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Asset Management
CY2017 - CY2022

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Large Consumer Regulators - Strategy

CY2017 – CY2022

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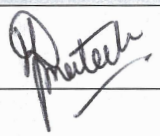
Asset Engineer	Prateek Kateelkar		19/12/2016

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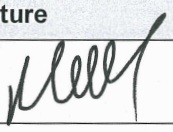
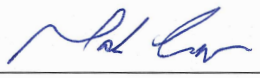
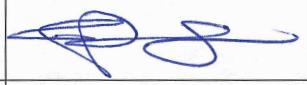
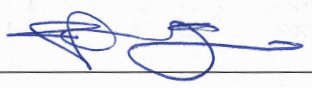
Reviewer	Senior Technical Officer	Max York		19/12/2016
Reviewer	Gas Asset Manager	Mark Cooper		19/12/2016
Endorsed	Head of Gas Network Strategy and Performance	Troy Praag		19/12/2016
Approved	General Manager, Gas Networks	Mark Beech		19/12/2016

Executive Summary

This document outlines the maintenance and replacement strategy for the Large Consumer Regulators on the Multinet Gas network. Large consumer regulators are defined as those supplying customers[1]:

- Greater than 140 sm^3/h of Natural Gas off the Low Pressure system; or
- Greater than 30 sm^3/h of Natural Gas off the High Pressure or the Medium Pressure system and at a metering pressure greater than 2.75 kPa.

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, which includes maintenance of such installations.

To fulfil its regulatory obligations and maintain alignment with Network Objectives (refer section 3.1), Multinet completes the following annual programs.

- Obsolete Regulator Replacement Program; and
- Gas Meter Room Remediation Program.

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 real cost escalators for the purpose of reconciliation with that of the overview documentations which support our forthcoming Access Arrangement submission (2018 – 2022).

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

Program	CY2017	CY2018	CY2019	CY2020	CY2021	CY2022
Obsolete Regulator Replacement Program	$908	$747	$1,084	$561	$833	$721
Gas Meter Room Remediation Works	$25	$25	-	-	-	-
Total Direct Expenditure	**$933**	**$772**	**$1,084**	**$561**	**$833**	**$721**
Overhead	$56	$46	$65	$34	$50	$43
Subtotal	**$989**	**$818**	**$1,150**	**$596**	**$883**	**$764**
Real cost escalation	-	$5	$6	$4	$10	$9
Total Direct Expenditure	**$989**	**$823**	**$1,156**	**$600**	**$892**	**$773**

[1] Customer installations which are fed off directly from the High Pressure 2 (HP2) or Transmission pressure system are treated the same as Field Regulators. Refer Supply Regulator Strategy (MG-SP-0006)

Table of Contents

1. Document Overview

1.1. Objectives

This document articulates Multinet Gas' approach to the lifecycle management of its existing Large Consumer Regulating assets.

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 Consumer Regulators" asset group; 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 covers the management of Multinet Gas' existing Large Consumer Regulating assets. It focuses on gas pressure regulating devices installed for supply to Industrial and Commercial (I&C) consumers – commonly known as 'System Operations' units. Materials and plant used in the construction of large consumer regulator assemblies (excluding the meter) identified as "at risk" are also included.

Large consumer regulators are defined as regulators designed (and approved) for supplying customers[2]:

- Greater than 140 sm^3/h of Natural Gas off the Low Pressure system; or
- Greater than 30 sm^3/h of Natural Gas off the High Pressure or the Medium Pressure system and at a metering pressure greater than 2.75 kPa.

The strategy excludes:

