

Multinet Gas Asset Management CY2017- 2022



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Large Meter Strategy

CY2017 – CY2022

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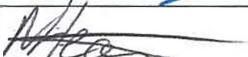
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Executive Summary

This document outlines the replacement strategy for Large Gas Meters on the Multinet Gas network. Large Meters are defined as having capacity greater than 10 Sm³/hr and contributes 3.4% (circa 27,000) of Multinet's installed consumer meters.

Multinet is required by the Gas Distribution System Code to provide an appropriate metering installation at each supply point (i.e. connection) off the network. Multinet 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, Multinet completes the following annual programs:

- Time Expired meter replacement – replacement of meters at end of compliance periods;
- Field Life Extension Testing – testing of qualifying meters nearing the end of their compliance periods;
- Meter Faults – replacement of meters that fail in service; and
- Data Logger and Flow Computer installations - new and replacement installations to comply with code requirements.

Table 0-1 provides the financial summary of the capital expenditure which is expected to be incurred in the calendar year period 2017 to 2022. Table 0-1 includes a breakdown of direct, overheads and labour escalators for the purpose of reconciliation with that of the overview documentations which support our forthcoming (2018-22) Access Arrangement submission.

Table 0-1: Summary of Capital Expenditure (\$'000)

Program	CY2017	CY2018	CY2019	CY2020	CY2021	CY2022
Time Expired Meter Replacement	\$38	\$244	\$219	\$262	\$93	\$183
Field Life Extension	\$38	\$38	\$41	\$27	\$26	\$38
Defective / Faulty Meters	\$63	\$67	\$69	\$72	\$76	\$79
Data Loggers & Flow Computers	\$100	\$100	\$100	\$100	\$100	\$100
Total Direct Expenditure excluding real escalation	\$239	\$449	\$429	\$462	\$294	\$400
Overhead	\$14	\$27	\$26	\$28	\$18	\$24
Total Expenditure excluding escalation	\$254	\$476	\$455	\$489	\$312	\$424
Real cost escalation	-	\$3	\$2	\$4	\$3	\$5
Total Expenditure	\$254	\$478	\$457	\$493	\$316	\$429

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1. Document Overview

1.1. Purpose

This document articulates Multinet Gas' approach to the lifecycle management of its existing Large Gas Meter assets. Large Meters are defined as having capacity greater than 10 Sm³/hr.

It has the following objectives:

- Articulate the key areas of focus in relation to asset management, risk, investment, cost and service standard outcomes for the "Large Meter" asset group;
- Minimise the cost of meters to the end use customer by repairing and or purchasing new meters in line with regulatory, safety and reliability requirements; and
- Show alignment of asset management practices with Gas Network Objectives.

The document is intended for use by:

- Multinet Gas staff (and it's contractors); and
- Regulators - Technical, Safety and Economic.

1.2. Scope

This strategy applies to Multinet Gas' large consumer meters located throughout the Multinet Gas distribution system and includes all meters with a capacity greater than 10m³/h of Natural Gas.

The strategy covers the management of the existing metering fleet, including:

- Strategies to maintain regulatory compliance and consumer safety of existing metering assets; and
- Forecasts of meter replacements, meter faults and sampling programs.

The strategy does not cover:

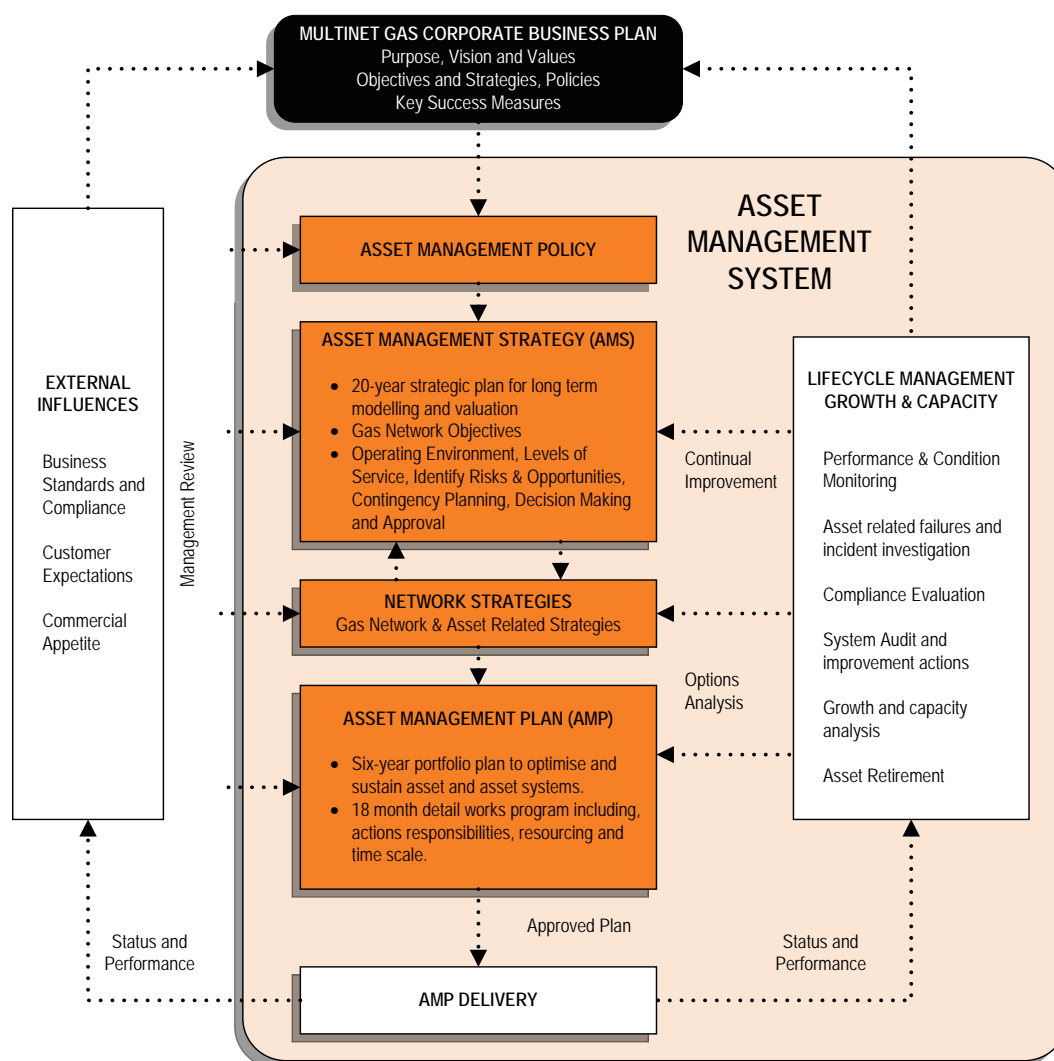
- The forecast for new meter connections (i.e. network growth) ¹;
- Program specific processes and procedures;
- Market operations (i.e. meter reading operations); and
- Meters with capacity smaller than 10 Sm³/h - Refer to Small Metering Strategy (MG-SP-0007).

1.3. Relationship With Other Key Asset Management Documents

The Large Meter Strategy is one of a number of key asset management documents developed and published by Multinet Gas in relation to its gas network. As indicated in Figure 1-1, Detailed Network Strategies - including the Large Meter Strategy - informs both the Asset Management Strategy (AMS) and Asset Management Plan (AMP) of the programs needed to achieve the long-term objectives of the gas distribution network.

¹ Refer to Multinet Gas' Growth Strategy (MG-PL-0002) for information on meter purchases for new connections

Figure 1-1: Asset Management Framework



1.4. Phasing and Financial Disclosure

All programs defined within this strategy are presented in calendar years consistent with the reporting requirements of the Australian Energy Regulator (AER) and where applicable the Gas Distribution System Code (Version 11).

Where required for conversion to financial year (July to June), dollars and volumes can be estimated using a 50:50 expenditure split.

