Jemena Gas Networks (NSW) Ltd

2015-20 Access Arrangement Information

Appendix 6.1

JGN 20 yr Asset Class Strategy

Public

30 June 2014

JEMENA GAS NETWORKS

20 YEAR ASSET CLASS STRATEGIES

APRIL 2014

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JEMENA GAS NETWORKS

20 YEAR ASSET CLASS STRATEGIES

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EXECUTIVE SUMMARY

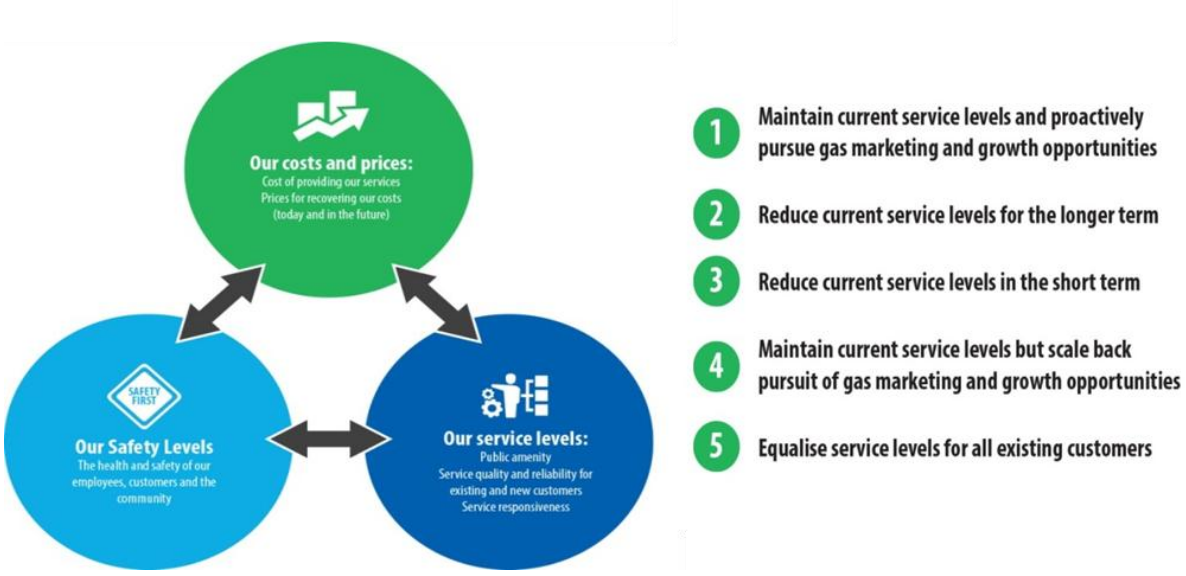
The Asset Class Strategies relate to the Jemena Gas Network's (JGN) gas distribution network delivering gas in Sydney, Newcastle, Wollongong and the Central Coast region and over 20 country centres within the Central Tablelands, Central West, Southern Tablelands and Riverina regions of NSW. The network consists of over 25,000 km of mains and pipelines, transporting natural gas to approximately 1.2 million customers who consume nearly 90 petajoules of gas per annum.

Jemena's vision is to be recognised as a world class owner and manager of energy delivery assets. To deliver on this vision, JGN has established the following objectives that underpin this strategy which governs how the gas network is to be operated and maintained, namely:

1. Maintain and Improve Safety of Services;
2. Maintain Integrity of the Services;
3. Maintain Capacity to meet the expected Level of Demand for Services; and
4. Comply with Regulatory Obligations and Requirements.

The Asset Class Strategies document is JGN's holistic approach to the management of network assets, and establishes the linkages with and between Jemena's objectives, asset class specific drivers, asset management strategies and resultant asset management plans and expenditure programs. This approach delivers a safe and reliable distribution network meeting the levels of services as expected by the community at optimal lifecycle cost. The 20 year forecast capital expenditure programs have been developed to meet Jemena's objectives and community expectations with regards to levels of service. The levels of service delivered by JGN in relation to the community expectations has been summarised down to six core KPIs representing safety, public amenity, responsiveness, reliability and gas availability.

JGN has modelled five scenarios based upon the interaction between capital and operating expenditure, levels of service and average cost per customer, over the next 20 years. This modelling is depicted in the diagram below. Customer feedback on these scenarios has guided JGN's decision making on its forecast capital expenditure.



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ABBREVIATIONS

Acronym	Description	Acronym	Description
AA	Access Arrangement	ILI	In-line Inspection
AER	Australian Energy Regulator	JGN	Jemena Gas Networks (NSW) Ltd
ALBV	Automatic Line Break Valve	KPI	Key Performance Indicator
AMP	Asset Management Plan	LPRS	Low Pressure Regulator Sets
AS	Australian Standard	MAOP	Maximum Allowable Operating Pressure
DBB	Double Block and Bleed	MPRS	Medium Pressure Regulator Sets
DRS	District Regulator Sets	OH&S	Occupational Health and Safety
CDP	Capacity Development Project	O&M	Operating and Maintenance
CHOS	Customer Hours Off Supply	PE	Polyethylene
CP	Cathodic Protection	PIMP	Pipeline Integrity Management Plan
CTS	Custody Transfer Station	POTS	Packaged Off-take Station
DCVG	Direct Current Voltage Gradient	PPM	Penrith Primary Main
DRS	District Regulator Set	PRS	Primary Regulating Station
EGP	Eastern Gas Pipeline	SAOP	Safety and Operating Plan
E / I	Electrical and Instrumentation	SGL	Sydney Gas Limited
E to G	Electricity to Gas	SMS	Safety Management Study
FSA	Formal Safety Study	SRS	Secondary Regulator Set
HDPE	High Density Polyethylene	TRS	Trunk Receiving Station
I & C	Industrial and Commercial	UAG	Unaccounted for Gas

Table 1 Abbreviations

1. INTRODUCTION

This Asset Class Strategy for JGN's NSW network outlines the strategic actions and associated capital expenditure forecast for the asset classes in order to achieve regulatory and business performance targets for the next 20 years.

The outcomes defined in this document are set to meet the following sub-set of JGN strategic objectives to meet the Jemena Key Success Factors:

- Safe and Efficient Operation:
    - Ensure the safe, reliable, efficient and responsible operation of the network
- Proactive Customer and Market Engagement:
    - Maintain in real terms the cost per customer while maintaining consumer expectations regarding service quality
- Strong Financial Returns:
    - Promote better utilisation of the network
    - Maintain a long term, stable and sustainable return from assets
    - Develop investment opportunities
- Effective Regulatory Management.

1.1 PURPOSE

The purpose of this Asset Class Strategy is to provide transparency to stakeholders for support of:

- A program of augmentation, refurbishment and replacement within the asset classes focussed on efficiently securing the gas needs of customers through the next 20 years;
- Developing safe, reliable and efficient network assets; and
- An understanding of JGN's future development requirements for each asset class.

1.2 SCOPE

This Asset Class Strategy covers JGN's high, medium and low pressure gas network system in NSW. The network includes the following asset classes:

- Trunk Pipelines;
- Primary Mains;
- Secondary Mains;
- Medium and Low Pressure Mains and Services;
- Trunk Facilitates including Trunk Receiving Stations, Packaged Off-Take Stations (POTS) and Bulk Metering Stations;
- Primary Regulating Stations;

- District Regulator Sets;
- Residential Gas Meters;
- Residential Hot (and Cold) Water Meters; and
- I & C Meter Sets.

1.3 JEMENA'S VISION AND STRATEGIC OBJECTIVES

1.3.1 JEMENA'S VISION

Jemena's vision is to be recognised as a world class owner and manager of energy delivery assets.

1.3.2 JEMENA'S STRATEGIC OBJECTIVES

Jemena will realise this vision through achievement of the following objectives:

- Embed a world class safety culture;
- Be a high performing and engaged workplace that attracts, develops and retains industry leaders;
- Have highly efficient operations;
- Deliver customer focused operational excellence;
- Be an influential market leader with strong customer, regulatory, stakeholder and community relationships;
- Deliver financial performance that is superior to industry peers; and
- Achieve regulatory outcomes aligned to the business plan.

1.4 Asset Management Approach

JGN has an overall Asset Management System within which this 20-year Asset Class Strategy is a key element. The Asset Management System provides guidance when establishing work programs focussed on enhanced safety, performance and efficiency. It brings together the external influences, asset management drivers, business values and selected strategies to deliver sustained performance for the benefit of all stakeholders.

The Asset Management System is summarised in Figure 1 Asset Management System below.

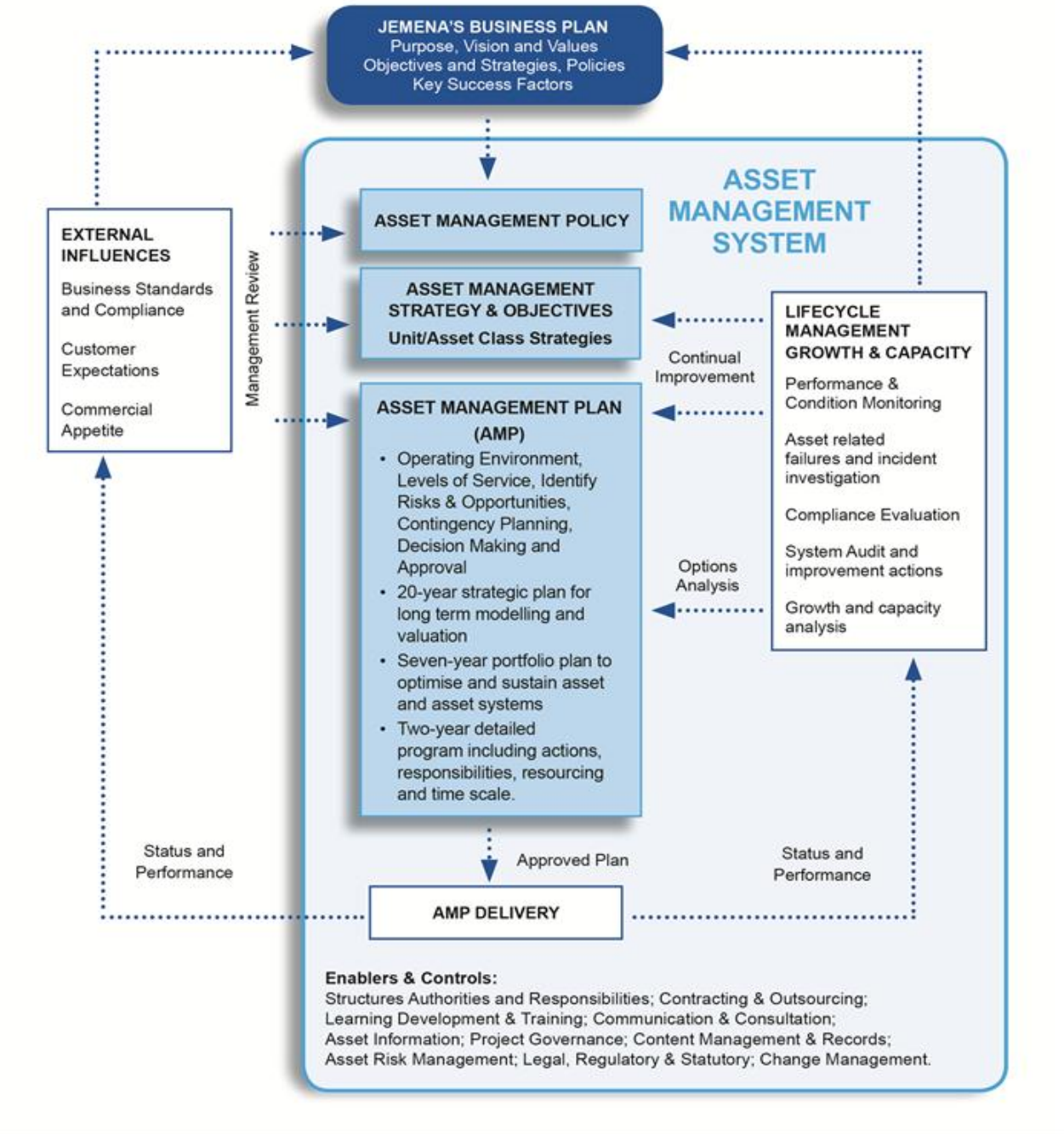

Figure 1 Asset Management System

2. DESCRIPTION OF NETWORK

2.1 NETWORK OVERVIEW

JGN owns and operates a gas distribution network which serves the Sydney metropolitan area, northern and southern NSW coastal areas and NSW country regions, as shown in Figure 2 below.

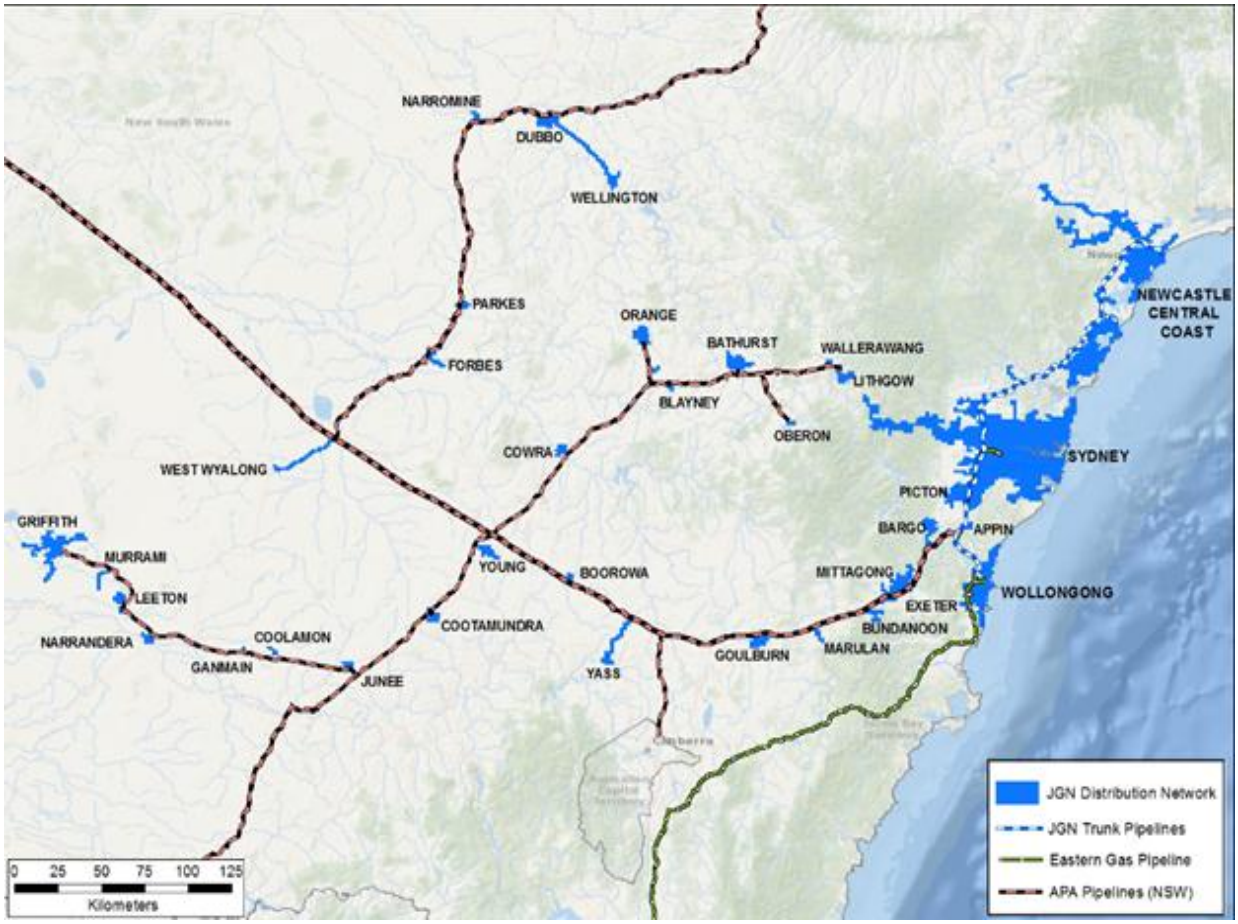

Figure 2 JGN Gas Network

The network comprises of a high pressure trunk and primary system that operates at 6.895MPa and 3.4MPa respectively, a secondary network of mains and services which operates at 1050kPa and which provides gas to a low and medium pressure distribution networks via district regulator sets. The low and medium pressure network operates between 2 to 7kPa and 30 to 400kPa respectively.

