Multinet Gas Networks

Attachment 9.13

SCADA Strategy

Final Plan 2023/24 – 2027/28

July 2022

Multinet Gas Networks

SCADA Strategy

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1. Executive summary

This document outlines the maintenance and replacement strategy for SCADA (Supervisory Control and Data Acquisition) assets and their associated components in the Multinet Gas Network (MGN). It also outlines the requirement for new installations to maintain and improve network monitoring and control of the network.

The strategy covers the field-based SCADA equipment (i.e. peripheral hardware) in the MGN. It does not extend to SCADA software, which is covered in MGN's ICT strategy.

We have identified the following planned replacement capital works programs that must be delivered during the next access arrangement (AA) period (2023 to 2028):

- End of life remote terminal units (RTU) replacement – replacement of equipment with more contemporary assets that will align our SCADA systems with industry good practice and compliance obligations including those under the Australian Energy Sector Cyber Security Framework (AESCSF);
- Hazardous area rectification – upgrades and relocation of equipment to ensure SCADA sites meet safety requirements for electrical equipment within a gas/air environment; and
- Network monitoring – installing new SCADA sites and data loggers to improve asset utilisation and safety of our network assets with timely and accurate data and information, which in turn informs short term asset management responses and long-term asset planning.

The capital expenditure (capex) works for the next AA period are summarised in the following sections.

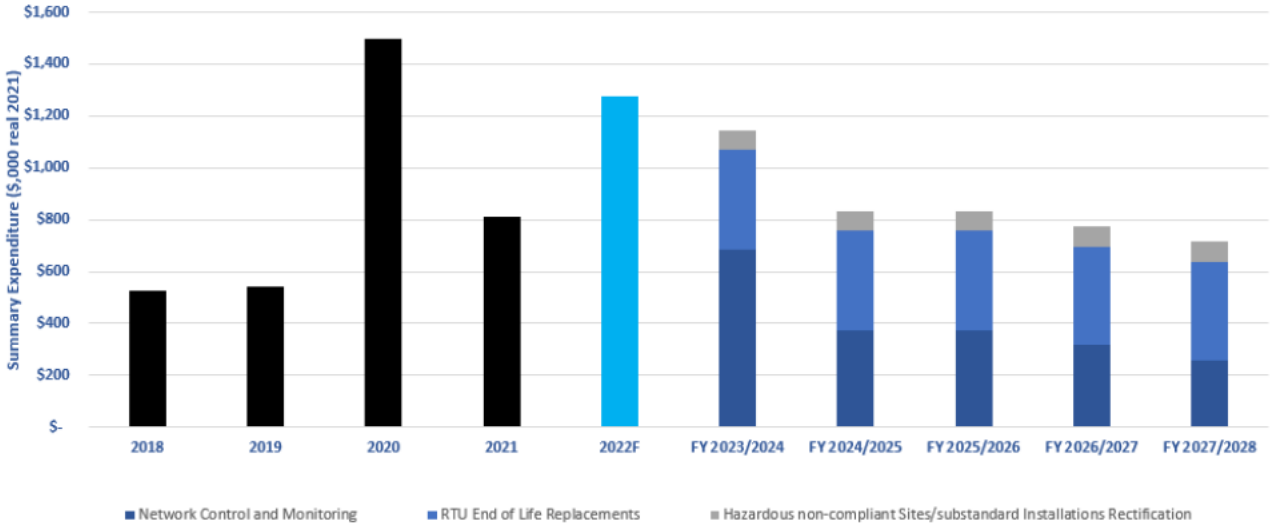
1.1. Financial summary

Table 1-1 summarises the proposed capex on these three programs.

Table 1-1: Summary of capital expenditure, $'000 real 2021

Program	2023/24	2024/25	2025/26	2026/27	2027/28	Total
End of life RTU replacement	384	384	384	384	384	1,920
Hazardous area rectification	75	75	75	75	75	373
Network monitoring	686	372	372	314	255	2,000
Total expenditure	**1,145**	**831**	**831**	**773**	**714**	**4,293**

Figure 1-1: Historical and Forecast Expenditure



1.2. Program background

1.2.1. End of life RTU replacement program

The forecast RTU replacement program for 2023/24 to 2027/28 is based on the need to remove [redacted] end of life RTUs over the next ten years. Table 1-2 summarises the capital cost of the proposed works.

Table 1-2: Summary of end of life RTU replacement program, $'000 real 2021

	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total expenditure	**384**	**384**	**384**	**384**	**384**	**1,920**

Unit rates are based on the latest market-tested prices, updated to reflect recent price increases in electronics, labour and materials experienced across Australia in the wake of the COVID-19 pandemic. Forecast costs reflect recent vendor estimates.

SCADA end of life replacement rates are driven predominantly by obsolescence.

We will retire our Kingfisher PC1 RTU fleet over the next two AA periods. Kingfisher PC1 RTUs have a technical design life of ten years. However, we manage the fleet to often extend the life of some assets through the use of using early retired assets from upgrades sites as spares and spare parts from cannibalised assets[1]. Currently [redacted] per cent of our RTUs are beyond the end of their technical design life. In the next AA period, we will address half of the backlog of the [redacted] RTUs that are beyond their technical design life. This will ensure we have a reasonable ongoing replacement

[1] Expenditure associated with the maintenance and repair of RTUs is included as operating expenditure and is not covered by this strategy.

program into the future, rather than creating an unbalanced profile of works replacing the entire asset class over five years, then having no replacements over the following five years.

The age of SCADA equipment is a good indicator of its condition. The older the asset, the more likely it is to fail. Where an asset is beyond the technical design life, there is also limited support and replacement parts for equipment. Having end-of-life and unsupported SCADA, increases the likelihood of the SCADA system failing and a pressure incident affecting the safety and reliability of services to customers.

We prioritise the replacement of assets based on risk. Those that have greater impact on network monitoring upon failure are targeted for replacement first. This promotes a balanced and deliverable program of works over the long term to ensure volumes and costs are prudent and efficient.

1.2.2. Hazardous area rectification program

In 2020, we commenced a program to assess each SCADA site visited through the broader inspection and maintenance work programs we undertake through assessment with the requirements in the Australian Standards (AS 60079 suite) for electrical equipment within a gas/air environment.

The forecast hazardous areas rectification program is based on the historical number of SCADA sites identified on average and subsequently remediated, and an average historical unit rate. These works may consider the use of future fuel compatible componentry on the site where efficient and practicable to do so[2]. Table 1-3 summarises the proposed works.

Table 1-3: Summary of hazardous area rectification program, $'000 real 2021

	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total expenditure	**75**	**75**	**75**	**75**	**75**	**373**

An accurate assessment of the hazardous area rectification work to be undertaken over the next five years would require physical visits to all SCADA sites across the network. This would be time consuming and expensive, and therefore would not be prudent. Instead, we have forecast the volumes and costs based on the historical program of work and identification rates for remedial works.

Certain rectification works can be undertaken during the standard maintenance visits, and where inspections identify deficiencies, more detailed rectification works are bundled and also aligned with upcoming inspection visits to site.

Recently, we have found that around [redacted] SCADA sites per annum typically require rectification works to bring them up to standard. We have therefore based our forward estimate on addressing this number of sites per year.

Unit rates for this program of work have been determined as an average of historical hazardous area rectification costs across the sites requiring remediation. While the actual work and therefore unit rates vary depending on the compliance assessment, we consider an average provides the best estimate of forward looking costs. Moreover, these works are undertaken as part of a bundled project and therefore reflect the most efficient estimate due to the economies of scope achieved.

[2] Upgrades to SCADA sites required as a result of the injection of hydrogen into the network where not efficiently absorbed as part of works considered within this strategy are included in the MGN Hydrogen MGN (MG-SP-0017).

This delivery approach will also promote a balanced and deliverable program of works over the long term to ensure volumes and costs are prudent and efficient.

1.2.3. Network monitoring program

The effective operation of our SCADA system is required to ensure we have visibility of the network. In turn this improves our ability to manage our assets in a safe and reliable way, and address any issues on the network as they arise. The information provided through our SCADA system is also used in planning future investments to allow us to prudently invest in our network, and is crucial to our mandatory compliance and operational reporting activities.

The forecast network monitoring program for 2023/24 to 2027/28 is the continuation of a well established program of work expanding the amount of real-time information we have for use in monitoring and controlling pressure in our network. Table 1-4 summarises the proposed works.

Table 1-4: Summary of network monitoring program, $'000 real 2021

Project		2023/24	2024/25	2025/26	2026/27	2027/28	Total
Network monitoring	Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Cost estimate	280	200	200	200	200	1,079
Flow metering	Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Cost estimate	351	117	117	58	-	643
Gas detector installation	Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Cost estimate	56	56	56	56	56	279
Total expenditure		**686**	**372**	**372**	**314**	**255**	**2,000**

Where there are relevant historical projects and data, unit rates are based on historical average expenditure values, updated to reflect more recent vendor estimates where practicable. The delivery program is smoothed over the period and reflects a prudent and deliverable rate of replacement.

1.3. Efficiency of the proposed solution

We consider the proposed SCADA and communications programs of work are the minimum required to efficiently manage the asset class and mitigate the risk associated with loss of monitoring or control of pressure in the MGN. The overall SCADA program is relatively consistent with historical expenditure and rates of replacement.

The effective operation of our SCADA system is required to ensure we have visibility of the network. In turn this improves our ability to manage our assets in a safe and reliable way, and address any issues on the network as they arise. The information provided through our SCADA system is also used in planning future investments to allow us to prudently invest in our network, and is crucial to our mandatory compliance and operational reporting activities.

A functioning SCADA system is vital to MGN meeting its obligations in the Victorian Gas Distribution System Code, which requires us to use all reasonable endeavours to ensure minimum prescribed

pressures are maintained at gas delivery points.[3] SCADA is also critical to providing safe and reliable network service to our customers in accordance with AS4645 and AS2885.

We are also required to maintain our SCADA equipment in line with AS3000 and AS60079, which for example sets the industry standards for the maintenance for electrical equipment in explosive atmospheres.

We submit that maintaining the current average rate of SCADA investment, targeting the replacement of critical assets at the end of their technical design life reflects prudent asset management and makes the most efficient use of resources.

We consider the proposed replacement and upgrade programs satisfy the requirements of the following National Gas Rules:

- **NGR 79(1)** – the proposed solution is consistent with good industry practice, several practicable options have been considered, and market rates have been tested to achieve the lowest sustainable cost of providing this service.
- **NGR 79(2)** – the proposed capex is justifiable under NGR 79(2)(c)(i), (ii) and (iii), as it is necessary to maintain and improve the safety of services, maintain the integrity of services and comply with regulatory obligations.
- **NGR 74** – the forecast costs are based on the latest market rate testing and project options considering the asset management requirements as per the latest Asset Management Strategy. The estimate has therefore been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.

[3] Gas Distribution System Code, Ver 14.0, p 52

2. Document overview

2.1. Purpose

This document articulates Multinet Gas Network's (MGN) approach to the management of its existing SCADA assets and their associated components.

It has the following objectives:

- identify the capital works program for 2023/24 to 2027/28;
- present cost estimates for the works program;
- provide justification and evidence that demonstrates the proposed program is prudent and efficient (as per requirements of NGR 79);
- demonstrate that the program cost and volume estimate have been arrived at on a reasonable basis (as per requirements of NGR 74); and
- provide a record of the proposed works program to help inform program delivery and asset management during the period (2023/24 to 2027/28).

The document is for use by:

- MGN Staff (and it's contractors); and
- regulators - technical, safety and economic.

