Jemena Gas Networks (NSW) Ltd

2015-20 Access Arrangement Information

Appendix 7.5

UAG methodology and justification

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GLOSSARY

AA	Access Arrangement
Frontier	Frontier Economics
TVN	Tariff Variation Notice
UAG	Unaccounted for Gas
WACC	Weighted Average Cost of Capital

1. CURRENT UAG FRAMEWORK

1. The phrase ‘unaccounted for gas’ (**UAG**) refers to gas supplied into the gas network that is unaccounted for in delivery from the network. It is calculated as the difference between the measured quantity of gas entering the network system (receipts) and metered gas deliveries (withdrawals). UAG is also expressed as a percentage of receipts into the network. This allows UAG levels to be viewed in terms of efficiency and benchmarked between networks.

2. There is a range of factors that contribute to UAG, including:

   - metering uncertainty in both receipt and delivery meters
   - degradation of meter accuracy
   - measurement uncertainty, including uncertainty introduced through fixed factor billing and heating value allocation
   - leakage
   - unmeasured gas used for operational purposes
   - theft.

3. JGN is required under the terms of its Access Arrangement (**AA**) to replace any gas lost whilst in its custody.[1] The total cost of UAG is a product of the volume of UAG and the replacement cost of gas purchased by JGN to replace UAG. This gas is acquired by JGN through a competitive market tender process.

4. JGN’s AA includes, as for a majority of operating expenditure, an incentive to minimise the rate of UAG. JGN is provided a fixed allowance for a quantity of UAG based on a target percentage rate of total network receipts. In the current AA period this rate is 2.34 per cent of receipts. If the actual UAG rate is below (above) this rate, JGN over (under) recovers its actual UAG costs.

5. Gas receipts and the replacement cost of gas are outside JGN’s control. As a result the current AA includes pass through arrangements to account for these factors. The current AA stipulates a one year lag for the pass through of the recoverable amount.[2] Actual gas receipts for the full regulatory year are not known at the time JGN submits its annual tariff variation notice (**TVN**). The AA requires JGN to use the latest forecast of gas receipts to calculate the recoverable amount. JGN’s annual TVN is therefore not submitted until the deadline of 15 April each year.

[1] See clauses 9.4, 9.5(d) and 9.5(e) of the Reference Service Agreement.

[2] A time value of money (WACC) adjustment is applied to account for this lag.