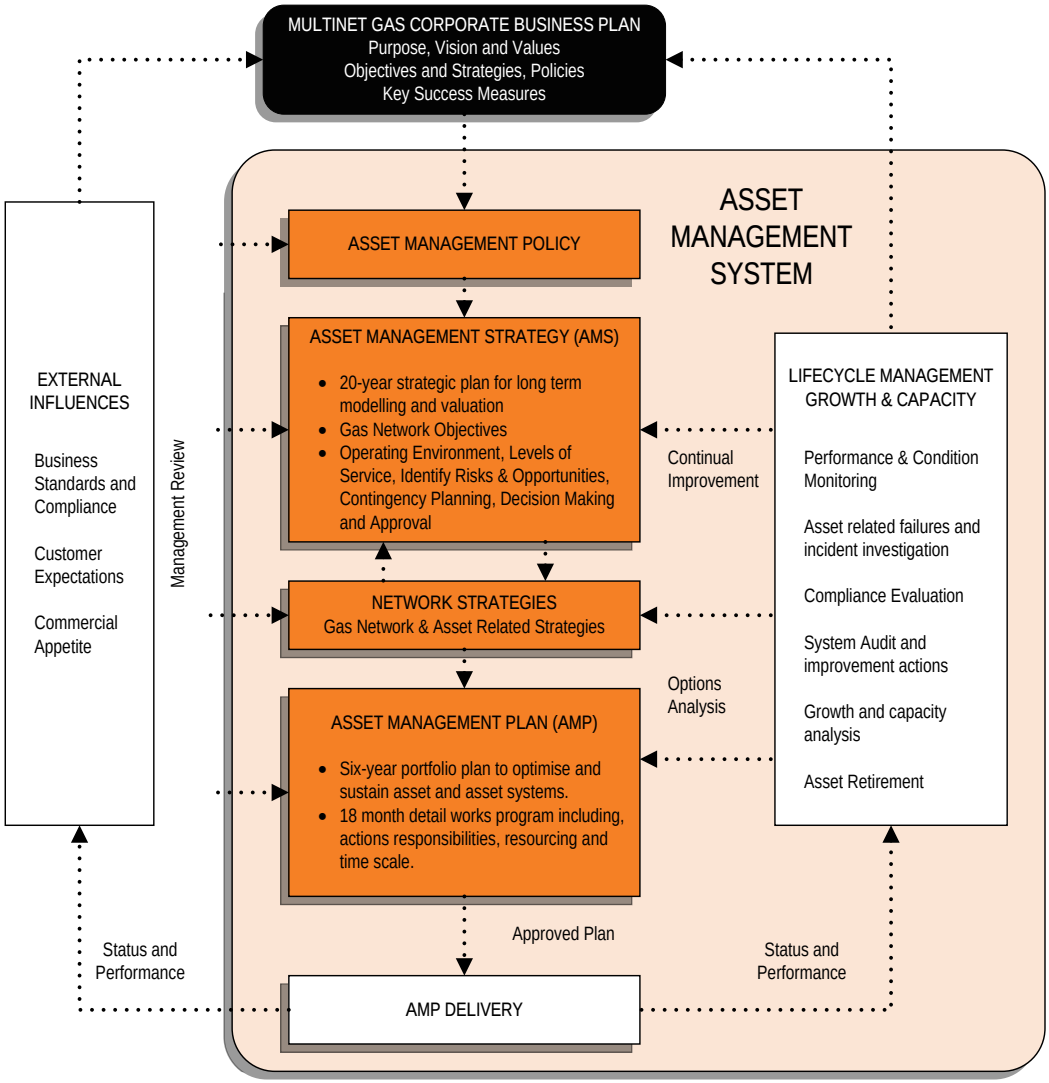
- Metering assets at each location – Refer Large Meter Strategy (MG-SP-0008); and
- Small consumer regulators.

1.3. Relationship with other Key Asset Management Documents

The Large Consumer Regulator 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 Consumer Regulator 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.

[2] Customer installations which are fed off directly from the High Pressure 2 (HP2) or Transmission pressure are treated the same as Field Regulators. Refer Supply Regulator Strategy (MG-SP-0006)

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 Consumer Regulator Strategy:

- SAP: ERP tool used for data collection, analysis and maintenance management of MG assets.

1.6. References

- AS 4645 series - Gas Distribution Networks;
- Multinet Gas Risk Model; and
- Multinet Gas - System Operations Manual.

