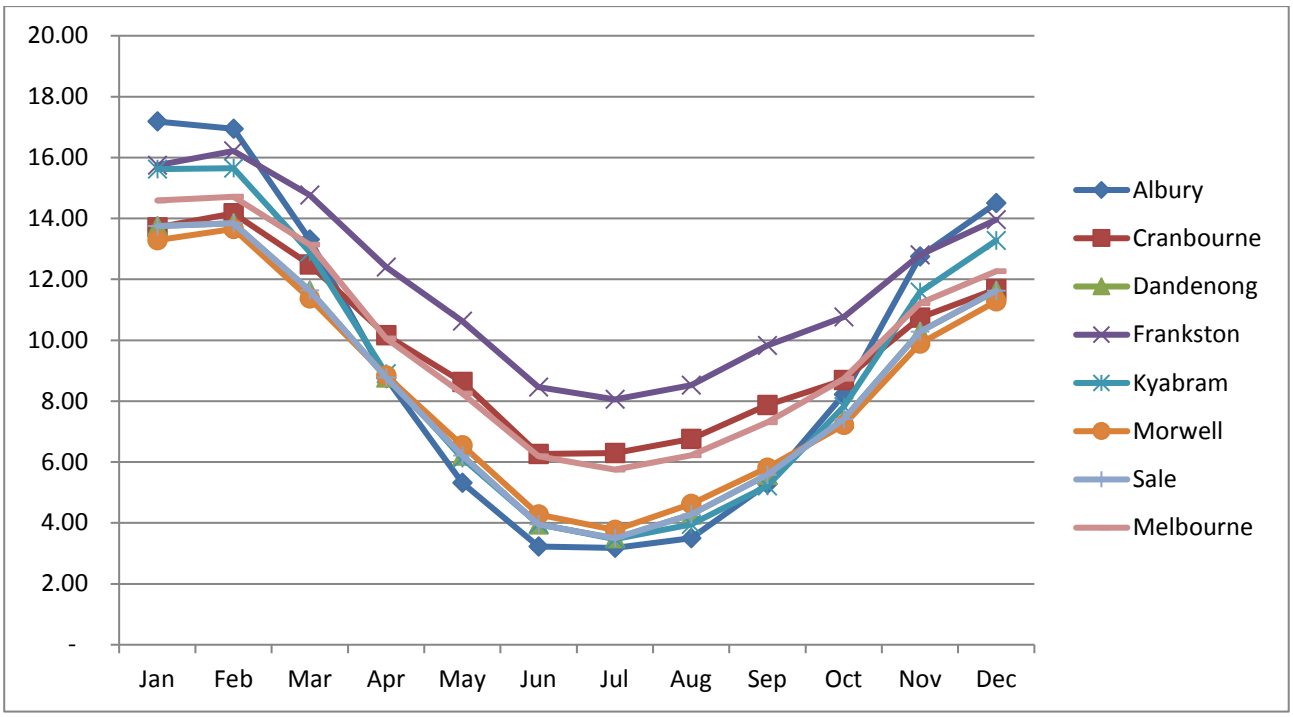

FIGURE 7 - AVERAGE 10 YEAR MINIMUM DAILY TEMPERATURE (DEGREES C) PER MONTH

Temperature variations are an important influence on UAFG as it not only effects gas temperature but it also effects throughput and pressure in the network, both of which impact on UAFG.

These analysis demonstrate that temperature variations from the 15C assumed for customer billing has the potential to be a significant contributor to UAFG. As a consequence of these analyses, AGN are exploring the technical options of installing across the AGN network a number of new domestic meters that record gas pressure and temperature. These will be installed downstream of a customer's meter and allow AGN to assess the differences in customer billing when correcting for actual pressure and temperature. This could lead to the development of cost effective UAFG reduction initiatives such to remove this significant source of UAFG (eg extension of temperature correction to domestic meters).

6.9 Billing Systems

The correct billing of customers and the minimisation of UAFG is totally dependent on accurate data in AGN's billing systems. This includes not only meter readings but the appropriate correction factor applied to customer billing.

