AusNet Gas Services Pty Ltd

Gas Access Arrangement Review 2018–2022

Appendix 6G: Meter Management Strategy – Public

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Meter Management Strategy

Gas Network

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Executive Summary

This document details AusNet Services' approach to the management of existing gas metering assets. The following annual programs maintain consumer safety and compliance with obligations under the Gas Distribution System Code (GDSC version 2011):

- Annual In-service Compliance Testing of domestic meters nearing the end of their compliance periods. The outcome of compliance testing leads to a field life extension or the meter family being removed from the field.
- Time Expired Meter Replacement Programs to remove domestic, and Industrial and Commercial (I&C) meters, from the field at the end of their useful life.
- 'No Access' Meter Replacement Program to remove meters that have remained in the field beyond their in-service compliance periods due to access restrictions.
- Reactive Meter Replacement to replace meters that are faulty or have been damaged within the field.

Each program defined under this strategy is aligned to the Gas Network Objectives, as summarised below:

- The programs maintain network safety in accordance with the Gas Safety Case through the removal of defective meters from the field.
- All programs support the objective to maintain top quartile operating efficiency, by ensuring pragmatic replacement that avoids premature replacement and delivery strategies that allow for unit rate efficiencies.
- The expenditure for meter replacement is considered to be prudent and sustainable network investment as it ensures compliance with the GDSC whilst reducing the volume of unplanned interruptions in the future.
- Each program delivers a safe and reliable service to customers as defective meters are replaced with accurate, correctly functioning units, reducing risk of gas leaks and incorrect billing.

Table 1 summarises the proposed capital works programs and expenditure in 2018 to 2022. These forecasts are based on detailed analyses of historic asset performance and predicted failure rates.

Table 1: Calendar Year financial Plan Meter Management

Program	CY:	2017	2018	2019	2020	2021	2022	Total
In-service compliance testing – Field Life Extension	Units	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**7,372**
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**$1,375**
Domestic meter replacement (Time Expired)	Units	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**142,044**
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**$19,265**
I&C replacement (Time Expired)	Units	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**2,719**
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**$3,303**
"No Access" meter replacement	Units	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**3,746**
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**$1,150**
Reactive meter replacement	Units	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**15,757**
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**$4,850**
TOTAL Expenditure ('000)		**$5,551**	**$6,092**	**$6,488**	**$5,875**	**$5,398**	**$6,089**	**29,942**

1 Document Overview

1.1 Purpose

This document details AusNet Services' approach to the management of existing gas metering assets. The document is for use by:

- Internal staff and senior management; and
- Regulators – economic, technical and safety.

This document details strategies to maintain regulatory compliance and consumer safety relating to existing metering assets. Existing metering assets include domestic, industrial and commercial gas meters in AusNet Services' distribution network. The forecast cost of new connections (i.e. network growth) is not included in the scope of this strategy.

Custody Transfer Meters (CTMs) are also excluded from this strategy, as they are owned and maintained by the respective transmission businesses.

This plant strategy does not cover consumer regulators, often located at the gas meter installation as these assets are detailed in a standalone plant strategy, AMS 30-53 Consumer Regulator Strategy.

1.2 Definitions

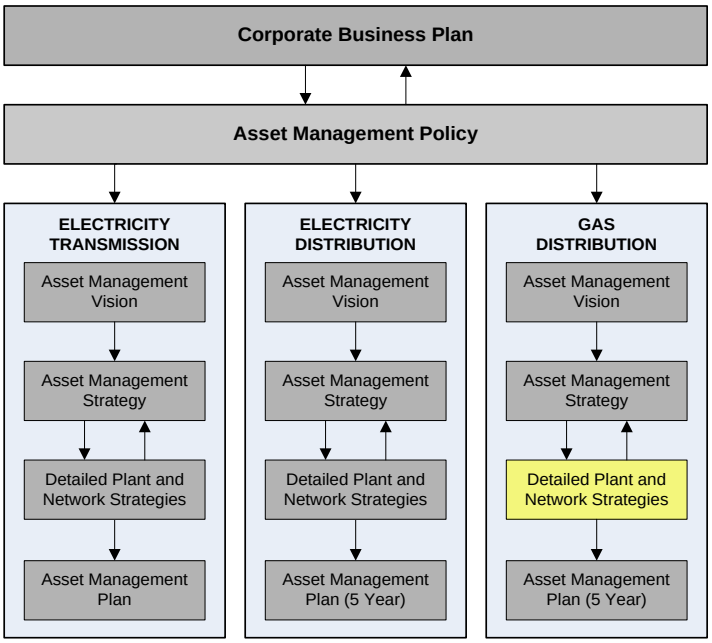
Attributes	A method of statistical analysis where the meter is classified as either conforming or non-conforming or the number of nonconformities in the meter is counted, with respect to given requirements.
Australian Energy Regulator (AER)	Body responsible for the economic regulation of energy networks, including natural gas distribution in Australia.
Commercial Meter	Large meter installations (>25m^3/hr) operating at pressures less than 4kPa.
Custody Transfer Meter (CTM)	Large capacity meter installed at every injection to AusNet Services' transmission and distribution networks.
Diaphragm Meter	A type of gas meter with two or more chambers formed by movable diaphragms.
Domestic Meter	Small capacity (<25m^3/hr) residential meter operating at a pressure less than 4kPa and typically located at the front of a domestic property.
Energy Safe Victoria (ESV)	Government body responsible for the safety and technical regulation of Victorian energy networks, including gas distribution network.
Field Life Extension (FLE)	See in-service compliance testing.
Gas Distribution System Code (GDSC)	Defines the minimum standards for the operation and use of a gas distribution system.

Gas Meter	A device which measures the quantity of gas passing through it.
Industrial Meter	A large capacity metering installations (>25m^3/hr) operating at pressures greater than 4kPa. Industrial meters can only be maintained by System Operations trained personal.
Initial In-service compliance period	The period of time allowed to a meter population or meter type to remain in-service without retesting or replacement.
In-service compliance testing	A sampling program for diaphragm meters (<25m^3/hr) nearing the end of their initial in-service compliance period. Outcomes of testing determines whether extensions of on-going in-service compliance periods can be applied. Also known as Field Life Extension (FLE).
Installation type	The classification of domestic, commercial or industrial meters.
Meter Family	A group of the same meter brand, and type, installed on the network within the same calendar year. (e.g. Email 602 1999)
Meter Type	The meter technology used to measure gas flow i.e. Rotary, Turbine, Diaphragm.
'No Access' Meter	A meter that was unable to be replaced due to inability to safely access the meter (e.g. due to locked gates, aggressive dog, etc.)
Primary Service Provider (PSP)	AusNet Services' contracted provider of operational and maintenance services.
Refurbished Meter	A meter that has been removed from the field, at the end of the initial compliance period, and sent back to the meter manufacturer for refurbishment.
Regulator	A device that that reduces the gas to a usable pressure as per the customer demand.
Rotary Meter	A type of meter with two rotors that spin in precise alignment, with a known volume of gas passing through the meter with each revolution.
Select Solutions (SS)	The commercial arm of AusNet Services is responsible for the management of testing and procurement of new gas meters.
Time Expired Program	The annual program that replaces meters at the end of their compliance periods with new approved meters.
Turbine Meter	A type of meter which measures the volume of gas by determining the speed of the gas moving through the meter.
Variables	A method of statistical analysis that measures a quantitative characteristic for a sample taken from this population. The quantitative characteristic is used to establish the acceptability of the population.

1.3 Relationship with Other Management Documents

The Meter Management Strategy is one of a number of asset management related documents developed and published by AusNet Services in relation to its gas distribution network. As indicated in Figure 1 below, detailed plant strategies, in which the Gas Meter Management Strategy belongs, informs both the Asset Management Strategy (AMS) and Asset Management Plan (AMP) of the required capital programs needed to achieve the long-term objectives of the gas distribution network.

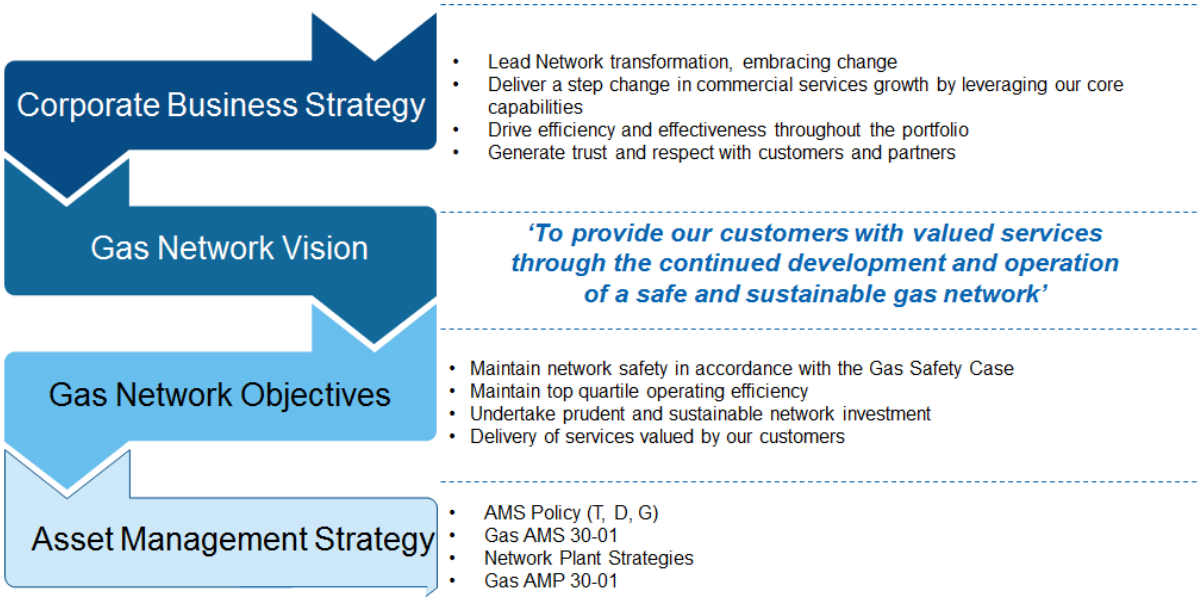
Figure 1: Asset Management System document interdependencies



