Jemena Gas Networks (NSW) Ltd

Measurement Asset Class Strategy

Table of contents

List of tables

List of figures

List of appendices

Abbreviations

ABS	Asset Business Strategy
ACS	Asset Class Strategy
AER	Australian Energy Regulator
AIP	Asset Investment Plan
AMS	Asset Management System
APAIR	Asset Performance and Integrity Review
COWP	Capital and Operation Work Plan
ENP	Embedded Network Provider
FLE	Field Life Extension
IT	Information Technology
JGN	Jemena Gas Networks
TRS	Trunk Receiving Stations
UAG	Unaccounted for Gas

Asset class snapshot

Asset sub-classes

- Gas measurement equipment
- Water measurement equipment
- Data collection equipment
- Gas quality measurement equipment

Expenditure drivers

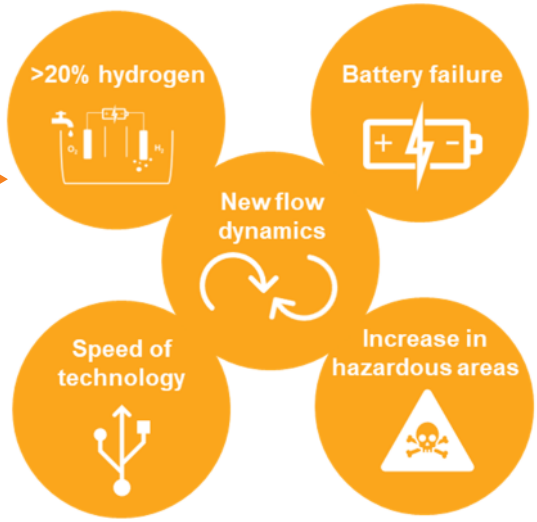
Asset management considerations

- Current or upcoming obsolescence
- Contemporary technologies and innovations
- Unaccounted for gas accuracy
- Emissions reduction

Performance

- Estimated customer reads
- Consecutive meter reads
- Risks identified in FSA
- Defect rate
- Compliance with prevailing standards
- Maintenance complete
- Testing plan compliance
- Optimised field life extension
- Opex budget control
- Ready for biomethane and 10% H_2
- Suite of renewable gas KPI's
- Reduced UAG
- TBD Capex per new connection / dwelling

Emerging risks and opportunities



Key initiatives

- Improving meter reading in chronic no access locations
- Ultrasonic, digital and understanding impact of >10% hydrogen blend on metering
- Connection of renewable gas suppliers
- Hydraulic network modelling for new injection points
- Working in hazardous areas

PART A: Strategy and asset management principles

1. Purpose of this document

The purpose of this Asset Class Strategy (**ACS**) is to explain the approach and principal methods by which the measurement asset class contributes to delivering the Jemena Gas Networks (**JGN**) asset objectives, as defined in the JGN Asset Business Strategy (**ABS**) and driven by the overarching Jemena Network Strategy. The ACS is reviewed and updated annually and considers up to a 20-year outlook for the asset class.

Figure 1–1: Summary of JGN asset objectives and asset management principles

As shown in Figure 1–1, the Jemena Networks Strategy sets out what we want to achieve with our network assets (both gas and electricity) as Group. This then informs our JGN asset objectives, which outline what we want to achieve with our gas network assets. We then have a set of asset management principles, that inform the approach we will take to achieving our JGN asset objectives.

The role of the ACS is to bring these together and explain at a high level of **how** we will manage each asset class. From here we can develop the various business cases and works programs that form our annual work plan, budgets, and ongoing expenditure forecasts.

The Measurement ACS includes information about each asset sub-class, including:

- **Drivers for expenditure** – the key asset management drivers that inform why and when we invest in our measurement assets
- **Asset management considerations** – the important factors we consider when determining when and how to invest in our measurement assets
- **Asset performance** – information about performance, condition, and service levels
- **Emerging risks and priorities** – identified threats, opportunities, strengths and weakness that we need to be aware of and factor into our measurement asset management plans
- **Key initiatives** – taking all of the above into consideration, the ACS provides a high level summary of key initiatives / asset management practices we will undertake to ensure our measurement assets meet the JGN asset objectives

The ACS also includes appendices containing contextual information on the asset class profile. This is the detailed information about the type, specifications, life expectancy and age profile of the measurement asset sub-class in service across the JGN distribution network.