All financial figures quoted within this document - unless otherwise specifically stated - have the following characteristics:

- Real Expenditure / Cost (reference year = 2017);
- Direct Expenditure only (i.e. excludes overheads and finance costs);
- In units of \$1,000 (i.e. '000); and
- All years are denoted in Calendar Year format.

Total values shown in tables and referred to in the text of this document may not reconcile due to rounding.

Conversion factors used in the escalation of historic expenditure to real 2017 equivalent expenditure is provided in Table 1-1. Cumulative conversion factors have been provided by Multinet Gas' Regulatory department.

Table 1-1: CPI Conversion Factors

	2012	2013	2014	2015	2016	2017
CPI Index - \$2017	1.09619	1.07465	1.05192	1.02819	1.01296	1.00000

1.5. Data Sources

The following data sources have been drawn upon in development of the Large Meter Strategy:

- **SAP** - the Multinet Gas primary asset management database used to store all metering related data;
- **Tableau** - uses an extract (duplicate) of the SAP database so reporting can be performed in real time without diminishing the available bandwidth of SAP for business as usual processes.

1.6. References

- Gas Safety Case;
- Gas Distribution System Code Ver. 11.0;
- Retail Market Procedures (Victoria);
- National Gas Rules: Part 19 - Declared Wholesale Gas Market Rules;
- AS/NZS 4944:2006 Gas meters – In-service compliance testing.

1.7. Document Review

This document shall be reviewed every two (2) years or earlier if required, with the next review due on or before 31 December 2018.

2. Asset Overview

2.1. Introduction

Multinet Gas defines “large” gas meters as those with a capacity of greater than 10 Sm³/hr.

As of May 2016 approximately 27,231 Large Gas Meters were installed on the gas distribution network

Large Gas Meters are used for large consumer applications as well as non-standard small consumer applications. Almost all (98.6%) of these large consumer meters are of the larger robust diaphragm. The remainder of the Multinet Gas Large Gas Meters include approximately 290 rotary meters (1.1%) and 78 larger capacity turbine meters (0.3%), refer Table 2-1.

Refer to the Appendix for a breakdown of Multinet Gas’ Large Meter Fleet by meter type (Section 5.1, p. 28) and an overview of metering technologies employed on the network (Section 5.3).

Table 2-1: Meter Type Breakdown (May 2016)

Meter Type	Maximum Flow rate	Meters	Percentage of Large Meters
Diaphragm	500 m ³ /hr	26,863	98.6%
Rotary	1,500 m ³ /hr	290	1.1%
Turbine	9,000 m ³ /hr	78	0.3%

Multinet Gas has approximately 314 interval meter sites capable of recording hourly consumption data; of which 125 have flow computers correcting gas flow for temperature and / or pressure.

The number of new large consumer meters purchased each year is dependent on network growth, yearly repairable meter quantities and the accuracy criteria specified in the Gas Distribution System Code.

2.2. Asset Age Profile

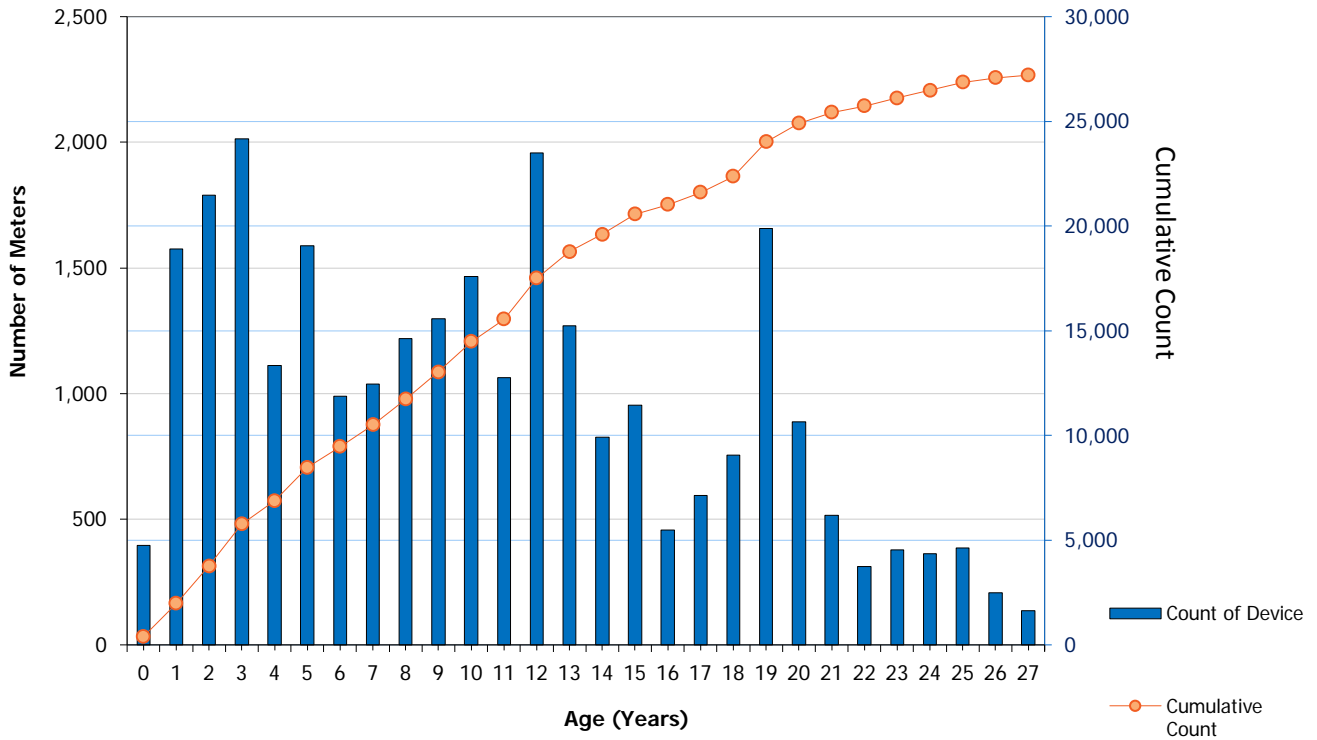
The age profile of Multinet Gas’ Large Consumer Meters is shown in Figure 2-1. The average age (May 2016) of Multinet Gas’ Large Meter fleet is 10.70 years, broken down to:

- Diaphragm meters: 10.75 years;
- Rotary Meters: 6.9 years; and
- Turbine Meters: 5.8 years.

The initial expected life of large meters is 10 or 15 years, at which they are refurbished (where possible) and put back into service again.

Diaphragm meters have a higher average age - when compared to rotary and turbine meters - due to Multinet Gas’ ability to extend the life of diaphragm meters which qualify for sample testing under AS/NZS 4944:2006 (Section 3.3.1).

Figure 2-1: Age Profile for Large Meters



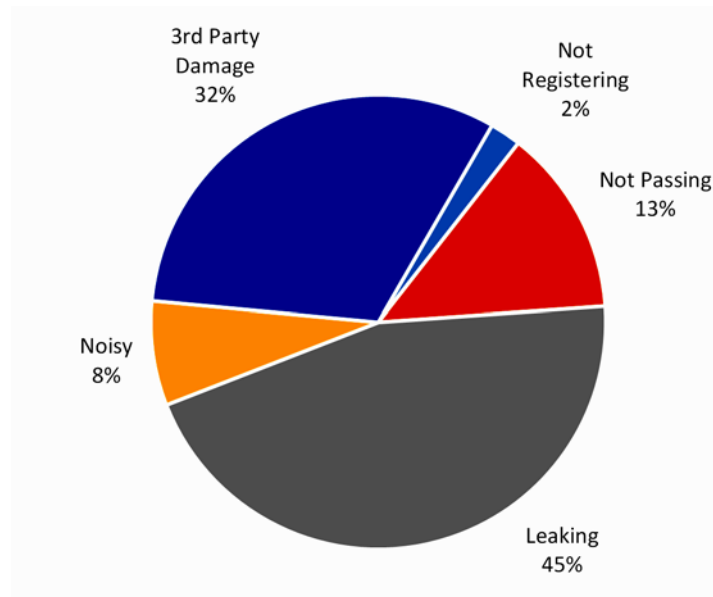
2.3. Asset Performance

2.3.1. Defective Meters / Failures

As a whole, Multinet's metering population is considered reliable with stable failure rates of close to 0.36%² of the metering population each year. Leaking meters (45%) and third party damage (32%) are the two leading causes of defective meter removals (Refer to Figure 2-2).

