Jemena Gas Networks (NSW) Ltd

Connection and metering forecast methodology

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Overview

The purpose of this document is to provide additional information on our approach to forecasting connections and meter replacement capital expenditure (capex). Our forecasting methodologies, outlined in this document, are consistent with the methodologies used in the 2020-25 access arrangement. This document is structured as follows:

Section 1 provides a detailed description of our connections capex forecasting method with the aim of supporting the connections forecast model by explaining the approach taken and the calculations made.

Section 2 provides a detailed description of our meter replacement capex forecasting method with the aim of supporting the meter replacement capex forecast model by explaining the approach taken and the calculations made.

All financial numbers have been presented in unescalated, direct real 2025 dollars, excluding overheads and aligns with the data presented in the forecast Reset RIN templates.

Forecast principles

Our forecast based is based on the same principles used in the 2020-25 forecast. We use the revealed historical costs as the basis for the future costs because it is simple to understand, transparent and relies on consistent data which is representative of the expected future cost of connecting customers and replacing meters.

Revealed historical cost

The foundation of the Australian regulatory regime is to provide network businesses with incentives to only incur efficient costs.[1] Incentives work by introducing financial repercussions for cost increases and rewards for finding ways to lower costs. The rewards from cost savings finance the investment (in terms of money and risk) required to trial new ways of working and find continuous improvement.

To provide customers and the AER with confidence in our forecast, we have built our forecast primarily on our actual revealed historical costs (incurred with the incentive to reduce and constrain costs). This approach ensures the efficiencies we have achieved in the past flow through into our forecast costs. Where we do not have actual costs for a particular activity, such as the installation of a new meter technology, we have built a specific project estimate on a case-by-case basis.

This approach is consistent with the AER's approach for forecasting our connection and meter replacement costs for the 2021-25 period and its preferred method for forecasting operating expenditure (**opex**) for all network businesses.

Simple and transparent

We sought to adopt a simple and transparent approach to ensure that the forecast can be easily reviewed and verified. To do this we have based our forecasting approach on the AER's top-down method for the 2021-25 period as much as possible.

Consistent data

To address the AER's past concerns about combining different data sets we have sought to rely on consistent data. We primarily rely on data submitted as part of our RIN response, disaggregated RIN data or data reconciled to the RIN data. This data is presented in AER RIN templates and has been audited, in line with the quality assurance requirements set out in the RIN. Where additional data was required we sought to use the most consistent data possible from our new SAP financial information system to avoid using data from different information sources.

1 Depending on the market forces and cost pressures this could either lead to cost reductions or constrained cost increases.

Interaction between our models

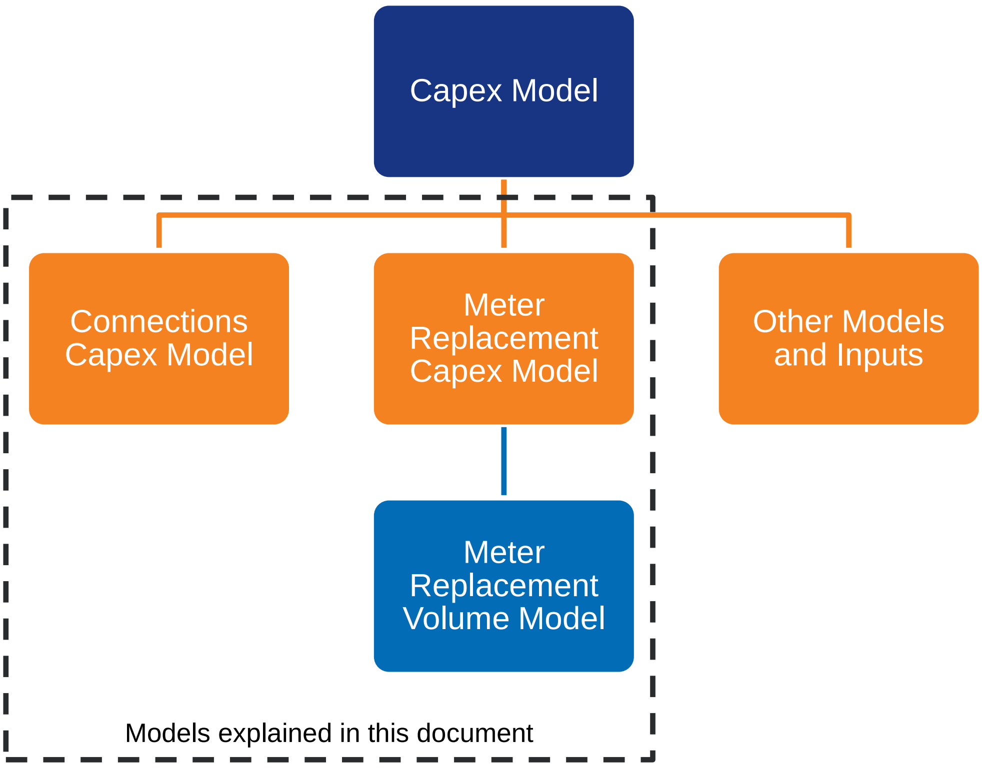
Our total capex forecast relies on a single model (the Capex Model) submitted to the AER. This contains the full forecast that is entered into the proposed Post Tax Revenue Model (PTRM). It is important to note that the Capex Model centrally:

1. calculates the real cost escalation component of our capex forecast,
2. calculates the capitalised overhead costs (ie. Indirect costs) included in our forecast,
3. allocates the capitalised overhead costs to each project or program in our capex forecast.

The Capex Model depends on a number of inputs, including other models. This document explains how three of those models work, they are:

- **Connections Capex Model**: which calculates our forecast connections capex and is described in section 1.
- **Meter Replacement Capex Model**: which calculates our meter replacement capex and is described in section 2.
- **Meter Replacement Volume Model**: which calculates the quantity of meters forecast to be replaced and is described in section 2.

Figure OV–1: Capex Model Hierarchy



1. New connections capex

1.1 Forecast principles

This section provides a detailed description of our connections capex forecasting methods. It aims to support the connections capex forecast model[2] by explaining the approach taken and the calculations made.

Our forecast based is based on the same principles used in the 2020-25 forecast. We use the revealed historical costs as the basis for the future costs because it is simple to understand, transparent and relies on consistent data which is representative of the expected future cost of connecting customers.

1.2 Forecasting methods

We have applied a single forecasting method to the majority of the new connections capex, with the forecast capex for new Industrial & Commercial – Contract customers using its own method (discussed below).

1.2.1 Primary forecasting method (average historical unit rates)

Our primary forecasting method uses an average cost per connection method. At a high level this approach can be summarised as:

Forecast capex = average unit rates x volume forecast

Where:

- **Average historical unit rates** (cost per metre of main, per service and per meter) is the historical unit rates calculated from the actual cost of installing new connections. It is important to note that our methodology is calculated as:
  - First, we calculated the sum of the direct cost (excludes capitalised overheads) of connecting customers over the last 4 years (RY20 to RY23). We have adjusted the nominal amounts into the same real dollars. We also removed the costs associated with the non-routine projects as they are forecast separately.
  - Second, we calculated the number of connections and the associated volume of assets installed over the same 4 years (RY20 to RY23). We ensured the volumes associated with non-routine projects were removed.
  - Finally, we divided the sum of the costs from the first step, by the sum of the connection volumes calculated in the second step to derive a unit cost associated with the volume of assets installed.

  This method accounts for situations where costs are recognised in one year but the volumes were entered into the system in the following year and vice versa.

- **Volume forecast** which is the total length of mains, number of services and number meters we expect to install. We calculate this as:
  - First, we calculate the historical average volume mix from the same 4-year period (RY20 to RY23) as the costs. That is, we calculated the average length of mains, number of services and number of meters installed per connection.
  - Second, we multiply the volume mix by the number of connections forecast by Core Energy & Resources (**Core**). This is based on the assumption that each connection type in the forecast period will continue to have the same average mix of assets installed to connect new customers for the past 4 years.