1.7. Document Review

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

2. Asset Overview

2.1. Introduction

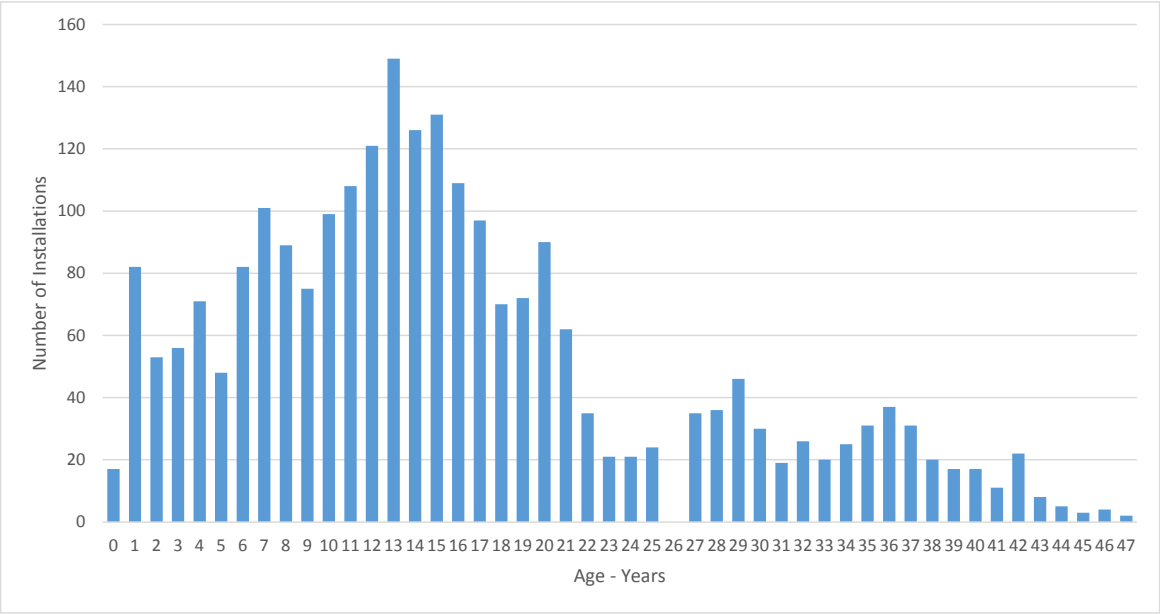
Large consumer regulators are spread across the entire Multinet Gas distribution network, but are more predominant in the southern industrial areas. This strategy applies to large consumer regulators which are predominantly located on the consumer's premises and supplied from the Multinet Gas distribution network.

2.2. Asset Age Profile

The large consumer regulator age profile encompasses a broad time-span, with the older sites installed in the late 1960's. The majority of these sites were installed / constructed by the former Gas and Fuel Corporation (GFC) and are spread throughout the Multinet Gas distribution network.

A total of 27% of all large consumer connections have occurred over the last 10 years. The average age of all large consumer connections is 17 years. The age profile for Multinet's Large Consumer Regulators is provided in Figure 2-1. Refer to the Appendix (Section 5.3) for a list of regulators installed each year since 1969.

Figure 2-1: Asset Age Profile[3]



2.3. Asset Performance

Regulators do not tend to exhibit a useful life or end-of-life failures. Their refurbishment / replacement is typically driven by their inability to be serviced due to critical spare parts not being available or specific operational requirements.

The current condition of Multinet's large consumer regulator installations is predominantly good with the following exceptions and comments:

1. A number of the older installations (30+ years old) display aged coatings that will require repair and / or re-coating. Some existing coatings may contain lead and will need to be conducted by suitably qualified contractors. (Sites to be determined); and

[3] Note: Figure 2-1 excludes data anomalies in 1990 (26 years old) where 397 installations were recorded.

2. A number of installations, predominantly installed during the early 1980's, are suffering from corrosion due to some components (steel fittings, fasteners etc.) being of an inferior quality.

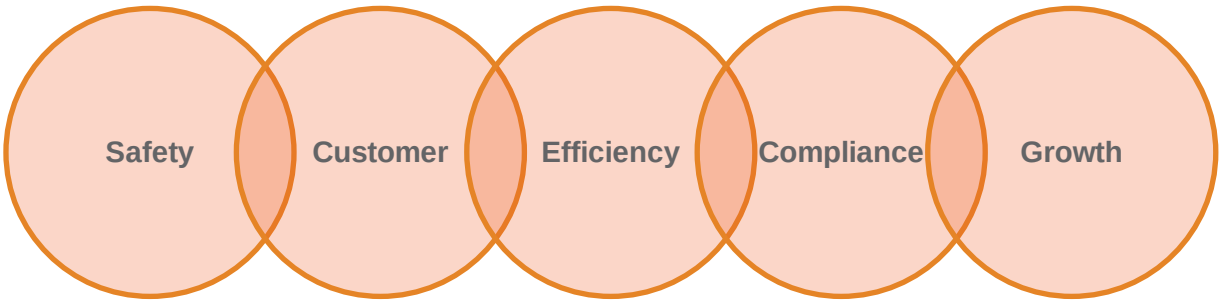
Refer to the Appendix (Section 5.3) for a list of regulators installed, by type, since 1969. The table only includes sites/regulators currently on a scheduled maintenance program (also commonly known as 'System Ops' units).

