Asset Management Strategy

AMS – Gas Networks

Document number:	AMS 30-01
Issue number:	11
Status:	Approved
Approver:	Strategic Asset Management Committee
Date of approval:	30 November 2021

ISSUE/AMENDMENT STATUS

Issue	Date	Author	Reviewed	Approved
10	22/05/2020	D Counsell		AMC
11	30/11/2021	J Lai	S Dick	SAMC

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EXECUTIVE SUMMARY

AusNet Services is an energy delivery service business that owns and operates Victoria's largest network of electricity and gas infrastructure that is committed to the safe, efficient, and reliable supply of energy.

AusNet Services is one of three natural gas distribution business in Victoria; each considered a natural monopoly operating under a licence from the Department of Environment, Land, Water and Planning (DELWP). The Australian Energy Regulator (AER) is responsible for economic regulation of the network under the National Gas Law (NGL) and the National Gas Rules (NGR), with Energy Safe Victoria (ESV) responsible for technical regulation, overseeing the safety of employees, contractors, consumers and the general public.

AusNet Services' gas business services approximately 750,000 customers[1] across the west of Victoria, including the outer northern and north-west metropolitan area of Melbourne. The network consists of over 12,000km of mains operating at different pressures and pressure regulating facilities spanning a geographically diverse region of approximately 60,000km. The gas demand profile of the network is winter peaking, with a pronounced spike arising from the increased customer usage due to domestic heating.

AusNet Services is committed to the provision of safe and reliable network services by investing in the upgrade and maintenance of the network. A total lifecycle approach is adopted, with AusNet Services' Asset Management System being accredited to the requirements of ISO 55001; the international standard for Asset Management. Adoption of this standard enables AusNet Services to achieve its objectives through effective and efficient management of its assets. Key asset issues requiring focus are:

1. The energy market is changing resulting in a decrease in demand per customer and an improvement in the relative competitiveness of electricity. These changes combined with a potential increase in gas retail price and a warmer climate are expected to further moderate gas consumption.
2. Performance of domestic regualtors continues to decline and an appropriate asset management system and product alternatives will be sourced and tested to improve performance in this area.
3. Strong population growth exists in Melbourne localities such as Hume, Melton and Wyndham and regional areas such as Bendigo, Ballarat and Geelong, overall customer growth is forecast to increase by an average of 2.1% to 2028, demanding augmentation activies to maintain supply through the winter peak.
4. Renewal of older low pressure and medium pressure mains is a key focus of the capital program to improve leak performance, safety, operational efficiencies and reduce UAFG.
5. Preparing the network for future needs which may include conversion to renewable gas substitutes.

[1] CIE Report October 2021

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1 DOCUMENT OVERVIEW

1.1 Purpose

The Gas Asset Management Strategy (AMS) is central to AusNet Services' processes for the delivery of safe and reliable network services to customers.

This AMS has the following key functions:

- To outline AusNet Services' overarching approach to the management of network assets;
- To define the linkage between the Asset Management Strategy and the underpinning detailed asset specific management plans and the Gas Network Objectives;
- To outline the gas business Key Performance Indicators (KPIs)
- To articulate the key areas of focus in relation to asset management, key risks, key programs, and key cost and service standard outcomes.

The Gas AMS is written for both internal and external stakeholders. It is AusNet Services' belief that the Gas AMSS (and all the documents underpinning it) complies with all legal obligations imposed on AusNet Services for operation of its gas distribution and transmission assets, including but not limited to:

- the National Gas Law (NGL);
- the National Gas Rules (NGR);
- the Gas Safety Act (1997);
- Gas Safety (Gas Installation) Regulations (2018);
- Gas Safety (Safety Case) Regulations (2018);
- the Victorian Gas Distribution System Code (GDSC); and
- relevant Australian Standards.

1.2 Scope

The Gas Asset Management Strategy (AMS) covers AusNet Services' natural gas distribution and transmission assets operating in the western region of metropolitan and rural Victoria, including all:

- Transmission pipelines, distribution mains and associated easements and access tracks;
- Regulators and regulating stations (including building and civil infrastructure), valves, heaters, filters, vents, syphons and auxiliary assets used in the operation of the distribution and transmission networks from the Victorian Transmission System (VTS) to end consumers;
- Corrosion protection, control, metering and communications equipment;
- Related functions and facilities such as spares, maintenance and test equipment; and
- Asset management processes and systems such as Supervisory Control and Data Acquisition (SCADA) and asset management information systems (including asset repositories).

AMS 30-01 is supported by key IT AM systems. However, it does not cover IT and its related infrastructure.

1.3 Relationship with Other Management Documents

AusNet Services' Asset Management System, including the policy, objectives and its underlying methodology, context, process, decision making criteria and certification are detailed in *AMS 01-01 Asset Management System Overview*.

The Gas AMS is one of several asset management related documents. It provides more specifi information on the issues strategies specific to the gas network. The suite of documents together comprises the Asset Management System as represented in Figure 1, with this document circled in red.

Gas Asset Management Strategy

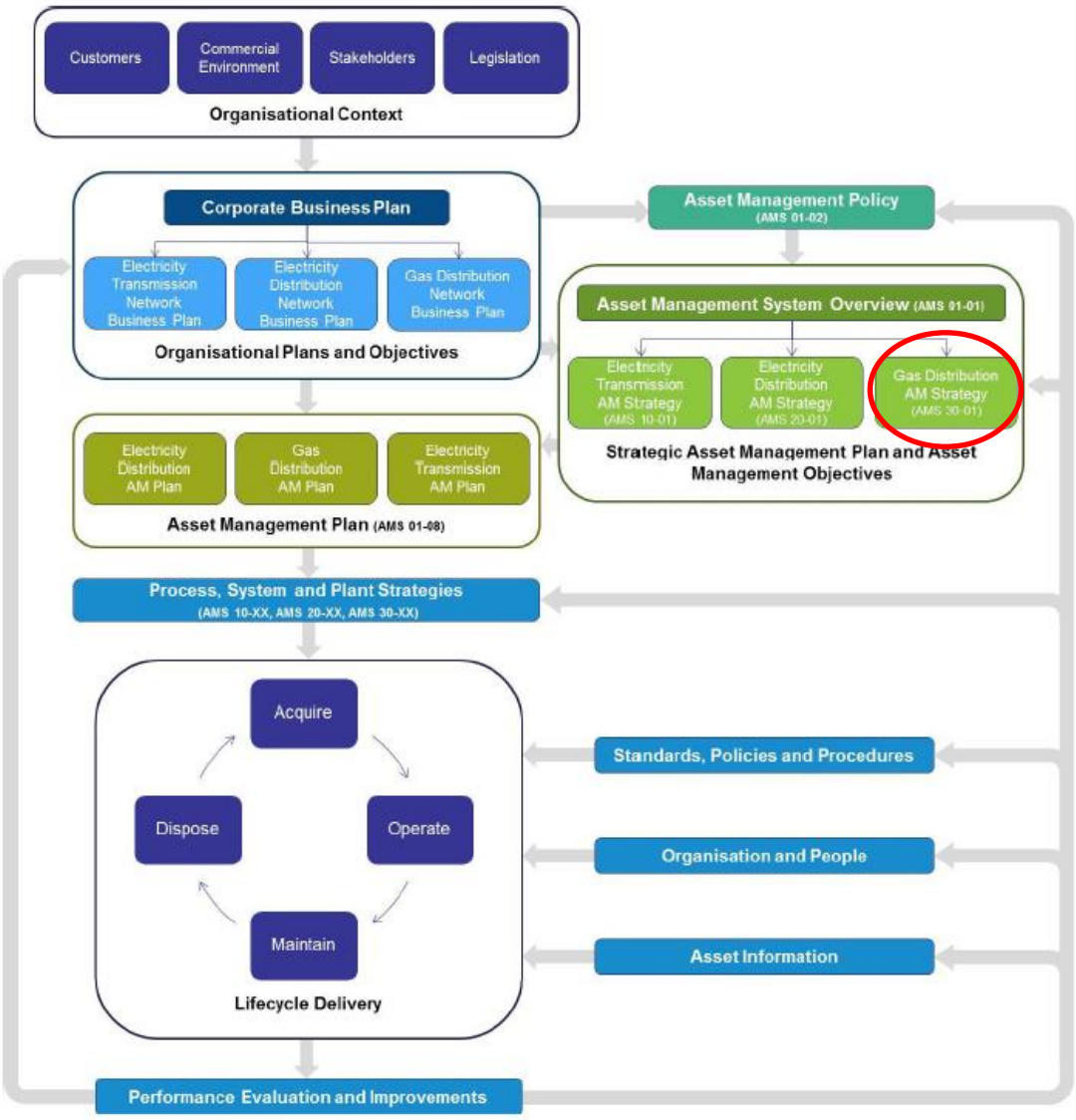

Figure 1. AusNet Services' Asset Management System Framework

2 GAS NETWORK OVERVIEW

This section provides an overview of AusNet Services' gas network.

2.1 Locality and Geography

AusNet Services owns an extensive natural gas transmission and distribution network throughout western metropolitan Melbourne and south-west and west regional Victoria. This is shown shaded blue in Figure 2 below.

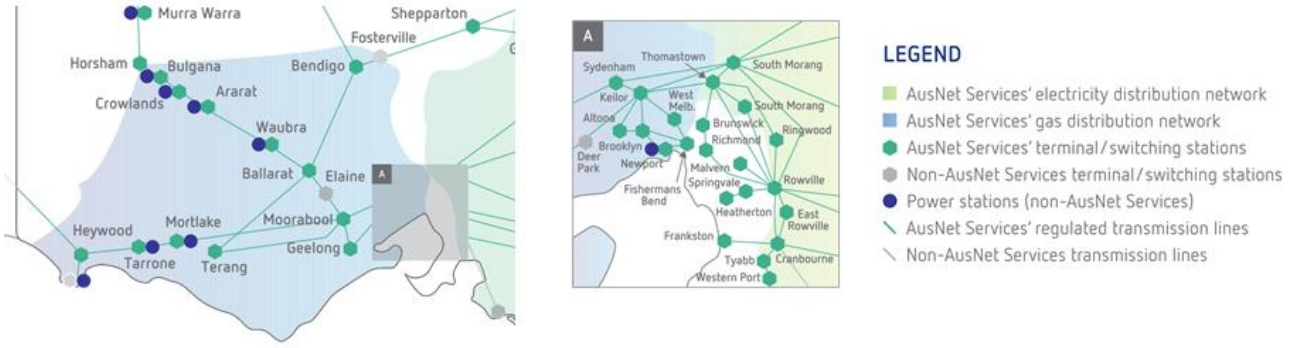

Figure 2. AusNet Services Gas Network

The network distributes natural gas from the gas transmission system to individual gas meters, which supply customers' appliances. In total, gas is delivered to over 750,000 customers across a geographical diverse region. The gas transmission and distribution network includes mains, mainline valves, pressure regulating facilities (including city gates, field and district regulators), service pipes, meters and ancillary equipment.

AusNet Services also owns an LPG vapour reticulation network at Mt Baw Baw (not pictured).

2.2 Asset Summary

The AusNet Services gas distribution network consists of:

- approximately 12,000km of distribution mains and services operating at high (up to 515 kPa), medium (up to 70 kPa) and low (up to 7 kPa) pressures;
- a small portion of the network operates at 'sub-transmission' pressure called HP2, with an operating pressure range of 515kPa to 1,050kPa; and
- 183km of licensed transmission pipelines operating at a minimum pressure of 1,050kPa to a maximum allowable operating pressure (MAOP) of 2,800kPa.

Over 80% of the distribution system operates at high pressure with a minimum allowable pressure of 140kPa to a maximum of 515kPa.

Pressures are regulated through major facilities known as 'City Gates' which regulate supply from the Victorian Transmission System (VTS), which is owned and operated by APA Group in conjunction with the Australian Energy Market Operator – AEMO, to AusNet Services' distribution network.

The network has been constructed over a period of more than 100 years and consequently consists of a variety of pipe materials. Cast iron and steel was predominantly used until the introduction of polyvinyl chloride (PVC) for low pressure like-for-like replacement and polyethylene for high pressure networks in the late 1970s.

Currently, polyethylene is the material of choice for pipe renewals.

Table 1 provides a summary of the asset installed in the gas distribution network.

Table 1: Gas Distribution Network Asset Summary

Asset	Number / Length	Mean Service Life (Average Years)	Expected Service Life
Transmission Pipelines	183km	42 years	80 years
Distribution Mains High Pressure 2 (HP2) High Pressure (HP1) Medium Pressure (MP) Low Pressure (LP)	12,197km 97km 11,005km 634km 421km	23.8 years 34.2 years 20.6 years 43.2 years 45.0 years	 50 years 50 years 50 years 50 years
Meter Types	763,412 units	9.3 years	-
– Domestic Meters	744,547 units	9.3 years	22 years
– Industrial & Commercial Meters	18,865 units	9.0 years	15 years
City Gates	41 units	31 years	50 (est.) years
Gas Pre Heaters	39 units	19 years	50 (est.) years
Field Regulators	107 units	28 years	50 (est.) years
District Regulators	44 units	31 years	50 (est.) years
SCADA (remote terminal units)	220 units	19 years	15 years
Cathodic Protection Units (CPU)	196 units	Various	30 years

2.3 Network Growth

Demand on AusNet Services' gas network is forecast to remain reasonably stable over the next five years, with customer growth expected to compensate for lower consumption per capita. Recent forecasts show lower growth than earlier estimates, but nevertheless, a 2.1% growth rate is still predicted. Strong population growth is forecasted in Melbourne growth corridors such as Hume, Melton and Wyndham and regional areas such as Bendigo, Ballarat and Geelong. On the other hand, smaller housing, energy efficiency and the increasing competitiveness of electrical appliances is expected to reduce residential consumption per household over the same period.

The gas demand profile of the network is winter peaking, with a pronounced spike arising from the increased customer usage due to domestic heating.

2.4 Characteristics of the AusNet Services Gas Network

There are a number of characteristics of AusNet Services' gas network which add complexity and cost to operating and maintaining the network:

- **Geography:** remoteness increases the need for remote control of core infrastructure and increases repair and inspection costs.
- **Weather:** a wide range of climatic conditions drives a need to increase current capacity margin. The rapid expansion / contraction of ground conditions caused by water saturation / drought increases the incidence of main failures, especially on the brittle cast iron network,
- **Ground Conditions:** existence of rock and clay-based soils increases pipe laying costs and frequency of failures due to ground movement.
- **Demographics:** urban growth corridors (areas) place increasing demand on the existing network.

- **Holiday Resorts:** seasonal demand and identification of faults results in additional costs to cater for uneven requirements on AusNet Services' resources.
- **Network Configuration:** much of the current growth is away from transmission pipelines, requiring large infrastructure development to meet reliability requirements.

3 ORGANISATIONAL CONTEXT

3.1 Legislative and Regulatory Requirements

Legislative and regulatory requirements impact a number of areas of AusNet Services' gas distribution business. These are outlined in and discussed in the following sections.

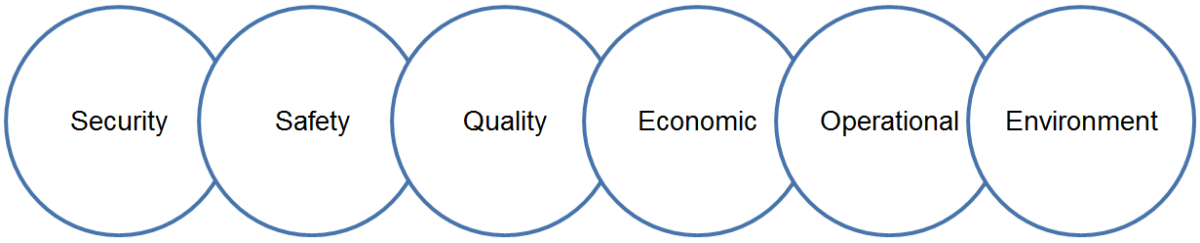

Figure 3: Legislative and Legal Influences on AusNet Services' Gas Distribution Network

3.1.1 Security

Part 7A of the Emergency Management Act has been enacted to counteract the threat of terrorism or sabotage to critical infrastructure. Emergency Management (Critical Infrastructure Resilience) Regulations 2015 have also been established to reduce the risk of injury to the public, or asset damage caused by vandals, following unauthorised access to assets. The Security of Critical Infrastructure Act 2018 and subsequent amendments also affect the operations of our sites.

These instruments reflect the increasing physical priority of security as a critical component of asset management.

3.1.2 Safety

Energy Safe Victoria (ESV) is an independent Victorian statutory authority responsible for the safety and technical regulation of electricity and gas networks (including pipelines) in Victoria. The *Energy Safety Victoria Act 2005* specifies the role and functions of the ESV.

Victorian *Gas Safety (Safety Case) Regulations 2018* requires network businesses to lodge a Gas Safety Case (GSC) Management System, with ESV.

AusNet Gas Services' current Gas Safety Case was approved by ESV in 2018.

3.1.3 Quality

Quality of supply strategies in the AMS are focused on managing gas network pressures and the continuity of supply to AusNet Services' domestic and Industrial/Commercial customer base with reference to the Victorian Gas Distribution System Code (GDSC) Version 12.

Broad planning and investment strategies, individual project economic evaluations, and network performance monitoring alike, must be cognisant of the quality of supply standards, including the Gas Safety (Safety Case) Regulations 2018 and Australian Standard AS 4564 Specification for General Purpose Natural Gas.

3.1.4 Economic

The AER has responsibility for the economic regulation of AusNet Services' network in accordance with the National Gas Rules (NGR) and National Gas Law (NGL).

The AER's key gas related responsibilities include:

- Regulating the revenues of transmission and distribution network service providers;
- Monitoring the gas wholesale market;

- Monitoring compliance with the national gas law, national gas rules and national gas regulations;
- Investigating breaches or possible breaches of provisions of the national gas law, rules and regulations and initiate and conduct enforcement proceedings against relevant market participants;
- Establishing service standards for gas transmission and distribution network service providers; and
- Establishing ring-fencing guidelines for business operations with respect to regulated transmission and distribution services.

The economic regulation of the Gas Distribution Industry is subject to a national regulatory framework. The framework is governed by the NGL, and contained in the NGR.

In relation to the former, the key sections are:

Section 23 National Gas Objective

"The objective of this Law is to promote 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."

The key rules underpinning the economic regulation of the Gas Distribution industry considered during development of this asset management strategy include Rule 79 and Rule 91 of the NGR.

Rule 79 outlines the "*New capital expenditure criteria*", which in turn underpins the AER's assessment of AusNet Services' proposed capital expenditure requirements.

Rule 79 New capital expenditure criteria

1) Conforming capital expenditure is capital expenditure that conforms with the following criteria:

a) the capital expenditure must be such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services;

b) the capital expenditure must be justifiable on a ground stated in sub rule (2).