[2] See *JGN - RIN – 4.3 - Connection Capex Forecast Model*

1.2.2 Industrial & commercial (demand) forecasting methodology

We apply a simple 4-year average of historical costs, adjusted for inflation to ensure the average is presented in a common real dollar basis.

1.2.3 Changes since the 2021-25 forecast

We have streamlined the following parts of our methodology for the reasons outlined below:

- **No price adjustments.** In the 2021-25 forecast we made price adjustments to account for expected movement in our contractor unit rates. We do not expect contractor arrangements to change over the forecast period, so we have not calculated any price adjustments for the 2026-30 connections capex forecast.
- **Separated meter costs for medium density and high-rise connections.** In 2021-25, we captured meter costs for medium density and high-rise connections collectively and they were manually disaggregated using an assumed cost profile. We have established a new code in our financial system to capture the actual meter costs in the following categories:
  - Medium density,
  - Individually metered high-rise, and
  - Boundary metered high-rise.

  As a result we are now able to calculate a more accurate unit rate for the meter costs per connection for medium density and high rise connections. We have only captured these costs for the last 3 years so we have used a 3-year average instead of 4-year average.
- **Forecasting medium density and high-rise mains and services costs by connection**. In 2021-25, we calculated the forecast cost per site/building instead of per customer. This was because there was not a consistent relationship between our mains and services costs and connection numbers.

  Prior to the 2021-25 forecast, a per connection measure would have captured 1/88 of the total mains and service costs for a high-rise building (as there are about 88 connections per site). A per connection measure had to reflect 100% of the mains and services costs as there will be a single connection for each site. We expect the ratio of connections to mains and services costs across medium density and high connections to be more stable in the 2026-30 forecast. So we have applied a unit cost per connection, instead of per site.

1.3 Connections capex forecast

1.3.1 Average unit rates

The average unit rates used to forecast the direct capex required to connect the new customers are based on the audited actual costs reported in template E5.1 in the historical Reset RIN response. The data presented in our RIN response to the AER's RIN provides unit rate data – annual costs for mains (per metre), services (per service) and meters (per meter) by market segment.

These unit rates capture all direct costs including contractor costs, restorations, internal labour and materials, which are different to the contract unit rates which we pay our contractors.

Unit rates vary from year to year due to:

- Timing differences non-routine costs like restoration work can often be paid several months after the work is completed.
- Natural variation in the type of jobs that are performed – for example costs are higher when we connect more customers in higher density areas due to the greater traffic management requirements.

To account for this natural variation we take a four year average of costs to smooth our these fluctuations.[3] While we adjust for inflation we do not take into account movements in real cost escalation in our connections capex model. This results in 4-year average unit rates per metre of main, per service and per meter installed for each customer segment.

Table 1–1: Average unit rates ($2023, direct)

		2019-20	2020-21	2021-22	2022-23	4-year average
New Homes						
Distribution mains	$ / metre of mains	[redacted]				
Inlet service pipes	$ / service	[redacted]				
Meters	$ / meter	[redacted]				
Electricity to Gas						
Distribution mains	$ / metre of mains	[redacted]				
Inlet service pipes	$ / service	[redacted]				
Meters	$ / meter	[redacted]				
Medium Density & High Rise						
Distribution mains	$ / metre of mains	[redacted]				
Inlet service pipes	$ / service	[redacted]				
Meters (Medium Density)	$ / meter	[redacted]				
Meters (High Rise VI)	$ / meter	[redacted]				
Meters (High Rise VB)	$ / meter	[redacted]				
Industrial & Commercial Tariff						
Distribution mains	$ / metre of mains	[redacted]				
Inlet service pipes	$ / service	[redacted]				
Meters	$ / meter	[redacted]				

1.3.2 Volume forecast

We engaged Core to forecast demand for gas across our network for the forecast access arrangement period. As part of this forecast, Core developed a forecast number of new connections by each customer segment (Table 1–2 Number of forecast new connections) that allows us to forecast the new connections capex.