2 Alignment of AusNet Services' Business Drivers and Objectives

AusNet Services' purpose statement is to "Empower communities and their energy future". This statement places the customer (as individuals and communities) at the forefront as a business driver and acknowledges the critical relationship with their energy supply and usage, and is a key theme throughout the Corporate Business Strategy. The following diagram provides the linkage between AusNet Services' corporate strategy, and the gas network vision consistent with providing valued customer service and sustainable network investment. The gas network objectives which stems from the network vision drives the development of the programs for each of the asset strategies

Figure 2: Alignment of Corporate, Business and Network objectives



The gas network objectives alignment with the business, regulators, and the delivery of plant strategies are detailed below:

Maintain network safety in accordance with the Gas Safety Case

Maintains the alignment to AusNet Services' commitment to 'Mission Zero'. The objective to maintain network safety is in recognition of AusNet Gas Services' current safety performance and design of the network.

Maintain top quartile operating efficiency

Aligns to the Corporate Business Plan with AusNet Services' aspiration to operate "all three core networks in the top quartile of efficiency benchmarks".

Undertake prudent and sustainable network investment

Alignment to AusNet Services' obligation to undertake prudent and sustainable network investment, as defined in the National Gas Rules and Gas Distribution System Code.

Delivery of valued services to our customers

Establishes the need to better understand our customers (their needs and behaviours) and deliver services they value.

2.1 Phasing and Financial Disclosure

All programs within the Meter Management Strategy are defined in calendar years, consistent with the requirements of the Gas Distribution System Code (GDSC), and the reporting requirements of the Australian Energy Regulator (AER).[1]

All financial figures quoted within this document, including all historic and forecasted expenditure – unless otherwise specifically stated – have the following characteristics:

- Real Expenditure / Cost (reference year = 2016);
- Direct Expenditure only (i.e. excludes overheads and corporate finance costs); and
- In units of $1,000 (i.e. '000).

[1] The AER requires notification of the outcomes of in-service compliance testing by 30 September each year. Both in-service compliance testing and meter replacement programs are defined, tracked and reported on a calendar year basis.

2.2 References

- 30-4004: Materials Manual – Section 12: Meters;
- AS/NZS 4944:2006 – In-service compliance testing of diaphragm meters up to 25m3/hr
- AS 4647:2011 – Diaphragm gas meters
- Gas Distribution System Code (Version 11); Sections 5-8
- TS 0501 – Gas Specific Materials and New Technologies Approval Process
- TS 5202 – In-service compliance testing of gas meters

3 Asset Overview

3.1 Function

A gas meter is a flow device, used to measure the volume of gas consumed by an end user. Gas meters are installed at domestic, commercial, and industrial sites to determine the volume of gas, and consequently the usage charges passed on to the customer.

3.2 Metering Technology

A variety of gas metering technologies are found within AusNet Services' distribution network. The most common are summarised in Table 2 below. Other meter technologies include Orifice, Ultrasonic and Coriolis meters that are currently used for Custody Transfer Meters only.

Table 2: Metering Technology within AusNet Services' Distribution Network

Meter Type	Description	Applications	Examples
Diaphragm	Positive displacement meters with two or more chambers formed by movable diaphragms.	Domestic Industrial & Commercial	L&G 750, U10, AL-425 to AL-5000, Email 602,610 & 750
Rotary	Two figure "8" shaped lobes (also known as impellers), spin in precise alignment, with a known volume of gas passing through the meter with each revolution.	Industrial & Commercial	Romet Meters, Roots Meters
Turbine	Volume of gas is inferred by determining the speed of the gas moving through the meter.	Industrial	AMC GT 18M to 60M, Fluxi, Instromet

3.3 AusNet Services' Metering Fleet

AusNet Services owns and operates a fleet of 655,602[2] domestic and industrial & commercial (I&C) meters.

Domestic (often referred to as residential) meters are small capacity (<25m^3/h) diaphragm meters. These are typically located at the front of domestic properties. I&C meters are larger capacity meters (≥25m^3/h), installed for higher volume users and may be a combination of diaphragm, rotary or turbine types.

AusNet Services describes a group of meters, of the same meter brand and type, installed within the same calendar year, as a 'Meter Family'. Table 3 shows a summary of the meter fleet. A complete list of meter types and population sizes is provided in Appendix A.

[2] As of June 2016.

Table 3: Summary of AusNet Services' Gas Meter Fleet[2]

Installation Type	Units	Number of Meter Families
Domestic Meters	639,882	162
I&C Meters	15,720	339
TOTAL	**655,602**	**501**

3.3.1 Domestic Meters

Figure 3 shows the age profile of domestic meters in AusNet Services' gas network. Each of the meter types (Email 602, 610, etc.) are represented. The average age of the domestic meter fleet is 9.5 years. The Australian Standard specifies a 15 year life for a domestic meter before any life extension or replacement is undertaken. Figure 3 below shows a large volume of meters installed during 2008 (8 years old). This may cause a large spike in field life extension testing or meter replacements in 2023 (after the initial 15 year life has expired). The proportion of meters that have exceeded their initial 15 year design life[3] is 16%.

Figure 3: Domestic Meter Age Profile[4]

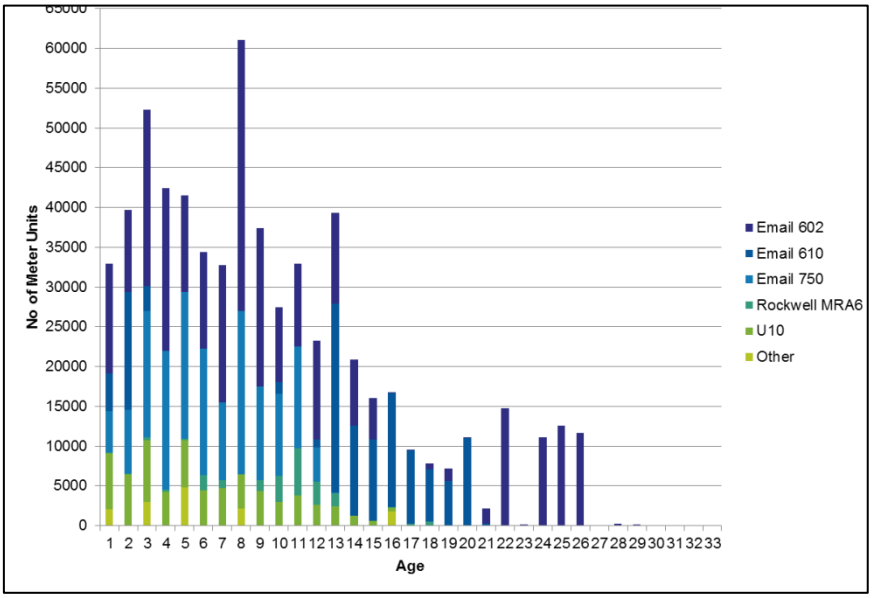
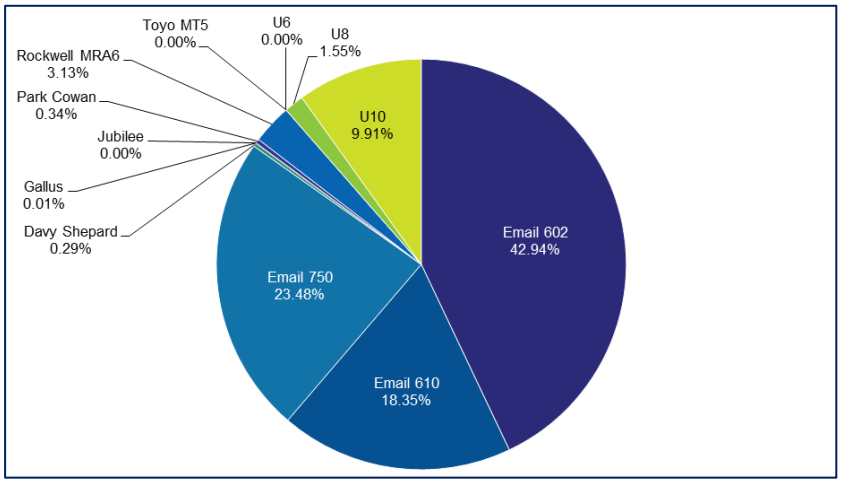


Figure 4 below presents the distribution of domestic meter types. Email 602 and Email 610 meters are discontinued models and have been replaced with the Email 750 model.

[3] Meters exceeding 15 year initial design life have gained life extensions in compliance with relevant Australian Standards.

