Jemena Gas Networks (NSW) Ltd

2020-25 Access Arrangement Proposal

Attachment 5.3

Network Asset Management Plan

Jemena
bringing energy to life

Jemena Gas Networks (NSW) Ltd

Asset Management Plan

2019-2025

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ABBREVIATIONS

ABS	Asset Business Strategy
AIP	Asset Investment Plan
ALARP	As Low As Reasonably Practicable
AMP	Asset Management Plan
AMS	Asset Management System
AMSRC	Asset Management System Review Committee
APGA	Australian Pipeline and Gas Association
APSC	Asset Public Safety Committee
AS 2885 ATCC	AS 2885 Assets Technical Code Committee
AS 4645 ATCC	AS 4645 Assets Technical Code Committee
BASIX	Building Sustainability Index
Capex	Capital expenditure
CAPs	Capacity Augmentation Projects
DMS	Distribution Management System
DRS	District Regulator Sets
E2G	Electricity to Gas (conversion)
EEHA	Emergency Equipment Holding Areas
EMP	Environmental Management Plan
EMS	Environmental Management System
EPIs	Environmental Performance Indexes
FSAs	Formal Safety Assessments
GCs-6	Gas Chromatographs
GIS	Geographic Information System
GSMRC	Gas Safety Management Review Committee
HDPE	High Density Polyethylene
HSE	Health, Safety and Environment
HSEQ	Health, Safety, Environment and Quality
I&C	Industrial and Commercial (customers)
IC&E	Instrumentation, Control and Electrical
JCARS	Jemena Compliance and Risk System
JGN	Jemena Gas Networks
KPIs	Key Performance Indicators
LGA	Local Government Areas

LNG	Liquified Natural Gas
MAOP	Maximum Allowable Operating Pressure
MDL	Meter Data Loggers
NBN	National Broadband Network
NGERS	National Greenhouse and Energy Reporting Scheme
NGL	National Gas Law
NGR	National Gas Rules
NSW	New South Wales
OEMPs	Operational Environmental Management Plans
OHS	Occupational Health and Safety
OMS	Outage Management System
Opex	Operating Expenditure
OPSO	Over Pressure Shut Off
PE	Polyethylene
PMM	Project Management Methodology
POTS	Packaged Off Take Stations
PRS	Primary Regulating Station
RF	Radio Frequency
RTS	Real Time Systems
SAOP	Safety and Operating Plan
SCADA	Supervisory Control and Data Acquisition
SDRS	Secondary District Regulator Sets
SLA	Service Level Agreement
SPM	Sydney Primary Main
TJ	Terajoule
TRIFR	Total Recordable Injury Frequency Rate
TRS	Trunk Receiving Station
UAG	Unaccounted for Gas

EXECUTIVE SUMMARY

This Asset Management Plan (**AMP**) covers Jemena Gas Network's (**JGN**) gas network and non-network assets (excluding IT). The AMP provides information about how we manage our network assets in order to continue to provide a safe, reliable and affordable gas supply to our customers.

Our asset management practices and strategies inform our proposed expenditure plans and programs of work, and are key input into the forecast expenditure program for the forthcoming Access Arrangement period (1 July 2020 to 30 June 2025). This document should therefore be read in conjunction with the 2020-25 Access Arrangement proposal (referred to as the 2020 Plan) and its associated attachments.

In summary, over the next five years in Access Arrangement period, we will:

- connect 130,000 homes and businesses across NSW continuing to expand the network to meet demand, where efficient to do so;
- undertake key capacity augmentation development projects to supply gas to Western Sydney Aerotropolis including the new Western Sydney Airport;
- remove the highest risk medium/low pressure ferrous mains from the network;
- rectify shallow secondary mains in high density community use areas;
- replace more than 425,000 residential and commercial gas meters;
- reconfigure the Sydney Primary Main to enable in-line inspection (or 'pigging');
- continue to pursue new technology and asset management practices that will allow us to defer capital expenditure where prudent and safe to do so.

Note that this is not an exhaustive list, nor does it include all ongoing corporate or non-asset management related costs/projects we plan to deliver over the next seven years. Asset management requirements are continually reviewed and will likely change over the course of program delivery. Our forecast works program includes ongoing maintenance, provision for reactive asset replacement, and other minor works not included in the summary list above.

For full details of required capital expenditure and the works program scheduled for the coming years, refer to the expenditure forecast detailed in the 2020 Plan.

ISO 55001 accreditation

Our asset management approach (and the asset management system that underpins it) have been externally audited and accredited as conforming to the requirements outlined in the international standard ISO 55001. In keeping with ISO 55001, we focus on the value assets provide to both JGN and its customers, and aim to balance risk and safety performance against reliability, customer expectations and cost.

We also build continual improvement practices into our AMS and decision making process. We do this by regularly reviewing the asset data available to us and identifying how we can improve the quality of our data, the systems that hold our data, and the way we apply that data in our investment decisions. As a result, we are continually refining and enhancing our asset management capabilities, which in turn leads to more fully informed and prudent expenditure forecasts.

Developing our asset management plans

Our asset management decisions are shaped by our operating environment and by the feedback we receive via our customer engagement program. The Australian energy market is changing. The onset of technology and the increasing competitiveness of renewable energy resources means the way customers use natural gas and the gas network itself are evolving, and will continue to do so over the coming decades.

These changes provide both a challenge and an opportunity. The natural gas distribution network has a vital role in Australia's energy future, and while the precise nature of that role is some way from being defined, it is clear that the way we operate and invest in the network today is different to the way we managed the network 20 years ago, and will be different again in 20 years' time.

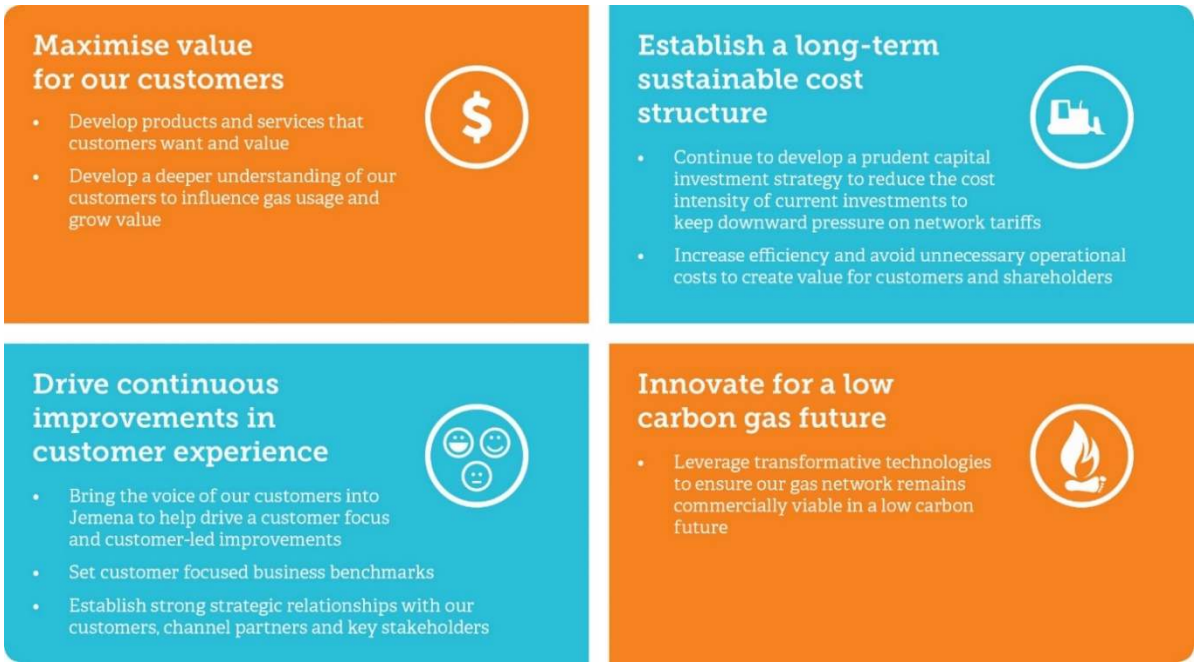
Residential customers have told us they believe natural gas remains a preferable and affordable option compared to electricity – particularly for cooking and heating. However, there is some concern regarding increasing costs, and there is a clear desire for gas to remain affordable. The affordability concerns are echoed by commercial and large industrial customers, who value a reliable gas supply, but want to ensure costs are sustainable.

Customers have also told us they are conscious of environmental impact. They recognise natural gas is a more environmentally friendly choice at the moment than mains electricity, but they foresee significant changes in the energy market and generally expect that the energy industry will deliver a zero-carbon solution in the long term.

While affordability is the key issue, there is a reluctance to trade-off price against reliability, with customers generally not prepared to accept lower service standards. Customers have told us they are satisfied with current services standards and would not want to pay for these to be increased.

We have therefore built these customer expectations into our asset management plans, which have in turn informed our work program. Our aim is to build a more commercial and competitive business, and deliver fair outcomes across the communities we serve. Key to achieving this is our commitment to maximise the sustainability of our gas network by continuing to connect new customers, reducing capital investment intensity, and achieving our 2030 Gas Markets Vision.

2030 Gas Markets Vision



We will achieve the 2030 Gas Market Vision through continued application and refinement of our ISO 55001 accredited asset management system (AMS). The AMS creates line of sight between the Jemena Business Plan, asset business strategies, individual asset class strategies, and the activities detailed in 2020 Plan.

For example, the Jemena Business Plan includes a series of goals relating to Customers, Operational Excellence, Growth and Our People, while the Gas Market Strategy sets out the 2030 Gas Markets Vision. Combined, these set the direction for the gas business, factoring in a range of investment scenarios and potential changes in the Australian energy sector.

These then inform our asset objectives and how we aim to manage our business in an evolving energy market. Asset objectives are then used to develop JGN's various asset class strategies, which define how we will manage each class of assets in our network (as well as shared non network assets related to the gas business such as SCADA, property and fleet).

Outcomes of our asset management plan

Over the 2020-25 period we will continue to spend capital expenditure to deliver outcomes for our customers. Our investments will remove unacceptable safety risks, maintain our current standard of service and lower bills (by connecting new customers).

We will measure our asset management performance against our suite of asset safety, reliability and customer service key performance indicators (**KPIs**), detailed in chapter 8 of this AMP.

1. INTRODUCTION

JGN considers sound asset management and governance processes are essential for prudent and efficient investment in the gas distribution network. Perhaps more importantly, having sound asset management and governance processes allows us to maintain a safe, reliable and affordable gas supply, and ensure the services we provide are consistent with our customers' expectations.

The purpose of this AMP is to provide an overview of how we manage our assets and our business. Our aim is to demonstrate that our asset management activities are prudent and based on good practice, which help ensure our work program and expenditure forecasts are efficient.

This AMP should be read in conjunction with the 2020 Plan and its associated attachments.

1.1 SCOPE

This AMP covers JGN's network and non-network assets (excluding IT). Network assets include high & secondary pressure gas pipelines, medium & low pressure mains and services, metering assets and gas facility assets (e.g. regulating stations). Non-network assets covered by this AMP include property, fleet and supervisory control and data acquisition (**SCADA**).

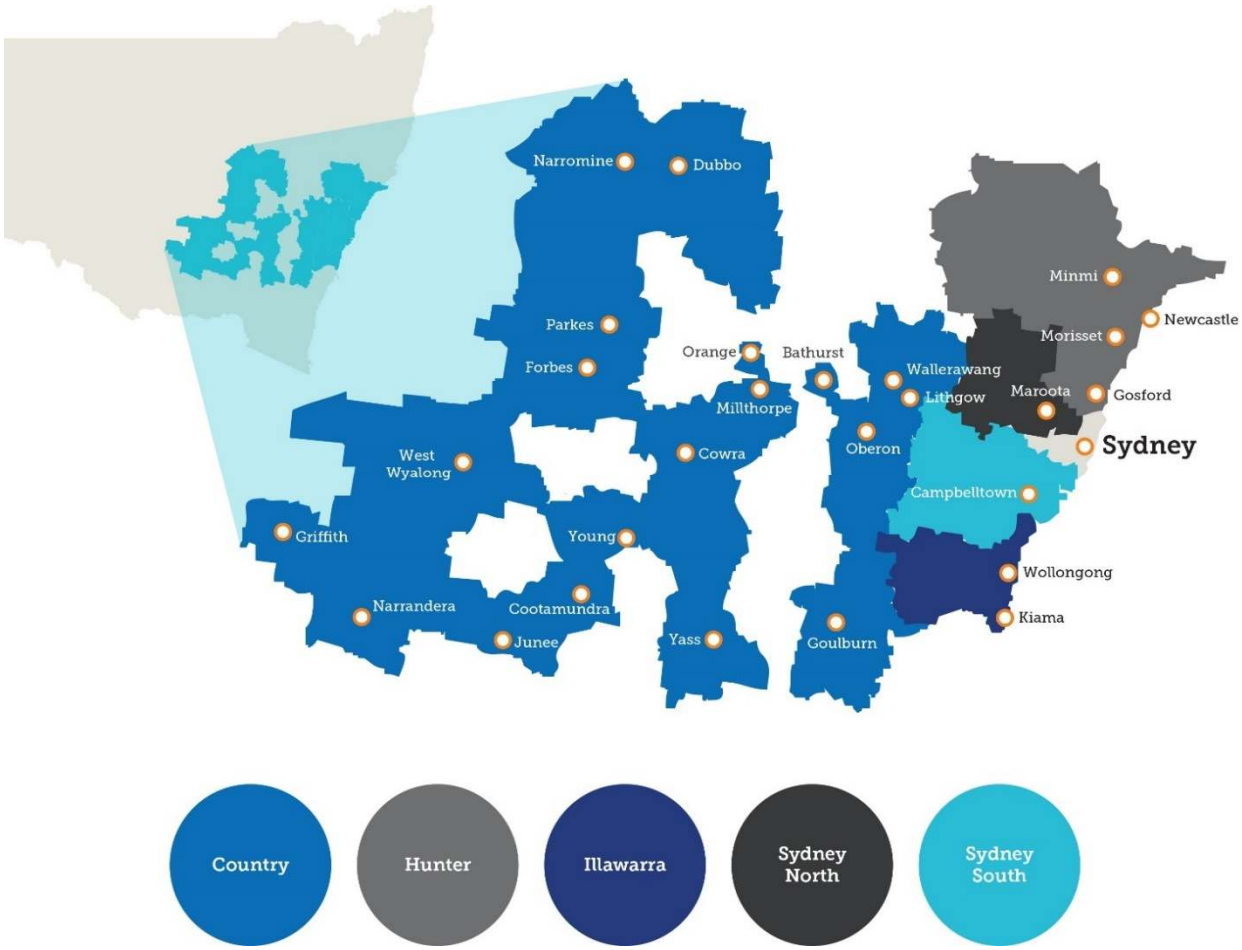
Our network and non-network assets each have asset class strategies, which define the specific asset and risk management activities for each type of asset. The AMP summarises the high-level asset management activities required to meet asset and organisational objectives.

To the extent required by law, and in compliance with regulatory requirements, we generally apply similar management practices to regulated and non-regulated assets.

1.2 ABOUT JGN

JGN is Australia's largest and one of the fastest growing gas distribution networks. We own and manage the 24,000 km of pipelines that distribute natural gas to almost 1.4 million homes and businesses across New South Wales (**NSW**) (see Figure 1–1).

Figure 1–1: JGN's network



We transport gas through our network on behalf of network users (such as retailers) to customers' premises. We also read and maintain the meters that measure how much gas is being used by each customer. We are part of a broader energy supply chain that spans from gas production to retailing, and our charges make up around 40% of a typical residential customer's gas bill.

The JGN network has 1.4 million connections and delivers approximately 90 PJ of gas per annum. Some other key network statistics are set out below.

Table 1–1: Key JGN asset statistics

Network	Quantity
Trunk mains (km)	271
Primary mains (km)	144
Secondary mains >=1,050kPa (km)	1,449
Medium and low pressure mains < 1,050kPa (km)	22,848
Trunk receiving stations (including packaged off take stations)	54
Bulk metering stations	4
Primary regulating stations	17

Network	Quantity
District regulator sets	642

In addition to transporting gas through our network, we also undertake a range of other activities for our customers (see Figure 1–2).