2.2. Scope

This strategy applies to MGN's field-based SCADA assets (i.e. peripheral hardware) throughout the network, including:

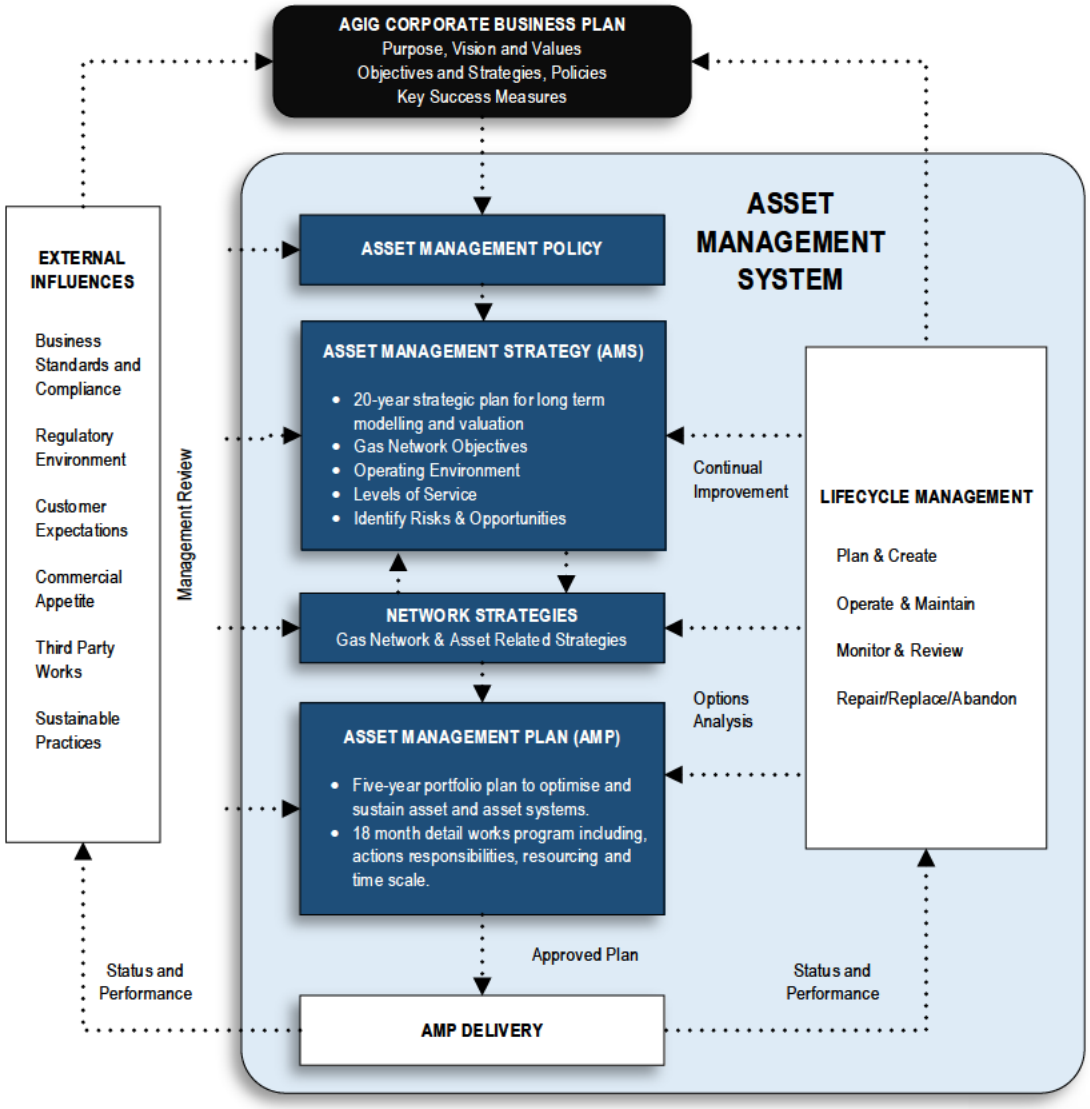
- field instrumentation and sensors for SCADA monitoring and control systems e.g. pressure transmitters, temperature transmitters, flow transmitters, limit switches and gas detectors;
- motorised actuators and solenoids for gas pilots and generally anything electrical in nature that may be found in the hazardous area of the site;
- remote terminal units (RTUs) and their interface hardware, firmware and field service applications;
- RTU and communications equipment power supplies (AC-DC), power converters (DC-DC), solar panels, chargers and backup batteries;
- aerials, antennas, masts, radio frequency (RF) feeder cables and lightning arrestors used for SCADA monitoring;
- communications equipment including modems, radio modems and transceivers, of wireless and wired technologies related to field based data collection;
- communications networks and services explicitly used for SCADA; and
- data loggers.

The SCADA Strategy does not extend to SCADA software, which is covered in MGN's ICT Strategy.

2.3. Relationship with other key asset management documents

The SCADA Strategy is one of several key asset management related documents developed and published by MGN in relation to its gas network. As shown in Figure 2-1, detailed asset strategies, including the SCADA Strategy, inform both the Asset Management Strategy (AMS) and Asset Management Plan (AMP) of the programs needed to achieve the long-term objectives of the gas transmission and distribution networks.

Figure 2-1: Asset Management Framework



2.4. Financial figures used in this document

All financial figures quoted within this document, unless otherwise specifically stated, are:

- real unescalated expenditure / cost (reference year = June 2021);
- direct expenditure only (i.e. excludes overheads and finance costs); and
- in units of $1,000 (i.e. ,000).

2.5. Data sources

The following data sources have been drawn upon to develop the SCADA Strategy:

- SAP – the primary asset management database;
- MOSAIC – the real-time SCADA application for network monitoring;
- OSI Pi – the semi-real-time data warehouse for time series data;
- Service Provider monthly reports; and
- Tableau – 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.

MGN is building an internal database of asset performance and integrity information as MGN continuously replacing legacy equipment and builds internal asset management capability. This may lead to increased volumes due to better practices but MGN will continue to manage and prioritise programs based on age and risk.

2.6. References

- Gas Safety Case
- Gas Distribution System Code Ver. 14.0
- AS 4645 – Gas Distribution Network Management
- AS 2885 Series – Pipelines Gas and liquid Petroleum
- AS 3000 – Electrical Installations
- AS 60079 – Explosive Atmospheres
- MGN - System Operations Manual
- Australian Communications and Media Authority (AMCA) Electro Magnetic Radiation ruling
- Australian Energy Sector Cyber Security Framework

3. Asset overview

3.1. Introduction

MGN uses SCADA assets and their associated components to monitor and report on the gas flow, pressure, and temperature of gas at 208 sites across the network in real time. SCADA also allows us to control pressure at many of these sites.

This strategy details MGN's lifecycle management of our existing SCADA assets and their associated components[4], including the replacement of existing assets. We are required to maintain our SCADA equipment under AS 3000:2018, and in line with the hazardous areas requirements in AS 60079, which for example sets the industry standards for the maintenance for electrical equipment in explosive atmospheres. Given the criticality of SCADA and communications assets, MGN must ensure existing assets are in effective working order.

This strategy also considers the requirement for new installations to maintain and improve network monitoring and control where prudent and efficient. MGN aims to expand the SCADA and communications network to include RTUs in all new greenfield sites as the network organically grows (for example South Gippsland Pipeline). This will ensure the network is appropriately monitored and operations are as efficient as practicable.

The effective operation of our SCADA system is required to ensure we have real time visibility of the network, thereby:

- allowing information on the health of the network represented graphically through software applications in MGN's control room
- minimising the risk of the SCADA system failing, leading to a pressure related event, and the associated safety and operational impacts;
- increasing the timeliness of the diagnosis and rectification of a failing or failed critical network asset, thereby minimising the safety and operational impacts;
- allowing us to maintain the risk of those assets failing at 'as low as reasonably practicable' (ALARP);
- allowing us to comply with our reporting obligations;
- improving our ability to comply with safety and reliability standards (AS 4645, 2885 and 60079, Gas Distribution System Code[5], AESCF etc);
- providing critical information about our network assets to allow prudent and efficient investment in our network over the long term;
- helping ensure accurate billing information for our customers; and
- assisting in minimising unaccounted for gas losses.

At December 2021, MGN's SCADA system includes:

- network control sites for all eight gate stations, 74 of the 112 field regulators and one fringe of grid location; and

[4] This SCADA Strategy does not extend to SCADA software. Software and applications supporting the monitoring and control of the network are included in MGN's ICT strategy.
[5] A functioning SCADA system is vital to MGN meeting its obligations in the Victorian Gas Distribution System Code which requires us to use all reasonable endeavors to ensure minimum prescribed pressures are maintained at gas delivery points.

- network monitored sites for 23 field regulators and 62 fringe of grid locations.

We still have 15 field regulators without SCADA capability, and continue to identify fringe of grid locations where monitoring and/or control capability would be advantageous.

Each of these sites also includes auxiliary equipment and other general SCADA equipment.

3.1.1. Network control sites

Network control sites have the ability to regulate and control network pressures in addition to having network monitoring capability. Pressure regulation occurs when the pilot motor applies a positive (or negative) load pressure to the main diaphragm of the regulator which in turn changes the opening position of the main valve of the regulator. The pilot itself has a valve which controls the load pressure applied based on downstream pressure of the regulator.

Control sites typically also monitor:

- pressure (inlets, outlets, differentials);
- temperature (gas, gas heaters);
- entry conditions (pit, RTU, battery box);
- power conditions (battery, mains, fuses, amps);
- slamshut status;
- gas detection;
- switches;
- water levels;
- failsafe modes, statuses and settings; and
- gas heater conditions.

These statuses or conditions are typically set with an alarm which will notify the control centre of any abnormalities.

3.1.2. Network monitored sites

Monitored sites do not have network pressure control capabilities. They also typically monitor fewer inputs such as:

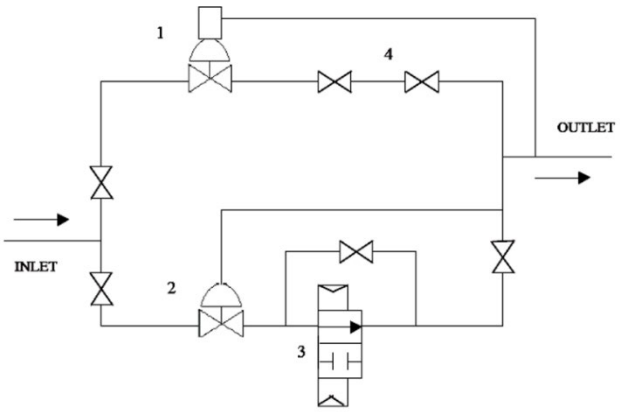
- power conditions (mains, battery, amps);
- entry conditions (pit, RTU, battery box);
- pressures;
- slamshut statuses;
- temperature (gas, cabinet, heaters); and
- gas detectors.

These statuses or conditions are typically set with an alarm which will notify the control centre of any abnormalities.

3.1.3. Auxiliary equipment

The SCADA control panel is the interface between the SCADA input from the RTU and the regulator output. It contains the components which control the outlet pressure of the station and the failsafe devices. Figure 3-1 shows a schematic of a typical control panel, with the auxiliary equipment described further below.

Figure 3-1: RTU Control panel



Pilot motor drive (item 1 above)

The pilot motor drive is operational when a signal is received from the control room via the RTU. The pilot motor drive will then raise or lower the pressures by operating the motor for a pre-determined period of time. This motor drive is also calibrated so the pilot cannot exceed a lower or upper pressure limit. The pilot may be isolated by shutting the valves either side of the device.

Failsafe pilot (item 2 above)

The failsafe pilot is a pre-set pilot regulator which is made active by opening the solenoid valve preceding the device. The failsafe pilot is set to a predetermined network safe setting. This gives an indication as to whether the motor pilot is operationally correct or not. The failsafe pilot may be isolated by shutting the valves either side of the device.

Solenoid valve (item 3 above)

The solenoid valve enables the regulator station to be put into the failsafe mode. When the solenoid is de-energised, the motor driven pilot is commanded to go to top limit. The control for the site is then through the failsafe pilot.

Relief valve (item 4 above)

The relief valve is used in the case of any leakage through the fail-safe pilot, while not in use. This relief valve is set at 680 kPa to relieve any pressure build up that can be would otherwise cause damage to the solenoid valve.