Table 1–2: Number of forecast new connections

Customer segment	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
New Homes	16,132	13,321	8,133	9,532	10,163	9,112	7,739
Electricity to Gas	3,500	3,325	2,993	2,394	1,676	1,173	587
- Medium Density	*574*	*901*	*1,492*	*922*	*477*	*147*	*24*

3 While taking a longer sample provides greater smoothing out cost fluctuations it has the disadvantage of using older information which no longer reflects the costs of delivering services (it also affects the volume mix discussed in step 3). Given recent changes in the market (increasing tariff management costs etc.) and as we have not taken into account real price escalation over this period we have not included data from 2013-14, 6 years prior to the start of the 2020 period. This results in a slightly shorter averaging period relative to the AER's previous approach (5 years). The difference between taking a 4 or 5 year averaging period has an immaterial (less than 1%) effect on the overall capex forecast.

- High Rise VI	*1,660*	*2,641*	*4,415*	*2,705*	*1,370*	*381*	*11*
- High Rise VB	*61*	*61*	*61*	*61*	*61*	*61*	*61*
Medium Density & High Rise	2,295	3,603	5,968	3,687	1,908	589	95
Industrial & Commercial Tariff	584	591	599	607	615	623	631
Total	**22,511**	**20,841**	**17,693**	**16,221**	**14,363**	**11,498**	**9,053**

To forecast the total connections cost for each forecast new connection, we need to determine the volume of assets that will be commissioned per connection. We used the 4-years (2019-20 to 2022-23) of actual data to calculate the mix of assets required, on average, for each connection as shown in Table 1–3 Historical average volume mix.

Table 1–3: Historical average volume mix

	2019-20	2020-21	2021-22	2022-23	4-year average
New Homes	[redacted]				
Metres of mains per connection					
Number of services per connection					
Number of meters per connection					
Electricity to Gas					
Metres of mains per connection					
Number of services per connection					
Number of meters per connection					
Medium Density & High Rise					
Metres of mains per connection					
Number of services per connection					
Number of meters per medium density connection					
Number of meters per high rise VI connection					
Number of meters per high rise VB connection					
Industrial & Commercial Tariff					
Metres of mains per connection					
Number of services per connection					
Number of meters per connection					

(1) Rounded to 1 decimal place

1.3.3 Average cost per connection

Using the **volume mix** means that this method is effectively an average cost per connection approach. The average cost per connection can be seen by applying the price adjusted unit rates directly to the volume mix. This average unit rate can be applied to the connection forecast to obtain the capex forecast.

In line with the AER's methodology for the 2020-25 period, we use RIN data. To be consistent with our approach for unit rates we take a 4-year average to smooth out year to year variations.

Table 1–4: Average cost per connection ($2023, direct)

Customer segment	2019-20	2020-21	2021-22	2022-23	Average
New Homes	[redacted]				
Electricity to Gas					
Medium Density					
High Rise Individually Metered					
High Rise Volume Boundary					
Industrial & Commercial Tariff					

1.3.4 Industrial & commercial (demand) new connections forecast

Relative to the volume market segments, the volume of industrial & commercial demand market connections is significantly lower and the variability in connection costs is higher. Despite this our annual costs are relatively steady.

As a result, we are forecasting the costs of connecting these customers by applying a 4-year average of historical connection costs. Table 1–5 New connections capex ($m 2025, escalated direct) shows the average capex of $3.9m ($m 2023, unescalated direct) per annum.

1.3.5 Capex forecast

The last step is to combine the **unit rates** and the **volume forecast**. These connection costs flow through to our capex forecast model (Attachment 5.2) which then applies real cost escalation (only to the labour component). The following table shows the total direct costs including the impact of labour cost escalation.

Table 1–5: New connections capex ($m 2025, escalated direct)

Customer segment	2025-26	2026-27	2027-28	2028-29	2029-30
New Homes	24.5	27.5	29.5	26.7	22.9
Electricity to Gas	16.1	13.0	9.1	6.4	3.3
Medium Density & High Rise	12.6	8.1	4.5	1.8	0.8
Industrial & Commercial Tariff	8.7	8.9	9.1	9.2	9.4
Industrial & Commercial Demand	4.4	4.4	4.4	4.4	4.4
Total capex	**66.2**	**61.8**	**56.6**	**48.6**	**40.8**

2. Metering capex forecast

2.1 Forecast principles

This section provides a detailed description of our meter replacement capex forecasting methods. It aims to support the meter replacement capex forecast model[4] by explaining the approach taken and the calculations made.