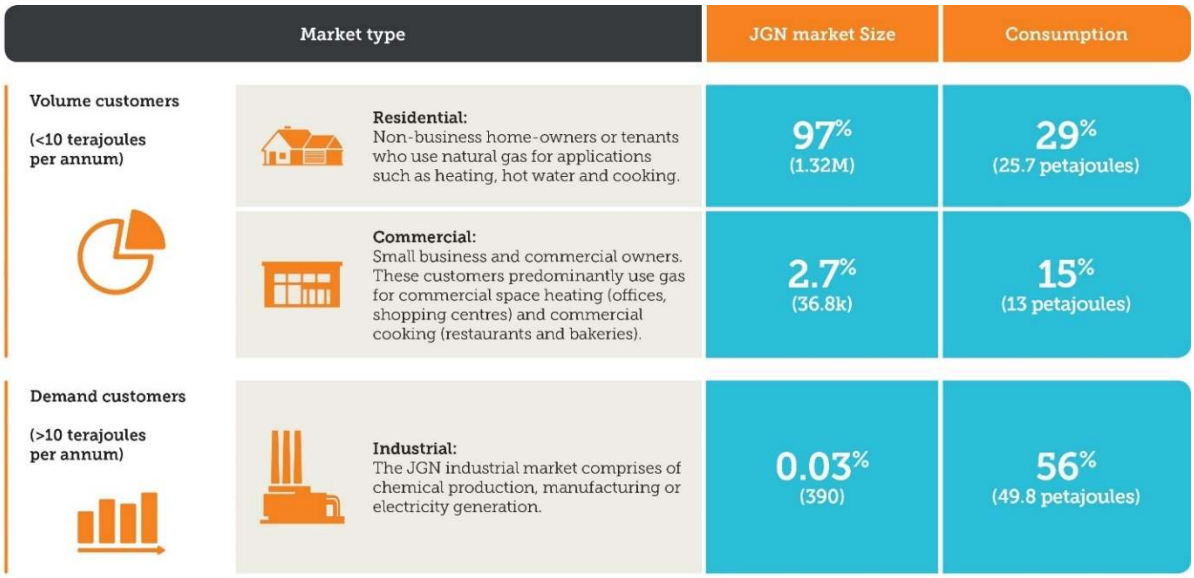
Figure 1–2: What JGN does for its customers

We group customers into three high-level categories:

- residential
- commercial; and
- industrial.

We also separate our customers into market types based on their energy usage (see Figure 1–3).

Figure 1–3: Our customers



Our volume market consists of customers that consume less than 10 terajoules (**TJ**) of gas each year, while the demand market comprises customers that consume more than 10 TJ of gas each year.

Our aim is to manage and invest in our network to ensure we can continue to deliver a safe, reliable and affordable gas supply to customers. To help us do this, we have a comprehensive asset management system (**AMS**) that guides and governs our asset management decisions. Our AMS comprises a suite of documentation, data and processes that enable us to direct, coordinate and control asset management activities throughout an asset's life cycle. The AMS allows us to balance costs, opportunities and risks against performance, so we can make the right investments.

Put simply, our AMS helps us understand what assets to invest in, when to invest, and how best to maintain the assets in order to provide a service that customers value. Our ISO 55000 accreditation provides assurance to external stakeholders that JGN's asset management system and processes have been audited and represent good industry practice.

1.3 OPERATING ENVIRONMENT

The operating environment and stakeholder expectations are crucial inputs into how JGN operates and invests in the network. The Australian energy market is changing. The onset of technology and the increasing competitiveness of renewable energy resources means the way customers use natural gas and the gas network itself are evolving, and will continue to do so over the coming decades.

These changes provide both a challenge and an opportunity. The natural gas distribution network has a vital role in Australia's energy future, and while the precise nature of that role is some way from being defined, it is clear that the way we operate and invest in the network today is different to the way we managed the network 20 years ago, and will be different again in 20 years' time.

We constantly monitor changes and emerging trends in the energy sector to help shape our investments and services. This allows JGN to remain a commercial and competitive business that provides customers with products they want and value, and provides reasonable returns for shareholders seeking long term stable cashflows.

External factors that impact our business are:

- market trends and competitive position;
- customer and community expectations;
- long term sustainable costs;
- innovation and technology; and
- regulatory and legislative environment.

The following sections summarise current and emerging trends across these categories. These trends inform our asset management activities.

1.3.1 MARKET TRENDS AND COMPETITIVE POSITION

Demand for natural gas in NSW has been strong for many years, particularly within the residential market. Continued housing growth and ongoing residential high rise development, coupled with natural gas' position as a competitive alternative to electricity, means the natural gas network provides an important and valued service to customers.

However, the economic advantage natural gas has over electricity in the residential sector has reduced in recent years. While natural gas remains commercially competitive and desired by customers[1], the following key trends are impacting the NSW gas market:

- **Increasing liquified natural gas (LNG) export demand** – A growing LNG export market continues to put pressure on east-coast supply and domestic gas wholesale prices.
- **Constrained supply** – Moratoriums on natural gas exploration in NSW and Victoria are putting pressure on domestic gas supplies.
- **Environmental policy** – Australia is moving towards a low carbon future with a Federal Government carbon emissions reduction target of 26-28% by 2030 and NSW Government net-zero target by 2050.
- **Increasing need to support renewables** – Gas plays an important role in providing inter-seasonal storage to support increasingly intermittent renewable electricity generation.
- **Record housing growth** – The current NSW housing and infrastructure boom has created unprecedented demand for natural gas connections and infrastructure projects.
- **Lower consumption per household** – Although overall demand is growing, Jemena's residential gas customers are using less gas as households decrease in size, appliances become more efficient and some customers switch to non-gas appliances.

We factor these emerging trends into our investments and business decisions, and are investigating how natural gas and the gas network might be used in the future.

1.3.2 CUSTOMER AND COMMUNITY EXPECTATIONS

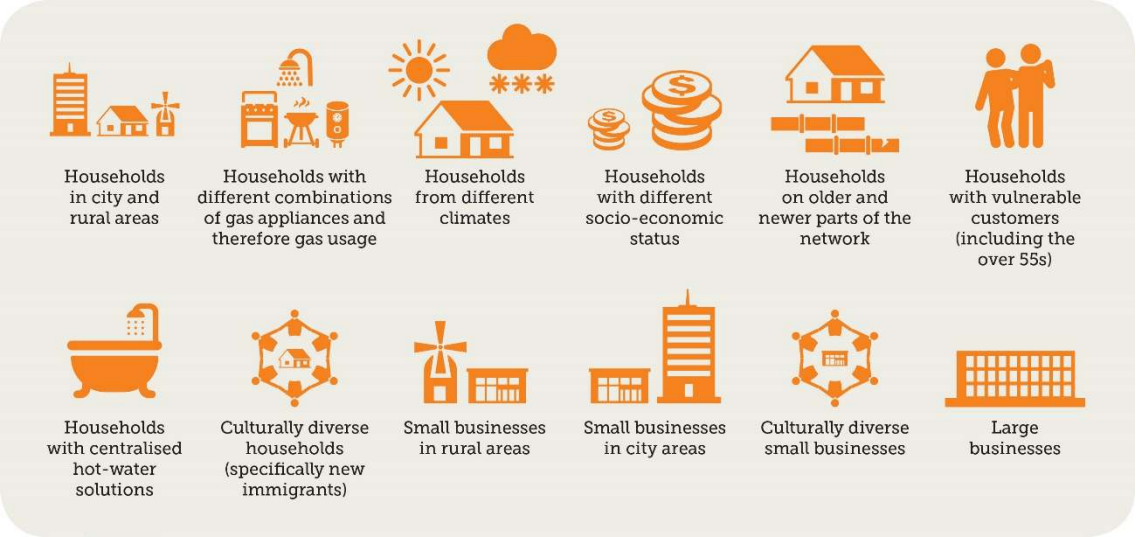
Customers' needs are central to JGN's investments and business decisions. We undertake regular customer and community engagement to understand how the way customers use our network is changing and what their future expectations are. Feedback from customer engagements is used to:

[1] Discussed in section 1.3.2 of this AMP.

- provide insights on customer expectations and their energy needs, which helps us develop product growth objectives;
- guide investment in JGN's capabilities, process and systems; and
- assess JGN's customer experience performance.

We started our engagement program for our 2020 Plan in 2017, working with a range of customers to understand what topics were important to them, and how we should shape our services and investment over the coming Access Arrangement period. Figure 1–4 shows the customer groups we identified. As well as directly seeking the views of customers, we also sought the views of gas retailers and stakeholders such as customer advocates.

Figure 1–4: Customer groups engaged as part of JGN Access Arrangement development process[2]



Key take-outs are summarised below[3]:

- affordability remains a major concern for all customers. Small businesses and vulnerable customers are particularly sensitive to price increases, and all customer categories stressed the importance that gas remains affordable;
- customers want to see the key principles of affordability, fairness, reliability and the environment considered in future planning and investment decisions;
- customers understand the inherent value of the gas network and agree – in fact, they expect – JGN will actively seek to identify and develop ways in which this value can continue to be leveraged for the future;
- while customers are sensitive to price, particularly in the immediate to short-term, they understand the business model JGN operates under and that decisions about asset renewal and maintenance need to be made now, even though the future is uncertain;

2 While this is an extensive list, given the broad diversity of our customer base, it has not been possible to talk to all customers. However, we have included a sample of each customer type where possible.

3 For more detail see attachment 2.2 of the 2020 Plan – JGN's customer engagement, RPS.

- as discussed in our 2020 Plan[4], most (72%) customers expressed a preference for us to invest for the long-term, even though this option costs more in the short term. Customers have told us they would prefer JGN builds more capacity now – recognising that this capacity might not be fully utilised if gas network usage declines – to reduce the risk of rework in the future. Customers also said JGN should be bold and invest with confidence.
- customers expect safety not to be compromised and they want to know JGN cares about the impact of their business decisions on all customers.

Despite the uncertainty surrounding natural gas over the longer term, customers indicate they value natural gas and will continue to use it for the foreseeable future. While customers believe steps should be taken to avoid significant price increases, they also support ongoing investment to grow and maintain the network where prudent to do so.

The views we capture from customers are factored into our asset management activities. Customer feedback, along with other considerations such as asset performance, cost, risk and long-term sustainability, then inform the asset management strategies and ultimately the work program we deliver. Detail of our engagement approach and the findings from our most recent customer engagement activities are provided in Attachment 2.1 of the 2020 Plan.

1.3.3 LONG TERM SUSTAINABLE COSTS

It is vital JGN has a long term sustainable cost structure. This will ensure the business remains commercially viable and can attract the capital investment that will enable us to continue to invest in and operate the network efficiently.

Strategies for JGN's expenditure in the network include:

- shortening the investment horizon where supported by customers, with a focus on reducing capital expenditure and minimising JGN's asset base;
- pursuing innovative non-network solutions, reducing cost intensity of current investments, and incorporating changes in design standards or deferring spend (where it is safe and prudent to do so); and
- recovering new capital expenditure more quickly to ensure improve alignment of cost recovery with asset utilisation, given the uncertainty beyond 2050.

1.3.4 INNOVATION AND TECHNOLOGY

Australia is moving towards a low carbon future. Digital technologies also provide customers access to more data and control over their energy usage. With this in mind, two of the key strategies we are pursuing are summarised below:

- **Innovating for low carbon gas** – The Federal Government has committed Australia to reducing carbon emissions by 26% – 28% between 2005 and 2030. The NSW Government has set a more ambitious target of net-zero carbon emissions for the state by 2050.

  We are looking into opportunities to position gas as a viable energy source in the low carbon future. One of these is the Western Sydney Green Gas Trial pilot project, which seeks to convert excess renewable generation into hydrogen by the electrolysis of water.

[4] See attachment 5.1 of the 2020 Plan - Capital expenditure.

We are also investigating the role gas can play in microgrids. As part of 'Project Navigate', JGN will install solar PV, battery technology, and a natural gas micro/co-generator into participant's homes. We will then monitor energy use through smart metering and assess the feasibility and profitability of natural gas micro/cogeneration as an unregulated product.

- **Establishing customer-focused technologies** – Access to energy usage data and the physical meters themselves is one of the key areas JGN is seeking to apply technology to improve the customers experience. For example, JGN is considering smart metering technology to allow remote data acquisition, and providing customers access to their data via a smart app.

1.3.5 REGULATORY AND LEGISLATIVE ENVIRONMENT

JGN is governed by a range of technical, safety, economic and environmental regulations and legislative instruments. It must also comply with its gas distribution licence requirements. Regulatory compliance is an important investment driver, not only from a safety and operational excellence perspective, but also in terms of reputational risk. Compliance with various regulatory obligations has a direct impact on corporate reputation and our ability to attract investment. We therefore factor shareholder's compliance expectations into our reputational risk threshold and asset management strategies accordingly.

An overview of the key regulatory obligations affecting investment in the NSW natural gas network is provided below.

- **Technical and safety** – The Department of Industry, Resources and Energy (NSW) regulates the technical and safety aspects of JGN's network including design, construction, operation and maintenance. Gas distribution licences impose a significant number of obligations on JGN relating to metering, asset safety, compliance and reporting. To remain commercially competitive, we must continue exploring opportunities to meet the minimum specifications and standards without compromising economic, environmental or customer requirements. We will work within the safety and technical framework to reduce costs to customers through efficient asset lifecycle management.
- **Economic** – JGN operates under the National Gas Law (**NGL**) and the National Gas Rules (**NGR**). Satisfaction of the National Gas Objective in the NGL, and the NGR tests for conforming capital expenditure under rule 79 and efficient operating expenditure under rule 91, are key considerations in all JGN's investment planning.
- **Environment planning and assessment** – The NSW Government's Building Sustainability Index (**BASIX**) scheme applies to all new homes, new medium density and high rise apartment buildings. Upon construction, a building is required to attain a BASIX scheme certificate that declares anticipated water consumption and greenhouse gas emissions levels will achieve minimum sustainability targets.

  Natural gas is an important feature in this government-driven scheme. The BASIX currently advises that the most efficient water system is a gas-boosted solar hot water system, followed by a gas-fired instantaneous or storage hot water system. The BASIX also specified that the most efficient space heating appliance is a gas-flued heater with a high star rating.

  As a result, natural gas continues to feature heavily in residential development and NSW planning and building design. JGN must therefore ensure the gas network is available and operating at a sufficient standard to allow customers to install the hot water and heating appliances described above.

2. THE JEMENA BUSINESS PLAN

The Jemena Business Plan defines Jemena's values, strategic objectives, key success factors, strategy, vision and business purpose. The plan helps us position our business so we can consistently deliver on our customers' and stakeholders' expectations, promoting a successful and sustainable future.

Key drivers of the Jemena Business Plan include:

- shareholder requirements and expectations;
- customer requirements and expectations; and
- changes in regulatory requirements.

The Jemena Business Plan is reviewed annually and is approved by the Managing Director. The current Jemena Business Plan is illustrated in Figure 2-1 below.

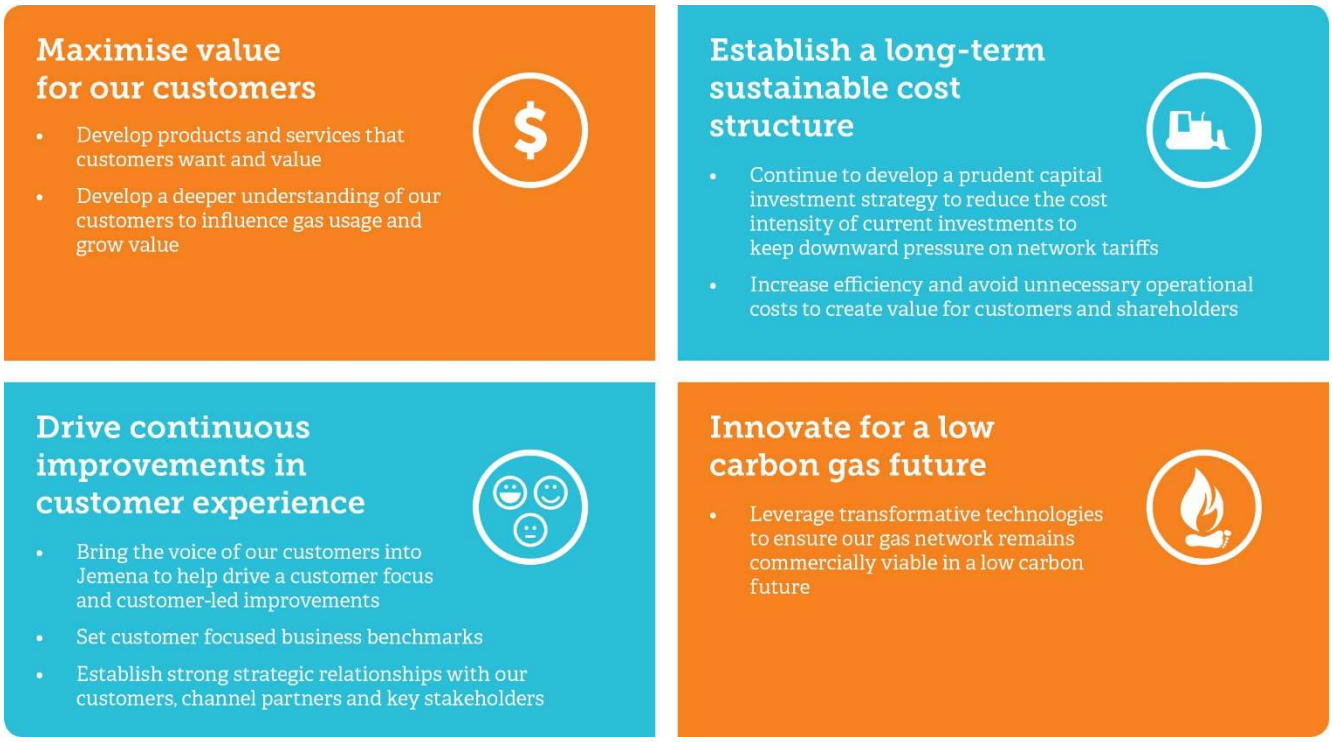
Figure 2-1: Overview of Jemena Business Plan

The goals under the four pillars of the Jemena Business Plan apply to all Jemena asset businesses, and are used to inform the specific asset objectives and targets for JGN.