During the current regulatory period, AGN has implemented both a national Enterprise Asset Management (Maximo) system and a national Customer Care and Billing (CCB) system. These implementations have also included some optimisations to ensure significant increases and decreases in basic metered consumption are identified and reviewed. The implementation of the new systems indicated a significant decrease in consumption. AGN is currently investigating whether there may be a meter failure that is contributing to both lost revenue and also increased UAFG.

6.10 Billing System Audits

The metering and site billing department periodically undertake reviews between the Enterprise Asset Management System (Maximo) and the Customer Care and Billing System (CCB) to check that the appropriate correction factor is in the billing system. These reviews do find a small number of incorrect correction factors hence the reviews are undertaken regularly.

As a matter of practice for some years AGN have included all sites with inlets/services only (ie no meter attached) on our meter reading routes. This provides an additional audit activity / control mechanism to ensure should someone illegally connect a meter after disconnection, or paperwork from a meter fix was mislaid or not delivered by a contractor, then AGN would identify this within the next meter read cycle (ie within 2 months).

In addition to this, AGN teams undertake various reviews including:-

- Business and Residential – ensuring high consuming sites are set up correctly
- MIRN reconciliation between Maximo and CCB
- Meter status reviews
- MIRN status discrepancies between Maximo and CCB

6.11 UAFG Monitoring

UAFG has a high priority within the management of the AGN network. UAFG levels are monitored reported monthly at the APA Group Monthly Operating and Management Report for AGN. Meeting minutes indicate that any increases in UAFG are promptly investigated and action taken to remedy.

7 STRATEGY TO MINIMISE UAFG 2018 TO 2022

The principal elements of AGN's strategy to minimise UAG in the forthcoming Access Arrangement (AA) are included in the following documents submitted to the AER:-

- AGN Victorian and Albury Access Arrangements 2018 to 2022, Dec 2016
- AGN Distribution Mains and Services Integrity Plan 2016
- AGN Meter Replacement Management Plan December 2016

These are summarised below.

7.1 MAINS REPLACEMENT

The Distribution Mains and Services Integrity Plan has been submitted to the AER and sets out in detail the strategy of mains and service replacement for the 2018 to 2022 period. This is a significant driver in the minimisation of UAFG.

This includes:-

- The risk based principles to identify the mains and services for replacement
- The replacement of all the 177 km remaining cast iron and unprotected steel (high risk and high leakage)
- The replacement of 110 km of high risk PVC
- The replacement of 10 km of older HDPE

The replacement of all the cast iron and unprotected steel is a major milestone in the mitigation of risk and the reduction of UAFG in the AGN network.

In AGNs network in South Australia there has been a propensity of sudden cracking in the older (over 35 years) HDPE. There is 597 km of HDPE of a similar type and age in Victoria. AGN are therefore prudently undertaking replacement of 7 km the older HDPE population in order to ascertain its condition. AGN will also sample 3 km of the 2,408 km of younger HDPE. This is being undertaken in conjunction with Deakin University who will lead the technical assessment to:-

- Develop methods to identify and measure the deterioration of this "first generation" HDPE material
- Identify the causes of the cracking behaviour eg defects created by "squeeze offs"

AGN will use these outcomes to:-

- Continue with research and development of inline camera technology to identify defects
- Develop reliability forecast models for this older HDPE to optimise mitigating measures including future replacement

AGN have received a letter from the ESV supporting AGN's proposed mains and services replacement strategy and replacement programme over the 2018 to 2022 period.

7.2 Meter Replacement Programme

Ongoing meter replacement ensures the accuracy of meters for customer billing and to minimise this source of UAFG. AGN will continue with the meter family accuracy testing and meter replacement programme as required by the National Standard AS 4944 2006. The strategy for 2018 to 2022 is detailed in the AGN Meter Replacement Management Plan December 2016 that has been submitted to the AER. In summary this strategy includes:-

- Replacement of domestic and commercial meters driven by their age profile and life extension testing forecasting high volatility in annual replacement ranging from 17,760 to 52,725 for domestic and 508 to 2,147 for commercial meters.
- To optimise the volatility of the programme in order to minimise the effect on delivery risks (workforce and meter availability) the range has been smoothed to 26,000 to 40,000 for domestic and 1300 to 1,800 for commercial meters.
- Over the next AA, AGN plan to replace 152,621 domestic meters which is 6% higher than those replaced in the current AA. This increase is largely due to the growth in domestic meters in 2003 to 2007 period (now approaching their 15 year life), and the higher life extension failure rate evident in newer meters.
- There are 7,055 commercial meters planned for replacement in the forthcoming AA which is almost double that replaced in the current AA. This is primarily due to the growth of commercial meters in the 2003 to 2007 period now approaching their service life.
- Life extension testing will continue throughout the 2018 to 2022 period as required by AS4944 2006.