2.2 ASSET SUMMARY

A summary of the total assets owned and managed by JGN are shown below in Table 2 below.

Network Facility	Quantity
Trunk Mains	267 km
Primary Mains	147 km
Secondary Mains <=1050kPa	1,500 km
Medium and Low Pressure Mains	23,470 km
Trunk Receiving Stations (inc. POTS)	55
Bulk Metering Stations	2
Primary Regulating Stations	17
District Regulator Sets	619
Consumer Gas Meters	1,121,553
Water Meters	173,188
I&C Meters	43,865

Table 2 JGN Asset Summary (note: All data as of 30 June 2013)

3. STRATEGIC ASSET MANAGEMENT DRIVERS

JGN has identified a series of strategic asset management drivers. Along with the drivers' specific to a particular asset class, these drivers are used as the basis for the development of the strategies adopted for the management of the various asset classes forming the gas distribution network. Where there is inconsistency between drivers, JGN uses its' understanding of the drivers and its asset management experience and expertise to balance the drivers in order to optimise the outcomes from the strategies. These drivers include:

- Community Expectations;
- Integrity;
- Regulatory Compliance;
- Health and Safety;
- Capacity;
- Service Age; and
- New / changing supply sources.

3.1 COMMUNITY EXPECTATIONS

The community is defined as our customers, network users, the industry regulators, government departments and the broader community. The community expects:

- Environmental responsibility;
- A safe and reliable level of service;
- Responsive Service;
- Enhanced Public Amenity;
- Common levels of service available to all consumers; and
- Affordable pricing.

3.2 INTEGRITY

The requirement to maintain asset integrity and operational safety is a key driver for the gas network asset management. A network failure, due to a loss of integrity, can be catastrophic with the potential for personal injury or loss of life, property and environmental damages and loss of supply. As such, JGN's asset management needs to comply with corporate and legislative requirements, including for example, AS2885 requirement to ensure "continued pipeline integrity during the life of the pipeline".

Integrated into integrity, as a driver, is JGN's commitment to ensuring asset and public safety. Outcomes from reviews such as Safety Management Studies (SMS) and Formal Safety Studies (FSAs) are inputs to the strategies for each asset class as applicable.

JGN will ensure safe operations in the future by continuing to comply with corporate and legislative requirements, as well as implementing prudent and "industry best practice" measures.

3.3 Regulatory Compliance

As operator of a gas distribution pipeline, JGN must hold a reticulator's authorisation under the Gas Supply Act 1996. Authorisations are granted by the NSW Minister for Resources and Energy on advice from the NSW Independent Pricing and Regulatory Tribunal (IPART).

JGN also holds five pipeline licences under the Pipelines Act 1967. The licences cover the construction, operation and maintenance of the trunk pipelines. They are granted by the Governor of NSW and administered by the NSW Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS).

Between them, the Gas Supply Act 1996 and the Pipelines Act 1967 and their associated regulations, as well as the authorisation and pipeline licences themselves, impose a significant number of obligations on JGN including obligations relating to metering, asset safety, compliance with standards and reporting. Included in these obligations are the requirements for JGN to have Safety Management Systems including the independent auditing of critical documents such as the Safety and Operating plans and the documents under these plans.

These obligations together require, or, in the case of access regulation, provide strong incentives for JGN to plan operate and maintain its assets in a prudent and efficient manner, in accordance with good industry practice.

3.4 Health and Safety

JGN is committed to ensuring that all operations meet or exceed its corporate safety standards and the requirements of relevant state and federal legislation, as well as meeting employee, customer and community expectations for the management of health and safety.

All lifecycle activities are designed to ensure compliance to health and safety standards.

Applicable legislation in this area is NSW Work Health and Safety Act 2011 and Work Health and Safety Regulation 2011. The Work Health and Safety legislation replaces previous OHS legislation in NSW as part of the federal move to harmonise OH&S legislation between states.

3.5 Capacity

The gas distribution network is constantly evolving to meet changing needs. A key driver in the future asset management of the network is to continuously meet these demands at the current level of service and maintaining security of supply at acceptable risk levels.

These changing demands are primarily a result of the following:

1. New housing developments;
2. New major gas users;
3. Increased demand driven by increasing urban density and changing peak demand of existing consumers; and
4. New connections in established areas (network augmentation) i.e. E-G.

Network capacity modelling is continuously being updated to meet these changes.

Forecasts for new connections required for the market expansion category have been developed by industry expert demand forecasters Core Energy in its report Demand, Energy and Connection Forecasts, Jemena Gas Networks NSW, Gas Access Arrangement Review 2015 – 2020, February 2014.

Demand forecasts for purposes of CDP capital expenditure are derived separately to the market expansion forecast. There are at least two practical reasons for these forecasts being developed separately:

- The demand, energy and connection forecasts developed by Core Energy are for the whole of JGN's network and are designed to reflect the range of macro factors that affect annual energy, demand and connections, whereas CDP forecasts are a function of peak demand in specific network segments where capacity is forecast to be constrained and a CDP project are required. The CDP forecast reflects demand growth in specific network segments which is not characteristic of the network as a whole. Some segments of the network will be relatively immature with significant growth from new customers as new estates are connected. Other segments will be more mature and demand growth will be much lower.
- The demand being considered in each local segment is not the annual demand, but the peak winter demand. Experience shows that peak usage is growing at a higher rate than annual usage as customers replace their appliances with more efficient models. This is particularly true where instantaneous hot water units are replacing storage hot water units. Instantaneous hot water units are inherently more efficient than storage units because water is only heated to the required temperature (typically round 40 degrees Celsius) rather than the storage temperature (typically 65 to 80 degrees Celsius) and because it is heated as it is used rather than stored thus avoiding heat lost during storage. JGN expects that in areas where there is significant new estate development demand will be peakier as customers install modern high efficiency gas appliances. In contrast, more mature areas will see a progressive replacement of older, less efficient gas appliances with more efficient high demand capacity ones.

The gas distribution network is constantly evolving to meet these changing needs. Load growth drives system reinforcements and new connections require continuous extensions to the network. Changing patterns of gas use also require alterations to the existing network and sometimes decommissioning of parts of the network.

In the capacity development planning phase, a key driver is to maximise the utilisation of the existing network such that capital expenditure requirements to meet the changing demand are minimised, while maintaining adequate security of supply. Engineering assessments are performed to review network growth options to arrive at optimum solutions.

3.6 Service Age

Service age is an inexact but useful indicator for asset condition, functionality and sustainability. In general, older assets operating near their technical design limits, present higher risks to network performance, the environment and health and safety through functional limitations and progressive deterioration from environmental factors, loading cycles and operating cycles.

Older assets will tend to need replacement or refurbishment due to the following:

- Inadequate performance;
- Lack of integrity;
- Non-compliance with current codes and standards or company policies;
- Non-compliance with Work Health Safety requirements; and
- Obsolescence: Spare parts, manufacturer support, etc.

A number of assets have undergone rehabilitation/replacement programs in recent years however asset age will remain an important driver of capital expenditure into the future.

3.7 New Supply Sources

At present the section of the JGN network that supplies Sydney, Newcastle and Wollongong has five receipt points through which it accepts gas from three principal sources:

- the Moomba to Sydney Pipeline (MSP), owned by the Australian Pipeline Trust and APT Investment Trust (APA Group), which principally transports natural gas produced in the Cooper basin (and some CSG from Queensland) to JGN's Wilton receipt point.
- the Jemena-owned Eastern Gas Pipeline, which principally transports gas produced in Bass Straight from the Longford plant in Victoria to:
    - JGN's Horsley Park receipt point;
    - JGN's Port Kembla receipt point; and
    - JGN's Albion Park receipt point.
- AGL Upstream Investments, which injects local coal seam methane at the Rosalind Park receipt point near Campbelltown.

New supply points need to be accommodated into the network, as these emerge.

New or changing gas receipts can lead to requirements for changes to the operations of the gas network. These changes can include additional capital expenditure (e.g. higher inlet pressures can require heating and/or upgrade of pressure control facilities).

4. SERVICE LEVEL SCENARIOS

The levels of service delivered by JGN in relation to the community expectations has been summarised down to six core KPIs representing:

- Safety;
- Service Quality;
- Public Amenity;
- Responsiveness;
- Reliability; and
- Gas Availability.

Future KPI performance has been assessed based on qualitative assessments and historical trends and presented as a series of forecast performance ranges. JGN has relied upon the best information available and the extensive knowledge and experience of its asset management personnel to develop these performance ranges. The forecasts have been represented as a performance range reflecting normal annual variability.

The following levels of service performance ranges have been developed:

- "Current Acceptable Range" representing the range of current service level as expected by the community;
- "Service Improvement" representing an increased level of service range above current acceptable levels; and
- "Service Reduction" representing a decrease level of service range below current acceptable levels.

As a discretionary fuel the perceived quality of service of the gas network is critical to attracting and retaining gas customers. Reduced service performance in the above KPIs is likely to materially deter new customer connections in the short, medium and long term, whereas improved levels of service are likely to have a minor positive impact on long term customer numbers, customer connections (and retention of existing customers) in the short term.

Using a series of performance ranges for levels of service provides an important tool to aid decision making by providing a yardstick to ascertain the effect of decisions, especially when testing future scenarios. In Section 6 these performance ranges have been used as a key parameter in testing the interaction between capital and operating expenditure, levels of service and average cost per customer, over the next 20 years

4.1 NETWORK SAFETY

The total number of reportable incidents to JGN's technical regulator is a convenient and simple safety measure. While not all incidents are safety related this measure provides a lag indicator on the effectiveness of JGN's risk management systems and processes. Overall safety performance is driven in the long term by the application of rigorous design standards and integrity management planning and prudent investment in asset replacement expenditure. In the shorter term safety can be impacted by reduction in operations and maintenance expenditure and resourcing.

Jemena believes maintaining a high level of safety is not negotiable, however there is a range of safety outcomes in the longer term that still meet the high standards historically expected.

Maintaining this acceptable level ILI of service would keep the number of reportable incidents at current levels, with a possible slight reduction over time. Jemena's proposed operating and capital expenditure plans will deliver this outcome.

A service improvement scenario would see a further reduction in reportable incidents but would require increased capital expenditure on asset replacement over 20 years.

Reducing asset replacement expenditure and changing the maintenance strategy to operate to fail, results in lower short term operating costs, however in the long term planned maintenance expenditure is replaced with larger reactive maintenance expenditure and an increase in reportable incidents in the order of 20-50% above current acceptable levels over the long term.

There are very minor impacts on customer numbers in the short term as a result of all three scenarios, however in the medium and longer term the service reduction scenario would result in lower E to G connections and higher levels of disconnections as a result of increased consumer safety concerns.

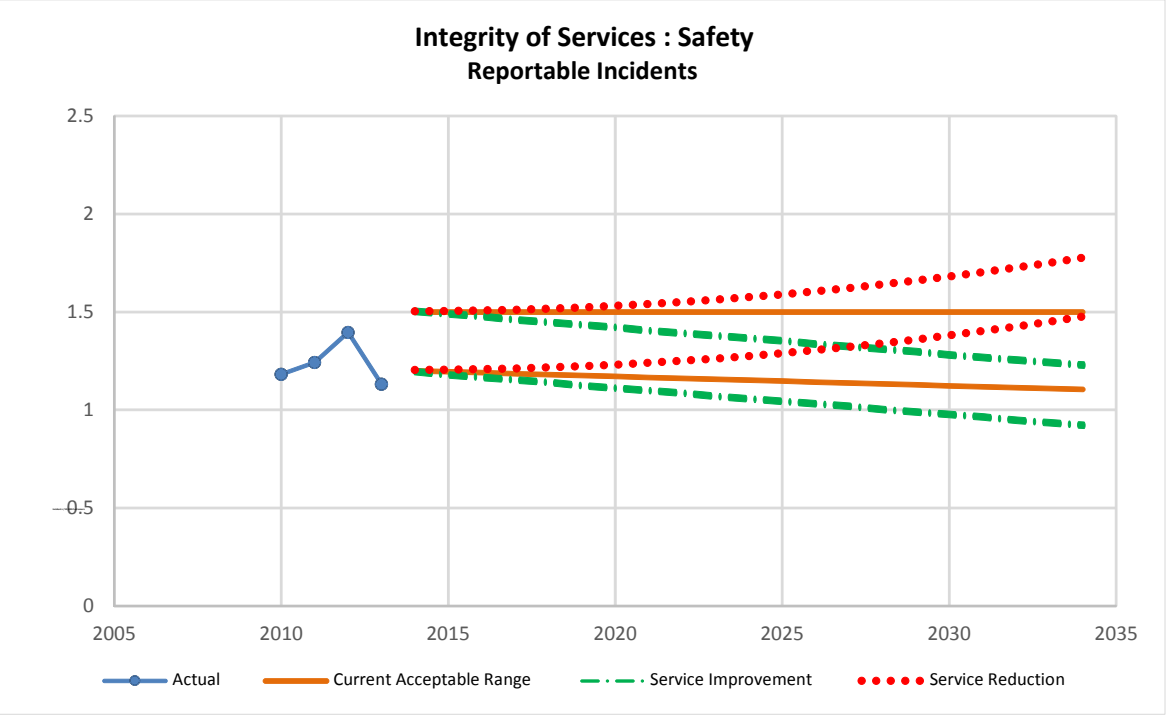

Figure 3 Level of Service Scenario – Safety

4.2 Public Amenity

While increased public reported gas escapes and disruptions/street closures resulting from emergency response to reported gas escapes could be seen as a safety issue, it also has a serious impact on the amenity of the community through nuisance smells, traffic disruptions and the perception of an increased level of safety risk. The level of public reported escapes in the long term

is impacted by level of asset replacement investment and in the short term by the level of non-urgent leakage repairs and planned inspection and maintenance activities.

The service range scenarios are similar to the previous KPI, maintaining the current level of service will be delivered by Jemena's current plans.

Service improvement can be delivered by an increase in asset replacement expenditure and current maintenance strategies.

Under a service reduction scenario Jemena would reduce asset replacement expenditure, reduce or delay non urgent gas mains repairs, lowering short term maintenance expenditure. In the medium to longer term reactive maintenance costs would increase and would result in the public experiencing an increase of leaks in the order of 50% over the long term.

There are very minor impacts on customer numbers in the short term as a result of all three scenarios, however the medium and longer term the service reduction scenario would result in lower E to G connections and higher levels of disconnections as a result of consumer concerns over the perceived quality of Jemena's service.