2.1 GAS MARKET STRATEGY

Along with the Jemena Business Plan, JGN's Gas Market Strategy is a key input into to our asset management activities. Central to the JGN Gas Market Strategy is the 2030 Gas Markets Vision, summarised in Figure 2-2.

Figure 2-2: Gas Markets Vision – 2030



The Gas Markets Vision outlines what we want to achieve with our gas network assets and our business more broadly. The Gas Markets Vision guides our Gas Market Strategy, which is a living document that defines JGN's strategic objectives and positioning. The Gas Market Strategy dictates how we will create value for our customers and shareholders, and the strategic themes and opportunities we will pursue.

Our Gas Market strategy helps us remain a commercial and competitive business by:

- providing a clear and consistent view of our customers and markets;
- helping us to develop services that meet customers' needs;
- guiding us to make more informed investment decisions and manage risks;
- identifying new technologies and capabilities to position us for future network needs;
- supporting proactive industry and regulatory environment management;
- identifying opportunities to grow our business, and
- feeding important insights into other functional and business strategies.

The Gas Market Strategy provides an important link between the Jemena Business Plan and our asset management activities. It takes the overarching Jemena goals, vision and priorities from the business plan, and translates them into specific actions and outcomes for JGN.

3. ASSET MANAGEMENT SYSTEM OVERVIEW

JGN's asset management system (**AMS**) describes the inter-linked processes that support decision making throughout the asset life cycle. The AMS is the framework for our structured and systematic asset management approach.

The AMS creates line of sight between the Jemena Business Plan, Asset Business Strategy (ABS), individual asset class strategies, and the activities detailed in our 2020 Plan. For example, the Jemena Business Plan includes a series of goals relating to Customers, Operational Excellence, Growth and Our People, while the Gas Market Strategy sets out the 2030 Gas Markets Vision. Combined, these set the direction JGN, factoring in a range of investment scenarios and potential changes in the Australian energy sector.

We take direction from the Jemena Business Plan and Gas Market Strategy and combine it with feedback and insight on customer expectations, which we capture via regular customer engagement activities. These inform our asset objectives and shape how we aim to manage our business in an evolving energy market. Asset objectives are then used to develop JGN's various asset class strategies, which define how we will manage each type of asset in our network (as well as shared non-network assets related to the gas business such as SCADA, property and fleet).

ISO 55000 accreditation

Our AMS has been externally audited and accredited as conforming to the requirements outlined in the international standard ISO 55000. The ISO 55000 series of standards (55000, 55001 and 55002) defines an asset as an item, thing or entity that has potential or actual value to an organisation. Asset management is defined as the co-ordinated activity of an organisation to realise value from assets.

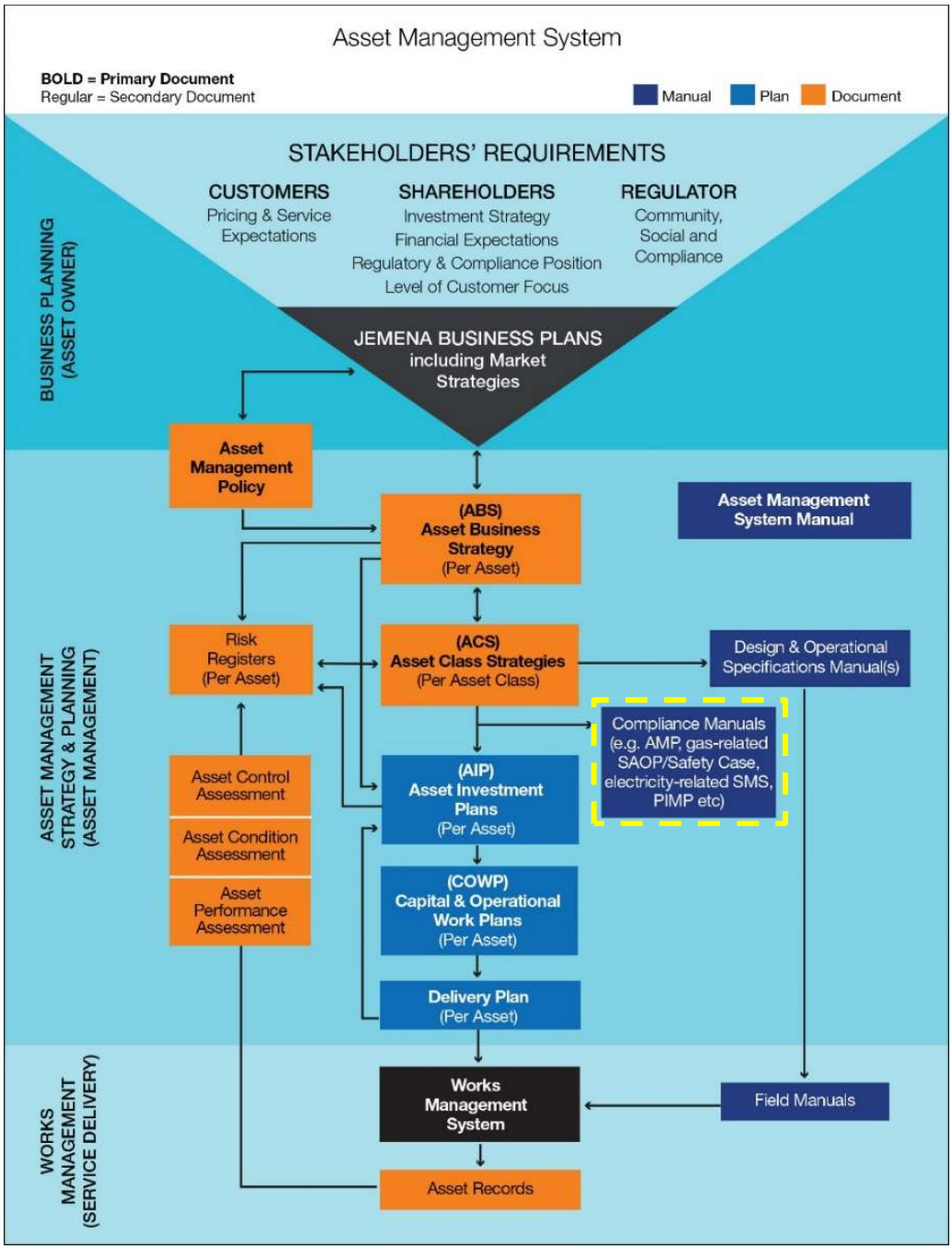
In keeping with ISO 55000, our asset management approach focuses on the value the asset can provide to JGN and its customers. The value of an asset (which can be tangible or intangible, financial or non-financial and include risks and liabilities) is defined by the organisation (JGN) and its stakeholders (customers, investors, shareholders).

Stakeholders can have very different and potentially conflicting expectations. We therefore make trade-offs to maximise the value of assets within the bounds of customer service performance, technical performance, funding availability, and regulatory constraints. These trade-offs include the difference between short and long-term goals, and, the balance between risk, cost and performance. We also consider the conflict between procurement costs for new capital items versus ongoing operational and maintenance costs.

As per the requirements of ISO 55000, we also build continual improvement practices into our AMS and decision making process. We do this by regularly reviewing the asset data available to us and identifying how we can improve the quality of our data, the systems that hold our data, and the way we apply that data in our investment decisions. As a result, we are continually refining and enhancing our asset management capabilities, which in turn leads to more fully informed and prudent expenditure forecasts.

The hierarchy of data, information sources and documentation within JGN's AMS is illustrated in Figure 3-1.

Figure 3-1: JGN AMS document hierarchy



As identified in Figure 3-1, the AMP (highlighted in the yellow dotted box) is a compliance manual, designed to provide an overview of JGN's asset management capabilities. It is designed for an external audience and is necessarily high-level. The AMP itself not used for decision making within JGN, rather it draws together our overall asset management approach for quick and easy reference. The ABS, asset class strategies and various risk registers and assessments (the orange boxes in the diagram) are the key documents used to inform asset treatment and investments.

The AMP is a consolidation of key internal documents, drafted and presented in a way that can be used by external stakeholders to understand how Jemena's capital and operating plans conform to our obligations and requirements.

Our AMS is designed on the principles of continuous improvement and adopts the method of Plan, Do, Check and Act (see Table 3–1). This is in line with good asset management practice as defined in ISO 55000.

Table 3–1: JGN asset management method

Phase	Description
Plan	Two-year, seven-year and 20-year capital and expenditure horizons are developed based on assessment of performance, reliability, condition, risk and cost.
Do	Projects and programs are approved in accordance to investment planning and governance processes. Approved works are executed in accordance with approved budgets and controlled and monitored using formal project management methodology.
Check	Key performance indicators are reviewed monthly and reported to Jemena senior management.
Act	Asset management issues and risks are assessed and prioritised to inform the scope of projects and programs for the development of the next iteration of the ABS/AIP and various asset class strategies.

In addition to ISO 55000, JGN's systems for safety, environmental, quality and risk management comply with good industry practice. We maintain accreditations for AS/NZS 4801 Occupational Health and Safety Management Systems, ISO 14001:2015 Environmental management systems, ISO 9001:2015 Quality Management Systems, and AS/NZS ISO 31000:2009 Risk Management Standard.

Compliance with good industry practice helps confirm that our asset management activities achieve a high standard and provides assurance that expenditure programs are efficient.

3.1 ASSET MANAGEMENT POLICY

JGN produces several key policy statement documents, one of which is the Asset Management Policy. Our Asset Management Policy provides a statement about Jemena's intentions and the principles for asset management as applied throughout our business. The Asset Management Policy supports the Jemena Business Plan and Jemena Values.

3.2 ASSET BUSINESS STRATEGY

The ABS sets Jemena's asset objectives and long-term strategy for managing gas network assets to deliver the Jemena Business Plan. The ABS is the primary link between the Jemena Business Plan, the Gas Market Strategy and the AMS.

The purpose of the ABS is to translate Jemena strategic goals and priorities into asset objectives, and to give an indication of the level of expenditure (capital and operating) required by JGN over the next 20 years. Having taken the various inputs and strategies from the Jemena Business Plan and Gas Market Strategy into consideration, the ABS is essentially our statement of how we aim to manage our business.

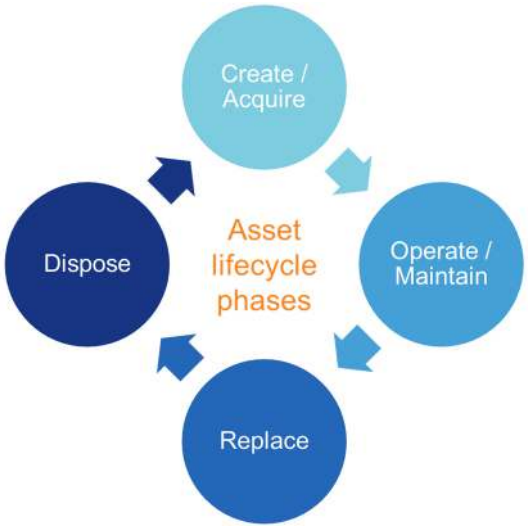
The asset objectives are then built into individual asset class strategies for each type of gas network and non-network assets. The ABS also includes high level KPIs, which are used to determine whether the asset objectives are appropriate and are being met.

Long-term capex and opex forecasts in the ABS are used for high-level planning and as a top-down expenditure challenge. They should not be considered a substitute for more detailed expenditure forecasts, such as those included in the 2020 Plan. [5]

3.3 ASSET LIFECYCLE ACTIVITIES

We take a whole-of-lifecycle approach to managing assets, modifying and refining the way we manage each asset depending on the lifecycle phase the asset is in. The phases of the asset lifecycle are illustrated in Figure 3–2 and described below.

Figure 3–2: Asset lifecycle phases



- **Create / Acquire** – asset creation/acquisition involves ensuring all the specification, design, construction, procurement, commissioning and handover activities have been planned and executed, resulting in a new asset. This is typically the phase where asset installation and capacity augmentation projects are developed.
- **Operate / Maintain** – assets are used in the business to produce a range of outputs within strict quality, environmental and safety requirements and obligations. As assets deteriorate or fail, maintenance activities are conducted to keep the asset at – or bring it back – to desired levels of operational performance. Maintenance is conducted in full consideration of the asset life cycle to ensure excessive maintenance spend is avoided.
- **Replacement** – once maintenance activities are no longer sufficient to keep assets operating within an acceptable performance level or tolerable risk threshold, replacement of that asset (if the asset is still required) is considered. Like-for-like asset replacement or substitutes are considered as part of options analysis. Efficiency savings may also be an asset replacement trigger.
- **Disposal:** At the end of a project, or in the case of worn-out assets at the end of their lives, assets are disposed of safely, with no damage to the environment or to the communities in which JGN operates.

We manage assets throughout their lifecycle in accordance with the following principles:

[5] Long term expenditure profiles in the ABS are indicative only. The ABS provides a high level estimate of the amount of capex and opex that would be required over the long term in order to maintain asset performance and deliver service levels at a standard our customers expect. As a result, the expenditure forecasts in the ABS are subject to change as Jemena's strategies, customers' expectations and technology evolve.

- define and approve asset solutions based on whole-of life costs;
- select, create, and commission assets that are fit for purpose;
- modify or upgrade assets to increase capability and/or reduce lifecycle costs;
- operate assets to sustainable levels of performance, cost and risk;
- maintain asset costs effectively to defined performance levels;
- monitor assets to maintain their expected levels of service;
- dispose of assets in a sustainable and compliant manner;
- comply with any statutory and regulatory asset management requirements;
- focus on the continuous improvement of asset and AMS performance; and
- identify, assess, and manage asset-related risk.

4. GOVERNANCE

Our corporate governance arrangements help us deliver services efficiently and make sure we comply with legal and regulatory obligations. They ensure the regulated and unregulated parts of our business remain disparate, with no cross-subsidisation. Our governance framework, and in particular our investment framework, helps ensure our investments are consistent with the requirements of the NGR, in that:

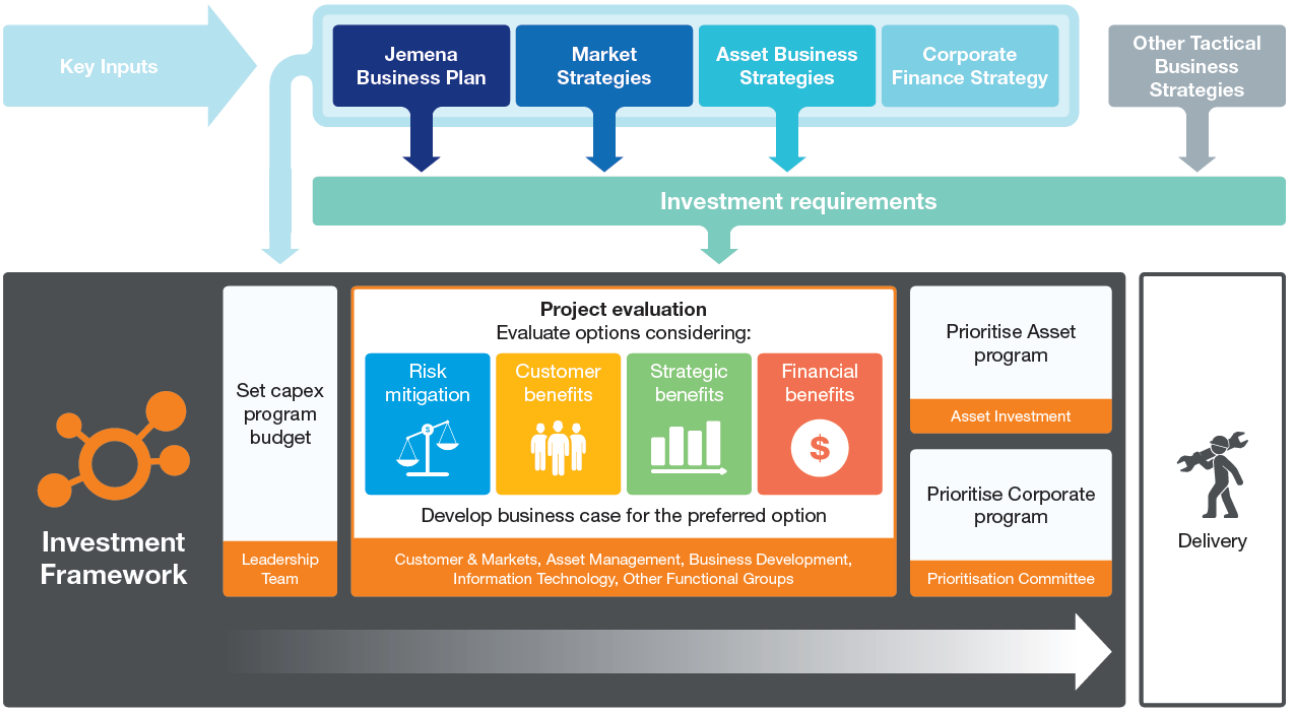
> *…investments are consistent with those of a prudent service provider, acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services.*[6]

The Jemena Investment Framework helps us prioritise investments. As shown in Figure 4-1, the framework offers a consistent method of analysing investment options against four criteria: risk mitigation, customer benefits, strategic benefits and financial benefits.