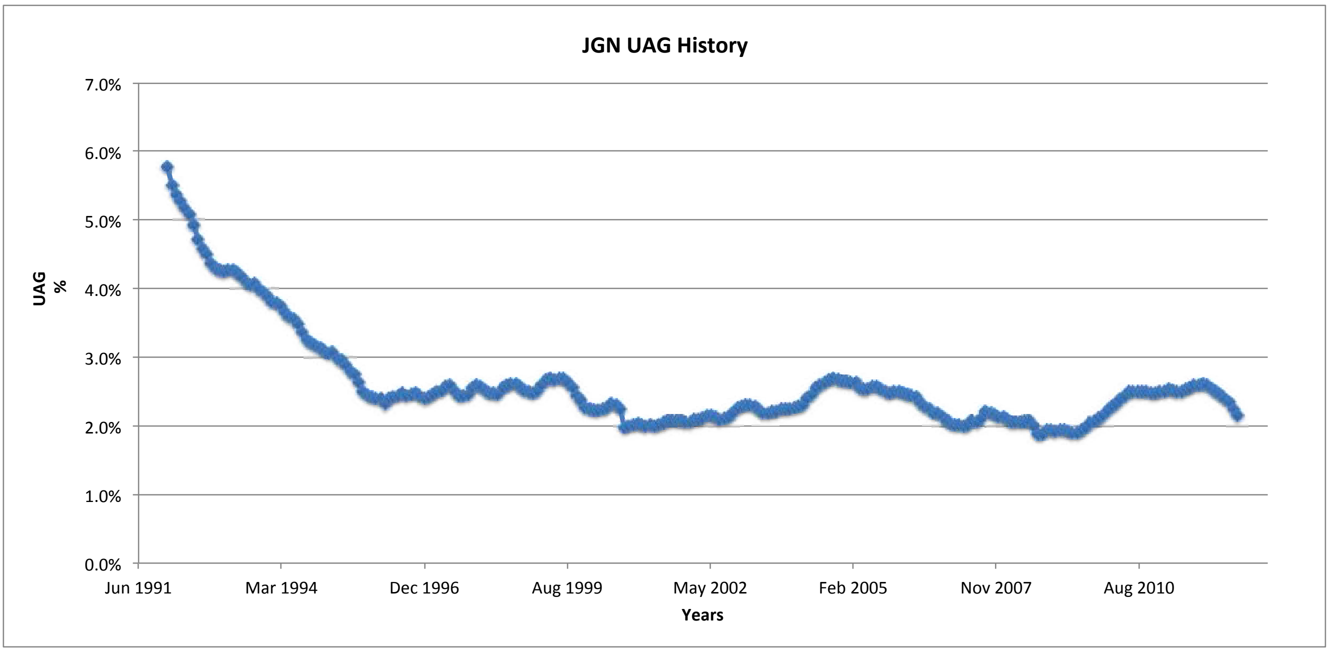
2. UAG PERFORMANCE

6. JGN performs well against industry UAG benchmarks.

2.1 HISTORICAL PATTERN OF UAG

7. Figure 2–1 shows JGN's historical pattern of UAG.

Figure 2–1: JGN's historical UAG pattern 1991-2014



Source: Jemena

8. This pattern reflects high levels of UAG that developed in the 1980s as a result of the introduction of natural gas in 1976 and subsequent conversion of AGL's gas mains and services from delivery of towns gas (made from cost or naptha and, latterly, natural gas) to direct delivery of natural gas. This conversion was completed in 1990. The effect of natural gas was to dry out the lead yarn and rubber ring joints on cast iron mains, thereby creating a significant increase in the number of leak paths through pipe joints. In the late 1980s AGL commenced a major rehabilitation project that involved rapid, mass rehabilitation of the majority of leaky gas mains. Rehabilitation involves insertion of cast iron mains and galvanised iron services with polyethylene or nylon pipe capable of operating at higher pressures and with leak tight welded or solvent welded joints.

9. The result of this major project is demonstrated by the steep decline in UAG from 6 per cent (and higher in earlier years) to between 2.1 and 2.7 per cent from 1996 on, upon completion of the project. It should be noted that while over 80 per cent of cast iron mains were rehabilitated, AGL, and subsequently JGN, continued to rehabilitate the remaining sections of cast iron main on a slower basis, reflective of the less degraded condition of the remaining cast iron mains at that time.

10. Since 1996 UAG has varied between 1.9 and 2.7 per cent. This variation is consistent with the range of contributors to UAG.

2.2 EFFICIENT RANGE

11. JGN continues to actively monitor and when required manage any of the contributors leading to increases in UAG, including the continued mains and services rehabilitation programs. However, while JGN's UAG could potentially be reduced further, the cost of doing so, in most cases, will outweigh the benefits, principally the reduced cost of UAG. JGN considers that the current range of UAG is an efficient range. Consequently, use of the historical five year average as the benchmark value for setting the UAG allowance is also sound.

12. The efficiency of the JGN's UAG is best understood by considering the contributors to UAG to estimate an efficient range.