2) Capital expenditure is justifiable if:

a) the overall economic value of the expenditure is positive; or

b) the present value of the expected incremental revenue to be generated as a result of the expenditure exceeds the present value of the capital expenditure; or

c) the capital expenditure is necessary:

i) to maintain and improve the safety of services; or

ii) to maintain the integrity of services; or

iii) to comply with a regulatory obligation or requirement; or

iv) to maintain the service provider's capacity to meet levels of demand for services existing at the time the capital expenditure is incurred (as distinct from projected demand that is dependent on an expansion of pipeline capacity); or

d) the capital expenditure is an aggregate amount divisible into 2 parts, one referable to incremental services and the other referable to a purpose referred to in paragraph (c), and the former is justifiable under paragraph (b) and the latter under paragraph (c).

3) In deciding whether the overall economic value of capital expenditure is positive, consideration is to be given only to economic value directly accruing to the service provider, gas producers, users and end users.

4) In determining the present value of expected incremental revenue:

a) a tariff will be assumed for incremental services based on (or extrapolated from) prevailing reference tariffs or an estimate of the reference tariffs that would have been set for comparable services if those services had been reference services; and

b) incremental revenue will be taken to be the gross revenue to be derived from the incremental services less incremental operating expenditure for the incremental services; and

c) a discount rate is to be used equal to the rate of return implicit in the reference tariff.

5) *If capital expenditure made during an access arrangement period conforms, in part, with the criteria laid down in this rule, the capital expenditure is, to that extent, to be regarded as conforming capital expenditure.*
6) *Conforming capital expenditure that is included in an access arrangement revision proposal must be for expenditure that is allocated between:*
   a) *reference services;*
   b) *other services provided by means of the covered pipeline; and*
   c) *other services provided my means of uncovered parts (in any) of the pipeline*
   d) *in accordance with rule 93.*

The AER's discretion under this rule is limited.

Rule 91 outlines the “Criteria governing operating expenditure”, which in turn underpins the AER’s assessment of AusNet Services’ proposed operating expenditure requirements.

Rule 91 Criteria governing operating expenditure

7) *Operating expenditure must be such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of delivering pipeline services.*
8) *The forecast of required operating expenditure of a pipeline service provider that is included in the full access arrangement must be for expenditure that is allocated between:*
   a) *reference services;*
   b) *other services provided by means of the covered pipeline; and*
   c) *other services provided by means of uncovered parts (if any) of the pipeline,*
   d) *in accordance with rule 93.*

The AER's discretion under this rule is limited.

AusNet Services' asset management and operational policies are designed to comply with the NGL.

3.1.5 Operational

Various Acts, Codes, Regulations, Guides, Standards and Agreements define the expected operating standards for the distribution system.

As a minimum, the network must be designed and managed to meet the requirements set out in current versions of:

- Access Arrangement (Sections A, B and C);
- Tariff Order;
- Distribution License;
- *Gas Industry Act, (2001);*
- *Gas Safety Act*; (1997);
- Gas Distribution System Code;
- Victorian *Occupational Health and Safety Act 2004*;
- *Pipeline Regulations 2007*; and
- Appropriate Australian and International Standards.

The expected level of service is expressed in terms of various KPIs that are used to monitor the performance of individual asset items and the distribution system as a whole. Asset and performance data is submitted on a quarterly and annual basis to the AER and ESV.

In addition, it is noted that planning for the VTS assets in Victoria is coordinated through three Gas Distribution companies and AEMO in its role as Victoria Transmission Network Planner.

Annually, each Gas Distributor provides new connection details and forecast load information to assist in the development of the Victorian Annual Planning Report. This is published and is available on the AEMO website.[2]

3.1.6 Environment

The regulatory instruments (including the NGR, Distribution License and other acts) require AusNet Services to comply with all applicable regulatory obligations or requirements associated with the provision of network services.

In addition to the above, AusNet Services focuses on the protection of the immediate environment through its AS/NZS ISO 14001 certified Environmental Management System[3] (EMS). The EMS is the principle tool through which AusNet Services identifies environmental risks, develops and implements solutions and monitors success in controlling such risks.

3.2 Capital Expenditure Sharing Scheme

The Capital Expenditure Sharing Scheme (CESS) was approved to be introduced in the 2018-2022 regulatory period.

The CESS will:

- Strengthening the incentive to deliver capex efficiencies
- Ensuring that investment to efficiency gains is the same irrespective of the year in which an investment is made
- Provide stronger and balanced incentives for the efficient trade-off between capex and opex.

The mechanism for CESS payments is contingent on maintaining current service standards. If service standards were to decline, then AusNet would receive a reduced CESS reward or have the payments removed entirely.

The service standard measures are as follows:

- Leaks on mains
- Leaks on services
- Leaks on meters
- System average interruption frequency index (SAIFI), and
- System average interruption duration index (SAIDI).

Further details on the CESS calculations and their impact on our returns is outlined in the GAAR determination[4].

3.3 Long Term Influences Affecting the Gas Distribution Business

3.3.1 Network Growth

The reliability of the network can be at risk due to complex operating procedures that raise and lower network pressure to re-distribute peak loadings. AusNet Services continues to invest in core infrastructure to meet the growing demand for natural gas within these and other small areas of development within the state.

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2 www.aemo.com.au

3 EMS 10-01 Environmental Manual, AusNet Services.

4 AusNet Services GAAR 2018-2022 - https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/ausnet-services-access-arrangement-2018-22

Notwithstanding ongoing investment in network augmentation, AusNet Services has managed to maintain efficient capital expenditure, while managing the risk to security of supply during times of peak demand (i.e. one-in-two winters peak). This model is however changing with ongoing growth in fast growing network corridors combined with customers using less gas.

3.3.2 Advances in technology

The changing market conditions on the gas network including decrease in demand per customer and penetration rates, coupled with technology improvements and greater customer control in the electricity sector, threatens the competitiveness of gas. In order to develop and remain a relevant energy network, AusNet Services must invest in new technologies, systems and opportunities for customers.

The energy market is transitioning to a clean energy future. There is a place for gas during the transitionary period where emission can be reduced by the use of gas fired power generation stations rather than coal. At the other end of the supply chain, emissions will futher be reduce through the use of increasingly efficient gas consumer appliances.

Renewable gas including biogas and hydrogen produced from renewable sources or from fossil fuels with carbon capture and storage has potential to be an alternative to natural gas. Biogas, when upgraded to biomethane has a similar composition to natural gas but is ~90% less emissions intensive than other fossil fuels. Hydrogen, initially blended with natural gas, could be used domestically and in industry to decarbonise heat demand. Hydrogen could also improve energy security by providing storage to the electricity system. It also has potential to diversify fuel supply options for transport. The introduction of renewable gasses and blending will have several safety, operational, regulatory and engagement implications which will need to be addressed in collaboration with various stakeholders.

At the primary asset level, new technology often brings with it significant improvements in functionality and reduced maintenance costs, however asset management strategies must also consider the implications for older equipment that may become unsupported and hence obsolete before the end of their intended service lives.

3.4 Stakeholder Expectations

AusNet Services previously launched a customer and stakeholder engagement strategy for the gas network. The objective of this program was to deliver authentic, customer priority-driven engagement that will meet external stakeholder expectations, and inform the development of business plans.

This objective does not mean being ‘customer compelled’ in the development of current and future plans. Rather, it acknowledges that AusNet Services’ approach to engagement will be driven by an understanding of the long term interests of consumers of natural gas. Given the level of maturity within AusNet Services and the industry in undertaking broader customer and stakeholder engagement to date, AusNet Services has adopted a realistic and pragmatic approach to customer and stakeholder engagement.

A key benefit of this approach is that it is centred on devoting resources and effort to establishing a relationship with end-user customers and their advocates, and building internal capability through practical experience of customer consultation. The stakeholders for AusNet Services’ energy networks are summarised in Table 2 below.

Table 2: Stakeholder Expectation Summary

Stakeholders	Driver / Expectation
Connected Parties (energy consumers, electricity generators and gas producers, other network service providers)	– Responsive service – Efficient service costs – Network access – Capacity, reliability, quality, safety, environmental, compliance and security performance within Code or Agreement
Community	– Public safety – Environmental performance within Code
Employees and contractors	– Safe work place – Reward and recognition – Skill development
Shareholders	– Return on investment – Growth in investment value – Commensurate opportunities, liabilities and risks
Energy Retailers	– Reliable information – Efficient service costs
Safety Regulator	– Compliance with Acts, Regulations & Codes – Improving safety performance – Transparent processes – Reliable information
Economic Regulator	– Compliance with Law, Rules & Codes – Efficient service costs – Transparent processes Reliable Information
State and Federal Government	– Compliance with Acts and Regulation – Support economic development – Improving safety performance – Efficient service costs
Local Government and VicRoads	– Coordinated infrastructure development – Coordination of works – Public land reinstatement

3.5 AusNet Services Safety Vision

"Safety is our way of life. Everyone is responsible for leading safety. Together we seek out and correct all unsafe behaviours and situations and aim for zero injuries."

Our safety vision is symbolised by the simple expression:

mission zero

When it comes to the safety of our people, contractors and visitors, zero injuries is the only acceptable target. We will not compromise on safety and we will not tolerate unsafe acts and behaviours. It is this mindset that drives us to ensure there are no negative impacts on our families and communities as a result of our business operations. To achieve our safety vision, our mission must be to work together to implement a common strategy with unified purpose and consistency of attitude.

3.6 Corporate Values

A purpose, strategy, and aspiration, on their own, are not sufficient to define how the business will achieve company goals. We also need values to express what we stand for and guide the way we do things. AusNet Services has four company values, shown in Figure 4.

Figure 4. AusNet Services values

4 ASSET MANAGEMENT SYSTEM

This section provides an overview of AusNet Services' Asset Management System including its underlying methodology, context, process, objectives, decision making criteria, and certification. Refer to AusNet Services' AMS 01-01 Asset Management System Overview for additional information.

AusNet Services adopts the lifecycle approach to the management of its assets. This means the different phases of an assets lifecycle are considered when determining the optimal cost-benefit solutions to network issues.

4.1 Strategy and Planning

AusNet Services has both short-term and long-term strategies that align with AusNet Services' corporate objectives. Strategies cover the operation and maintenance of existing assets, as well as network expansion, both organically and through new reticulation of regional towns.

4.2 Design, Build and Commission

The network design function is divided into three major categories:

- **Network / System Design** – incorporates the high-level, strategic design of the network. It takes into consideration elements such as future load growth, asset capacity, major customer developments and overall network performance; including reliability and security.
- **Complex designs** – incorporates the design of complex facilities, such as field regulator stations and city gates. It typically involves site-specific designs with references to Australian and international standards, as well as focusing on the design considerations and risk assessments associated with the asset concerned.
- **Standard Designs** – involves the application of standard network designs, documented design standards, procedures and principles to a range of less complex assets. Such design works typically incorporate mains replacement and reticulation extensions and are undertaken on an as-need basis (i.e. for specific projects). The designs are carried out in accordance with design standards, procedures and principles developed and specified by AusNet Services.

Construction activities are divided into two following categories:

- **General Construction** – involve the application of AusNet Services' standards, documented procedures, AusNet Services' or industry-accepted equipment and materials for the construction of an asset to a standard design. Such works typically include mains and services reticulation work and are generally undertaken by a contractor on behalf of AusNet Services.
- **Complex Construction** – encompass installations of a unique nature and incorporate non-standard items of plant and/or equipment. Such installations typically include city gates, field regulators and transmission pipelines. Construction of such installations typically incorporates a range of different activities such as civil works, structural works, construction and commissioning.

In addition to AusNet Services' standard procedures and specification, specific procedures are developed (if required) in compliance with industry standards for commissioning of assets constructed under this category. Support from external experts is sought if not available internally.

4.3 Network Operations

Day-to-day management of the network is necessary to monitor and control network pressures to ensure reliability of supply, safety, and other operating requirements are maintained. Operations also include responding to faults and emergencies.

Detailed information regarding system contingency and associated responsibilities are in the Gas System Contingency Plan.

4.4 Maintenance

AusNet Services categorises its maintenance into the following:

- **Unplanned Maintenance** – Work carried out in response to reported problems or defects (e.g. pipe failure causing leakage, mechanical failure), with the aim being to provide speedy, appropriate and effective response to unforeseen equipment or system breakdown; minimising interruption, inconvenience and risk to the customer.
- **Condition Maintenance** – Work carried out to a predetermined frequency such as inspection of cathodic protection systems and leakage surveys. The aim is to ensure that plant and equipment operate reliably and economically as the first part of a preventive maintenance program.
- **Scheduled Maintenance** – Work carried out to a predetermined schedule such as regulator overhaul for City Gates, Field and District Regulators and lubrication of valves. The aim of this maintenance is to perform routine major maintenance at preselected intervals to maximise equipment life and minimise the possibility of interruption of supply to the customer, whilst maintaining costs at an optimum level in accordance with best practice.

More specific details on asset maintenance can be obtained from the AusNet Services' Gas Maintenance Plan (AMP 30-02).

4.5 Condition and Performance Monitoring

The expected level of service is expressed in terms of various KPIs that are used to monitor the performance of the individual asset items and the distribution system as a whole. AusNet Services is benchmarked against the other distribution businesses by the AER in its Gas Industry Comparative Performance Report.

4.6 Renewal/Replacement

Asset renewals are undertaken to restore, rehabilitate, replace or renew an existing asset to its original or improved capacity. Factors driving these activities are:

- the safety of the entire network;
- reliability of supply;
- compliance with performance requirements; and
- efficiently manage maintenance costs.

The main activities in this area are the pipe mains renewal and meter replacement programs.

4.7 Retire

This encompasses retiring or de-commissioning of faulty, old or redundant assets. Strategic planning, Risk Assessment and Network Modelling determines and prioritises the assets to be decommissioned from the network.

De-commissioning of faulty or old assets helps in eliminating or reducing the risks associated with the outgoing asset and increases network safety. Retirement of fault prone assets also increases network performance and prevents inefficient increases in maintenance costs.

Disposal and/or decommissioning may occur for the following reasons:

- obsolescence;
- failure to meet regulatory requirements;
- repairs exceed replacement costs; and/or
- policy changes.

4.8 Review / Audit

AusNet Services' facilities are subject to regular reviews and audits to verify compliance with specified technical, operational and safety standards and legislative requirements. Reviews and audits are undertaken in accordance with specified procedures to ensure the requisite compliance is achieved in all aspects of the design, construction, installation, operation and maintenance of the network.

Audit plans are developed annually in accordance with AusNet Services' Technical Compliance Audit Strategy (QMS 21-11).

5 GAS NETWORK OBJECTIVES

AusNet Services' purpose statement is "Connecting communities with energy and to accelerate a sustainable future". This statement places the customer (as individuals and communities) at the forefront as a business driver and acknowledges the critical relationship with their energy supply and usage. The following diagrams shows that Customers are a key theme linking the Corporate Business Strategy with the Gas Network Vision and Gas Network Objectives, which influence the key plant strategies forming the basis of the regulatory submission.

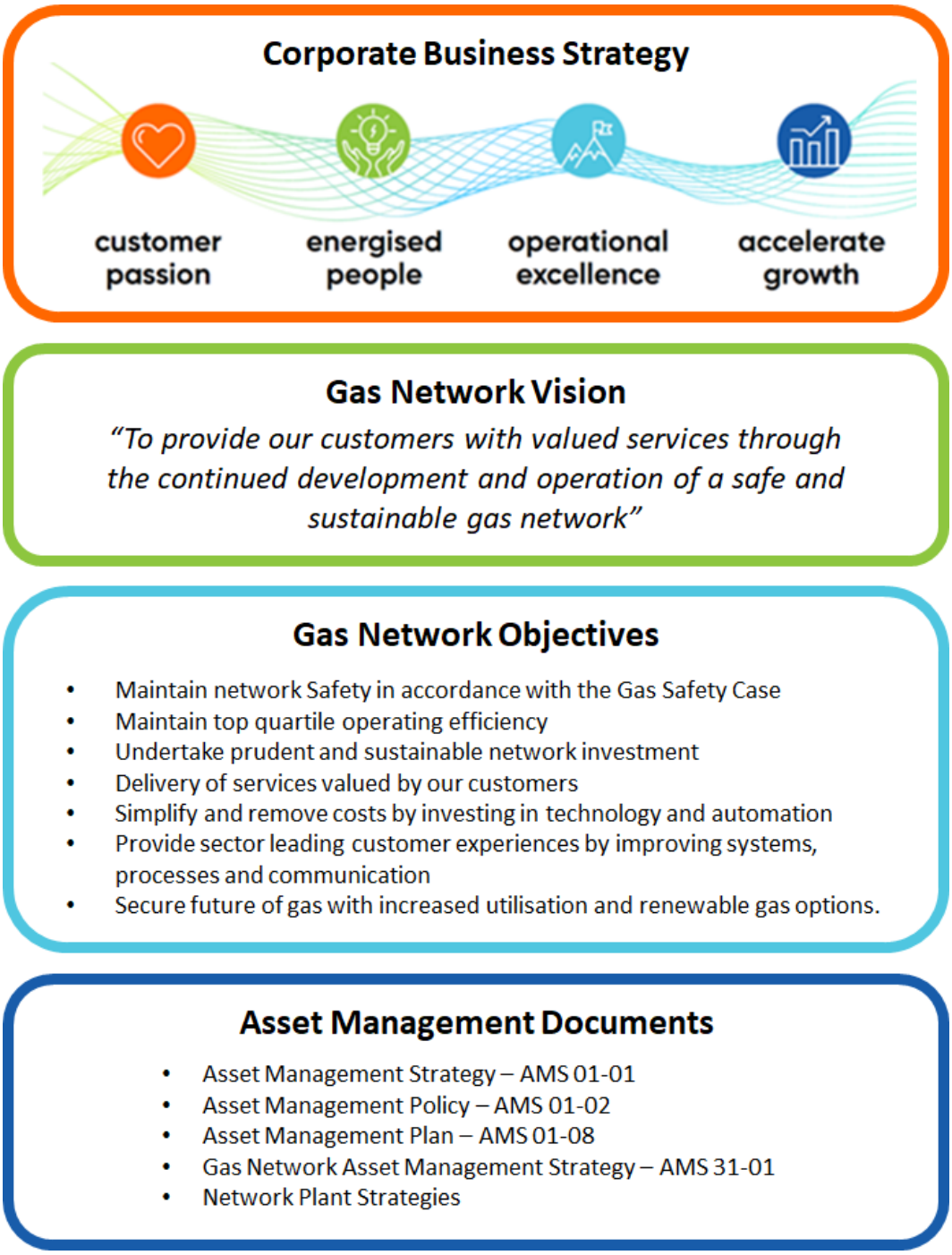

Figure 5. Gas Network Objectives and relevant AMS components

6 PROCESS AND SYSTEM STRATEGIES

The objective of this section is to provide an overview of the major processes and system strategies required to manage AusNet Services' gas distribution network for the achievement of network objectives.