Slamshut panel

Slamshut panels are used on our pressure regulating stations to protect the downstream pipework against over-pressurising. This is a basic requirement of AS 4645 and AS 2885. The level of over-pressure protection is dependent on the inlet and outlet pressures at the station. The panel operates pneumatic actuators on the regulator valves which are immediately upstream of the two runs of two regulators which form part of a gate station or field regulator station.

The purpose of the device is to shut down a faulty run of regulators, or in the unlikely event of failure of both regulator runs, to control within safe limits the outlet pressure of a station. In this case the slamshut system would open and close the inlet valve, maintaining an approximate downstream pressure by acting as a 'rough cut' regulator.

Figure 3-2 is an example of a slamshut panel.

Figure 3-2: Slamshut panel

3.1.4. General SCADA equipment

General SCADA equipment encompasses all other items that fall under SCADA operations and maintenance but typically play a support role in maintaining SCADA functionality, including:

- cabinets;
- batteries and solar panels;
- junction boxes;
- antennas; and
- cable supports.

3.2. Asset age profile

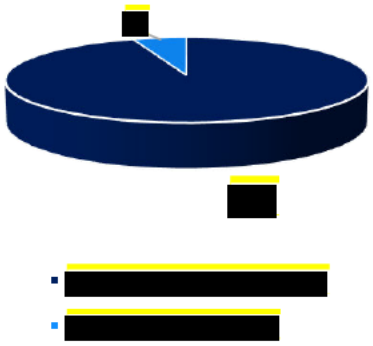
SCADA assets started being installed in the MGN in 1983, when the then owners Gas & Fuel deployed Email Minitran RTUs. In 1989, Microtran RTUs were rolled out throughout the network. Although none of these original RTUs remain, much of the general SCADA equipment supporting the primary assets (such as cabinets and fit out assets) are still in service.

In subsequent years several waves of upgrades, expansion and replacement have taken place including, more recently:

- In 1999 we replaced 65 existing Minitran and Microtran RTUs with Kingfisher RTUs.
- In 2001/02 we replaced 140 low pressure district regulator mechanical time clocks and chart recorders with Kingfisher RTUs as a local programmable logic controller (PLC) and data logger (with no real time communications capabilities).
- In 2003 we installed radio communications at 70 low pressure district regulator RTUs to provide real time SCADA capability.
- In 2004 we installed radio communications at 11 sites with low pressure district regulator RTUs and General Packet Radio Service (GPRS) communications at another 40 sites.
- Over time we have also introduced new SCADA sites through various capacity expansion and augmentation driven projects to provide enhanced control and monitoring capability.

SCADA end of life replacement rates are driven predominantly by obsolescence. RTUs have a technical design life of 10 years. To maintain our SCADA asset fleet within the OEM's technical limits, we would need to replace half of our population each AA period. However, we have prudently deferred replacement of a number of our assets by extending the life of some of our less critical assets through the use of using early retired assets from upgrades sites as spares and spare parts from cannibalised assets[6].

We prioritise the replacement of assets based on risk. Those that have greater impact to network monitoring upon failure are targeted for replacement first. This ensures a balanced and deliverable program of works over the long term to ensure volumes and costs are prudent and efficient.



Currently [redacted] per cent of our RTUs are at or beyond the end of their technical design life. In the next AA period, we will address half of the backlog of the [redacted] RTUs that are beyond the end of their technical design life.

As most general SCADA equipment (such as cabinets and fit out assets) is not critical to the operation of the SCADA system and real time data provision, these assets are replaced on failure, and can be up to 33 years old.

[6] Expenditure associated with the maintenance and repair of RTUs is included as operating expenditure and is not covered by this strategy.

3.3. Asset performance

Electronic components rarely display poor performance indicating wear or age. The age of SCADA equipment is therefore the best indicator of its condition. The older the asset, the more likely it is to fail. Where an asset is beyond the technical design life, there is also limited support and replacement parts for equipment. Having end-of-life and unsupported SCADA, increases the likelihood of the SCADA system failing and a pressure incident affecting the safety and reliability of services to customers.

Radio systems through a combination of performance issues degrade over time reducing the effectiveness and responsiveness of the SCADA system. Faulty systems consume more bandwidth than healthy system and a small number of defective systems can adversely impact as many as 100 SCADA sites.

Table 3-1 provides examples of typical performance issues for SCADA assets.

Table 3-1: Typical performance issues of SCADA and communications assets

Asset	Performance issues
RTUs	• Module failure due to age • Backplane failure due to thermal expansion • Vandalism or third party damage • Environmental damage (e.g.: corrosion of cabinets)
Field end devices	• Transmitter failure or drift • Gas detector failure or drift • Solenoid or limit switch failure • Solenoid brush failure • Actuator failure • Water ingress
Aprissa 4RF Radio	• Interference from other RF sources • Adverse and extreme weather including heat, cold, rain and lightning • Overgrowth of foliage and interruption of line of sight - wet trees will attenuate RF signals • Redevelopment of an area - buildings and structures can block, reflect or ghost RF signals • Antenna alignment and movement - Yagi antennas have large surface areas and can be inadvertently misdirected by wind and vibration causing low RF signal levels • A misbehaving radio site can degrade an entire radio channel

4. Asset management drivers

4.1. Network vision

The network vision informs the way we manage and invest in our assets.

Figure 4-1: Network vision and objectives

When developing our work program and asset management strategies for the MGN network, we consider how the work we conduct and investments we make will help achieve the three key vision objectives outlined in the figure above.

These vision objectives and how they relate to the SCADA work program is summarised in the following sections.

4.1.1. Delivering for customers

Our aim is to continue to deliver customers the service they want and value. This includes keeping people safe from harm, maintaining a reliable gas supply, and providing quality customer service.

The MGN gas distribution and transmission pressure network is located in densely populated areas. This means we have a duty of care to make certain our assets are functioning properly, and that we can detect and prevent any potential safety issues.

Maintaining and investing in our SCADA and communications assets is integral to this, as it improves monitoring and control of pressure in our network (amongst other things) in real time. This in-turn allows us to detect and address issues before they turn into public safety and/or reliability issues such as those that may arise from a network pressure event or the extended response to containment of emergency situations.

4.1.2. A good employer

We strive to be a leader in health and safety by ensuring employees and contractors are mindful of the factors affecting their physical and mental health. This is done through strict health and safety procedures, incentive programs and regular workshops and health screenings.

Wherever practicable and prudent to do so, we aim to apply technologies such as telemetry and remote monitoring, which helps limit our employees' and contractors' exposure to manual and sometimes hazardous network management activities. We also focus on maintaining asset integrity, reducing the risk of leaks and/or failure which carry the potential for harm.

We aim to ensure high employee engagement by keeping employees up to date with relevant town halls and workshops of the entire business. Skills development is also a focus, ensuring both contractors and employees have the relevant skills and requirements for performing their roles.

4.1.3. Sustainably cost efficient

We aim to be sustainably cost efficient in working within benchmarks and still providing benefits to the customer and to shareholders. We intend to ensure natural gas remains a competitive, value-for-money fuel option in line with customer interests and expectations.

The maintenance and replacement strategies outlined in this document are aimed at improving the efficiency of the MGN network – providing the lowest cost of service to network users. We aim to deliver these programs for the lowest practicably sustainable cost, and consider a range of options before committing to a course of action.

We are also mindful of our environmental and social responsibilities, and will test our asset management strategies and work practices against relevant environmental, sustainability and societal obligations.

4.2. Network objectives

We manage the network in line with six asset objectives, which are linked to AGIG's vision and underpin our asset management practices. Achieving these network objectives enables us to provide good customer service, remain a good employer and is sustainably cost efficient.

Table 4-1: Summary of MGN network objectives

Operate and invest in assets to keep the public and MGN's employees safe	MGN will achieve this by: • Investing in and operating the network in line with the Gas Safety Case, zero harm principle and all laws and relevant industry standards; • Managing known risks to as low as reasonably practicable (ALARP); and • Meeting emergency response Key Performance Indicators (KPIs) (call centre, high priority leaks).
Maintain continuity of supply to MGN's customers	MGN will achieve this by: • Meeting network availability KPIs; • Maintaining operating pressures through monitoring and augmenting MGN's network; and • Addressing leaks in line with MGN's leak management plan.

Improve MGN's customers' service experience in line with their expectations	MGN will do this by: • Maintaining accuracy of metering assets within relevant industry standards; • Delivering valued services to customers at the lowest sustainable price; and • Meeting customer KPIs (reliability/outages, safety, complaints, and overall customer satisfaction).
Balance network performance and costs to deliver affordable services	MGN will do this by: • Optimising overall asset lifecycle management costs; • Maintaining operating efficiency without compromising safety and reliability; • Developing investment plans that consider stakeholder expectations; and • Leveraging people, data and technology to deliver continuous improvement.
Promote gas usage to ensure the networks remain sustainable	MGN will achieve this by: • Connecting new greenfield expansion projects in a timely manner; • Enabling new urban infill connections; • Engaging with key stakeholders to develop adequate network solutions for future supply options; • Increasing long term competitiveness of networks through higher asset utilisation; and • Promoting use of gas.
Embrace innovation and work towards net-zero emissions	MGN will achieve this by: • Considering alternative innovative, sustainable and/or lower long-term cost solutions; • Pursuing research and development opportunities where they facilitate us to meet MGN's vision and objectives; and • Supporting the decarbonisation of MGN's gas supplies and the move to smarter gas networks.

4.3. Regulatory requirements

4.3.1. Technical obligations

A functioning SCADA system is vital to AGN meeting its obligations in the Victorian Gas Distribution System Code, which requires us to use all reasonable endeavours to ensure minimum prescribed pressures are maintained at gas delivery points.

SCADA is also critical to providing safe and reliable network service to our customers in accordance with AS 4645 and AS 2885.

SCADA equipment typically has a technical life of around 10 years. We are required to maintain our SCADA equipment in line with AS 3000 and AS 60079, which for example sets the industry standards for the maintenance of electrical equipment in explosive atmospheres.

Our SCADA equipment is also critical to MGN meeting the requirements of the Australian Energy Sector Cyber Security Framework by securely transmitting data from our network.

Given the criticality of SCADA and communications assets, there are a number of standards to adhere to regarding the use of our monitoring and control systems, including:

- Gas Distribution System Code Ver. 14.0;
- AS 4645 – Gas Distribution Network Management;
- AS 2885 series – Pipelines Gas and liquid Petroleum;
- AS 3000 – Electrical Installations;
- AS 60079 – Explosive Atmospheres;
- ACMA Electro Magnetic Radiation ruling; and
- Australian Energy Sector Cyber Security Framework.

4.3.2. Consistency with the National Gas Objective and the National Gas Rules

In developing these forecasts, we have had regard to the National Gas Objective (NGO) and Rule 79/91 and Rule 74 of the National Gas Rules (NGR). With regard to all projects, and as a prudent asset manager/network business, we give careful consideration to whether capex is conforming from a number of perspectives before committing to capital investment.

National Gas Objective

This strategy furthers the NGO by promoting efficient investment in, and efficient operation and use of, natural gas services for the long-term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.

National Gas Rules

We consider the proposed replacement and upgrade programs satisfy the requirements of the following National Gas Rules:

- **NGR 79(1)** – the proposed solution is consistent with good industry practice, several practicable options have been considered, and market rates have been tested to achieve the lowest sustainable cost of providing this service.
- **NGR 79(2)** – the proposed capex is justifiable under NGR 79(2)(c)(i), (ii) and (iii), as it is necessary to maintain and improve the safety of services, maintain the integrity of services and comply with regulatory obligations.
- **NGR 74** – the forecast costs are based on the latest market rate testing and project options considering the asset management requirements as per the latest Asset Management Strategy. The estimate has therefore been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.

4.4. Risk management

Risk management is a constant cycle of identification, analysis, treatment, monitoring, reporting and then back to identification (as illustrated in Figure 4-2). When considering risk and determining the appropriate mitigation activities, we seek to balance the risk outcome with our delivery capabilities and cost implications. Consistent with stakeholder expectations, safety and reliability of supply are our highest priorities.