² Failure statistics only include meters that have failed during operation. Results from in-service compliance testing are excluded from the percentages in Figure 2-2.

Figure 2-2: Large Meter Failure Modes (November 2016)



Historical meter failure rates (from FY2014 to FY2016) are summarised in Table 2-2. The volume of meter failures as a percentage of the meter fleet has been relatively flat over the period averaging 0.36% of the large meter fleet.

Table 2-2: Large Meter Fault History

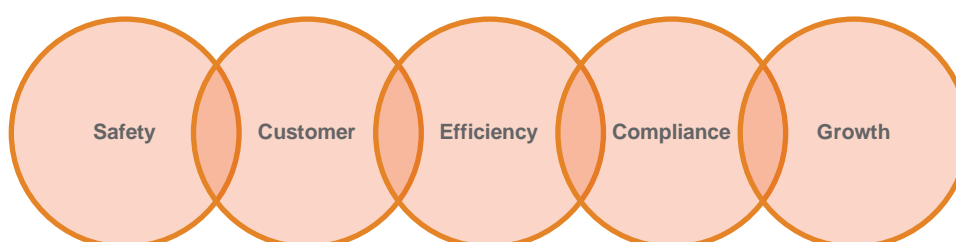
	FY2014	FY2015	FY2016	Average
Large Meter Failures	74	102	97	91
Total Large Meters – MG Network	24,400	24,995	27,231	-
Percentage of Failures.	0.30%	0.41%	0.36%	0.36%

3. Asset Management Drivers

3.1. Alignment with Gas Network Objectives

Multinet Gas has established five (5) network objectives that govern how the network is operated and maintained. This is reflected mostly in regulatory obligations and in some cases prudent and responsible behaviour, justifiable on economic grounds. Achievement of these objectives ensures the sustainable and reliable operation of the gas distribution network.

Figure 3-1: Gas Network Objectives



3.1.1. Safety – Achieve Zero Harm, while maintaining current levels of network safety.

This strategy aims to achieve a high level of reliability and personnel / public safety through inspection, preventive and corrective maintenance and asset replacement. All planned maintenance activities for various families of meters are underpinned by the need to ensure safety for the customer, general public and the field personnel who carry out any maintenance activity on the equipment.

3.1.2. Customer – Effortless Customer Experience

This strategy aims to achieve a high level of customer satisfaction and experience by providing a reliable means of gas supply to the customer. Meter accuracy and performance is maintained through periodic maintenance and annual replacement programs.

The planned maintenance activities are designed to cause minimum or no interruption of supply to the customer to ensure that the maintenance does not cause a hindrance or financial loss to the customer.

3.1.3. Efficiency – Sustainable and prudent network investment

The maintenance and replacement strategies outlined in this document are aimed at improving the accurate working life of meters within the Multinet Gas network – providing the lowest cost of service to network users.

3.1.4. Compliance – Maintain regulatory and technical compliance

This strategy aims to achieve a high level of regulatory and technical compliance by ensuring that all maintenance and replacement activities are carried out to meet the requirements of Multinet's Safety Case, AS/NZS 4944, and the Gas Distribution System Code.

3.1.5. Growth – Seek opportunities for new growth

Opportunities for growth are not in scope of the Large Meter Strategy. This document outlines how Multinet Gas will replace and maintain accurate and reliable meters to current network users.

3.2. Regulatory Requirements

The Gas Distribution System Code (Version 11) outlines the requirement for Multinet to provide consumer metering installations, the standard of those installations (including testing requirements) and the provision of metering data to retailers.

In summary, Multinet is required to provide an appropriate metering installation at each supply point (i.e. connection) off the distribution network. Multinet Gas 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, Multinet Gas completes the following activities:

1. **New Meter Connections** to the distribution network;
2. **Defective / Faulty Meters** replacements;
3. **Field Life Extension Testing** of qualifying meter families nearing the end of their compliance periods; and
4. **Annual “Time Expired” Meter Replacement Program** to remove meters at the end of the useful life (in-service compliance period).

3.3. Lifecycle Management

3.3.1. General

Unlike diaphragm meters, larger consumer turbine and rotary meters require regular maintenance to remain in operable condition. Diaphragm meters are changed over at 10 or 15 year intervals depending on capacity and almost all meters are refurbished.

Service Providers on behalf of Multinet Gas maintain a number of large turbine and rotary meters as emergency stock for spares in case of sudden meter failure. Stock numbers are maintained at levels to meet new customer growth while meters removed from the field at the end of their initial life are repaired and returned to stock for future use.

3.3.2. Approved Meters

Only approved meters are used on Multinet Gas' distribution network.

Any new meter pattern or type (or significant variation of an existing meter type) is reviewed and approved for use on the network by the Gas Networks (GN) Department.

Technical specifications exist for all approved meter types – new and refurbished. Meters supplied for use within Multinet Gas network must conform to the approved specifications.

3.3.3. Meter Procurement

Meter supply contracts are established with Landis & Gyr & EDM (Victoria's two largest meter suppliers) for the purchase and repair of all meters. These contracts are novated to Multinet Gas' Service Providers (ZNX & Comdain) and are bound by the corresponding Operations and Management Service Agreement (OMSA).

3.3.4. Inspection and Preventive Maintenance

All meters are inspected during the repair and manufacturing process for quality. Field audits are regularly conducted on contractors to ensure installation procedures and standards are being followed.

Maintenance on large consumer rotary and turbine meters involves periodic replacement of the lubrication oil. Large consumer meter maintenance schedules ensure oil-changes occur on a 6 monthly cycle for turbine meters and 12 or 18 monthly for rotary meters. Monitoring of oil levels is maintained by Multinet Gas Service Providers.

Multinet Gas' 314 interval sites have equipment that are maintained at six monthly intervals, with calibration and replacement of parts and being performed as required

3.3.1. In-service Compliance Periods

Initial in-service compliance period:

A meters' initial in-service compliance period refers to the "period of time allowed to a meter population or meter type to remain in-service without retesting or replacement". The initial compliance period for gas meters are outlined in section 7.2.3 of the Gas Distribution System Code and AS/NSZ 4944:2006

Table 3-1 outlines the initial in-service compliance periods for meters on Multinet Gas' distribution network.

Large Meters are replaced at regular intervals of 10 or 15 years depending on the capacity of the meter. Meters with a capacity greater than 100 Sm³/h are removed at 10 years while meters less than this capacity are removed at 15 year intervals. The exception is diaphragm meters with a capacity of <30 Sm³/hr who's in-service compliance period could be extended subject to outcomes of FLE (Section 4.4).

Table 3-1: In-service Compliance Periods

Meter Group	Typical Application	Meter Examples	Initial life (Years)	FLE Testing Required?
Small Meter (<=10m ³ /hr)	Domestic	New /Rep L&G 750/1010 Email 602, RKMR08	15	Yes
Large Meter (>=12m ³ /hr to 28m ³ /hr)	Domestic / Commercial	AL425 to AL1000	15	Yes
Large Meter (30m ³ /hr - 100m ³ /hr)	Industrial / Commercial	AL1400, AL2300, RK1000 to RK5000	15	No
Large Meter (>100m ³ /hr to)	Industrial / Commercial	AL5000, RK10000, Roots 5M to 38M, Romet 140 to 650, GT4M to GT12M	10	No

New Meter Types

The initial life for new diaphragm meter types (<30 Sm³/hr), including refurbished meters, are calculated as per the requirements within AS/NZS 4944:2006. In-service compliance testing of these meter families will be conducted no earlier than three (3) years and no longer than five (5) years after the meter type is first installed within the field to establish the initial in-service compliance period.