6.1 Risk Management Approach

AusNet Services operates a corporate Risk Management Framework[5] that utilises the principles of AS/NZ ISO 31000:2018 *Risk management –Guidelines* to assess a range of business risks under the following categories:

- Health and Safety;
- Environment and Community;
- Reputation;
- Customers;
- Regulation, Legal and Compliance;
- Management Impact and People; and
- Financial Impact.

By adopting common metrics across the broad range of business risks and investment portfolios, AusNet Services can more effectively manage business risk and optimize network outcomes and objectives.

AusNet Services' RM 10-01 *Risk Management Policy and Framework* sets out the overarching philosophy, principles, requirements and responsibilities for a sound approach of risk oversight, management and ongoing internal control assurance required within AusNet Services.

The Framework addresses the following:

- Governance and responsibilities;
- Risk management principles and methodology;
- How AusNet Services assesses and manages risk; and
- How AusNet Services monitors and reports on risk.

As part of AusNet Services' Gas Safety Case, a Formal Safety Assessment (FSA) has been carried out consistent with the Gas Safety Act 1997 and the Gas Safety (Safety Case) Regulations 2018. This assesses risks associated with AusNet Services' gas distribution network as defined within the Facilities Description and Safety Management System Overview (GSC 10-01) which forms part of the Safety Case documentation.

Refer to AusNet Services' Safety Case and FSA for a complete list of identified risks.

Within the gas distribution network, all identified risks are contained within acceptable limits. However, action plans to further mitigate the greater risks are in place or planned over the next 5 years.

6.2 Gas Safety Case

Safety Legislation requires gas network businesses to lodge a Gas Safety Case (GSC) Management System with ESV. AusNet Services' GSC for the current regulatory period was accepted by the ESV in 2018.

The Gas Safety Case provides a road map to the systems AusNet Services has in place to manage the safe operation of the natural gas transmission, distribution and LPG networks.

[5] RM 001-2006 Risk Management Framework, 2007, AusNet Services.

The document:

1. Describes the AusNet Services gas network;
2. Identifies the hazards and risks faced by the network; and
3. Describes the Safety Management System in place to ensure identified risks are managed to a level that is As Low As Reasonably Practicable (ALARP).[6]

The GSC meets the requirements of the Gas Safety Act 1997.

The AMS has been prepared with regard to the latest GSC requirements, and is intended to facilitate AusNet Services' compliance with those requirements.

6.3 Environmental Management

AusNet Services is committed to responsible environmental and resource management through its ISO 14001 accredited EMS.

6.3.1 Greenhouse Emissions

AusNet Services directly and indirectly emits greenhouse gases in its day-to-day activities. These emissions (principally methane and carbon dioxide) are associated with losses incurred in the transport of gas through our network, primarily as a result of leaking pipes.

AusNet Services has a number of action plans in place to reduce the level of greenhouse gas emissions. These include:

- Gas mains replacement;
- Network augmentation programs;
- Electronic pressure control on major regulating stations; and
- National Greenhouse and Energy Reporting Scheme (NGERS) reporting.

6.3.2 Pipelines and the Environment and Cultural Heritage

Before the construction and commissioning of pipelines, AusNet Services conducts a range of environmental studies along the pipeline route and adjacent areas to:

- Establish characteristics, values and level of significance of the area;
- Identify key environmental and cultural heritage issues and potential impacts on the area; and
- Devise methods and management practices to mitigate potential impacts on the area.

6.3.3 Asbestos

The *Occupational Health and Safety (Asbestos) Regulations* (2003) requires strict work methods for removal of asbestos from the workplace as well as stringent requirements when working with asbestos-containing materials. Environmental Protection Authority (EPA) guidelines detail transport and disposal requirements.

Asbestos has been identified at a number of the former Tempered Liquid Petroleum Gas and coal gas production sites. The asbestos is found in some wall and roof cladding. The material is deemed safe and has been labelled and recorded in the AusNet Services asbestos register. The demolition and land remediation will encompass the safe removal of the asbestos.

[6] Further information regarding ALARP can be found in the Gas Safety Case

6.3.4 Land Contamination

Eight former gas works sites in western Victoria, of which only three remain, have been identified as having contaminated soil, arising from historical production of town gas from black coal prior to AusNet Services' purchase of the business.

An environmental management plan was put in place in 2001 to monitor site conditions and manage the risks posed by each site.

The status of each site is summarised in Table 3.

Table 3: Status of decontamination work at former gas works sites

Site	Status
Stawell	EPA inspection / signoff completed. Awaiting sale.
Ararat	Remediation and clean-up work completed. Awaiting sale.
Portland, Warrnambool, Hamilton	Awaiting remediation. Program to be developed in FY2021

6.4 Condition Monitoring

6.4.1 Overview

AusNet Services manages the condition of its assets through:

- Real-time data acquisition and recording via Supervisory Control and Data Acquisition (SCADA);
- Leakage surveys, leak reports, and UAfG monitoring;
- Asset inspection programs and corrosion surveys; and
- Gas quality monitoring, including management of oil-in-gas issues.

These various condition-monitoring activities are outlined below.

6.4.2 Real-time Data Acquisition and Recording

AusNet Services uses a SCADA system to monitor and control assets across the network from the transmission system to the network fringe. The SCADA system provides data on the real-time performance of the assets, and data for long-term evaluation of gas demand and network performance to identify potential system deficiencies.

6.4.3 Leakage Surveys

AusNet Services has a risk based leakage survey methodology that focuses leakage survey efforts to the areas of highest risk. Currently, all mains in locations of high risk are surveyed on an annual basis. Transmission pipelines, internal services and high-risk special crossing (e.g. railway line crossing) are also surveyed on an annual basis. Cast iron mains are subject to spot surveys when monthly leakage rates within a postcode exceed pre-determined levels.

AMS 30-24 Leakage Management Strategy was updated in May 2019 and incorporates the learnings from the Maddingly incident. As a proactive measure, the leakage survey template was updated to capture the status for "Smell of Gas" during the routine surveys. Any leak with reading greater than 20,000 PPM (40% LEL) and no odour will require a survey of the surroundings. This will require a survey carried out in a radius of 200 m around the source of the leak. This measure will enable identification of leaking gas traversing through the soil into neighbouring underground pits or other buried infrastructure.

6.4.4 Publicly Reported Leaks

Publicly reported leaks are captured through the AusNet Services' emergency response system (i.e. PowerOn). A response team is sent out to assess the leak and leak information is then entered into the SAP system in a similar manner to survey results. This means that important leaks are addressed immediately and also factored into AusNet Services' pipe replacement and future leakage survey programs.

6.4.5 Regulator Inspections

AusNet Services has a number of different regulators for city gates, field, district and residential purposes. These are inspected regularly, and inspection information collected in SAP

Refer to Appendix C *Regulating Facilities – Network* and Appendix D *Regulating Facilities – Consumer* of the AMS for further information on AusNet Services' management of regulating facilities.

6.4.6 Surge Protection/Corrosion Surveys

Electrical surge protection is placed on steel pipes to minimise the risk of electrical discharge through the steel pipe system. All surge protection devices are inspected annually and specialised devices have additional testing every five years.

Surveys are performed on protected steel pipes to assess corrosion protection levels every:

- Six months for high risk areas (e.g. transmission pipe and stray current zones); and
- Twelve months for low risk areas.

Refer to Section Appendix G *Corrosion Protection* of the AMS for further information on AusNet Services' corrosion protection strategy.

6.4.7 Gas Quality Monitoring

AusNet Services' gas quality monitoring is primarily concerned with odorant checks to ensure enough odorant is present to allow leaks to be detected by the public. However, some areas of the network have suffered from oil contamination originating from upstream plant passing into the system.

Refer to Liquids in Gas Strategy (30-2507-19) for further information.

6.5 Operations Management

The operation of the overall system and of individual assets is a key part of asset management to ensure that system performance targets are achieved, the integrity of the assets is not compromised, and safety and environmental requirements are met.

AusNet Services determines its operational requirements by reference to industry best practice, and by introducing incremental refinements to established programs as a result of accumulated knowledge of the asset base. An overriding principle is to ensure that operational staff have access to systems that can provide them with relevant information in a format that assists them to make timely and accurate decisions.

The following strategies will provide improved operation of the network:

- Implement key SCADA system improvements including:
  - Continue to develop enhanced pressure management systems to better protect and respond to energy and network demands; and
  - Implement Distribution Management systems that provide real time monitoring, management and optimisation tools such that network components can be more effectively monitored for failure and better predictive actions;
- Maintain and enhance plant operating thresholds and schedules to assist network controllers;

- Outage management system to be integrated with asset management systems and Geographical Information Systems (GIS);
- Field mobility for data collection and validation;
- Continue to optimise the timing of the planned outages of assets using the maintenance management and network management systems;
- Further digitisation network monitoring devices;
- Continue to enhance and develop the direct contacting of customers during network pressure issues;
- Regular review of all current operational procedures to ensure they remain relevant with the introduction of new technologies; and
- Continue to enhance and ensure that the backup Control Room (i.e. the Customer & Energy Operations Team) and back up Data Management Centre are regularly tested.

6.6 Contingency Planning

AusNet Services has developed a Gas System Contingency Plan (AMS 30-05) to support the recovery from incidents adversely affecting the performance of AusNet Services' gas system. Such incidents may result from plant failure, natural events or deliberate actions by individuals or groups.

Effects from isolated intentional attacks on physical facilities are only marginally different from those of natural events. This analogy applies to the nature of the damage inflicted and to the ability to begin repair operations.

As each emergency may be different in size, duration, and impact, the systems contingency plan, in partnership with SPIRACS, provides an initial response, and is aimed at bringing the emergency under control by:

- Managing the immediate cause of the emergency;
- Identifying the parts of the system affected by the emergency; and
- Identifying and allocating appropriate resources to ensure the continued operation of the system assets.

6.7 Customers

The Gas Distribution System Code specifies the minimum standards for connection and disconnection of customers to AusNet Services' distribution network.

In summary, AusNet Services must, upon request and within specified time periods, connect a customer to the distribution network if it complies with regulatory requirements and on fair and reasonable terms. In essence, standard residential connections with existing infrastructure passing the property are connected without charge (from AusNet Services) to the customer.

Connections that are not as straight forward are assessed utilising a 'Customer Contribution Model' to calculate a connection charge based on the cost of augmentation relative to expected future revenues to AusNet Services.

AusNet Services business strategy is to move to better understand our customers. the strategy will be to further understand customer penetration rates, pain points and map out the end to end processes in which customers currently face.

6.8 Capital Expenditure (CAPEX) Prioritisation

AusNet Services operates an overall capital governance process designed to ensure the objectives of customers, regulators, owners, and other stakeholders are met as efficiently as possible.

Selection of capital projects and programs into the company wide portfolio of projects is the prime responsibility of the respective business portfolio. The selection is aided by the prioritisation methodology and process, which is managed by CMA.

The prioritisation model has been designed to capture, per project, the answers to a set of criteria which are consistent across the network. The capture of these responses is incorporated in SAP – Portfolio Performance Management.

For each portfolio, the outcome of running the model is to provide a list of projects which are ranked in order of priority based on the scores of each project in that portfolio. These lists can be produced as required to support business planning and price reviews. The list produced from the model will form the basis of discussion by relevant stakeholders to ensure that an agreed prioritisation list of projects is balanced and meets business objectives efficiently.

The selection criteria are as follows:

- Stage 1 (criteria 1 and 2) is a gate which considers the level of discretion and the level of commitment. Projects which have already commenced or are mandatory to commence due to their nature (e.g. safety, regulatory obligations etc.) are given the highest possible ranking, at this point, and
- Stage 2 (criteria 3-7) contain five criteria which are used subsequent to stage 1's prioritisation to further rank projects with consideration of Strategic Alignment, Technical Assessment, Certainty of Benefit Realisation, Risk Reduction and Financial Return.

This capital governance process ensures that the overall level of capital is adequate to achieve an appropriate set of outcomes for customers and other stakeholders, and that CAPEX is explicitly managed in the most efficient manner.

6.9 Network Maintenance

6.9.1 General Overview

Routine maintenance is the regular day-to-day operations necessary to keep assets operating safely and reliably. AusNet Services categorises maintenance work in five areas:

1. **Scheduled Maintenance:** preventative maintenance work carried out to a predetermined schedule (e.g. regular overhaul of city gates, field regulators and district regulators, lubrication of valves).
2. **Condition Monitoring Maintenance:** work carried out a predetermined frequency (e.g. inspection of cathodic protection systems, leakage surveys, checking access to valves).
3. **Unplanned Maintenance:** work carried out in response to reported problems or defects (e.g. pipe failure causing leakage, mechanical failure).
4. **Site Management:** maintaining the site in a clean, functional, safe and visually acceptable condition.
5. **Damages:** repairs to assets (i.e. services and mains) damaged by third parties.

Most plant is checked at fixed time intervals. For example operational checks are conducted biannually on all city gates and field regulators, and annually on district regulators and line valve installations on transmission pipelines. AMP 30-02 Gas Maintenance Plan details the unplanned, condition monitoring and scheduled maintenance activities for each asset class, referencing the particular AusNet Services' Technical Standard or Field Procedure to which the work is to be performed.

6.9.2 Historical Performance

Over the 2002-2012 period, Reliability Centred Maintenance (RCM) analysis was applied to a number of the maintenance applications with the biggest impacts made in changes on maintenance frequencies. These were applied on regulator station maintenance (i.e. City Gates, Field Regulators, and Industrial and Commercial installations), leakage survey methods, leak repair criteria and potential surveying of CP protected steel distribution pipelines.

Mains and services leak repairs amount to approximately 30% of total maintenance expenditure. Older cast iron and bare steel pipes in the inner suburban low-pressure areas generate the majority of the leaks and subsequent expenditure. These pipes are the primary contributors to water ingress and gas supply problems that occur on the network.

Small domestic regulators passing up to 10 m^3/hr, have no preventative maintenance and are replaced on failure. AusNet Services uses a number of strategies (post-commissioning) to reduce the occurrence of and increase responsiveness to asset damage including:

- Daily patrol of transmission pipelines;
- No Go Zone;
- 'Dial Before You Dig';
- 'Hot spot' patrolling;
- Work Permit system;
- Use of inspectors when working within 3 metres of transmission pipelines;
- Marker-posts;
- Installation of tracer wire, marker tape and protective slabbing; and
- Easement landowner visits.

6.9.3 Methodology Used to Develop Maintenance Programs

AusNet Services determines its maintenance activities by reference to industry best practice, and by introducing incremental refinements to established programs as a result of accumulated knowledge of the asset base. From time to time these schedules are revised to cater for external changes (e.g. new legislation) or reviewed from a zero-base (e.g. application of Reliability Centered Maintenance to maintenance schedules).

Maintenance programs are established to minimise the total lifecycle cost of the asset, taking into account the risk and consequence of failure.

6.9.4 Maintenance Forecast

Reactive maintenance activity is forecast to reduce in the next 10 years on a per connection basis due to the targeted capital investment planned for the network, particularly the mains replacement program. This investment will result in a reduced number of leaks that AusNet Services must action, and reducing the number of activities associated with visits to regulators. This however will not reduce overall maintenance due to growth on the network.

6.9.5 Maintenance Strategies

The following long-term maintenance strategies are adopted for maintenance activities on AusNet Services' gas distribution networks.

- Continue to apply and further refine risk-based and RCM approach to maintenance;
- Further ease the possibility of asset damage by:
  - Education sessions to construction industry associations;
  - Information brochures to councils;
  - Promoting *Dial Before You Dig* via plant and equipment hire companies;
  - Media advertisements.

6.10 Contractor Management

6.10.1 Operations and Maintenance Contract

In 2019, AusNet Services' operations, maintenance and minor capital contract was renewed with Downer. The structure of the agreement aims to better align contractor incentives to continually improve network and operational performance.

The agreement is a unit rate contract where the contractor is paid monthly for units completed. These units include such activities as searching for escapes (subsequent to a public report of smell of gas), conducting leakage survey, repairing mains and other standard maintenance activities. Within this contract AusNet Services' primary service provider also provides the majority of customer connections works, these are standard connections in terms of laying mains and services. For larger developments the connection work is generally referred to the capital works tender panel.

Ongoing contract performance is monitored and controlled via KPIs, which are regularly reviewed to ensure the contractors' performance continues to be consistent with AusNet Services' businesses objectives.

6.10.2 Major Capital Works

Major capital works projects typically have a value of over $100,000 and are awarded to successful applicants pursuant to the Installation Service Provider (ISP) or capital works agreement. The ISP Panel consists of 4 panel members appointed for a 3 year period to 31 March 2022 with 12 month options. Panel members have been selected based on an assessment process where their safety, competiveness, quality, delivery record and financial viability are assessed, and their performance against these variables determine whether their term on the panel is extended.

Individual projects are periodically released to the panel members, who are invited to bid competitively. Following an appraisal and approval process, the works are awarded to the successful panel member. Projects are typically negotiated to be delivered within a set timeframe and are subject to fixed price agreements to transfer price risk to the service provider. AusNet Services' internal resources focus on the core functions of project planning, overall project delivery and contract management.

AusNet Services' contracting approach benefits AusNet Services and our customers by:

- appropriately balancing the use of internal and external resources;
- utilising market expertise and intellectual property;
- securing lower prices by requiring panel members to compete for work;
- obtaining economies of scale by ensuring that panel members expect to deliver appropriate volumes of work; and
- Ensuring high quality and timely project delivery through effective monitoring of performance.

6.11 Infrastructure Security

Commonwealth and State governments have imposed legal responsibilities on both the owners and operators of critical gas infrastructure. They must take all necessary preventative security measures to ensure continuity of supply.

The five main security threats to the gas distribution network are:

1. **Safety** – of untrained persons in the vicinity of energy-containing equipment;
2. **Malicious** – motivated by revenge, fame, association or challenge;
3. **Criminal** – profit driven; includes theft, fraud, sabotage or extortion;
4. **Terrorism** – threat or use of force to influence government or public through fear or intimidation[7], and
5. **Accidents or natural disasters** – that breach secure perimeters and/or cause security protections to fail.

The Infrastructure Security Risk Assessment Tool (ISRAT) is used to assess physical security risks and control measures in AusNet Services' installations. The Infrastructure Security Strategy is informed by more than 50 individual assessments, of major sites, and 20 generic assessments for the multiplicity of less significant installations. These assessments are enhanced by a representative sample of physical inspections by qualified and competent Security Risk Management practitioners that validate the ISRAT findings.