3. Asset Management Drivers

3.1. 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



The alignment between network objectives and the Large Consumer Regulator strategy is detailed below.

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 are underpinned by the need to ensure safety for the customer, the general public and the field personnel who carry out maintenance activities.

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. The planned maintenance activities are designed to cause minimum or no interruption of supply to the customer to limit financial loss or inconvenience to the customer.

The objective of the Obsolete Regulator Replacement program (Section 4.2, p.14) is to target the old regulator models for which spare parts are difficult to obtain and replace them with newer models to ensure ongoing gas supply for the customer.

3.1.3. Efficiency – Sustainable and prudent network investment

The strategies outlined in this document are aimed at improving the efficiency of the large consumer regulators installed in the network. The Regulator Replacement program targets certain regulators (e.g. Dival 250's, Dival 100's and Fisher 298's) which are not in production anymore and OEM soft spare parts are difficult to obtain. The timing of replacement of these regulators is planned to coincide with the dates of their planned strip-down maintenance (in SAP) so as to ensure that these regulators are replaced in the most cost-efficient manner.

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 MG Safety Case, AS 4645 and the Gas Distribution System Code.

The drivers for the Obsolete Regulator Replacement program and the Gas Meter Room remediation program have compliance driven aspects to them. In particular, the Gas Meter Room remediation program is driven by the need to make sub-standard gas meter rooms comply with modern day engineering standards and building codes.

3.1.5. Growth – Seek opportunities for new growth

This strategy does not cover the growth of Large Consumer Regulators. Refer to Multinet's Capital Growth Plan (MG-PL-0002).

3.2. Lifecycle Management

3.2.1. General

The maintenance activities undertaken since 1987 (developed by the former Gas and Fuel Corporation) were changed in 2000 to more closely reflect a risk based maintenance program. In 2009, this was revised and the preventative maintenance frequency was extended to 36 month cycle with 12 year overhaul and an additional task list was created. This change only applies to direct actuating regulators, with the exception of Dival regulators target for replacement due to obsolescence (Refer to Section 4.2).

3.2.2. Inspection and Preventive Maintenance

Inspection and Preventive Maintenance activities are undertaken on either an:

- 18 month Operational Check / 126 month (10.5 years) Full maintenance schedule; or
- 36 month Operational Check / 144 month (12 years) Full maintenance schedule.

Maintenance frequencies are dependent on the type of site, operational and regulatory requirements. For scheduled maintenance activity details refer to the Multinet Gas System Operations Manual and maintenance schedule review documents.

Regulators being supplied by the low pressure network have a reduced maintenance frequency.

3.2.3. Corrective Maintenance - Faults and Defects

Faults are generally reported by the consumer in the form of 'no gas' or 'gas leakage' reports, or by the public. Faults are rectified as a priority over scheduled works.

Defects are reported and rectified as follows:

- Reported by the consumer or via the emergency telephone number posted at the site.
- Reported during audits/inspections. Multinet Gas rectifies defects either during the next scheduled maintenance or by a special visit, if warranted.
- Rectified by the Multinet Gas maintenance crew who are expected to attend to any defects as far as practicable, during scheduled maintenance activities.

3.2.4. Refurbishment

Refurbishment of large consumer regulators and associated components is usually undertaken as a project and where possible aligned with scheduled maintenance activities. As components vary widely with regards to age, type, function and utilisation, refurbishment is determined on a case-by-case basis.

The primary drivers for refurbishment are:

- Regulators failing to maintain lock-up and/or set pressure;
- Gas leakage – internal and/or external;
- Reduced/increased operational requirements; and
- To improve maintenance efficiencies.

Refurbishment of large consumer regulator sites shall also include the replacement of any associated obsolete components (e.g. non-lugged butterfly valves).

3.2.5. Replacement

The replacement of large consumer regulators and associated components is primarily driven by:

- **Availability of serviceable components**

  As critical equipment replacement parts become unavailable and the equipment can no longer be maintained to the satisfactory levels such equipment must be replaced with suitable commercially supportable units. The basis of regulator family replacement will be on the forecast availability of spares and the current level of regulator family exposure.