[4] As of June 2016.

Figure 4: Domestic Meter Type Breakdown



3.3.2 Industrial and Commercial (I&C) Meters

A combination of three (3) meter types; rotary, diaphragm or turbine gas meters are commonly used at I&C sites. Table 4 provides a breakdown of I&C meters currently installed across the network.

Table 4: Breakdown of I&C Meter Types[5]

Meter Type	Maximum Flow Rate m^3/hr	Units	Initial technical life (yrs)	Average Age (yrs)
Diaphragm	500	15,205	15	8.5
Rotary	1,500	364	13	7.1
Turbine	9,000	151	13	7.4
	TOTAL	**15,720**		**8.5**

3.4 Historical Asset Performance

3.4.1 Meter Faults

Over the last 5 years AusNet Services' metering assets have experienced average annual failure rates of 0.38%[6] of the total population. A breakdown of failures by type is shown in Table 5.

[5] As of June 2016

[6] Failure statistics only include meters that have failed during operation. Results from in-service compliance testing are excluded from the percentages in Table 5 and Table 6.

Table 5: Meter Failures by Installation Type

Installation Type	CY11	CY12	CY13	CY14	CY15	Average
Domestic Meter Failures	1,761	2,044	2,049	1,970	2,988	2,162
- % Population	0.31%	0.35%	0.35%	0.32%	0.47%	0.36%
I&C Failures	191	239	193	82	109	163
- % Population	1.20%	1.48%	1.20%	0.54%	0.70%	1.02%
Total Meter Failures	**1,952**	**2,283**	**2,242**	**2,052**	**3,097**	**2,325**
- % Population	**0.33%**	**0.38%**	**0.33%**	**0.33%**	**0.48%**	**0.38%**

Domestic meter failures increased during 2015, compared to previous years. The two main failure modes resulting in this increase are damaged meters (including third party damage) and inadequate size, both of which cannot always be directly influenced by AusNet Services. This trend is expected to continue in upcoming years due to increased population density, particularly in metro areas, and increased load from gas appliances.

Figure 5 below shows failure modes, as a percentage of total failures, experienced during 2014 and 2015.

Figure 5: Percentage Breakdown of Meter Failure Modes (2014 and 2015 Calendar Years)

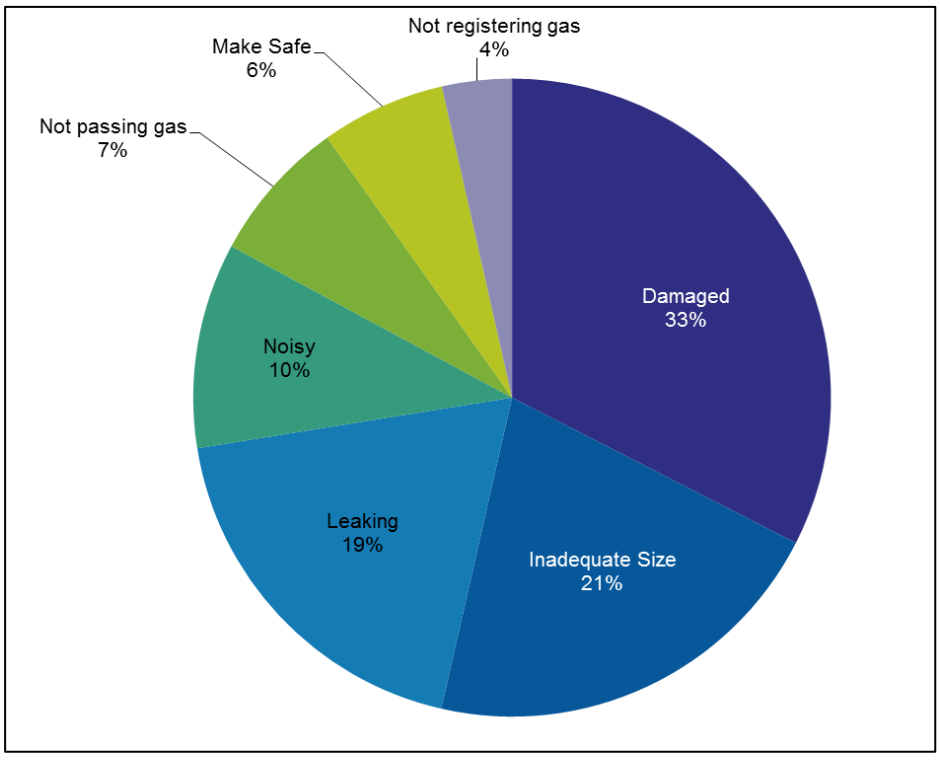


Table 6 compares failure modes across Domestic and I&C meters. Damaged meters are the primary cause of meter failure for both domestic and I&C, followed by inadequate meter sizing and leakage.

Table 6: Meter Failure Modes (2014 and 2015 Calendar Years)

Failure Mode	Domestic (<10m3/hr)	I&C (≥25 m3/hr)	Total
Damaged	33%	29%	33%
Inadequate size	21%	34%	21%
Leaking	19%	8%	19%
Noisy	11%	1%	10%
Not passing gas	7%	5%	7%
Make Safe	6%	8%	6%
Not registering gas	3%	15%	4%

The meters failures, described in Table 6 above, have the potential to cause the following:

- Injury to property and public due to a gas leak. In the most extreme case, a gas leak at the meter has the potential to cause fatality;
- Inaccurate billing to customer, increasing customer charges if the meter is over reading; and
- Under recording of customer usage, impacting revenues that can be realised by both AusNet Services and retailers, in the event the meter is under reading, or not registering gas.

3.4.2 In-Service Compliance Testing – Failed Meters

In addition to reactive meter failures, meter testing is carried out when a domestic meter nears the end of its useful life. Seven (7) meter families have failed testing over the last five year period, resulting in a further 60,424 meters replaced in the field (approximately 9% of current domestic meter population). The primary reason for meter failure during testing is performance against meter accuracy criteria.

4 Regulatory Obligations

AusNet Services' metering obligations are primarily defined within sections 5 to 8 of the GDSC, Version 11. The code outlines the obligation to provide metering installations, the standard of those installations, testing requirements and the provision of metering data to retailers.

In summary, AusNet Services is required to provide an appropriate (type varies depending on application) metering installation at each supply point (i.e. connection) off the distribution network. AusNet Services is required to periodically maintain these installations, replace meters when their field life has expired and provide periodic metering information to retailers for billing purposes.

To fulfil its obligations under the GDSC Version 11, a number of meter testing and replacement programs are undertaken. The programs are described in section 5.2.

5 Meter Specifications and Replacement Methodologies

Section 5.1 describes the technical specifications of meters installed. Section 5.2 details the programs, responsibilities and replacement methodologies.

5.1 Meter Technical Specifications

As part of the replacement programs described in Section 0, only approved meters are installed within AusNet Services' distribution network. Document 30-4004: Materials Manual, Section 12: Meters, provides a complete list of approved meters.

Any new meter type (or significant variation to an existing meter type) is reviewed and approved for use by the Gas Engineering Department. New meter types conform to all requirements within the approved technical specifications. Once approved, the meter type is added to 30-4004. Document TS-0501 outlines AusNet Services requirement for approval of new meters.

5.1.1 Initial In-service Compliance Period

The initial in-service compliance period refers to the "period of time allowed for a meter family or meter type to remain in-service without retesting or replacement." The initial in-service compliance period is applied to a new family when it is introduced to the network. AusNet Services considers the start date of the initial in-service compliance period to begin on 1 January of the year in which the meter was installed.

Existing Meter Types

In-service compliance periods for existing meter types are outlined in Table 7 and prescribed in section 7.2.3 of the GDSC (I&C) and AS/NSZ 4944:2006.[7] Initial compliance periods for turbine and rotary meters have been adopted as an outcome of field tests conducted in 2006.

Table 7: Initial In-service Compliance Periods for Existing Meter Types / Families

Meter Type	Installation Type	Meter Examples (Brands)	Initial Life (Years)
Diaphragm (<25m^3/hr)	Domestic	Email 602 New / Rep Email 750	15
Diaphragm (≥25m^3/hr)	Industrial / Commercial	AL-425 to 5,000 Rockwell 1,000 to 10,000	15
Rotary	Industrial / Commercial	Roots 3M to 38M Romet RM140 to RM650	13
Turbine	Industrial / Commercial	AMC GT 18M to 60M Fluxi	13

New Meter Types (not previously approved for use)

When first approved for use on the network, the initial life for new diaphragm meter types (<25m3/hr), is calculated as per the requirements within AS/NZS 4944:2006 Section 6.

In-service compliance testing of these meter families is conducted no earlier than three (3) years and no longer than five (5) years after the meter type is first installed within the field. Test results are applied against the criteria in AS/NZS 4944:2006 to determine the initial life for the meter type. The calculated initial life is applied to all subsequent meter families of the same type.

[7] AS 4944:2006 applies only to diaphragm meters, with capacity equal to or less than 25 m^3/h.

For all other meter types, i.e. Rotary & Turbine and large diaphragm, for which AS/NZS 4944:2006 does not apply, the initial meter life as they fall under the requirements outlined in the GDSC, Version 11.