1.1 Structure of this ACS

Main body

The main body of ACS is structured into three broad parts, designed to allow the document to be reviewed and updated easily:

- **Part A: Strategy and asset management principles** – this section makes the link between the ACS and the overarching Jemena Network Strategy, summarising the asset class objectives, expenditure drivers and governance process for managing the measurement assets.

  The information in Part A should be relatively static, only changing when there is a material change to the overarching Jemena strategies. While Part A should be revisited as part of the annual ACS review, it is unlikely to require significant updates, and should be reserved for a major review every five years.

- **Part B: Asset performance** – this section summarises the current performance and risk associated with the asset class. It also includes a summary of asset quantities as at the end of the last full calendar year. Part B is essentially a summary of the critical information from the annual Asset Performance and Integrity Review (**APAIR**), as well as the relevant asset risk register for each asset class.

  The information in Part B should be high level only, with the finer detail on asset performance and risk available in the related APAIR and risk register. Part B should be reviewed and updated annually, to reflect the critical information from these two documents.

- **Part C: Emerging risks and priorities** – this section summarises any risk or opportunities that we need to be aware of when managing the asset class. This may include, for example; technical obsolescence; pending supply or specification changes; government policy; or technical developments/innovation.

  Part C should also include a high-level summary of the current key initiatives or asset management approach being applied to the asset class. It does not need to go into detail on specific projects or costing (as this information is contained in the individual business cases and Capital and Operating Work Plan (**COWP**)), it just needs to provide the Asset Class Owner a high-level view of the strategies we are undertaking.

  The information in Part C should be reviewed and updated annually, to make sure it still reflects the emerging risks, priorities and current projects.

Appendices

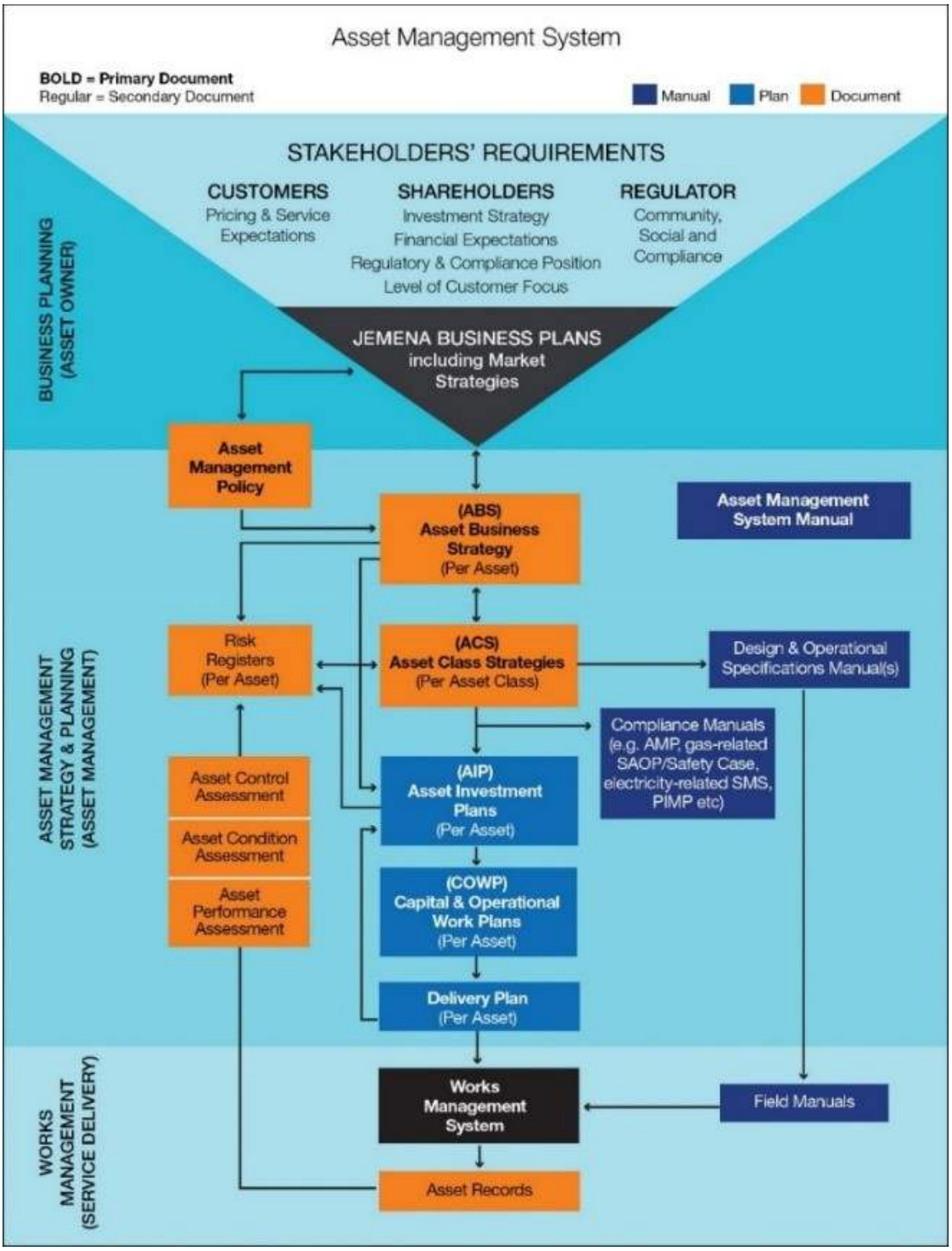
The ACS also includes appendices that contain additional exhaustive information on the asset class type, failure modes, lifecycle management, regulatory and legislative framework, and information requirements. The information in these appendices is relatively static in nature and should not require an annual update. It should be reserved for a major review every five years.