- **Ability to meet capacity requirements.**

  Consumer and network driven gas load/pressure changes can cause components to exceed original design ratings and hence force the necessity for replacement.

- **Ability to meet Operational, Safety and Regulatory requirements.**

  Many sites were constructed/installed at the formation of the (former) Gas and Fuel Corporation. Some of these sites no longer meet current industry standards or Multinet Gas standards and require re-work/replacement in order to meet current operational requirements. These sites are rectified as required.

3.3. Performance Measures

Large consumer regulator performance is measured during regulator performance trials, prior to acceptance and use by Multinet Gas. Individual regulator site performance is measured and recorded during scheduled and corrective maintenance works. These measures are analysed on a regular basis to ensure the correct strategies are being applied.

4. Capital Program – 2017 to 2022

4.1. Overview

Multinet Gas completes the following annual programs to maintain its alignment with the Network Objectives (refer Section 3.1) and remain compliant with its regulatory obligations under the Gas Distribution System Code, MG Safety Case and AS 4645.

- Obsolete Regulator Replacement Program; and
- Gas Meter Room Remediation Program.

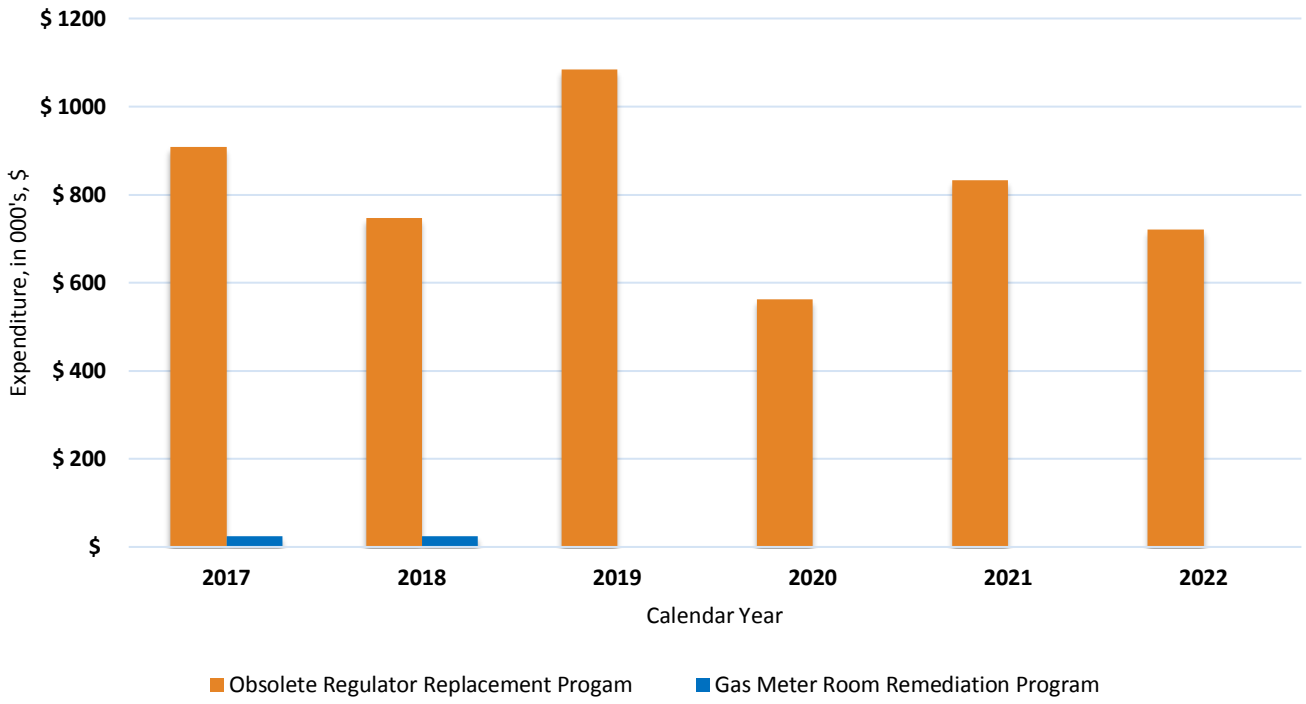
Table 4-1 and Figure 4-1 provides a breakdown of capital expenditure from 2017 to 2022 by program. Total expenditure for large consumer regulators is driven by the Obsolete Regulator Replacement Program which contributes 99% of forecast expenditure. Average annual expenditure is $818k for the period.