5.1.2 Refurbished Meters

Several meter manufacturers offer a refurbishment program for selected meter types. Once removed from the field, at the end of the initial compliance period, meters are sent back to manufacturers for refurbishment. Refurbished meters can then be purchased at a lower unit rate, compared to a new meter. Once installed on the network, a refurbished meter is considered equivalent to a new meter and assigned a discrete meter family with an initial in-service compliance period as per Table 7.

Refurbished meters are only be installed at I&C sites, where the cost savings outweigh any additional whole of life costs associated with refurbished meters.

All domestic meters are disposed of and not refurbished once removed from the field (either at the end of the meters useful life, fault or abandonment). Meters are replaced by a new compatible meter of similar capacity.

In the past, refurbished meters were used on the network in domestic applications, however all future domestic meter replacements will be new meter units.

This change in strategy is driven by results from whole of life cost analyses comparing the cost of a new and refurbished meter over several replacement cycles. The analyses considered the cost of replacement, administrative activities and field life extension testing.[8] Higher costs associated with refurbished domestic meters are attributed to the following:

- **Historic performance of refurbished meters**
  On average, refurbished domestic meters in the network have failed during field life extension testing after 18 years in the field. This compares to new meter failures after 20-30 years in the field, meaning refurbished meters will incur more frequent replacement costs. Additionally, recent domestic meter refurbishment rates have been as low as 30% (i.e. for every 100 meters sent to suppliers, only 30 meters are returned as successfully refurbished).
- **Increasing cost to refurbished meters**
  Due to changing technologies and labour conditions, the cost of a refurbished meter is expected to increase significantly over the next five year period. The removal of meters from the field and delivery to meter suppliers for refurbishment incurs additional handling and administration fees for both parties. Suppliers will generally pass on any additional costs associated with refurbished meters to AusNet Services for all meters returned for refurbishment, including those with unsuccessful refurbishment outcomes.
- **Supply risk**
  There is also growing concern that due to increasing labour costs and advances in new metering technology, the appetite from meter manufacturers to continue refurbishment programs may reduce or stop completely. This is supported by recent trends in new and refurbished meter prices. Over the last 10 year period the unit price of a new meter has decreased by 30%, compared to only 15% for refurbished meters bringing the cost of new and refurbished meters closer together.

5.2 Meter Testing and Replacement Programs

AusNet Services complete the following annual programs to remain compliant with its obligations under the GDSC outlined in Section 0 and to maintain consumer safety.

- **In-service compliance testing** of domestic meter families nearing the end of their compliance periods. The outcome of compliance testing leads to a field life extension (5, 3, or 1 year) or the meter family being removed from the field.

[8] The analyses included several sensitivity tests to test impact of variables including unit meter costs, refurbishment rates and discount rates.

- **Domestic meter replacement program** to remove domestic meters (<25m3/hr) meters at the end of their in-service compliance period.
- **I&C meter replacement program** to remove I&C meters (≥25m3/hr) at the end of their in-service compliance period.
- **'No Access' Meter replacement program** to remove meters that have remained in the field beyond their in-service compliance periods due to access restrictions.
- **Reactive Meter replacement program** to replace meters that are faulty or have been damaged within the field.

Sections 5.2.1 to 5.2.4 describe each of these programs in more detail, providing an overview of scope, methodologies and historic performance.

5.2.1 In-service Compliance Testing of Domestic Meters

Annual in-service compliance testing is carried out on all domestic meter families nearing the end of their service lives. This program is often referred to as the Field Life Extension (FLE) program.

A sample size of each meter family is removed from the field and tested by a NATA (National Association of Testing Authorities) accredited facility.

Based on the results of the FLE testing, a meter family is either retired from service or granted an in-service life extension (equivalent to 5, 3 or 1 years).

Meter families that fail FLE testing are then identified in the following year's Domestic Meter Replacement Program (refer to Section 7.3).

Program Scope

AS 4944:2006, and therefore the FLE program, applies to diaphragm meters with less than or equal to 25m^3/hr capacity. This includes all domestic meters and the AL 425 I&C meter.

All other I&C meters are excluded from the annual testing program and replaced at the end of the meters initial compliance period (refer to Table 7).

For economic reasons (i.e. whole of life costs), the following domestic meter types are excluded from in-service compliance testing and disposed of when their initial in-service compliance period has been reached. These meter types are older models and comprise a very small proportion of the domestic meter fleet (<1% of total domestic meter population). Meters are replaced by a compatible meter of similar capacity.

- Davey Sheppard
- Jubilee
- UGI U6
- Park Cowan U6
- U10 Tin case aluminium Case
- Gallus 2000

FLE Testing Method

Testing is conducted during the year preceding the end of the meter family's initial life.

AS/NZS 4944:2006 outlines two methods of statistical analysis that can be adopted for FLE testing:

- Variables:[9] A method that consists of measuring a quantitative characteristic for each item of a population or a sample taken from this population. The quantitative characteristic is used to establish statistically the acceptability of the population from results contained from the items in the sample.

  OR

- Attributes:[9] Inspection wherein the meter is classified as either conforming or non-conforming or the number of nonconformities in the meter is counted, with respect to given requirements.

[9] Definitions are from AS/NZS 4944:2006 Section 4.2.

In the first instance the "Variables" method of sample testing is adopted. If a meter family fails the criteria for "Variables" testing, the "Attributes" method is then adopted. This involves additional meters being removed from the field to increase sample sizes.

Sample Size Determination

Sample sizes vary based on testing methodology adopted and population of the meter family. Sample sizes are defined within tables 1, 2 and 6 of AS/NSZ 4944:2006.

Testing Requirements

Testing of sample meters is conducted in a NATA accredited facility. Examples of required tests are listed in Table 8.

Table 8: Tests carried out on meters

Test	Summary
$0.2Q_{max}$	Meter Accuracy (+/-) at 20% of max capacity
Q_{max}	Meter Accuracy (+/-) at max capacity
Q_{min}	Meter registration of flow only at minimum flowrate
External leakage	Pressurised to 2 times operating pressure

Source: AS 4944:2006

Test Results

Test results are analysed in accordance with the requirements of AS 4944:2006 and meters are passed or failed in accordance with AS 4944:2006.

Ongoing in-service compliance period

Table 9 summarises the ongoing in-service compliance period that can be assigned to a meter family following testing. This is based on results from accuracy testing.

Table 9: Ongoing in-service compliance periods

Accuracy	In-service Compliance Extension
± 3.0%	1 year
± 2.5%	3 years
± 2.0%	5 years

Source: AS 4944:2006

Historical Performance

A summary of the FLE program (2012-16) is provided in

Table 10. Five (5) large meter families failed testing during 2015 and 2016. These failures are a result of a manufacturing change on a particular meter type (Email 610). This meter type has been superseded by a newer model however, eight (8) meter families of this meter type still remain within the network.

Table 10: Summary Results of Completed In-service Compliance Testing Programs

Test Year	Meter Families Tested	Meter Population Tested	Sample Size – Variables[10]	Sample Size – Attributes[10]	Families Failed	Meters Failed
CY12	10	68,919	640	1,805	1	2,464
CY13	12	84,088	770	2,206	0	0
CY14	11	37,969	495	1,337	1	2,594
CY15	10	74,151	670	1,925	2	24,379
CY16	9	69,727	665	1,902	3	22,112

5.2.2 Domestic Meter Replacement (Time Expired)

This annual replacement program replaces meters at the end of their compliance periods with new approved meters. This program ensures the metering fleet remains compliant with the GDSC.

The domestic meter replacement program is commonly referred to as the Time Expired (TE) program. The program is finalised before or during the month of December each year. AusNet Services' primary service provider carries out meter removal and replacement in the field, along with relevant system updates.

Program Scope

The TE program applies to all domestic meters and is made up of the following elements:

- Meter families at the end of their in-service compliance periods that either failed FLE testing or were not included within the testing process; and
- Meter families being prematurely retired to avoid volatility in future replacement program sizes. The premature retirement of meters is discussed further in section 7.2.

Historical Performance

Historical performance of the TE program (from 2012) is outlined in Table 11 below. Meters that remain in the field beyond their initial in-service compliance period do not meet the requirements of the GDSC and result in an increased safety risk to consumer.

An inability to access a meter for replacement (i.e. 'No Access Meters') is the primary reason for meters remaining in the field beyond their initial compliance periods. See Section 5.2.4 for further details.

[10] AusNet Services did not elect to test via attributes over this period.

Table 11: Historic Domestic Meter Replacement Program Outcomes

Year	Total Number of Meters	% Completed	Outstanding Meters
2012	27,003	99.4%	155
2013	28,159	99.2%	222
2014	24,806	98.8%	300
2015	24,976	99.0%	244
2016	28,043	50% complete at time of document preparation, outstanding meters unknown.	

5.2.3 I&C Meter Replacement Program

As with the TE program for domestic meters, the I&C meter replacement program is conducted to ensure AusNet Services remains compliant with its obligation under the GDSC.

Program Scope

I&C meters are not subject to in-service compliance testing and field life extension, with the exception of AL425 meter type. All I&C meters are replaced at the end of their initial in-service compliance period (refer to Table 7). AL425 meters are included in FLE testing scope as they meet the size and type requirements under AS 4944:2006. An AL425 meters that fails FLE testing is replaced under the I&C Meter Replacement Program.

Historical Performance

Historical performance of the I&C meter replacement program (from 2012) is outlined in Table 12 below.