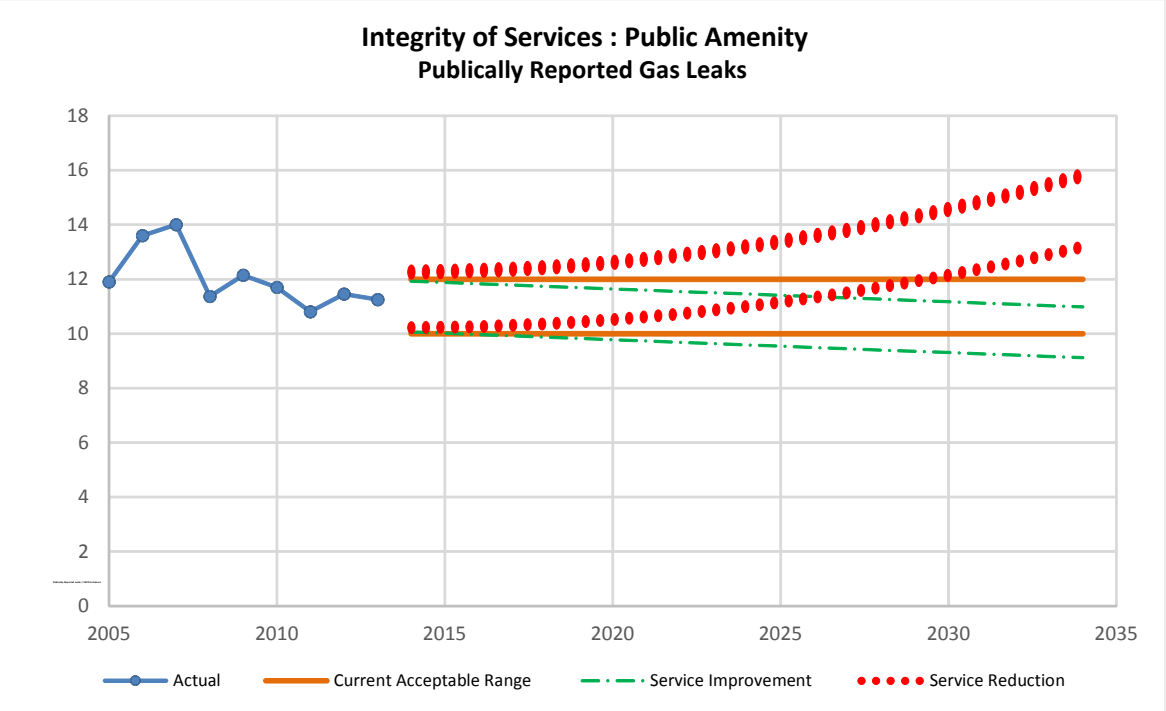

Figure 4 Level of Service Scenario - Public Amenity

4.3 RESPONSIVENESS – INCIDENT RESPONSE

One measure of responsiveness is JGN's ability to respond to incidents within an acceptable timeframe to minimise community disruption. Longer response times increases the disruption to the community through outage periods, extended traffic disruptions etc. and potential to increase the risk of damage to property or people.

JGN's ability to respond effectively is driven by resourcing, geographic density of crews and the number of incidents requiring a response. This is also influenced by considerations including network standardisation and arrangement.

Jemena currently establishes its resourcing levels to ensure consistent geographic coverage for emergency response. This comes at a cost in terms of employee productivity. Jemena's proposed operating plan maintains this approach, whereas the service reduction scenario adopts a resourcing plan based purely on lowest cost, increasing response times. The service improvement scenario has a gradual improvement in responsiveness as a result increased resourcing levels and resulting higher operating costs.

There is minimal impact in short, medium or longer terms on customer numbers as a result of variations in this specific KPI.

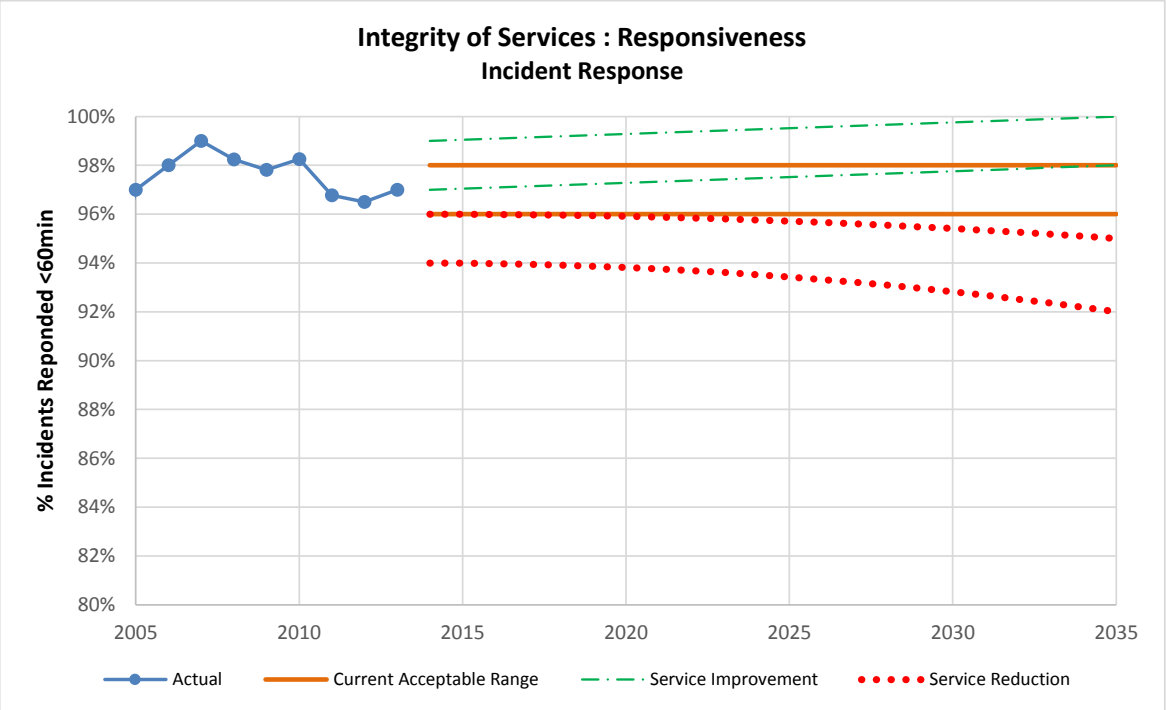

Figure 5 Level of Service Scenario – Responsiveness

4.4 RESPONSIVENESS – CUSTOMER HOURS OFF SUPPLY (CHOS)

The majority of major outages are a result of third party incidents impacting JGN's assets, and as such responsiveness to the incident in restoring supply is a key controllable aspect to this KPI. This can be impacted by the level of emergency resources and geographic density of crews as above. Long term performance of this KPI is also impacted by the level of supply planning and investment in Capacity Development to enhance security of supply.

Jemena proposed capital and operating plans will keep CHOS within current acceptable service levels. A slight reduction in off supply hours for the service improvement scenario can be achieved through increased capacity development capital expenditure enhancing security of supply to customers. Adopting a lowest cost resourcing strategy as described in the previous section would result in a significant increase in CHOS due to increased response times.

There is minimal impact in short, medium or longer terms on customer numbers as a result of variations in this specific KPI.

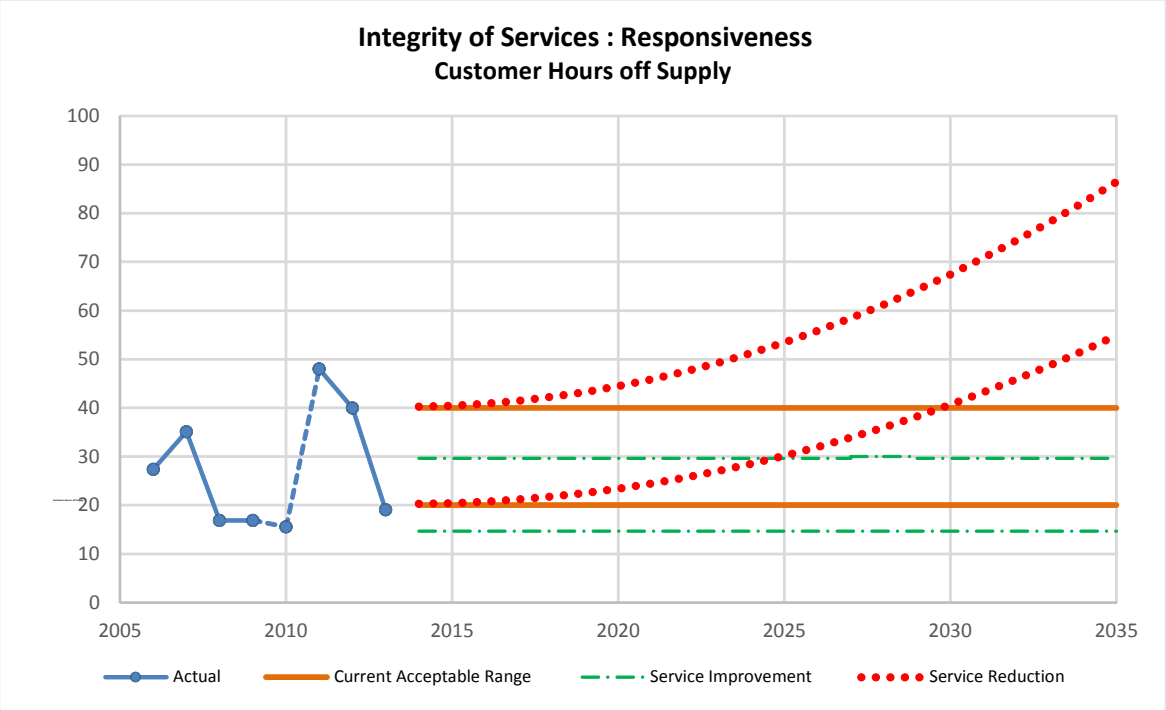

Figure 6 Level of Service Scenario - CHOS (note: Bowral TRS incident excluded)

4.5 Reliability – Poor Supply

The level of total loss of supply represented by CHOS for the JGN network is very low and is primarily driven by third party incidents. Reliability is better measured by the level of reported poor supply per 1000 customers, which is the measure of customers experiencing low or fluctuating gas pressure which adversely affects the performance of their gas appliances. Poor supply is mainly driven by the level of network investment in Capacity Development and asset replacement, prudent investment is required to ensure supply pressures are maintained at minimum levels for an expected weather range.

JGN currently bases its investment decision on supplying a peak 1 in 10 winter weather condition.

The service reduction scenario represents an investment decision based on a peak 1 in 2 winter weather condition, while the service improvement scenario is based on a peak 1 in 20 year winter condition.

Jemena's proposed capital and operating plans will deliver a slight improvement in levels of service as a result of the replacement of the last remaining un-rehabilitated low pressure networks over the next five years. Service level improvements can be delivered through greater capital expenditure in capacity development as a result of tightening the capacity development criterion to a 1 in 20 year weather planning scenario. Reduced capital expenditure on capacity development and asset replacement would result in a steady increase in poor supply reports.

There are very minor impacts on customer numbers in the short term as a result of all three scenarios, however in the medium and longer term the service reduction scenario would result in lower E to G connections and higher levels of disconnections as a result of consumer concerns over the perceived quality of Jemena's service.

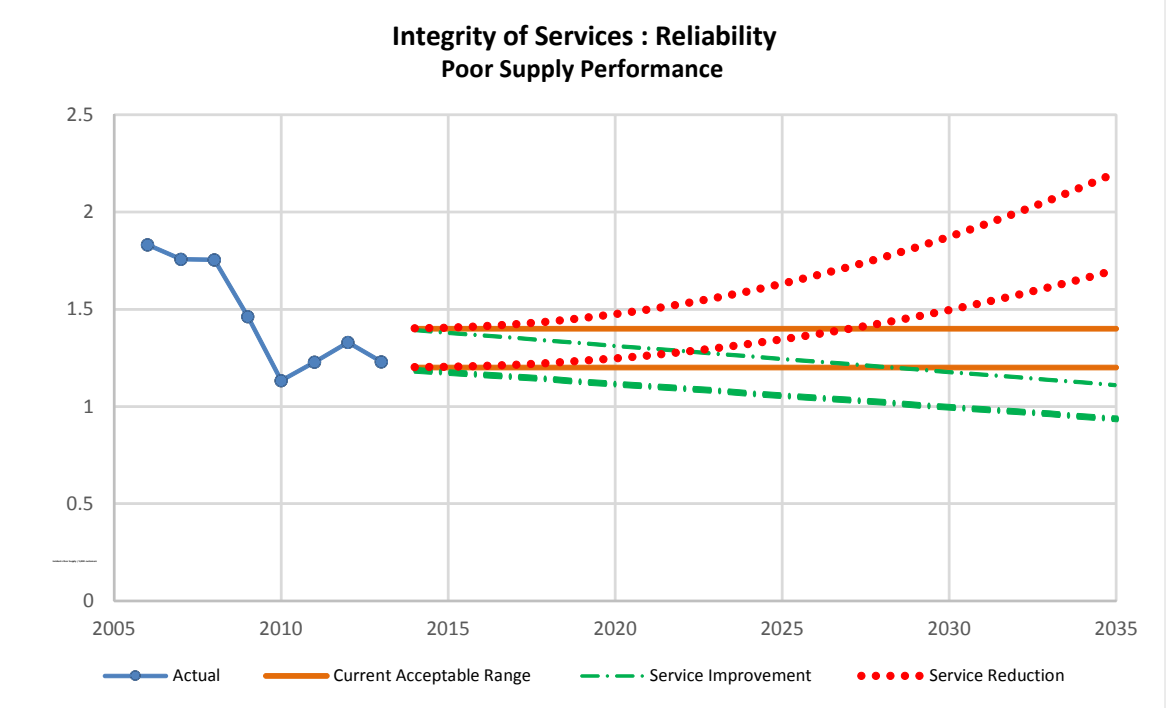

Figure 7 Level of Service Scenario – Reliability

4.6 Gas Availability – New NSW dwellings connecting to gas

The proportion of new dwellings in NSW connecting to natural gas is driven by the viability of making gas available in new housing estates and urban consolidation zones. The viability in turn is driven by the consumer demand for gas. If the average load and connection rates drop, fewer new housing estate expansions will be economically viable, therefore reducing access to gas for new dwelling builders. Jemena's gas marketing program is key to maintaining high rates of new dwelling connections. The program promotes the desirability of gas and underpins ongoing connection rates and average load per customer.

There has been an increase in the proportion of new homes connecting to gas in recent years as a result of Jemena's marketing program which began in 2007.

Jemena aims to maintain this level of connection with the current marketing program and market expansion capital and operating plans. Further gradual improvements in gas availability can be delivered through higher levels of gas marketing operating expenditure and increased capital investment specifically reticulating existing suburbs which currently have no gas reticulation. The service reduction scenario represents a cessation of the marketing program and a resulting lower operating expenditure and a reduction in market expansion capital expenditure as a result of fewer new dwellings connecting to gas and reduced levels of E to G connections.

There is a material impact on the short and long term forecast of number of customers connected to the network as result of the scenarios presented above.

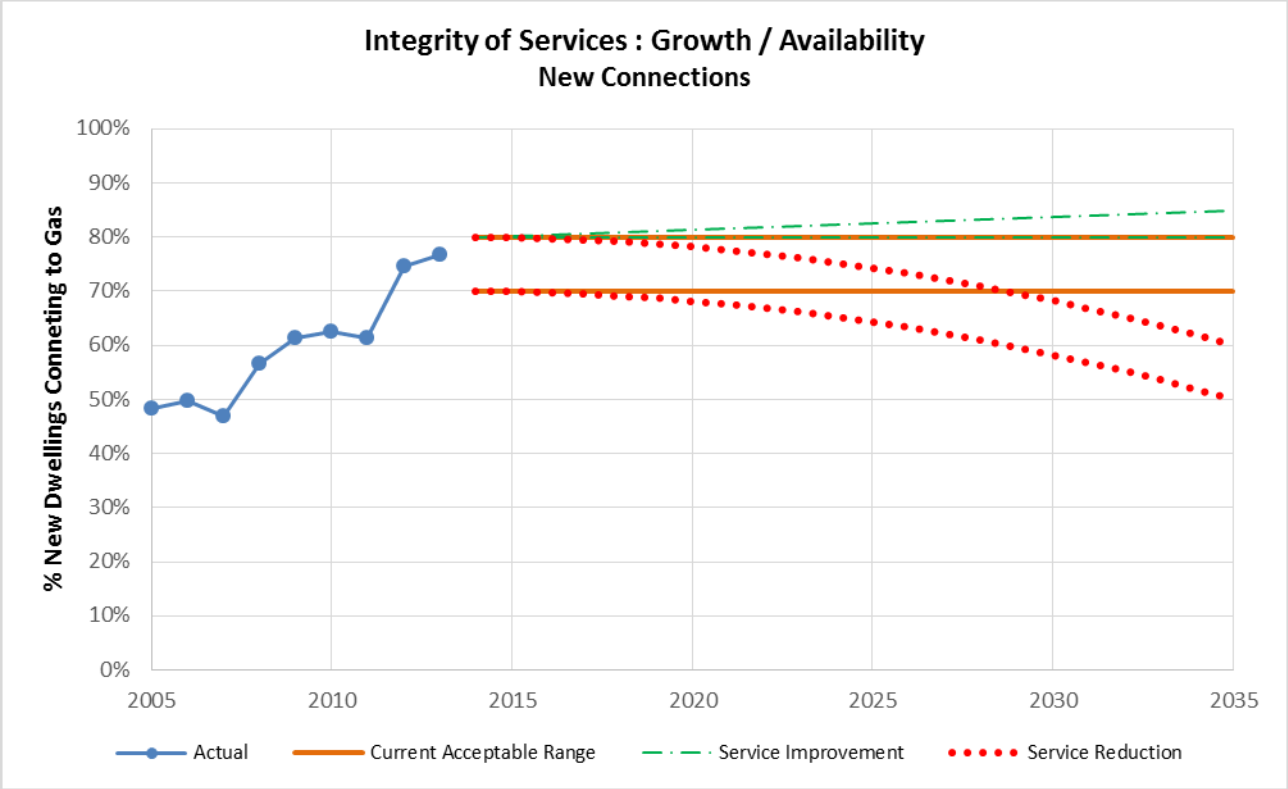

Figure 8 Level of Service Scenario - New Connections

5. ASSET CLASS STRATEGIC PLANS

5.1 OVERVIEW

Future capital works for each asset class are established based on the asset management drivers to meet JGN's strategic objectives and strategic performance requirements.