Extension to compliance period

For Diaphragm meters of <30 m³/hr capacity, the in-service compliance period may be extended subject to the outcomes of sample testing conducted in accordance with AS/NZS 4944:2006. Testing may lead to a field life extension of five, three or one year, or the meter family being removed from operation.

The AL425 and AL1000 meter families have sufficient annual meter populations to justify statistical sampling and are tested using AS/NZS 4944:2006. From 2019, Multinet Gas will also begin testing the AL800 meter family.

Results of in-service compliance testing and the decision to extend the life of a meter family is reported to the AER within 3 months of Multinet Gas' intention to expend the life of a meter family.

All remaining Large Meter types are removed from the field following their initial in-service compliance period (Refer to Table 3-1).

3.3.2. Corrective Maintenance - Faults and Defects

Any faulty meter is repaired either under warranty or as part of the annual repair contracts. Warranty periods vary from manufacturer to manufacturer. Meters that can no longer be repaired or have reached the end of their economic life are disposed of when they are returned from the repairer or returned from the field. All older style diaphragm tin case meters have now been removed and are no longer in service.

Faults and defects are reported and rectified as follows:

- By the meter reader with rectification occurring during a special visit, if warranted;
- By the public who phone the faults and emergencies number or their retailer, with rectification occurring during a special visit, if warranted; or
- By staff/contractors during other works, audits and inspections, with rectification occurring during a special visit, if warranted.

Refer to Section 4.5 (p.23) for Multinet Gas' forecast of large meter faults to 2022.

3.3.3. Meter Repair / Refurbishment

Where possible, Multinet Gas repairs (refurbishes) all Large Gas Meters as this provides the lowest cost of providing a metering installation to the end consumer. Once repaired, the meter is to be identified as "refurbished" in terms of a meter family but treated as a new meter in terms of its initial in-service compliance period (Section 3.3.1).

Refurbishment of existing meters are subject to inspection for corrosion and internal meter inspection with top half of meter components being replaced and repaired as necessary. Repair specifications are included in the tenders of meter repairs. Manufacturers are subject to regular quality audits by representatives of Multinet Gas

The refurbish rates used for to forecast expenditure by program is summarised in Table 3-2.

Table 3-2: Meter Refurbish / Repair Rates

Refurbish Rate	Application
████	All Large Meter types with the exception of Rockwell 1000's
████	Rockwell 1000 meter type
████	Defective / Faulty Meters.
0%	None. All Large Meters are consider repairable

The procurement of new meters is driven by new customer connections to the network, and the volume and refurbish rates of replaced meters.

3.4. Performance Measures

The performance of large customer meters is measured by:

1. Regulatory compliance – Percentage (%) of in field meters that are not Time Expired as of 31st December. Target = 99.5%. Some meters are not replaced with compliant meters within the required timeframe due to not being able to gain access to the meter.
2. Non failure of in-field meters (defective) – Percentage (%) of meters that remain in field until Time Expired. Target = 98.5%.

3.5. Asset Strategy - Current Issues

3.5.1. Pattern and Verification Testing

Gas meters are currently exempt from the relevant requirements of the National Measurement Act 1960 (Cth) via Regulation 5.6 in the National Trade Measurement Regulations 2009. The exemption for gas meters has the potential to be lifted within the period of this strategy.

The lifting of this exemption will require gas meter manufacturers to obtain pattern approval and verification of gas meters to insure that each meter type is fit for trade and performs and functions as designed within the maximum permissible error (MPE) over a range of operating conditions.

NMI has currently engaged a Gas Metering Advisory committee to review, adopt and implement the International Standard OIML R137 Gas Meters and OIML R140 Measuring Systems for Gaseous Fuels.

The adoption of these Standards will likely create economic and technical issues concerning the implementation of pattern approval and verification of gas meters in Australia.

These changes will require Multinet Gas to change processes and IT systems to accommodate National requirements. Costs associated with process and IT changes have not been considered in the Large Meter Strategy.

3.5.2. Diversity of Meter Suppliers

The small size of the Australian Gas Industry limits the number of available large gas meter suppliers in Australia. Multinet Gas predominantly uses the two major suppliers. The availability of more than one supplier provides competitive pricing and spreads the risk of any supply issues.

The risk of one of the major Suppliers closing down remains a moderate risk to Multinet Gas and the Australian Gas Industry. A loss of one of the Suppliers would cause a sudden increase in the unit cost of new and repaired meters as well as causing availability issues across the Industry.

4. Capital Program - 2017 to 2022

4.1. Summary

Multinet Gas completes the following annual programs to remain compliant with its obligations under the Gas Distribution System Code:

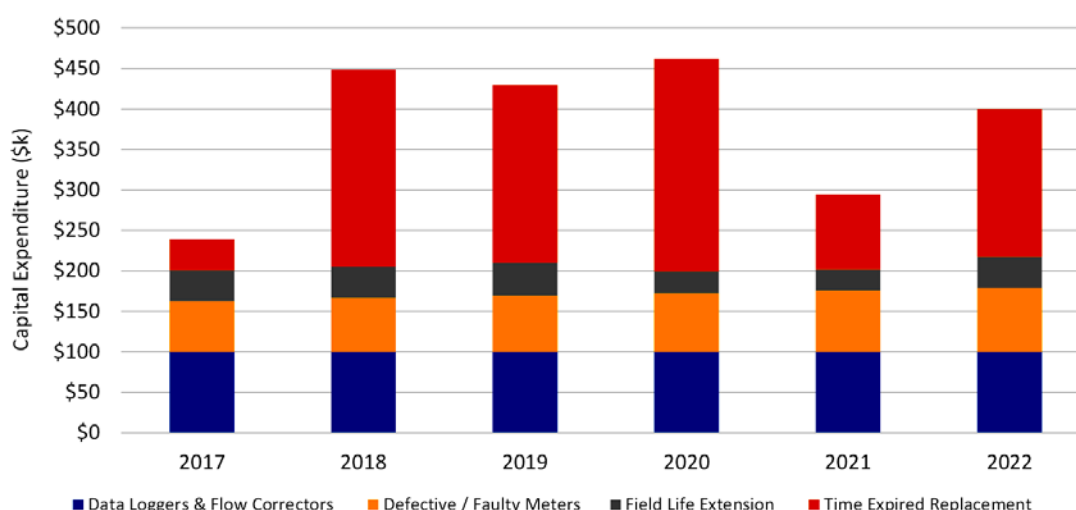
- Time expired meter replacement;
- Field Life Extension;
- Defective meter replacement; and
- Data Loggers & Flow Corrector installation / replacement.

Table 4-1 and Figure 4-1 provides a breakdown of expenditure from CY2017 to CY2022 by program. Variations in annual capital expenditure is highly influenced by the Time Expired Replacement Program.

Table 4-1: Capital Expenditure Summary

Ref	Program	2017	2018	2019	2020	2021	2022
4.3	Time Expired Meter Replacement	\$38	\$244	\$219	\$262	\$93	\$183
4.4	Field Life Extension	\$38	\$38	\$41	\$27	\$26	\$38
4.5	Defective / Faulty Meters	\$63	\$67	\$69	\$72	\$76	\$79
4.6	Data Loggers & Flow Computers	\$100	\$100	\$100	\$100	\$100	\$100
Total Expenditure		\$239	\$449	\$429	\$462	\$294	\$400

Figure 4-1: Capital Expenditure Summary



4.2. Capitalisation Policy

Multinet Gas capitalises the purchase of new meters installed on the network. This includes the procurement of meters to replace existing due to regulatory requirements or meter failure. Installation (labour) is expensed for all meter replacement activities but capitalised when installing a new meter for a new network connection.

Multinet Gas' capitalisation policy is summarised in Table 4-2.