Table 12: Historic I&C Meter Replacement Program Outcomes

Year	Total Program	Percentage (%) Completed	Outstanding Meters
2012	498	99.4%	3
2013	663	99.7%	2
2014	999	98.8%	12
2015	460	94.6%	25
2016	335	2016 program 50% complete at time of document preparation, outstanding meters unknown.	

5.2.4 'No Access' Meter Replacement Program

'No Access' meters are those which remain within the field beyond their in-service compliance period.

A 'No Access' meter, as the name suggests, is a meter that was unable to be replaced due to inability to access the meter. Reasons for this may include:

- Locked gates;
- Aggressive dogs;
- Refused access by owner.

In addition to the regulatory compliance implications (i.e. meter installed beyond their in-service compliance period), 'No Access' meters present a safety risk to the consumer as the integrity of the installation is unknown. As such, the removal of the non-compliant 'No Access' meters are of primary concern to AusNet Services.

Steps taken to reduce the volume of 'No Access' meters include:

- The introduction of incentive mechanisms to service providers (i.e. those who complete the physical replacement of the meters) for the delivery of defined meter replacement programs;

- Targeted replacement programs;
- Rollover of outstanding meters into the following time expired program; and
- Disconnection (in extreme circumstances).

Program Scope

AusNet Services undertakes a number of actions to limit the volume of 'no access' meters. Additional effort and hence additional expense is required to overcome the barriers for replacement including:

- Contact with retailers and/or customers directly;
- Multiple site visits;
- Special out of hours site visits; and
- Customer appointments.

The required additional effort, and unique characteristics of each installation, results in an elevated unit cost when compared to a standard domestic meter replacement.

Historical Performance

This program of works (in addition to the time expired programs) began in 2012, with the intent of reducing the volume of 'No Access' meters within the network. Since this program was introduced, 'no access' meters, as a percentage of the annual TE program, have been reduced from 3% to 2%. In addition to 'No Access' meters that fall out of the annual TE program there are currently 1,453 known non-compliant meters that are also targeted as part of this program. The 'No Access' meters are considered non-compliant meters as they have not been replaced at the end of their compliance period during earlier TE meter replacement programs.

5.2.5 Reactive Meter Replacement (Faulty/Damaged)

Reactive meter replacement is undertaken for all meters in AusNet Services' metering fleet. Meter faults described in section 3.4 are predominantly identified by the public. Meters are then replaced following an investigation. Failed or faulty meters are replaced with new or refurbished units (I&C only) of similar capacity, where inadequate size is not the cause of failure. In circumstances where inadequate size is identified as the meter failure, a new meter of similar type, but appropriate capacity, will be installed in place of the existing meter.

Historical Performance

Meter failure, especially those resulting in leaks, increases the risk to public safety as a potentially explosive atmosphere could develop in the area surrounding the meter. As indicated in section 3.4, on average 0.36% of all domestic meters and 1.02% of all I&C meters fail or are damaged each year.

Domestic meter faults increased significantly during 2015, compared to previous years. The two main failure modes resulting in this increase are damaged meters (Third party damage) and inadequate size. This trend is expected to continue in upcoming years due to increased population density, particularly in metro areas, and increased load from gas appliances.

6 Alignment with Network Objectives

Each program described under this strategy is aligned to at least one, and in most cases, all of the AusNet Services' gas network objectives.

Table 13: Alignment to gas network objectives

Meter Management Program	Gas Network Objective			
	Maintain network Safety	Maintain operating efficiency	Undertake prudent & sustainable investment	Deliver valued services to customers
In-Service Compliance Testing	•	•	•	•
Domestic Time Expired Replacement	•	•	•	•
I&C Time Expired Replacement	•	•	•	•
'No Access' Meter Replacement	•			•
Faulty Meter Replacement	•	•		•
Digital Metering Program		•		•

The following sections provide further detail around the program alignment to each of the gas network objectives.

6.1 Maintain Network Safety in accordance with the Gas Safety Case

Clause 32 of the *Gas Safety Act 1997* requires a gas company to ensure facilities are maintained and operated to minimise hazards and risks to the public. Each of the meter management programs has the aim of maintaining integrity of metering installations through the removal of defective meters from the field. This minimises the likelihood of gas meter leaks, resulting in reduced hazards and risks to the public.

6.2 Maintain top quartile operating efficiency

Under the GDSC, AusNet Services is required to provide a compliant metering installation at each supply point off the distribution network, test meter installations and replace meters as required. The meter management programs have been designed to maintain operating efficiency whilst ensuring compliance with sections 5 to 8 of the GDSC.

Field life extensions granted under the FLE program avoid unnecessary meter replacement costs. The size of annual programs, and smoothing of the domestic (high volume) meter replacement program, allows for unit rates to be competitively negotiated with meter manufacturers and labour contractors.

Furthermore, proactive meter replacement and planning ensures meter stock can be procured in anticipation of meter failures and replacements, enabling more efficient replacement programs and avoiding material lead time.

6.3 Undertake prudent and sustainable network investment

The proactive programs described under this strategy ensure compliance with the GDSC but also reduce the volume of unplanned interruptions in the future. The programs identify meter families that are defective and remove these from the field, avoiding more costly reactive replacement costs in future years.

The strategy also considers whole of life costs of refurbished and brand new meters purchased from meter suppliers. Refurbished meters are not installed at domestic sites, due to the increase in whole of life costs associated with these units. This is considered prudent and sustainable investment as it considers the cost impacts to the customers beyond a 5 year period.

6.4 Delivery of valued services to our customers

Each meter management program has the aim to deliver a safe and reliable service to customers. Defective meters are replaced with accurate, correctly functioning units. This maintains integrity of the billing system, ensuring consumers are charged correctly for their gas usage.

Proactive testing and replacement also avoids unplanned outages and disruptions to customers due to meter failures.

7 Forecast Capital Expenditure

7.1 Summary

Table 14 summarises forecast annual replacement volumes and capital expenditure for each meter testing and replacement program over the 2017 to 2022 period. Descriptions of the methodologies to determine forecast volumes are summarised in sections 7.2 to 7.6. Unit rate development is described in further detail within Appendix B.

Table 14: Calendar Year Capital Expenditure to 2022

Program	CY:	2017	2018	2019	2020	2021	2022	Total
In-service compliance testing – Field Life Extension	Units	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**7,372**
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**$1,375**
Domestic meter replacement (Time Expired)	Units	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**142,044**
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**$19,265**
I&C replacement (Time Expired)	Units	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**2,719**
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**$3,303**
"No Access" meter replacement	Units	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**3,746**
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**$1,150**
Reactive meter replacement	Units	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**15,757**
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**$4,850**
TOTAL Expenditure ('000)		**$5,551**	**$6,092**	**$6,570**	**$5,875**	**$5,398**	**$6,089**	**29,942**

7.2 In-Service Compliance (FLE) Testing of Domestic Meters

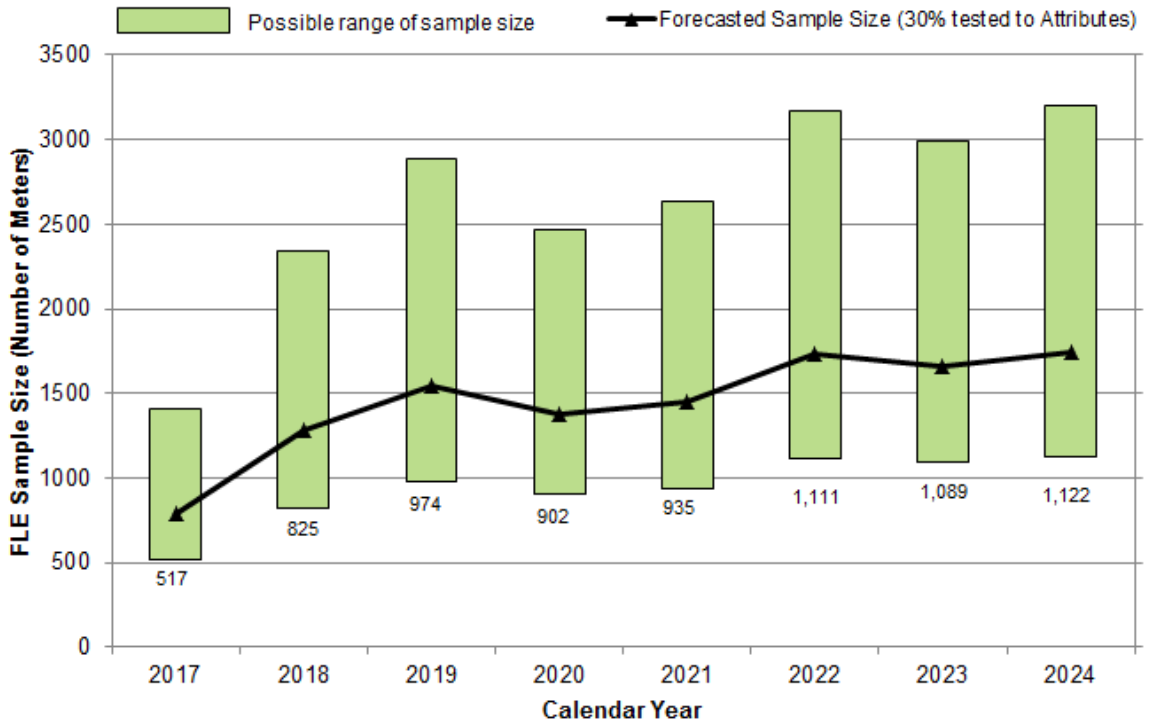
7.2.1 Proposed Works Program (2017-2022)

AusNet Services' FLE program for 2017-22 has been forecasted based on a set of assumptions around expected life extension and failure. The forecasting assumptions, found in Appendix A, have been developed from historical performance of the FLE program. Trends for specific meter type have been established and applied from historical FLE test results.