AusNet Services' physical security control measures are founded on the following principles:

- Consistent risk identification and quantification;
- Defence in depth – increasing the number and sophistication of control measures commensurate with the degree of intrusion risk;

[7] A 'terrorist act' is an act or threat intended to advance a political, ideological or religious cause by coercing or intimidating an Australian or foreign government or the public; causing serious harm to people or property, creating a serious risk of health and safety to the public, disrupting trade, critical infrastructure or electronic systems - *Criminal Code Act 1995* [Commonwealth].

- Deterrence – measures including signage, lighting, site attendance, law enforcement awareness training (leading to patrol attendance) and more to deflect would-be intruders towards other targets;
- Delay – measures including locks, fences, barbed wire and lighting to increase the time and effort required to successfully intrude;
- Response – Mobile Patrol and Security guarding measures to promptly and appropriately deal with intruders and associated consequences; and
- Contingency planning – measures to promptly recover service and minimise societal impact.

AusNet Services' Infrastructure Security Policy (AMS 20-14) covers all high risk installations across AusNet Services' three energy networks, inclusive of City Gate regulating facilities.

SPIRACS (AusNet Services' Integrated Response and Contingency System) contains detailed instructions to inform and instruct a person tasked with managing security at any impacted sites to do so competently and comprehensively.

AusNet Services' Corporate Security Policy details an organisation-wide approach to security preparedness and, amongst other things, provides a detailed framework for the application and administration of access control protocols dictating staff access to sites.

6.12 Asset Management Data and Information Systems

AusNet Services manages asset-related data in a series of specialist systems.

Table 4 provides a summary of such systems. Each system is operated by internal specialists and supported by internal software owners or expert contractors. Daily system backups to a remote site provide disaster recovery capability. All systems can be operated remotely.

Table 4: AusNet Services' Gas Business Systems

System	Function
AREVA	Monitoring and Remote operation of gas facilities
Spatial Data Management Gas	SDMG is AusNet Services' vehicle for accessing and maintaining network system connectivity, and spatial asset location data. SDMG operates on the GE GIS application.
AutoCAD	Drawing application used for storing detailed information on assets.
SAP	Asset maintenance management system. All network assets (except meters) are registered in SAP, together with their operations, inspection, and maintenance records. SAP is also utilised for Human Resourcing, Project and Finance Management.
Hansen Hub	Customer data management system used to track and record meter information.
Objective	Drawing viewing software.
PI	Transmission and distribution information repository for SCADA history.
PowerOn	Connection point management system used to manage and store supply fault information and outage management.
PowerOn Web	Connection point management system used to manage all service order work and to log fault calls.
SCADA Web	Real Time SCADA desktop monitoring.
Stoner/SynerGEE	Network planning model used for design of network capacity.

6.13 Data Management

AusNet Services has recognised the need to “transform” to become a more customer focused and process driven organisation. The current systems have a complex architecture as seen below in Figure 6.

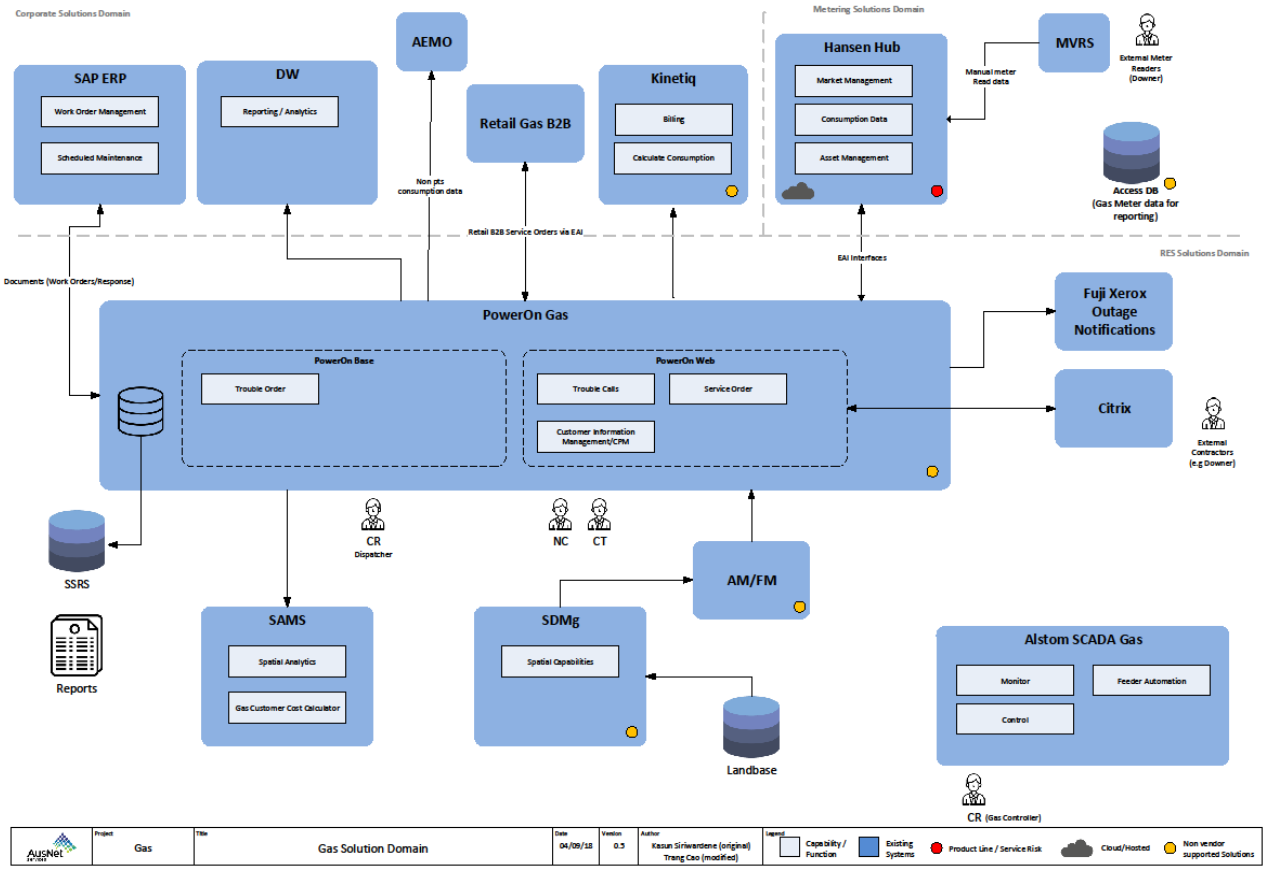

Figure 6: AusNet Services’ complex system architecture

The gas business is prioritising a “Gas Systems Roadmap” that will look to define the data and systems landscape required for the gas business in the medium term and in preparation for the next GAAR. In the short term, the gas business is focused on:

1. An Enterprise Application Integration (EAI) interm solution to ensure compliance with new Gas Life Support obligations which came into effect on 1 July 2020.

2. Exploiting opportunities to improve Meter Management data reporting

3. Utilising functionality from the IM platform

4. Improving data analytical capability across the gas business

5. Utilising the Business Continuous Improvement to improve data and systems.

6.14 Network Capacity

AusNet Services has an obligation to various regulatory authorities to make all reasonable endeavours to maintain sufficient distribution system pressures consistent with the Gas Safety Case (this being compliant with the Gas Safety Act and Gas Safety Regulations) and the Gas Distribution System Code.

AusNet Services’ annual augmentation program, which includes network reinforcements resulting from forecasts of both customer numbers and throughput, is required to create new assets, or upgrade the capacity or functionality of existing assets to achieve appropriate outcomes for customers and other stakeholders.

Network augmentation includes:

- Installation of new supply and reticulation mains;
- Upgrade of existing regulating and metering facilities, including auxiliary equipment;
- Installation of new regulating and metering facilities, including auxiliary equipment; and
- Installation of future supply mains as an enabler for network growth.

The Gas Network Capacity Strategy (AMS 30-17) outlines the augmentation required on AusNet Services' distribution and transmission assets required to meet its regulatory obligations.

6.14.1 Drivers Underpinning Network Augmentation

Demand on AusNet Services' gas network is forecast to remain reasonably stable over the next five years, with customer growth expected to compensate for lower consumption per capita. With strong population growth in Melbourne localities such as Hume, Melton and Wyndham and regional areas such as Bendigo, Ballarat and Geelong, overall customer growth is forecast to increase by an average of 2.1% to 2028. On the other hand, smaller housing, energy efficiency and the increasing competitiveness of electrical appliances is expected to reduce residential consumption per household by 1.7% per annum over the same period. The combination of customer growth and lower demand per customer is projected to result in Tariff V demand increasing by 0.6% in the next five years.

6.14.2 Historical Network Performance

Overall asset utilisation is moderating due to an overall decrease in demand across the network. Demand forecasts are expected to increase by 2% in the next five years. Growth corridors are subject to high demand due to high volume of connections; areas including the surf coast have suffered poor supply. Works are in place to ensure that demand is met in the growth areas of concern.

6.14.3 Methodology Used to Identify Network Reinforcement

AusNet Services' distribution networks are continually expanding due to residential growth, and commercial and industrial development. To manage this, continued planning and management is undertaken with the aid of computer-calibrated models that predict the operation of the networks in the field. Models are based on 1-in-2 winters peak day (also known as a 14.60 Effective Degree Day). Essentially this means that AusNet Services Gas Network will be developed to maintain supply on all days excluding the highest demand day every two years.

Modelling of forecast gas consumption often indicates the need for future augmentation to the networks to ensure the security of supply and maintenance of fringe pressures in accordance with the Gas Safety Case and the Gas Distribution System Code. AusNet Services' Network Planning group identifies necessary augmentation by simulating forecast growth and demand, which in turn determines the appropriate timing of individual projects.

A major input to augmentation planning is the winter testing program – i.e. a detailed pressure monitoring program conducted at selected locations across the network during peak load conditions. Winter testing data is analysed and used to ensure the accuracy of network models, as well as to identify required reinforcements to ensure that network fringe pressures remain above required minimum levels – even in peak load conditions

Network models are validated on a periodic basis or as required (i.e. following a major augmentation project on a network). Document AMS 30-14 Gas Network Planning – Winter Testing defines the criteria for prioritising and selecting networks for winter testing.

Table 5: Minimum Network Pressure – Gas Distribution System Code

Network Pressure	Minimum Obligated Pressure
High Pressure	140kPa
Medium Pressure	15kPa
Low Pressure	1.4kPa

Source: Gas Distribution System Code, Version 11, Schedule 1, Part A

6.15 Unaccounted for Gas

Unaccounted for Gas (UAfG) refers to the difference between the measured quantity of gas entering the gas distribution system and the amount of gas used by consumers. UAfG can arise because of leakage from the system, metering errors, theft, inaccuracy in the conversion from quantity of gas measured to energy (reflecting discrepancies in temperature, pressure, heating value, altitude or the gas compressibility factor), and a number of other minor causes.

AusNet Services' Gas Distribution Network is subject to a UAfG incentive mechanism set by the ESC. The benchmark data can be found in Schedule 1 Part C of the GDSC (Version 11).

7 ASSET MANAGEMENT PLANS

An overview of AusNet Services' detailed plant strategies, with reference to future capital and operational requirements is provided in Appendix B to Appendix J.

Highlighted within each strategy will be:

1. Asset/plant overview;
2. Historical and current performance;
3. Capital requirements;
4. Operational requirements; and
5. Plant specific strategies.

Further detail can be found in individual Plant Asset Management Strategies.

APPENDIX A GAS NETWORK KEY PERFORMANCE INDICATORS

A.1 COMMERCIAL INDICATORS

The following commercial indicators are monitored as part of the Gas Business Plan (as at EOFY20).

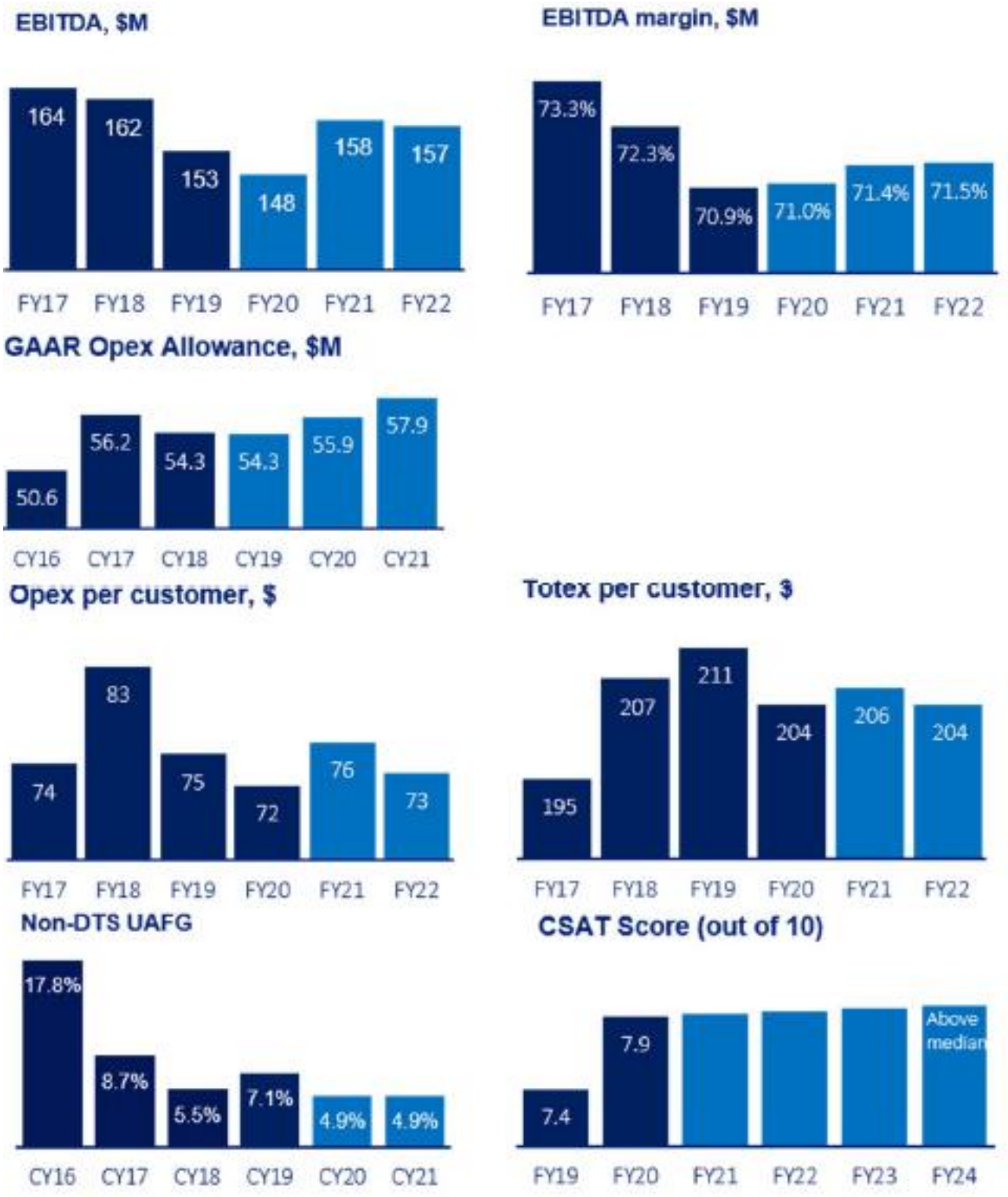

Figure 7: Commercial indicators of performance

A.2 NETWORK KPIs

The following network KPIs are published in the Asset Management Plan (AMS 01-08) and are tracked monthly by the Network Safety Management Committee (refer to Gas Network Performance Targets CY21 for further detail).

Table 6: 2021 Targets

Measure			2021 Target	2020 Target	2019 Target	Comments	Forum Reported
Safety Related Programs		Low pressure mains replacement	**>58km**	**70km**	**70km**	- Safety related program; proactive replacement of deteriorated mains, with driver to reduce leaks. - Measured by length of mains abandoned. - Update MP renewal target to align with 2018-2022 GAAR approved target of 55km. Note LP target is 350km. - Despite these individual targets by pressure type, a risk-based approach will be taken to renewal which will be pressure agnostic, so the overall 81km/per year is the key target.	ESV, AER, Monthly KPI dashboard, NSMC, AMS
		Medium pressure mains replacement	**>5km**	**11km**	**7km**		
		Service damages per 1000 customers	**≤ 1.8 damages**	**≤ 1.8 damages**	**≤ 1.8 damages**	- Indicator of network safety. - The dial-before-you-dig program, free asset locating services, contribute to the reduction of 3rd party incidents on the network. -	Monthly KPI dashboard, NSMC
		Main damages per 1000 km	**≤ 6.6. damages**	**≤ 6.6. damages**	**≤ 6.6. damages**		
Capital Expenditure Sharing Scheme (CESS) - Asset Performance Index (API) *New incentive mechanism approved by AER as part of 2018-22 GAAR. Asset performance metrics and weightings: USAIDI (25%), USAIFI (25%), mains leaks (20%), service leaks (23%), meter leaks (7%).*	***Leaks***	Mains leaks per km	**≤ 0.090 leaks**	**≤ 0.090 leaks**	**≤ 0.095 leaks**	- Amount of leaks are a network performance and safety indicator. - Benchmarks aligned and updated (if required) in-line with approved benchmarks in the 2018-2022 GAAR as part of the CESS. - Leaks identified are a result of publicly reported and third party damages (excludes proactive leaks identified from leakage surveys).	ESV, AER, Monthly KPI dashboard, NSMC, AMS
		Services leaks per 1000 customers	**≤ 5.5 leaks**	**≤ 5.5 leaks**	**≤ 5.2 leaks**		
		Meter leaks per 1000 customers	**≤ 16 leaks**	**≤ 16 leaks**	**≤ 24 leaks**		
	Reliability	Unplanned supply average interruption duration index (USAIDI)	**≤ 0.892 min**	**≤ 0.892 min**	**1.0 min**	- Network reliability indicators. - Benchmarks align with approved benchmarks in the 2018-2022 GAAR as part of the CESS. - USAIDI was impacted from Yarraville water ingress incident in April 2019. - USAIFI is introduced to align with performance and safety indicators as part of the CESS.	ESV, AER, Monthly KPI dashboard, AMS
		Unplanned supply average interruption frequency index (USAIFI)	**Not published**	**≤ 0.021 interruptions**	**-**		
Emergency Response (within 60 mins)		Metro business hours	**95%**	**95%**	**95%**	- Core reactive safety indicator. - A measure of the percentage of 'Class A' emergencies responded to within 60 minutes. - Benchmark set by ESV.	ESV, AER, Monthly KPI dashboard, NSMC
		Metro after hours	**90%**	**90%**	**90%**		
		Non-Metro all hours	**90%**	**90%**	**90%**		
Un-Accounted for Gas (UAFG)		Declared transmission system (DTS)	**≤ ~3.44%**	**Not established**	**≤ ~3.44%**	- This measure is the percentage difference between gas injections and withdrawals. - Benchmarks set by ESC for 2018-2022 period and adjusted for usage (2019 benchmark and forecast only an estimate at this stage). - DTS covers the entire network except the Avoca, Ararat, Stawell & Horsham (non-DTS). - Non DTS UAFG levels are on decline.	ESC, AER, Monthly KPI dashboard, NSMC
		Non-declared transmission system (Non-DTS)	**≤ ~4.9%**	**Not established**	**≤ ~4.9%**		
Reportable Incidents to ESV			**Not published**	**≤ 34**	**≤ 25**	- Reportable gas related incidents are those associated with liability (third party infringements etc.), breaches of regulations and weaknesses in systems and processes. Reportable incidents to ESV is outlined in TS 0503 (Gas Incident Reporting Technical Standard). - Reportable incidents is forecast to go over the year end benchmark, discussed in Appendix A.	ESV, Monthly KPI corporate dashboard, NSMC, AMS
Transmission Pipeline Unauthorised Activities			**Not published**	**≤ 9**	**≤ 9**		

APPENDIX B TRANSMISSION PIPELINES

B.1 Asset Overview

AusNet Services currently has 20 individually licenced transmission pipelines totalling 181.5km, operating at pressures up to 2,760kPa and ranging in diameters from 100mm to 500mm. Transmission pipelines operate at high pressure to efficiently move large amounts of energy over large distances. Permits to operate licensed pipelines are issued by DELWP with written consent from the Minister of Energy required for their operation. The individual licences contain details of pipe location and route, length, size, maximum allowable operating pressure and material specification.