Table 4-2: Capitalisation Policy for Meter Replacement / New Connections

	New Meter	Repaired Meter	Installation
New Connections ³	CAPEX	OPEX	CAPEX
Meter Replacement (including Time expired, FLE or Faults)	CAPEX	OPEX	OPEX

4.3. Time Expired Meter Replacement

4.3.1. Introduction

The Time expired meter replacement program is conducted to ensure Multinet Gas remains compliant with its obligation under the GDSC by replacing meters at the end of their in-service compliance period.

Time expired meter replacement is a common program undertaken for both Small and Large Meter types; and Multinet Gas' Small Meter Strategy (MG-SP-0007) details the time expired replacement for small meters.

4.3.2. Scope

The annual Large Meter replacement program is made up of the following elements:

- Meter families within the final year of their in-service compliance period; and
- Non-compliant meters outstanding from previous meter replacement programs.

4.3.3. Strategic Alignment

Undertaking time expired meter replacement is reflected in Multinet Gas' network objectives through:

- **Compliance:** Multinet Gas is required to undertake time expired replacement of meters by the GDSC;
- **Safety:** Maintaining meter integrity is a primary driver for meter replacement; and
- **Customer:** Meter accuracy (within defined limits) is a primary driver for meter replacement.

4.3.4. Forecasting Field Life Extension Outcomes (FLE)

A key input to forecast meter replacement capital expenditure is a forecast of the meter families that are expected to fail FLE testing, and the year in which failure is expected to occur.

For meters that qualify for FLE testing, Multinet's approach is to extrapolate FLE testing results on a 5, 3, or 1 year extension period to determine the potential year of failure. The extension period commences from the last sample testing result, or where no sample testing has been done the extension commences at 5 years for all AL series meters that qualify for FLE testing, (e.g. AL425, AL800 and AL1000).

Meter families which do not qualify for FLE are replaced at the end of their initial in-service compliance periods (Section 3.3.1).

³ The capital cost of new connections is not covered in the Large Meter Strategy. Please refer to Multinet Gas' MG-PL-0002 Capital Growth Plan for the meter costs associated with new customer connections

4.3.5. Program Performance

Multinet's performance (replacement rates) for the time expired replacement program is summarised in Table 4-3. Since 2011, Multinet achieved an average program completion of approximately 90%. Outstanding meters are rolled into the following year's program.

Table 4-3: Time Expired Meter Replacement program outcomes – Large Meters

Year	Total Program	Percentage Completed	Outstanding Meters
2011	709	96.5%	25
2012	510	93.9%	31
2013	626	91.7%	52
2014	385	88.8%	43
2015	238	77.3%	54

4.3.6. Works Program

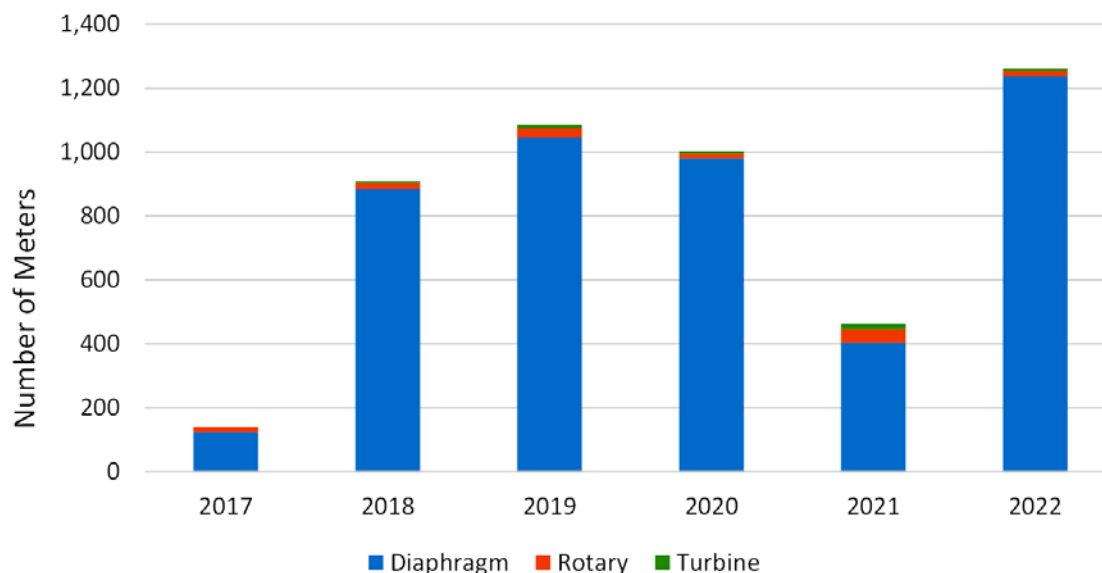
The Large Meter time expired replacement program to 2022 is outlined in Table 4-4, summarised in Figure 4-2. Both show the variable nature of the program, influenced by:

- The outcomes of the preceding year's FLE testing, and
- Meters at the end of their in-service compliance periods (for large capacity diaphragm, rotary & turbine meter types).

Table 4-4: Large time expired Meter replacement program - breakdown by meter type.

Meter Type	2017	2018	2019	2020	2021	2022
Diaphragm	123	884	1,046	981	403	1,236
Rotary	17	20	28	14	43	17
Turbine	0	5	11	8	16	7
TOTAL	140	909	1,085	1,003	462	1,260

Figure 4-2: Large time expired Meter replacement program



Capital expenditure for the large meter time expired replacement program is provided in Table 4-5. The expenditure profile for time expired replacement is highlight variable over the period, peaking at \$262k in 2020 from a minimum of \$38k in 2017.

Table 4-5: Capital Forecast - Large Meter Time Expired replacement Program

	2017	2018	2019	2020	2021	2022
Forecast meters	140	909	1,085	1,003	462	1,260
- Repairable Meter Types (to be replaced)						
- Repairable Meter Types (to be replaced)						
- Non repairable Meter Types (to be replaced)						
New Meter Purchases						
Unit Rate (\$/meter) ⁴						
Total Expenditure	\$38	\$244	\$219	\$262	\$93	\$183

The build-up of meter types within the replacement program varies from year to year (i.e. program to program). This results in a variable unit rate (by year) for the program. A detailed breakdown of the program, including unit rate desegregation is provided as an Appendix (Section 5.4).

4.4. Field Life Extension

4.4.1. Introduction

Multinet Gas undertakes Field Life Extension (FLE) testing on selected diaphragm meter families (<30m³/hr) nearing the end of their service lives. The program is also known as in-service compliance testing.

⁴ Average meter purchase cost. Refer to Appendix (Section 5.4) Breakdown of unit costs.

FLE testing is undertaken in accordance with the requirements of AS/NZS 4944:2006 and is required to extend the in-service compliance period of a qualifying meter family. Results of annual testing and Multinet's intention to extend a meter family beyond their initial life are communicated annually to the AER by 30 September each year.

4.4.2. Scope

FLE testing applies to all diaphragm meters with capacity of <30 Sm³/hr.

With a focus on Large Meters, the AL425 and AL1000 meter families have sufficient annual meter populations to justify statistical sampling and are tested using AS/NZS 4944:2006. From 2019, Multinet Gas will also begin testing the AL800.

4.4.3. Business Drivers and Strategic Alignment

Undertaking of FLE testing is reflected in Multinet Gas' network objectives through maintaining:

- **Compliance:** Multinet Gas is required to undertake FLE to extend the life of qualifying meter families;
- **Safety:** Maintaining meter integrity is a primary outcome of FLE testing;
- **Efficiency:** Favourable outcomes of FLE testing allows for the extension of in-service compliance periods of meter families, resulting in a lower cost to the end customer; and
- **Customer:** Meter accuracy (within defined limits) is a primary outcome of FLE testing.

4.4.4. Program Performance

Multinet Gas adopted AS/NZS 4944:2006 in 2008 as the primary reference for the in-service compliance testing program. Before this, Multinet Gas followed detailed testing criteria outlined within the Gas Distribution System Code (this has since been removed), which required annual testing of all meter families beyond 15 years of age.