Our forecast is based on the same principles used in the 2020-25 forecast. We use the revealed historical costs as the basis for the future costs because it is simple to understand, transparent and relies on consistent data which is representative of the expected future cost of replacing meters.

2.2 Our forecasting methods

We forecast the capex required for each of our metering programs using one of the following methods:

1. **Average historical unit rates** – Consistent with our connections forecasting approach, we calculate average unit rates based on historical data. These unit rates are then applied to a separately derived volume forecast.

   As with our connections forecasting method (discussed in section 2) this approach ensures that the efficiencies we have made in the past flow into our forecast. We do not re-explain the details in this section on Meter Replacement.

   The per unit nature of this method is best for areas of our program where the volumes of work varies year-to-year but the scope of work remains relatively constant.

2. **Project Cost Estimate Methodology** – where we apply our Project Cost Estimation Methodology.[5] This approach produces a whole project cost, or a unit rate which is then applied to a volume forecast.

   We use this method where historical unit rates will not provide the best forecast, typically when we do not have historical data or the scope of work changes over time.

3. **Average Historical Capex** – a simple average of historical annual costs.

   This approach is applied where volumes are not expected to significantly change. As with the historical unit rate approach, this method relies on revealed costs producing a forecast that ensures that the efficiencies we have made flow into our forecast.

2.3 Applying our forecasting approaches to our metering program

Applying our forecasting methodology varies for each program. Appendix A Metering program names provides a reference of which methods have been applied to each of the meter replacement programs. The meter replacement programs have been broadly categorised as:

- Planned residential
- Planned industrial & commercial
- Defective / meter upgrades
- MDL
- Metreteks

[4] See *JGN - RIN – 4.3 - Connection Capex Forecast Model*

[5] See *JGN – RIN - 4.3 - Jemena Infrastructure Cost Estimation Methodology*

- Meter access program.

2.3.1 Planned residential

Our planned residential meter replacement programs involve replacing gas and hot water meters when they reach the end of life. It also includes replacing a sample of the gas meter population for accuracy testing. Refer to Appendix A to see the list of individual programs.

If the sample is determined to read accurately then the lot/family of meters that the sample belongs to is assumed to be fit for purpose for another 5 years. If it is not measuring gas consumption accurately, then the family/lot is also considered to be inaccurate and is therefore at the end of its life and will be replaced. Our forecast assumes that the last sample test will be undertaken at age 28 and if it passes the test it is automatically replaced at age 35 without further testing.

In contrast, hot water meters are not sample tested and instead are replaced based on the expected life of the internal battery (which prevents life extensions).

The planned residential meter replacement program involves replacing large volumes of meters every year so using the historical unit costs is a reliable method to forecast the expected cost of replacing meters in the forecast access arrangement period.

Accordingly, the capex forecast is based on two components:

- Unit rates based on historical unit rates, calculated by summing direct costs over the last four years and dividing by total volumes.
- Applying the historical unit rates to expected volumes, from our meter replacement volume forecast model, described in 2.5.1.1.

2.3.2 Planned industrial & commercial

Like the planned residential meter replacement programs, our planned industrial & commercial meter replacement programs involve replacing gas meters when they reach the end of life and replacing a sample of meters for testing. Refer to Appendix A to see the list of individual programs.

Unlike residential meters, there is a high degree of variability in the size and type of our industrial and commercial meters we replace with either new or refurbished meters. In turn, our planned replacement program costs change over time depending on the mix of meters in our program. Our industrial & commercial meter replacement program also includes other testing to allow our meters to have longer service lives. For example, we undertake throughput analysis on some meters, which allows us to leave some meters in service beyond their standard lives.

To address the variability in the industrial & commercial meter replacement programs, we have developed project estimates on a case-by-case basis. This approach produces a granular unit cost forecast which we can then apply to our forecast. We did not apply historical average unit rates as this approach assumes no changes to the mix over time and leads to an inaccurate forecast.