7.3 Leakage Management

Leakage response and leak repair times are important mitigation measures to minimise UAFG. The AGN document, Asset Management Plan December 2016, sets out AGN's strategy for these activities for the 2018 to 2022 period.

The strategy maintains its current targets for response times for public reported escapes, the times for repairing Class 1 and 2 leaks, and the completion of the leakage survey programme.

The robust monitoring of leakage survey completion and the response time and repair time KPI's that are reported monthly to senior AGN and APA management ensure that actions will be taken to remedy any performance that does not meet the required targets as evident by AGNs performance in the current AA (Section 6.4). AGN have a process that seeks to tighten over time the KPI target level of leaks responded to within 2 hours as demonstrated in 6.4 above.

7.4 Other UAFG Actions in the 2018 to 2022 Period

In addition to the above, AGN have planned numerous actions and initiatives to reduce and further understand UAFG. These are outlined below:-

- Further investment in improving the SCADA system thereby improving pressure management and managing UAFG. This will include expanding the SCADA to 30 new sites and the upgrade of 24 existing sites.
- Replacement or refurbishment of 12 CTM sites.
- Continue with the robust invoicing of parties causing damage to the network.
- Planning to install domestic meters with pressure and temperature correction at strategic locations around the network to ascertain the potential materiality of UAFG from the current billing assumptions of gas pressure and temperature. This data will feed into a study on the cost effectiveness of extending pressure and temperature correction to commercial and domestic meters.
- Continue with billing system audits to ensure critical customer billing data is correct and consistent between the customer billing system and asset management system.
- Continue with the focus on UAFG monitoring and actions at the monthly AGN O&M Meeting.

8 PROPOSED 2018 TO 2022 BENCHMARKS

AGN have used the "Revealed Cost" methodology to establish the UAFG benchmark as recommended by the ESC. The multi-year average for years 2013 to 2015 produces a Class B UAFG benchmark of 4.0%. AIA consider this an appropriate benchmark for the 2018 to 2022 period.

9 CONCLUSIONS

For AGN's Victorian networks AIA has applied its UAFG model to the network information provided by APA and AGN.

This model assessed the contribution of UAFG to each Measurement and Fugitive Emission element of UAFG as shown in Figure 1. The major contributors to UAFG were assessed to be leakage from the distribution mains, gas supplied at temperatures below the billing temperature (15C), gas supplied at higher HHV than the declared State average, gas supplied at higher pressures than that assumed at billing and uncertainty in CTM and large customer meters

The cumulative assessment of UAFG identified 1,585 TJ of attributable UAFG resulting in 485 TJ of "unknown" UAFG, with much of the "unknown" likely due to measurement uncertainty of the CTM injection and all the withdrawal meters.

This "unknown" UAFG was distributed to each UAFG element in proportion with the each element's likely uncertainty as shown in Figure 2. This indicates that in addition to mains leakage, CTM measurement, meter accuracy and supplying gas at a lower temperature to that assumed when billed are probably significant contributors to UAFG.

This analysis indicates that Fugitive Emissions account for 856 TJ, and Measurement accounts for 1,214 TJ of the total 2,070 TJ of UAFG in 2015.

The analysis indicates that the major contributors to UAFG per kilometre are the LP and MP mains at 68 TJ and 67 TJ respectively. The prime drivers are the population of cast iron, PVC and unprotected steel. Replacement of the LP and MP cast iron and unprotected steel population should reduce both the UAFG and the risk of any gas escapes entering a building, particularly on the MP network.