Key questions posed by the Jemena Investment Framework are:

- Risk mitigation – what regulatory, safety, operational or other risks identified could be reduced?
- Customer benefits – what are the benefits for our customers?
- Strategic benefits – how does it support the Jemena Business Plan?
- Financial benefits – what are the financial impacts?

Figure 4-1: Jemena Investment Framework process flow



In terms of workflow, the four key components of the investment framework are:

6 NGR 79.

- **Set capex program and budget** – the Jemena Leadership Team sets an overall capex program and budget, taking into consideration the current business plan, market, financial and asset business strategies;
- **Project evaluation** – project initiators evaluate new investment options using defined criteria including risk mitigation, customer, strategic and financial benefits. They are also assessed against future potential market scenarios to help determine if we should progress the option any further;
- **Prioritise asset investment programs** – asset investment options are reviewed, prioritised and where appropriate, approved by JGN's Asset Investment function; and
- **Prioritise corporate investment programs** – corporate investment options are reviewed, prioritised and where appropriate, approved by a prioritisation committee.

By taking this consistent approach to investment (and asset creation), we can help ensure our capex program is well balanced and subject to sufficient top-down and bottom-up rigour, which in turn promotes prudent investment decisions.

4.1 DEVELOPING ASSET MANAGEMENT ACTIVITIES AND WORK PROGRAMS

We review and update asset strategies annually to reflect any changes to the Jemena Business Plan and external (customer or market-driven) factors. This annual review, which is signed-off by the General Manager Asset Investment & Major Projects, considers:

- changes arising from the asset class strategies;
- responsibility for developing and implementing the asset class strategies and their continual improvement, including resource requirements;
- input and review processes, which stakeholders need to be considered, and what information is required for which stakeholders;
- delivery of the current program of work and any slippages or potential reprioritisation;
- interdependencies with other asset management strategies;
- levels of resources and funding available; and
- other matters, such as applicable standards or codes.

Expenditure forecasts are reviewed and approved through our budgeting process, and ultimately endorsed by the Board. Approved budget items are split into two categories; routine and non-routine.

4.2 PROGRAM ENDORSEMENT

Once a program of work has been developed, the General Manager Asset Investment & Major Projects manages the endorsement process. The Executive General Manager Asset Management must also endorse the work program.

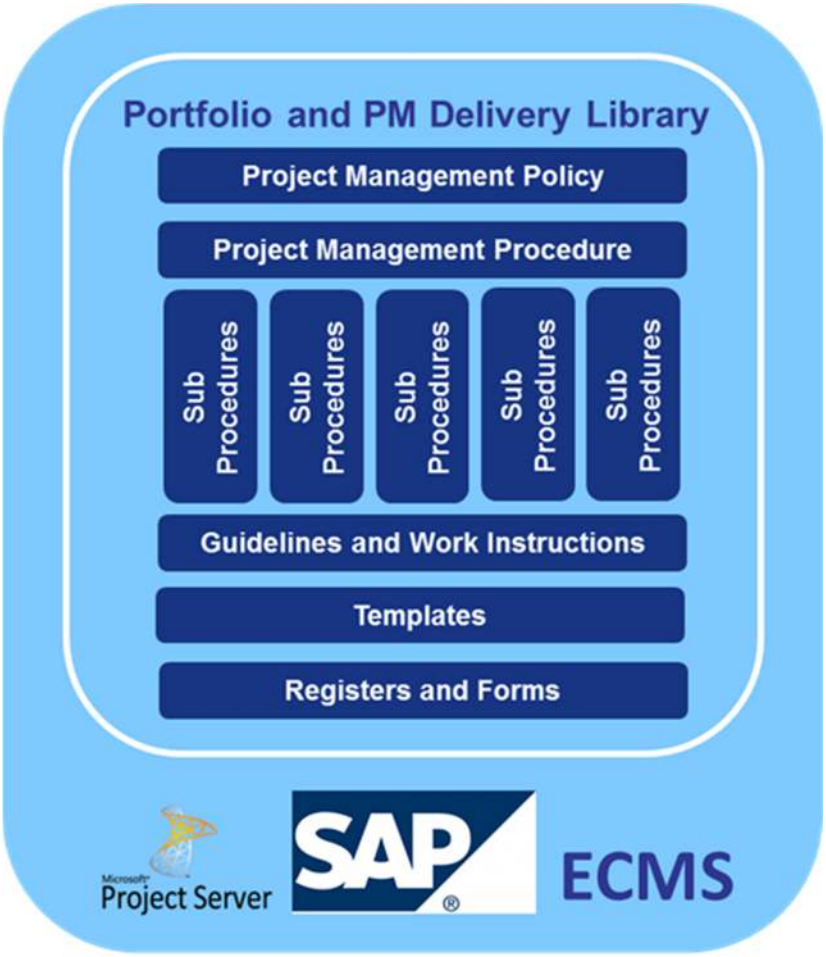
This review by our Leadership Team promotes alignment of Jemena's internal business needs with the expectations of regulators, customers, shareholders and other stakeholders. It does this by linking the business planning process (strategy, budgetary and asset management) and the regulatory submission cycle with Jemena's long term economic strategic objectives.

4.3 PROJECT MANAGEMENT METHODOLOGY

We adopt a standardised approach to project management across all our asset businesses. We use SAP as the repository for our project management documentation suite. This approach helps ensure a consistent level of quality and cost control when delivering projects involving JGN network and non-network assets.

Our Project Management Methodology (**PMM**) framework, illustrated in Figure 4-2, consists of Jemena policies, processes, procedures, templates and tools to support efficient and effective project delivery. We adapt the PMM to accommodate projects of varying complexity.

Figure 4-2: Jemena Project Management Methodology framework



The PMM has a stage-gate process to ensure investment scrutiny and promote efficient outcomes. All projects and programs of work are controlled through the sequential gate process outlined in Table 4–1.

Table 4–1: PMM stage gate process and requirements

Stage gate	Description	Requirement to pass PMM gate
Project mandate	Pre gate 1 – initial options development	Issue is identified and information gathered.

Stage gate	Description	Requirement to pass PMM gate
Gate 1	Option confirmed	The requirement to pass gate 1 is to establish project requirements and agree on the preferred delivery option. This includes completion of an asset scope with delivery concepts and constraints.
Gate 2	Scope and requirements defined	The requirement to pass gate 2 is to conduct the relevant Front End Engineering Design (FEED) including scope feasibility confirmation and solution design.
Gate 3	Final financial investment decision and delivery approved	The requirement to pass gate 3 is to develop designs, costings and project delivery plans to support the scope. This also involves obtaining stakeholder acceptance of designs and the cost estimate. The key output from gate 3 is the approved business case or customer offer. The approval of these documents will identify the preferred option to be pursued and the scope of how the work will be delivered. Business case approval within Jemena is via the relevant Delegated Financial Authority Policy.
Gate 4	Ready for construction	The requirement to pass gate 4 is to finalise designs, costings and project plans to align with the scope and budget. This involves establishing project management, administration and logistics.
Gate 5	Construction complete	The requirement to pass gate 5 is to complete construction of the project, including testing. Site demobilisation will commence at this point in time. Key activities are delivery, monitoring and reporting of the construction work. The key outcome of the gate 5 review process is that all relevant documentation has been adhered to and that the project is ready for commissioning and handover.
Gate 6	Project delivered (commissioned)	The requirement to pass gate 6 is to commission the asset or equipment via placing into service and handing it over to the customer. The customer must confirm that all the necessary gate requirements have been satisfied during the delivery phase of the project. The key deliverable is the commissioning and handover of the project. The approval of these documents will deem the project to be commissioned, recognising that project finalisation activities will continue until the project is formally closed at gate 7.
Gate 7	Project closed	The requirement to pass gate 7 is to confirm that all the necessary gate requirements have been satisfied and to verify that the project has been formally closed. Key deliverables include the financial settlement of the project and post implementation review.

4.4 PROJECT AND PROGRAM COST ESTIMATING PROCESS

We estimate project costs using four key inputs:

- actual costs of completed projects that are of a similar scope;
- cost estimations developed by providing a design brief and functional scope, developed by project managers, engineering and other relevant personnel;
- quotations from external service providers; and
- industry standard benchmarks.

For large non-routine / more complex projects, specific project estimates are developed. Costs are sourced from JGN's supplier panel, and in some cases may be complemented by obtaining quotations from specialist external service providers (where the necessary resources are not on the supplier panel). For routine or less complex projects, we estimate costs based on the previous year's expenditure, factoring in any changes in asset management strategy.

As a further measure to ensure our expenditure program is prudent and efficient, we overlay a top-down assessment onto our bottom-up asset-specific planning approach. We adopt top-down challenge to consider how expenditure can be optimised across asset categories to achieve the desired level of risk at the lowest practicably sustainable cost.

The top-down challenge provides the following benefits:

- it validates that the bottom-up expenditure forecasts reflect prudent and efficient costs; and
- it enables JGN to control expenditure at the aggregate level and identify potential duplication or opportunity to mitigate risk more efficiently by combining/sequencing multiple activities.

We are committed to early and rigorous community and stakeholder engagement to provide transparency and to reinforce the need for and benefits of the proposed new projects. Our works program is reviewed and modified on an ongoing basis, using our most recent risk assessments, asset data and customer feedback to influence the work we actually undertake.

4.5 DELIVERABILITY

When delivering works, we aim to keep our staff, suppliers and the public safe. This is our number one priority. While our aim is always to complete work on time and within budget, we will not compromise safety.

Our capex and opex work programs are assessed against available resources as part of the investment approvals process. This is done together with our maintenance programs to identify opportunities to align similar and sequential works in the same area, which can reduce customer disruption and potentially result in lower costs.

When we assess our works programs, we consider two main constraints:

- deliverability – we adjust workloads by asset class to account for potential deliverability constraints. This allows us allocate resources across portfolios more effectively; and
- available resources – we forecast the resource requirements of the works plan and adjust it as necessary to ensure efficient use of internal capacity and available funding.

For more information please refer to JEM PMM-PR-2542 Jemena Infrastructure Cost Estimation Methodology.

5. SAFETY

Our customers have told us they value and expect a safe and reliable gas service. First and foremost, this means we must not compromise on the safety of our customers, the public, or our employees. JGN is committed to ensuring all operations are conducted in worksites that are safe from harm. Safety is the most important consideration when developing asset management strategies and associated capital investment forecasts.

We take a risk-based approach to asset management, and wherever possible ensure we are managing safety risk to as low as reasonably practicable (**ALARP**), at the lowest sustainable cost. We will not compromise safety over cost or service performance, and are committed to maintaining and replacing risky assets within timeframes that minimise the risk of safety or supply incidents.

5.1 JEMENA HSE POLICY AND STRATEGIC FRAMEWORK

Jemena maintains a company-wide Health, Safety and Environment (**HSE**) Policy. The policy outlines our health and safety beliefs, commitments and the ways in which these commitments are to be achieved.

Supporting the policy, we have an integrated Health, Safety, Environment and Quality (**HSEQ**) strategic framework that is linked to the Jemena Business Plan, vision and values. Our HSEQ framework is common across all Jemena business assets, and is applied as part of JGN's day-to-day activities.

The key objectives of the Jemena HSEQ strategic framework are as follows:

- improve HSEQ maturity (moving from calculative to proactive in the Hudson Cultural Maturity Model);
- reduce the risk rating of any workplace risks with a catastrophic severity rating from 'extreme' to 'high' (by reducing the likelihood of the risk occurring); and
- reduce total recordable injury frequency rate (**TRIFR**) to less than three.

5.2 JEMENA HEALTH, SAFETY AND ENVIRONMENT COUNCIL

Our HSE Council provides HSE leadership and strategic guidance on HSE matters as they affect workers (employees and contractors), customers and the community. Council membership includes the Jemena Leadership Team, General Manager HSEQ, General Manager Asset Risk & Management Systems and HSE Committee Chairs.

The HSE Council has an Asset and Public Safety Sub-Committee, which monitors and reports on the effectiveness of strategies and practices to manage risks associated with the safe operation of Jemena's network and pipeline assets.

5.3 HEALTH AND SAFETY (EMPLOYEES & CONTRACTORS)

We apply the following key principles in the management of the health and safety performance of employees and contractors:

- every contractor must complete a gas network induction and have a signed contract that includes provisions that cover the currency of mandatory training and occupational health and safety (**OHS**);

- every person employed by a contractor that works on the gas network must have suitable training for the task and must have completed a JGN induction; and
- audits are conducted to ensure compliance with industry codes and regulations.

We are committed to supporting employee health and wellbeing. Our work plan for health and wellbeing focuses on building resilience and looking at what we can do to embed healthier ways of working into day-to-day business practices.

5.3.1 REGULATORY OBLIGATIONS

Legislative obligations and internal requirements around employee and contractor health and safety are managed by line managers and supported by the HSEQ Team. Applicable legislation in this area is the Work Health and Safety Act 2011 (NSW) and Work Health and Safety Regulation 2011. The Work Health and Safety legislation replaces previous Occupational Health and Safety legislation in NSW as part of a move by the Commonwealth Government to harmonise OHS legislation between states.

5.4 SAFETY MANAGEMENT SYSTEM

JGN has a detailed safety management system that describes the processes required to ensure Jemena focuses on critical HSE needs, forecasts and allocation of resources. The safety management system sets the direction for HSEQ activities and consistently delivers improved HSEQ performance across our business.

Figure 5–1 illustrates the interrelationship between legislative requirements, risk management and our asset management strategies.

Figure 5–1: Safety management system

5.4.1 SAFETY MANAGEMENT SYSTEM COMMITTEES

An important component of our safety management system are the various committees, which are designed to provide oversight of our asset management practices, while facilitating engagement with key stakeholders such

as shareholders and the technical regulator. The responsibilities of our key safety committees are summarised below.

- Asset Management Review Committee (**AMSRC**) – The AMSRC has responsibility for the asset management system across Jemena with the purpose of strengthening the Jemena asset management system by providing governance, alignment and review across Jemena.
- Asset Public Safety Committee (**APSC**) – The APSC monitors and reports on the effectiveness of strategies and practices to manage risks associated with the safe operation across Jemena's portfolio of asset businesses.
- Gas Safety Management Review Committee (**GSMRC**) – The GSMRC assists the APSC by monitoring and reporting on the effectiveness of strategies and practices to manage risks associated with the safe operation of Jemena's gas network and pipeline assets. The GSMRC:
  - monitors the performance of gas network asset and public safety-related KPIs;
  - monitors the health of the safety management system and strength of controls as they apply to the gas network;
  - makes decisions on the operation and structure of the safety management system as it applies to the gas network;
  - responds to regulatory initiatives or directives;
  - reviews the impact of legislative changes affecting the safety requirements of the gas network;
  - reviews safety audit recommendations;
  - reviews the program of work for audits, safety management studies and formal safety assessments; and
  - reviews incidents and incident investigations on the gas network and ensures earnings are captured and embedded; and
  - drives continual improvement by critiquing the quality of data and practices available to address risk associated with the gas network.
- Standardisation committees – The AS 2885 Assets Technical Code Committee (**AS 2885 ATCC**) and the AS 4645 Assets Technical Code Committee (**AS 4645 ATCC**) each focus on implementing the requirements of their respective standards. The standardisation committees provide oversight on operational excellence across all gas infrastructure assets governed by the respective suite of standards for gas pipelines and facilities. Each committee is responsible for developing, aligning and implementing good practice and consistent procedures across the business.

5.4.2 SAFETY AND OPERATING PLAN (SAOP)

The Gas Supply (Safety and Network Management) Regulation 2013 sets out the regulations governing the safe supply of gas and establishes an obligation for network operators to lodge, implement and review safety and operating plans. Our key output under this Regulation is the JGN SAOP, which sets out the strategies for ensuring the continued safe management and operation of the network, and how the business will comply with relevant legislative requirements and Australian Standards.

The SAOP is independently audited to comply with the following:

- Gas Supply Act 1996 (NSW);
- Gas Supply (Safety and Network Management) Regulation 2013;

- Pipelines Act 1967 (NSW);
- Pipelines Regulation 2013; and
- Australian Standards Series AS 2885 and AS 4645.

The SAOP and its supporting information have been prepared to meet the combined conditions derived from Jemena requirements, the relevant NSW state legislation, pipeline licence conditions and gas industry codes of practice, guidelines, standards and procedures. Under the Gas Supply (Safety and Network Management) Regulation 2013 and Pipeline Regulations 2013, it is a requirement to perform periodic audits by a nominated competent and independent auditor, with audit reports submitted to the Director General Department of Industry Energy and Resources. These audits occur in April/May and October/November each year.

6. ENVIRONMENT

The Jemena Environmental Management System (**EMS**) provides the framework to manage Jemena's environmental risks. Environmental risks are managed through the individual asset Environmental Management Plan (**EMP**). In addition to EMPs, we have a range of environmental procedures that must be complied with when undertaking work for Jemena.

Our environmental objectives are to:

- be recognised as an environmentally responsible company;
- demonstrate responsible and diligent governance of operations in the environment in which we operate; and
- limit adverse environmental effects in providing for the efficient, safe, and reliable distribution and supply of energy and energy related services.