13. The key contributors are:

- *receipt point uncertainty*[3]—Meter stations, at receipt points use high standards of measurement equipment. At these sites, a number of measurements are required to generate the standard volume (i.e. converted to account for the volume difference between measured conditions and standard conditions). The measurements include the primary volume measurement (via devices such as an orifice plate, turbine meter, ultrasonic meter, coriolis meters, etc.), temperature and pressure measurement and, at key sites, gas composition measurement. The combination of the errors in each of the contributing measurements allows a receipt point meter to be accurate to within, at best, +/- 1.0 per cent of the true quantity being measured.
- *delivery point uncertainty*—upon installation the meters supplying customers typically have an accuracy of +/- 1.0 per cent of the volume being measured.
- *delivery point meter degradation*—customer meters are installed for long terms: turbine for five years, rotary meters for ten years and diaphragm meters for 15 to 25 years. While they generally remain within the accuracy requirements set by technical regulations[4] aging will cause meter degradation. The regulated accuracy requirement for gas meters is +2/-3 per cent. Turbine and rotary meters used for large demand customers will read slow as they age. These meters are replaced every five years to ensure metering accuracy is maintained. Diaphragm meters also degrade and may either read "fast" or "slow" as a result of age, though on average the inherent bias is for these meters to slow. Another common phenomenon is meters may stop registering altogether as they age with the result that 100 per cent of usage is not measured. A significant proportion of non-registering meters are identified and replaced after one or two billing cycles, although some may not be identified for longer periods. As meters age with an inherent bias to reading slow, the result of all of these is an increase in UAG. JGN estimates the impact on measurement accuracy is +/- 0.93 per cent.
- *fixed factor uncertainty*—all residential meters and small industrial and commercial meters have fixed factor metering. This comprises the use of a pressure regulator to hold the metering pressure constant. Correction factors are applied to convert gas volumes to standard volume measurements based on daily temperatures and barometric pressures from the Bureau of Meteorology and this 'constant' metering pressure. While these corrections are essential for maximising the accuracy of gas measurement, they are imperfect representations of the conditions at each customer's meter and there is an inherent additional uncertainty in the measurement of gas being delivered from the network. JGN estimates the impact on measurement accuracy is +/- 0.5 per cent.

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[3] Metering uncertainty is often called metering error because it is the difference between the amount measured and the true measurement which cannot be known.

[4] Schedule 1 of Gas Supply (Consumer Safety) Regulation is the regulation governing metering and applies AS 4944

- *heating value allocation uncertainty*—the heating value of gas in the network is measured at a number of places to enable gas volumes to be converted into energy quantities. The network is divided into network sections to reflect the different sources of gas entering the network. The applicable heating value is then applied to delivery meters in these network sections. Whilst this is a logical and practical approach to characterising the heating value of delivered gas, as the volume of gas from sources and the demand from customers changes both within and between days, the network sections would need to be continuously adjusted to fully represent the heating value of the gas being delivered. This has an inherent impact on the accuracy of measurement of gas deliveries. JGN estimates the impact on measurement accuracy is +/- 0.5 per cent.
- *leakage*—as already identified a majority of gas leakage occurs on sections of cast iron main. Leakage also occurs on older technology plastic mains, above ground fittings and venting of customer meter regulators. Clearly leakage increases UAG. JGN's capital, maintenance and operating practices are designed to minimise the levels of leakage, however, most leakage works are reactive in nature and many small leaks do not pose any safety issues and are not prudent to remediate. JGN estimates leakage to represent approximately 1.1 PJ per annum or 1.1 per cent of gas receipts.
- *unmetered gas for operational purposes*—gas escapes from the network when gas mains are being commissioned and during maintenance. It also escapes when there is third party damage to gas mains. While JGN's systems are designed to limit third part damage through participation in the "Dial before you dig" service and patrols of its high pressure networks, third party damage is still a common occurrence and contributes to UAG. JGN estimates unmetered operational gas to be 0.5 per cent of gas receipts.
- *theft*—this is considered to be uncommon, due to the inherent hazards of unskilled work with gas. While hard to estimate, JGN considers an estimate of 0.075 per cent of gas receipts to be reasonable.