Although the replacement of these distribution mains will reduce the fugitive emissions from the network, these reductions are counterbalanced by increases in UAFG from two sources:

a) The majority of mains replaced are from the LP network, and are usually replaced by a HP supply. This HP supply has to be reduced in pressure just before the meter, and the Joule Thomson affect from this pressure reduction causes cooling of the gas by approximately 2 degrees C. This cooled gas delivered to the meter increases the UAFG by 27 GJ /Km (based on a 2 degrees C less than standard temperature and 68 customers per km of network).
b) The remaining LP / MP network is subject to continuous deterioration with age. This can be demonstrated by the trends in PRE's Km LP Network / Leaks per km MP Network / Breaks per Km Cast Iron.

All things being equal, once the mains replacement program is completed, the 68 TJ and 67 TJ of UAFG from the LP and MP mains respectively would be eliminated and replaced by an estimated 30 TJ from the HP related UAFG, resulting in an estimated annual net decrease of around 105 TJ of UAFG.

The observed increase in Class B UAFG over the period since 2013 from 3.7% to 4.3% is, in our opinion, not the result of inefficiency. A number of factors have influenced the recent small increases in Class B UAFG, such as the systematic uncertainty of CTM's (replacement program in progress) statewide declared HHV being lower than the AGN average HHV and the ongoing connection of customers to the HP network (resulting from the lower temperature effect of new customer connections and connection of existing customers to HP following the replacement of LP mains) and the uncertainty in CTM and large customer meters). One important factor in 2015 is the particularly cold winter which resulted in the weighted average temperature of gas in the distribution network to be assessed at 13.5 C (using temperature monitoring at large I&C sites).

Importantly, in terms of AGN's current performance, AIA considers that AGN's UAFG management and policies are in line with best practice as indicated by the review included in Appendix 1. AIA has reviewed the actions undertaken by AGN over the current AA period as outlined in Section 6 of this report, and conclude that AGN have prudently undertaken a comprehensive range of activities to minimize UAFG. Hence, in our opinion, AGN has maintained UAFG at efficient levels over the 2013 to 2017 period.

Going forward, AGN have in place detailed plans on managing their assets that have been submitted to the AER which are designed to cost effectively minimise UAFG in the 2018 to 2022 period. These are outlined in Section 7 of this report.

AIA agree with the views of ESC in their March 2013 Draft Decision on UAFG Benchmarks in that many factors, which pull in opposite directions, affect the current levels of UAFG.

AGN have used the "Revealed Cost" methodology to establish the UAFG benchmark as recommended by the ESC. The multi-year average for years 2013 to 2015 produces a Class B UAFG benchmark of 4.0%. AIA consider this an appropriate benchmark for the 2018 to 2022 period.

AIA also acknowledge that the Victorian Distribution Businesses, as is the case in other jurisdictions, need to ensure that any investment in reducing UAFG needs to be cost effective as any investment that does not prove to be prudent can be disallowed by the AER.

10 RECOMMENDATIONS

Our key recommendations, set out below, identify a number of UAFG issues that AGN should consider in the forthcoming regulatory period.

10.1 MAINS REPLACEMENT

The continuation of the planned mains replacement of the LP and MP network focused on the cast iron, unprotected steel and PVC parts of the network. In the 2018 to 2022 period AGN plan to remove all the remaining cast iron and unprotected steel.

10.2 METER REPLACEMENT

The continuation of the planned meter testing and replacement programme in order to maintain the accuracy of customer billing and to minimize UAFG

10.3 CTM UPGRADE AND REPLACEMENT

The APA GasNet report recommending both upgrades and replacement of 12 CTM sites should be implemented as a matter of urgency. This should result in the reduction of the uncertainty of the CTM population, by replacing CTM's over 20 years old and ensuring all CTM sites are operating within their design capacity. These meters are owned by APA GasNet, but it is AGN's responsibility to approve expenditure for replacement and refurbishment.

10.4 LARGE TARIFF D METERS

Review these meters to ensure all aspects of metering design, operation and maintenance are correctly undertaken by AGN. Priority should be given to the largest Tariff D meters.

10.5 TEMPERATURE

Correction for basic meters. With improving technology review the method and feasibility to change fixed correction factors for Basic Meters to reflect the actual weighted average temperature of gas being measured. Consideration needs to include the regulatory position and ability to change. This is likely to include a fuller assessment of temperature data over network. The focus should be to consider the use of meter correction in certain locations that are known to have colder gas, or meter types (eg ultrasonic) that are less susceptible to this error.