We have applied the historical average unit rate approach for the replacement of the sample for testing as these costs are steady over time. This only applies to a subset our industrial & commercial diaphragm meters.

2.3.3 Defective / meter upgrades

These programs include the replacement of defective meters, regulators and associated equipment. It also includes replacing meters that need to be upgraded to reflect their increased or decreased gas demand or usage. We forecast these costs using the average historical capex approach.

To forecast our capex in these programs, we use the average of annual costs incurred over the last four years. This approach captures the historical failure rate and the historical average unit costs. We consider that this represents a conservative forecast as it does not take into account the expected rise in failure rates as our meters age and wear. Similarly, it captures the volume of customers whose gas usage has changed and they required a meter upgrade/downgrade.

2.3.4 Meter Data Loggers

This program includes the replacement of Meter Data Logger (MDL) devices that help with storing and communicating the gas consumption data. It also includes the costs associated with replacing ancillary components of these devices, such as the batteries in MDLs.

These programs are not driven by customer demand and the price of the devices change as technology evolves. Therefore, we have developed project estimates on a case-by-case basis using our project estimation methodology.[6]

2.3.5 Metreteks

This program includes the replacement of Metretek devices that help with storing and communicating the gas consumption data. It also includes the costs associated with replacing ancillary components of these devices.

These programs are not driven by customer demand and the price of the devices change as technology evolves. Therefore, we have developed project estimates on a case-by-case basis using our project estimation methodology.[7]

2.3.6 Meter access

This program includes the replacement of mechanical meters with digital meters. The roll-out of digital meters will involve different costs and volumes compared to the past. We have therefore forecast these costs using our project estimation methodology. It should be noted that this program lists the incremental costs of using digital meters instead of mechanical replacement meters. The like-for-like cost of replacement is included in the underlying program.[8]

[6] See RIN attachment 4.3 - Jemena Infrastructure Cost Estimation Methodology

[7] See RIN attachment 4.3 - Jemena Infrastructure Cost Estimation Methodology

[8] See the business case in RIN Attachment 4.3 - End of Life Replacement of Mechanical Gas Metes with Digital Gas Meters – BC fo further details.

2.4 Forecast capex program

Table 2–1: Meter replacement capex program ($m 2023, escalated direct)

ID	Project	RY26	RY27	RY28	RY29	RY30
Planned residential						
R-RAQ	Replacement of residential Hot Water Meters	0.1	0.0	1.3	3.3	3.8
R-RAS	Sample & compliance testing of residential gas meters	0.3	0.3	0.4	0.5	0.4
R-RAZ	Planned replacement of Residential aged gas meters	3.9	4.1	9.1	14.3	13.7
R-RDG	Replacement of Difficult to Access Resid. Gas Meters	1.3	0.0	0.0	0.0	0.0
R-RDH	Replacement of Difficult to Access Resid. Hot Water Meters	2.6	1.3	0.0	0.0	0.0
Subtotal		8.3	5.7	10.9	18.1	17.9
Planned industrial & commercial						
R-RA2	Replacement of Testing Sample of I&C Diaphragm Meters	0.7	0.8	0.7	0.7	0.8
R-RA7	End of Life Replacement of I&C Turbine Gas Meters	0.2	0.2	0.1	0.2	0.2
R-RAF	End of Life Replacement of I&C Diaphragm Meters Sets	1.4	4.7	11.6	12.4	6.5
R-RAM	End of Life Testing & Replacement of I&C Rotary Meter Sets	0.4	1.1	1.6	3.0	3.3
Subtotal		2.6	6.7	13.9	16.3	10.7
Defective / meter upgrades						
R-RA4	Replacement of Defective Residential Hot Water Meters	2.5	2.5	2.5	2.6	2.6
R-RA8	Replacement of Defective I&C Gas Regulators	0.1	0.1	0.1	0.1	0.1
R-RAE	Upgrade or downgrade of Meter Capacity	1.3	1.3	1.3	1.3	1.3
R-RAG	Replacement of Defective Mercury/Metretek Equipment	0.3	0.3	0.3	0.3	0.3
R-RAI	Replacement of Defective Meter Data Loggers	0.7	0.7	0.7	0.7	0.7
R-RAJ	Replacement of Defective Regulators	1.0	1.0	1.0	1.0	1.0
R-RAN	Replacement of Defective I&C Turbine Gas Meters	0.0	0.0	0.0	0.0	0.0
R-RAO	Replacement of Defective I&C Rotary Gas Meters	0.1	0.1	0.1	0.1	0.1
R-RAP	Replacement of Defective Diaphragm Gas Meters	0.2	0.2	0.2	0.2	0.2
R-RAV	Replacement of Defective Residential Gas Meters	2.1	2.2	2.2	2.2	2.2
Subtotal		8.3	8.4	8.5	8.5	8.6
MDL / Metreteks						
10068368	Trial of Large I&C Remote Reading Technology	0.1	0.3	0.0	0.0	0.0
R-RA1	Replacement of Meter Data Logger Batteries	1.1	1.2	1.2	1.2	1.1
R-RA5-AA	Replacement of Residential and Small I&C Remote Reading	0.2	0.4	0.2	0.2	0.3
R-RA6	End of Life Replacement of Metreteks	1.2	6.7	1.0	0.4	0.0
Subtotal		2.6	8.6	2.5	1.8	1.3
Meter access program						
R-RDZ	Replacement of Mechanical Meters with Digital Meters	0.1	0.9	0.9	0.9	0.9
Subtotal		0.1	0.9	0.9	0.9	0.9
Meter Replacement Capex		**22.0**	**30.4**	**36.6**	**45.6**	**39.4**