Figure 4-2: Risk management principles

Our risk assessment approach focuses on understanding the potential severity of failure events associated with each asset and the likelihood that the event will occur. Based on these two key inputs, the risk assessment and derived risk rating then guides the actions required to reduce or manage the risk to an acceptable level.

MGN's risk management framework is based on:

- AS/NZS ISO 31000 Risk Management – Principles and Guidelines;
- AS 2885 Pipelines-Gas and Liquid Petroleum; and
- AS/NZS 4645 Gas Distribution Network Management.

The Gas Act 1997 and Gas Regulations 2012, through their incorporation of AS/NZS 4645 and the Work Health and Safety Act 2012, place a regulatory obligation and requirement on MGN to reduce risks rated high or extreme to low or negligible as soon as possible (immediately if extreme). If it is not possible to reduce the risk to low or negligible, then we must reduce the risk to as low as reasonably practicable (ALARP).

When assessing risk for the purpose of investment decisions, rather than analysing all conceivable risks associated with an asset, we look at credible, primary risk events to test the level of investment required. Where a credible risk event has an overall risk rating of intermediate or higher, we will undertake investment to reduce the risk.

Six consequence categories are considered for each type of risk:

1. **People** – injuries or illness of a temporary or permanent nature, or death, to employees and contractors or members of the public
2. **Environment** (including heritage) – impact on the surroundings in which the asset operates, including natural, built and Aboriginal cultural heritage, soil, water, vegetation, fauna, air and their interrelationships
3. **Supply –** disruption in the daily operations and/or the provision of services/supply, impacting customers
4. **Compliance** – the impact from non-compliance with operating licences, legal, regulatory, contractual obligations, debt financing covenants or reporting / disclosure requirements.
5. **Reputation** – impact on stakeholders' opinion of MGN, including personnel, customers, investors, security holders, regulators and the community
6. **Financial** – financial impact on MGN, measured on a cumulative basis

Note that risk is not the sole determinant of what investment is required. Many other factors such as growth, cost, efficiency, sustainability and the future of the network are also considered when we develop engineering solutions. The risk management framework provides a valuable tool to manage our assets, and prioritise our works program, however it is not designed to provide a binary (yes/no) trigger for investment. As prudent asset managers, we apply our experience and discretion to manage and invest in our distribution networks in the best interests of existing and potential customers.

4.5. Lifecycle management

Lifecycle Management is broken up into four components:

1 Plan and create

2 Operate and maintain

3 Monitor and review

4 Repair, replace, abandon

These are discussed in the following sections.

4.5.1. Plan and create

Planning and creation considers current and future customer growth and load demands, asset performance and service needs, and secures the necessary approvals for expenditure. It includes the creation of new assets to:

- extend the network;
- provide new network, metering and SCADA facilities; and
- augment/upgrade/replace existing assets.

4.5.2. Operate and maintain

Operation and maintenance involves three principal sub-processes. These are described below.

Surveillance and monitoring (inspections)

Routine inspections are carried out as part of the scheduled preventative maintenance cycle for a given site. Nearly all sites are continuously electronically monitored via the RTU, hence failures should be detected as soon as they occur. In some instances, pending failures can be detected and rectification undertaken prior to complete failure of the site.

Radio systems have integrated diagnostic capabilities and are electronically monitored to ensure that the radio systems and site performance exceeds the minimum operating parameters, such as signal strength, frequency drift and transmit power levels.

Below are inspections that occur as a result of inspections of other assets.

- **City Gate station and field regulator sites with SCADA control** - These sites are routinely inspected every four months and receive an operational check every eight months to ensure integrity. Inspections are scheduled to occur between operational checks as part of preventative maintenance.

- **DRS with RTU** - These sites are inspected annually for housing integrity, regulator operation, gas leakage and water ingress in accordance with AS 4645. These sites currently receive two scheduled pressure changes visits coordinated to cater for seasonal demand.
- **DRS with time clock modules and Cello data loggers** - These sites are inspected bi-monthly. The inspection covers housing integrity, regulator operation, gas leakage and water ingress in accordance with AS 4645. These sites receive scheduled pressure changes visits coordinated to cater for seasonal demand.
- **Field regulator sites without SCADA control** - These sites are inspected every six months for housing integrity, regulator operation, gas leakage and water ingress in accordance with AS 4645 and AS 2885.3. Slam Shut panels (where fitted) are checked for correct actuator operation.

Preventive maintenance

Preventive maintenance is performed on SCADA assets during the sites scheduled maintenance. Each site is periodically maintained on a schedule consistent with the importance of that site:

- SCADA control sites are attended annually;
- monitored sites are attended yearly (including Custody Transfer Meters (CTM) in conjunction with upstream provider);
- fringe monitoring sites are attended annually; and
- district regulator RTU's are attended every three years.

Routine maintenance includes:

- visual inspection;
- battery load tests;
- instrumentation calibration checks and recalibration (if outside of nominal tolerance);
- testing and operation of solenoids, actuators and limit switches;
- enclosure maintenance and pest control;
- hazardous area inspection and clearing of any hazards identified (for example water in the pit);
- correction of any defects identified;
- antenna alignment and assessment against the ACMA Electro Magnetic Radiation ruling;
- The motorised actuators are overhauled every three years, with the motor brushes and gearbox bearings being replaced at this time; and
- Recording and reporting of the maintenance visit.

Corrective maintenance - faults and defects

The sites are visited on an 'as needs' basis to perform corrective maintenance as soon as a failure has been detected, usually via an alarm at the control centre. Corrective maintenance is required to be available constantly, however, unless critical in nature, the usual response expectation is attendance by next normal work period.

The SCADA system inherently includes quality of data checks which drives corrective maintenance.

The communications networks used for SCADA include wireless networks and fixed point to point services. Each of these networks and systems are monitored at either a system or site level with diagnostic tools.

Signal levels and radio performance of each RTU site is logged and alarmed if they exceed the nominated thresholds. An underperforming radio can trigger corrective maintenance. Periodic analysis of long term data is performed to identify trends and may trigger additional works at the next scheduled routine maintenance cycle for a site.

The SCADA system routinely reports total communications failure of a site, which usually triggers corrective maintenance on that site.

Critical host SCADA infrastructure (servers, serial converters, radio transmitters etc.) are automatically monitored by application monitoring software (currently HP Open View, soon to be NAGIOS, and by the core application MOSAIC itself). Corrective maintenance and support of the master station / host SCADA is carried out constantly and consistently.

4.5.3. Monitor and review

Monitoring

Monitoring of assets includes the following:

- capacity to meet customer demands for gas, delivered at required flow rates and pressures;
- to highlight existing and emerging issues related to normal aging over time, accelerated aging or new risk issues;
- continuous collection of operational data, trend monitoring for emerging issues and amendment to operational procedures or capital program recommendations post risk analysis;
- auditing to ensure activities and processes comply with required industry standards. The results of both internal and external auditing are reported to management.

Performance measures

Key performance indicators (KPI) have been developed to directly measure the overall response and condition of the SCADA and communications assets. These KPIs have a direct correlation to the quality and reliability of the SCADA monitoring and control systems and have a flow on effect to other MGN KPIs.

Our SCADA KPIs include:

- percentage availability of Mosaic which is a measure of the operational up time expressed as a percentage of the period (usually reported monthly); and
- percentage availability of SCADA communications which is a weighted measure of the availability of all remotely monitored SCADA assets expressed as a percentage of the period (usually reported monthly).

Audits

Key internal audits include the following:

- supervisor monitoring audits;
- verification audits to verify that audits of task related activities provide credible and consistent results; and

- technical facility audits, the findings of which are reported to management through detailed reports.
- MGN audits as required to provide confidence that contractors are operating with due diligence and in compliance with requirements;

Key external audits include the following:

- Regulatory audits conducted by regulators as a means of ensuring that activities performed conform to legislative requirements; and
- Safety Management Plan audits typically conducted by external auditors on particular aspects of safety or operating plans.

Reviews

Reviews include:

- review of real time data;
- review of field reports and assessments;
- review of asset performance, condition and integrity KPI's. These are reviewed on a monthly basis in the monthly operating and management report and annually through, amongst others, the Distribution System Performance Review (DSPR); and
- review of quarterly and annual regulatory reports

4.5.4. Repair, replace, abandon

From time to time, based on assessment, there is a requirement to undertake significant repair, replacement, or abandonment of a SCADA asset.

Equipment is considered for replacement when it is no longer fit for service. This can be either due to age, that is, maintenance parts no longer available, or that the operating criteria has changed and the equipment will no longer perform at a satisfactory standard. Typically, SCADA assets are replaced on age as it is the best indicator of performance of this type of asset.

Where equipment requires refurbishment/repair, it is usually undertaken as a project, especially if it involves a family of equipment located across several sites. Whenever possible, equipment refurbishment is aligned with the scheduled maintenance visits as a means of increasing efficiency.

Equipment is typically only abandoned for example when a SCADA fringe point is relocated or due to obsolescence and the replacement with new technology in a differing location.

4.6. Network adaptation – renewable gas

In line with MGN's objective to support energy sector decarbonisation, our asset management practices consider the introduction of hydrogen into MGN's network. Where practicable, when replacing gas distribution network equipment and components, we purchase parts that are compatible with hydrogen and renewable gas, taking a prudent and incremental approach to making the network 'hydrogen ready'.

This incremental approach allows us to facilitate the energy policy direction to decarbonise Australia's energy sector, and to do so in an efficient manner. Gas transmission and distribution pipelines are among Australia's most important energy transportation systems. It is vital these high value assets keep pace with the energy transition happening right across the country, and we ensure the gas networks are ready to transport renewable gas.

5. Capital program – 2023/24 to 2027/28

5.1. Program overview

The SCADA and communications capital program for 2023/24 to 2027/28 has three components:

1 End of life RTU replacement

2 Hazardous area upgrades

3 Network monitoring

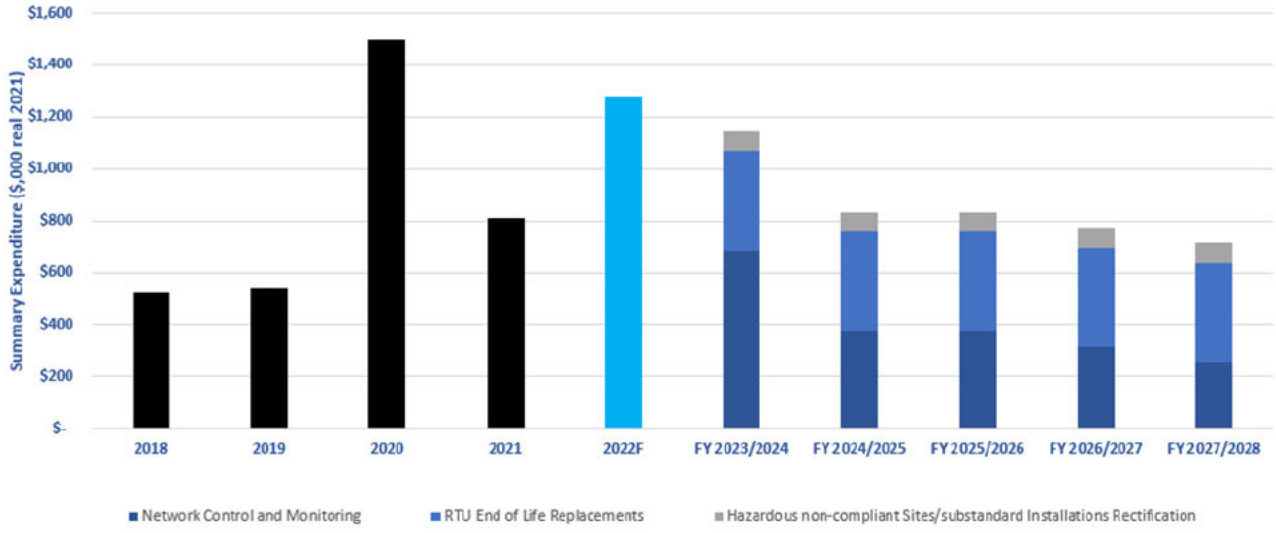
Table 5-1 summarises the proposed expenditure on these three programs. Capex allocation is captured within the AER regulatory accounts 'SCADA' category.