10.6 PRESSURE SET POINTS ON I&C SUPPLIES

The set points on all I&C supplies should be validated to correspond with the Pressure Correction Factors (PCF's) appropriate for each meter. This will also confirm or otherwise the level of UAFG from this source.

10.7 HHV

The differential in HHV between AGN and State-wide appears to have now stabilised following the increase over the last few years with the increasing supply of higher HHV gas into AGN's network. This coincides with the trend in AGN's Class B UAFG from 3.7% to 4.3%. The current average impact

on UAFG is 136 TJ per year. The generation of data on HHV values in AGN over the coming years should feed into the AEMO Industry Reference Group to review the current methodology prior to future GAAR reviews.

10.8 Class A classification

The classification of a customer as Class A or Class B does affect the average network benchmark and therefore has a financial effect on the UAFG settlement. The effect it to distort the benchmark on an annual basis depending on how many customers are incorrectly classified in one year. The allocation of Class A customers needs to be continually monitored and updated, potentially retrospectively. Regular audits are undertaken to ensure the correct classification of these customers as outlined in AEMO procedures.

One interesting point on Class A customers in AGN is that the vast majority (over 85% of these customers equating to 65% of throughput) are connected to the HP network, and due the significant contribution to UAFG of HP leakage, meter uncertainty and HHV losses the actual UAFG for 65% of the Class A throughput is closer to the 3.7% Class B benchmark than the 0.3% Class A benchmark. Calculated on the basis of only 35% of the Class A having a realistic benchmark of 0.3%, then the "effective" Class B UAFG for AGN reduces from 4.1% to 3.6%. It may be timely to review the appropriateness and level of the Class A benchmark. In broad terms approximately 55% of the UAFG included in the AGN Class B benchmark also applies to 65% of the throughput of Class A customers. This would suggest an appropriate Class B of around 1.5% (35% @ 0.3% and 65% @3.7 x 55%)

10.9 UAFG Benchmarks

AGN have used the "Revealed Cost" methodology to establish the UAFG benchmark as recommended by the ESC. The multi-year average for years 2013 to 2015 produces a Class B UAFG benchmark of 4.0%. AIA consider this an appropriate benchmark for the 2018 to 2022 period.

Appendix 1 - **REVIEW OF AGN VICTORIA UAFG STRATEGY AND POLICIES**

AIA have reviewed the current AGN UAFG management policies, procedures and management meeting minutes, the details are covered in numerous documents as provided by AGN including:-

- APA Group Document - VICTORIAN NETWORKS UAFG POLICY
- AGN Victorian and Albury Access Arrangements 2018 to 2022, December 2016
- AGN APA Asset Management Plan December 2016
- APA Group Document - Victorian Networks UAFG Plan
- AGN Document – Distribution Mains and Services Integrity Plan 2016
- APA Group Document – Victoria Networks Mains Replacement Plan 2012
- APA Group Document – Victoria Distribution Networks Leakage Management Policy 2015
- APA Group Document – Victoria Distribution Networks Leakage Management Procedures 2015
- APA Group Document – Leakage Survey Procedures 2014
- APA Group Document – Engineering Procedures for Planning a Gas Distribution System
- APA Group Document - Pressure Control Station / Industrial and Commercial Metering Station Scheduled Maintenance 2014
- AGN Document – Station Assets Integrity Plan 2014 (pressure reduction supplying the Distribution Network)
- APA Group Document – I&C Meter Station Maintenance Procedure March 2017
- APA Group Document – Networks Control and Monitoring Plan 2014
- APA Group (GasNet) Document – AGN Victoria Metering Strategy Plan 2016.
- APA Group Document – Gas Measurement Management Plan 2014
- AGN Document – Gas Metering Asset Integrity Plan 2015
- AGN Meter Replacement Management Plan December 2016
- AGN Mains Renewal Monthly Reports
- APA - AGN O&M Monthly Report December 2015
- AGN Contingent CESS Submission March 2017
- ESV and AER Performance Report December 2015
- AEMO Document - Wholesale Market Distribution UAFG Procedures (Victoria) Version 3.0
- AEMO Document – Wholesale Market Metering Uncertainty Limits and Calibration Requirements Procedures (Victoria)

Listed below is a summary the activities AGN / APA carry out which impact UAFG:

1. The UAFG Policy drives the development of a UAFG Management Plan, implements initiatives to reduce UAFG, procures appropriate skills and resources to reduce UAFG and ensure regular reviews to seek improvements in reducing UAFG. The policy also requires the monthly calculation and reporting of UAFG to identify any trend change for further investigation.
2. The UAFG Plan identifies the factors that contribute to UAFG together with the parts of the

APA organization that is responsible for the mitigation measures and specified actions to reduce UAFG.