Much of the information contained in the appendices is drawn from other parts and documents within our Asset Management System (**AMS**). It is collated in the ACS to provide a central source of useful and contextual information for the Asset Class Owner. It is also retained here to provide line of sight across our AMS and demonstrate consistency with the holistic asset management good practice contemplated by the ISO 55001 asset management standard.

1.2 Asset Management System

The relationship between the ABS and other documents within JGN's Asset Management System is illustrated in Figure 1-2.

Figure 1-2: JGN Asset Management System document hierarchy



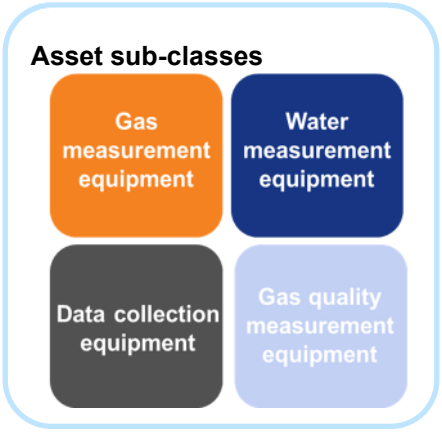
A detailed description of JGN's asset management system and its constituent parts is available in the Jemena Asset Management System Manual[1].

[1] JEM AM MA 0001 Jemena Asset Management System Manual

2. Description of assets covered

The measurement ACS covers the following asset sub-classes:

- gas measurement equipment (excludes customer pressure control);
- water meters[2];
- data collection equipment (includes remote electronic devices but excludes shared Information Technology (IT) and communication equipment); and
- gas quality measurement equipment (including gas chromatographs, hydrocarbon analysers and water dewpoint analysers installed at trunk receiving stations (TRS).



The red dotted line in Figure 2–1 shows how the measurement asset class fit within the broader gas distribution network.