FLE forecasts assume 30% of meters families will require testing by attributes. The green shaded bands in Figure 6 below indicate the minimum (by variables) and maximum (by attributes) sample sizes required for FLE testing.

Forecast volumes include a 10% allowance for meters removed from the field which cannot be tested due to a fault or condition only identified once in testing labs (e.g. fused fittings which cannot be removed for testing).

Figure 6: Forecast Sample Sizes for Annual FLE Program



The annual size of the FLE program is trending upwards over the next 8 year period. This upwards trend is largely related to the age profile of meters, and increasing number of meter families, installed on the network.

A summary of the forecasted FLE program is summarised in Table 15 below. An average of 1,445 domestic meters will require testing on an annual basis. A detailed breakdown, listing meter families, of the proposed FLE program can be found in Appendix A.

Table 15: Proposed In-service Compliance Testing Programs

Test Year	Meter Families Tested	Meter Population Tested	Sample Size – Variables	Sample Size – Attributes	Forecast Number of Meters Removed and Tested[11]
CY17	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
CY18	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
CY19	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
CY20	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
CY21	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
CY22	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C

[11] Includes additional 10% of meters removed from field to allow for meters that cannot be tested.

7.2.2 Capital Expenditure

Capital expenditure for the FLE program is summarised in Table 16.

Table 16: Capital Expenditure – Annual In-service Compliance Testing Program (Calendar Year)

Program CY	2017	2018	2019	2020	2021	2022	Total
In-service compliance testing (Meters)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	**7,372**
Unit rate[12] ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	
TOTAL Expenditure ('000)	**$174**	**$250**	**$278**	**$262**	**$269**	**$314**	**$1,375**

Refer to Appendix B for a description of unit rate development.

7.3 Domestic Meter Replacement (Time Expired)

7.3.1 Proposed Works Program 2017-2022

Predicted TE Replacement Program

Results from FLE testing directly influence the volume of meters requiring replacement in the following calendar year.

The forecasted volume of meter replacements to 2024[13] is summarised in Figure 7. Volumes quoted are based on predicted outcomes of FLE testing and does not include meters rolled over from pervious programs. Outstanding meters (i.e. those rolled over from previous programs) are accounted for in section 7.5 ("No Access" Meter replacement program) of this strategy.

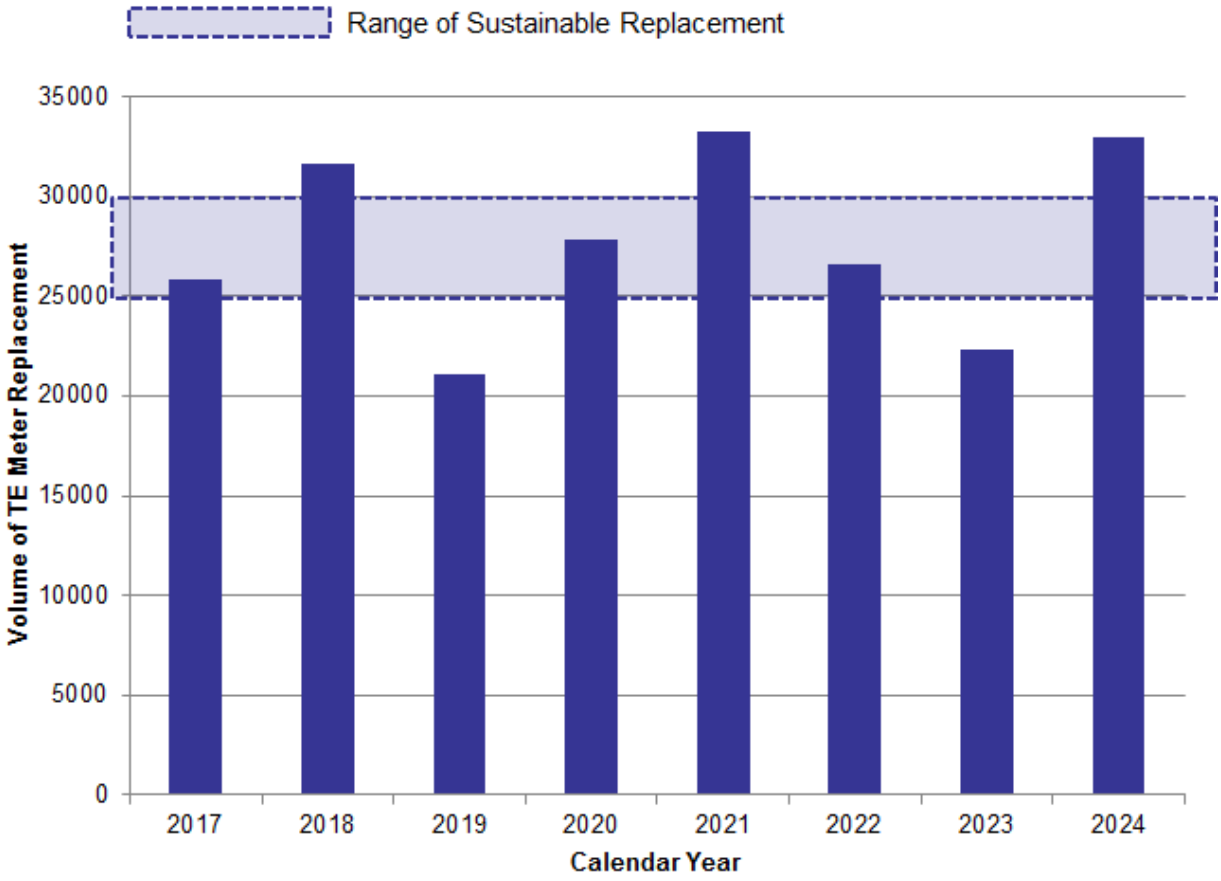
Forecasting assumptions of FLE testing outcomes and meter replacements are detailed in section Appendix A. All assumptions have been based on historical performance of meter families and FLE test results.

Figure 7 indicates the predicted program is expected to peak in 2018, 2021 and 2024. Conversely, smaller replacement programs are expected in 2019 and 2023. The average replacement volume for the period is approximately 28,000 meters per annum. The variability in program size, from as little as 21,000 meters (2019) to 33,000 meters (2021) is of concern as it places significant pressure on program delivery and per unit replacement costs. AusNet Services considers a replacement rate of 25,000 – 30,000 a sustainable range to avoid resourcing pressures and significant unit rate variation.

[12] Unit rates have been calculated using a bottom up approach. Unit rates vary annually, due to the changing composition of meters requiring replacement, each with varying material and labour costs. Fixed program costs for each program also contribute to the variation in annual unit rate.

[13] Forecasts are shown until 2024 to identify any future spikes in meter replacement beyond the 5 year strategy period.

Figure 7: Predicted TE Program Volumes



Adjusted TE Replacement Program

A TE replacement program with low levels of variability, ideally between 25,000 to 30,000 meters per annum (refer range of sustainable replacement in Figure 7 above), will be adopted to:

- **Ensure regulatory compliance is maintained:** The risk of major non-compliance increases with the size of the program due to constraints in labour and raw materials.
- **Demonstrate efficient spend:** Fluctuations in program sizes result in poor unit rate outcomes resulting from the need to mobilise (and subsequently demobilise) resources to deliver programs. Smoothing replacement volumes provides the lowest sustainable cost of providing compliant domestic metering installations.

The adjusted TE replacement program is shown in Figure 8 below.

Smoothing of the program by a few years is achieved by bringing forward the replacement of meter families before the end of their deemed useful life. Delaying the replacement of an assumed failed meter family is not consistent with the requirements of the GDSC. Typically these meters have an actual life of over 13 years. A summary of all early retirements is provided in Table 17 below.

The adjusted TE program reduces the predicted peak of 33,000 (in 2021) to approximately 30,000 meters (in 2018).

Refer to Appendix A for a detailed list of meter families requiring replacement within each year.