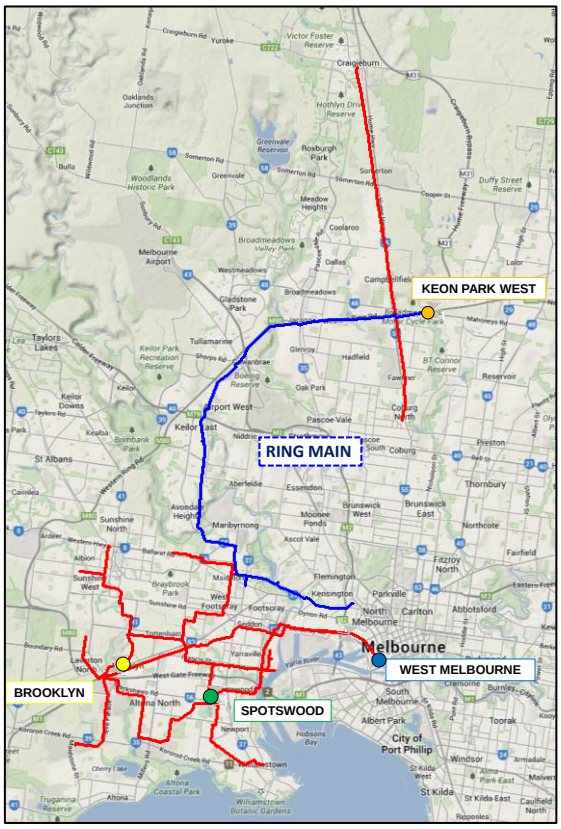

Figure 8: AusNet Services' Metropolitan Gas Transmission Network

In 2019, the Department of Environment, Land, Water and Planning (DELWP) cancelled City Gate pipeline licences 235 (Colac CG), 256 (Woodend CG) and 257 (Lancefield CG). This was done on the basis that the authorised routes under the licences run entirely on land owned and controlled by AusNet Services and hence was subsequent licence cancellation is in accordance with the Pipelines Act 2005, Schedule 1 Clause 2(c).

In 2007, the government altered the licensing regulations such that if a new installation is approved by the ESV, then a licence is not needed. As such, neither Plumpton nor Wyndham Vale City Gates (AusNet Services' newest City Gates) are licenced. Instead, these sites have gas easements placed upon them.

Transmission pipelines are designed and constructed to Australian Standard (AS) 2885.1 using high-grade steel and maintained and operated to the latest version of AS 2885.3 (2008). Corrosion protection and pipeline patrols are examples of proactive measures used to maintain the integrity of the transmission network.

The average age of AusNet Services' pipelines is 46 to 50 years, with the latest pipeline constructed in 1991 (Portland City Gate to Portland Smelter). The conservative engineering life of transmission pipelines is 80 years.

Further details on AusNet Services' Transmission network can be found in the Transmission Pipelines Plant Strategy (AMS 30-50).

B.2 Current Performance

The transmission system is in good condition due to original construction techniques and controls, and the ongoing maintenance management, particularly the cathodic protection program.

Network analysis indicates that the existing transmission system remains adequate (in terms of capacity), based on current load forecasts with sufficient supply from the VTS, which is operated by AEMO.

B.3 Capital Requirements

The management of AusNet Services' existing transmission network is considered operationally intensive when compared to ongoing capital requirements.

Increased pipeline integrity, which leads to increased public safety and security of supply, are the primary drivers for proposed capital works in the short to medium term. The requirement for new pipelines or major alterations of existing pipelines is predominately customer driven and not discussed within this section. Refer to Section 6 of AMS 30-17 Network Capacity Strategy, for proposed capital investment on transmission pipeline alterations driven from capacity constraints.

Capital programs to 2024-28 are detailed within the Gas Transmission Pipeline Strategy (AMS 30-50).

B.4 Operational Requirements

Public safety and regulatory (license) compliance are the dominant drivers underpinning maintenance activities on licensed pipelines. Maintenance includes pipeline patrol, third party work inspections, leakage survey, corrosion (cathodic) protection, minor coating repairs, fault repairs, maintenance of pipeline markers and easements, pipeline integrity inspections and line valve/branch valve maintenance.

AusNet Services has developed and maintains a Transmission Pipeline Integrity Management Plan (AMP 30-03) which covers each of AusNet Services' licensed pipelines. A qualitative pipeline risk assessment has been used for the purposes of prioritising pipelines based on risk rankings.

Each pipeline is reviewed every 5 years and assessed in terms of:

- Historical data (coating defects, pigging data, damage data, repair data);
- Asset data (MAOP, wall thickness, design factors, %SMYS, operating pressure);
- Assessment data (Hot spots, over-pressure protection review, MAOP review); and
- Environmental Line List.

Utilising a risk based approach; strategies for further maintenance and/or inspections may be recommended following the assessment of individual pipelines.

Inspection strategies may include:

- Increase coating defect survey intervals;
- Intelligently pig the pipeline;
- Non-invasive pipe inspection tools (eg, Dig ups, No Pig Tool); and
- Increase leakage survey frequency.

Proposed Operating Strategies may include:

- Pressure downgrading of pipeline;
- Review of current protection measures; and
- Introduction of automated control of line valves for instant pipeline isolation.

B.5 Plant Specific Strategies

The following plant specific strategies are employed for the management of transmission pipelines. Refer to *Transmission Pipelines Strategy* (AMS 30-50) and *Transmission Pipeline Integrity Management Plan* (AMP 30-03) for further details.

- Ongoing revision of maintenance practices (e.g. pipeline patrol). Implement changes based on "risk" rather than historical practices.
- Remediation works identified in the environmental line list
- Continuation of hot spot surveying, identifying and recording areas of high risk. Increase frequency of integrity dig-ups confirming the integrity of protective coatings.
- Investigate and implement improved methods of demonstrating pipeline integrity.
- Continue management of cathodic protection systems with the aim of maintaining levels of protection above 98%.
- Relocate below ground, for the purposes of safety and security of supply, identified sections of above ground transmission pipelines.

APPENDIX C REGULATING FACILITIES – NETWORK

C.1 Asset Overview

C.1.1 Pressure Regulators

A pressure regulator is a valve that automatically opens or closes to match the flow of gas through the regulator to the demand for gas placed on the downstream network. The regulator does this by maintaining a predetermined set pressure downstream of the regulator. Pressure regulators are used throughout the network to maintain safe and useable pressures within its networks.

There are three (3) broad classifications of network pressure regulating stations:

- **City Gates** that regulate gas into AusNet Services' high-pressure and transmission pressure networks from Victoria's VTS.
- **Field Regulators** that feed gas into AusNet Services' high-pressure and medium-pressure distribution networks. The facility is either supplied by AusNet Services' transmission or high-pressure distribution network.
- **District Regulators** that control the pressure levels in the low-pressure reticulation system by the reduction of either high or medium pressure to low-pressure.

Each facility may include a host of auxiliary equipment namely valves, filters, SCADA, civil assets and cathodic protection. A city gate also includes highly accurate metering assets known as CTMs, which are owned and maintained by the VTS operator.

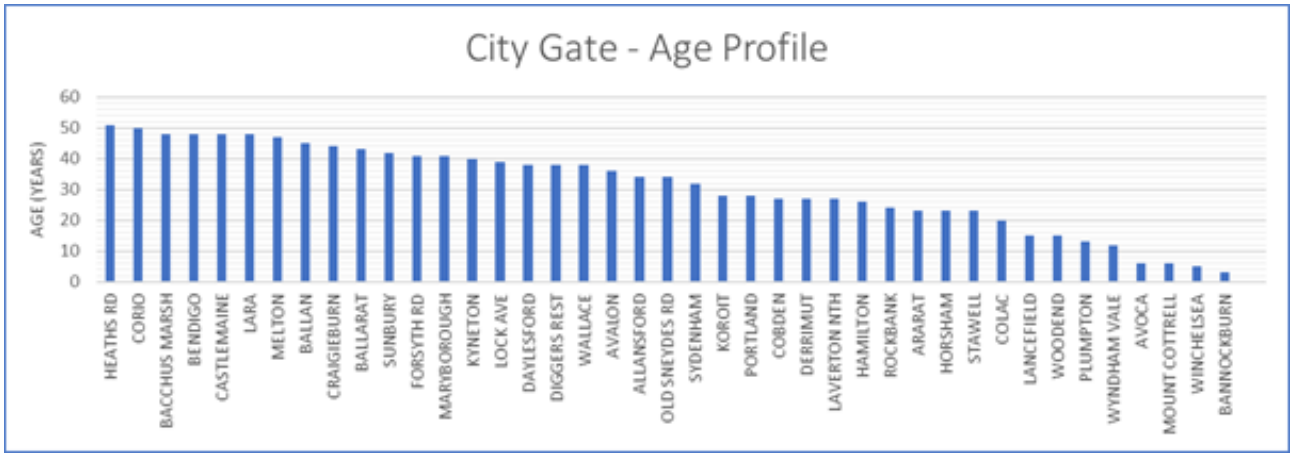

Figure 9: Age Profile City Gates

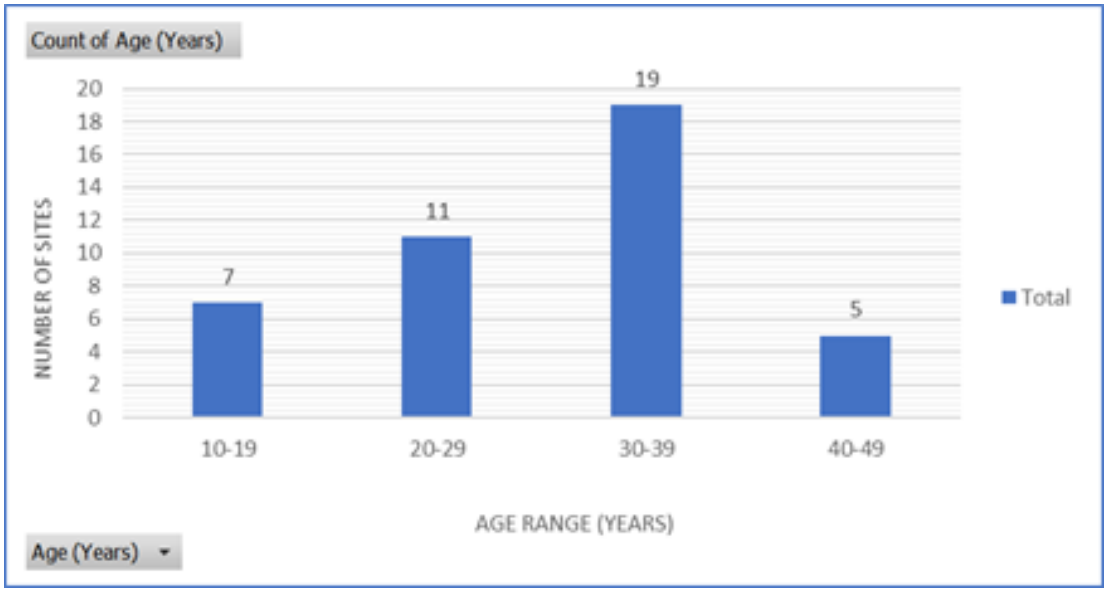

Figure 10: Age Profile Field Regulators

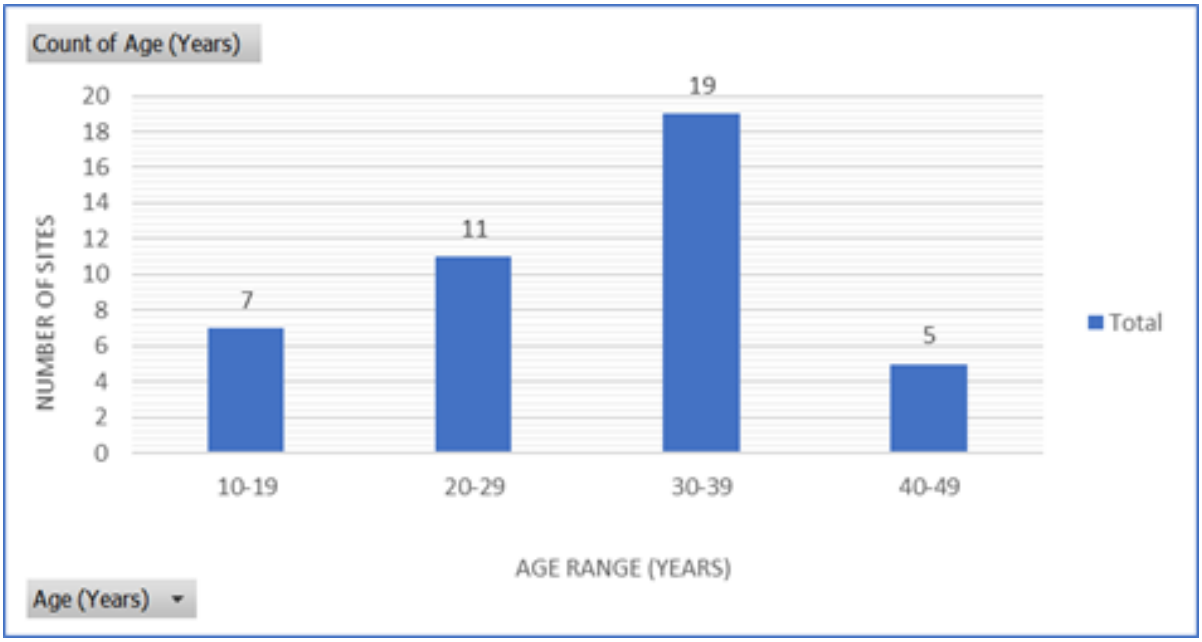

Figure 11: Age Profile District Regulators

C.1.2 Heaters

Gas pre-heat is required at City Gates or Field Regulators where the pressure drop across the facility causes a significant drop in gas temperature resulting in icing of pipework. The phenomenon is known as the Joules-Thompson effect which equates to approximately a 5.6°C temperature drop per 1,000kPa decrease in pressure. Icing of pipe work causes reliability and control problems with regulators and an inability to operate site valves. AusNet Services currently operates 36[8] gas pre heaters at various city gate sites.

[8] As of June 2016.

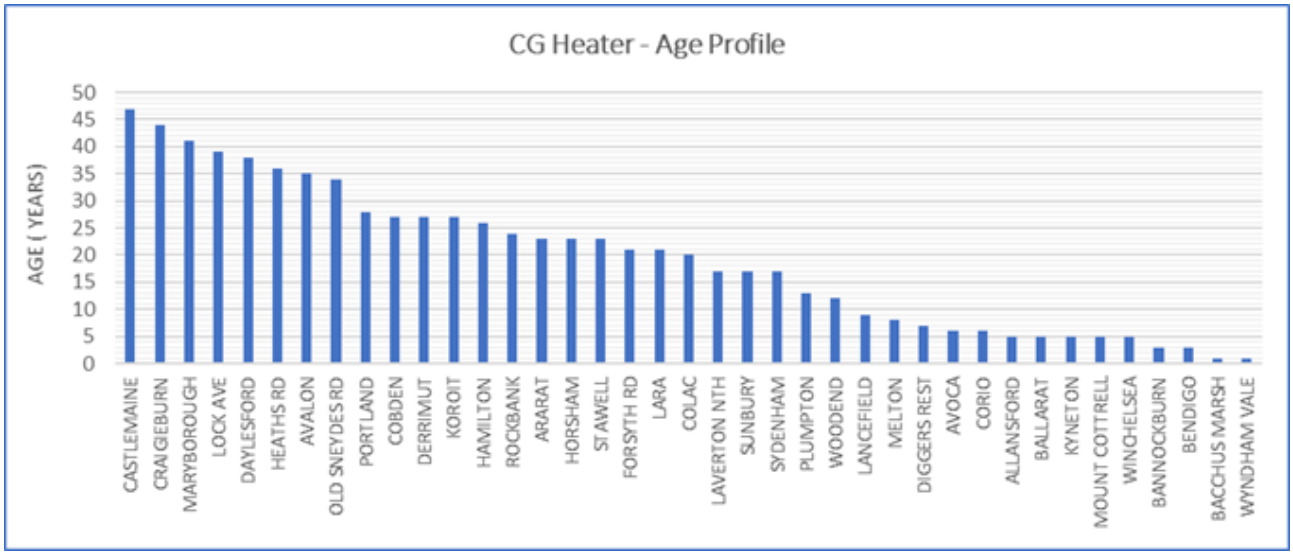

Figure 12: Age Profile of Network Heaters

C.1.3 Liquid Contamination (Coalescers)

To prevent liquids entering AusNet Services' networks a number of Coalescer filters have been installed at City Gates and consumer connection points. Additionally, two portable skid-mounted Coalescers have been built and are available for rapid installation within the network when signs of liquid contamination arise. Portable Coalescers have also been used to protect AusNet Services' assets during pigging operations conducted by the VTS operator.