Table 5-1: Capital Expenditure Summary

Program	2023/24	2024/25	2025/26	2026/27	2027/28	Total
End of life RTU replacement	384	384	384	384	384	1,920
Hazardous area upgrades	75	75	75	75	75	373
Network monitoring	686	372	372	314	255	2,000
Total	**1,145**	**831**	**831**	**773**	**714**	**4,293**

Figure 5-1 shows how this proposed investment compares with that undertaken over the last five years.

Figure 5-1: Forecast expenditure - SCADA and communications program by activity ($'000 real 2021)



A functioning SCADA system is vital to MGN meeting its obligations in the Victorian Gas Distribution System Code, which requires us to use all reasonable endeavours to ensure minimum prescribed

pressures are maintained at gas delivery points.[7] SCADA is also critical to providing safe and reliable network service to our customers in accordance with AS 4645, AS 2885 AS 3000 and AS 60079.

Unit rates are based on the latest market-tested prices, updated to reflect recent price increases in copper, electronics, labour and materials experienced across Australia in the wake of the COVID-19 pandemic. Forecasts costs reflect recent vendor estimates where available.

The delivery program is smoothed over the period, and reflects a prudent and deliverable rate of replacement. Asset replacement is prioritised by risk, with the riskiest/poorest condition assets being targeted for replacement first.

5.2. Customer and stakeholder engagement

MGN is committed to operating the network in a manner that is consistent with the long-term interests of our customers. To facilitate this, we conduct regular stakeholder engagement to understand and respond to the priorities of our customers and stakeholders. Feedback from stakeholders is built into our asset management considerations and is an important input when developing and reviewing our expenditure programs.

Our customers have told us their top three priorities are price/affordability, reliability of supply, and maintaining public safety. The asset management activities outlined in this strategy are primarily associated with maintaining reliability of supply at the lowest practicable cost.

Our customers rely on a continuous gas supply to be able to heat their homes and operate their businesses. Any disruption to supply can adversely impact residential customers, and carry significant financial consequences for our industrial and commercial customers. With this in mind, our SCADA strategy is designed to minimise the risk of disruption to customer supply by providing network visibility and control capability to our operators which in turn allows us to detect issues before they result in asset failures and/or supply interruptions.

5.3. Delivery capacity

The program of works has been designed to be resource neutral. While there is a forecast uplift in RTU end of life replacement works, this is offset by reductions in the network monitoring and control program. As these programs use the same skills and experience, we expect our primary contractor will be able to manage the program with existing resources.

5.4. Estimating efficient costs

These costs are developed using actual costs and the standardized approach through MGN's Operation, Maintenance and Services Agreement (OMSA), in place with its field services provider. The unit rates assumed in this program are based on the latest market rates, updated to reflect current higher costs for copper, electronics and other materials resulting from the pandemic-driven supply issues experienced globally.

These costs are inclusive of end-to-end delivery of all field works, MGN approved sub-contractors, any materials and other procurement costs and SAP (asset data) updates.

The forecast cost breakdown is shown in the table below.

[7] Gas Distribution System Code, Ver 14.0, p 52

Table 5-2: Forecast capex – SCADA, $'000 real 2021

	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Labour	687	499	499	464	429	2,576
Materials	458	332	332	309	286	1,717
Total	**1,145**	**831**	**831**	**773**	**714**	**4,293**

Tables may not sum due to rounding

5.5. End of life RTU replacement program

5.5.1. Program summary

MGN has installed Kingfisher RTUs in the network since 1999 (Series II and more recently PLUS+). These RTUs have an OEM technical design life of 10 years. At December 2021, we have [redacted] Kingfisher RTUs in the network that are over ten years old and at the end of life, and are becoming increasingly unreliable.

In addition, the OEM – CSE Semaphore[8] advised us the Kingfisher Series II PC1 module, which is the most extensively used module on the network, will no longer be produced or supported from a technical perspective.

Of the [redacted] obsolete RTUs, [redacted] will be redundant and decommissioned along with the associated low pressure mains. We plan to replace the remaining [redacted] RTUs with the new Kingfisher CP-35 RTU[9] in a delivery smoothed profile, replacing [redacted] per annum over the next AA period, then [redacted] over the following AA period.

This balanced program of work is possible due to the size of our fleet allowing sufficient spares to replace faulty units to smooth the delivery profile over the next five years.

Table 5-3: End of life RTU replacement program, $'000 real 2021

	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Expenditure	**384**	**384**	**384**	**384**	**384**	**1,920**

It is prudent to replace all the RTUs with the proposed more modern RTUs as keeping the ageing and obsolete Kingfisher PC1's on the network degrades SCADA network reliability and increases operational maintenance costs.

MGN utilises a panel of approved sub-contractors to market test and ensure a competitive price for the program. This expenditure listed above is reflective of this process.

[8] CSE Semaphore: https://www.servelec-group.com/technologies/
[9] MGN has decided to go with the Kingfisher CP-35. This is because the technology is compatible with some existing PC1 hardware, minimising the cost of the upgrade and allowing us to maximise the utility of our existing hardware, and the technology supports secure device management protocols, logical access control and logging capabilities, facilitating improved cyber security.

This option achieves a good balance of both being cost effective and risk reduction. Aside from this option, MGN has considered

- Replacing these assets in conjunction with various other SCADA related projects as they arise
- Replace the assets at an accelerated rate

5.5.2. Recommended option

A summary of options considered for end of life RTU replacement is provided in 0.

The recommended option is to install [redacted] new RTUs over the next five years as the most prudent option because it will:

- minimise the risk of the SCADA system failing, leading to a pressure related event, and the associated safety and operational impacts;
- maintain visibility of key network assets to allow timely diagnosis and rectification of network and asset performance issues before problems arise;
- maintain pressure control of existing controlled SCADA sites to prevent pressure incidents to maintain the safety and reliability of services to customers;
- provide visibility of our critical network assets, allowing us to maintain the risk of those assets failing at 'as low as reasonably practicable' (ALARP)
- ensure all critical SCADA assets are technically supported by the manufacturer thereby reducing the risk of unresolvable asset failure and reactive replacement;
- replace end of life assets with the contemporary equivalent which in most cases has significantly improved functionality;
- improve our compliance with safety and reliability standards (AS 4645, 2885 and 60079, GDS code etc.), good industry practice, and our Asset Management Strategy;
- provide critical information about our network assets to allow prudent and efficient investment in our network over the long term;
- provide a deliverable solution; and
- provide the most cost effective option consistent with our vision of deliver for customers and will support lower overall costs of delivering services which is sustainably cost efficient and in the long term interests of customers.

5.6. Hazardous area upgrades program

5.6.1. Program summary

Like all other assets, our SCADA assets must meet certain safety standards, importantly including those related to electrical equipment within a gas/air environment under AS 60079 (hazardous area requirements). There is a significant lack of granularity of the various components that comprise SCADA assets within the SCADA data management system. This means it is unclear to what degree our SCADA sites are compliant, and makes a desktop study of site compliance with safety standards ineffectual.

Instead, while we are performing other SCADA works, we assess the primary SCADA equipment, auxiliary equipment and general SCADA equipment at each site to assess compliance. As part of the broader SCADA program of works, the site if determined to be hazardous, is rectified and made compliant. Remedial work at these non-compliant sites is varied, and can include rectification of the following non-compliant assets:

- RTU cabinets and antennas;
- auxiliary pipework at field regulators;
- solenoids; and
- switches.

In addition, we:

- update RTUs with 'Failsafe Code' to the new standardised 'Failsafe Diagnostic Code';
- review and update all site-specific drawings, and standard drawings to reflect any changes;
- review and update all SAP information to reflect current conditions; and
- review and update all site-specific Hazardous Area Dossiers to reflect any changes.

The site selection and type of work is reactive in nature, as it is based on the physical site assessment. As part of our regular SCADA program of works we attend on average ten SCADA sites per year[10] and therefore will assess and remediate various aspects of each.

An allowance is required for site rectification work, which will be applied, as required, to SCADA projects as they are carried out. We have based the forecast expenditure on an average of the historical actual cost of SCADA site remediation works undertaken in the current AA period.

It should be highlighted these works are discrete from the upgrades that would have to be made as a result of the injection of hydrogen into the MGN network. [11]

Table 5-4: Hazardous area upgrades program, $'000 real 2021

	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Expenditure	**75**	**75**	**75**	**75**	**75**	**373**

5.6.2. Recommended option

A summary of options considered for the hazardous area upgrades program is provided in Appendix B.

The option to assess and rectify [redacted] SCADA sites each year over the AA period is the most prudent option because it:

[10] We note there will be an increase in the number of SCADA sites visited in the next AA period due to the end of life RTU replacement program. However, we have not increased the volume of hazardous area upgrades commensurately as we do not expect all sites to require hazardous area remediation.
[11] Upgrades to SCADA sites not considered within this strategy as part of prudent work required as a result of the injection of hydrogen into the network are included in the Hydrogen strategy and MGN plan (MG-SP-0016)

- manages the risk of non-compliance with safety standards and reduces the risk of public and employee safety incidents;
- addresses non-compliant SCADA sites in the most efficient manner through physical site inspection bundled as part of broader SCADA works;
- is forecast based on the:
  - average historical site remediation cost;
  - average number of SCADA sites visited per year;
- is consistent with MGN's vision;
- is deliverable, as evidenced by the historical number of sites remediated in the current AA period.

5.7. Network monitoring program

5.7.1. Program summary

The effective operation of our SCADA system is required to ensure we have visibility of the network. In turn this improves our ability to manage our assets in a safe and reliable way, and address any issues on the network as they arise. The information provided through our SCADA system is also used in planning future investments to allow us to prudently invest in our network, and is crucial to our mandatory compliance and operational reporting activities.

The forecast network monitoring program for 2023/24 to 2027/28 is the continuation of a well established program of work expanding the amount of real-time information we have for use in monitoring and subsequently controlling pressure in our network.

The program of work outlined in Table 5-5 allows for:

- the continuation of the pressure monitoring and vortex flow meter installation programs at historical rates; and
- the installation of gas detectors over the next five years.

Table 5-5: Summary of network monitoring program 2023/24 to 2027/28, $'000 real 2021

Activity	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Network monitoring	280	200	200	200	200	1,080
Flow metering	351	117	117	58	-	643
Gas detector installation	56	56	56	56	56	280
Total expenditure	**687**	**373**	**373**	**314**	**256**	**2,003**

5.7.1.1. Network monitoring

A functioning SCADA system is vital to MGN meeting its obligations in the Victorian Gas Distribution System Code which requires us to use all reasonable endeavours to ensure minimum prescribed pressures are maintained at gas delivery points. To meet these requirements, MGN uses a mix of

permanent SCADA sites, and permanent and temporary data loggers across the network, depending on requirements, including for:

- winter testing;
- monitoring of fringe of grid sites;
- monitoring of pressure regulating stations; and
- assessing individual consumer supply reliability issues.

MGN uses fixed location SCADA RTU's where pressure monitoring is required at higher frequencies, and/or where real time information is critical. Historically, each year MGN has budgeted for [redacted] new fixed network SCADA fringe RTU sites dedicated to specific networks. In recent years, to mitigate fixed RTU installation costs, MGN has also pursued investment in lower cost portable data loggers for temporary monitoring of fringe locations of concern. Due to the flexibility of these loggers, they are also able to be used during winter testing, at specific station sites that are not SCADA monitored and also at specific customer premise sites where supply issues have been reported. As such, historical allowance has been made for [redacted] new portable data loggers per year for use as required, at strategic sites across the network, which can be readily relocated at low cost[12].