14. Table 2-11 provides an estimate of the efficient range of UAG for JGN. Individual contributing factor ranges are 95 per cent confidence intervals (mid-point +/-1.96 standard deviations). The UAG range is the 95 per cent confidence interval for UAG i.e. the probability that UAG will be less than the lower limit or greater than the upper limit is 2.5 per cent in each case. The distribution for UAG has been formed by summing the distributions of the contributing factors, assuming that each is normally distributed.

Table 2–1: Efficient range of UAG

Contributing Factor	Mid-point [%]	Range (+/-) [%]	Source
Receipt points	0.00	0.58	Standard accuracy assumption
Delivery Points	0.00	0.04	Standard accuracy assumption
Meter degradation	0.93	0.46	JGN meter degradation model
Fixed factor billing	0.00	0.50	JGN estimate
Heating Value Allocation	0.00	0.50	JGN estimate
Leakage	1.10	0.30	JGN estimate
Unmetered gas for operational purposes	0.10	0.05	JGN estimate
Theft	0.08	0.05	JGN estimate
Total[1]	**2.21**	**1.07**	
Expected UAG Range - 1.08% to 3.22%			

(1) Totals will not sum because standard deviations are not additive.

15. JGN's recent UAG range of 1.9 to 2.7 per cent sits well within the range of efficient UAG levels estimated above.

2.3 BENCHMARKED PERFORMANCE

16. JGN's UAG performance over the past five years is set out in Table 2–2.

Table 2–2: Prior 5 years UAG performance

	2008-09	2009-10	2010-11	2011-12	2012-13
UAG (TJ)	2,120	1,921	2,577	2,355	2,071
Receipts (TJ)	102,549	99,156	102,833	92,960	96,265
UAG (%)	2.07	1.94	2.51	2.53	2.15

17. The average UAG for this period is 2.24 per cent and for the first three years of the current AA period (2010-11 to 2012-13) is 2.40 per cent compared to the UAG allowance for the period of 2.34 per cent.

18. JGN's UAG rate compares favourably against a range of UAG benchmarks as set out in a report for the Essential Services Commission of Victoria by Zincara[5] and presented in Table 2–3.

Table 2–3: UAG benchmarks (per cent)

Gas Distributor	UAG Benchmark
APA Allgas Queensland	4.0
Envestra Queensland	0.5
Envestra SA	8.3
ActewAGL	1.8
Envestra Victoria	2.86
Multinet	4.03
SP AusNet	3.53
IGU Working Committee Oct 2009	2.7

19. Apart from the potentially anomalous benchmark for Envestra Queensland, and the relatively low value for ActewAGL Distribution (which has no cast iron pipe in its network, and therefore significantly lower leakage) JGN's UAG clearly sits below that of other gas network businesses, all of which have a similar long history to JGN's network and the international benchmark from the International Gas Union (**IGU**). Therefore, JGN's proposal that its UAG allowance be based on its five year average is strongly supported by benchmarking analysis.

5 Review of Gas Distribution Businesses Unaccounted for Gas, prepared for the Essential Services Commission, 7 April 2013, Zincara Pty Limited

3. UAG PROPOSAL

20. JGN proposes that:

- the current UAG incentive scheme continues to apply based on an efficient annual target rate of UAG
- JGN is compensated for variation in total market volumes and costs of purchasing UAG (which remain outside JGN's control) and through an automatic annual adjustment
- the efficient level of UAG be represented as two different UAG target rates – one applied to daily metered customer withdrawals and the other to gas received to supply non-daily metered customers
- to promote customer and stakeholder engagement on JGN's annual TVNs, a two year lag be applied to cost recovery, removing reliance on forecast gas receipts and allowing JGN to submit its annual TVN as early as 15 March each year.

3.1 TARGET RATE PROPOSAL

3.1.1 CONTINUATION OF INCENTIVE REGULATION

21. As explained in section 2, JGN has been a strong UAG performer.

22. JGN therefore proposes that the target efficient percentage of UAG should be set from the average of the most recent 5 years of actual data. For the purposes of the 2015-20 AA submission, JGN has used data for the 5 years to June 2013. The overall efficient level of UAG would be 2.24 per cent of receipts.