Our drivers for environmental management are to:

- comply with all applicable laws and regulations;
- safeguard the environment for communities within which Jemena operates through prevention of environmental impact and the considered risk management of all activities;
- continuously improve the EMS;
- identify innovative environmental solutions for services delivered;
- ensure all significant environmental hazards and risks are identified, assessed and controlled; and
- ensure employees and contractors understand their responsibility for the environmental performance of their activities.

6.1 JEMENA ENVIRONMENTAL POLICY

Jemena maintains a company-wide Environmental Policy, which outlines our goals and responsibilities for environmental performance. We are committed to reducing our environmental footprint. Our policy promotes reducing, recycling and reusing materials wherever we can, and the protection and revitalisation of natural habitats around our operations. Our EMS is consistent with the principles of ISO 14001, meaning we monitor and aim to reduce our environmental footprint and continuously improve our performance.

6.2 ENVIRONMENTAL MANAGEMENT PLANS

Operational Environmental Management Plans (**OEMPs**) have been developed to support our environmental performance. The plans help ensure activities are undertaken consistently and with minimal impact on the environment.

The OEMP is prepared with reference to Jemena procedures and the Australian Pipeline and Gas Association (**APGA**'s) Code of Environmental Practice – Onshore Pipelines (as revised October 2013). The OEMP is updated every three years and contains the following information:

- the Jemena Environmental Policy;
- environmental performance objectives;
- divisional structure and responsibility;
- environmental risk (aspects and impacts) register, environmental procedures and environmental mitigation measures;
- legal requirements and the environmental assessment process;
- incident and emergency procedures;
- monitoring, inspection and auditing regimes;
- reporting processes;
- rectification/improvement processes; and
- processes for the dissemination of information.

All personnel associated with the JGN distribution network are required to understand and adhere to JGN environmental requirements and their responsibilities in the OEMP.

6.2.1 IMPACT ASSESSMENTS

Environmental assessments are undertaken during the planning stages of new projects. They may also be performed if there are changes to operations that may impact on the environment.

An environmental assessment covers the impact of JGN activities, assets and materials on the environment, as well as the need for environmental approvals, permits or licences. Mitigation measures are identified in construction environmental management plans and are implemented prior to works commencing.

6.3 ENVIRONMENTAL PERFORMANCE

6.3.1 REGULATORY REPORTING

6.3.1.1 National Greenhouse and Energy Reporting Scheme

The National Greenhouse and Energy Reporting Scheme (**NGERS**) is a Commonwealth Government program that enforces mandatory reporting of industry greenhouse gas emissions and energy data. JGN emissions predominately result from fugitive gas and leaks. The reporting system undergoes annual third party assurance audits.

6.3.1.2 National Pollutant Inventory reporting

As a distribution network, reporting is not required under the National Pollutant Inventory reporting framework.

6.3.1.3 Safeguard mechanism

The safeguard mechanism is a component of the Commonwealth Department of the Environment and Energy's Direct Action Plan to cut emissions to five per cent below 2000 levels by 2020 and to 26 to 28 per cent below 2005 levels by 2030. It is designed to prevent companies from allowing their emissions to creep up in the absence of a price on carbon. The safeguard mechanism took effect from July 2016 and applies to JGN as a facility emitting

over 100,000tCO_2e. The safeguard mechanism baseline for JGN has been set at 528,234tCO_2e. If this emission level is exceeded, carbon credits will need to be purchased to make up the difference.

6.3.2 JGN ENVIRONMENTAL PERFORMANCE

Corporate environmental objectives and targets have been established in the OEMP. An example of these objectives and targets is detailed in Table 6–1.

Table 6–1: Corporate environmental objectives and target for JGN

Area	Objective	Target
Compliance	To conduct operational activities in compliance with environmental legislation and licence requirements.	Receive no penalties for non-compliance on an annual basis.
Environmental management system	Operational personnel to be involved in the review and improvement of the Environmental Management System.	A hierarchy of EMS documentation to be prepared with a schedule of documents to reviewed and updated bi-annually.
Environmental training	Jemena personnel who perform operational activities on JGN gas infrastructure to receive appropriate environmental training.	Operational personnel to receive environmental training periodically.
Environmental performance	Environmental performance indicators relevant to and reflective of operational activities in the natural environment will be developed and reported on.	Monthly reporting of environmental performance indicators with an annual target of 100% performance.
Environmental incidents	To minimise the occurrence and severity of environmental incidents during operational activities.	All environmental incidents to be recorded in EMS and investigated appropriately.

In addition to these corporate asset targets, there are environmental performance indexes (**EPIs**) which are tracked monthly. EPIs drive environmental performance improvement at an asset level.

7. RISK

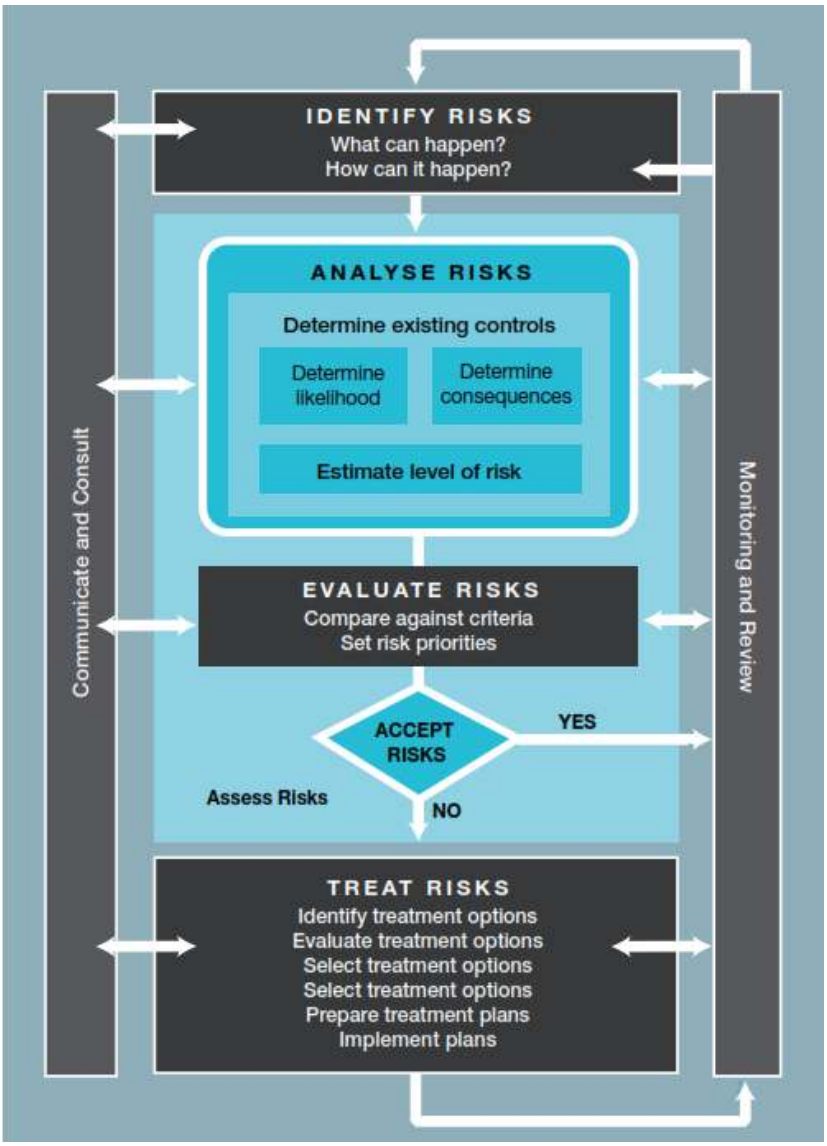
All asset management decisions are linked, in various degrees, to managing risk. For a gas distributor this includes safety risks, avoiding capacity constraints, managing asset failure risk through maintenance and renewals, or managing procurement and delivery to ensure financial prudence.

We recognise risk management is a fundamental driver of effective corporate governance and operational efficiency. We adopt a proactive approach to risk management and build consideration of risk into our day-to-day activities in order to:

- enhance the likelihood of achieving Jemena's business objectives, hence improving business performance;
- provide a source of competitive advantage;
- provide a structured basis for strategic planning;
- enhance the effectiveness and efficiency of Jemena's operations;
- encourage proactive rather than reactive management;
- improve the quality of decision making throughout Jemena;
- protect Jemena's reputation, value and integrity;
- aid compliance with relevant legal and regulatory requirements and international norms;
- safeguard Jemena's assets, personnel, finance and property (and the assets, personnel and property of the assets managed under contract); and
- safeguard our customers and the community.

To promote effective risk management across the organisation, we have a Risk Management Policy and Risk Management Manual. Both documents are approved by the Risk, Health, Safety and Environment Committee, which is a sub-committee of the Board. Our risk management approach (as outlined in Figure 7-1) is consistent with the risk management standard, AS/NZS ISO 31000:2009.

Figure 7-1: Jemena risk management approach



The key elements of our risk management approach are summarised below.

- **Identify risks** – we identify and document asset risks as part of FSAs required by AS 4645 and AS 2885. Risks are captured in various JGN and asset class risk registers, and managed/monitored via the Jemena Compliance and Risk System (**JCARS**).
- **Analyse risks** – our risk analysis includes considering what risk controls are in place and the consequence and likelihood of risks eventuating. We apply this qualitative risk assessment using the matrices in the Jemena Group Risk Management Manual.
- **Evaluate risk** – where a risk is assessed as extreme or high, we develop action plans to reduce risk to intermediate or lower. Intermediate risk must be assessed to investigate whether there are any reasonably practicable measures available to reduce the likelihood or consequence, thereby reducing the risk to low or negligible. Where no reasonable measures can be identified, a risk may be deemed to be ALARP. A risk ranked as low or negligible is tolerable and there is no requirement to reduce risk further.

- **Treat risks** – where risk action plans require implementation of capital projects, we assess these plans against risk priorities, availability of capital funds, resource availability, deliverability, project management and timing. Our project and program cost estimating processes are designed to ensure options analysis is undertaken, and that the solution with the lowest sustainable cost is selected.
- **Monitor and review** – to ensure risk management and asset lifecycle processes are robust and being adhered to by the business, JGN has a suite of internal and external reporting and audit processes. This helps evaluate the effectiveness of the overall asset management approach and allows improvements to be identified and implemented.

7.1 MANAGING RISK TO ALARP

We recognise complete elimination of risks is neither practical nor gives the best outcome to the business and customers. However, it remains important for risks to be identified, evaluated and managed to ALARP. The first stage of ALARP assessment is to identify additional or alternative controls that could be applied to further reduce risk. The hierarchy of effectiveness of controls is considered as part of this process. Where additional controls are identified, the feasibility of these options is assessed in terms of practicability and risk reduction benefit.

An intermediate risk may be deemed ALARP when no additional reasonable controls have been identified, or assessment of potential additional controls has deemed them unreasonable (i.e. the cost is grossly disproportionate to the benefit gained).

7.2 RISK REPORTING

We make a conscious effort to integrate risk management into the culture of the organisation. Workshops are conducted on a regular basis to identify and assess risks and determine action plans. For each planned action, the responsibility for implementation is allocated to a member of staff. Progress on these is monitored at six-monthly intervals and more frequently in the case of critical tasks.

We also conduct risk assessments when there are significant changes to processes, equipment or materials. All significant projects undergo a risk assessment phase. Field-based activities completed by contractors are monitored through targeted, risk-based audits.

Risk management reporting includes:

- ad-hoc reports such as those written to serve a specific purpose at a point in time;
- scheduled or automated reports (e.g. monthly or annual reports); and
- graphical reports available on the JCARS user dashboard, which allows uses to drill down to obtain more detail if required.

Risk reporting is provided to the Leadership Team Risk Management Committee and Risk Management Committee of the Board.

7.3 JGN ASSET RISK REGISTER

We have a JGN asset risk register, which is drawn from the various asset class risk registers housed within JCARS. The register covers risks associated with the gas infrastructure assets which are currently owned by Jemena and managed by JGN.

The JGN asset risk register was developed in line with the Group Risk Management Manual using the approved consequence materiality and risk likelihood tables. The scope of the JGN asset risk register is limited to risks with the potential to prevent the achievement of Jemena's Business Objectives. Risks associated with specific assets are captured in the asset class (and sub-class) risk registers, which are owned and maintained by each relevant JGN Asset Manager.

7.4 RISK PROFILE

All risks included in the JGN asset risk register are monitored in JCARS. We regularly reassess the current risk profile as work programs are completed and more up-to-date asset data is collected. Risks with a significant, high or extreme severity rating are assessed more frequently than low and moderate risks.

Of the 27 risks included in JGN asset risk register, none are currently rated as extreme. JGN's risk profile based on residual risk severity is shown in Table 7–1.

Table 7–1: JGN asset risk register risk profile May 2019

Residual risk rating	Number of risks
Extreme	0
High	2
Significant	10
Moderate	7
Low	8
Total	**27**

8. LEVELS OF SERVICE

8.1 BUSINESS AND ASSET PERFORMANCE

A suite of KPIs are used to measure JGN's business and asset performance on a rolling monthly basis. We currently have 29 KPIs in total, split into two categories:

- customer service (13 KPIs); and
- asset safety and reliability (16 KPIs).

Customer service KPIs focus on the reliability of gas supply to customers, incident response, gas connections and responsiveness to customer communications. An important principle we apply when managing customer service levels is the balance of cost against risk, in combination with customers' expectations of our network. For example, while customers would rather not experience supply interruptions, they do not want improvement at any cost.[7] We also recognise that eliminating supply or safety risk entirely is not feasible and almost certainly not economically efficient. Therefore, our approach is to achieve a high standard of service that customers are satisfied with, and then maintain (rather than improve) service levels, only targeting improvement in areas of the network where service is below expectations.

Asset safety and reliability performance is largely determined by factors such as the historical design, age, location and condition of the distribution network as well as the changing operational environment that causes variation in asset performance from year-to-year. To manage these factors, we conduct regular detailed network analysis and develop appropriate and cost efficient responses to ensure performance targets are met.

As per our customer service KPIs, our aim is to maintain current overall asset safety and reliability performance. We will do this by continuing our risk-based approach to asset replacement and maintenance, prioritising replacement/rehabilitation of gas network assets that pose the highest risk and are most likely to result in safety/supply issues (for example ferrous mains and legacy assets). Again, in keeping with the principle of balancing risk against cost, we will endeavour to extend the life of assets and defer major capital expenditure where safe and prudent to do so. However, we will not compromise safety.

Ongoing performance against our customer service and asset safety and reliability performance is recorded monthly. Performance as at January 2019 is summarised in the following tables.

Table 8–1: JGN customer KPIs and performance at 31 December 2018

Calendar year (CY) / Financial year (FY)	Measure	CY18		
		Actual	Target	Performance
Monthly (CY)	% of first time resolution of enquiries received	91.93%	80%	Green
Monthly (CY)	Percentage of meters activated within 5 business days from installation	77%	95%	Red
Monthly (CY)	Resolution time for customer claims ≤15 days	12	15	Green
Monthly (CY)	Percentage of standard electricity to gas (E-G) connections completed within 20 days	95.08%	95%	Green
Monthly (CY)	Reduction of Ombudsman case investigations	9	84	Green

7 See Attachment 2.1 of the 2020 Plan: *Overview of our customer engagement program.*

Monthly (CY)	Percentage of customers who receive more than 2 estimates in a 12 month period	5.42%	4%	Red
Monthly (CY)	% of estimated reads JGN	3.62%	5%	Green
Monthly (CY)	Basic connection offers % delivered within time (1)	99.92%	95%	Green
Monthly (CY)	Negotiated gas connection offers % delivered within 60 business days (1)	99.92%	95%	Green
Annual (CY)	JGN customer satisfaction (Annual survey) (1)	TBA	64%	Green
Annual (CY)	Demonstrate improvement in reputation survey results from retails and large customers (1)	TBA	>=Mod/Avg.	Green
Rolling (12mth)	Planned outage customer notification (1)	100%	99%	Green

(1) New measure introduced for 2019.

Table 8–2: JGN asset safety and reliability KPIs and performance at 31 December 2018

Calendar year (CY) / Financial year (FY)	Measure	CY18		
		Actual	Target	Performance
Monthly (CY)	Network incidents notifiable to technical regulator	70	150	Green
Monthly (CY)	Type B high pressure pipeline encroachments	4	6	Green
Monthly (CY)	Agreed actions from internal & external audits (FSA/SMS/NCR) not closed off within 1 month of due date (year-end focus)	0	0	Green
Rolling (12mth)	GIS outstanding	100%	95%	Green
Rolling (12mth)	Public reported escapes per 1000 customers	12.94	14	Green
Monthly (CY)	Percentage of emergency response jobs attended to within 30 minutes	87.40%	85%	Green
Rolling (12mth)	Third party hits (rolling 12 months)	2508	2520	Green
Monthly (CY)	Type A high pressure pipeline encroachments	0	0	Green
Monthly (CY)	Pipeline patrol scheduled compliance	100%	99%	Green
Monthly (CY)	Maintenance plan compliance	97.49%	90%	Green
Monthly (CY)	High risk valves proving (Completion of maintenance activities for high risk areas)	99.11%	95%	Green
Monthly (CY)	SCADA availability	99.98%	99.96%	Green
Monthly (CY)	Customer hours off supply	21409	16000	Red
Monthly (CY)	Number of odourant level non-conformances to targeted levels	0	4	Green
Rolling (12mth)	Unaccounted for gas (**UAG**)	2.05%	2.53%	Green
Rolling (12mth)	Poor supply incidents reported by the public per 1000 customers	0.63	1.40	Green

9. CUSTOMER INITIATED PROJECTS

Customer initiated projects comprise:

- routine and non-routine new customer connections; and
- unregulated customer-driven works.