Capex allocation is captured within the AER regulatory accounts 'Other' category (RJA sub-category).

Table 4-1: Capital Program – Large Consumer Regulators

Ref ID	Program	2017	2018	2019	2020	2021	2022
4.2	Obsolete Regulator Replacement Program	$908	$747	$1,084	$561	$833	$721
4.3	Gas Meter Room Remediation Works	$ 25	$ 25	-	-	-	-
	Total Direct Expenditure	**$ 933**	**$ 772**	**$ 1085**	**$ 562**	**$ 833**	**$ 721**

Figure 4-1: Capital Program - Large Consumer Regulators



4.2. Obsolete Regulator Replacement Program

4.2.1. Introduction

Multinet has been replacing obsolete regulator models and configurations (listed in Section 4.2.2) since 2012.

Each regulator type has been targeted due to the Original Equipment Manufacturer (OEM) no longer manufacturing or supporting the equipment. This has resulted in a scarcity in certain soft spares used for maintenance, resulting in increased repair costs and network risk. The average age of the regulators which are planned to be replaced at these sites is more than 17 years.

The manufacturer has indicated that the production of certain soft spares will cease for these models and it will be difficult for Multinet Gas to maintain these regulators to a satisfactory level in the near future.

By proactively replacing these obsolete regulators when they are due for a full strip down maintenance, Multinet can install the current manufacturer supported models in a cost efficient manner and build up a suitable level of strategic spares for the remaining population of obsolete regulators.

4.2.2. Scope

The Obsolete Regulator Replacement Program targets the following I&C regulator models:

1. Dival 100;
2. Dival 250 LBP ;
3. Dival 250 LTR;
4. Rockwell 243 RPA / RPC;
5. Fisher 298 (incl. TEG50, TET40, TK, TK40);
6. Grove 80, 81; and
7. Reliance 2002M.

4.2.3. Business Drivers and Strategic Alignment

The primary drivers for this program are:

- To achieve alignment with gas network objectives of safety, regulatory compliance, customer satisfaction and efficiency;
- Availability of spare parts and suppliers to hold the necessary emergency spare parts in case of a failure;
- Reduced maintenance frequency;
- Reduce the burden on staff training; and
- Improved stock holding capability.

This program is planned to be carried out as per the schedule listed in Table 4-2. Scheduling of the replacement works has been timed to align with the scheduled overhaul maintenance package (QCH activity type in SAP) which is due for that particular site. However, it is important to note that the regulator models which are targeted are no longer in production and the availability of their spare parts will influence the timing of the replacement of certain models as they may either be replaced ahead of schedule or deferred to the later years depending on the availability of spare kits.

The drivers of replacement for each regulator type is detailed below.

Fisher 298 Regulators

The production of the Fisher 298 regulator model has ceased many years ago and getting spare parts is proving to be difficult and expensive. The current lead time on orders exceeds 12 weeks and manufacturers are not providing

assurances regarding the spare parts availability over the next 5 – 10 years. This poses a risk of supply interruption to the customer in the event of a regulator breakdown as the spare parts to repair the regulator are not readily available.

Depending on the load requirements of the consumer, the replacement of the Fisher 298's with a smaller regulator would be a much more cost effective strategy than an overhaul at 10.5 years. This reduces the quantity of Fisher 298's deployed within the network and the dependence on the spare parts. The Fisher 298 regulators are planned to be replaced with [redacted] as and when the scheduled overhaul maintenance package (QCH activity type in SAP) of these units is due over the next two access arrangements.

Dival Regulators

The Dival 100 family (LBP, LTR and LMP), Dival 250-LBP and Dival 250-LTR models are experiencing issues with availability of spare parts. The Dival direct actuating regulator has been installed on new connections for at least 20 years. Early models have had lock up issues; however it is not yet determined up to which year or model modification this is isolated to. The Dival 100 family of regulators are intended to be replaced with [redacted] as and when the scheduled overhaul maintenance package (QCH activity type in SAP) of these units is due. The Dival family of regulators are currently on an 18 month operational check and a 10.5 yearly overhaul maintenance schedule.