A summary of program results – since 2011 – is provided in Table 4-6. A detailed breakdown of program results is contained in the Appendix (Section 5.5).

Table 4-6: Summary results of completed in-service compliance testing programs

Test Year	Meter Families Tested	Meter Population Tested	Families Failed	Meters Failed
2011	2	482	0	0
2012	3	1,533	1	382
2013	5	2,605	1	151
2014	8	2,279	1	138
2015	5	1,624	0	0
2016	4	1,044	0	0

4.4.5. Works Program

AS/NZS 4944:2006 outlines two methods of statistical analysis (i.e. *Variables* or *Attributes*) that can be adopted for in-service compliance testing:

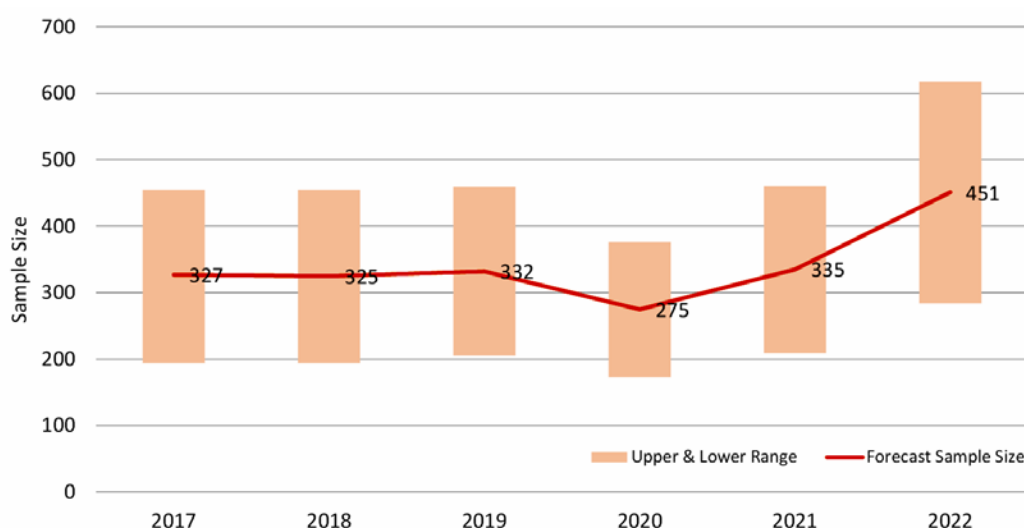
- **Variables⁵:** A method that consists of measuring a quantitative characteristic for each item of a population or a sample taken from this population. The quantitative characteristic is used to establish statistically the acceptability of the population from results contained from the items in the sample.
- **Attributes:** Inspection wherein the meter family is classified as either conforming or non-conforming or the number of nonconformities in the meter family is counted, with respect to given requirements.

Testing by “Variables” requires a smaller sample size when compared to “Attributes” but must pass a test for normality to ensure the sample set is statistically relevant. With “Variables, each characteristic is tested relative to the meter, i.e. individual meters pass/fail. For attributes, each characteristic is grouped together for the family, i.e. the family passes / fails as a whole.

Multinet Gas adopts (initially) the “Variables” method of sample testing. If a meter family fails the criteria for “Variables” testing then the “Attributes” method is then adopted. Additional meters will subsequently be removed from the field to bolster required sample sizes.

Multinet’s forecast for FLE testing is summarised in Figure 4-3. Sample volumes are expected to remain relatively flat over the period.

Figure 4-3: Field Life Extension – Sample Ranges



The orange shaded bands within Figure 4-3 indicate the minimum (by variables) and maximum (by attributes) samples sizes required for in-service compliance testing. Modelling assumes 50% of all meter families tested will move to the “Attributes” method of testing.

Capital expenditure for the FLE program is provided in Table 4-7.

⁵ Definitions are from AS/NZS 4944:2006 Section 4.2

Table 4-7: Capital Forecast – Field Life Extension

	2017	2018	2019	2020	2021	2022
Forecast meters	327	325	332	275	335	451
- Repairable Meter Types (█████ to be replaced)	█████	█████	█████	█████	█████	█████
- Non repairable Meter Types (█████ to be replaced)	█████	█████	█████	█████	█████	█████
New Meter Purchases	█████	█████	█████	█████	█████	█████
Unit Rate (\$/meter) ⁶	█████	█████	█████	█████	█████	█████
Total Expenditure	\$38	\$38	\$41	\$27	\$26	\$38

The build-up of meter types within the program varies from year to year (i.e. program to program). This results in a variable unit rate (by year) for the program. A detailed breakdown of the program, including unit rate desegregation is provided as an Appendix in Section 5.6.

4.5. Defective / Faulty Meters

4.5.1. Introduction

Leakage, inaccuracy, damage, excess noise and seizure are all failure methods for gas meters. Meter faults are predominantly identified by the public with meters replaced following an investigation by Multinet Gas' primary service provider.

Meter Failure, especially those resulting in a leak, increases the risk to public safety as a potentially explosive atmosphere could develop in the area surrounding the meter.

4.5.2. Scope

Large meter types that have failed during operation.

4.5.3. Strategic Alignment

The replacement of defective or failed meters is reflected in Multinet Gas' network objectives through:

- **Compliance:** Multinet Gas is required to meter all gas used on the distribution network;
- **Safety:** Meter failures cause gas to be emitted at ~75% meter failures⁷. Replacing defective meters reduced / maintains network safety; and
- **Customer:** Meter accuracy (within defined limits) is the primary function of a gas meter.

4.5.4. Works Program

In forecasting meter failures, historic failure rates provide the best indication of future failure rates. Table 4-8 provides a forecast of the number of meter faults expected on the network to 2022. This is calculated assuming a constant 0.36% of meter fleet failures against the anticipate growth of the large meter fleet.

Capital expenditure for the replacement of failed large meters is also summarised in Table 4-8. Only the purchase cost of new meters required to replace failed meters are capitalised by Multinet Gas. A █████ refurbish rate is applied to forecast new meter costs for failed meters.

⁶ Refer to Appendix (Section 5.6) Breakdown of unit costs.

⁷ Gas escapes occur during Gas escapes (45% of failures) & third party damages (32% of failures).

Table 4-8: Capital Forecast – Defective / Faulty Meters

	2017	2018	2019	2020	2021	2022
Metering Fleet – Large Meters	28,731	30,231	31,731	33,231	34,731	36,231
Forecast Defective Meters / Faults (0.36% of Fleet)	94	99	103	108	113	118
New Meter Purchases (█ to be replaced)	█	█	█	█	█	█
Unit Rate (\$/meter) ⁸	█	█	█	█	█	█
Total Expenditure	\$63	\$67	\$69	\$72	\$76	\$79

Due to the uncertain nature of meter failures (i.e. the type of meter failing), an average unit rate has been applied for large meter purchases which represents the weighted average cost of large meters in Multinet Gas' metering fleet (Appendix, Section 5.7).

4.6. Data Loggers and Flow Correctors

4.6.1. Introduction

Data Loggers and Flow Correctors are known more commonly as interval metering equipment. These electronic devices count meter pulse outputs from a physical meter index which directly relate to the flow of metered gas. This flow is then corrected to energy usage for billing purposes.

There are two types of interval metering installations:

- **Data Loggers** are used to record hourly gas flow and converted to energy using only fixed temperature and fixed pressure values; and
- **Flow Correctors** are used to correct gas flow with either fixed / live temperature and live pressure readings on site. These temperature and pressure values are aggregated 6 times per hour, with the calculations utilising the average values over the hour.

The obligation for energy correction is outlined by the Gas Distribution System Code⁹ with a detailed basis of calculation outlined in AEMO's publication "Declared Wholesale Market Energy Calculation Procedure (Victoria)".

4.6.2. Scope

Data Loggers and Flow Correctors are installed on installations which satisfy one (or more) of the following criteria:

- Use (or plan) to use over 10,000 gigajoules in a 12 month period;
- Require a metering pressure higher than 450 kPa; and/or
- Where sites are regulated after the meter.