The strategy and activities planned in order to manage, maintain and operate the assets in accordance with the strategic objectives are described in the subsequent sections for the following asset classes:

- Trunk Pipelines;
- Primary Mains;
- Secondary Mains;
- Medium and Low Pressure Mains and Services;
- Trunk Facilitates including Trunk Receiving Stations, POTS and Bulk Metering Stations;
- Primary Regulating Stations;
- District Regulator Sets;
- Residential Gas Meters;
- Residential Water Meters; and
- I & C Meter Sets.

The following sections address the following for each asset class:

- Description;
- Asset Condition;
- Risks and asset specific drivers;
- Capital Requirements; and
- Operational Requirements.

5.2 TRUNK PIPELINES

5.2.1 **DESCRIPTION**

The JGN trunk pipeline system comprises trunk pipelines, cathodic protection (CP) systems, pig launcher and receiving stations and easements. The trunk pipelines provide natural gas to Sydney, Wollongong and Newcastle distribution network segments.

The supply points to the trunk pipelines are:

- Moomba-Sydney pipeline owned by APA to the JGN's Wilton receipt point;
- Jemena owned East Australia Pipeline to receipt points at Horsley Park, Port Kembla and Albion Park; and

- AGL Upstream Investments which inject coal seam gas at the Rosalind Park receipt point near Campbelltown.

The trunk pipelines are constructed of high strength steel pipe and are internally and externally protected against corrosion by an anti-corrosion pipe coating and internal lining. Additional protection is also achieved with a CP system.

The high pressure trunk pipelines are critical assets that must continue to perform safely to avoid personal injury or death, damage to environment and/or property and significant disruption of supply.

5.2.2 ASSET CONDITION

The age profile of the pipelines is summarised below. The trunk pipelines were predominantly constructed in the mid-1970s to the early 1980s and are between 35-40 years old.

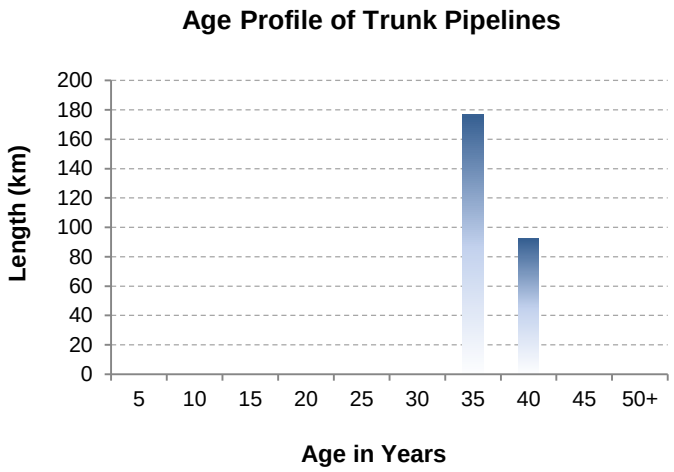

Figure 9 Trunk Pipelines Age Profile

The trunk pipelines are generally in sound condition and have performed safely without failure to date. JGN ensured this by managing the pipelines in accordance with the following requirements:

- Licence conditions;
- Jemena SAOP;
- Australian AS2885 standards;
- Jemena Pipeline Integrity Management Plan (PIMP) and;
- Good Industry practice consistent with JGN Business Policies and Objectives.

The pipelines' condition has been determined based on data derived from the following pipeline activities:

- Pipe wall condition: inspection/testing using pipeline pigging and/or integrity digs;
- Corrosion protection: CP monitoring (planned activity) with DCVG as required;
- Operation controls: pressure, temperature and gas quality monitoring;
- Maintenance activities: planned work to the approved procedures and work methods; and

- External interference controls: SMS undertaken as required to assess, monitor and control proposed work.

The trunk pipelines assessment is provided in the 5-yearly Safety Management Study (SMS), the latest of which was conducted in 2010. Details of the findings from the latest SMS is provided in the AMP.

The mains have adequate capacity to meet the future 20 year operational requirements and hence no augmentation, replacement or remediation works are predicted or included in the capital expenditure plan.

5.2.3 ASSET CLASS SPECIFIC DRIVERS

While the pipelines have adequate capacity to meet the forecasted demand, it is a strategic requirement to maintain these assets in their current condition for this 20 year period and beyond without degradation of operational capacity or safety and integrity of service.

The key drivers and associated risks/opportunities for the trunk pipelines, which together govern the asset management strategies, are summarised in Table 3 below.

Driver	Risk/Opportunity Description	Consequence
Integrity	Third party damage resulting from encroachment and increasing activity along trunk lines	Reduction in safety of service causing threat to public safety. Loss of supply to entire network due to loss of integrity.
	External corrosion due to aging and breakdown of external pipeline and field join coatings	Reduction in safety of service causing threat to public safety. Loss of supply to network due to degradation of MAOP / capacity.
	Mine subsidence resulting in unmitigated stresses and pipeline failure	Loss of supply to entire network due to loss of integrity.
Regulatory Compliance	Insufficient information or data to confirm integrity / compliance to operate at current MAOP	Loss of supply to network due to reduction of capacity

Table 3 Trunk Mains Specific Drivers and Risks

5.2.4 CAPITAL REQUIREMENTS

The key drivers for the trunk mains identified above have led to the asset management strategies and activities defined herein.

Specific Driver(s)	Asset Strategy	Activities / Capital Requirements
Integrity, Regulatory Compliance	Mine Subsidence Monitoring	Monitoring and rehabilitation at Mallaty Creek
Integrity, Regulatory Compliance	In-Line Inspection (ILI)	Execution of In-Line-Inspection Programs to detect and assess metal loss and third party damage
		Modification of pipeline systems to allow ILI where deemed necessary from the results of the SMS
		Validation digs to verify inline inspection data
Integrity Regulatory Compliance	Integrity Digs	Integrity Digs to provide measured pipe data at selected locations for non-piggable pipelines

Table 4 Trunk Mains Strategies and Activities

Details of the capital expenditure and schedule are provided in the AMP for this asset class. However, a number of key items are highlighted below.

The interval between ILIs has been assumed to be 10 years. Data obtained from an ILI will usually identify features which must be investigated with validation digs and repaired. Subsequent ILI intervals will be defined based on these inspection and validation dig results together with the remaining life and risk assessment outcome from the SMS.

Validation digs will be carried out on the pipeline between ILI. These digs validate the inspection results and repair defects identified. Historical data from prior inspections has been used to forecast future validation dig requirements.

Integrity digs are conducted on pipelines which cannot be in-line inspected, and where the SMS deems this to be an appropriate inspection method. While one to two digs per year has been assumed, the SMS will determine the number of digs required for each pipeline.

5.2.5 OPERATIONAL REQUIREMENTS

Integrity and regulatory compliance are the dominant drivers underpinning operational activities on the trunk pipelines and hence JGN will continue to operate the trunklines in accordance with the following requirements:

- Licence conditions;
- Jemena SAOP;
- Australian AS2885 standards;
- Jemena Pipeline Integrity Management Plan (PIMP); and
- Good Industry practice consistent with JGN Business Policies and Objectives.

The operational expenditure plan is guided by the outcomes from the 5 yearly risk based SMS and provides for inspections, maintenance and monitoring tasks as defined below:

- Cathodic Protection (CP) monitoring to confirm adequate protection against corrosion at locations of poor pipe coating ;
- Direct Current Voltage Gradient (DCVG) measurement to provide an indication of coating defects which can lead to pipeline corrosion;
- Regular pipeline patrolling and third party works inspection; and
- Maintenance of pipeline marker and easement.

The requirements for these operational activities are largely independent of the capital expenditure works.

5.3 PRIMARY MAINS

5.3.1 **DESCRIPTION**

The JGN primary mains system is comprised of a network of pipelines, ALBV's, pigging facilities, pipeline coating, CP Systems and easements. The system has a maximum allowable operating pressure of 3,500kPa and provides natural gas to the Sydney, Penrith and Wollongong distribution network segments from the trunk pipelines. The primary main assets can be split into 4 individual Primary Mains:

1. The Sydney Primary Main (SPM);
2. The Sydney Primary Loop (SPL);
3. The Wollongong Primary Main; and
4. The Penrith Primary Main (PPM).

These high pressure mains are critical assets that must continue to perform safely to avoid personal injury or death, damage to environment and/or property and significant disruption of supply. They are constructed of high strength steel pipe and are protected by pipeline coatings. Additional protection is achieved through the CP system.

5.3.2 ASSET CONDITION

The age profile of the primary mains is summarised below. The primary mains were predominantly constructed in the mid 1970's and are between 40-45 years old. The SPL was constructed in mid-2000s to improve security of supply to the Sydney metropolitan region and is less than 10 years old.

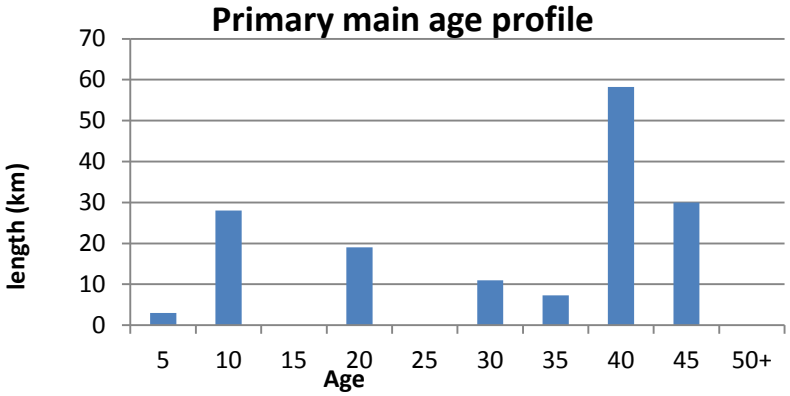

Figure 10 Primary Mains Age Profile

The Primary Mains are generally in good operating condition and have been confirmed as "Sustainable." This has been achieved by managing the mains in accordance with regulatory requirements, corporate policies and good industry practice and determined by a number of monitoring and control measures including:

- Planned reviews such as the 5 yearly MAOP review in addition to ILI (pigging) activities, integrity dig excavations and DCVG; and
- Routine activities including pipeline patrols, CP surveys and bond checks.

5.3.3 ASSET CLASS SPECIFIC DRIVERS

The primary mains system must continue to operate for the next 20 years and beyond without degradation of current service levels and capacity. Furthermore, long term capacity planning has forecast that supply constraints will occur in a number of regions for the current system, hence augmentation of the primary mains system will be required to meet the required levels of service to the Northern Sydney region and Emu Plains.

The primary mains are located in residential and high density areas, resulting in a significant amount of third party activity. Unlike the trunk pipelines, these mains are not licensed, which would provide some level of control of activities over the mains easement. Therefore, encroachment over the mains results in significant risk with respect to third party damage and stray current corrosion[1].

The key drivers for the primary mains and associated risks, which together govern the asset management activities, are summarised in Table 5 below.

[1] The stray currents responsible for this corrosion come from DC distribution lines, railway systems, substations and alternating current, among other sources. These currents then flow through steel structures or piping systems, causing corrosion.

Driver	Risk Description	Consequence
Capacity	Supply constraints not meeting demand.	Loss of supply to customers at peak periods. Reduced network growth.
Integrity	Third party damage resulting from encroachment and increasing activity over mains easement specifically in thin wall sections	Reduction in safety of service causing threat to public safety. Loss of supply to entire network due to loss of integrity.
	External corrosion due to aging and breakdown of external pipeline and field joint coatings	Reduction in safety of service causing threat to public safety. Loss of supply to network due to degradation of MAOP / capacity.
	External corrosion due to stray currents	Reduction in safety of service causing threat to public safety. Loss of supply to network due to degradation of MAOP / capacity.
Regulatory Compliance	Insufficient information or data to confirm integrity / compliance to operate at current MAOP	Loss of supply to network due to reduction of capacity.

Table 5 Primary Mains Specific Drivers and Risks

5.3.4 CAPITAL REQUIREMENTS

The key drivers for the primary mains identified above have led to the asset management strategies and activities defined herein.

Driver(s)	AM Strategy	Activities / Capital Requirements
Capacity	Capacity Development	Northern Primary Mains Development
		Emu Plains extension
Integrity, Regulatory Compliance	ILI	Execution of ILI Programs to detect and assess metal loss and third party damage in SPL
		Modification of Sydney Primary Main to allow ILI as deemed necessary from the results of the SMS
		Validation digs to verify inline inspection data
	Integrity Digs	Integrity Digs to provide measured pipe data at selected locations for non-piggable pipelines
Integrity	Coating rehabilitation	Coal tar coating rehabilitation to mitigate corrosion Exposed mains rehabilitations
	Thin wall section replacement	Upgrade of PPM thin wall section to mitigate third party damage
	Third Party Damage Protection	Concrete Capping for SPM

Table 6 Primary Mains Strategy and Activities

Details of the capital expenditure and schedule are provided in the AMP for this asset class. However, a number of key items are highlighted below.

The interval between ILIs has been assumed to be 10 years. Data obtained from an ILI will usually identify features which must be investigated with validation digs and repaired. Subsequent ILI intervals will be defined based on these inspection and validation dig results together with the remaining life and risk assessment outcome from the SMS.

Validation digs will be carried out on the pipeline between ILIs. These digs validate the inspection results and repair defects identified. Historical data from prior inspections has been used to forecast future validation dig requirements.

Integrity digs are conducted on pipelines which cannot be in-line inspected, and where the SMS deems this to be an appropriate inspection method. While one to two digs per year has been assumed, the SMS will determine the number of digs required for each pipeline.

5.3.5 OPERATIONAL REQUIREMENTS

Integrity and regulatory compliance are the dominant drivers underpinning operational activities on the primary mains. JGN will continue to operate the mains in accordance with the following requirements:

- Jemena SAOP;
- Australian AS2885 standards;
- Jemena Pipeline Integrity Management Plan (PIMP) and;
- Good Industry practice consistent with JGN Business Policies and Objectives.

As for the trunk a pipeline, the operational expenditure plan is guided by the outcome of the 5 yearly risks based SMSs and is largely independent of capital expenditure. The plan provides for inspections, maintenance and monitoring tasks as defined below:

- CP monitoring to confirm adequate protection against corrosion at locations of poor pipe coating;
- DCVG measurement to provide an indication of coating defects which can lead to pipeline corrosion;
- Regular pipeline patrolling and third party works inspection; and
- Maintenance of pipeline markers.

5.4 SECONDARY MAINS

5.4.1 DESCRIPTION

The secondary mains provide gas to the medium and low pressure networks from the primary mains system and have an MAOP of 1,050kPa. The secondary mains also directly supply a number of larger demand market customers. This asset class is comprised of secondary mains, secondary services, line valves and CP systems.

The Secondary Mains network is constructed from steel pipe which is externally coated with High Density Poly Ethylene (HDPE) to protect it from corrosion and internally lined to reduce frictional losses. A limited number of mains have coal tar coating. Additional, corrosion protection is also

achieved with the CP system. The secondary mains have a relatively large wall thickness as a result of higher safety factors i.e. wall thickness limited to 20% Specified Minimum Yield Strength (SMYS).