C.2 Current Performance

C.2.1 Pressure Regulators

The reliability of AusNet Services' regulating stations is critical to system integrity and continuity of supply. The reliability of each site type, since 2008 is summarised below:

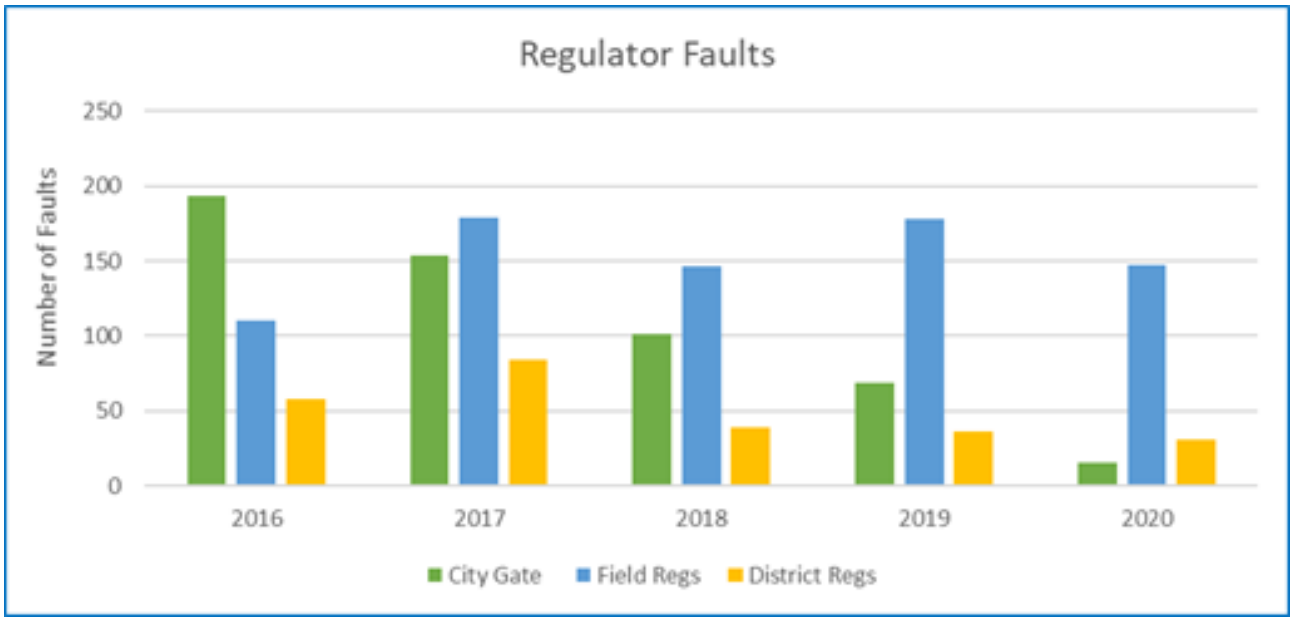

Figure 13: City Gate, Field Regulator and District Regulator failure rate

- **City Gates:** There are currently 41 city gate sites on the network. There is a decrease in city gate failure due to the benefits of replacement of Welker Jet and Grove regulator sites.
- **Field Regulators:** AusNet Services has 107 field regulator sites. Failure rates of these regulators have remained stable.
- **District Regulators:** AusNet Services currently has 39 district regulators. District regulators are removed from the network as part of the mains replacement program and failure rates have therefore decreased over time.

The low pressure network will be removed from the network over the next access arrangement period. Hence, all remaining district regulators will also be removed from the network, reducing failures to 0 by 2028.

C.2.2 Heaters

Failure rates on heater sites have increased. The majority of the increase in failures is due to pilot lights going out, resulting in the heater system failing.

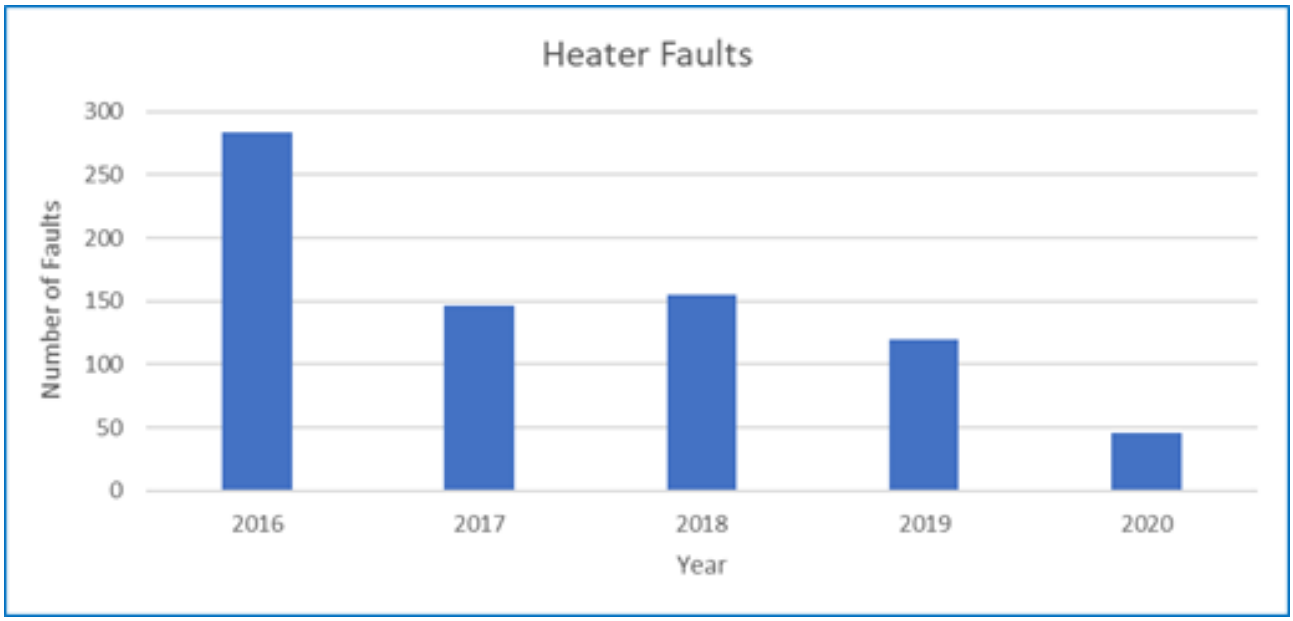

Figure 14: Heater Failure Data

C.3 Capital Requirements

Capital programs identified from maintenance or operational deficiencies are detailed within AusNet Services' Network Regulators Strategy (AMS 30-51). Capital requirements (upgrade or replacement) due to capacity constraints are captured within AusNet Services' Network Capacity Strategy (AMS 30-17).

The following principles/strategies are followed during the definition of the capital program for network regulating facilities.

- **Asset Replacement:** Proactive replacement of poor perforing and/or obsolete regulators and actuators operating at high, medium and low pressures where parts are no longer manufactured by the Original Equipment Manufacturer (OEM).
- **New Facilities:** Replacement of heaters to major regulating stations to improve downstream asset integrity.
- **Asset Safety:** Programs to increase public and/or employee safety. Examples include the installation of water bath heater platforms to reduce OH&S risks onsite and a program to relocate regulating stations to underground due to urban growth encroachment.
- **Asset Security:** Upgrade of security fencing at high risk sites to prevent unauthorised access.

C.4 Operational Requirements

Operational requirements and maintenance frequencies for network regulators are contained within AusNet Services' Asset Maintenance Plan (AMP 30-02), and summarised below.

C.4.1 Pressure Regulators

City Gates have full refurbishment schedules that vary from 'breakdown only' for low risk stations to 10 years for low risk stations, 6 years for medium risk stations and 3 years for high risk stations.

Detailed analysis of historical fault data via RCM modelling, on the various types of city gate configurations and components as well as the impact of failure on the network has determined the best fit maintenance regime.

Field and District regulators are stripped and rebuilt every 6 or 10 years depending on whether they are deemed high or low risk. Operational checks are conducted at least every six to 12 months.

City gates, Field and District regulators have a useful life of 60 years with this type of major maintenance.

C.4.2 Heaters and Coalescers

Water bath heater maintenance and Coalescer maintenance is performed at the same time as the City Gate regulator maintenance as they are part of the same City Gate station facility.

Heater coil inspections/refurbishments are carried out every 8 years or as identified during full maintenance.

Filtering elements within Coalescers are replaced during the scheduled full maintenance of the regulating facility it operates.

Refer to Section 7 of the Networ Regulators Strategy (AMS 30-51) for additional details on current and future maintenance programs.

C.5 Plant Specific Strategies

The following plant specific strategies are employed for the management of AusNet Services' network regulating assets. Refer to AusNet Services' Network Regulators Strategy (AMS 30-51) for further details.

- Replace poor performing and/or obsolete regulators where parts are no longer manufactured by original equipment manufacturer (OEM) providers.
- Installation and replacement of heaters at City Gates to mitigate freezing of regulating facilities and downstream assets.
- Asset Safety & Security investment to mitigate and reduce hazards.
- Continual optimisation of maintenance frequencies (based on RCM principles) to improve or maintain network safety and reliability.
- Introduction of new network technology to automate network pressure control.
- Improved asset selection that minimises total lifecycle costs.

APPENDIX D REGULATING FACILITIES – CONSUMER

D.1 Asset Overview

As with network regulators, each supply point (i.e. connection) from the distribution network contains a regulator that matches the flow of gas through the regulator to the demand for gas by the consumer. In total AusNet Services has approximately 760,000 connection points to the distribution network, each with a dedicated regulating facility.

Regulators are sized based on expected consumer demand which can range from 6m^3/hr for domestic loads to in excess of 2,500m^3/hr for large industrial and commercial customers, for which a purpose-designed regulator unit is installed. Regulator assemblies exist in a variety of designs (e.g. single run or dual run) and enclosures (e.g. black boxes, metering room, etc) which are dependent on the consumers demand profile and underlying site conditions.

Accompanying the pressure regulator, each supply point also contains a gas meter used to measure the volume of gas flowing to the consumer.

Refer to Appendix F of this AMS for AusNet Services' management of metering assets.

D.2 Current Performance

AusNet Services' asset management database does not record the location and detail of domestic regulators commissioned within the network, therefore, the age profile of domestic regulators can be estimated but is essentially unknown.

A rising trend of leaks on meters has heavily influenced the network leakage rate which attributes 75% of those leaks as occurring at the meter. Recent performance has improved and by the end of 2020, the rate of meter leaks stood at 18 leaks / 1,000 customer connections, down from the 2019 high of 22.5 leak / 1,000 connections.

The decrease in recorded meter leaks correlates with the decreasing failure rates of domestic regulators. The recent trend seen in AMS 30-53 could therefore be attributed to the decrease in domestic regulator leaks. Under the current practice of reactive replacement of domestic regulators (i.e. upon failure), the field fault rate of domestic regulators may return to an upwards trend in the future.

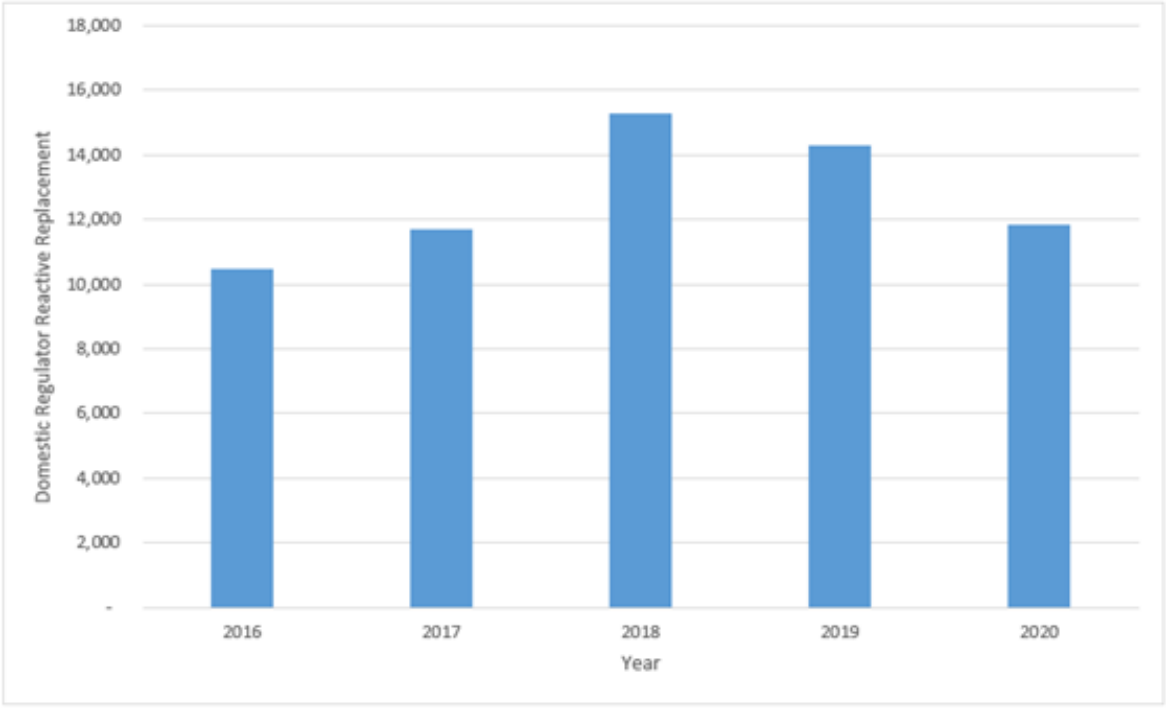

Figure 15: Replacements due to Domestic Regulator Faults

Internal analysis suggests that ~90% of 'meter leaks' occur on a component of the regulator unit, and in most cases the regulator was replaced. The current strategy being implemented is:

1. The investigation of superior regulators: The Gas Network has over 760,000 domestic meters and regulators. A Business Case is underway for the procurement of ~2,000 superior regulators to be piloted in FY21/22 on a small part of the network to determine whether this reduces reported meter leaks. Two other regulators are also undergoing preliminary assessment.

2. Management intend to upgrade the meter management system to capture data to proactively identify and analyse any performance issues associated with certain types of regulators. A Business Case was due to be completed by June 2020 but has been delayed in light of COVID-19 impacts.

3. Updating of the asset management system (SAP) to collect accurate data from the field for regulator replacements. This is a minor enhancement aimed to be completed in FY21/22.

D.3 Capital Requirements

Capital requirements for consumer regulators are identified proactively during maintenance activities and reactively if a regulator was to fail. Security of supply, public safety, spare part availability, and financial efficiencies are all drivers for capital works on consumer regulators.

An overview of capital programs delivered for consumer regulators is provided. Refer to AusNet Services' Consumer Regulators Strategy (AMS 30-53) for further details.

- **Replacement of Obsolete Industrial & Commercial Regulators:** Active replacement of industrial and commercial regulators that have become obsolete with spares no longer manufactured by the OEM providers. Proactive replacement promotes network integrity and security of supply.
- **Replacement of High Risk Regulators:** Active replacement of industrial and commercial regulators that have high risk due to large consequence of failure. Replacement with a different desgin removes the risks of large amounts of gas being released upon failure.
- **Replacement of Deteriorated Regulators:** older actuators past their expected operation life are at higher risk of failure and have a greater chance of no longer being supported by the manufacturer.
- **Miscellaneous Works:** Capital expenditure is regularly incurred on minor ad hoc work at industrial and commercial sites. This work is required due to a combination of OH&S, risk mitigation, regulatory compliance, asset integrity, and/or operational requirements.

D.4 Operational Requirements

Domestic regulators are *'run to fail'* with no scheduled maintenance conducted. When failure does occur, it is replaced with a new regulator of similar capacity. Domestic regulators are not refurbished as it is not financially viable to do so.

Industrial and Commercial installation with outlet pressures ≥ 4kPa are classified as system operations units and undergo 6 or 12 monthly operational checks. In addition, the same regulating installations are periodically refurbished (soft rubber components are replaced) as part of the preventative maintenance regime. The interval between refurbishment, 6 years or 10 years, is based upon the RCM principles and the criticality of the regulating station.

D.5 Plant Specific Strategies

The following plant specific strategies are employed for the management of AusNet Services' consumer regulator assets. Refer to the Consumer Regulators Strategy (AMS 30-53) for further details.

- Improve the safety, security and accessibility of legacy installations.
- Replace obsolete regulating assets on commercial and industrial stations (before in-service failure)
- Replace high consequence assets with alternative designs.
- Replace deteriorated assets past their expected life.
- Improved asset selection that minimises total lifecycle costs.
- Implement IT system to record the location and asset details of domestic regulators.

APPENDIX E DISTRIBUTION MAINS AND SERVICES

E.1 Asset Overview

The gas mains distribution network is comprised of approximately 12,157 kilometres (km) of mains that operates up to 1,050kPa maximum operating pressure. The distribution system transports gas from the transmission network (>1,050 kPa) via three main pressure tiers to consumer service lines. The pressure tiers are referred to as low, medium, and high with a fourth minority pressure tier known as 'High Pressure 2'. This pressure tier accounts for less than 1% of the total distribution network. In relation to material types, four dominant material types exist (cast iron, poly vinyl chloride, polyethylene and steel).

Table 7: Length of mains by pressure classification

Pressure Tier[9]	Operating Pressure (kPa)	Length (km)	% Allocation
Low (LP)	Up to 3 kPa	421	3%
Medium (MP)	15 kPa – 140kPa	634	5%
High (HP1)	140 kPa – 515 kPa	11,005	91%
High (HP2)	515 kPa – 1050 kPa	97	1%
Total		**12,157**	**100%**

Gas services operate at pressures up to 515kPa. They are predominantly constructed from polyethylene with a small percentage constructed in steel, aged wrought iron and poly vinyl chloride (PVC).

The age profile of AusNet Services' distribution mains are displayed in the Figure 16 below. The age profile of the network ranges to 121 years with an average network age of 23 years.