New connection (routine and non-routine) projects comprise a significantly larger proportion of our forecast capital works program than unregulated customer-driven work. It should also be noted that the capital costs associated with unregulated works are not added to JGN's regulated asset base, nor funded from regulated revenue.

New connection costs are largely outside of our control, and can vary significantly from forecast based on market trends, building/dwelling growth and decisions made by individual customers. We use recent historical data to predict short-term requirements, complemented by long-term estimates developed by economic forecasting experts. For the 2015-2020 Access Arrangement period, and again for the 2020-25 Access Arrangement period, we have used forecasts developed by expert consultants Core Energy and Resources (**Core**).

Connecting new customers makes up the largest part of the capex program in our 2020 Plan. Connections forecast capex in our 2020 Plan covers the cost of new mains along streets, services to homes and businesses, and meters to measure how much gas is used. Connections capex is driven by two market types:

- volume market (annual consumption <10 TJ); and
- demand market (annual consumption >10 TJ).

The volume market comprises of the following customer types:

- residential electricity-to-gas (**E2G**) – customers currently not using gas, generally converting from electricity and/or LPG appliances;
- residential new homes – customers connected in new home developments and knock-down rebuilds in established areas;
- residential medium – customers in medium-density villa-type housing or small high rise developments (generally up to three floors in height);
- residential high rise apartments – customers in high density developments (generally over 3 floors in height with centralised facilities); and
- industrial and commercial volume market – small-scale commercial and industrial customers.

The demand market is made up of major industrial and commercial customers that individually consume more than 10 TJ of gas per annum.

10. CAPACITY AUGMENTATION

Capacity augmentation projects (**CAPs**) are identified as part of JGN's annual capacity planning cycle, and are directly impacted by changes in forecast demand. CAPs typically involve installing additional or higher capacity mains, and/or new regulator sets. Capacity augmentation is needed to:

- cater for higher levels of demand when peak demand grows;
- enable new customers to connect to our network; and
- improve the integrity of our network or reduce the risks borne by our customers, employees and the general public.

The network is designed to ensure gas is available to customers during peak times – typically on cold winter days. Each year, the Capacity Planning Team assesses the of utilisation of peak gas demand for the network. This is done by comparing annual pressure gauges and telemetry information alongside network models. Peak gas demand forecasts are developed based on the number of new connections and historical growth, and these forecasts are added to the network model to predict where and when a potential loss of gas supply is likely to occur.

When a section of the network is identified as being at risk of loss of supply, we look at network augmentation options to eliminate that risk. These options are then analysed as part of our investment governance process, and business case development for a CAP will commence.

10.1 AUGMENTATION PLANNING METHODOLOGY

When developing CAPs, we consider the following factors:

- **Network configuration and condition** – the network configuration, its topology, geography, location and physical state are critical considerations. For example, crossing a river, railway line or major highway can prove to be difficult and costly, so alternative routes would be assessed to minimise these types of crossings.
- **Cost effectiveness of potential options** – to promote efficient investment, the capacity assessment process requires development of several options that balance the benefit to customers with the cost of implementation.
- **Timing –** as a general principle, we implement augmentation projects as late as possible. This extends the life of existing assets where prudent and safe to do so, but not so late as to create an unacceptable risk of loss of supply. We balance the expected timing of loss of pressure with the time to implement the option. We do this by running network optimisation software and simulations to model peak network flows. Simulations are updated for the most recent demand and growth forecasts. The year in which gas pressures are simulated to decline significantly below the minimum pressures is typically chosen as the year by which the CAP must be completed.

10.2 CAPACITY PLANNING CRITERIA

The main criteria used in the capacity management decision making process are:

- network pressures; and
- peak flow rate.

These criteria are discussed in the following sections.

10.2.1 NETWORK PRESSURES

Capacity management is driven by increases in peak demand that are forecast to reduce network pressures below critical thresholds. In most cases, increases in peak demand occur incrementally as customer numbers increase in parts of the network.

Historically, peak gas demand has been increasing. Growth typically occurs in established residential areas and is driven by customers upgrading appliances, for example installation of instantaneous hot water systems. New housing growth can also contribute to the increasing peak.

However over 2015-20, growth in peak demand has slowed. This is due to the saturation of instantaneous hot water systems and a shift by some customers to reverse cycle heating. This slowdown in growth has allowed us to defer a number of CAPs that were initially planned to meet a higher forecast peak.

We have also used the changing demand profile to modify our investment approach. Previously, at the medium pressure level (100-400kPa) we installed additional capacity whenever network pressures fell below 70kPa. With slower peak demand growth, we are able to continue monitoring our network and only install capacity when pressures drop below 40kPa.[8] To facilitate this we have upgraded our network monitoring systems from ~60 mechanical gauges to ~300 newer electronic gauges, which allow us to monitor more locations with greater data granularity.

We are confident this change in approach will not result in supply issues, as slower peak growth provides us more time to monitor network performance and respond by installing additional capacity. Further, a smaller number of capacity projects reduces the risk we cannot mobilise at short notice to install additional capacity.

If peak demand growth picks up or if we need to revert to installing additional capacity at 70kPa (based on increased reports of poor supply), we will reconsider our investment thresholds and incur expenditure accordingly.

10.2.2 PEAK FLOW RATE

Capacity is measured as the peak flow rate the network can deliver if a particularly high winter peak demand occurs (forecast to a 1 in 10 probability of occurring). This ‘1 in 10’ assessment is used rather than the annual, average or daily throughput, as it ensures the network is resilient and more likely to withstand cold conditions.

A diversity factor is applied to the annual gas load to take into consideration the individual / local area peak flow patterns. The use of more efficient gas appliances, individual lifestyle patterns and geographical locations impact the daily and seasonal peak demand requirements, whereas hourly peak flow rates remain linear.

We have recently commenced the Flow Diversity Monitoring Project, in which we are investigating the peak hourly demand of an established area of the network and four high rise buildings that have instantaneous hot water. Our aim is to use data from this project to improve our peak flow rate measurement and forecasting capability so we can factor this into our capacity planning. Pending the success of this project, our aim is to expand our analysis to consider a more diverse range of areas such as newly developed estates in different regions / climates such as in Sydney’s West, Newcastle, Country NSW and Canberra.

[8] This is only possible on a case-by-case basis depending the location of our larger customers.

10.3 CAPACITY AUGMENTATION PROJECTS

We develop a Capacity Augmentation Plan to determine the gas infrastructure required to support the growth in the Sydney and Greater Sydney network areas for the next seven years. CAPs are grouped into three categories:

- **Existing customer demand growth (organic growth)** – CAPs required as a result of peak demand rising in established areas, typically due to customers installing higher capacity appliances or household behavioural changes.
- **Medium density and high rise developments –** CAPs required to connect new (typically residential) developments, where there is a concentrated gas load with a single service connection. If several medium density/high rise buildings are being developed in one area, we consider the capacity requirements of subsequent/concurrent projects and plan accordingly. Areas around rail corridors and train stations such as in Parramatta, Auburn and Bankstown are experiencing high growth in medium density apartments. Medium density/high rise residential developments may also have commercial tenants at ground level, which adds to peak demand.
- **New estate growth areas** – CAPs generally in greenfield areas that have minimal or no gas infrastructure and require feeder mains and / or regulators to extend the gas network to service the proposed new estate.

10.4 QUALITY OF SUPPLY

Our capacity augmentation investments over the next seven years are informed by recent customer consultation and demand forecasting developed for our 2020 Plan. One of our KPIs is the number of poor supply incidents that occur in the network. This is essentially a measure of instances where a customer experiences poor gas supply, typically due to lack of capacity. Poor supply incidents are therefore an important driver of CAPs.

The worst affected areas for poor supply and capacity constraints are the 2kPa networks. Jemena completed the rehabilitation of the Kensington area during 2010 to 2016, which converted approximately 5,000 customers from 2kPa to a 210kPa network in a staged approach.

With JGN's commitment to convert all remaining 2kPa networks, the 2kPa area of Maitland and its ~400 customers is scheduled to be converted in 2019 and 2020. The 2kPa area of Matraville and its ~2,300 customers is scheduled to be converted in 2020-2023.

11. NETWORK ASSET REPLACEMENT

This section provides an overview of asset management activities and key asset replacement/rehabilitation projects expected to be required during 2020-25. The section is designed to be high level only. For detail on specific asset management practices and forecast investments, refer to the asset class strategies and the expenditure forecasts provided in the 2020 Plan.

Our overall approach for asset replacement is informed by the individual asset class strategies prepared for each of the JGN network asset classes. Our gas network asset classes[9] are:

- Distribution network;
- Pipelines;
- Gas facilities; and
- Measurement (metering).

Our asset class strategies are intended to cover a minimum period of 20 years and seek to ensure reliable performance and prudent risk management. The asset class strategies help ensure an appropriate balance of capex and opex through the consideration of total lifecycle management costs. Our aim is to ensure assets are managed optimally to the benefit of our customers.

When developing asset class strategies, we consider the following information:

- asset class profile, which includes information about the type, specifications, life expectancy and age profile;
- asset class objectives, which define what we want to achieve with each class of asset in order to achieve the broader JGN asset objectives detailed in the ABS;
- asset risk, which includes identifying threats, opportunities, strengths and weakness. This includes asset performance objectives and measures, criticality and condition. Risks and opportunities are then documented and compared against asset objectives to develop a ranking/prioritisation;
- asset performance, which includes information about current performance against asset indicators, objectives, drivers, and service levels;
- asset strategy, which includes the Jemena Business Plan, Gas Market Strategy, asset management policy, and ABS;
- scenario analysis, which considers variables such as time, capital and maintenance costs to confirm risk tolerance and opportunities for efficiency improvements or investment deferral;
- growth and capacity analysis, either directly or through capacity, regional or development strategies and plans;
- asset expenditure assessments, which include information about historical and forecast operating and capital requirements and the impact on prices to gas consumers.

The current asset class strategies are summarised in the following sections.

[9] Non-network assets are discussed in chapter 12 of this AMP.

11.1 KEY ISSUES

The overall condition of the JGN assets is generally good. Other than specific pockets of the network where assets are nearing the end of their technical life, or require replacement in order to reduce risk (or manage it to ALARP), the overall risk associated with the gas network is within tolerable levels.

Subject to the current controls being maintained, plus execution of the expenditure proposed for the forthcoming Access Arrangement period, we expect the gas network to remain safe and to continue to provide a reliable gas supply to customers.

The primary types of risk that impact JGN network assets are:

- asset failure (e.g. corrosion);
- operational risks (e.g. human error);
- third party hits;
- failure or reduction in control effectiveness (e.g. inadequate signage or shallow cover);
- regulatory or compliance risks (e.g. change in mandatory compliance/standards); and
- asset lifecycle risks (obsolescence of equipment).

Key network asset replacement programs required in the next seven years to help mitigate these risks include:

- rehabilitating the ferrous mains in the 2 kPa and 7 kPa networks in Matraville, the 30kPa mains in Newcastle and 210kPa in Mittagong;
- rehabilitating the 100 kPa steel mains in Kurri Kurri;
- rectifying shallow secondary mains in high density community use areas, which is needed to prevent future damage to the network, improve safety to the public and reliability of supply.
- de-rating a degraded section of the Sydney Primary Main to secondary pressure;
- reconfiguring the remaining sections of the Sydney Primary Main to enable in-line inspection (or ‘pigging’);
- replacing more than 450,000 residential and I&C gas meters;
- proactively replacing more than 55,000 hot water meters (plus reactive replacement of defective meters)
- replacing boundary regulators that have reached the end of their useful life or do not have over pressure shut off valves;

Note this is not an exhaustive list. Asset replacement requirements are continually reviewed and will likely change over the course of program delivery. Our works program also includes ongoing maintenance, provision for reactive asset replacement, and other minor works not included in the summary list above.

For full details of forecast expenditure and the works program scheduled for the coming years, refer to the expenditure forecast provided in the 2020 Plan.

11.2 DISTRIBUTION NETWORK

The distribution network asset sub-classes are:

- secondary network (mains and services operating up to 1050 kPa);
- medium and low pressure mains and services;
- network pressure control (district regulator stations); and
- consumer pressure control (boundary regulators).

Asset management strategies for each of these sub-classes are summarised below. For more detail, refer to the Networks Asset Class Strategy.

11.2.1 SECONDARY NETWORK

The JGN secondary network consists of approximately 1,500 km of mains operating at a Maximum Allowable Operating Pressure (**MAOP**) of 1050kPa, with a minimum operating pressure of 525kPa. The network also includes services, line valves and cathodic protection systems. The secondary mains provide gas to the district regulator sets in the distribution networks and also directly supply a number of larger industrial and commercial (I&C) customers.

The secondary mains network is primarily constructed from steel pipe with a small section of SDR9 PE100 installed in the Wakehurst Parkway in Sydney's Northern Beaches. The majority of the network is externally coated with HDPE to protect it from corrosion and internally lined to reduce frictional losses. Since 2012, mains have been externally coated with either a tri-laminate coating or fusion bonded epoxy coating. Additional corrosion protection is also achieved by the cathodic protection system.

Main line valves (~1,200 of them) are devices used to manually isolate secondary mains gas flow. The valves are operated during emergencies or when isolation is required.

11.2.1.1 Performance and requirements

The secondary mains are generally in good condition, however an incident in 2018 where a rock breaker punctured a shallow secondary main in Sydney CBD initiated a review of our high pressure mains. The post-incident investigation found the risks associated with shallow mains and isolation valve locations are higher than previously assessed.

We are therefore delivering projects over the next few years to identify the location of shallow mains and isolation valves in populated areas. The risk of third parties hitting shallow mains will then be reduced by either burying the main deeper or installing a physical barrier. The risk treatment in each case will depend on the location, asset type and associated risk. We will also install additional isolation valves to ensure leaks can be contained quickly in the event of a third party hit.

Table 11–1 shows the key secondary network projects to be delivered during 2020-25.

Table 11–1: Key secondary mains projects for 2020-25

Year	Project name	Project description
2020-23	Shallow secondary mains	Locate shallow secondary mains in high density areas and either insert a physical barrier or bury mains deeper to prevent third parties coming into contact with them.

Year	Project name	Project description
2020-23	Secondary isolation valves	Install secondary isolation valves in high density areas to ensure efficient isolation of gas supply in an emergency response/gas escape.

11.2.2 MEDIUM AND LOW PRESSURE MAINS AND SERVICES

The medium and low pressure mains and services supply natural gas to domestic, industrial and commercial users. The networks are comprised of mains, services and valves. The low pressure mains have a MAOP of 2kPa or 7kPa, medium pressure have a MAOP of 210 kPa, 300 kPa or 400 kPa and a small number operate at 15kPa, 30kPa and100 kPa. The medium and low pressure network consists of more than 22,900 km of plastic pipe, with approximately 1,000 km being cast iron or steel.

During 2017, a review was undertaken to consider the strategy of moving from predominantly using nylon materials to polyethylene (PE) for mains and services. Some of the benefits include efficiencies due to the economies of scale of the use of PE in the gas distribution sector and other utilities. Other benefits are that the robustness of jointing has significantly improved over time, more innovation for the PE material, and not having to rely on only two suppliers.

The decision to move to PE was approved in October 2017. As of 1 November 2018, following a transition period, all new market expansion works are 100% PE. The majority of like-for-like works and rehabilitation projects have also been transitioned to use of PE going forward with a view to completely stop laying nylon in all scenarios within 5 years.

11.2.2.1 Performance and requirements

The vast majority of the low and medium pressure network is within its design life. Overall the condition of the plastic mains is considered fit for purpose. Most plastic mains in the network are less than 30 years old. This is a result of the large scale rehabilitation program carried out in the 1990s to replace the then ageing and leaking network. During the renewal program most of the cast iron and steel pipe in the low and medium pressure networks was inserted with nylon.

The cast iron and steel pipe that remains in service is more than 50 years old. We monitor these sections of the network via leakage surveys and leakage data analysis, and we prioritise these sections for replacement based on risk. Our aim is to maintain these ferrous mains to ALARP until they can be completely removed from service as part of our ongoing mains rehabilitation program.

Key mains rehabilitation projects to be completed/commenced during 2019-25 are summarised in Table 11–2.

Table 11–2: Key mains rehabilitation projects for 2019-25

Year	Project name	Project description
2019-20	Maitland 2kPa Rehabilitation	This rehabilitation project is required to improve safety, integrity, and provide an equivalent level of service to other areas by eliminating the corroded cast iron mains. Scope is to insert 9.2km of main and transfer 316 customers.
2020-22	Matraville 7 kPa and 2 kPa Rehabilitation	The 2 and 7 kPa rehabilitation project is required to improve safety, integrity and level of service by eliminating the unprotected and corroded steel mains. Scope is to insert 44km of main on the 7kPa network.