Secondary Services supply end users directly from the secondary mains network. These services are constructed to the same standards as the secondary mains, with a minimum diameter of 50mm at an MAOP of 1,050kPa.

Line valves are devices used to manually isolate secondary mains gas flow. The valves are operated during emergencies or when isolation is required.

5.4.2 ASSET CONDITION

The age profile of the secondary mains is summarised in Figure 11 below.

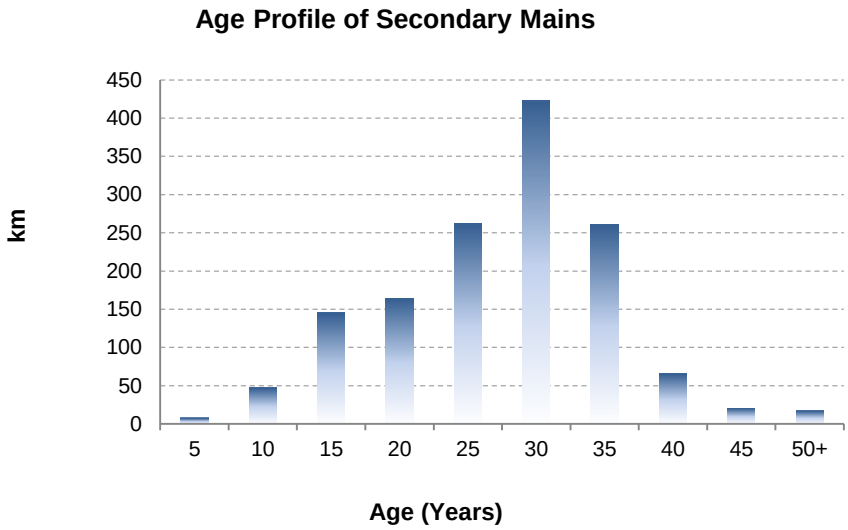

Figure 11 Secondary Mains Age Profile

System integrity of the secondary mains is currently fit for purpose which has been assessed through integrity/performance assessments which use monitoring/performance methods including leakage survey, publically reported leaks, field reports and feedback, pipeline patrol and review of data from CP surveys and circuit checks.

The mains are not piggable and DCVG surveys and integrity digs are usually not performed as most of the mains are located in roadways and are difficult to access. As a consequence, CP provides a crucial role in maintaining the integrity of the secondary mains.

5.4.3 ASSET CLASS SPECIFIC DRIVERS

The secondary mains system must continue to operate for the next 20 years and beyond, without degradation of current service levels and capacity. Development of new mains and upgrade of existing mains will be continually driven by demand growth throughout this 20 year period. Current planning activities include a number of secondary mains extensions to improve capacity within the secondary network in Rouse Hill, Kellyville and Castle Hill. There are also some long term projects planned for the Northwest Growth Sector, Sydney City and the Southwest Growth Sector.

A number of current and emerging integrity, performance and regulatory issues require management to ensure the continued safe operation over this 20 year period. These include:

- Protection from physical damage to the mains from third party activities;
- AC induction and stray currents on secondary mains from high voltage power cables and other sources posing a potential safety concern and risk of corrosion;
- Soil erosion has resulted in the depth of cover along a number of mains being reduced, exposing the mains to increased risk of third party damage;
- Exposed mains remain an issue under management. There are 333 exposed mains sites across the JGN network including the primary, secondary and medium/low pressure networks. This issue is managed under the operations and maintenance program called "exposed mains" inspection, and rectification.

External corrosion is the major threat to the secondary mains integrity and usually as a result of damaged and/or deteriorated protective coatings. Corrosion is mitigated by a CP system which is managed and maintained through the maintenance program. However, a comprehensive review of the system in 2012 highlighted critical failures resulting in safety and technical compliance issues. These compliance issues are currently being addressed in the Maintenance Plan.

The key drivers and associated risks for the secondary mains, which together govern the asset management activities, are summarised in Table 7 below.

Driver	Risk/Opportunity Description	Consequence
Capacity	Supply constraints not meeting demand.	Loss of supply to customers at peak periods.
Integrity	Third party damage resulting from encroachment and increasing activity over mains easement	Reduction in safety of service causing threat to public safety. Loss of supply to entire network due to loss of integrity.
	External corrosion due to aging and breakdown of external pipeline and field joint coatings and inadequate CP	Reduction in safety of service causing threat to public safety. Loss of supply to network due to degradation of MAOP / capacity.
	External corrosion due to AC and stray currents and inadequate CP	Reduction in safety of service causing threat to public safety. Loss of supply to network due to degradation of MAOP / capacity.
	Exposed mains exposed to third party damage and corrosion.	Reduction in safety of service causing threat to public safety.
	Erosion of cover leading to reduction in protection from third party damage	Reduction in safety of service causing threat to public safety.
Regulatory Compliance	Insufficient information or data to confirm integrity / compliance to operate at current MAOP	Loss of supply to network due to reduction of capacity.

Table 7 Secondary Specific Drivers and Risks

5.4.4 CAPITAL REQUIREMENTS

The key drivers for the secondary mains identified above have led to the asset management strategies and activities defined herein.

Driver(s)	AM Strategy	Activities / Capital Requirements
Capacity Capacity	Market Expansion	NRC Mains, Marsden Park and East Leppington
	Capacity Development	New secondary mains and services to meet demand growth
Integrity, Regulatory Compliance	CP System	Upgrade of CP system for effective corrosion protection
	Erosion Management	Washaway mitigation program to reduce third party damage risks
	Integrity investigation	Weld Investigation

Table 8 Secondary Mains Strategy and Activities

Details of the capital expenditure and schedule are provided in the AMP for this asset class.

5.4.5 OPEX REQUIREMENTS

The operational expenditure plan provides for engineering, inspections and monitoring tasks as defined below:

- Continued update of 5 yearly Formal Safety Assessments (FSA);
- CP monitoring to confirm adequate protection against corrosion; and
- Allocation of resources to monitor and control the increasing number of third party activities.

5.5 MEDIUM AND LOW PRESSURE MAINS

5.5.1 DESCRIPTION

The low and medium pressure mains and services supply natural gas to domestic and industrial and commercial (I&C) customers. The networks comprise of mains, services, valves, boundary regulators, and a small number of CP circuits. The low pressure networks have a MAOP of 2kPa or 7kPa. The medium pressure networks have a MAOP of 210kPa, 300kPa, 400kPa with a small number operating at 30kPa and 100kPa.

Low and medium pressure mains and services are generally plastic with about 10% being cast iron and steel.

Valves are devices used to isolate the flow of natural gas. This includes both standard sector isolation valves and high risk sector valves.

5.5.2 ASSET CONDITION

The age profile of the medium and low pressure mains is summarised in Figure 12 below.

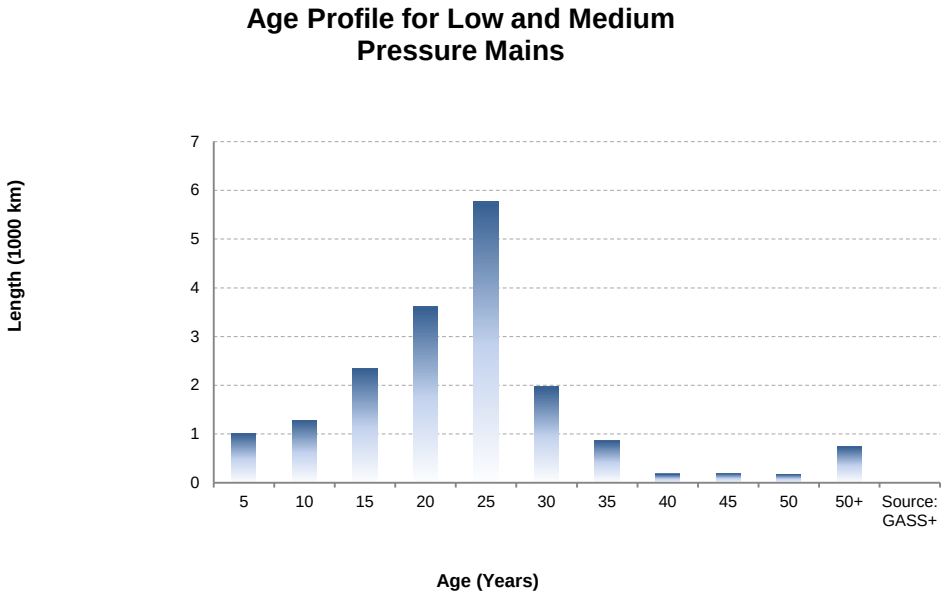

Figure 12 Low and Medium Pressure Mains Age Profile

The majority of the network is in good condition. A large scale rehabilitation program which began in the late 1980s replaced much of the aging and leaking network. During this renewal program, most cast iron and steel pipe in the low and medium pressure networks was inserted with nylon, which has an industry expected design life of 50 years. As a result, only about 10% of the current network consists of cast iron and steel. These remaining sections of the network continue to be managed under rehabilitation programs.

These remaining areas pose two concerns when compared to the remainder of the network. Firstly, the level of service available to customers is of a lower standard as they may not be able to connect newer more efficient appliances that require a higher metering pressure than available in these areas and in some cases there may even be restrictions on the connection of new customers. Secondly, there is a lower level of system integrity in these areas leading to high levels of leakage and maintenance costs.

System integrity of the low and medium pressure mains has been assessed through integrity/performance assessments which use monitoring/performance methods including Unaccounted-For-Gas (UAG), leakage surveys, publically reported leaks, network incidents and poor supply.

UAG is a measure of gas lost (or gained) with respect to total gas entering the network. There are a number of factors which contribute to UAG including losses through the network. Metering differences are also a significant contributor. Historically, the total network trends between 1.9% and 2.7% of UAG against gas receipts. This result is aligned with the performance and expectation of

a network rehabilitated during the 1980s and 1990s. Benchmarking against other networks indicates that JGN performs well with respect to UAG levels.

However, losses through the network do vary from section to section. Leakage tests performed on a number of sections have shown leakage rates in excess of 20%. Sections with poor performance are assessed in detail as candidates for rehabilitation. In comparison, the high pressure steel systems have virtually no leakage.

5.5.3 ASSET CLASS SPECIFIC DRIVERS

Development of new networks and upgrade of existing networks will be continually driven by demand growth throughout this 20 year period. Maintaining adequate capacity is a major issue for the network with continuously increasing demands, particularly where older suburbs are redeveloped into high density housing. This issue is managed with comprehensive modelling to optimise network utilisation.

For the existing network, a number of current and emerging integrity, performance and regulatory issues require management to ensure the continued level of service over this 20 year period. These include:

- Protection of the mains due to third party activities;
- Security of supply; and
- Mitigation of network leaks, typically in area where old cast iron and steel is still in service.

JGN continually assesses network performance and identifies areas which require rehabilitation based on the following considerations:

- Reduction in risks to public due to gas leaks;
- Improved network reliability;
- Compliance with regulatory benchmarks;
- Reduction in carbon emissions;
- Reduction in network maintenance; and
- Rehabilitation workload/resource forecasting and scheduling.

The capital expenditure plan provides for an ongoing rehabilitation program for upgrade locations with aging cast iron, steel and HDPE mains with leak and integrity issues.

The key drivers and associated risks for the medium and low pressure mains, which together govern the asset management activities, are summarised in Table 9 below.

Driver	Risk/Opportunity Description	Consequences
Capacity	Supply constraints not meeting demand.	Loss of supply to customers at peak periods.
Integrity	Increasing UAG due to increasing leaks in critical network sections	Increasing UAG – Public disruption, carbon emissions and environmental impact. Reduced safety of service causing threat to public due to increasing gas leaks. Reduced integrity of service due to poor network reliability. Increase in network maintenance.
Regulatory Compliance	Insufficient information or data to confirm integrity / compliance to operate at current MAOP	Loss of supply to network due to degradation of capacity.

Table 9 Medium and Low Pressure Mains Specific Drivers and Risks

5.5.4 CAPITAL REQUIREMENTS

The key drivers for the medium and low pressure mains identified above have led to the asset management strategies and activities defined herein.

Driver(s)	AM Strategy	Activities / Capital Requirements
Capacity	Market Expansion	Multiple new developments.
	Capacity Development	New medium and low pressure mains and services to meet demand growth in existing network.
Integrity, Regulatory Compliance	Services Rehabilitation and Renewal	Rehabilitation of existing mains and services with new PE lines in critical areas.
		Distribution Isolation Valves (HRVs and Bushfire areas)

Table 10 Medium and Low Pressure Mains Strategy and Activities

Details of the capital expenditure and schedule are provided in the AMP for this asset class.

5.5.5 OPERATIONAL REQUIREMENTS

Both proactive and reactive maintenance is conducted on medium and low pressure to ensure their ongoing integrity, and reliability of supply. These are performed in conjunction with capital works to ensure minimisation of public risk and lifecycle costs.

The proactive operational activities include the following:

- Continued update of 5 yearly Formal Safety Assessments;
- Leakage surveys;
- Exposed mains inspections; and
- Allocation of resources to monitor and control the increasing number of third party activities.

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

5.6 TRUNK FACILITIES

5.6.1 DESCRIPTION

The asset class comprises Trunk Receiving Stations (TRSs), Packaged Off-Take Stations (POTS), Bulk Metering Stations, Automatic Line Break Valves (ALBVs) and Water Bath Heaters.

TRSs are gas pressure reduction and filtration facilities. They are supplied at trunk pressure and deliver gas at the appropriate pressure to the downstream network.

POTS are smaller capacity installations combining or 'packaging' the functions of measurement, filtration and pressure reduction. They are supplied at trunk pressure and deliver gas at the appropriate pressure to the downstream network.

Water bath heaters are heat exchangers used to preheat gas to ensure that the temperature reduction (Joule-Thompson effect) caused by large pressure drops through regulators does not adversely affect the facility and downstream pipeline.

Automatic Line Break Valves (ALBV) are safety devices used to automatically isolate certain segment of a pipeline when a rapid change in system pressure (representing a rupture) is detected.

Bulk metering stations are high pressure facilities that deliver gas to a single, generally large industrial, customer. There are two bulk metering stations in the trunk facilities group: Incitec at Kooragang Island, and Munmorah Off Take Metering Station.

5.6.2 ASSET CONDITION

The age profile of the trunk facilities are summarised in Figure 13 below.

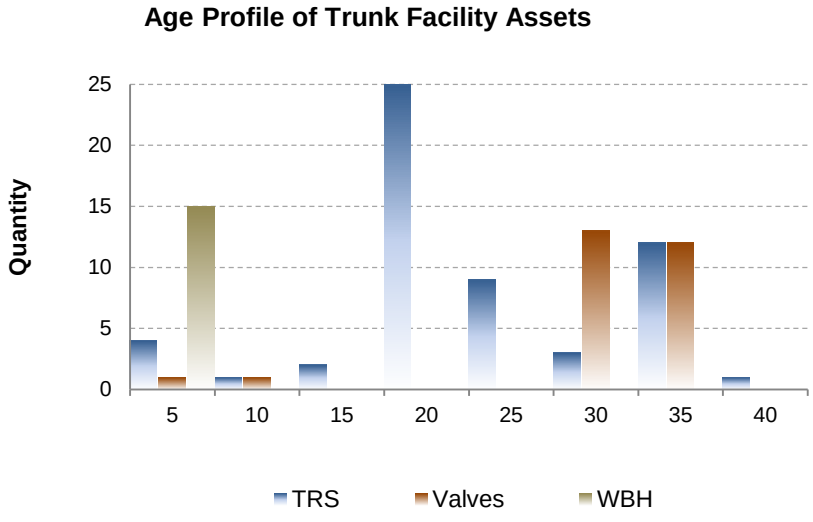

Figure 13 Trunk Facilities Age Profile

While there are a variety of trunk facility assets including TRS, POTS, ALBVs, water bath heaters and bulk metering stations and the condition of these assets varies across the network, overall, the structural integrity is currently adequate for containment and reliability of supply.