Figure 8: Predicted TE Program Volumes – Adjusted

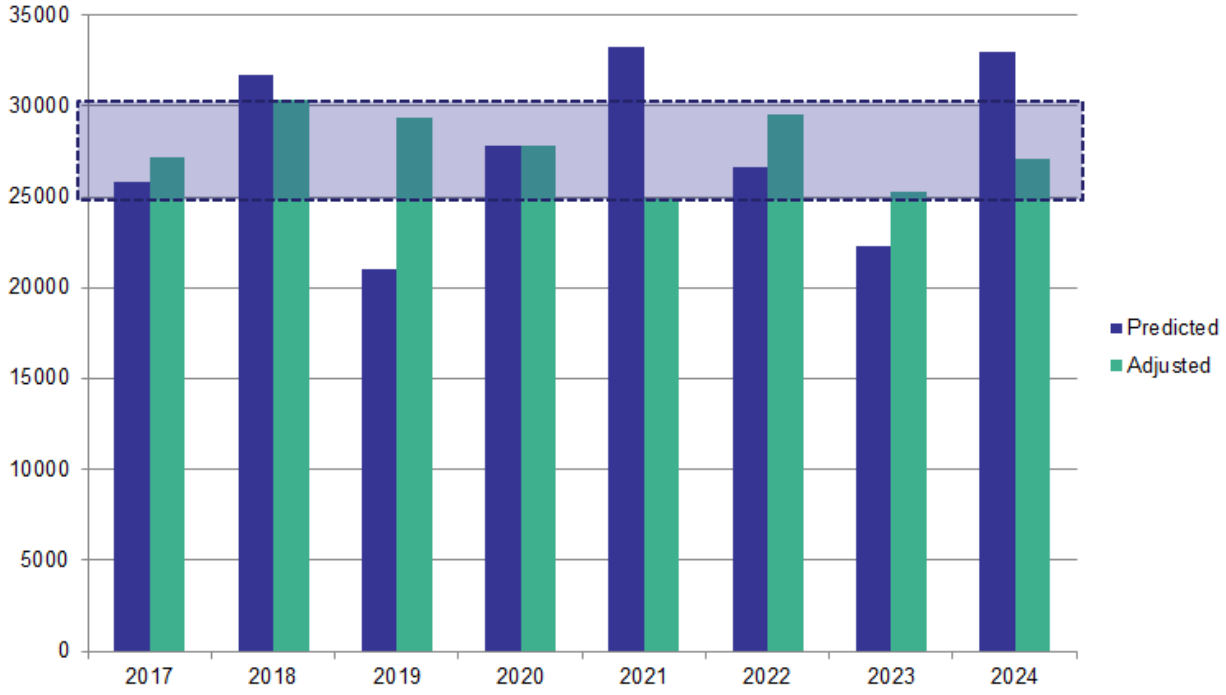


Table 17: Adjusted retirements – Adjusted TE program

Meter Type	Installation Date	Year of Predicted Replacement	Year of Voluntary Replacement (Early Retirement)	Age of Meter at early replacement	Volume of Meters
Email 602	1998	2018	2017	19	744
Email 750	2003	2018	2017	14	72
Davy Shepherd	2003	2018	2017	14	4
Gallus	2003	2018	2017	14	1
Rockwell	1998	2018	2017	19	540
Email 602	2002	2021	2019	17	8,276
Rockwell MRA6	2004	2023	2022	18	2,939
Rockwell MRA6	2005	2024	2023	18	5,890
			Total	**18472**	**18,472**

Only 77 meters (0.4%) of the early retired meter families has an age of 15 years.

7.3.2 Capital Expenditure

Capital expenditure for the Domestic TE program is summarised in Table 18.

Table 18: Capital Expenditure – Domestic Time Expired Replacement Program (Calendar Year)

Program CY	2017	2018	2019	2020	2021	2022	Total
Domestic Meter Replacement (Meters)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Unit rate[14] ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	-
TOTAL Expenditure ('000)	**$3,730**	**$4,092**	**$3,961**	**$3,761**	**$3,369**	**$4,081**	**$19,265**

Refer to Appendix B for a description of unit rate development.

[14] Unit rates have been calculated using a bottom up approach. As such, unit rates vary annually, due to the changing composition of meters requiring replacement, each with varying material and labour costs. Fixed program costs for each program also contribute to the variation in annual unit rate.

7.4 I&C Meter Replacement Program

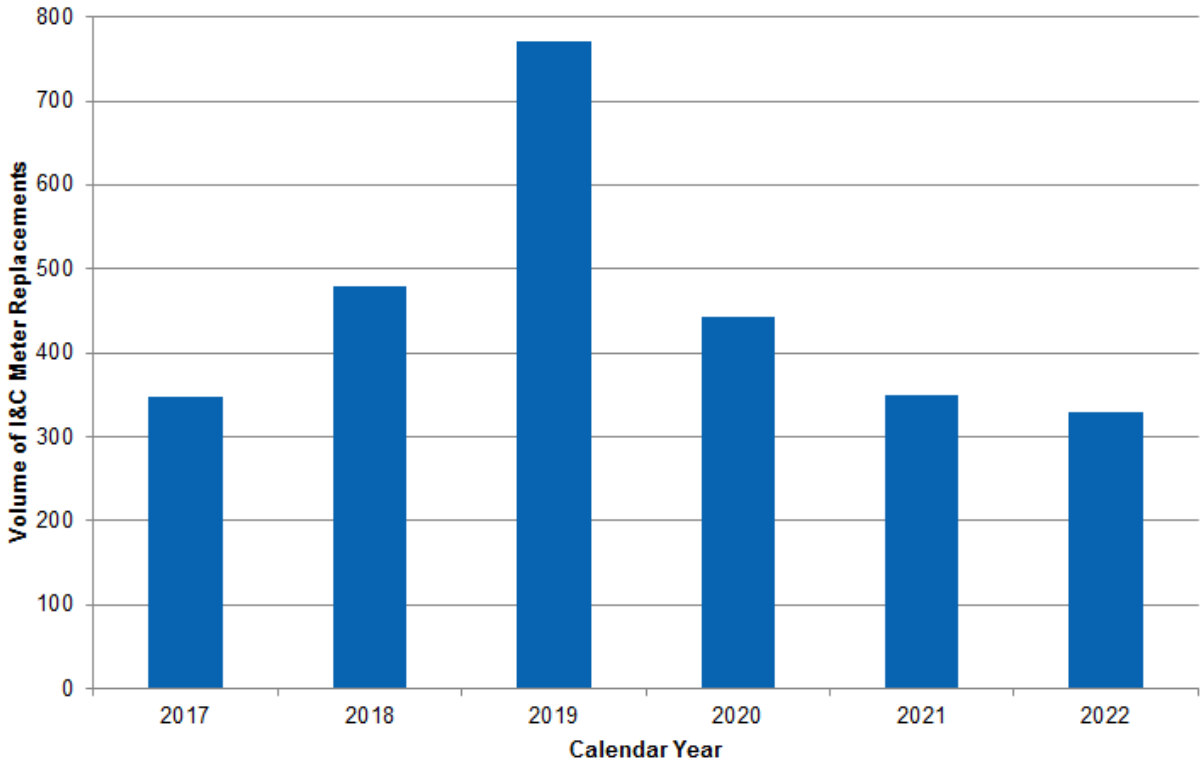
7.4.1 Proposed Works Program 2017-2022

I&C meter replacement is not exposed to the same uncertainty as the domestic program as the majority of meters are automatically replaced at the end of their initial in-service compliance period, without any field life extension.

The forecasted I&C meter replacement program is shown in Figure 9. Forecasts are based on the length of time a meter family has been installed in the field. The annual replacement volumes fall between 300 – 500 meters for all years, except 2019. The large spike in I&C meter replacements in 2019 is due to the predicted failure of the AL425 1997 meter family (497 meters). This is the only I&C meter type subject to FLE testing and life extension.

Similar to the Domestic TE program, smoothing of the replacement volumes was considered to evenly distribute the 2019 spike in I&C meter replacements. The 497 AL425 meters, causing this spike in 2019, are small capacity I&C meters, comparable in size and complexity to a large domestic meter. As such, given the low cost and complexity of these I&C replacements, a smoothing solution was not applied to the I&C replacement program. It is considered that this volume of meter replacements during 2019 will not materially affect labour and material availability, as the domestic meter replacement forecasted for that year does not exceed 30,000 units.

Figure 9: Annual I&C Meter Replacement



7.4.2 Capital Expenditure

Capital expenditure for the I&C Time Expired meter replacement program is summarised in Table 19.

Table 19: Capital Expenditure – I&C Time Expired Replacement Program (Calendar Year)

Program CY	2017	2018	2019	2020	2021	2022	Total
I&C Meter Replacement (Meters)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Unit rate (’000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	-
TOTAL Expenditure ('000)	**$602**	**$683**	**$773**	**$714**	**$607**	**$526**	**$3,303**

Refer to Appendix B for a description of unit rate development.

7.5 “No Access” Meter Program

7.5.1 Proposed Works Program 2017-2022

The volume of meters within this program is dependent on the level of no-access experienced during the preceding year's replacement program. Historically, 'no access' meters have equated to approximately 2-3% of the respective time expired replacement program (see Table 11 for historical performance of domestic meter replacement programs). A rate of 2.5% has been applied to forecast TE volumes to determine the volume of 'No Access' meters falling out of the 2017-22 meter replacement programs.

In addition to the meters that roll-over from TE programs, 1,453 ‘no access’ meters from earlier programs still exist within the field. Significant effort will be made to remove these meters as they continue to present a safety risk while they remain in service. A targeted replacement program will be undertaken in 2019 with the aim to remove these 1,453 historical ‘no access’ meters from the field. This targeted program will be tendered by, and delivered separately to all other meter replacement programs which are currently delivered by AusNet’s primary service provider.

7.5.2 Capital Expenditure

Capital expenditure for the ‘No Access’ program is summarised in Table 20 and broken down into the following:

- Continuous replacement of ‘no access’ meter falling out of TE programs; and
- Targeted replacement of historical ‘no access meters’.

Table 20: Capital Expenditure – 'No Access' Meter Replacement Program

Program CY	2017	2018	2019	2020	2021	2022	Total
'No Access' meters – rollout from preceding year’s TE program (Units)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Unit rate (’000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	-
'No Access' meter– targeted program rollout from historical TE programs (Units)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Unit rate (’000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	-
TOTAL Expenditure ('000)	$154	$151	$616	$169	$155	$142	$1,150

Refer to Appendix B for a description of unit rate development.