Figure 2–1: Schematic of JGN asset classes – measurement assets

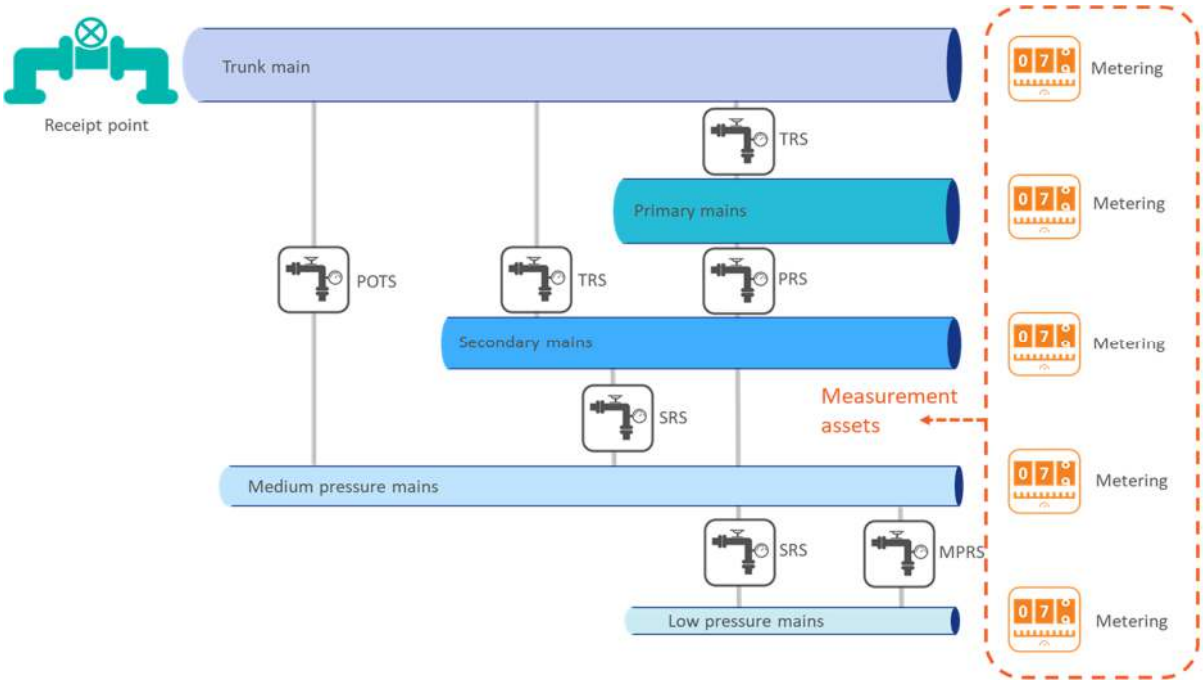


Table 2-1 summarises each measurement asset sub-class, what the assets do, and the different types of measurement assets.

Table 2-1: Summary of key measurement asset types

Asset sub-class	Description	Element
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	Diaphragm meters
		Rotary meters
		Turbine meters
		Ultrasonic meters

[2] JGN uses water measurement as a proxy for gas measurement where connections are shared between customers and gas is required to be allocated. For this purpose, the share of water consumption is a relatively accurate proxy for the amount of gas consumed and is able to be used to allocate gas consumption.

Asset sub-class	Description	Element
	valves, meter bracket and communications equipment	Regulators (excluding high pressure secondary pressure and boundary gas regulators)
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	Water meters
Data collection equipment	JGN uses data collection equipment to record and transmit metering and gas quality data across the network	Tariff meter data loggers
		Modems/Gateways
		Tariff Radio Frequency data loggers
		Volume correctors
		I&C Modems
		Commercial pulse accumulators
		Communications sets (includes telephone lines, wires and earthing, intrinsic safety barriers, telephone suppressors)
Gas quality measurement equipment	This equipment measures and communicates gas quality information to ensure JGN distributes gas that meets contractual requirements and gas standards	Gas chromatographs
		Hydrocarbon dewpoint analysers
		Water dewpoint analysers
		Odorant analysers

The quantity of each types of asset in our network is continually changing. The number of each different type of asset as at the end of the last calendar year is summarised in Part B of this ACS.

A detailed asset description, along with failure modes and our lifecycle management methodologies, is provided in Appendix B.

3. Strategy and asset management principles

3.1 Alignment of asset objectives

The measurement asset class objectives are designed to support the JGN asset objectives, which are detailed in the JGN Asset Business Strategy (**ABS**). The measurement asset class objectives are designed to align with the JGN asset objectives. We have established measures and targets against which we can measure our performance. Table 3-1 provides a line of sight between the overall JGN objectives, measurement objectives and shows the measures and targets for each.