It is proposed to continue this program at the historical rate to ensure we can continue to meet our compliance obligations to maintain pressure in the network. This is particularly important where these sites are not currently monitored, or where the more efficient temporary monitoring via data logging may show value in the installation of a more permanent SCADA solution.

In the next AA period, we will also focus on increasing visibility of our medium pressure network through the installation of new monitoring arrangements across [redacted] regulator sites. While SCADA can provide both monitoring and control capabilities, we consider it prudent to only introduce monitoring capability at this time. Should our greater visibility of these areas of the network demonstrate control is beneficial and cost effective, we will seek to upgrade these sites in the future.

Due to this ongoing assessment and ongoing program of pressure monitoring works, in 2023/24 we propose to only install two new fixed SCADA sites at the fringe of our grid. These sites are: [redacted] and in the vicinity of [redacted]

Unit costs are market tested estimates from the service provider. Program expenditure is estimated as shown in Table 5-6.

Table 5-6: Network monitoring program, $'000 real 2021

Activity		2023/24	2024/25	2025/26	2026/27	2027/28	Total
MP SCADA sites	Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Expenditure	106	106	106	106	106	530
Data loggers	Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Expenditure	94	94	94	94	94	470

[12] [redacted]

Activity		2023/24	2024/25	2025/26	2026/27	2027/28	Total
Fringe points	Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Expenditure	80	-	-	-	-	80
Total expenditure		**280**	**200**	**200**	**200**	**200**	**1,080**

5.7.1.2. Flow metering

Flow metering is essential in understanding the network because it provides information on the:

- consumption of gas at certain injection points, which allows us to plan works that will mitigate the risk of supply loss due to below standard pressure;
- seasonal behaviour of the network and alter network boundaries to utilise gas from other injection points where required;
- whether a regulating station is close to capacity, allowing us to plan pre-emptive maintenance works to prevent regulator failures and emergency situations; and
- network flows to calibrate our distribution models to accurately determine the most cost-efficient mix of network capital expenditure.

Vortex or wafer cone flow meters (shown in Figure 5-2) are ideal assets for flow monitoring as they require minimal upstream or downstream pipe runs and can be installed almost anywhere in a network. It is also ideal for small size lines, and with no moving parts, no replacement parts or scheduled maintenance, this type of flow meter offers the most cost efficient option.

Figure 5-2: Vortex Flowmeter

The program of flow meter installations is driven by the number and schedule of supply regulator replacements and regulator capacity upgrades. We will install [redacted] flow meters over the next AA period, aligned with the works described in:

- MG-PL-0002 Network Capacity Strategy; and
- MG-SP-0003 Supply Regulator Strategy.

Unit costs are market tested estimates from the service provider. Program expenditure is estimated as shown in Table 5-7.

Table 5-7: Flow meter installation, $'000 real 2021

	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Volume						
Expenditure	**351**	**117**	**117**	**58**	**-**	**643**

5.7.1.3. Gas detector installation

Electronic gas detectors can reduce the risk from, and improve response to, gas escapes. They are an early warning device for potentially explosive atmospheres in pressure reducing stations. The focus has been on the installation of these detectors at sites deemed to be in proximity to population or nearby development. This is especially important in urbanised areas where there is slow encroachment on surrounding land where regulating pits are stationed (e.g. road widenings and footpaths). The installations will provide automated gas detection alarms for the control centre upon any significant build-up of gas.

The Seiger Searchline Infra Red Point Gas Detectors are the preferred equipment for use in regulator pits. They are robust units capable of less than three second responses under normal operating conditions, range of 0 to 5 lower explosive limit (LEL) and its high sensitivity allows for low alarm set points. MGN have responds to any anomalies in gas detector readings as follows:

- 1-2% LEL: No response
- 40% LEL: Response next business day
- 75% LEL: Immediate response

Figure 5-3 shows examples of gas detectors used in the network.

Figure 5-3: Examples of gas detectors

Included in the installation of gas detectors is the:

- installation and termination of cabling at site pit;
- correct termination of all new equipment;
- provision of an updated SIOS;
- liaison with RTS for updated RTU code/configuration files;
- liaison with RTS for screen display changes and commissioning;
- loading of software;

- full commissioning and end to end testing of the RTU and associated equipment;
- post-installation checking of RTU and settings;
- update of drawings to suit the MGN drafting standards and templates;
- update of the site" Hazardous Area Dossier";
- update of the SAP equipment details; and
- site clean-up.

The forecast work program is based on historical actual volumes and unit rates.

Table 5-8: Gas detector installation program, $'000 real 2021

	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Expenditure	**56**	**56**	**56**	**56**	**56**	**280**

[redacted]

5.7.2. Recommended option

A summary of options considered for the network monitoring program is provided in Appendix C.

The network monitoring program is the most prudent option because it:

- is necessary to maintain the integrity of services;
- manages the risk of non-compliance with safety standards and reduces the risk of public and employee safety incidents;
- allow us to continue to meet existing or increasing levels of demand by providing us with enough data to appropriately plan network augmentations and drive network pressures;
- provides an overall economic benefit by automating manual, labour intensive processes thus reducing opex;
- is forecast based on the:
  - average historical unit rates;
  - average number of units per annum;
- is the most cost effective option consistent with our vision of deliver for customers and will support lower overall costs of delivering services which is sustainably cost efficient and in the long term interests of customers; and
- is deliverable, as evidenced by the historical number of sites remediated in the current AA period.

Appendix A End of life RTU replacement program – options analysis

A.1 Options considered

We considered the following options to manage the backlog of end of life RTUs in the network:

- Option 1 – Replacing end of life RTUs over the next 10 years to allow the use of salvaged and spare parts
- Option 2 – Replacing all end of life RTUs over the next five years
- Option 3 – Reactively replacing failed RTUs

Each of these options are discussed in the following sections.

A.1.1 Option 1 - Replacing RTUs over the next 10 years

This is the preferred option as outlined with the main body of this strategy.

Cost assessment

Table Appendix 1: Option 1 – End of life RTU replacement program 2023/24 to 2027/28, $'000 real 2021

	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Expenditure	**384**	**384**	**384**	**384**	**384**	**1,920**

Risk assessment

The primary risk event identified for end of life RTUs is equipment failure, coinciding with a failure in the facility, which would go undetected as a result. The undiagnosed failure of a primary supply regulator facility or other strategic asset, or pressure excursion can interrupt supply to tens of thousands of customers, or in severe cases, can lead to an overpressure incident that has the potential to cause serious injury.

The untreated risk[13] rating is presented in the table below.

Table Appendix 2: End of life RTU risk assessment – untreated risk

	MGN Operational Risk Matrix						Overall risk
Untreated risk	**People**	**Supply**	**Environment**	**Reputation**	**Financial**	**Compliance**	
Frequency	Remote	Remote	Remote	Remote	Remote	Remote	Intermediate
Severity	Major	Major	Minor	Severe	Severe	Severe	
Risk Level	Intermediate	Intermediate	Negligible	Low	Low	Low	

In certain circumstances, SCADA equipment failure can result in an over pressure incident that may cause a major safety incident causing serious permanent injury, or supply interruption to >1,000 customers. This gives rise to a risk likelihood of remote and a consequence of major. As a result, the overall untreated risk rating is Intermediate.

[13] Untreated risk is the risk level assuming there are no risk controls currently in place. Also known as the 'absolute risk'.

This would also result in a severe compliance risk as we would not be compliant with our regulatory obligations under the Gas Distribution System Code, AS4645, AS2885, AS3000, AS60079 and a number of other SCADA related standards. There is potential for MGN to be found in breach of its operating licence, with significant punitive measures from Energy Safe Victoria (ESV).

The preferred option reduces the risk to an acceptable level, is aligned to good industry practice and maximises asset integrity and life. This option is consistent with the requirements of our risk management framework, and meets the test of a prudent asset manager/network business.

Table Appendix 3: Risk assessment – End of life RTU replacement Option 1

	MGN Operational Risk Matrix						Overall risk
Option 1	**People**	**Supply**	**Environment**	**Reputation**	**Financial**	**Compliance**	
Frequency	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Low
Severity	Minor	Minor	Minor	Trivial	Trivial	Minor	
Risk Level	Low	Low	Low	Negligible	Negligible	Low	

Alignment with vision objectives

The following table shows how Option 1 aligns with our vision objectives.

Table Appendix 4: Alignment with vision – End of life RTU replacement Option 1

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	Y
Delivering for Customers – Customer Service	Y
A Good Employer – Health and Safety	Y
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	Y
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	Y

This option would align with the MGN objective of *Delivering for Customers*, as it would address the public safety and reliability risks associated with a significant failure of the SCADA system leading to an undiagnosed failure of a primary supply regulator facility with potential for network pressure event or the extended response to containment of emergency situations.

Option 1 would also align with the MGN objective of remaining *Sustainably Cost Efficient* as it is the least cost option of addressing the high risk associated with end of life RTUs. It is also consistent with industry standards as conforms to the requirements of the Victoria Gas Distribution System Code. It is therefore consistent with MGN's objective of working within industry benchmarks.

A.1.2 Option 2 – Replacing all end of life assets over the next 5 years

The option is similar to the preferred option, but replaces all [redacted] end of life RTUs in the next five years.

Cost assessment

Table 5-10: Option 2 – End of life RTU replacement program 2023/24 to 2027/28, $'000 real 2021

	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Expenditure	**942**	**942**	**942**	**907**	**907**	**4,639**

Risk assessment

This option reduces the risk from intermediate to low, the same as the preferred option (Option 1). However, the risk reduction is achieved sooner.

The residual risk outcomes are shown in the table below.

Table Appendix 5: Risk assessment – End of life RTU replacement Option 2

	MGN Operational Risk Matrix						Overall risk
Option 2	**People**	**Supply**	**Environment**	**Reputation**	**Financial**	**Compliance**	
Frequency	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Low
Severity	Minor	Minor	Minor	Trivial	Trivial	Minor	
Risk Level	Low	Low	Low	Negligible	Negligible	Low	

Alignment with vision objectives

The following table shows how Option 2 aligns with our vision objectives.

Table Appendix 6: Alignment with vision – End of life RTU replacement Option 2

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	Y
Delivering for Customers – Customer Service	Y
A Good Employer – Health and Safety	Y
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	N
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	Y

Option 2 aligns with our objectives of *Delivering for Customers*, and being *A Good Employer*, as it addresses the safety and supply risks associated with these assets.

However, this option would not be consistent with our objective to be *Sustainably Cost Efficient*, as the cost is significantly greater than Option 1, while not delivering a materially better risk outcome. Further, the larger program is near the limit of our delivery capability, which may attract a premium if the replacement rates fall behind and we need to catch up.

A.1.3 Option 3 – Reactively replacing failed RTUs

Not replacing RTUs at their end of life was considered.

Cost assessment

There is no capital cost associated with this option, however reactive maintenance costs would escalate, and should RTU modules require replacement urgently, this would significantly increase the replacement cost.

While it is not possible to estimate precisely how many asset failures will occur during the next five years, broad cost estimates can be developed based by escalating the cost of the proposed works program if delivered reactively. It is a generally accepted asset management principle that delivery of works reactively is significantly more expensive that undertaking proactive or preventative works. Various sources cite the increase in reactive costs compared with proactive can be between two and five times[14] more than undertaking the same works proactively.

Risk assessment

This option is an intermediate-risk option that can interrupt supply to tens of thousands of customers, or in severe cases, can lead to an overpressure incident that has the potential to cause serious injury.

This would also result in a severe compliance risk as we would not be compliant with our regulatory obligations under the Gas Distribution System Code, AS4645, AS2885, AS3000, AS60079 and a number of other SCADA related standards. There is potential for MGN to be found in breach of its operating licence, with significant punitive measures from Energy Safe Victoria (ESV).

Essentially, Option 3 would do little or nothing to address the untreated risk and is therefore not a prudent course of action.