2.5 Forecast meter volumes model

To forecast the volume of meters to be replaced we have developed a meter replacement volume forecast model. We use this model for the following programs:

- Residential gas meters replacement and statistical sampling programs.
- Residential hot water meters replacement program.
- Industrial and commercial meters (diaphragm, turbine and rotary) replacement and the diaphragm statistical sampling programs.

We monitor the performance of our meters by 'lots' – a group of meters manufactured under the same set of conditions.

The meter replacement volume forecast model takes the age profile of our meters (by lot) and projects forward an age profile. Each year the model adjusts the meter population for the expected number of defective meters, meters removed for statistical sampling and meters replaced by our planned replacement program.

2.5.1.1 Residential gas meters and statistical sampling programs

We test residential gas meters in accordance with Australian Standards[9] to identify the accuracy and leak tightness of meters installed in the network.

We first test meters at the age of 13 years so that we can make a decision on whether to extend or replace the specific lot of meters by the time they reach 15 years of age. If the meter readings are accurate to ±2% we extend their life by five years.

We then subsequently test these meters again two years prior to the end of their life extension.

The meter replacement volume model takes into account the statistical sampling test results (at 13, 18 and 23 years) of each lot of meters. If the meters:

- Fail – they are scheduled for replacement two years out from when replacement is due.
- Pass – another statistical test is scheduled in five years[10] and the meters to be tested are removed from the meter population to ensure they are not double counted.

Where we don't have testing results, based on the latest meter performance results we assume that all untested residential gas meters will pass their 15 and 20 year life extensions and will be replaced at 25 years. We do not account for the proportion of meters which will fail these tests, leading to a conservative (lower) volume forecast.

2.5.1.2 Residential hot water meters

Hot water meter replacement volumes are based on field failure information and initial purchase specifications including Original Equipment Manufacturer (**OEM**) recommendations. Our approach is to replace:

- Mechanical hot water meters at 25 years. This reflects the historical field failure data.
- Hot water meters with a Cyble head[11] at 10 years, reflecting the battery life of 10 years, field performance and as indicated by the OEM.

[9] AS/NZS 4944:2006 Gas Meters – In-service compliance testing

[10] The number of meters we test is determined by the lot size and is set out in the meter replacement volume forecast model.

[11] The Cyble is a device attached to a hot water meter. It sends pulses to a Meter Data Logger (MDL) to communicate how much hot water has been used.

- All other hot water meters with a battery at 15 years. This reflects the battery life of 15 years as indicated by the OEM.