Table 3-1: Measurement asset class objectives

JGN asset objective	Measurement asset class objective	Measure	Target
Meet customers' service expectations	Maintain customer read estimations within reasonable limits	Estimated customer reads	<5.93%[3]
Maintain asset safety, reliability and compliance	Maintain asset integrity and targeted risk levels	Risks identified in FSA – measurement assets	All risks at targeted levels
		Defect rate	Weighted average of sub asset classes <1.00%
	Maintain compliance with legislative/regulatory requirements	Ensure measurement equipment is compliant with prevailing standards	100%
		Measurement maintenance completed	≥95%
		Testing plan compliance	100%
Reduce capital investment intensity	Reduce the cost of investing in and maintaining measurement assets, without compromising risk	Optimised Field Life Extension	491,728 meters >15 years
Optimise operational spend		Opex budget control	Opex costs at or below allowance level
Facilitate net zero for JGN and our customers	Renewable gas readiness	Measurement assets ready for Biomethane 100% & H_2 10%	100%
	Renewable gas readiness	Develop KPIs	By Q3 2024
	Reduce fugitive emissions	Unaccounted for gas	<3.02%
Increase network competitiveness to remain sustainable and viable	Downward pressure on the cost of new measurement equipment	Capex per new connection / dwelling	Connection costs at or below allowance level

3.2 Asset management principles

As detailed in the ABS and JGN-10 strategies, the operating environment and stakeholder expectations are crucial inputs into how we operate and invest in the network. External factors, including regulations, technical standards, technological advances, and customer requirements are regularly evolving, which means we must regularly review and monitor the strategic drivers for investment.

[3] The estimated customer read target is 5.93% in line with the target from the Regulator as part of the 2020-2025 Access Arrangement.

The ABS identifies the following principles that influence how we manage our assets. A summary of how these principles relate to the measurement asset class is provided in the table below.

Table 3–2: How the ABS asset management principles apply to the measurement asset class

ABS asset management principles	Summary	Measurement ACS
Prioritise safety and service	Our priority is to make certain our assets are safe, provide the service or function our customers and staff need	Design standards in alignment with Australian Standards are in place to ensure JGN has safe and compliant metering equipment
Listen to our customers and stakeholders	We will listen to customer feedback and seek to offer them the network services they want, working within the regulatory and legislative framework set by our stakeholders	In addition to safe installations, customers have a desire for readable and accurate measurement information.
Maximise asset value	Where possible we will seek to change the investment triggers for replacement/rehabilitation of assets such as meters, facilities, pipelines and network pressure mains, with a view to extending asset life where safe and prudent to do so	We maximise asset life through effective use of Field Life Extension (FLE) programs as well as ongoing assessments of repair vs replacement.
Net zero	We will pursue opportunities to use our assets, or connect new assets, to help reduce our own or our customers' emissions, where economically efficient to do so	We strive for the most accurate measurement possible to determine network UAG, and maintain measurement equipment within accuracy tolerances to enable accurate customer readings. Measurement assets are ready for Biomethane and up to 10% hydrogen blends.
Incremental approach	We will adopt an incremental approach to modernising and adapting the network, introducing new asset types as older assets fall due for replacement, avoiding large-scale, high-cost replacement programs where practicable	Where prudent and cost effective we will incrementally replace components with >10% hydrogen blend capable materials. We will install new equipment such that hazardous area expansion issues have been proactively mitigated.
Use data to inform decisions	We will seek to inform our asset management practices with better data, for example using more sophisticated leak detection data to target mains and services replacement	Ongoing gas quality and measurement data is critical to asset management decisions. This area is under constant review, especially as network hydraulic modelling evolves with new renewable gas injection points.
Pursue innovation	We will follow technological advancements and investigate how we can apply innovative solutions to ensure the gas network remains valued by customers	As biomethane and hydrogen becomes more commonplace, renewable ready measurement equipment and technology is quickly becoming more cost effective and is under constant review.