Table Appendix 7: End of life RTU replacement Option 3

	MGN Operational Risk Matrix						Overall risk
Option 3	**People**	**Supply**	**Environment**	**Reputation**	**Financial**	**Compliance**	
Frequency	Remote	Remote	Remote	Remote	Remote	Remote	Intermediate
Severity	Major	Major	Minor	Severe	Severe	Severe	
Risk Level	Intermediate	Intermediate	Negligible	Low	Low	Low	

Alignment with vision objectives

The following table shows how Option 3 aligns with our vision objectives

Table Appendix 8: Alignment with vision – End of life RTU replacement Option 3

Vision objective	Alignment
Delivering for Customers – Public Safety	N
Delivering for Customers – Reliability	N
Delivering for Customers – Customer Service	N
A Good Employer – Health and Safety	N

[14] Marshall Institute, Omega engineering, ARMS reliability.

Vision objective	Alignment
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	N
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	N

Option 3 does not align with any of our vision objectives. Any short-term financial benefits resulting in saved capital expenditure would result in significant increases in future costs, as well as creating unacceptable risks to the network.

We would be operating areas of the network in non-compliance to AS/NZS 2885.1 and/or AS/NZS 4645.1, and in doing so we would fail NGR79 2(c)(iii), and also be at risk of punitive measures from ESV.

Appendix B Hazardous area upgrades program – options analysis

B.1 Options considered

We considered the following options to manage the remediation of hazardous areas in the network:

- Option 1 – Continuing the program to remediate hazardous areas identified as part of site visits under other SCADA programs
- Option 2 – Conducting a desktop assessment of all SCADA sites and planning and delivering a proactive remediation program

Each of these options are discussed in the following sections.

B.1.1 Option 1 – Continuing reactive remediation of hazardous areas

This is the preferred option as outlined with the main body of this strategy.

Cost assessment

Table Appendix 9: Option 1 - Hazardous area upgrades program 2023/24 to 2027/28, $'000 real 2021

	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Volume	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Expenditure	**75**	**75**	**75**	**75**	**75**	**373**

Risk assessment

The primary risk MGN is addressing in relation to this program is that undetected issues with electrical equipment within a gas/air environment (hazardous area). This coupled with a gas leak result in the potential for ignition resulting in fatality or permanent injury and/or loss of supply to >1,000 customers.

This would also result in a major compliance risk as we would not be compliant with our regulatory obligations under the Gas Distribution System Code, AS4645, AS2885, AS3000 and AS60079. There is potential for MGN to be found in breach of its operating licence, with significant punitive measures from Energy Safe Victoria (ESV).

This gives rise to a risk likelihood of unlikely and a consequence of severe. As a result, the overall untreated risk is intermediate.

The untreated risk[15] rating is presented in the table below.

Table Appendix 10: Hazardous area upgrades program risk assessment – untreated risk

	MGN Operational Risk Matrix						Overall risk
Untreated risk	**People**	**Supply**	**Environment**	**Reputation**	**Financial**	**Compliance**	
Frequency	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Intermediate
Severity	Severe	Trivial	Trivial	Minor	Trivial	Severe	
Risk Level	Intermediate	Negligible	Negligible	Low	Negligible	Intermediate	

[15] Untreated risk is the risk level assuming there are no risk controls currently in place. Also known as the 'absolute risk'.

The preferred option reduces the risk to an acceptable level, is aligned to good industry practice and is the most cost-efficient way of addressing the risk. This option is consistent with the requirements of our risk management framework, and meets the test of a prudent asset manager/network business.

Table Appendix 11: Risk assessment – Hazardous area upgrades Option 1

	MGN Operational Risk Matrix						Overall risk
Option 1	**People**	**Supply**	**Environment**	**Reputation**	**Financial**	**Compliance**	
Frequency	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Low
Severity	Minor	Minor	Minor	Trivial	Trivial	Minor	
Risk Level	Low	Low	Low	Negligible	Negligible	Low	

Alignment with vision objectives

The following table shows how Option 1 aligns with our vision objectives.

Table Appendix 12: Alignment with vision – End of life RTU replacement Option 1

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	Y
Delivering for Customers – Customer Service	-
A Good Employer – Health and Safety	Y
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	Y
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	Y

This option would align with the MGN objective of *Delivering for Customers*, as it would address the public safety and reliability risks associated with undetected issues with electrical equipment in a hazardous area, coupled with a gas leak resulting in the potential for ignition.

This option provides for the electrical safety of our operatives and the general public and therefore is consistent with being *A Good Employer*.

Option 1 would also align with the MGN objective of remaining *Sustainably Cost Efficient* as it is the least cost option of addressing the high risk associated with undetected electrical issues in hazardous areas. It is also consistent with industry standards as conforms to the requirements of the Victoria Gas Distribution System Code. It is therefore consistent with MGN's objective of working within industry benchmarks.

B.1.2 Option 2 – Conducting physical site assessments and establishing a planned remediation program

This program involves attending each of the [redacted] SCADA sites across the network and assessing them against the hazardous area requirements in AS 60079, then developing a planned, prioritised remediation program of works over the next several AA periods.

As we do not have a view of the assets requiring remediation, we are unable to develop a cost estimate for this program of work. However, we estimate the cost of the physical site assessment alone would be in the order of [redacted] per site, meaning the assessment alone would cost $600,000 and take almost 3 months.

The remediation works are expected to be undertaken at the same or higher cost as under the preferred option (Option 1), as they are currently bundled with other SCADA programs reducing the number of site visits, achieving economies of scope.

Risk assessment

This option reduces the risk from intermediate to low, the same as the preferred option (Option 1), however reduces the risk quicker. The residual risk outcomes are shown in the table below.

Table Appendix 13: Risk assessment – Hazardous area upgrades program Option 2

	MGN Operational Risk Matrix						Overall risk
Option 1	**People**	**Supply**	**Environment**	**Reputation**	**Financial**	**Compliance**	
Frequency	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Low
Severity	Minor	Minor	Minor	Trivial	Trivial	Minor	
Risk Level	Low	Low	Low	Negligible	Negligible	Low	

Alignment with vision objectives

The following table shows how Option 2 aligns with our vision objectives.

Table Appendix 14: Alignment with vision – Hazardous area upgrades program Option 2

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	Y
Delivering for Customers – Customer Service	-
A Good Employer – Health and Safety	Y
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	Y
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	Y

Option 2 aligns with our objectives of *Delivering for Customers*, and being *A Good Employer*, as it addresses the safety and supply risks associated with these assets.

However, this option would not be consistent with our objective to be *Sustainably Cost Efficient*, as the cost is expected to be higher than Option 1, while not delivering a materially better risk outcome.

Appendix C Network monitoring program – options analysis

C.1 Options considered

The following options have been identified to address the risk associated with limited visibility of the MGN network:

- Option 1 – Continue network monitoring at strategic sites on the network
- Option 2 – Do nothing

Each of these options are discussed in the following sections.

C.1.1 Option 1 – Continue network monitoring at strategic sites on the network

This is the preferred option as outlined with the main body of this strategy.

Cost assessment

Table Appendix 15: Option 1 – Network monitoring program 2023/24 to 2027/28, $'000 real 2021

Activity	2023/24	2024/25	2025/26	2026/27	2027/28	Total
Network monitoring	280	200	200	200	200	1,080
Flow metering	351	117	117	58	-	643
Gas detector replacement	56	56	56	56	56	280
Total expenditure	**686**	**372**	**372**	**314**	**255**	**2,000**

Risk assessment

The primary risk event identified for insufficient network monitoring is the inability for MGN to detect a pressure related event or failure of a primary supply regulator facility or other strategic asset, which could interrupt supply to customers for an extended period, or in severe cases, can lead to an overpressure incident that has the potential to cause serious injury.

The untreated risk associated with this program is intermediate primarily based on the supply and compliance risk a lack of network monitoring may cause. An adequately monitored network is consistent with good practice, and is a prudent a relatively low cost program that will improve our asset management and investment decision capabilities.

The untreated risk[16] rating associated with insufficient network monitoring is shown in the table below.

[16] Untreated risk is the risk level assuming there are no risk controls currently in place. Also known as the 'absolute risk'.

Table Appendix 16: Risk rating – untreated risk

Untreated risk	MGN Operational Risk Matrix						Overall risk
	People	Supply	Environment	Reputation	Financial	Compliance	
Frequency	Remote	Frequent	Remote	Unlikely	Remote	Frequent	Intermediate
Severity	Major	Minor	Minor	Minor	Trivial	Minor	
Risk Level	Intermediate	Intermediate	Low	Low	Negligible	Intermediate	

Option 1 does not reduce the overall risk, but does reduce the supply and compliance risk from intermediate to low by lowering the likelihood of supply and compliance risks from frequent to unlikely.

The preferred option reduces the risk to an acceptable level, is aligned to good industry practice and maximises asset integrity and life. This option is consistent with the requirements of our risk management framework, and meets the test of a prudent asset manager/network business.

Table Appendix 17: Risk rating – Network monitoring program Option 1

Option 1	MGN Operational Risk Matrix						Overall risk
	People	Supply	Environment	Reputation	Financial	Compliance	
Frequency	Unlikely	Unlikely	Occasional	Occasional	Occasional	Occasional	Low
Severity	Minor	Minor	Minor	Trivial	Trivial	Minor	
Risk Level	Low	Low	Low	Low	Low	Low	

Alignment with vision objectives

The following table shows how Option 1 aligns with our vision objectives.

Table Appendix 18: Alignment with vision – Option 1

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	Y
Delivering for Customers – Customer Service	Y
A Good Employer – Health and Safety	Y
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	Y
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	Y

Option 1 would align with our objective of *Delivering for Customers*, as it would address the security of supply and reliability risks associated with ineffective network monitoring capability in the network. It will reduce the risk of pressure deviations (either high or low) not being identified, with potential for network pressure event or the extended response to containment of emergency situations.

Option 1 would also align with our objective of remaining *Sustainably Cost Efficient* as it is the least cost option of addressing the risks associated with not ineffective monitoring of the network. It is also consistent with industry standards and conforms to the requirements of the Victorian Gas Distribution Code and industry standards, and is therefore consistent with our objective of working within industry benchmarks.

C.1.2 Option 2 – Do nothing

This option would see the ongoing network monitoring program of works cease. Under this option, network performance would deteriorate over time as a result of non-continuous monitoring. Under Option 2 there remains the potential for network faults and under/over pressure events to go undetected.

Cost assessment

There are no additional upfront costs associated with this option beyond what is incurred as part of ongoing surveying/maintenance of existing assets. However, insufficient network monitoring can lead to undetected asset faults, including pressure related events resulting in reactive repairs or mains isolation, and or a supply event.

A reactive replacement resourcing approach is significantly more costly.

Risk assessment

Option 2 would result in the same level of risk as the untreated risk rating.

Table Appendix 19: Risk assessment – Network monitoring program Option 2

	MGN Operational Risk Matrix						Overall risk
Option 2	**People**	**Supply**	**Environment**	**Reputation**	**Financial**	**Compliance**	
Frequency	Remote	Frequent	Remote	Unlikely	Remote	Frequent	Intermediate
Severity	Major	Minor	Minor	Minor	Trivial	Minor	
Risk Level	Intermediate	Intermediate	Low	Low	Negligible	Intermediate	

Alignment with vision objectives

The following table shows how Option 2 aligns with our vision objectives.