7.6 Reactive Meter Replacement (Faulty/Damaged)

7.6.1 Proposed Works Program 2017-2022

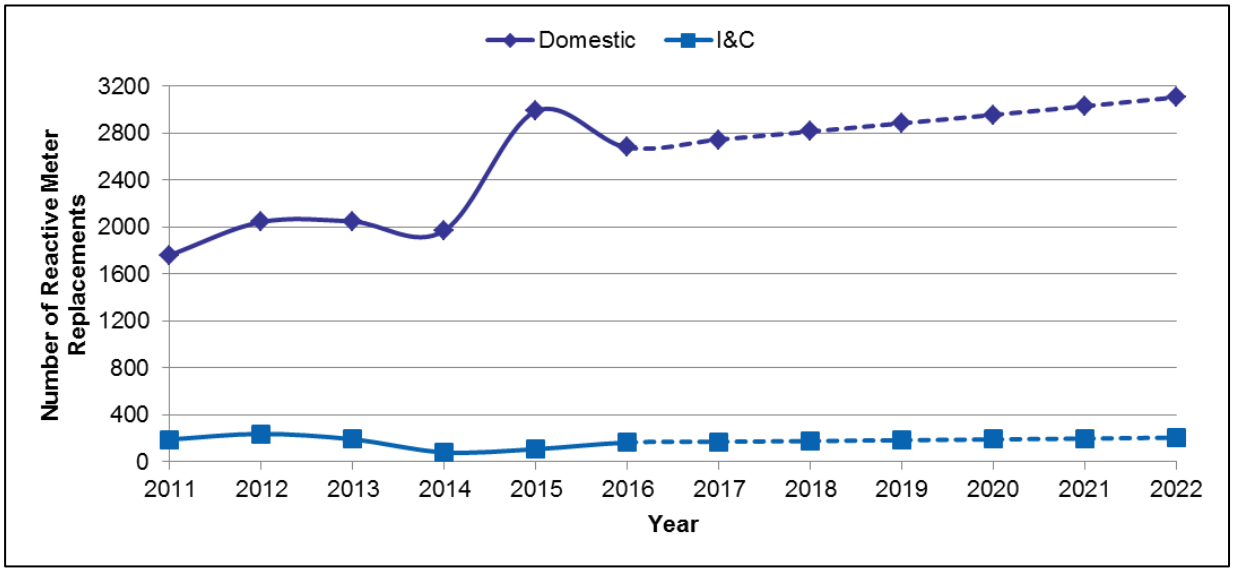
The volume of reactive meter replacement for 2017-2022 is forecasted based on historical performance. Average failure rates, calculated over the last 5 year period, are applied to forecast meter populations to determine estimated reactive meter replacement.

Table 21: Average Failure Rate of exiting Metering Fleet

Meter Type	Average Failure Rate (% Total Population)[15]
Domestic	0.36%
I&C	1.02%
Total	0.38%

Figure 10 displays the forecasted number of meter faults based on the above failure rates, recent trends and anticipated growth of domestic and non-domestic meters.[16] Actual volumes of meter failures for 2011 to 2015 are shown.

Figure 10: Forecast meter faults requiring reactive replacement



[15] Average failure rates found in Table 5: Meter Failures by Installation Type.

[16] The annual meter growth rate is 2.5% for domestic and 3.8% for I&C.

7.6.2 Capital Expenditure

Capital expenditure for the reactive meter replacement program is summarised in Table 22.

Table 22: Capital Expenditure –Forecast reactive meter replacement

Work Type	CY	2017	2018	2019	2020	2021	2022	Total
Domestic Meter Faults	Meters	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
	Unit Rate ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
I&C Meter Faults	Meters	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
	Unit Rate ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
	Exp. ('000)	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
TOTAL Expenditure ('000)		**$891**	**$916**	**$942**	**$969**	**$997**	**$1,025**	**$4,850**

Refer to Appendix B for a description of unit rate development.

7.7 Digital Metering Program

With the potential risk of the metering market shifting exclusively to digital metering, AusNet Services has identified the need to investigate the potential implications and benefits of digital metering. In order to optimise performance and understand the full implications of introducing a digital metering fleet, an investigation is proposed to test the capability of the new metering technology.

Three separate scenarios have been investigated and a trial proposed in order to understand the benefits and implications of the technology.

The trial will involve digitising the meter data collection process, enabling the collection of more accurate and frequent consumption data, and using this information to improve billing, regulatory and internal reporting, network configuration, and network planning. Some of the program benefits of the implementation of the program are included below:

- Improved meter reading process, eliminating the need for manual visits and estimated reads.
- Accurate and timely consumption data and billing to customers will reduce billing errors, high-bill complaints, and rework involved with processing billing adjustments, improving customer service. The use of optional in-home displays would facilitate real time monitoring of gas consumption, offering the customer the ability to alter their usage patterns and minimise their consumption and hence cost.
- Reduction in safety risks associated with manual meter reads including slips, trips and falls, and other environmental risks by eliminating the need to physically enter properties to obtain meter reads.
- Improvement in consumption modelling, network planning and forecasting.
- Reduction of unplanned outages.
- Improved information management and reporting capabilities.

The findings from the trial will inform AusNet Services of the best direction to support the shift in market and enable a smooth transition for its customers.

Appendix A Forecasting Assumptions

Table 23: Assumptions for Time Expired and FLE Testing Forecasting

Extension	Extension Applied to:
5 Years	– AL 425 meter families tested for the first time
3 Years	– New and Refurbished meters (except AL425 and Email 610) tested for the first time – Any meter type that previously gained a 5 year extension
1 Year	– Any meter type that previously gained a 3 year extension
Failed	– All meter families excluded from in-service compliance testing – Any meter type that previously gained a 1 year extension – All Email 610 meters tested at the end of their initial in-service compliance testing life (15 years)

Appendix B Unit Rate Breakdown

A breakdown of unit costs for each replacement program is detailed below. Unit costs have been calculated using a bottom-up approach for each program type. For this reason, the unit rate for each changes year on year as the program composition changes. Unit rates comprise of the following:

- **Internal Labour:** AusNet Services and Select Solutions project management costs.
- **External Labour (Contractors):** Physical replacement of meter, logistics and transportation and labour component of additional works resulting from meter replacements (i.e. after hours refix relight, meter relocations).
- **Materials:** Meter costs (refurbished or new) combined with material component of additional works resulting from meter replacements (i.e. new fittings).

In-service compliance testing

Component ($'000)	2017	2018	2019	2020	2021	2022	Total
Material	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Labour – Internal	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Labour – External	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Total	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C

- Internal labour (per unit) includes the analysis of in-service compliance test results.
- External labour costs include the removal of meters and testing to the requirements AS-4944. Removal costs (per unit) are higher than that for the TE program due to the random nature of sample group.
- Material costs vary slightly year to year due to the composition of meters types within the annual program and their ability (inability) to be tested and replaced in the field.

Domestic Meter Replacement (Time Expired)

Component ($'000)	2017	2018	2019	2020	2021	2022	Total
Material	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Labour – Internal	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Labour – External	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Total (	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C

- External labour costs include the removal of meters. Replacement costs are kept at a minimum due to the bulk replacement of meters within an area.
- Material costs vary slightly year to year due to the composition of meters types within the annual program.

I&C Meter Replacement (Time Expired)

Component ($'000)	2017	2018	2019	2020	2021	2022	Total
Material	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Labour – Internal	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Labour – External	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Total	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C

- Internal labour (per unit) includes the labour component for the procurement of meters which is more complicated than the domestic TE program due to the numerous meter sizes and types.
- External labour costs include the removal and replacement of meters from the field. Labour costs vary from year to year due to the composition of meters types within the annual program. There is large variation between meter sizes and technical specifications which impacts installation charges.
- Material costs vary greatly from year to year due to the composition of meters within the annual program and their ability (inability) to be refurbished.

No Access Meter Replacement Program

Component ($'000)	2017	2018	2019	2020	2021	2022	Total
Material	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Labour – Internal	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Labour – External	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Total	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C

- Internal labour (per unit) includes increased program management costs for the specialised program. Additional functions performed internally include additional retailer and customer liaison to gain access to properties.
- External labour costs include the removal and replacement of meters from the field. A premium is paid to the service provider for these meters due to their difficulty to replace. This premium is higher again for the targeted replacement of historical meters for which site specific information is not well understood.
- Material costs vary from year to year due to the composition of meters within the program.

Reactive Meter Replacement

Component ($'000)	2017	2018	2019	2020	2021	2022	Total
Material	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Labour – Internal	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Labour – External	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C
Total	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C	C-I-C

- A constant unit rate has been applied for all future years due random nature of meter failures (i.e. it is not possible to predict which meter types will fail). The bottom-up cost build-up assumes a composition similar to the current domestic and I&C meter fleets.
- Internal labour (per unit) is kept to a minimum due to the reactive nature of the program, which is mostly managed by AusNet Services' primary service provider.
- External labour costs include the removal and replacement of meters, including a premium for the reactive nature of the program, which includes after hour replacement for majority of cases.

Digital Metering

Component ($'000)	2017	2018	2019	2020	2021	2022	Total
Digital Metering Trial				$330	$1082	$250	**$1,662**

- The procurement of meters for proposed trial is included in proposed costs.