The condition of ALBV actuators is deteriorating. The valves are fully operational however the majority show signs of wear consistent with the age of the equipment. A review conducted in 2008 identified that the Vane actuators required seal replacement.

5.6.3 ASSET CLASS SPECIFIC DRIVERS

Development of new facilities and upgrade of existing facilities will be continually driven by demand growth throughout this 20 year period. Confirmed capacity expansion works required to meet increased demand includes Windsor TRS, Yass POTS, Appin POTS, Campbelltown TRS and Eastern Creek TRS. The forecast capital expenditure provides for these projects and future expansion projects consistent with demand forecasts.

Facilities upgrade expenditure also provides for the introduction of the new supply source or sources from the region to the north or north-west of Newcastle. The introduction of this new supply source will result in higher pressure at 11 TRS sites on the Northern trunk, resulting in the need for water bath heaters at these sites to avoid excessive cooling due to the Joule-Thompson effect. The forecast capital expenditure provides for these upgrades, although timing is externally driven.

In addition, to ensure continued safe operation, the following performance issues related to service age will need to be addressed;

- E&I components will require refurbishment each 10 to 15 years to meet current code requirements;
- Mechanical equipment upgrades to maintain performance levels; and
- The condition of ALBVs is deteriorating due to age. While these are currently operational, an upgrade program will be required to maintain them at this level of service.

The key drivers and associated risks for the trunk facilities, which together govern the asset management activities, are summarised in Table 11 below.

Driver	Risk/ Opportunity Description	Consequence
Capacity	Supply constraints not meeting demand.	Loss of supply to customers at peak periods.
Integrity	Corrosion of mechanical equipment	Loss of supply to network due to degradation of MAOP / capacity.
	Bush fire radiation damage to equipment	Loss of supply to network due to degradation of MAOP / capacity.
Service Age	ALBV Performance	Reduced safety of service due to lack of adequate isolation.
	E&I components service age	Reduced integrity of service due to poor reliability. Regulatory non-compliance.
	Mechanical equipment service age	Reduced integrity of service due to poor reliability. Regulatory non-compliance.
New/Changing Sources	Increased inlet pressure at TRS and POTs causing icing of equipment	Reduced integrity of service due to poor reliability.
Regulatory Compliance	Insufficient information or data to confirm integrity / compliance to operate at current MAOP	Loss of supply to network due to reduction of capacity.
Health and Safety	Older TRS site layouts causing increasing OH&S risks	OH&S risks to employees.

Table 11Trunk Facilities Specific Drivers and Risks

5.6.4 CAPITAL REQUIREMENTS

The key drivers for the trunk facilities identified above have led to the asset management strategies and activities defined herein.

Driver(s)	AM Strategy	Activities / Capital Requirements
Capacity	Capacity Development	New TRS at Albion Park, Windsor TRS Upgrade.
		POTS Upgrade for new Capacity.
New Supply Source	Northern Trunk TRS Upgrade	Upgrade TRS on northern trunk for higher inlet pressure.
	Riverina Pressure Enhancement	Upgrade Riverina POTS for higher inlet pressure.
Integrity, Service Age, Regulatory Compliance, Health and Safety	E&I upgrade	E&I end of design life upgrade for instrumentation that does not comply with code.
	ALBV Rehabilitation	ALBV upgrade including seal replacements, actuator refurbishment.
	TRS mechanical equipment upgrades	TRS equipment upgrade.
		Enhanced fire protection.

Table 12 Trunk Facilities Strategy and Activities

Details of the capital expenditure and schedule are provided in the AMP for this asset class.

5.6.5 Operational Requirements

The operating expenditure plan provides for the planned inspections, maintenance and monitoring tasks to be performed in conjunction with the capital works described previously to optimise life cycle costs while meeting the performance requirements. The planned activities are defined below:

- Continued update of 5 yearly SMS and High Pressure Facility Reviews;
- CP monitoring to confirm adequate protection against corrosion;
- Periodic visual inspections; and
- Routine maintenance work as defined in the maintenance plan.

5.7 Primary Regulating Stations

5.7.1 Description

This asset class comprises Primary Regulating Stations (PRS) and ALBV.

PRSs are gas pressure reduction and filtration facilities located at each off-take on the primary main. They reduce the pressure from 3,500kPa to 1,050kPa to supply the secondary network or lower metering pressures to specific customer.

ALBVs isolate sections of the primary main upon detection of rapid depressurisation across the valve as would occur in the event of a rupture.

5.7.2 Asset Condition

The age profiles of the primary regulating stations and ALBV's are summarised in Figure 14 below.

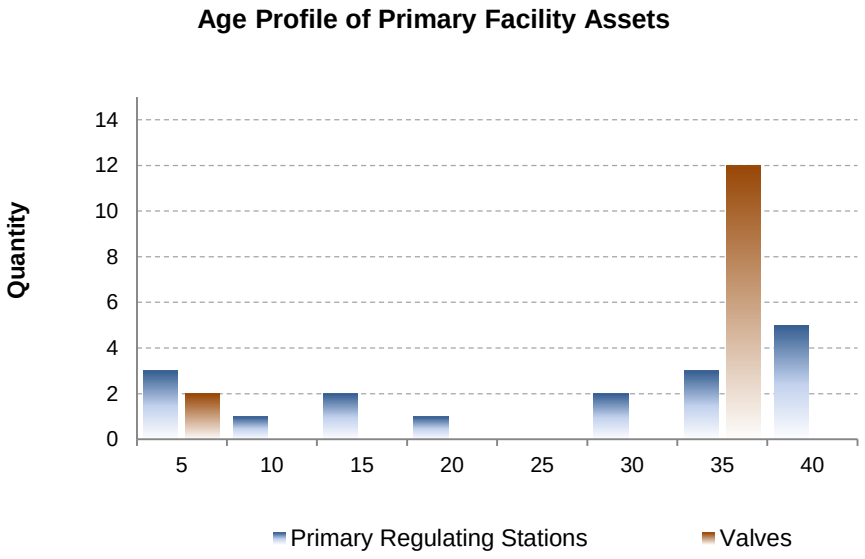

Figure 14 Primary Facilities Age Profile

The majority of PRSs were commissioned in 1976 when natural gas was introduced to the Sydney market. A number were added more recently, including Moorebank PRS, Riverwood PRS and Lane Cove PRS. Overall, the structural integrity and level of service is reasonable considering the age of the assets. However, due to the service age of a large proportion of this asset class, a number of current and emerging integrity, performance and regulatory issues will require additional management to ensure the continued safe operation and level of service over this 20 year period.

5.7.3 ASSET CLASS SPECIFIC DRIVERS

As for other asset classes, the development of new facilities and upgrade of existing facilities will be continually driven by demand growth throughout this 20 year period. Confirmed capacity expansion works due to increased demand includes a new PRS for the northern primary project and another at Emu Plains for the Penrith mains extension. The forecast capital expenditure provides for these projects and future expansion projects consistent with demand forecasts.

In order to maintain safety of service and the required integrity of service throughout this 20 year period, a number of emerging integrity and service age related issues will need to be managed for this asset class. The key issues are highlighted below:

- Corrosion will be a continually growing issue with the facilities due to the age, configuration and location of the assets. Corrosion will need regular monitoring and mitigation, especially for equipment in below ground structures and at above/below ground interfaces;
- Noise and vibration (fatigue) has been identified as an issue for aging control valves;
- Lack of safe isolation by double black and bleed (DBB);
- Structural integrity of pits due to concrete spalling, resulting in no longer being rated for vehicle loading;
- E&I components will require refurbishment each 10 to 15 years to meet current code requirements; and
- The conditions of ALBVs are deteriorating due to age. While these are currently fully operational, an upgrade program will be required to maintain them at this level of service.

The key drivers and associated risks for the Primary Regulating Stations, which together govern the asset management activities, are summarised in Table 13 below.

Driver	Risk/Opportunity Description	Consequence
Capacity	Supply constraints not meeting demand.	Loss of supply to customers at peak periods.
Integrity	Corrosion of mechanical equipment	Loss of supply to network due to degradation of MAOP / capacity.
Service Age	E&I components service age	Reduced integrity of service due to poor reliability Regulatory non-compliance.
	Lack of safe isolation (Double Block and Bleed) and ALBV lack of function	Reduced safety of service due to lack of adequate isolation.
	Mechanical equipment service age	Reduced integrity of service due to poor reliability Regulatory non-compliance.
Health and Safety	Older site layouts causing increasing OH&S risks	Reduced safety of service due to increased OH&S risks to employees.
Regulatory Compliance	Aging equipment not meeting code requirements	Loss of supply to network due to reduction of capacity.

Table 13 Primary Regulating Stations Specific Drivers and Risks

5.7.4 CAPITAL REQUIREMENTS

The key drivers for the trunk facilities identified above have led to the asset management strategies and activities defined herein.

Driver(s)	AM Strategy	Activities / Capital Requirements
Capacity	Capacity Development	New PRS to meet demand at Pymble (Northern Trunk), Lane Cove and Riverwood.
Service Age, Regulatory Compliance, Health and Safety	Double Black and Bleed	Upgrade DBB/ALBV for code compliance.
	PRS life extension	Refurbishment of PRS for life extension.
	PRS Upgrade	Mechanical and E&I upgrades to PRS to meet current requirements.

Table 14 Primary Regulating Stations Strategy and Activities

Details of the capital expenditure and schedule are provided in the AMP for this asset class.

5.7.5 OPERATING REQUIREMENTS

The operating requirements provide for planned inspection, maintenance and monitoring tasks to be performed in conjunction with the capital works described previously to optimise life cycle costs while meeting the performance requirements. The planned maintenance activities for the PRSs are defined below:

- Continued update of 5 yearly SMS and High Pressure Facility Reviews;
- CP monitoring to confirm adequate protection against corrosion;
- Periodic visual inspections;
- Pit structural assessments;

- Routine maintenance work as defined in the Maintenance Plan;
- Corrosion inspection and repair; and
- Vibration monitoring and replacement program for aging control valves.

5.8 District Regulator Sets

5.8.1 Description

District Regulator Set (DRS) is the generic term used to describe regulators that supply the medium and low-pressure networks. There are three types of District Regulator Sets (DRS) in operation to provide regulation at different stages on network.

- Secondary Regulator Sets (SRS) are installed at each off-take from the secondary network to supply medium pressure networks. SRSs reduce the inlet pressure of 1,050kPa to 400, 300, 210, 30 or 7kPa.
- Medium Pressure Regulator Sets (MPRS) are installed at each off-take from the medium pressure network to supply low pressure networks. MPRSs reduce the pressure from 210 and 400kPa inlet to 7 or 2kPa.
- Low Pressure Regulator Sets (LPRS) reduce an inlet pressure of 7kPa to 2kPa to supply low pressure networks.

Most DRSs are located on public land and are installed in underground boxes. A small number of DRSs are above ground installations.

5.8.2 Asset Condition

The age profile of the SRSs installed in the network is shown below. MPRSs and LPRs are not included in this age profile as there is insufficient information recorded to determine their age.

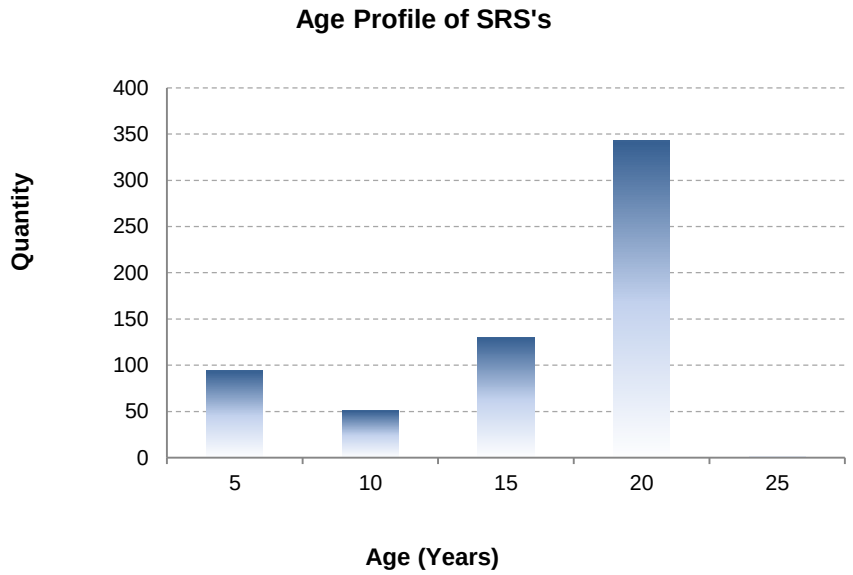

Figure 15 District Regulator Sets Age Profile

In 2013, a review was conducted assessing the integrity and levels of service of a number of DRSs. While the operational performance of the DRSs was considered satisfactory, a large number of issues were identified in the review. Major flaws with the design of existing DRS boxes resulted in numerous issues such as water ingress, maintainability issues, traffic hazards, ergonomics issues, etc. Major observations from the review are as follows:

- 50% of the DRSs had water within the box;
- 39% of the DRSs had pilots installed at the bottom of the box (access issues);
- 38% of the DRSs had ergonomics issues; and
- 20% of the DRSs had corrosion issues.

5.8.3 ASSET CLASS SPECIFIC DRIVERS

Corrosion continues to be an integrity issue with equipment in this asset class. District regulators are exposed to damp environments inherent with below ground sites. Many are fully submerged in water for significant periods.

Compliance with OH&S legislation and JGN policies is increasingly difficult since legacy designs and the location of district regulators have numerous ergonomic and OH&S issues. This impacts support levels with additional demands for traffic management and safer working practices in confined spaces.

There are currently more than 20 different types of aging district regulators in service in the network. This impacts many aspects of the operation and maintenance of this asset class including raining requirements, test and repair documentation and procedures, risk of operator error, inventory management and spare parts support.

Due to the above, JGN has implemented a DRS replacement strategy. This strategy is a 20 year program stretching over several Access Arrangement periods. DRSs are assessed against a “fitness for purpose” criterion and those units which fail this assessment are either overhauled or replaced with a standardised regulator type.

In addition to the drivers described above, new or upgraded assets of this class will be driven either by market expansion or capacity development.

The key drivers and risks associated for the District Regulator Sets, which together govern the asset management activities, are summarised in Table 15 below.

Driver	Risk/Opportunity Description	Consequence
Capacity	Supply constraints not meeting demand.	Loss of supply to customers at peak periods.
Integrity	Corrosion	Loss of supply to network due to degradation of MAOP / capacity.
Service Age	Many various types of aging regulators.	Reduced integrity of service due to poor reliability and lack of standardisation of spares and procedures. Regulatory non-compliance.
Health and Safety	Older boxes have serious ergonomic and maintainability issues. Compliance with OH&S requirements	OH&S risks to employees.

Table 15 District Regulator Sets Specific Drivers and Risks

5.8.4 CAPITAL REQUIREMENTS

The key drivers for the trunk facilities identified above have led to the asset management strategies and activities defined herein.

Driver(s)	AM Strategy	Activities / Capital Requirements
Capacity	Capacity Development	New DRS for medium and low pressure mains and services to meet demand growth in existing network.
Integrity, Service Age, Health and Safety	Replacement of aging regulator with Cocon 26	Planned replacement program to upgrade aging regulators beyond economical repair with standardised technology.

Table 16 District Regulator Sets Strategy and Activities

Details of the capital expenditure and schedule are provided in the AMP for this asset class.

5.8.5 OPERATIONAL REQUIREMENTS

DRSs are operated and maintained in accordance with JGN SAOP and Integrity Management Plan. The plans include integrity reviews and routine maintenance activities reflecting the requirements of AS4645 and other technical regulatory requirements.

Non routine maintenance activities are driven by integrity review activities. These determine the requirements to address specific issues such as replacing or extending the service life, if possible.

5.9 RESIDENTIAL MEASUREMENT

5.9.1 DESCRIPTION

Residential gas meter sets provide filtration, pressure regulation and metering to small end-point customers connected to the network. Residential metering is divided into the following sub-classes:

- Gas meters; and
- Hot and cold water meters.

The standard residential gas meter set comprises a diaphragm gas meter, a meter bar, an inlet riser and valve and a pressure regulator with filter. There are 1.2million residential gas meters in the network, consisting of 13 different types of meters.