3. Mains replacement strategy is focused on replacing the high leakage rate cast iron and unprotected steel hence reducing UAFG and greenhouse gasses from mains leakage.
4. Mains replacement is driven by the optimization of replacing assets with a high risk of leakage / fracture combined with the economic efficiency of block renewals.
5. The APA Leakage Management Policy sets out the leakage survey policy that proactively identifies assets in poor condition that are then prioritized for repair and or replacement. The policy also sets out how gas escapes reported by employees and the public are also used for this purpose.
6. The APA Leakage Management Procedure sets out the procedures for managing public reported gas escapes, leakage survey requirements and the reporting and reviewing all leakage from the network to ensure this critical leakage information feeds into asset repair schedules and the mains replacement planning process.
7. The Pressure Control Station Scheduled Maintenance document sets out the maintenance required on all pressure reduction stations to ensure they are operating reliably and operating at the appropriate minimum pressure to minimize leakage from the network.
8. AGN have fringe point controlled SCADA operated networks that control the supply pressure based upon demand. This minimizes UAFG by reducing the network operating pressure during low demand.
9. Annual review of regulator supply point and SCADA control settings to ensure the optimal operational performance of the low and medium and high pressure networks hence minimizing UAFG in all weather seasons.
10. Regular maintenance and calibration of sites with temperature and pressure transducers
11. Ensuring consistency in the pressure set points and operational performance of low and high pressure domestic supply regulators.
12. To minimize meter uncertainty, meters are replaced in accordance the frequency mandated by the Australian standards, except where families can be extended only after sample testing is found that they can remain in the field.
13. Large I&C meters are replaced within a shorter time frequency compared to domestic meters.
14. I&C customer meter regulator stations are subject to a standard preventative maintenance regime, which includes set point pressure checks.
15. Installation of live temperature and pressure correction monitoring with the installation of flow correctors for large consumers to minimize measurement error.
16. Auditing of Contractors carrying out calibration and maintenance of Daily Metered sites.
17. CTM calibration in accordance with AEMO market rules to minimize metering error (undertaken by APA GasNet). AGN regularly have a representative to witness APA GasNet undertake on site CTM calibration. APA look to maintain uncertainty within +/- 1.0% and when uncertainty is found outside this range then remedial action is recommended to bring the uncertainty back to +/- 1.0%.
18. APA GasNet has reviewed AGN CTM's and are recommending immediate or short term

upgrade or replacement to 12 AGN CTM sites. This is mainly due to lifecycle (20 years +) replacement or the CTM regularly operating around 120% capacity at 4 CTM sites (one operating at 200%) with an unknown impact on measurement uncertainly.

19. Annual reconciliation process to identify errors, duplications of meter readings etc.
20. Metering of all system own use gas such as water bath heaters.
21. Monitoring of Daily Metered Customer data for breakdown or faulty equipment.
22. Substitution of incorrect or missing data with estimated or recovered actual data.
23. Regular assessment of class A/class B customer classification.