Multinet Gas has approximately 315 registered sites on the Victorian Market Information Bulletin Board (MIBB) which utilise interval metering equipment and therefore require interval billing practices. AEMO is responsible for reading all interval meters in the Victorian gas market. The implication with respect to these sites is that they can have a daily impact on wholesale market pricing for Gas, and therefore are metered hourly to enable prompt settlement.

4.6.3. Business Drivers and Strategic Alignment

The installation of interval metering equipment is reflected in Multinet Gas' network objectives through:

- **Compliance:** Multinet Gas is required to install interval metering equipment on all sites that use (or plan to use) over 10,000 gigajoules in a 12 month period as per the Gas Distribution System Code;

⁸ Refer to Appendix (Section 5.7) Breakdown of unit costs for Defective Meters.

⁹ Gas Distribution System Code: Section 6.2 - Type of metering installation (p.10) and Section 7.4 - Correction)

- **Customer:** Meter accuracy (within defined limits) and performance is the primary function of interval metering installations.

4.6.4. Works Program

The installation of a Data Logger or Flow Corrector is driven by the requirements in the Gas Distribution System Code. The program is:

- Proactive when customers are applying for a new connection or an upgrade; and
- Reactive when rolling 12 month consumption figures dictate interval metering is required.

The number of interval metered sites within the Multinet Gas network is considered stable, fluctuating around the 315 sites. This implies the number of large gas consuming customers are downgraded (due to reduced usage) as often as they are upgraded. Existing interval metering equipment is reused where practical. Historically however, the equipment being downgraded is beyond its repairable/serviceable life and therefore new equipment will need to be purchased in its stead.

Capital expenditure forecast for the installation of new Data Loggers and Flow Correctors is summarised in Table 4-9. The program was estimated utilising historical expenditure.

Table 4-9: Capital Forecast – Data Loggers & Flow Computers

Program	2017	2018	2019	2020	2021	2022
Data Loggers & Flow Computers	\$94	\$94	\$94	\$94	\$94	\$94

5. Appendix

5.1. Glossary & Definitions

Term	Meaning
AEMO	Australian Energy Market Operator: Responsible for the administration and operation of the wholesale national electricity market in accordance with the National Electricity Code.
AER	Australian Energy Regulator: Responsible for the economic regulation of energy networks.
CAPEX	Capital Expenditure
CTM	Custody Transfer Meter. A large capacity meter installed at every injection point from the DTS to MG's network.
Data Logger	Interval metering equipment that counts pulses from the mechanical meter index and records gas volume.
EDMI	Meter manufacture and supplier to Multinet Gas
FLE	Field Life Extension. Alternative name for in-service compliance testing of domestic diaphragm meters.
FY	Financial Year
Flow Corrector	Interval metering equipment which can correct gas flow to energy with the help of live pressure and temperature values.
GAAR	Gas Access Arrangement Review
Gas Meter	Mechanical device (usually) used to measure the volumetric flow rate of gas that passes the device.
GDSC	Gas Distribution System Code
HHU	Hand Held Unit or meter reading devices
I&C	Industrial and Commercial
Interval Meter site	Installation which is large enough (with respect to gas usage) to warrant the use of hourly metering data via a data logger of flow corrector.
kPa	Kilopascals
L&G	Landis & Gyr – Meter manufacture and supplier to Multinet Gas
Large Meter	Meter with capacity less than >10 Sm ³ /hr.
Meter Family	A group of the same meter brand and type installed in the same calendar year.
Meter Type	Refers to the technique employed to measure gas flow i.e. Rotary, Turbine, Diaphragm.
MG	Multinet Gas
MIBB	Market Information Bulletin Board
MPE	Maximum Permissible Error
NMI	National Measurement Institute
OPEX	Operational Expenditure

Term	Meaning
SAP	An Enterprise Resource Planning tool which used recording asset data and maintenance management.
Sm ³ /hr	Standard cubic meters per hour (either Gas or Air).
Small Meter	Meter with capacity less than 10 Sm ³ /hr. Normally used for Residential (domestic) purposes.

5.2. Installations by Meter Model Type

Installed on MG Network (01/08/2016)					
Material	Population	%	Material	Population	%
AL425	13,104	50.76%	ROMT200	6	0.02%
AL1000	7,367	28.54%	ROMT300	6	0.02%
AL800	1,325	5.13%	RTS3M2	6	0.02%
RKMR12	1,001	3.88%	AL23004	5	0.02%
RK1000	731	2.83%	RKT630M	5	0.02%
AL23003	551	2.13%	RKT860M	5	0.02%
AL14002	530	2.05%	ROMT140	5	0.02%
AL50004	428	1.66%	ELRVGG160ROTARY	4	0.02%
RK5000	254	0.98%	RKT418M	3	0.01%
RK3000	133	0.52%	ROMT85	3	0.01%
1000A	56	0.22%	AL14003	2	0.01%
RTS11M4	51	0.20%	ELG2500-10	2	0.01%
RTS16M4	48	0.19%	FLUX03	2	0.01%
RTS7M3	44	0.17%	RTS5M3T	2	0.01%
RK10000	39	0.15%	AL23003H	1	0.00%
GT630M	21	0.08%	AL50004H	1	0.00%
AL1000H	19	0.07%	ELG2500	1	0.00%
RTS23M6	19	0.07%	FLUX06	1	0.00%
RTS5M3	17	0.07%	FLUX12	1	0.00%
GT418M	16	0.06%	GTS635M	1	0.00%
GT860M	13	0.05%	INSTG40	1	0.00%
RTS38M6	11	0.04%	INSTG2500	1	0.00%
AL425H	8	0.03%	RABOG65	1	0.00%
ELG65RVGROTARY	8	0.03%	RMG132AG65	1	0.00%
INSTG100	8	0.03%	ROM650	1	0.00%
ROMT450	7	0.03%	RTS23M175	1	0.00%
ELRVGG40	6	0.02%	Grand Total	25,815	100.00%

5.3. Meter Technology

A variety of metering technologies are utilised on Multinet Gas' distribution and transmission network. The most common are summarised.

Meter Type	Description	Applications	Examples
Diaphragm	Positive displacement meters with two or more chambers formed by movable diaphragms.	Domestic & Commercial	L&G 750, U10, AL-425 to AL-5000
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.	Commercial & Industrial	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
Orifice	A differential meter that infers the flow rate by measuring the pressure differential across a known orifice (flow disturbance)	Custody Transfer Meters only	Specific Applications
Ultrasonic	Measures the volume of gas by measuring the speed at which sound travels in the gaseous medium within the pipe.	Custody Transfer Meters only	Specific Applications
Coriolis	Uses resonant frequency vibrations within the meter caused by the gas flow to infer the volume of gas passing through the meter.	Custody Transfer Meters only	Specific Applications