Year	Project name	Project description
2019-20	Maitland 2kPa Rehabilitation	This rehabilitation project is required to improve safety, integrity, and provide an equivalent level of service to other areas by eliminating the corroded cast iron mains. Scope is to insert 9.2km of main and transfer 316 customers.
2020	Kurri Kurri Rehabilitation (100kPa)	The project is required to improve safety and integrity by eliminating the unprotected and corroded steel mains. Scope is to insert 11 km of main and transfer 985 customers.
2021	Mittagong Rehab	This rehabilitation project is required to improve safety and integrity in the Mittagong 210kPa network by eliminating the last remaining cast iron and steel mains. Scope is to insert 6.7 km of main
2023-26	Newcastle 30kPa	The project is required to improve safety and integrity by eliminating the unprotected and corroded cast iron mains. Scope is to rehabilitate 136km of cast iron mains and upgrade the area from 30kPa to 210kPa
2025-27	Haberfield / Strathfield / Campsie 7kPa	The rehabilitation project is required to improve safety and integrity in the 7 kPa network in Strathfield by eliminating the older generation high density polyethylene (HDPE) plastic and cast iron mains. Scope is to insert/lay 22 km of main
2025-27	Bankstown / Chullora / Greenacre 7 kPa	The project is required to improve safety and integrity service to other areas by eliminating the corroded cast iron and steel mains. Scope is to insert 22 km of main

11.2.3 NETWORK PRESSURE CONTROL

District regulator sets (**DRS**) is the generic term used to describe regulators that supply the medium pressure networks. There are three types of DRS in operation:

- secondary district regulator sets (**SDRS**) – these are installed at each off-take from the secondary network to supply the medium pressure networks. SDRS reduce the inlet pressure of 1,050kPa to 400kPa, 300kPa, 210kPa, 30kPa or 7 kPa;
- medium pressure district regulator sets – these are installed at each off-take from the medium pressure network to supply low pressure network. They reduce the inlet pressure from 210kPa and 400kPa to 7kPa or 2 kPa; and
- low pressure district regulator sets – these reduce an inlet pressure of 7 kPa to 2 kPa.

11.2.3.1 Performance and requirements

Overall, the DRS asset class is in good condition. There has, however, been an increase in corrective maintenance service orders due to leaks on older DRS. We will continue to monitor the condition of these assets and modify maintenance programs accordingly.

The Sydney area has gone through large amounts of growth resulting in changes from once low or medium, to high density living. This has impacted maintenance of our assets as the location of some DRS are now in areas that are present a safety risk for our gas technicians to attend.

Key DRS replacement/relocation projects scheduled for 2019-25 are summarised in Table 11–3.

Table 11–3: Key DRS replacement/relocation projects for 2019-25

Year	Project name	Project description
2019	Cocon bypass	This allocation is to alter ~50 cocons that contain above ground pipework. This is to remove the risk of being struck by a third party. The works are a results of a vehicle incident in Leppington where 400 customers lost supply.
2021	DRS Relocation - Five Dock	The DRS is located on the corner island of an intersection between Great North Rd and Lyons Rd, Five Dock, making it very difficult for technicians to access and carry out maintenance. The DRS is recommended to be relocated for technician access, to mitigate damage to the network and loss of supply to customers.
2022	DRS Relocation - Holson Street Casula	The DRS requires replacing due to the bypass containing no regulator. Currently, the technicians have to manual throttle a valve to obtain the correct pressure during maintenance. The project is to mitigate damage to the network and loss of supply to customers.

11.2.4 BOUNDARY REGULATORS

Boundary regulators are used to reduce the secondary or medium pressure at the property boundary to low pressure. The low-pressure end-user service then supplies medium or high-density housing, such as units, townhouses or villa complexes, shopping centres and some I&C customers.

Boundary regulators are installed to:

- reduce gas pressure to a safe minimal level before delivery into the customer's premises. Lowering the pressure reduces the consequences from the threat of a gas escape;
- protect the customers' (building) piping services from the threat of over pressurisation that can cause a gas leak within a building;
- protect the customer's appliances from the threat of over pressurisation that causes poor combustion and "lift off" of the flame; and
- avoid the need for over pressurisation management on internal meter sets. This eliminates the need for vent lines.

The volume of residential regulators is directly related to the number of customer connections. There are also approximately 5,000 internally installed I&C gas meter sets operating at <15kPa.

11.2.4.1 Performance and requirements

Overall, the consumer pressure control asset class is in good condition. All boundary regulators installed after 2000 have over pressure shut off (**OPSO**) valves, which will operate if the regulator fails. However, some older boundary regulators in the network only have a relief valve, which poses a safety risk.

We are monitoring the risk associated with these older regulators via annual service checks, and are undertaking a boundary regulator replacement program, targeting regulators without OPSOs.

11.3 PIPELINES

The pipelines asset class is split into two sub-classes:

- Piggable pipelines; and
- Non-piggable pipelines.

Asset management strategies for each of these sub-classes are summarised below. For more detail, refer to the Pipelines Asset Class Strategy.

11.3.1 PIGGABLE PIPELINES

All modern pipelines are regularly inspected through the use of an intelligent pipeline inspection tool commonly referred to as a pig, which inspects the thickness of the pipe wall from the inside. Pigging a pipeline is the most efficient and effective way to identify defects that could have arisen since the main was first laid, either due to corrosion or damage from an unreported third party hit. It provides a complete picture of the thickness of the pipeline wall without interrupting supply to customers, allowing us to identify and correct material defects and halt corrosion.

A piggable pipeline is a pipeline that is designed with sufficiently long radius bends, consistent internal diameter and pig launcher and receiver facilities.

Three sections of the JGN trunk pipeline system are piggable;

- Central Trunk (Licence 1) – this carries gas from Wilton to Horsley Park to serve the Sydney region and onwards to the Northern Trunk;
- Northern Trunk (Licence 3, 7, 8) – this is an extension of the Central Trunk that carries gas from Horsley Park to serve the Central Coast and Newcastle regions; and
- Southern Trunk (Licence 2a) (Piggable portion is, section 2a, Wilton Trunk Receiving Station (**TRS**) to Mt Keira) – this carries gas from Wilton to serve the Wollongong region.

There are two piggable assets on the primary main:

- Sydney Primary Loop – this connects West Hoxton TRS to Tempe Primary Regulating Station (**PRS**); and
- Western Sydney Primary Main – this connects Eastern Creek TRS to Emu Plains PRS.

11.3.1.1 Performance and requirements

The condition of the piggable trunk and primary mains is considered good and no major works are required in the next seven years. Ongoing performance will be monitored and the pipelines will be pigged very ten years, as per the current schedule.

11.3.2 NON-PIGGABLE PIPELINES

A non-piggable pipeline is a pipeline that cannot accommodate an internal inspection gauge. A non-piggable pipeline will have under-sized valves, inconsistent internal pipe diameters, bends of insufficient diameter, or no pig launcher or receiver. This means accurate data on pipe integrity and wall thickness is not available for these assets.

Three primary mains and one section of the JGN Trunk pipeline are non-piggable:

- Sydney Primary Main (**SPM**):
  - Horsley Park Trunk Regulator Station to Mortlake Automatic Line Break Valve (ALBV), continuing down to Banksmeadow PRS near Port Botany. The remaining section is between Banksmeadow PRS and Botany Bus Depot; and
  - the Sydney North Primary Main that is connected to the primary main at Breakfast Point and ends at Willoughby PRS.
- Wollongong Primary Main starting at Figtree (Govett Cres) Main Line Valve and extending past Wollongong PRS; and
- Southern Trunk (Licence 2b), this carries gas from Mt Keira to Govett Crescent to serve the Wollongong region.

11.3.2.1 Performance and requirements

As Sydney has grown, the environment around our trunk and primary pipelines has changed. In many areas there has been significant development and has resulted in a shallow depth of cover for our high pressure gas assets. A shallow depth of cover creates high safety risks and we have started to address this by implementing our SPM risk mitigation project to either relocate, install a physical barrier and/or additional signs and markers. In other instances a school has been built in close proximity to the primary main, with the main now in school grounds. We will improve public safety by relocating this pipe.

We commenced reconfiguring the SPM during the 2015-20 Access Arrangement period, starting with the Horsley Park to Lidcombe section. The key program scheduled for 2020-25 is to reconfigure the remaining sections to allow pigging (this project is called SPM corrosion failure due to CP shielding), with the exception of Lane Cove to Willoughby, where we plan to de-rate the pressure and install additional secondary mains instead.

Table 11–4: Key pipelines projects for 2019-25

Year	Project name	Project description
2021	Canada Bay primary main relocation	A section of the primary main is situated in the grounds of a Sydney School. This section needs relocating to ensure the safety of the public.
2020-22	SPM risk mitigation project	Relocate, install a physical barrier and/or additional signs and markers of shallow primary mains to reduce the safety and reliability risk of third parties coming into contact with them.
2020-27	SPM corrosion failure due to CP shielding	Reconfigure the remaining section of the SPM to allow pigging. This involves installing pigging facilities at three separate sections, running a pig through the converted section and completing validation digs.
2020-2024	Sydney Primary Main integrity management (Lane Cove to Willoughby)	Install two additional secondary mains in northern Sydney and de-rate a section of the Sydney Primary Main. This will lower the pressure on one of the oldest parts of the Sydney Primary Main and reduce risk to the public.

11.4 GAS FACILITIES

Gas facilities are split into two asset sub-classes:

- High pressure facilities, which includes:
  - pressure reducing and metering skids including packaged off take stations, trunk receiving stations, and primary regulating stations;
  - water bath heaters; and
  - the concrete pits or buildings that house these high pressure facilities.
- Instrumentation, control and electrical, which includes:
  - electrical earthing systems;
  - hazardous area classification;
  - electrical equipment in hazardous areas;
  - alternating current and direct current distribution systems; and
  - facility control philosophies.

Asset management strategies for each of these sub-classes are summarised below. For more detail, refer to the Facilities Asset Class Strategy.

11.4.1 HIGH PRESSURE FACILITIES

JGN owns and operates various AS 2885 pipeline offtake facilities downstream of Wilton Custody Transfer Station as well as various offtake receipt facilities along the APA pipelines that supply JGN distribution networks in NSW. High pressure facilities are used to measure, filter and reduce the pressure of natural gas to ensure it is being supplied at an appropriate pressure and quality downstream in the network.

11.4.1.1 Performance and requirements

Although rare, when high pressure facilities fail, the consequences can be catastrophic including fatalities, loss of assets and long term interruption to supply. Therefore, we have a number of ongoing programs and mitigation strategies to help ensure facilities remain safe and are operating within performance expectations.

The most significant performance issues and requirements for managing gas facilities identified over the next seven years are described below.

- Noisy control valves - the majority of the older PRSs were constructed with V ball control valves. Noise measurements exceed the manufacturer's guidelines. The high noise levels can cause vibration, resulting in fatigue of piping in the downstream. An incident in Auburn PRS was the result of such vibration. A program is in place to replace V balls with silent trim control valves.
- Concrete pits – some concrete pits that house PRSs show signs of deterioration due to inadequate concrete covering over steel reinforcement. Concrete structures have lost around 10% of structural strength due to spalling (however the strength remains adequate for the duty load). Our strategy is to extend the life of these facilities by another 20 to 30 years by resealing exposed steel reinforcements and implementing five-year inspections and minor repairs.
- Security at facilities – above-ground gas facilities are prone to vandalism and third party damage. JGN is investigating the introduction of webcams at every facility to deter intruders, detect "gate open" nuisance alarms, aid bush fire detection, enforce site entry protocol, and to assist decisions for remote station shutdown during emergencies.

- Facilities risk based safety upgrades - A number of instrumentation, control and electrical (IC&E) assets do not conform with the requirements of the Electricity Act 2004 and the Electricity Regulation 2006. A program is under way to upgrade/replace these assets in several PRS and CTSs. We will also conduct baseline studies on all assets that do not have an earthing layout drawing and/or hazardous area classification documentation.

The capital projects and maintenance activities listed in Table 11-5 have been identified for 2019-25

Table 11-5: Key facilities asset replacement/upgrade projects for 2019-25

Year	Project name	Project description
2019-25	Facilities risk based safety upgrades	Several high pressure facility are not compliant with the Electricity Act 2004 and the Electricity Regulation 2006. The project involves delivering an electrically complaint CTS and confirming the safety, process integrity and mechanical integrity.
2021	Appin Packaged Off Take Stations (**POTS**) Upgrade Stage 2	Upgrade of Appin POTS is needed to increase reliability of supply to the downstream network as the capacity of the station will be exceeded by winter 2021.
2021	Banksmeadow PRS Upgrade	This project is required to address station integrity and workplace health and safety issues by ensuring safe operation of the station and extension of service life. The project involves addressing the risk of high noise and vibration from the existing control valves, which is causing pipeline fatigue.
2023-25	TRS Security Upgrades	Several TRS sites require security upgrades to prevent unauthorised access, property damage and vandalism.

11.4.2 INSTRUMENTATION, CONTROL AND ELECTRICAL

The instrumentation, control and electrical (**IC&E**) asset sub-class covers the equipment that form part of a gas facility. Some of the equipment types include: electrical earth systems, transmitters, switches, intrinsic safe barriers and isolations, control valves etc.

11.4.2.1 Performance and requirements

A number of instrumentation, control and electrical (IC&E) assets do not conform with the requirements of the Electricity Act 2004 and the Electricity Regulation 2006. A program is under way to upgrade/replace these assets in several PRS and CTSs. We will also conduct baseline studies on all assets that do not have an earthing layout drawing and/or hazardous area classification documentation.

Replacement of IC&E assets will be undertaken as part of the facilities capital programs listed in Table 11-5 above.

11.5 MEASUREMENT

The measurement asset sub-classes are:

- Gas measurement equipment;
- Water measurement equipment;
- Data collection equipment; and
- Gas quality measurement equipment.

Asset management strategies for each of these sub-classes are described below.

11.5.1 GAS MEASUREMENT EQUIPMENT

Gas meter sets provide filtration, pressure control and volumetric measurement at the point of gas delivery from the network to end user. At the residential level, meter sets include the filter, regulator, gas meter, inlet and outlet isolation valves, meter bracket and communications equipment.

Gas measurement equipment includes:

- **diaphragm meters** – each customer has a gas meter installed when they are connected to the network. JGN has more than 1.4 million meters. Typically, diaphragm meters are installed for standard domestic and commercial and industrial customer connections.
- **rotary and turbine meters** – rotary and turbine meters are installed to provide data on high demand gas consumption. We have 28 turbine and rotary meters at packaged off-take stations, which measure gas entering regional distribution networks.
- **regulators** – regulators provide pressure control at the point of gas delivery from the network to the customer, ensuring safety of the downstream customer installation and correct billing. They are installed in contract customers, single dwellings, medium density and high rise developments.

11.5.1.1 Performance and requirements

Meter replacement is typically one of our largest capital programs. The internal components of meters wear over time and become inaccurate or simply stop working. We replace these meters so that we can continue to issue correct bills and continue to supply gas.

Our residential gas meters have lasted longer than expected and over the next Access Arrangement period we take into account the improved performance of our gas meters, in the absence of statistical testing results, assumes our meters will be replaced at 25 years.

11.5.2 WATER MEASUREMENT EQUIPMENT

Water meters provide measurement of water usage by the customer or hot water system. Installations consist of a master cold water meter and individual customer hot water meters. The meters are used to apportion the use of gas by the centralised hot water system to the individual customers on the basis of hot water consumption.

As of December 2018, there were 234,465 water meters installed in the gas network. JGN additionally operates cold water master meters within medium density high rise buildings. These meters are used as the reference meter for customer billing.

11.5.2.1 Performance and requirements

Water meters overall are in good condition. However, some families of mechanical hot water meters have experienced high failure rates. These meters have been the subject of legal and commercial negotiations on costs associated with rectifying the high failure rates. We are actively monitoring the performance of these meters and will not be using this particular brand going forward.

Hot water meters typically do not last as long due to the life of the inbuilt battery. However, we have also been able to defer significant amounts of water meter replacements over the past five years, and will continue to defer renewals where safe and prudent to do so.

11.5.3 DATA COLLECTION EQUIPMENT

We utilise data collection equipment to record and transmit metering and gas quality data across the network. Data collection equipment includes:

- **gas volume correctors** – these are remote electronic devices installed to measure and record pressure and temperature via pulsed signals from the meter, and calculate a correction factor to convert actual volumes recorded by the meter to the standard billing volume. They are normally installed on sites with consumption greater than 27 TJ or where meters are upstream of gas regulators such as POTS meters; and
- **meter data loggers (MDL)** – these are remote electronic devices installed to measure and record actual gas and water consumption volumes via pulsed signals from the meter, and are installed on sites with consumption below 27 TJ. Data is accumulated in the data loggers and transmitted to a server through a communications system for use in billing systems, where temperature and pressure correction is then applied to convert to standard billing volumes.

11.5.3.1 Performance and requirements

Data collection equipment is in good condition. However, there is a need to replace some MDLs due to obsolescence risk.

11.5.4 GAS QUALITY MEASUREMENT EQUIPMENT

JGN installs and maintains gas quality measuring equipment and associated communications in the distribution network. This is to ensure that gas quality meets contractual requirements and gas standards. Gas quality measuring equipment includes:

- **gas chromatographs (GCs-6)** – these instruments analyse the components of gas and measure gas composition ranging from methane to hexane. We use this equipment to calculate gas composition properties. These are important for billing and for UAG and in particular when there are different sources of gas supplied into a pipeline and/or network; and
- **hydrocarbon and water dewpoint analysers** – these instruments analyse the hydrocarbon and water content of gas. Gas that does not meet specifications could lead to water and liquid hydrocarbons dropping out of the gas into the pipeline. This could lead to corrosion, blockage of regulators and pipes and interruption of gas supply to townships and end users.