Residential water meters are used to measure the consumption of hot water in medium density developments. Typical medium density developments have centralised hot water systems which consist of one or more hot water heaters with master gas and cold water meters and a circulating ring main system serving a number of residential customers through individual domestic hot water meter. These meters are used to apportion the gas measured at the master gas meter.

5.9.2 CONDITION

The performance of the residential gas meter populations is managed by statistical sampling of the various meter types. The nominal life of a residential gas meter is 15 years. However AS4944 and, before that, the Gas Supply (Gas Meters) Regulation 2002, provides for the life of a particular cohort or population of meters to be extended on the basis of statistical sampling. The age profile of the residential meters is shown in Figure 16 below.

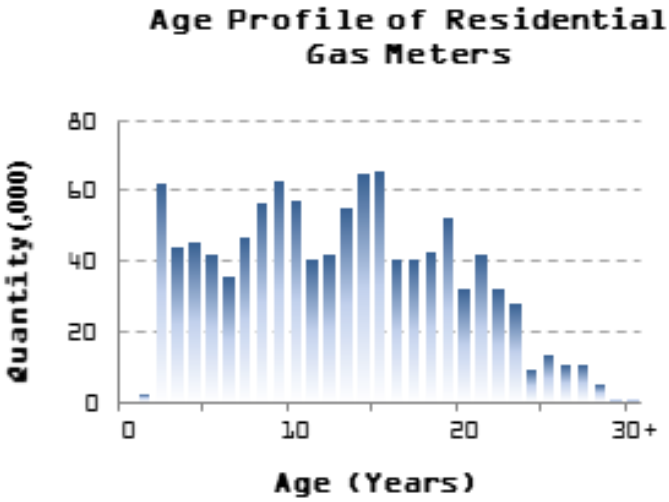

Figure 16 Residential Gas Meters Age Profile

Corrosion is an ongoing issue and usually manifests where meters have been buried in corrosive soils or exposed to beachside weather. This issue is managed with corrective maintenance.

The age profile for the residential water meters is shown in Figure 17 below.

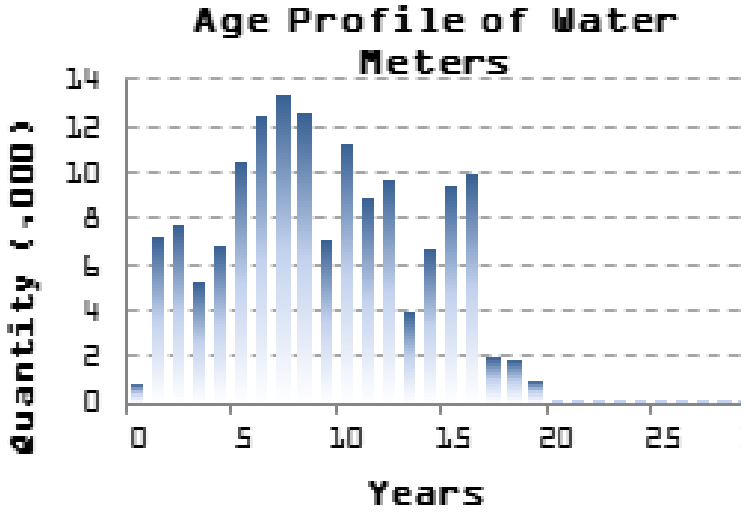

Figure 17 Residential Water Meters Age Profile

The condition of water meters currently in service has been found to be deteriorating prematurely. Over the last five years there have been increasing volumes of failures. The number of defective meters is currently estimated to exceed 10,000. Engineering assessments predict that the failure rate will increase over coming years.

5.9.3 ASSET CLASS SPECIFIC DRIVERS

Specific drivers for the asset management strategies for this asset class are service life, regulatory compliance and capacity.

The renewal and upgrade plan for residential gas meters is driven by the integrity review plan, specifically the statistical sampling program. The capital expenditure plan for residential meter replacement is based on the assumption that statistical sampling will support extending the life of residential meters to 20 years. However that will only be confirmed for a particular population when sampling is performed, beginning 13 years after installation. The renewal street also has included for the following:

- 3,017 Rockwell MR8 meters are approaching 20 years old and are not considered for life extension. They will be retired at 20 years.
- The current asset base includes meter populations in their second and third life extension. This includes Email 602 series JA, JB, JC, JD, JE and JW meters (47,250). A further life extension for this meter type is not likely to be successful. JGN is planning to replace these meters.

Replacement of aged residential water meter populations is not a statutory requirement. The primary drivers when developing a renewal and upgrade strategy for water meters are accuracy and integrity.

Water meters are replaced when they become operationally deficient. This is driven by sizing requirements or critical failure. The planned replacement program for water meter populations is driven by the results of the integrity activities. Implementing a policy for aged meter replacement aims to reduce the volume of corrective maintenance.

The key drivers and associated risks for residential gas and water meters, which together govern the asset management activities, are summarised in Table 17 below.

Driver	Risk/Opportunity Description	Consequence
Capacity	Supply constraints not meeting demand.	Reduced market expansion.
Service Age	Inaccurate meter reading outside of performance requirements. Meter failure.	Loss of revenue or overpricing to customers. Loss of supply to customers. Excessive reactive maintenance/replacement demands.
Regulatory Compliance	Inaccurate meter readings	Non-compliance with regulatory obligations. Loss of revenue or overpricing to customers.

Table 17 Residential Meters Specific Drivers and Risks Capital Requirements

5.9.4 CAPITAL REQUIREMENTS

The replacement of aged and defective meters is the key driver for the asset management strategies and activities defined herein.

Driver(s)	AM Strategy	Activities / Capital Requirements
Capacity	Market Expansion	Multiple Developments.
Service Age, Regulatory Compliance	Replacement of gas meters	Planned replacement program to upgrade aging gas meters.
	Replacement of water meters	Planned replacement program to upgrade aging/defective water meters.

Table 18 Residential Meters Strategy and Activities

Details of the capital expenditure and schedule are provided in the AMP for this asset class.

5.9.5 OPERATIONAL REQUIREMENTS

Residential gas meters are not routinely maintained outside the compliance sampling program. JGN reactively replaces meters that fail in operation. Typically JGN replaces approximately 5000-5500 defective meters annually, equating to 0.4% of the total population.

JGN does not have a policy for operating and maintaining water meters, however, work is progressing on developing a system to achieve efficient management of the asset with respect to levels of service, cost and risk.

5.10 INDUSTRIAL AND COMMERCIAL MEASUREMENT

5.10.1 DESCRIPTION

Industrial and Commercial (I&C) gas meter sets have the same functionality and purpose as residential meter sets. They provide filtration, pressure control and volumetric measurement at the point of final delivery from the network. I&C gas meter sets are installed wherever loads exceed the capacity of normal residential meters.

There are three different types of meter used in I&C measurement. These include:

- Diaphragm meters which allow accurate measurement of small gas loads. They are predominantly installed on residential and small commercial units. There are 41,960 units in the network;
- Rotary meters are capable of handling higher volumes and pressures than diaphragm meters. Within the meter, two figure 8 lobes spin in precise alignment, measuring the volume of gas with each turn. There are 1,785 units in the network, typically for small commercial loads; and
- Turbine meters, which measure the gas volume by determining the speed of the gas moving through the meter. Turbine gas meters can pass gas flow during meter service and are well suited to situations where continuity of gas is required. These meters are typically used for large users such as demand market contract customers. There are 120 units installed in the network.

Meters include associated equipment such as filters and pressure regulators.

5.10.2 CONDITION

The age profile for the various I&C meter types are shown in Figure 18 below.

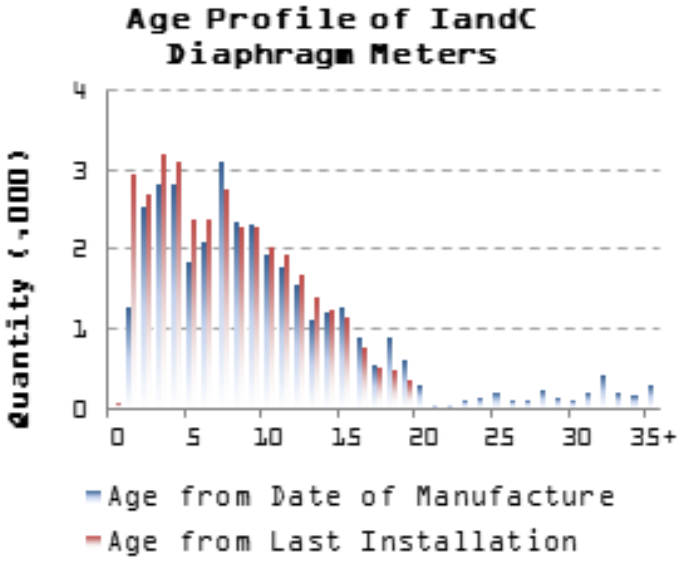

Figure 18 I&C Diaphragm Meters Age Profile

The general condition of the I&C Diaphragm population is good. Aged replacement and statistical sampling strategies in accordance with AS4944 ensure healthy populations, with the majority of the meters being retired from service after 15 years. There are no unmanaged issues impacting this asset class.

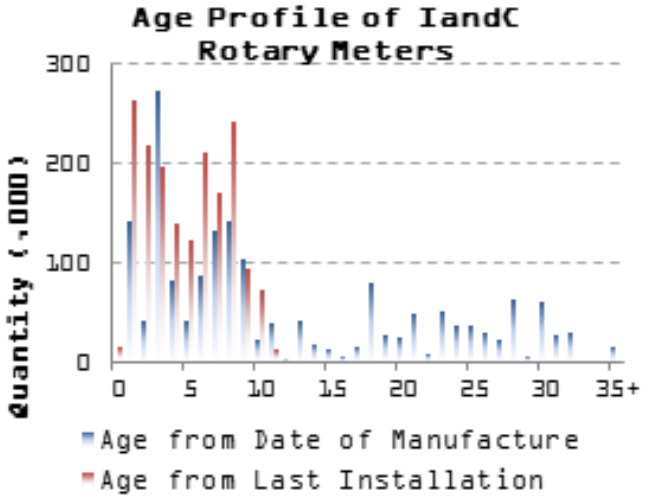

Figure 19 I&C Rotary Meters Age Profile

The age profile for the rotary meters illustrates an aging population. The current management strategy is to replace and refurbish the meters every 10 years, unless, the refurbishment cost exceeds 60% of new pricing. Large numbers have been refurbished more than once and are passing 20 years of service. Consequently, the condition of the I&C Rotary meter populations is mixed. The older meter populations are deteriorating, eroding dimensional tolerances and reducing meter accuracy.

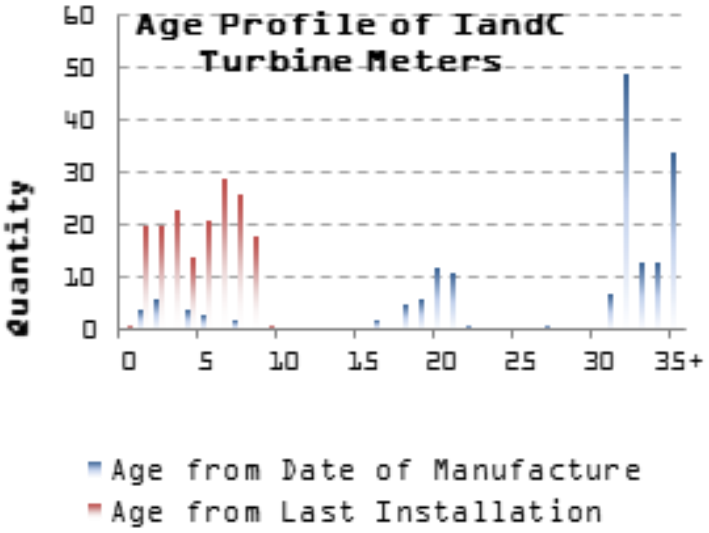

Figure 20 I&C Turbine Meters Age Profile

Turbine meters are replaced and refurbished every 5 years since these are used to measure some of the largest consumers in the network. The majority of I&C turbine meters are between 15 and 20 years old and therefore have been refurbished up to three times. Some meters are over 30 years old and have been refurbished up to six times. As a result of these service ages, the overall condition of the I&C turbine meter population is deteriorating, thus impacting accuracy and reliability. Meters are retired when the refurbishment cost exceeds 60% of new cost.

5.10.3 ASSET CLASS SPECIFIC DRIVERS

Inaccurate meter readings can expose JGN to revenue, regulatory and supply risks. Therefore the primary driver for the management of the meter fleet is to develop a renewal and upgrade strategy that achieves desired meter performance requirements, minimises lifecycle costs and reduces extreme volatility in replacement programs.

Diaphragm meters will continue to be managed in accordance with the aged replacement and statistical sampling strategy.

It is proposed that rotary meters will be retired after a maximum service life 20 years as refurbishment cannot rectify tolerance issues. This represents a maximum of two overhauls.

Similarly, a revised strategy is being proposed to retire turbine meters from service after a maximum of 20 years' service, with refurbishment at 5 year intervals, since refurbishment cannot rectify gearbox issues which have an impact on the meter accuracy. The specific drivers for the strategic management of the I&C meters are summarised in Table 19 below.

Driver	Risk/Opportunity Description	Consequence
Capacity	Supply constraints not meeting demand.	Reduced market expansion.
Service Age	Inaccurate meter reading outside of performance requirements. Meter failures.	Loss of revenue allocative inefficiency – under-pricing to some customers and overpricing to others. Loss of supply to customers.
Regulatory Compliance	Inaccurate meter readings.	Non-compliance with regulatory obligations. Loss of revenue or overpricing to customers.

Table 19 I&C Gas Meters Specific Drivers and Risks

5.10.4 CAPITAL REQUIREMENTS

The replacement of aged and defective meters is the key driver for the asset management strategies and activities defined herein.

Driver(s)	AM Strategy	Activities / Capital Requirements
Capacity	Market Expansion	Multiple new housing developments.
Service Age, Regulatory Compliance	Diaphragm gas meters replacement	Planned replacement program to upgrade aging diaphragm gas meters.
	Rotary gas meters replacement	Planned replacement program to upgrade aging gas water meters.
	Turbine gas meters replacement	Planned replacement program to upgrade aging turbine gas meters.
	Equipment upgrades	Replacement of Metreteks, Flow Computers, Gas Chromatographs.

Table 20 I&C Gas Meters Strategy and Activities

Details of the capital expenditure and schedule are provided in the AMP for this asset class.

5.10.5 OPERATIONAL REQUIREMENTS

I&C rotary and turbine gas meters are routinely maintained as part of the lifecycle management strategy described above, with refurbishment occurring every 10 and 5 years respectively.

There is no management plan for diaphragm meters.

The operational requirements, which are underpinned by regulatory and JGN policy requirements, also provides for engineering, inspections and testing tasks as defined below:

- Continued update of 5 yearly Formal Safety Assessments (FSA);
- Routine maintenance work as defined in the Technical Policy TPC.PROC 4.99.7 Metering Equipment Maintenance, Service and Disposal; and
- Statistical sampling in accordance with AS4944.

6. CAPITAL AND OPERATING EXPENDITURE FORECAST SCENARIOS

6.1 OVERVIEW

Scenario modelling is an important tool used by Jemena management to aid decision making. It enables management to test the risks and implications of various price, service and quality trade-offs. In turn, these results also provide a means of validating JGN's decisions with customers and other stakeholders. Modelling the various scenarios over extended time periods ensures that long term implications of different asset management decisions can be considered. Asset management decisions made within this context are more likely to ensure safe and reliable network operations whilst minimising total lifecycle costs, thereby avoiding price shocks, inter-generational inequity and deliver customer's long term interests.

The value of scenario modelling is largely determined by the quality of the information used to develop and model the various scenarios. JGN has relied on the best available information and the extensive knowledge and experience of its asset managers to inform its scenario modelling.

JGN has modelled five scenarios based upon the interaction between level of service, capital and operating expenditure and average cost per customer, over the next 20 years. This modelling is depicted in Figure 21 below. Customer feedback on these scenarios has guided JGN's decision making on its forecast capital expenditure.