UAFG data required by the Essential Services Commission

Australian Gas Networks - DTS network

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CTM injections (GJ)	61,772,570	58,454,586	61,817,239	59,049,530	62,382,745	59,895,137	59,822,388	56,635,756	55,809,397	61,075,346	
Total withdrawals (GJ)	60,345,021	56,990,311	60,040,866	57,467,475	60,582,165	58,184,093	58,152,202	54,718,635	54,169,652	58,920,649	
Class A withdrawals - Victoria (GJ)	15,690,936	15,087,088	14,866,311	13,342,285	14,610,597	13,179,872	11,108,255	9,703,395	9,933,504	10,583,618	
Class A withdrawals - Albury (GJ)	1,582,553	1,757,117	1,709,585	1,630,752	1,501,737	1,433,925	1,350,996	1,069,640	1,227,742	1,339,641	
Class B withdrawals - D customers (GJ)	8,812,235	8,702,310	8,636,814	8,229,223	8,711,127	8,916,395	9,081,754	9,154,054	9,345,446	9,453,693	
Class B withdrawals - V customers (GJ)	34,259,296	31,443,797	34,828,155	34,265,216	35,758,704	34,653,901	36,611,196	34,791,546	33,662,959	37,543,697	
Actual UAFG (GJ)	1,427,549	1,464,275	1,776,373	1,582,055	1,800,580	1,711,044	1,670,187	1,917,122	1,639,745	2,154,697	
Class A UAFG - Victoria (GJ)	47,214	45,397	44,733	40,147	43,964	39,659	33,425	29,198	29,890	31,846	
Class A UAFG - Albury (GJ)	1,584	1,759	1,711	1,632	1,503	1,435	1,352	1,071	1,229	1,341	
Class B UAFG (GJ)	1,378,751	1,417,118	1,729,929	1,540,275	1,755,113	1,669,950	1,635,409	1,886,853	1,608,626	2,121,509	
% UAFG	2.31%	2.50%	2.87%	2.68%	2.89%	2.86%	2.79%	3.39%	2.94%	3.53%	
% Class A UAFG - Victoria	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	
% Class A UAFG - Albury	0.10%	0.10%	0.10%	0.10%	0.10%	0.10%	0.10%	0.10%	0.10%	0.10%	
% Class B UAFG	3.10%	3.41%	3.83%	3.50%	3.80%	3.69%	3.46%	4.12%	3.61%	4.32%	

Reconciliation amounts received/(paid) $000	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Comment
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		N/A
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		N/A
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		not agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		N/A
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		not agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		not agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		not agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		agreed 2014 still reviewing 2015
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		N/A
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		not agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		agreed 2014 still reviewing 2015
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		agreed
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]		not agreed
Total	$67,210.61	($370,497.34)	($1,127,136.40)	($1,114,995.48)	($1,898,527.74)	($1,747,448.99)	($1,609,397.57)	($1,706,772.16)	$175,067.22	($1,464,175.81)		

Note:	Settled	Settled	Settled	Settled	Settled	Settled	Settled	Settled	Unsettled	Unsettled

Agreement has been reached with 9 retailers for 2014 and 7 retailers for 2015. The remaining retailers have indicated that they will confirm their agreement by mid-August 2017.
AGN will provide ESC an update when this occurs.

UAFG data required by the Essential Services Commission

Australian Gas Networks - Non-DTS network

	2008	2009	2010	2011	2012	2013	2014	2015	2016
CTM injections (GJ)	143,064	165,451	192,068	210,182	225,308	235,908	255,156	279,360	
Total withdrawals (GJ)									
Class A withdrawals (GJ)									
Class B withdrawals - D customers (GJ)	69,770	67,267	75,700	84,114	82,125	82,341	82,376	83,145	
Class B withdrawals - V customers (GJ)	71,314	92,118	110,907	124,507	141,614	149,109	169,701	189,459	
Actual UAFG (GJ)									
Class A UAFG (GJ)									
Class B UAFG (GJ)	1,980	6,066	5,460	1,561	1,569	4,457	3,079	6,756	
% UAFG									
% Class A UAFG									
% Class B UAFG	1.38%	3.67%	2.84%	0.74%	0.70%	1.89%	1.21%	2.42%	

Reconciliation amounts received/(paid) $000	2008	2009	2010	2011	2012	2013	2014	2015	2016
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	
[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	[C-I-C]	
Total	$3,186	($10,050)	($6,094)	$10,371	$11,873	$1,065	$8,251	($5,528)	

Note:	Unsettled	Unsettled	Unsettled	Unsettled	Unsettled	Unsettled	Unsettled	Unsettled

If any unsettled data is provided, please indicate.

Please note: Rule 317 of the National Gas Rules (NGR) sets out AEMO's obligation to produce a procedure for calculation of UAFG in a declared distribution system.

As stated in these Procedures they have effect only for the purposes set out in the NGR.