5.4. Time Expired Meter Replacement program – Volumes & Unit Rates

MODEL	TYPE	Time Expired Replacements						Replacement Cost	Refurbish Rate	New Meter Costs					
		2017	2018	2019	2020	2021	2022			2017	2018	2019	2020	2021	2022
AL800	Diaphragm	5	71	116	85	68	68								
AL425	Diaphragm	0	0	242	0	0	826								
AL425H	Diaphragm	0	0	1	0	0	0								
RKMR12	Diaphragm	1	0	282	66	139	102								
AL50004	Diaphragm	43	33	53	46	65	20								
AL50004H	Diaphragm	0	1	0	0	0	0								
RK10000	Diaphragm	5	4	0	7	17	0								
AL23003	Diaphragm	9	22	45	41	48	38								
AL23003H	Diaphragm	0	0	0	0	0	0								
AL23004	Diaphragm	0	0	0	0	0	0								
RK5000	Diaphragm	19	6	16	3	22	2								
AL14002	Diaphragm	11	37	53	37	30	30								
AL14003	Diaphragm	0	0	0	0	0	0								
RK3000	Diaphragm	11	2	8	6	11	13								
AL1000	Diaphragm	0	614	140	593	0	0								
RK1000	Diaphragm	19	94	90	97	3	137								
ELG2500	Turbine	0	0	0	0	0	0								
ELG2500-10	Turbine	0	0	0	0	0	0								
FLUX03	Turbine	0	0	0	0	0	0								
FLUX06	Turbine	0	0	0	0	0	0								
FLUX12	Turbine	0	0	0	0	0	0								
GT418M	Turbine	0	3	5	3	1	2								
GT630M	Turbine	0	2	3	3	5	3								
GT860M	Turbine	0	0	1	2	2	1								
GTS635M	Turbine	0	0	1	0	0	0								
RKT418M	Turbine	0	0	0	0	2	0								
RKT630M	Turbine	0	0	1	0	4	0								
RKT860M	Turbine	0	0	0	0	2	1								
ELG65RVGROTARY	Rotary	0	0	0	0	2	0								
ELRVGG160ROTARY	Rotary	0	0	1	0	0	0								
ELRVGG40	Rotary	0	0	4	0	0	0								
INSTG100	Rotary	0	0	0	0	2	4								
INSTG2500	Rotary	0	0	0	1	0	0								
INSTG40	Rotary	0	0	1	0	0	0								
RMG132AG65	Rotary	0	0	0	0	0	0								
ROM650	Rotary	0	0	0	0	1	0								
ROMT140	Rotary	0	0	0	0	3	1								
ROMT200	Rotary	1	0	0	1	2	0								
ROMT300	Rotary	0	1	0	0	4	0								
ROMT450	Rotary	0	3	0	0	3	1								
ROMT85	Rotary	0	0	0	0	0	0								
RTS11M4	Rotary	3	4	5	3	5	3								
RTS16M4	Rotary	5	6	11	5	8	4								
RTS23M175	Rotary	0	0	0	0	0	0								
RTS23M6	Rotary	1	0	3	1	1	2								
RTS38M6	Rotary	0	0	0	0	5	2								
RTS3M2	Rotary	0	0	0	0	1	0								
RTS5M3	Rotary	2	3	0	2	3	0								
RTS5M3T	Rotary	1	0	0	0	0	0								
RTS7M3	Rotary	4	3	3	1	3	0								

Total (Refurbish)	121	815	995	906	459	1123
Total (Refurbish)	19	94	90	97	3	137

Avg Unit Rate (Refurbish)						
Avg Unit Rate (Refurbish)						

Assumptions:

- Values based on average Service Provider rates;
- No expenditure escalation;
- No allowance has been made for operational labour costs to replace/install meters;
- Forecast replacement numbers are based on the Multinet Gas sampling plan; and
- Meters are repaired and re-cycled in the same year they are removed from the field.

5.5. Field Life Extension Results – Large Meters - 2011 to 2016

Sample Test Year:	Meter Construction Year:	Meter Type:	Result:	Field Life Extension:
2011	1989	AL1000	Passed	1 Year
	1995	AL1000	Passed	3 Years
2012	1989	AL1000	Passed	3 Years
	1996	AL1000	Failed	-
	1996	AL425	Passed	5 Years
2013	1994	AL1000	Failed	-
	1997	AL1000	Passed	3 Years
	1990	AL425	Passed	5 Years
	1994	AL425	Passed	5 Years
	1997	AL425	Passed	5 Years
2014	1991	AL1000	Passed	3 Years
	1992	AL1000	Passed	5 Years
	1995	AL1000	Failed	-
	1998	AL1000	Passed	1 Year
	1991	AL425	Passed	3 Years
	1992	AL425	Passed	5 Years
	1993	AL425	Passed	5 Years
	1998	AL425	Passed	5 Years
2015	1995	AL425	Passed	5 Years
	1999	AL425	Passed	5 Years
	1989	AL1000	Passed	1 Year
	1998	AL1000	Passed	3 Years
	1999	AL1000	Passed	3 Years
2016	2000	AL425	Passed	5 Years
	1989	AL1000	Passed	1 Year
	1997	AL1000	Passed	1 Year
	2000	AL1000	Passed	5 Years

5.6. Field Life Extension – Volumes & Unit Rates

MODEL	TYPE	Time Expired Replacements						Replacement Cost	Refurbish Rate	New Meter Costs					
		2017	2018	2019	2020	2021	2022			2017	2018	2019	2020	2021	2022
AL1000	Diaphragm	-	129	130	62	45	84	■	■	■	■	■	■	■	■
AL425	Diaphragm	-	196	189	196	277	354	■	■	■	■	■	■	■	■
AL800	Diaphragm	-	0	13	17	13	13	■	■	■	■	■	■	■	■
TOTAL		-	325	332	275	335	451	TOTAL (\$'000)		■	■	■	■	■	■
		Average per Replacement								■	■	■	■	■	■

Assumptions:

- Values based on average Service Provider rates;
- No expenditure escalation;
- No allowance has been made for operational labour costs to replace/install meters;
- Forecast replacement numbers are based on the Multinet Gas sampling plan;
- New meter numbers are based on repairing ■ of meters removed via the Time Expired Program. Meters which are non-repairable have equivalent numbers purchased as new;
- Meters are repaired and re-cycled in the same year they are removed from the field.

5.7. Defective Meters – Weighted Average Unit Rate

Installed on MG Network				
Meter Type	Population	%	Unit Rate for Replacement	Cost of Rep (\$k)
AL425	13,104	50.63%	████	████
AL1000	7,367	28.46%	████	████
AL800	1,325	5.12%	████	████
RKMR12	1,001	3.87%	████	████
RK1000	731	2.82%	████	████
AL23003	551	2.13%	████	████
AL14002	530	2.05%	████	████
AL50004	428	1.65%	████	████
RK5000	254	0.98%	████	████
RK3000	133	0.51%	████	████
1000A	56	0.22%	████	████
RTS11M4	51	0.20%	████	████
RTS16M4	48	0.19%	████	████
RTS7M3	44	0.17%	████	████
RK10000	39	0.15%	████	████
GT630M	21	0.08%	████	████
AL1000H	19	0.07%	████	████
RTS23M6	19	0.07%	████	████
RTS5M3	17	0.07%	████	████
GT418M	16	0.06%	████	████
GT860M	13	0.05%	████	████
RTS38M6	11	0.04%	████	████
AL425H	8	0.03%	████	████
ELG65RVGROTARY	8	0.03%	████	████
INSTG100	8	0.03%	████	████
ROMT450	7	0.03%	████	████
ELRVGG40	6	0.02%	████	████
ROMT200	6	0.02%	████	████
ROMT300	6	0.02%	████	████
RTS3M2	6	0.02%	████	████
AL23004	5	0.02%	████	████
RKT630M	5	0.02%	████	████
RKT860M	5	0.02%	████	████
ROMT140	5	0.02%	████	████
ELRVGG160ROTARY	4	0.02%	████	████

Installed on MG Network				
Meter Type	Population	%	Unit Rate for Replacement	Cost of Rep (\$k)
RKT418M	3	0.01%	████	████
ROMT85	3	0.01%	████	████
AL14003	2	0.01%	████	████
ELG2500-10	2	0.01%	████	████
FLUX03	2	0.01%	████	████
RTS5M3T	2	0.01%	████	████
AL23003H	1	0.00%	████	████
AL50004H	1	0.00%	████	████
ELG2500	1	0.00%	████	████
FLUX06	1	0.00%	████	████
FLUX12	1	0.00%	████	████
GTS635M	1	0.00%	████	████
INSTG40	1	0.00%	████	████
INSTG2500	1	0.00%	████	████
RABOG65	1	0.00%	████	████
RMG132AG65	1	0.00%	████	████
ROM650	1	0.00%	████	████
RTS23M175	1	0.00%	████	████
TOTAL	25,883	100.00%	TOTAL Replacement Cost	████
			Weighted Average Unit Rate	████

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