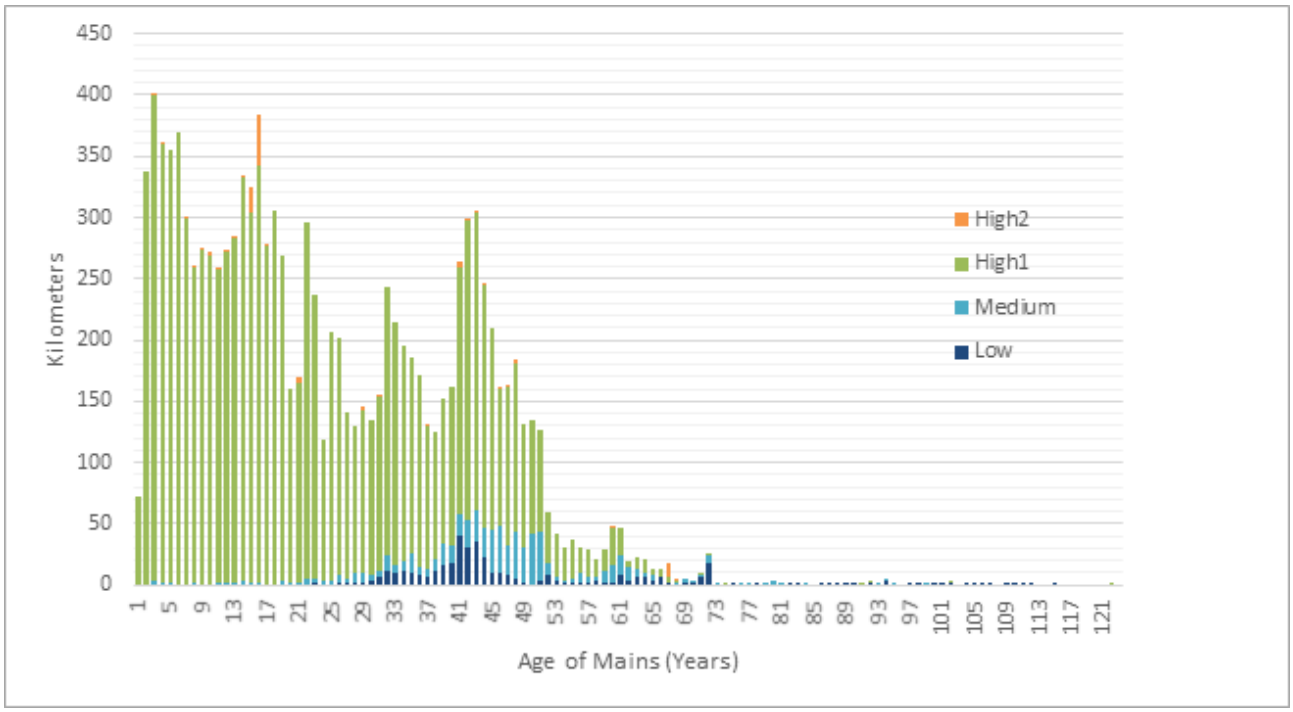

Figure 16: Whole Network Age Profile

[9] AusNet Services' Technical Standard TS-7600.

Table 8: Pipe Material Summary

Material Type	Network
Cast Iron	95km
Polyethylene	9,044km
Uncoated Steel	254km
Protected Steel	2,499km
PVC	266km

E.2 Current Performance

Figure 7 shows the Mains leakage rate (leaks per km of mains) by network pressure classification.

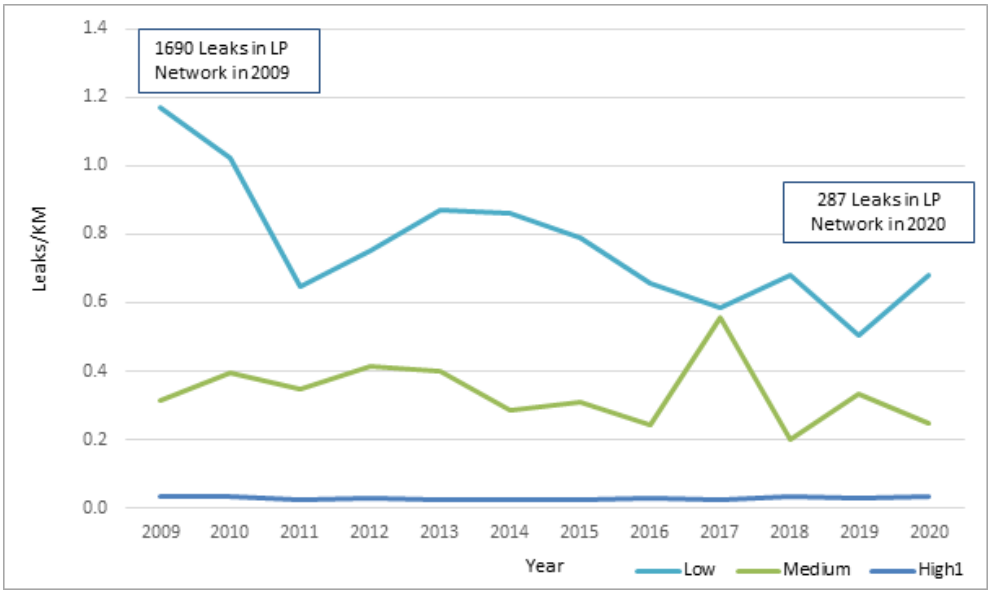

Figure 17: Mains leakage rate of by pressure classification

Periodic review is completed of failure data to monitor the relative performance of material types and pressure tiers. Cast iron mains contribute the most in terms of volume and leakage rates within the network. As cast iron is predominantly found within the low pressure system, the low pressure network contributes to the majority of network failures. However, these will be removed in the upcoming access arrangement period.

Refer to AusNet Services' Mains and Service Strategy (AMS 30-52) for detailed breakdowns of asset performance by material type and pressure tiers.

E.3 Capital Requirements

E.3.1 Mains Replacement

The mains replacement program involves replacement of aged and leaking LP mains with polyethylene main. Since the introduction of the program in 2003, AusNet Services has demonstrated its commitment to completing the program by 2028 with the decommissioning of over 1,455km of low pressure to date. In the current regulatory period, leakage rates were expected to increase due to the rate deterioration. However with

a targeted and increased rate of replacement, leakage incident rates have been maintained on the network in line with meeting the network objective of maintaining network safety.

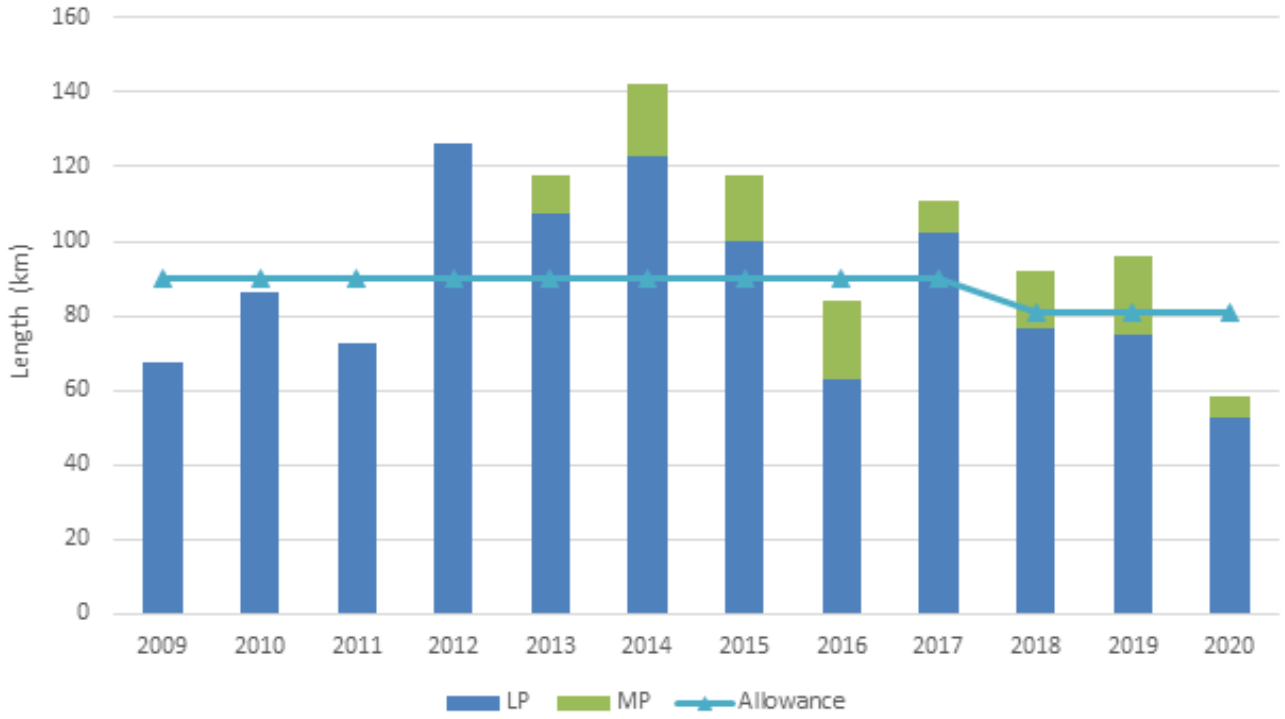

Figure 18: Kms of Mains Decomissioned by Year (2009-2020)

The focus of the current replacement program is to target heavily deteriorated low pressure cast iron mains; as inferred by a high incidence of leaks and replace with high pressure polyethylene mains. The responsible replacement of aging mains, on a safety risk prioritisation basis, is a key mitigation control set out in the Gas Safety Case. Over the upcoming access arrangement period, the remaining low pressure mains will be removed from the network.

In summary the mains replacement program has the following drivers:

- maintains network risk;
- Improved system capacity and reliability;
- Continued compliance with regulatory benchmarks, the GSC and GDSC;
- Reduction in carbon emissions and environmental impact;
- Long-term reduction in network maintenance; and
- Move towards a uniform high pressure gas network.

Completing the low pressure replacement program will achieve operational efficiencies by reducing the need for district regulators as well as the associated policies and procedres for the Low Pressure network.

A risk assessment has been completed providing the rationale some medium and high pressure mains to be prioritised for replacement. The analysis demonstrates that certain material types within each pressure category represent higher safety risks. AusNet Services' analysis indicates that although the risk of a medium pressure asset failure occurring is relatively low; the associated consequence (in any populated area) could be significant.

The analysis in the table below shows the relative risk associated with different main material types at different pressures. Failure modelling indicates that replacing the Low Pressure network and additionally targeting some Medium Pressure mains of specific material types will maintain safety and reliability by reducing incidence of leaks and outages.

Table 9: Risk Weighting Results (as at Dec 2014)

Pressure Tier	Material	Length (km)	Ave Annual LIR (leaks / km)	Gas Flow Ratio	Risk Weighting
High Pressure	Steel Protected	2289	0.02	11.95	0.24
	PE	7055	0.02	11.95	0.24
Medium Pressure	Steel Protected	305	0.09	4.01	0.36
	Steel Unprotected	147	0.76	4.01	3.05
	PE	204	0.05	4.01	0.20
	Class 250 PE (P4)	39	0.95	4.01	3.81
Low Pressure	Steel Unprotected	70	0.46	1.00	0.46
	Cast Iron	266	1.07	1.00	1.07
	PVC	420	0.14	1.00	0.14
	PE	18	0.07	1.00	0.07

The gradual replacement of the entire low pressure network is required to maintain a stable leakage rate. If left unchecked, the expected deterioration of the remaining cast iron and unprotected steel mains on the low pressure network is forecast to lead to rapid increases in leak incidences. The replacement rate of 60-70km per annum provides a sustainable approach to managing the risk profile of the low pressure network, as demonstrated in Mains and Services Strategy (AMS 30-52). AusNet Services plans to continue the low pressure mains replacement program until all low pressure assets are replaced, this is targeted to occur during, or around, the end of the next regulatory period (2028).

A program to replace deteriorated medium pressure mains will replace the highest risk (and the worst performing) CL250 PE and unprotected steel mains pon the network. The medium pressure program commenced in 2013 and reduced the leak incidence rate of the medium pressure network. As the low pressure program comes to a close, the medium pressure program is expected to ramp up again to an average of about 20km per year to be replaced by 2028. The program will target the worst performing sections of the network.

E.3.2 Minor Mains Replacement

Small sections of mains length identified by maintenance that is beyond repair and require urgent/emergency replacement are capitalised. It is expected that current failure rates will continue for minor mains replacement program.

E.3.3 Service Replacement

Any services identified by maintenance that fail a pressure test and/or are beyond repair, are replaced under a reactive mechanism and capitalised. It is expected that current failure rates will continue for minor mains replacement program.

E.4 Operational Requirements

Both proactive and reactive maintenance is conducted on AusNet Services' distribution mains and services to ensure their ongoing integrity, as well as to minimise public risk and lifecycle costs.

Proactive maintenance includes leakage survey program which employs a risk based survey methodology by targeting areas of highest risk. Cathodic protection techniques are also applied to steel mains to extend their useful life by limiting the incidence of corrosion.

The predominant form of reactive maintenance is the repair of both mains and service leaks identified through public reports and leakage survey activities.

E.5 Plant Specific Strategies

The following plant specific strategies are employed for the management of AusNet Services' distribution mains and services. Refer to Mains and Services Strategy (AMS 30-52) for further details.

- Completion of the current low pressure mains replacement program. Renewal of the low pressure network to high pressure is expected by the end of the next regulatory period (2028).
- Medium pressure mains replacement to address concerns with unprotected steel and first generation polyethylene mains (CL250).
- Begin the High pressure mains replacement program targeting worst performing (generally older) areas.
- Investigation into affect of squeeze off points on asset performance.
- Ongoing review of leakage management policies to find the correct balance between reactive and proactive maintenance activities.
- Improve asset data quality on mains and services, with particular attention on leak data, pipe characteristics and risk profiles, which are key inputs to AusNet Services' mains renewal and leakage management programs.

APPENDIX F METER MANAGEMENT

F.1 Overview

Gas meters are used to measure the volumetric flow rate of gas passing through the device. The volume of energy that passes through the meter is dependent on both gas pressure and temperature at the time of measurement.

AusNet Services is required by the Gas Distribution System Code to provide an appropriate metering installation at each supply point (i.e. connection) off the distribution network. AusNet Services is required to periodically maintain these installations, replace meters when their field life has expired, and provide periodic metering information to retailers for billing purposes.

F.1.1 Residential Meters

Residential meters are small capacity meters (<10m^3/hr) typically found at the front of domestic properties. All of AusNet Services' domestic meters are diaphragm type gas meters.

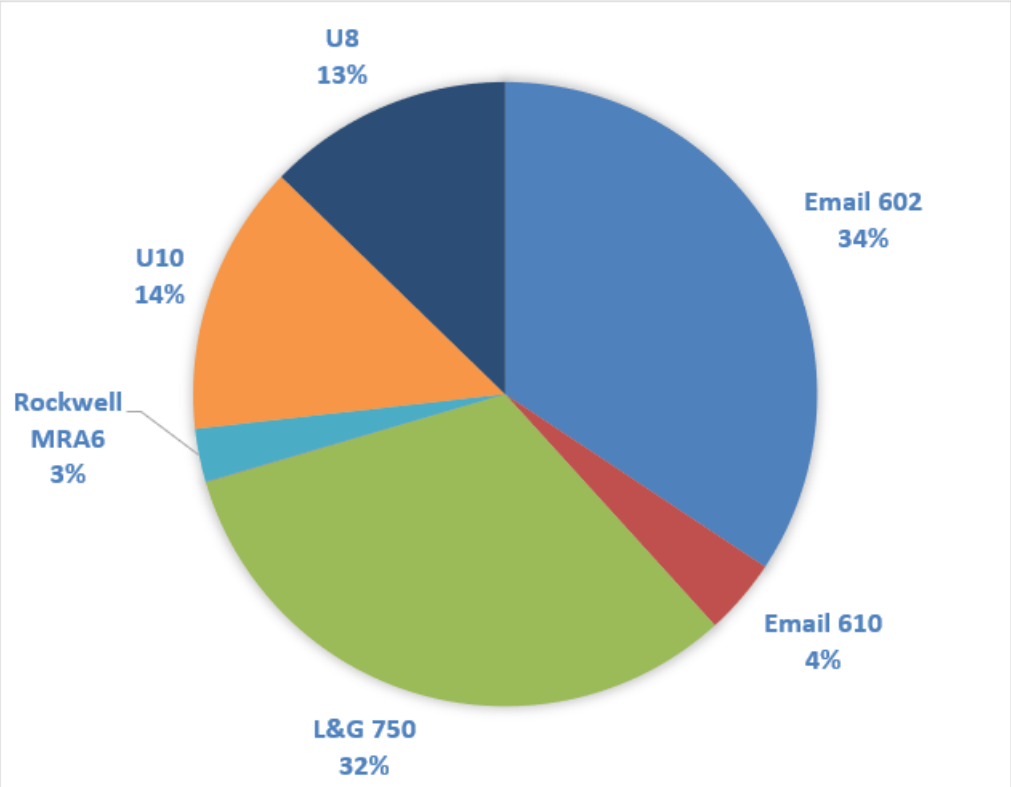

Figure 192: Domestic Meter Types

F.1.2 Industrial and Commercial Meters

Industrial and commercial sites are high users of gas, usually greater than 25m^3/hr. A combination of three (3) higher flow meter types; rotary, diaphragm or turbine gas meters is commonly used at I&C installations.

F.2 Current Performance

Domestic Meters are tested for field life extension. Their accurance dictates how many years their field life may be extended for. Table 10 shows the results of testing in recent years.

Table 10: Results of In-service compliance testing

Test Year	Meter Families Tested	Meter Population Tested	Families Failed	Meters Failed
2017	Email 602 MC 2001 & 2002 Email 610 2000 MR 8 2003 AL 425 1997/1998/2003 EDMI U10 2000/2003	517	AL425 1998 EDMI U10 2003	2,704
2018	Email 602 (new) 1990/1994 Email 602 (MC) 2003/2004 Email 610 2000/2004 Email 750 2004 MR8 1999/2003/2004 AL 425 1994/1999/2004 U10 2000/2004	930	Email 610 2000/2004 MR 8 2003 AL 425 1999 EDMI U10 2004	19,374
2019	Email 602 (new) 1991/1994 Email (repaired) 1995 Email 602 (IM) 1997 Email 602 (MC) 2002/2005 Email 610 1996 Email 750 2005 MR8 2005 AL425 1995/2000/2005 EDMI U10 2005	913	Email 602 2002 EDMI U10 2005	11,810
2020	Email 602 (MC) 2001/2006 Email 610 2006 Email 750 2006 MR8 2006 AL425 1996/2001/2005/2006 EDMI 2001/2006	605	Email 602 (MC) 2001/2006 Email 610 2006 MR 8 2006 AL 425 1996/2001	19,149
2021	Email 602 (new) 1992 Email 602 (MC) 2003/2004/2007 Email 750 2007 MR8 2007 AL 425 2002/2007 EDMI U10 2000/2007	754	Email 602 (MC) 2003/2004	22,320

F.3 Capital Requirements

A range of annual meter testing and replacement programs is completed to ensure ongoing compliance with the Gas Distribution System Code, Version 11. An overview of each program is provided. Refer to the Meter Management Strategy (AMS 30-54) for further details.

- **In-service compliance testing program:** Annual in-service compliance testing is completed on small capacity (<25m^3/hr) diaphragm meter families nearing the end of their in-service compliance periods. Testing follows the requirements of AS/NZS 4944:2006 (*Gas Meters – In-service Compliance Testing*) where meters are tested through either the 'variables' or 'attributes' sampling methods. Outcomes of compliance testing lead to a field-life extension (5, 3, or 1 year) or the meter family being removed from the field.
- **Replacement of I&C meters:** The in-service compliance testing program does not extend to I&C meters which are automatically removed from the field at the end of their in-service compliance periods.
- **Time expired meter replacement program:** Meters at the end of their in-service compliance periods (i.e. useful life) are removed from the field and have been replaced with new or refurbished assets of similar capacity.
- **Non-compliant meter:** Dedicated programs are established to target and replace meters that remain in the field beyond their in-service compliance periods. An inability to gain access to the meter during the time expired replacement program (due to locked gates, guard dogs, refused entry, etc.) is the primary reason for non-compliant meters within AusNet Services' network. In total, non-compliant meters equate to approximately 0.10% of all commissioned meters.
- **Meter Faults:** AusNet Services reactively replaces meters that fail within operation. Typically, AusNet Services replaces approximately 2,000 to 2,500 meters annually, equating to approximately 0.38% of the metering fleet.