Unlike gas meters we are unable to extend the lives of hot water meters using statistical sampling. This is due to the communication components of the hot water meters (which send signals to a central MDL) requiring a battery.

We have not forecast any planned replacement of cold-water meters reflecting our strategy to run these meters to failure and they are all replaced in the defective program.

2.5.1.3 Industrial and commercial gas meters

The testing approach is very similar[12] to residential meters. We test I&C diaphragm gas meters at the age of 13 meters (before they reach 15 years of age). If the meter readings are accurate to ±2% we extend their life by five years. We then subsequently test them again two years prior to the end of their life extension.

If we don't have test results we take the following approach based on historical statistical sampling data (as with our residential gas meter program) for meter models:

1. AL425 and AL1000 we assume they pass the 15 year test and then replaced at 20 years.
2. AL1400, AL2300 and AL5000 we assume they will need to be replaced at 15 years. Volumes of these meters are small and we do not have testing evidence which supports extending their life further.

We do not statistically test our rotary or turbine meters given the volume of gas that is measured by these meters. Instead we periodically take these meters out of service and test their performance. We generally refurbish the meters and reuse the meter. We replace rotary and turbine meters at 10 and five years in line with OEM recommendations.

[12] We test our larger meters using the 'attribute method' which consists of counting the number of non-conformities found in a random sample consistent with AS/NZS 4944:2006. This differs to the 'variable method' used with residential gas meters where a pass or fail depends on the average and variability of the measurements obtained.

Appendix A
Metering program names

A1. Metering program names

Table A1–1: Meter Replacement Capex Programs

Driver	Project Name	Project ID	Forecast Method
Planned residential	End of Life Replacement of Difficult to Access Residential Gas Meters	R-RDG	Average Historical Unit Rate
	End of Life Replacement of Difficult to Access Residential Hot Water Meters	R-RDH	Average Historical Unit Rate
	End of Life Replacement of Residential Hot Water Meters	R-RAQ	Average Historical Unit Rate
	Planned replacement of Residential aged gas meters	R-RAZ	Average Historical Unit Rate
	Planned statistical sampling of Residential aged gas meters (FY+2yrs) & Compliance testing	R-RAS	Average Historical Unit Rate
Planned industrial & commercial	End of Life Replacement of I&C Turbine Gas Meters (like for like)	R-RA7	Project estimate
	End of Life Replacement of Industrial & Commercial Diaphragm Gas Meters Sets	R-RAF	Project estimate
	End of Life Testing & Replacement of I&C Rotary Gas Meter Sets incl FEED	R-RAM	Project estimate
	Replacement of Testing Sample of I&C Diaphragm Gas Meters	R-RA2	Average Historical Unit Rate
Defective / meter upgrades	Replacement of Defective I&C Gas Regulators	R-RA8	Average Historical Capex
	Replacement of Defective Diaphragm Gas Meters	R-RAP	Average Historical Capex
	Replacement of Defective I&C Rotary Gas Meters	R-RAO	Average Historical Capex
	Replacement of Defective I&C Turbine Gas Meters	R-RAN	Average Historical Capex
	Replacement of Defective Mercury/Metretek Equipment	R-RAG	Average Historical Capex
	Replacement of Defective Meter Data Loggers	R-RAI	Average Historical Capex
	Replacement of Defective Regulators	R-RAJ	Average Historical Capex
	Replacement of Defective Residential Gas Meters	R-RAV	Average Historical Capex
	Replacement of Defective Residential Hot Water Meters	R-RA4	Average Historical Capex
	Upgrade or downgrade of Meter Capacity	R-RAE	Average Historical Capex
MDL / metreteks	End of Life Replacement of Meter Data Logger Batteries	R-RA1	Project estimate
	End of Life Replacement of Metreteks	R-RA6	Project estimate
	End of Life Replacement of Residential and Small I&C Meter Remote Reading Technology (R)	R-RA5	Project estimate
	Trial of Remote Reading Technology for Large I&C Meters (NR)	10068368	Project estimate
Meter access program	End of Life Replacement of Mechanical Gas Meters with Digital Gas Meters	R-RDZ	Project estimate