23. This is consistent with the Essential Service Commission of Victoria's June 2013 final decision on UAG benchmarks in the Gas Distribution System Code.[6]

24. JGN proposes that the replacement cost of gas, per GJ, is set with reference to JGN's 2013-14 contractual UAG supply cost on the basis that increases or decreases in this cost will be fully taken into account through the automatic annual adjustment in the reference tariff variation mechanism. This is preferable approach in the current circumstances where future wholesale gas prices are subject to significant uncertainty.

3.1.2 TWO DIFFERENT RATES

25. Historically, the single UAG benchmark has been a reasonable and workable mechanism for forecasting UAG levels and benchmarking. This is because annual gas consumption has grown in the volume (non-daily metered) market and has been stable or declining slightly for the demand (daily metered) market. However, the second of those two conditions is now changing as industrial demand for gas is declining as observed and forecast by Core Energy[7].

26. In the light of this changed circumstance JGN is proposing to use dual UAG benchmarks. This proposal has a sound technical basis that is more cost reflective and provides a better model of UAG behaviour on the gas network.

6 ESC, Gas Distribution System Code Review of Unaccounted for Gas Benchmarks Final Decision, June 2013, pp. 41-44.

7 Core Energy Group, Demand, Energy and Customer Forecasts, Jemena Gas Networks, Gas Access Arrangement 2015-2020, February 2014.

3.1.2.1 A more cost reflective allocation of UAG

27. A significant majority of the contributors to UAG (identified in section 2.2 above) apply to the medium and low pressure networks supplying volume customers. These are:

- leakage
- unmetered operational gas
- meter and metering system uncertainty
- meter degradation.

28. Leakage is associated with low pressure cast iron mains and older plastic pipe technology operating at medium pressure. All operational gas used for commissioning gas mains arises on the medium and low pressure systems. Fixed factor metering uncertainty is also of much greater significance to volume customer metering. All non-daily metered customers are supplied from the medium and low pressure networks.

29. In contrast, almost all demand customers are supplied from JGN's high pressure network, which has negligible leakage and operational gas use. In addition, metering for demand customers is not affected by the same level of meter and metering system uncertainty as the volume market, because the meters are temperature and pressure compensated rather than fixed factor.

30. This strongly supports an allocation of a higher UAG percentage allocation to volume customers and lower UAG percentage allocation to demand customers.

3.1.2.2 A better UAG forecast model

31. As identified above, Core Energy has forecast significant reductions in demand market gas usage—25 per cent between 2013 and 2020 of which 20 per cent is forecast to occur between 2015 and 2020. For the reasons above, UAG will not decline in proportion to the reduction in total receipts associated with the reduction in demand market usage. If UAG was forecast to decline with the decline in demand market usage, the total level of UAG would be underestimated.

32. JGN must be afforded a reasonable opportunity to recover the costs of efficiently replenishing UAG over the next AA period and this may be jeopardised if a single variable forecasting model is used. UAG is a significant component of JGN's overall costs and a UAG forecasting model that reflects the fact that UAG will reduce at a lower rate with demand market decline is to be preferred as it would be more likely to result in JGN being afforded a reasonable opportunity to recover its costs.

33. Accordingly, JGN is proposing dual UAG target rates, which assigns a lower forecast UAG percentage to the demand market (i.e daily metered customers) and a higher forecast percentage to the volume market (i.e. non-daily metered customers) annual consumption which represents equivalent benchmark performance to the historical 5 year average but is better suited to a forecast period in which large customer demand is expected to fall materially relative to the benchmark period. This approach will inherently provide a better forecast and should be adopted to be consistent with rule 74.