Meter replacement and sampling volumes for the aforementioned programs, are defined within AusNet Services' *Meter Management Strategy* (AMS 30-54).

F.4 Operational Requirements

I&C regulator units, in which the meter forms a vital component, are maintained on either a 6-monthly or annual basis. Maintenance of the physical meter is limited with the exception of rotary meters which require oiling of componentry.

Domestic meters are not periodically maintained outside the in-service compliance-testing program.

F.5 Plant Specific Strategies

The following plant specific strategies are employed for the management of AusNet Services' Metering assets. Refer to the Gas Meter Management Strategy (AMS 30-54) for further details.

- Continuation of in-service compliance testing programs to ensure meter lifecycle costs are minimised.
- Extend in-service compliance testing to other meter families that meet program criteria (i.e. diaphragm > 10m^3/hr).
- Utilise refurbishment of meters where possible, providing costs are economical.
- Implement a 'smoothing' strategy to replace an average of 25,000 to 35,000 meters per year to prevent extreme volatility within replacement programs, which inflates per unit replacement costs.
- Embrace any digital meter developments.

APPENDIX G CORROSION PROTECTION

G.1 Asset Overview

AusNet Services utilises Cathodic Protection, and associated systems to actively defend against corrosion of its buried steel assets within its gas transmission and distribution networks.

The gas transmission and distribution system features 196 active cathodic protection units of various current outputs that protect 2,683km of steel pipeline and mains from corrosion. All 181.5 km of AusNet Services' transmission network is fully cathodically protected. The steel mains of the distribution systems are also largely shielded. However, approximately 15% of steel mains cannot be effectively cathodically protected. Network cathodic protection is also aided by approximately 851 magnesium sacrificial anode bed sites, stray current drainage sites, earthing sites, and numerous surge protection devices.

A necessary adjunct to the cathodic protection systems are the numerous electrical isolation and surge protection devices used throughout the network. These assets provide electrical isolation of the steel assets to allow for targeted cathodic protection. The systems also aid in providing protection for field personnel from electrical surges.

G.2 Current Performance

The cathodic protection system is monitored via direct measurements of electrical potential (cathodic protection level). This is performed through test points directly wired to the steel assets throughout the network. AusNet Services aims to achieve the following percentages of its protected assets within the optimal range of cathodic protection (-850mV to -1100mV):

Table 11: Target CP Protection Levels

	Target Protection Level
Licensed (Transmission) Pipelines	98%
High Pressure Areas	90%
Medium Pressure Areas	85%
Low Pressure Areas	80%

Through AusNet Services' capital investments in cathodic protection, protection levels have steadily increased over time.

G.3 Capital Requirements

Cathodic protection capital requirements are primarily driven by the potential survey program used to monitor network performance. If the protection level for a specific area is found to be below the desired level, and operation of the local cathodic protection unit is confirmed, then rectification work will result.

Capital programs to 2028 are detailed within AusNet Services' Cathodic Protection Strategy (AMS 30-56) and follow the following principles:

- **Corrosion Protection:** The corrosion protection work program includes the installation of additional corrosion protections units (CPUs), upgrading of existing systems, installation of sacrificial anodes and replacing those that have been depleted. This program ensures cathodic protection levels are maintained in accordance with AusNet Services' Gas Safety Case, reducing corrosion rates and hence the safety risk of corrosion induced leakage.
- **Surge Protection:** The surge protection programs consist of installing surge protection to the AusNet Services' below ground installations. This work mitigates the chances of electrical surges and hence the dangers of electrocution, equipment damage and ignition of fugitive emissions that are associated with them.

G.4 Operational Requirements

Operational requirements for the cathodic protection system are aimed at maintaining the systems to ensure current levels of performance and coverage are maintained. This involves 6-monthly potential level surveys of both the transmission and distribution systems, coating defect surveys of transmission pipelines, coiling (interference) testing and stray current electrolysis testing conducted by the Victorian Electrolysis Committee (VEC). These works also allow capital works to be effectively targeted at areas requiring improved cathodic protection levels.

G.5 Plant Specific Strategies

The following plant specific strategies are employed for the management of AusNet Services' Corrosion Protection assets. Refer to AusNet Services' Gas Corrosion Protection Strategy (AMS 30-56) for further details.

- Medium and Low pressure networks will progressively be upgraded to High Pressure with subsequent corrosion protection becoming redundant.
- All City Gates and Field Regulating units to be appropriately protected from spark or surge currents in accordance with CPS 2308 (*Protection from Electrical Surges and Induced Voltages*).
- Introduction of SCADA technology to monitor and control Cathodic Protection systems.
- Monthly monitoring of CPUs.
- 5 yearly coating assessment surveys of transmission pipelines.

APPENDIX H SCADA SYSTEM

H.1 Asset Overview

AusNet Services uses a Supervisory Control and Data Acquisition (SCADA) system to monitor and control assets across the network from the transmission system to the network fringe. The SCADA system provides data on the real-time performance of the assets, and data for long-term evaluation of gas demand and network performance to identify potential system deficiencies.

The SCADA system is made up of Remote Telemetry Units (RTUs), a radio and telephone communications system, and a host computer system supporting the Customer Energy Operations Team (CEOT), which operates 24 hours a day, 365 days a year. Three classes of site are covered by the SCADA system:

- ***Controlled regulator sites*** where the SCADA system maintains a set fringe pressure by altering gas outlet pressures, either automatically or via remote manual control from the control room.
- ***Monitored regulator sites*** where outlet pressures are adjusted by field personnel and SCADA is used to alert the control room operators if pre-determined pressure alarm limits are breached.
- ***Fringe sites*** where SCADA is used to monitor the pressure at the lowest-pressure extremity of the system, allowing control room operators to react to pre-determined alarm limits.

Alarm limits and conditions have been set on the SCADA system which, when triggered, indicate abnormal conditions within the network. The limits, conditions, and required responses are reviewed annually following each winter peak.

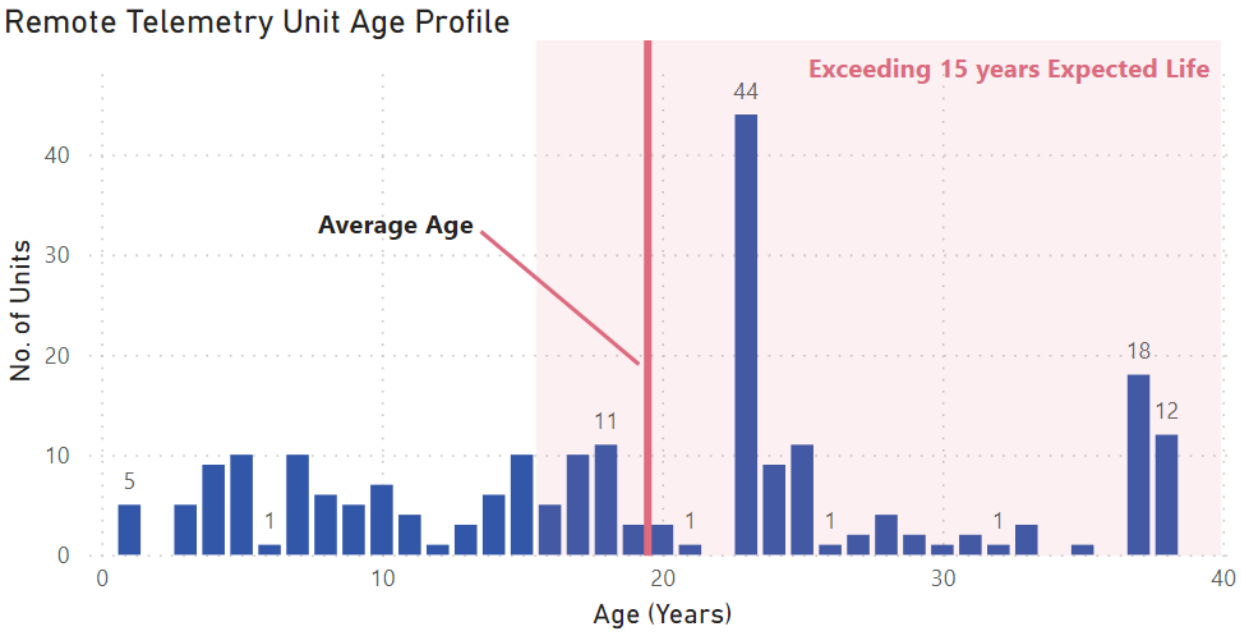

Figure 20: Age Profile of AusNet Services' RTUs

H.2 Current Performance

Currently, almost 50% of all high-pressure networks are operating under automatic control, with the remaining networks being monitored installations. MP and LP networks are all monitored but are slowly being phased out. This dynamic control of pressure is used to minimize leaks and unaccounted for gas (UAfG).

Table 12: AusNet Services' SCADA Assets

SCADA Assets	Average age		19.4 years
	Number of RTU's	Fringe	66 RTU's
		Monitor	92 RTU's
		District Regulator	2 RTU's
		Controlled	60 RTU's
		TOTAL	**220 RTU's**
SCADA Controlled Networks	Controlled HP Networks		12 Networks
	Monitored HP Networks		15 Networks
	Monitored MP Networks		All Networks
	Monitored LP Networks		All Networks
Communications Assets	Number of Radio Base Stations		9 Sites
	Data / Control Centres		2 Sites

H.3 Capital Requirements

The Gas SCADA System Strategy (AMS 30-57) provides details on plans to expand the current SCADA coverage and implement further controlled installations to ensure and maintain levels of service as the network grows.

The overall key drivers of SCADA capital program include network growth, improved consistency in network operation and fringe pressures, reduction in identified network risks, regulatory compliance and improved operating costs through greater automation.

The SCADA capital program falls within the following categories. Refer to the Gas SCADA System Strategy (AMS 30-57) for further details.

- Fringe RTU Installation / Relocation: As the size and flow characteristics of networks change, the fringe points of existing networks also change. Existing fringe points need to be relocated to more accurately control and monitor the network.
- End of Life Replacement: Replacement of obsolete equipment with current technology.
- Temperature Transmitter Replacement: Some transmitters are incompatible with Windows 10 and cannot be programmed correctly. This limits their operaion and maintainability.
- Slam Shut Switch Replacement: Retrofitted lever arms have experienced poor performance.
- Dossier Updates: Update of outdated or non-standarised dossiers for Hazardous Areas.
- Remote Pressure Logger Installation: Installation of remote pressure loggers will enable for improvements in network performance analysis and winter testing program requirements.

H.4 Operational Requirements

An in-house team of qualified technicians maintain AusNet Services' SCADA network. Operational activities include:

- Periodic operational checks and full maintenance of core and auxiliary equipment;
- Breakdown maintenance as required; and
- Data collection activities.

AusNet Services' Gas Maintenance Plan (AMP 30-02) provides details of required maintenance frequencies for SCADA assets.

H.5 Plant Specific Strategies

The following plant specific strategies are employed for the management of AusNet Services' SCADA assets. Refer to the SCADA Strategy (AMS 30-57) for further details.

- Continue installation of new fringe RTU's for new growth areas.
- Relocate fringe RTU when it is no longer located on the fringe.
- Install new CP-35's and backplanes at a small number of sites across the gas SCADA network.
- Utilise decommissioned PC-1s as spare parts to extend the life of sites fitted with PC-1s.
- Replace the most deteriorated RTU cabinet with stainless steel RTU cabinet.
- Remove non-compliant temperature transmitters and install YTA110's.
- Replace lever arm slam shut switches with dome slam shut switches.
- Progressively update all non-compliant SCADA site dossiers.
- Progressively roll-out remote pressure recorders.

APPENDIX I EXPOSED PIPEWORK

I.1 Asset Overview

Exposed pipes consist of gas mains infrastructure located above-ground due to the requirement for the gas main to cross or straddle a natural or manmade obstacle. Typically, exposed pipes occur on roads, rivers, creeks and drainage crossings, as well as in some instances due to historical maintenance activity or previously removed above ground assets i.e. meter or regulators.

In total, AusNet Services has 70 sites classified as exposed pipework. Table 13 provides a summary of exposed pipes within AusNet Services' network. Most of the 70 identified locations feature multiple descriptors and thus appear in multiple line items.

The vast majority were installed in the 1970s and 1980s, with a dramatic decline in their use post-1990 due to policy and technology developments.

Table 13: Asset Summary – Exposed Pipework

Description	TP	HP2	HP	MP	LP	Total
Pipe attached to side of bridge	-	1	14	2	2	19
Pipe suspended under structure	2	1	31	3	4	41
Pipe over railway	-	-	2	2	1	5
Pipe over channel	3	1	48	3	6	61
Pipe under walkway / roadway	2	1	31	3	4	41
Encased pipe / conduit	-	-	17	-	2	19
Pipe not exposed, but subject to erosion	1	-	1	-	-	2

I.2 Capital Requirements

As exposed pipework represents an increased risk both in terms of safety and security of supply, it remains AusNet Services' preference that above ground pipework be isolated and removed if alternatives are available, or decommissioning becomes possible.

The basis of this approach is computer modelling of the individual networks featuring exposed pipework to determine if they can be isolated and removed without a detrimental impact on the natural gas supply to the area. This modelling may also indicate that removal is possible provided additional reinforcement mains are installed at an alternate location.

I.3 Operational Requirements

Inspection frequencies of exposed pipework is determined based on a risk based methodology. Inspections have been conducted to evaluate asset condition based on seven critical parameters;

- Coating;
- Crevice Corrosion;
- Mechanical Damage;
- Pitting and General Corrosion;
- Transition Zone;
- Insulating Pads; and
- Supports

Outcomes of asset assessments – where parameters are rated Fail, Borderline or Satisfactory – lead to the allocation of priorities; which in turn sets timeframes for future inspection or remediation. Sites that obtain a 'fail' score for any parameter must result in remediation works.

Further, exposed transmission pipelines and HP2 sites are inspected on an annual basis regardless of inspection outcomes due to asset criticality and public risk.

I.4 Plant Specific Strategies

The following plant specific strategies are employed for the management of AusNet Services' exposed pipework assets. Refer to AusNet Services' Exposed Pipework Strategy (AMS 30-55) for further details.

- Periodic inspections of all known exposed pipe assets through the application of AMS 30-19 Exposed Pipe Inspection Strategy.
- Where possible, it is AusNet Services' preference that above ground pipework be isolated and removed if alternatives are available, or decommissioning becomes possible.
- Installation of exposed pipework as a last resort, following a risk assessment.

APPENDIX J LPG RETICULATION

J.1 Asset Overview

AusNet Services owns and operates a liquefied petroleum gas (LPG) vapour reticulation network at Mt. Baw Baw alpine village from a single LPG source. The network is known as an island network, and is not subject to AusNet Services' Access Arrangement.

The network supplies reticulated gas to the village's commercial and club premises, and 2 gas-fired generators operated by AusNet Services (Electricity), which supply electricity to the mountain village. The network was commissioned in May 1998.

In total, the network comprises of 1,700m of polyethylene mains operated at 140kPa, supplying 33 metered customers.

J.2 Current Performance

The design of the distribution network provides for an approximate 20-year forecast of gas demand for the village, including the generator station. At present it is functioning at 50% of available capacity (Total capacity = 750m^3/hr).

No new applications for gas have been received for the Mt Baw Baw network in last 5 years.

J.3 Capital Requirements

Due to the physical size and unutilised capacity within the network, capital requirements to 2020 are limited.

In 2013, all meters at Mt Baw Baw were replaced as part of the time-expired meter replacement program. This was combined with the upgrade of consumer regulators as a precaution due to tampering of the over pressure shut off (OPSO) device.

Refer to AusNet Services' Mt. Baw Baw LPG Reticulation Network Strategy (AMS 30-58) for further details.

J.4 Operational Requirements

Maintenance is conducted annually on all LPG assets at Mt. Baw Baw including:

- Leakage survey of the total mains, service and meter/regulator system; performed by walking the entire reticulation system, including regulator/ meter installations and generator room, with a specialised highly sensitive gas detector,
- Operational check of the gas reticulation system isolation valve.
- Gas samples from the two odorant test points are also taken and tested, ensuring they are within required levels.

Elgas Ltd is the owner of the LPG tank supplying the reticulation network. They are responsible for the control, maintenance, safety and security of the LPG storage vessel, its associated pressure regulators, vaporizer unit and pipework to the boundary of the security compound.

Energy Safe Victoria conducts an annual audit of the facility usually coinciding with programmed maintenance.

Refer to AusNet Services' Mt. Baw Baw LPG Reticulation Network Strategy (AMS 30-58) for additional details on operating and maintenance programs.

J.5 Plant Specific Strategies

The following plant specific strategies are employed for the management of AusNet Services' alpine LPG reticulation assets at Mr Baw Baw.

Refer to AusNet Services' LPG Reticulation Strategy (AMS 30-58) for further details.

- Increased signage requirements to increase public awareness and safety.

- Installation of meters at currently unmetered sitesand the Elgas vaporizer to enable accurate measurement of Unaccounted for Gas (UAfG) and subsequent carbon emissions.

APPENDIX K GLOSSARY

AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AMS	Asset Management Strategy
CEOT	Customer and Energy Operations Team
CP	Cathodic Protection
CTM	Custody Transfer Meter
DELWP	Department of Environment, Land, Water and Planning
DTS	Declared Transmission System
EMS	Environmental Management System
EPA	Environmental Protection Agency
ESC	Essential Services Committee
ESV	Energy Safe Victoria
FSA	Formal Safety Assessment
GDSC	Gas Distribution System Code
GIS	Graphical Information System
GSC	Gas Safety Case
KPI	Key Performance Indicator
LNG	Liquefied Natural Gas
MAOP	Maximum Allowable Operating Pressure
NGL	National Gas Law
NGR	National Gas Rules
OEM	Original Equipment Manufacturer
One-in-two	An effective degree day of 14.60 with a 50% chance of exceeding this value in any given year
OPSO	Over-Pressure Shut Off
RCM	Reliability Centred Maintenance
SCADA	Supervisory Control and Data Acquisition
Tariff D	The peak gas demand charge assessed for industrial and commercial customers
Tariff V	The tariff charged by volume for domestic customers
TP	Transmission Pipeline
UAfG	Un-Accounted for Gas
USAIDI	Unplanned Supply Average Interruption Duration Index
USAIFI	Unplanned Supply Average Interruption Frequency Index
VTS	Victorian Transmission System
VEC	Victorian Electrolysis Committee
SAP	Enterprise-wide software system.