Rockwell 243 Regulators

The Rockwell 243 RPC regulators have been installed on the gas network since 1989. The availability of Original Equipment Manufacturer (OEM) spare parts is now limited and hence these regulators are also planned to be replaced over the 2017 – 2022 period.

Grove regulators

There is a small population of Grove regulators (8) which are installed in I&C metering facilities. Spare parts for the Grove model 80, 81 are not readily available and are expensive to procure. The Grove family of regulators are planned to be replaced with suitable sized [redacted]

Reliance 2002M regulators

The over pressure protection for the sites installed with a Reliance 2002M model is a pressure relief valve and this is not deemed to be a satisfactory method of over pressure protection as per current Multinet Gas standards. Hence, these regulators are planned to be replaced with suitable [redacted] over the next 5 -10 years as and when they are due for maintenance.

4.2.4. Works Program

The capital expenditure for the Obsolete Regulator Replacement Program is provided in Table 4-2. Unit costs used in forecasting future expenditure estimates are based on the historical costs previously incurred in completing similar regulator replacement projects.

Table 4-2: Capital Forecast – Obsolete Regulator Replacement Program

Existing Regulator Model		2017	2018	2019	2020	2021	2022	Replacement Regulator Model
Dival 250 – LBP	Units	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Exp.	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Dival 250 – LTR	Units	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Exp.	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Dival 100	Units	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Exp.	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Rockwell 243 RPC	Units	[redacted]	-	[redacted]	[redacted]	-	-	[redacted]
	Exp.	[redacted]	-	[redacted]	[redacted]	-	-	
Fisher 298	Units	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Exp.	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Grove 80, 81	Units	[redacted]	-	-	-	[redacted]	-	[redacted]
	Exp.	[redacted]	-	-	-	[redacted]	-	
Reliance 2002M	Units	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Exp.	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Total Direct Expenditure		**$ 908**	**$ 747**	**$ 1085**	**$ 562**	**$ 833**	**$ 721**	

4.3. Gas Meter Room Remediation Program

4.3.1. Introduction

Gas Meter Room Remediation is an ongoing program forecast to continue to 2018 (inclusive). The program rectifies sub-standard meter rooms (built to GFC standards) identified from internal audit activities.

Background

Energy Safe Victoria had conducted a field compliance audit on the Multinet Gas Meter Rooms in back in February 2014. Particular locations of interest to ESV were large public gathering places like:

- Shopping centres (e.g. [redacted])
- Schools (e.g. [redacted])
- Hospitals and nursing homes (e.g. [redacted])
- High-rise apartments (e.g. [redacted])
- Theatres and sports venues (e.g. [redacted])

ESV had requested Multinet to provide all supporting information demonstrating the maintenance of these Gas Meter Rooms. The scope of their audit covered key aspects of Gas Meter Room's like location, design and construction, electrical safety, ventilation, valves, meter-regulator assembly, nature of service and site drawings.

Multinet Gas has taken this opportunity to inspect the meter rooms which are in high population density buildings and proactively fix any existing issues to ensure their safe operation. Based on the audit results, further rectification was carried out to achieve compliance with current Australian Standards.

Apart from the meter rooms to be fixed as a result of ESV audits, Multinet has also been proactive by undertaking internal audits on the Gas Meter Rooms, the results of which drive expenditure in this program.

4.3.2. Scope

Older gas meter rooms planned for inspected to ensure that they meet current Australian safety standards and building codes. The results of the audits will determine necessary remediation works.

4.3.3. Business Drivers and Strategic Alignment

The remediation of Meter Rooms is reflected in Multinet Gas' network objectives through:

- *Safety* - Ensure ongoing asset integrity by proactively rectifying the sub-standard gas meter rooms; and
- *Compliance* – Maintain ongoing safety and regulatory compliance.

4.3.4. Works Program

The capital expenditure allocation for Meter Room rectification works is outlined in Table 4-3.