3.1.2.3 Derivation

34. JGN has engaged Frontier Economics (**Frontier**) to assess the statistical validity and strength of a dual variable expression for forecast UAG through an independent expert review of JGN's approach to establishing appropriate forecast UAG rates for both markets. Frontier's report is provided as appendix 7.6 and the relevant spreadsheet is provided as appendix 7.7. A simplified explanation of our approach and Frontier's report is provided in Box 3–1.

35. The fit of Frontier's model is very good with an adjusted R-squared of 96.7 per cent. The proposed UAG rates are:

- for forecasting UAG costs in our 2015 AA submission operating expenditure allowance:
  - 0.450 per cent of forecast withdrawals for the demand (daily metered) market
  - 5.44 per cent of forecast withdrawals for the volume market customers
- for annual true-ups:
  - 0.427 per cent of withdrawals for the demand (daily metered) market
  - 5.16 per cent of the balance of total market receipts for non-daily metered market (comprising volume market withdrawals and UAG).

3.2 TIMING OF RECOVERY

36. JGN proposes that UAG costs be recovered with a two year lag to allow the annual TVN to be submitted by 15 March.

37. JGN makes this proposal to:

- makes it easier for customers and stakeholders to review JGN's annual TVN. JGN consulted with the JGN Customer Council and IPART in February 2014 and both expressed support for appropriate measures which would facilitate any earlier preparation of the TVN
- allows the true-up to be made on a full year of actual demand data, rather than 9 months of actuals and 3 months of estimates.

38. This amendment is reflected in JGN's 2015 AA proposal. A weighted average cost of capital (**WACC**) adjustment applies to the two year lag to take into account the time value of money.

Box 3–1 Simplified explanation of Frontier's report

We want to assess whether specific UAG rates for each market can be determined to split total UAG across the two markets. Total UAG and the level attributable to each market cannot be observed and must be estimated. The actual data used for these two tasks are:

- monthly receipts from suppliers (R)
- monthly large (daily metered) customer withdrawals (I)
- monthly small (non-daily metered) billed volumes (B).

We:

- derive the monthly tariff market residual (TMR, or T), which is the sum of small (non-daily metered) customer withdrawals (M) and actual network UAG (U), as R minus I
- estimate monthly small (non-daily metered) customer withdrawals (M^e) due to the lag between actual withdrawals (M) and billed volumes (B).

Task 1: Estimating the overall UAG rate

We estimate the overall UAG target rate as the average annual rate using 5 years of monthly estimates of UAG (U^e), where:

$$U^e = R - I - M^e$$

The value obtained is 2.239%, or 2.24% to two decimal places.

Task 2: Estimating the UAG rate for each market

The proposed regression appropriately uses a large data set – 10 years of data – and the equation is:

$$U_t^e = \alpha_I I_t + \alpha_T T_t + \varepsilon_t \qquad (1)$$

Noting that U is the dependent variable, but also a component of T, the proposed regression equation can be re-written as (and is equivalent to):

$$U_t^e = \beta_I I_t + \beta_M M_t^e + \eta_t \qquad (2)$$

The model is robust and the regression coefficients, after conversion back to the alpha coefficients in equation (1), are 0.427% for large customers (I) and 5.51% for the tariff market residual (T).

As the regression uses 10 years of data, these coefficients will not be consistent with the overall rate which uses 5 years of data. This is overcome by holding the estimated large customer coefficient (0.427%) constant, and deriving the TMR (5.16%). These co-efficients are used in equation 1 for annual true-ups to ensure JGN is trueing-up to a benchmark performance equivalent to the historical overall UAG benchmark rate of 2.24%.

For the purposes of forecasting UAG in our opex allowance, we apply the beta coefficients in (2) recognising the robustness of this equation. Once converted, these coefficients are 0.450% and 5.44% respectively. It is important to note that JGN's actual UAG recovery using equation (1) trues-up to the same volume of the UAG forecast using equation (2) for any allowance forecast.