6.2 LEVEL S OF SERVICE ATTRIBUTES

The six core service level KPI's outlined in Section 4 have been used as the basis for the levels of service attributes in the modelling. The relationship between the attributes tested and the core KPIs is as follows:

1. Safety – since a network failure, due to a loss of integrity, can be catastrophic with the potential for personal injury or loss of life, property and environmental damages and loss of supply, current safety levels have been maintained through all scenarios. JGN sees the safety of its employees, customers and the community as a non-negotiable top priority. Customer feedback supported this view.
2. Public Amenity – scenarios included effects on varying the number or gas leaks and the level of planning maintenance work affecting traffic disruptions;
3. Service Quality – scenarios included the effect of varying the level of service quality across different segments of the network, enabling or hindering these segments in installing new, more efficient (and more demanding) gas appliances, such as instantaneous hot water systems;
4. Reliability – scenarios included the effect of varying the level of potential service disruption and the resultant customer frustration;
5. Responsiveness –the time it takes to respond to supply disruptions and to reconnect customers and the time required to connect new customers; and
6. Availability – scenarios included the effect on new customer's ability to connect to the network.

JGN, through its consultative processes with stakeholders has validated that the attributes tested are those which the stakeholders consider to be a high priority.

6.3 Scenario Analysis

Figure 21 JGN Scenario Modelling

For the purposes of the scenario modelling Jemena assessed changes in operating and capital expenditure and the impacts on Jemena's average cost per customers over three time horizons:

- Short term – 5 years
- Medium term – 5 to 15 years
- Long term – 15 years and beyond

6.3.1 Scenario 1 : Maintain Current Acceptable Service Level

This scenario aims to maintain the service levels within the currently acceptable range as defined in Section 4 and represents Jemena's proposed capital and operating plan which is defined as the Base Case scenario.

JGN explained to customers that under this scenario, forecast total average costs per customer are expected to be lower than in the current period – creating an opportunity for price reductions.

6.3.2 Scenario 2 : Reduce Current Service Levels for the Longer Term

This scenario assesses the effect of reducing capital expenditure relative to Scenario 1 to deliver reduced level of service as defined in Section 4.

This scenario was designed to test customer preferences for reductions in current service levels for the longer term to further reduce average costs per customer and prices in the short term (relative to Scenario 1).

The resultant expenditure scenario is characterised by:

- Long term reduction in capital expenditure of up to 50% through reduced investment in market expansion, asset replacement and capacity development activity;
- Short term reduction in operating expenditure as a result of eliminating the proactive marketing of gas to new customers, lower emergency response resources and lower maintenance costs; and
- Long term increase in operating expenditure as a result of a sub-optimal maintenance strategy that leads to asset failures and increased emergency response activity.

The effect of this reduction in the level of service and expenditure is a reduction in customer numbers of approximately 10% over the 20 year period.

Relative to Scenario 1, the resultant cost per customer and price impacts is characterised by:

- Short term reductions in cost per customer as the lower operating costs are spread across a similar customer base; and
- Medium to long term increases in cost per customer as the reduced capital investment is more than offset by higher operating costs and, decreases in customer numbers as a result of declining service levels and proactive marketing to new customers.

This trend is shown in Figure 21 above.

6.3.3 SCENARIO 3 : REDUCE CURRENT SERVICE LEVELS IN THE SHORT TERM

This scenario assesses the effect of a:

- Significant short term reduction in capital expenditure relative to Scenario 1 to deliver reduced short term levels of service as defined in Section 4;
- Medium to long term increase in capital expenditure relative to Scenario 1 to deliver a long term levels of service consistent with Scenario 1.

This scenario was designed to test customer preferences for short term reductions in average costs per customer and prices by deferring capital expenditure to the medium term. This is known as 'inter-generational equity' in terms of who should pay for long term service levels.

The resultant expenditure scenario is characterised by:

- Short term reduction in capital expenditure of ranging from 25-50% and operating expenditure of 5% for non-marketing related activities, with no operating expenditure on proactive marketing programs;
- Medium term increase in capital expenditure ranging from an additional 25-50% in growth capacity and asset replacement capex, and operating expenditure of 10-50% to restore service levels to the levels consistent with Scenario 1.

Relative to Scenario 1, the resultant cost per customer and price impacts is characterised by:

- Short term reductions in cost per customer as the lower operating costs are spread across a similar customer base;
- Medium to long term increases in cost per customer as:
    - increased capital expenditure, including additional asset replacement and capacity development capital, and operating expenditure is required to remediate the degradation in service levels and restore the levels of service consistent with Scenario 1;
    - decreased customer numbers as a result of declining service levels and elimination of proactive marketing to new customers.

6.3.4 SCENARIO 4 : SCALE BACK PURSUIT OF GAS MARKETING AND GROWTH OPPORTUNITIES

This scenario assesses the effect of reducing:

- Both short term and long term capital expenditure on market expansion and capacity development;
- Both short term and long term reduction in operating expenditure on proactive marketing of gas to new customers.

This scenario was designed to test the benefits to customers in terms of lower average costs per customer from prudent marketing and expansion of the network for new customers.

The resultant expenditure scenario is characterised by:

- Long term reduction in capital expenditure of approximately 25-50% on market expansion and approximately 16% on capacity development;
- No expenditure in operating expenditure on proactive marketing of gas to new customers.

Relative to Scenario 1, the resultant cost per customer and price impacts is characterised by:

- Short term reductions in cost per customer as the lower operating costs are spread across a slightly smaller customer base; and
- Medium to long term increases in cost per customer as the reduction in expenditure is outweighed by the reduction in customer numbers.

6.3.5 SCENARIO 5 : EQUALISE SERVICE LEVELS FOR ALL CUSTOMERS

This scenario of assesses the effect of increasing capital expenditure relative to Scenario 1 to deliver improved levels of service for some customers, and a consistent or universal level of service for all customers as defined in Section 4. The improved service level would allow for a common standard metering pressure for all customers on the network.

This scenario was designed to test customer preferences for increases in average costs per customer and prices as a result of increasing the replacement capital expenditure for lower performing sections of the network.

The capital expenditure is defined by the activities described in section 5 with an additional 50% increase to mains and service replacement for the first five years of the 20 year plan, and is charted in Appendix 1.

The resultant expenditure scenario is characterised by:

- Short term increase in capital expenditure on mains and service replacement of 50% and no change to operating expenditure.

Relative to Scenario 1, the resultant cost per customer and price impacts is characterised by:

- Short term minor increases in cost per customer as a result of expenditure and a similar customer base; and
- Long term minor increase in cost per customer as a result of higher expenditure and a similar customer base.

6.4 Summary of Service Scenarios

Figure 22 summarises the cost impacts in terms of average cost per customer over the next regulatory period (2016-20) and the following 3 regulatory periods – a total of 20 years.

The cost per customer is calculated using 'building block costs', an approach specified in the gas regulatory framework. These building block costs form the basis of the revenue approved by the AER.

Each scenario represents a change in cost per customer relative to Scenario 1.

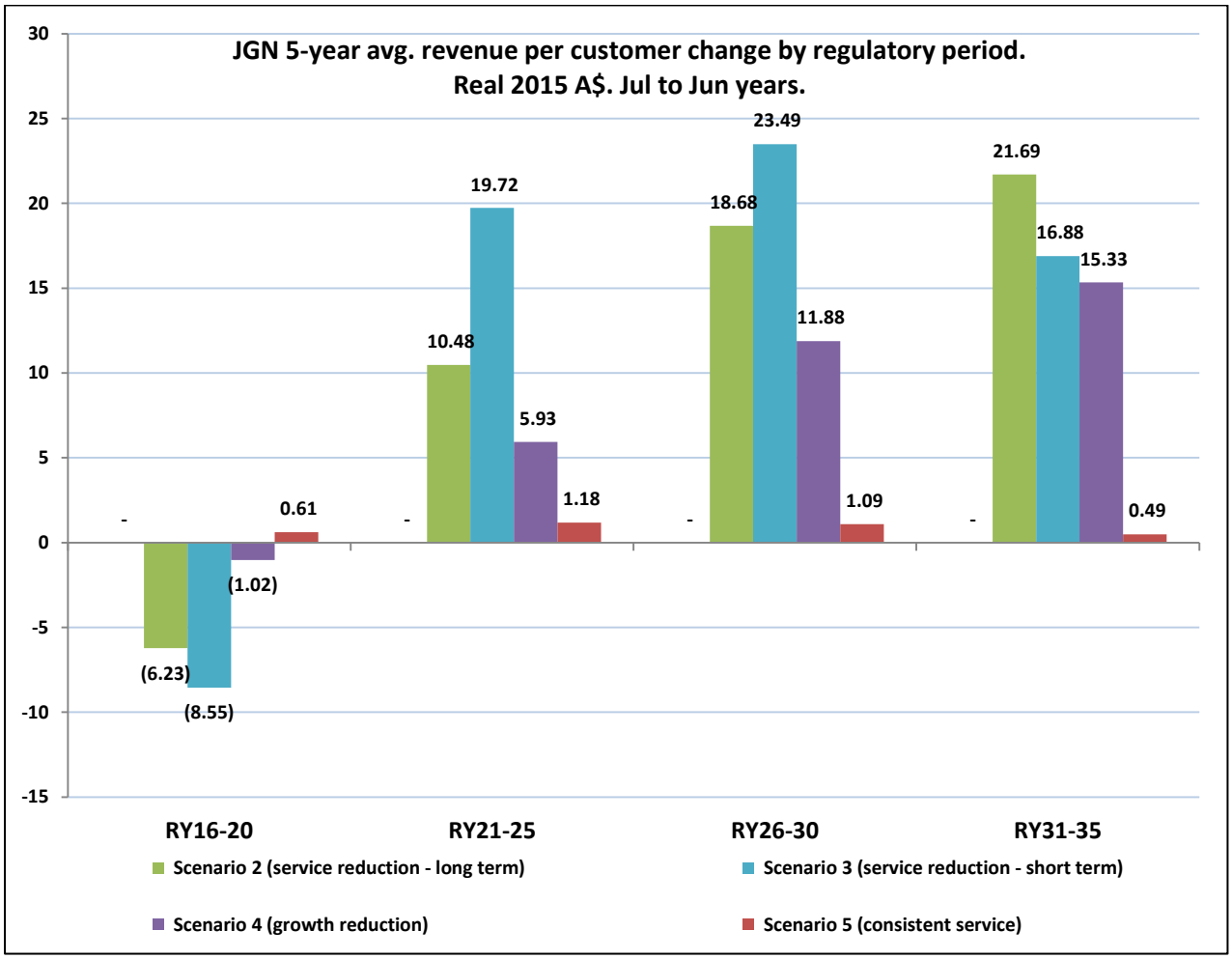

Figure 22 Expenditure Scenarios

6.5 Stakeholder Feedback on Service Levels

Jemena has tested stakeholder preferences based upon the scenarios, by engaging customers and community groups in a range of forums.

To assist the forum participants consider the scenarios and make informed decisions about their preferences, they were provided with clear and simple information on what is meant by 'service levels', the relationship between service levels and costs and how the five scenarios reflected this interaction.[2]

Customer feedback was that:

- A large majority (87%) indicated that current balance between safety, services and prices was 'right';
- There was strong support for retaining the current service levels (Scenario 1), or improving service levels for specific customers to provide a universal level of service (Scenario 5), with overall more support for Scenario 5:
    - Residential customers, both within the metropolitan area and in regional areas, strongly supported Scenario 5; and
    - Small business customers were more likely to support Scenario 1.

6.6 Recommended Asset Strategy

Jemena's proposed asset strategy is to adopt Scenario 5, which would result in Jemena continuing to deliver in the short, medium and long term the current range of acceptable service to its customers.

This scenario will bring forward mains and service replacement expenditure into the next five year period to deliver a consistent or universal level of service for all customers.

Appendix 1 provides a summary of the capital expenditure profile by asset class for the recommended scenario 5. This scenario is the basis for Jemena's regulatory submission.

[2] This information and options were communicated through presentations made by Jemena senior management, and then clarified and explored further through small round-table discussions facilitated by Newgate Research. Feedback was captured through the round-table discussions and through anonymous electronic voting.

7. APPENDIX 1 – CAPITAL EXPENDITURE FORECAST DETAILS

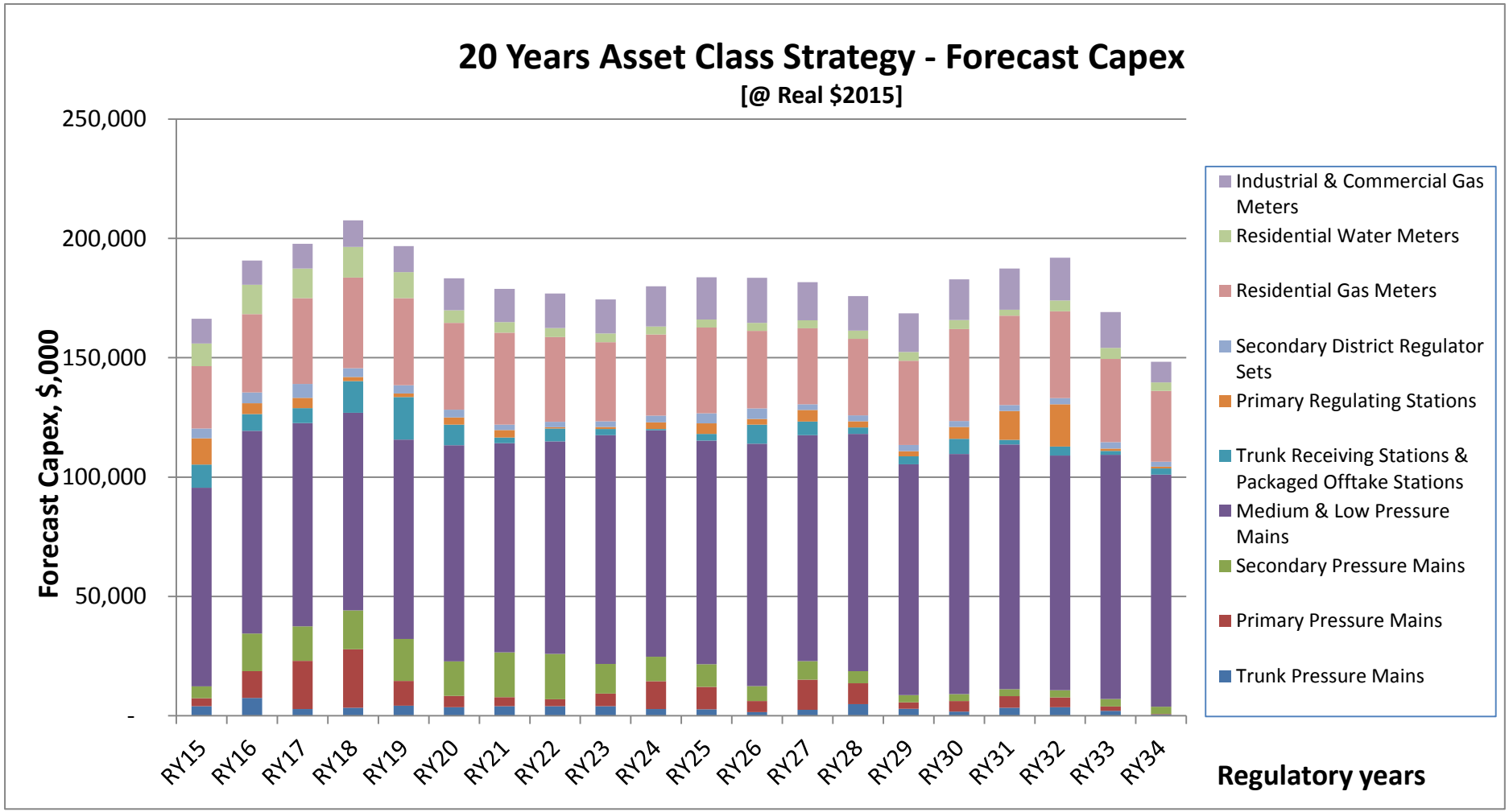

Figure 23 20 Year Asset Class Strategy - Forecast CAPEX