Table Appendix 20: Alignment with vision – Network monitroing program Option 2

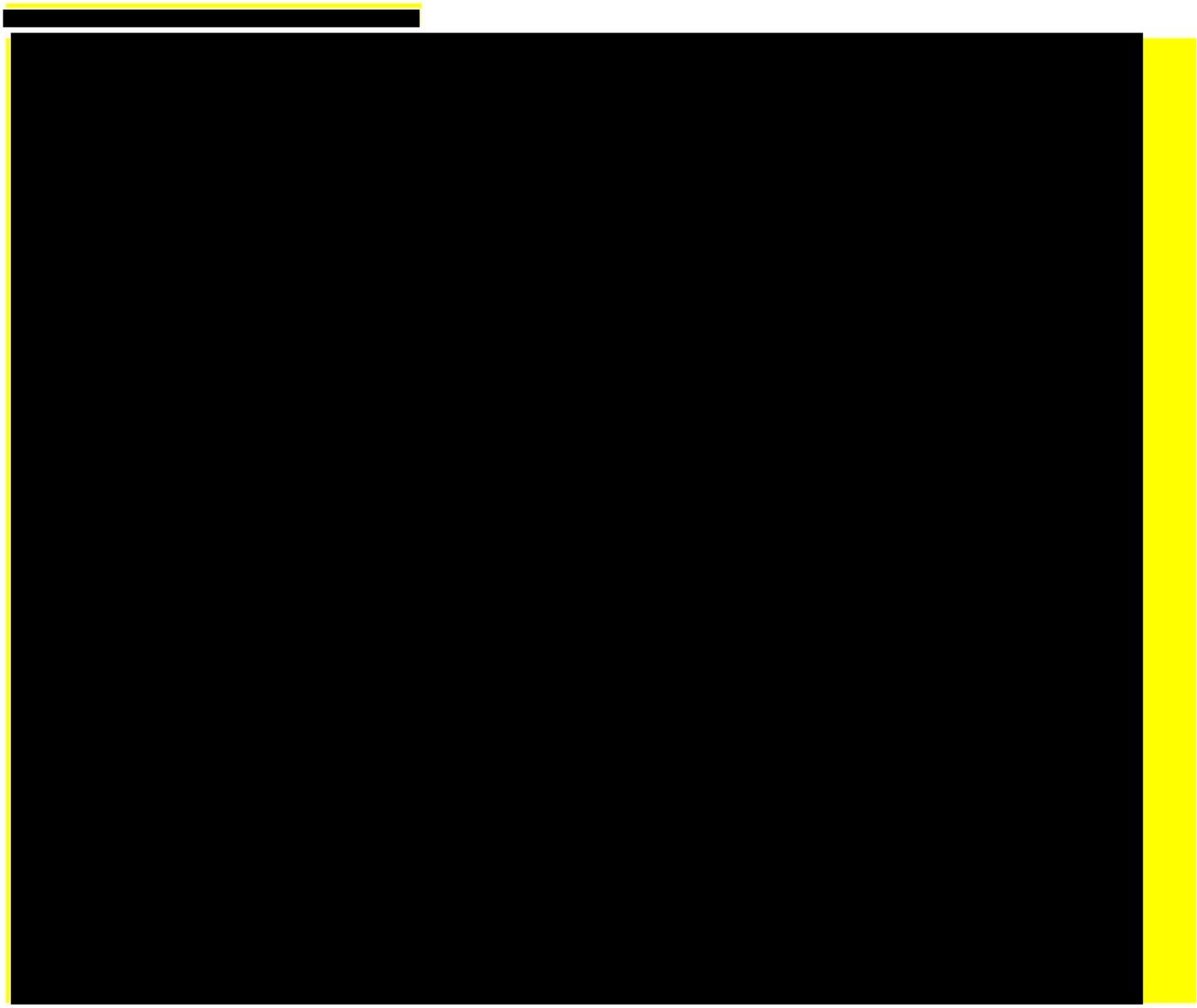
Vision objective	Alignment
Delivering for Customers – Public Safety	N
Delivering for Customers – Reliability	N
Delivering for Customers – Customer Service	N
A Good Employer – Health and Safety	N
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	N
Sustainably Cost Efficient – Delivering Profitable Growth	-

Vision objective	Alignment
Sustainably Cost Efficient – Environmentally and Socially Responsible	N

Option 2 would not align with our objective of *Delivering for Customers*, as it would not address the lack of visibility of asset performance in parts of our network. Having substandard network performance information would limit our ability to detect faults and address over and under-pressure events in the network, which may result in a loss of containment or loss of customer supply.

The costs of installing network monitoring have reduced over recent years and therefore not undertaking the project would not align with our objective to be *Sustainably Cost Efficient*. We would not realise the long term asset management investment benefits of having more reliable data on our assets, nor avoid shorter term reactive costs.

[redacted]



Appendix E RTU replacement sites

Table Appendix 21: List of RTU sites by complex and simple

Complex		Simple	
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
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Complex		Simple	
		[redacted]	[redacted]
		[redacted]	[redacted]
		[redacted]	[redacted]
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Glossary and definitions

The table below is a comprehensive list of asset management terminology and acronyms commonly used at AGIG. Note not all these terms may appear in this document.

Term	Meaning
AA	Access arrangement
ACIF	Australian Construction Industry Forum
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.
AGIG	Australian Gas Infrastructure Group
AGN	Australian Gas Networks
AHC	Australian Hydrogen Centre
ALARP	As low as reasonably practicable
AMP	Asset Management Plan
AMS	Asset Management Strategy
ARS	Ancillary Reference Service - Standard services offered by Multinet Gas at fixed charges
AS/NZ	Australian/New Zealand Standards
AUS EX	Australian Program for the Certification of Equipment for Explosive Atmospheres
Available testing	Testing of a non-faulty meter returned from the field less than 10 years old from purchase or repair tested in a meter testing facility before being re-installed in the field to complete its in-service life.
Capex	Capital expenditure
Cathodic protection	Prevention of corrosion by application of direct electric current to the surface of a metal.
Cathodic protection unit (CPU)	A device providing cathodic protection current, powered from an external energy source. Such energy sources include mains power, solar, etc. Cathodic protection units require permits and registration in accord with the Electricity Safety (Cathodic Protection) Regulations 2009
Cathodically protected	An electrically isolated area within the distribution system, of size convenient and practicable for assessing and maintaining the effectiveness of corrosion protection

Term	Meaning
(Distribution) area	
CI	Cast iron
Coating quality survey	A survey conducted by traversing directly above a coated main along its length using equipment and techniques designed to identify any defects in the coating. Methods in common use include "Pearson" and Direct Current Voltage Gradient (DCVG)
Coil (Electromagnetic coil) Survey	An electromagnetic tracing technique for locating points of failed insulation or electrical contact to other metallic structures.
Corrosion	The deterioration of metal caused by its electrochemical reaction with its environment
CP	Cathodic Protection
CPU	Cathodic Protection Units
CTM	Custody Transfer Meter. A large capacity meter installed at every injection point from the DTS to MGN's network.
Current AA period	Jan 2018 to June 2023
Data logger	Interval metering equipment that counts pulses from the mechanical meter index and records gas volume.
Direct Current Voltage Gradient (DCVG) Survey	A type of coating quality assessment survey conducted by traversing above the pipeline using equipment that applies pulsating DC electrical signals to identify coating defects.
Drainage Bond	An electrical connection via cable from a point in the distribution system to tram or train substations to prevent adverse effects from stray currents. These installations include equipment to control the direction and magnitude of current flowing.
DTS	Declared Transmission System
EDMI	Meter manufacture and supplier to MGN
EFT	Economic Feasibility Test
Electrical isolation	The electrical separation of structures to be protected from other structures and/or electrical systems. This is achieved by the installation of insulating flanges, monolithic insulating joints and insulating couplings
ESV	Energy Safe Victoria. A government body responsible for the safety and technical regulation of energy networks in Victoria.
FIRB	Foreign Investment Review Board

Term	Meaning
FLE	Field Life Extension. Alternative name for Sample Testing Program/in-service compliance testing of diaphragm meters <30m3/hr.
Flow corrector	Interval metering equipment which can correct gas flow to energy with the help of live pressure and temperature values.
FY	Financial year
Galvanic (Sacrificial) anode	A block of metal which provides protection by preferentially sacrificing itself instead of allowing the steel to corrode.
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
GDSC	Gas Distribution System Code
GFC	Gas and Fuel Corporation
GFCV	The Gas and Fuel Corporation of Victoria
GIS	Geographic Information System
GJ	Giga Joule, 1 Giga Joule = 1,000,000 Joules
GPC	Group Pressure Control
GPRS	General Packet Radio Services
GSC	Gas Safety Case
GSM	Global System for Mobile Communications
HDPE	High density polyethylene
HP	High pressure (140 to 515 kPa)
HP2	High pressure 2 (600 to 1050 kPa)
I&C	Industrial and Commercial
IEC EX	International Electrotechnical Commission System for certification to Standards Relating to Equipment for Use in Explosive Atmospheres
ILI	In line inspection
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.
IO	Input output

Term	Meaning
kPa	KiloPascals
L&G	Landis & Gyr – Meter manufacture and supplier to MGN
Large meter	Meter with capacity greater than >10 sm^3/hr.
LP	Low pressure (1.4 to 7 kPa)
MAOP	Maximum allowable operating pressure
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
MGN	Multinet Gas Networks
MHQ	Maximum Hourly Quantity
MIBB	Market Information Bulletin Board
MP	Medium pressure (35 to 210 kPa)
MPE	Maximum Permissible Error
NATA	National Association of Testing Authorities
NCC	Network Control Centre
Next AA period	July 2028 to June 2028
NGL	National Gas Law
NGR	National Gas Rules
NMI	National Measurement Institute
Non-reference Service	Non-standard services offered by MGN provided at fair and reasonable cost.
OEM	Original Equipment Manufacturer
OMSA	Operational and Management Services Agreement between MGN and Service Provider
Opex	Operating expenditure
PE	Polyethylene
PIG	Pipeline Inspection Gauge

Term	Meaning
PMC	Periodic meter change
PVC	Poly vinyl chloride
RAB	Regulated asset base
RF	Radio Frequency
RTU	Remote Telemetry/Terminal Unit
Sample testing program	Annual program whereby sample meters from each meter family population are tested as per AS/NZS 4944 to determine their on-going or extension to their in-service life in the field
SAP	An Enterprise Resource Planning tool which used recording asset data and maintenance management.
SCADA	Supervisory control and data acquisition
SEPP	State Environment Protection Policy
Shared assets	Shared network assets – for example, Mains in the street
SIOS	SCADA Input Output Schematic
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.
SMS	Safety Management Study
Spot potential reading	A measurement of pipe-to-soil potential taken at a given location at a particular point in time. Such readings can be used to assess protection status where potentials do not vary with time. However, in circumstances where potentials fluctuate due to telluric or stray current influences, recordings of potential over a period of time (usually 24 hours) are necessary
Stray current electrolysis	Is the effect of stray currents on buried metallic structures
Tariff D	Tariff D applies to customers using greater than 10,000 GJ a year or more than 10 GJ MHQ.
Tariff L	Tariff L is open to customers who consume more than 1,000 GJ per annum or less than 10,000 GJ per annum and have an MHQ demand of less than 10 GJ per hour.
Tariff V	Applies to customers using less than 10,000 GJ a year and less than 10 GJ MHQ.
Test point	A conveniently located termination point for electrical cables connecting to a buried pipeline. This allows measurement of the pipeline potential, and is the principal method of assessing the effectiveness of corrosion protection. Test points are also required for coating quality surveys and electromagnetic coil surveys to investigate losses in protection

Term	Meaning
Thyristor drainage unit (TDU)	Electrical equipment, usually installed in tram or train substations, to provide sufficient negative voltage for drainage bonds to be effective. The output voltage of TDUs is normally controlled so as to vary in accord with substation load
TJ	Terajoule
TP	Transmission Pressure (Pressure Range: Above 1050 kPa)
UAFG	Unaccounted for gas
UPS	Unprotected steel
Variable conductance drainage bond (VCDB)	Electronic equipment used to control the current in a drainage bond. The output current of VCDBs is normally controlled to maintain a set level of protection on a structure
Victorian Electrolysis Committee (VEC)	The Victorian Electrolysis Committee comprises membership of all parties affected by or causing stray current electrolysis. It is responsible for co-ordination of testing and adjustment required to maintain effective protection from stray currents and to control interference between adjacent cathodic protection systems. It is also responsible for administration of cathodic protection permits and regulations under the authority of Energy Safe Victoria.