11.5.4.1 Performance and requirements

Gas quality measurement equipment is in good condition. As such, there is only one project planned to replace one hydrocarbon and one water dew point analyser at Wilton TRS.

12. NON-NETWORK ASSETS

Jemena also has a number of non-network assets which are used to support the efficient operation of the gas network. Non-network assets covered by this AMP are:

- property (land and buildings);
- fleet (vehicles, plant and equipment); and
- SCADA and real time systems (**RTS**).

Some of these assets are shared by Jemena's various asset businesses, and are managed by dedicated asset management teams. These non-network assets are managed according to JGN requirements and are subject to the same robust decision-making and governance framework as network assets.

The following sections provide an overview of current asset management strategies for property, fleet and SCADA and RTS, with a focus on programs required to support the JGN business.

12.1.1 RISK

The primary types of risk that impact property are:

- expired leases/licences on network sites;
- unable to negotiate suitable land tenure;
- unable to negotiate on current terms (better than commercial rates);
- injury to employees or member of the public caused by property malfunction; and
- loss of a critical site leading to operational impacts.

The primary types of risk that impact fleet/plant assets are:

- fleet/plant not delivered to specifications;
- fleet/plant not maintained to recommended manufacturers service intervals;
- cost increases due to fleet/plant specification changes;
- third party impacts and accidents; and
- inappropriate asset use (human error);

The primary types of risk that impact SCADA and RTS assets are:

- asset failure (e.g. corrosion, leakage, mechanical failure, electronic failure);
- operational risks (e.g. human error);
- third-party issues (e.g. cyber attack, telecommunications failure, physical security breach);
- regulatory or reputational risks; and
- asset lifecycle risks (technological obsolescence).

A summary of the asset management approach for each asset class is provided in the following sections.

12.2 PROPERTY

Jemena manages a diverse portfolio of property assets in support of its portfolio of Australian energy and utility asset businesses. The property asset class is divided into two sub-classes:

- **Network properties –** land held for the construction, operation and maintenance of network/pipeline assets; and
- **Non network properties –** depots, emergency equipment holding areas, offices, accommodation and contaminated sites.

Jemena applies a strict set of principles when managing network and non-network property. The principles require all property decisions to:

- be financially sustainable;
- be cognisant of employee impacts;
- promote co-location and collaboration;
- consider proximity to Jemena assets; and
- facilitate Jemena's future operating model.

Asset management strategies for network and non-network properties are summarised below. For more detail, refer to the Property Asset Class Strategy.

12.2.1 NETWORK PROPERTY

Utility service providers require rights on parcels of land where network assets are required to be constructed and maintained. These rights protect Jemena's ability to install assets on the land and to access and maintain those assets.

Network property consists of primarily land only. Where JGN assets are housed within a building, Jemena's usual practice is to ensure responsibility for maintaining the building remains with the owner of the land. Jemena has visibility of both permanent and temporary property rights. Permanent rights include title (ownership) and easements registered on title. Temporary rights include leases and licenses. These property rights comprise the property assets in relation to network property.

Land crossing agreements, both in Jemena's favour and in a third party's favour, are also negotiated and maintained by the Property Portfolio Team.

Jemena acquires properties as required by its asset business. The requirement for property may be initiated by a customer request for our services or a Jemena requirement to extend or maintain our networks/pipelines. The different property rights are:

- **Freehold (Title)** – a title is an official record detailing the ownership of a parcel of land. The land is held in fee simple by the relevant Jemena entity. This is the strongest form of land tenure available in Australia and provides exclusive possession amongst other rights and responsibilities.

- **Easement** – an easement provides for enduring rights over land held by a third party. Typically, the type of rights conferred via easement will include rights of access and egress, restriction on land uses and activity rights for any infrastructure to remain on the land and rights to undertake necessary maintenance and other activities. Typically, easement rights will be registered on title and carry with the land.
- **Lease** – a lease represents an agreement between a landowner and another party to rent a portion of or a parcel of land. A lease arrangement is characterised by exclusive possession, duration and end date and payment of rental for the lease. It is typically registered on title and will carry with the land.
- **Licence** – a licence represents an agreement between a landowner and another party to use a parcel of land for a specified time. It is usually not registered on title and is a non enduring right.
- **Land crossing agreement** – a land crossing agreement is a form of consent and licence. It is an agreement between two or more parties for the joint use of a parcel of land, commonly used where assets intersect (i.e. a road crosses over a gas pipeline). These documents are not registered on title.

The acquisition strategy for network property tenure is largely driven by the asset on site and the business requirements for the site. Jemena's preference is to own any critical properties e.g. TRS sites, to reduce the tenure risk that these sites present to the business.

The following table shows the number of Jemena network sites.

Table 12-1: Jemena network sites (at 31 March 2019)

Jemena asset business	No. of owned network sites	No. of leased/licenced network sites	No. of easements	No. of land crossing agreements
JGN	19	>525	>20,000	>20

12.2.1.1 Performance and requirements

Network sites tend to be land, therefore asset performance is not applicable. No new land requirements for network assets have been identified during the forthcoming Access Arrangement period.[10]

12.2.2 NON-NETWORK PROPERTY

Non-network property includes properties held for the purpose of storing equipment and accommodating employees and contractors to operate the Jemena business. Non network properties include emergency equipment holding areas (**EEHA**), depots and corporate offices. Jemena acquires and maintains these properties as required by the business.

The different types of property tenure rights utilised for non-network properties are leased or freehold. The acquisition strategy for non-network property tenure is to own critical sites, where financially sustainable to do so.

The following table lists Jemena's **non-network** sites.

Table 12-2: JGN non-network sites (at 31 March 2019)

State	Address	Tenure	Asset	Function
NSW	Bathurst, 2 & 3 Bentinck St	Lease	JGN	Depot

[10] Note JGN plans to acquire a site in Bathurst during 2020-25 to accommodate a new depot/hub. However, this will fall under the non-network property asset sub-class.

State	Address	Tenure	Asset	Function
NSW	Brookvale, 5/26 Wattle Rd	Leased	JGN	EEHA
NSW	Cardiff, 5A Pennant St	Owned	JGN	Depot
NSW	Dubbo, 1/54 Mountbatten Dve	Leased	JGN	Depot
NSW	Pemulway, 4 Bellevue Circuit	Owned	JGN	Depot
NSW	Griffith, 7/16-24 Whybrow St	Leased	JGN	Depot
NSW	North Sydney, L9-15, 99 Walker St	Leased	JGN	Office
NSW	Old Guildford, 16 Donald St	Owned	JGN	Other
NSW	Punchbowl, 16/109a Bonds Rd	Leased	JGN	EEHA
NSW	Tuggerah, 5,15-17 Ace Cres	Leased	JGN	EEHA
NSW	Young, 17 Mackenzie St	Leased	JGN	Depot
NSW	Goulburn, 21 Gulson St	Leased	JGN	EEHA

12.2.2.1 Performance and requirements

The current condition of our leased non-network critical facilities is very good. However periodic refurbishment and upgrade is required to the offices in North Sydney (99 Walker Street), Melbourne (567 Collins Street), Cardiff, Old Duildford and Greystanes (4 Bellevue Circuit) within the next seven years as part of the current lease agreements.

The condition of all major sites is recorded via the development of lifecycle management plans. Where a site is in poor condition, JGN will either refurbish that site (where the property is owned) or seek alternative property arrangements (where the property is leased). Site condition is assessed against workplace health and safety requirements as well as ongoing operational requirements.

Details of current property condition and high level requirements is provided in the Property Asset Class Strategy. Key non-network property projects that are required to be completed/commenced during 2019-25 are summarised in Table 12–3.

Table 12–3: Key non-network projects 2019-2025

Year	Project name	Project description
2020	Old Guildford Refurbishment	Compliance based refurbishments, including: • upgrade to fire systems; • roof replacement and re-guttering; • services contingency; • lighting upgrade; • generator installation; and office upgrade.
2020	Cardiff Refurbishment	Compliance based refurbishments, including: • upgrade to fire systems; • roof replacement and re-guttering; • services contingency; • office upgrade; and • lighting upgrade.

Year	Project name	Project description
2021	Bathurst Depot	Purchase land and construct a purpose-built depot and training facility, similar to a smaller Greystanes Depot, which will be used as a training and meeting hub for the wider regions of the Central West, encompassing Dubbo, Orange, Parkes, Forbes and Lithgow.
2023	Greystanes Refurbishment	Compliance based refurbishments, including: • end of life replacements for mechanical, electrical, fire and hydraulics systems; • replacement of building security systems due to end of life; • training pits, compressors and pressure vessels; and • maintaining office accommodation standards and environments.
2023	99 Walker Refurbishment	Compliance based refurbishments, including: • end of life replacements for mechanical, electrical, • fire and hydraulics systems; • replacement of building security systems due to end of life; and • maintaining office accommodation standards and environments
2024	567 Collins Refurbishment	Compliance based refurbishments, including: • end of life replacements for mechanical, electrical, • fire and hydraulics systems; • replacement of building security systems due to end of life; and • maintaining office accommodation standards and environments

12.3 FLEET

Jemena owns, leases and operates various fleet and plant that are built specifically to meet the requirements of various business units. Responsibility for fleet and plant is shared between Jemena's Fleet Management Team and a contracted fleet management company. The Jemena Fleet Services Guideline sets out responsibilities for fleet and plant related activities, including:

- budgeting, asset strategy, fleet criteria specification and endorsement of purchases and disposals within five-year forecasts;
- procurement, management and disposal of fleet and plant equipment; and
- fleet servicing and maintenance.

The following table summarises the JGN fleet and plant numbers at 31 December 2018.

Table 12-4: JGN fleet assets (at 31 December 2018)

Heavy commercial vehicles	Light commercial vehicles	Material Handling	Plant	Passenger vehicles	Total
15	**216**	**17**	**48**	**47**	**343**

Fleet and plant assets are managed in accordance with Jemena's Fleet asset management principles, outlined below:

- **Vehicles selected are fit for purpose** - it is essential that all vehicles are safe, reliable and suitable for the task to which they are applied.
- **Achieving the lowest sustainable cost per kilometre –** we aims to achieve the lowest cost per kilometre when managing fleet and plant assets, while ensuring assets are safe and fit for purpose. We assess all fleet related costs to determine the most efficient cost per kilometre.
- **Ownership is the preferred purchase approach** – the advantages and disadvantages of fleet ownership versus fleet leasing have been evaluated and it has been concluded that ownership provides the most cost-effective fleet solution for Jemena.

The asset lifecycle is based on age of vehicle, kilometres travelled and/or hours of usage for mobile plant. We will continue to monitor the whole of life vehicle costs, and will periodically re-test and compare the whole of life vehicle ownership costs versus leasing costs. Previously leased vehicles are purchased and capitalised as part of the replacement program.

For more detail on our fleet management approach, refer to the Fleet Asset Class Strategy.

12.3.1.1 Performance and requirements

Assets are replaced subject to ongoing performance and condition assessments. The following table summarises the maintenance and replacement cycles for the different types of fleet and plant assets.

Table 12-5: Summary of fleet and plant requirements, maintenance and replacement cycles

Vehicle type	Purpose	Maintenance cycle	Replacement
Heavy commercial vehicle	The vehicles outlined within this category range from t5 tonnes through to the 22.5 tonnes. The majority of all the heavy commercial vehicles reside at the depots and are returned each day. • Construction/Maintenance Trucks – (7.5 tonne truck fitted out with shelving/cupboards • Large Task Trucks – (22.5 tonne truck fitted out with a mounted crane and heavy duty tray) • Gas emergency response – crane trucks • General tray trucks	Every 3 months	All heavy commercial vehicles that have cranes attached must be replaced at 9 or 10 years but prior to the regulatory 10-year anniversary as stated within the Australian Standards.[11]
Plant/Forklifts	Plant comprises of yard crane, backhoes, and trailer-mounted compressors /generators. These units are assigned to respective depots	Serviced as per manufacturer's instructions	Ad-hoc basis
Light Commercial Vehicle - LCV	The light commercial vehicle specifications range from the off the shelf utility/van to a specific fit for purpose fit out.	Serviced as per manufacturer's instructions	Every 150,000 km
Passenger Vehicle - PV	Passenger vehicles are assigned to Operational Manager as site based pool vehicles that support field resources, corporate staff and project planners / managers Vehicles assigned to a role for the purpose of emergency management or operating can return to	Serviced as per manufacturer's instructions	Every 150,000 km

[11] Australian Standards AS1418 – Crane, Hoist and Winches and AS2550 - Crane, Hoist and Winches – Safe Use.

	primary residence to be able to respond to on call availability duties from time to time. Vehicles assigned to corporate staff and planners reside at the respective depots and are returned each day.		
Trailers	JGN has trailers of various specifications.	Serviced as per manufacturer's instructions	10 – 15 years If trailer is deemed fit for purpose and safe to use it is recommended that trailer is used for a further 12 months.

12.4 SCADA AND REAL TIME SYSTEMS

SCADA and RTS assets are critical to the achievement of Jemena's business objectives. They facilitate the safe, reliable and secure operation of our network and capture, store and disseminate data for the purposes of market and network operations, network planning, billing and reporting. Table 12–6 shows Jemena's SCADA and RTS assets.

Table 12–6: Overview of Jemena SCADA and RTS assets

Asset	Location	Description
OSI Pi Historian	Alexandria and EDC data centres	Jemena disseminates SCADA real time data and data logged gauging information into the OSI Pi Historian. This data is utilised by Business Analysts and the JGN Emergency Load Management System (ELMS) which provides management of emergency outages.
GENe	Mitcham and Alexandria data centres	The GENe instances provide extensive electrical model and gas management calculations for Jemena's Electrical, Gas and Water Distribution assets.
Distributed management system	Mitcham and Alexandria data centres	A collection of applications designed to monitor and control the electricity distribution network.
Meter data logger	Alexandria and EDC data centres	The system produces activity reports for measurement to determine the changes to the business. A plumber will send SMS commands for each meter change and provide a meter as left setup and new meter number for collection by the system.
On-demand pressure monitoring	Alexandria and EDC data centres	The Metretek Central provides a data logging and alert capability. Field based devices will dial in on a daily basis with data logging information or on critical transition immediately to provide alerts. SCADA & RTS maintain software which integrates the new alarms within the Metretek Central and determines when a new alert has arrived. The software will then transfer this alert to the GENe SCADA.
Oracle NMS outage management system	Primus and EDC Data Centre	A set of tools to support the customers' ability to understand the service Jemena is delivering them. Jemena utilises the Oracle NMS OMS infrastructure and OUBI Data Warehouse to manage its outages and reporting requirements.

The SCADA and RTS asset class strategy mirrors Jemena's IT strategy, which is to replace end-of-life systems as necessary and economical to do so, with a preference to consolidate core technologies into single platforms where possible. This enables us to be more efficient, and have scalable systems while maintaining the quality, reliability and security of supply.

Our preference is to procure and maintain SCADA systems and RTS that leverage[12] corporate IT asset systems, strategies and contracts. Moreover, we employ corporate policies and standards to ensure all technology is fit-for-purpose.

SCADA and RTS assets are managed in accordance with the following principles:

- **Jemena prefers virtualisation infrastructure** - this reduces the number of servers required to manage the SCADA and RTS functionality and better support the backup and recovery processes;
- **Jemena prefers Windows infrastructure** – this allows us to better utilise the purchasing contracts in place with Windows support and management;
- **SCADA platforms should be kept up-to-date** – this allows cyber security requirements to be met and functional changes to be supported and maintained;
- **SCADA and RTS assets will be supplied via competitive tender** – this allows us to take advantage of bulk contracts for supply and support arrangements to reduce the total cost of ownership of these systems.
- **Jemena prefers to reduce the number of applications and server sets to a minimum** – this allows us to reduce resource and skills management required to maintain these additional applications.
- **Jemena will provide sufficient data management in line with criticality and privacy requirements** – this takes into account ring fencing requirements, data ownership, storage, security and disposal.
- **Jemena will provide supporting systems to support SCADA and RTS centrally –** this provide highly available redundant system, while maintaining cyber defences and data management responsibilities.
- **Asset management will be certified to both ISO 55001 and ISO 27001** – this ensures our asset and data management practices are consistent with good practice.

12.4.1.1 Performance and requirements

During the 2015-20 Access Arrangement period, we made a major investment in SCADA. We made more comprehensive upgrades to replace the underpinning SCADA platform. We made this change to improve our real-time monitoring of the network as well as the reporting and handling of outages, ultimately enhancing the safety of our network.

We undertake daily checks for issues with hardware, operating systems, database, SCADA and RTS applications and all supporting applications, with six-monthly testing of critical systems. As such, the condition of the asset class is generally good.

Due to the upgrades we have already made, our 2020 Plan does not include any significant investments in SCADA over the 2020-25 period.

[12] Jemena's Operational Technology (OT) network infrastructure and corporate IT network infrastructure remain separate.