Table 4-3: Capital Forecast – Gas Meter Room Remediation Works

Program	2017	2018	2019	2020	2021	2022
Gas Meter Room Remediation Works	$ 25	$ 25	-	-	-	-

5. Appendix

5.1. Glossary & Definitions

Term	Meaning
AER	Australian Energy Regulator
AMP	Asset Management Plan
AMS	Asset Management Strategy
ESV	Energy Safe Victoria
Gas Meter	Mechanical device (usually) used to measure the volumetric flow rate of gas that passes the device. The volume of energy that passes through the meter is dependent on both gas pressure and temperature when the volume is measured.
GFC	Gas and Fuel Corporation
I&C	Industrial and Commercial connections
MG	Multinet Gas
OEM	Original Equipment Manufacturer
QCH	A material activity type code in SAP used for a Complete Overhaul activity
SAP	Systems Applications and Products is an Enterprise Resource Planning tool which used at Multinet Gas for recording asset data and maintenance management.

5.2. Installations by Year

Large Consumer Regulator installations by year (Data Source: SAP)

Table 5-1: Large Consumer Regulator Sites – Quantity by Installation Year

Installation Year	Sites Installed	Installation Year	Sites Installed	Installation Year	Sites Installed
1969	2	1985	19	2001	131
1970	4	1986	30	2002	126
1971	3	1987	46	2003	149
1972	5	1988	36	2004	121
1973	8	1989	35	2005	108
1974	22	1990	397**	2006	99
1975	11	1991	24	2007	75
1976	17	1992	21	2008	89
1977	17	1993	21	2009	101
1978	20	1994	35	2010	82
1979	31	1995	62	2011	48
1980	37	1996	90	2012	71
1981	31	1997	72	2013	56
1982	25	1998	70	2014	53
1983	20	1999	97	2015	82
1984	26	2000	109	2016	17 (up to May 2016)
Total Sites					**2851**

5.3. Regulator Types – Model by Quantity

Table 5-2: Regulator Types – Model by Quantity as of 13/05/2016

Regulator Model	Installation Year	Average Age (Years)	Quantity Installed
Reliance 1843	1973 - ongoing	17	2006
Reliance 1843B	1974 - ongoing	30	285
Reliance 2002M	1974 - 2003	29	233
Reliance 1883	1970 – 1993	33	175
Dival 100-LTR	1990 - 2015	11	139
Reliance 2002	1970 – 2007	28	128
Dival 250-LTR	1969 - 2015	13	125
Reliance Axial Flow H5	1974 - 2010	25	99
Reliance 1813B	1969 – 2015	33	95
Fisher 99-41	1974 - 2009	25	84
Fisher 99-41-0	1975 – 2001	29	70
Fisher 298 TEG50	1977 – 2004	21	66
Dival 250-LBP	1973 – 2010	16	60
Fisher 298 TK40	1976 – 2008	25	60
Reliance 3000	1971 - 2006	31	54
Fisher 298 TET40	1980 – 2012	24	50
Reliance 3010	1971 – 2006	25	50
Donkin 226	1984 – 2010	20	47
Jeavons J125-S4	2003 – 2007	11	43
Reliance 1883B	1969 - 2015	30	34
Norval 375	1981 – 2015	15	31
Rockwell 243RPC	1985 - 1990	28	28
Dival 160-LTR	1990 – 2015	4	25
Rockwell 243RPA	1981 – 1990	29	24
Dival 512 LTR	2003 – 2015	4	21
Fisher 298 TK	1977 – 2009	20	16
Dival 100-LBP	1995 – 1997	11	13
Dival 600 LTR	1987 - ongoing	4	12
Reliance 1843C	2004 – 2014	4	7
Reliance Axial Flow H7	1974	52	7
Dival 160-LBP	1995 – 1997	20	6
Grove 11360	1971	45	5
Norval 495	2015	1	5
Fisher 630	1969	37	4
Grove 11135	1990	26	4
Grove 11351	1990	26	4
Dival 100-LMP	1969 – 2000	18	3
Reliance 1803	1990 – 2015	14	3
Dival 100	2000 – 2011	11	2
Donkin 226 MK3	2003	13	2
Donkin 999	1976 - 1990	33	2
Fisher 1098 EGR	1990	26	2
Norval 630	2015	1	2

Regulator Model	Installation Year	Average Age (Years)	Quantity Installed
Reflux 851	1994	22	2
Reliance 1803M	1990	26	2
Reval 182	1987 – 2016	4	2
Fisher 298 TEG40	2009	7	1
Fisher 298 TEK40	2002	14	1
Jeavons Regulator	1996 – 2015	18	1
Norval 375 TR	1969 - 2015	15	1
Total Regulators:			**4141**

5.4. List of Tables

5.5. List of Figures