3.3 Expenditure drivers and asset management considerations

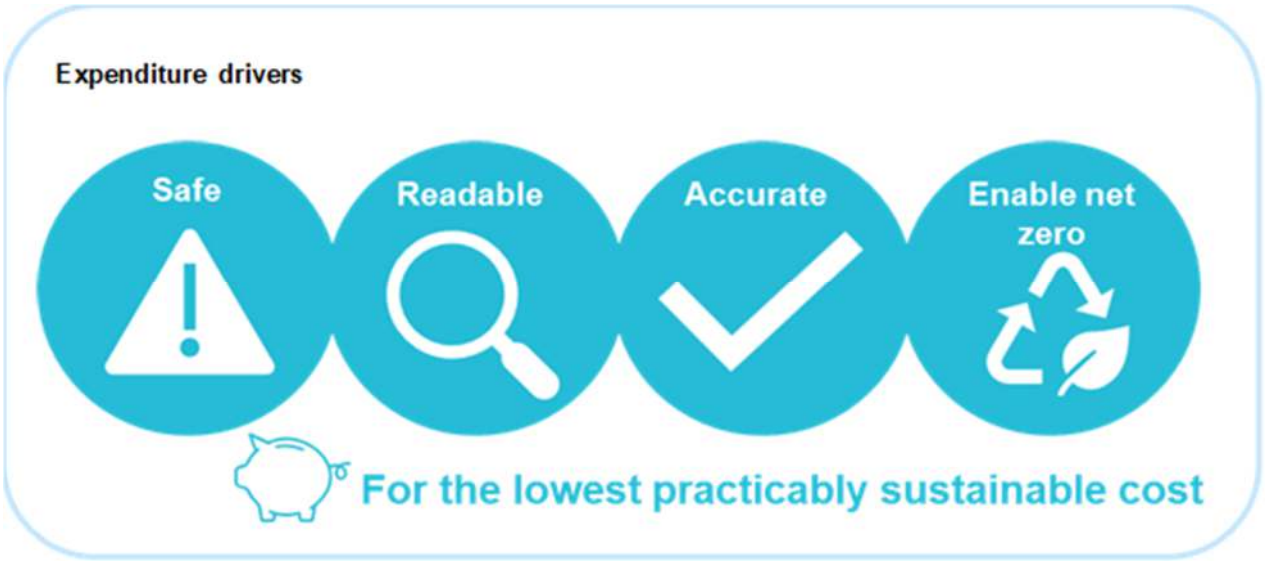
Measurement assets are necessary for accurate and timely billing services, understanding our fugitive emissions and are critical to deliver customer performance KPIs and compliance with JGN's legislative requirements.

Investment in the measurement asset class is largely driven by the volume of new connections, as well as the timely replacement of existing meters. We are obligated to connect new customers who request a gas network connection. New connections require the acquisition and installation of a new measurement asset.

Once measurements are in service, as prudent asset managers our role is to ensure these assets continue to function safely, and remain fit for purpose, replacing or refurbishing them in a timely manner. Our aim is to manage our various asset classes for the lowest practicably sustainable cost.

Figure 3–1 summarises the key drivers for expenditure in measurement asset replacement and/or refurbishment.

Figure 3–1: Drivers of expenditure in measurement asset replacement/refurbishment



These expenditure drivers are described further below:

- **Safe** – It is vital our measurement assets remain safe. We replace measurement assets when they pose an unacceptable safety risk. This may be due to deterioration in asset performance, or a change in the local environment that increases the risk associated with asset failure and/or gas leaks.
- **Readable** – Our measurement assets must be readable. We have an obligation to provide meter reads at least once every 12 months. While estimated reads are permissible in the short-term, it is imperative we can read measurement assets -either remotely or physically – to ensure gas network customers receive accurate bills, and we have accurate data on gas network consumption. We will therefore incur expenditure to enable measurement assets are readable and remain readable throughout their useful life. This may involve asset relocation or installation of remote metering or monitoring technology.
- **Accurate** – Our measurement assets must be accurate, within acceptable tolerances. We therefore periodically test the accuracy of measurement assets, and replace/refurbish these assets and related asset families that are performing outside of tolerance thresholds.
- **Enable net zero** – We have a responsibility under the Safeguard Mechanism and the Government's Net Zero 2050 targets to reduce our greenhouse gas emissions, and to use our network assets to help customers reduce theirs. The largest source of greenhouse gas emissions from our network is fugitive gas. Therefore, there is an opportunity to use our measurement assets to reduce or better track our greenhouse gas emissions we will consider investment. Similarly, where renewable or lower-emissions gas are introduced into the gas distribution system, we may also need to invest in the appropriate measurement assets to ensure they remain safe and that gas volumes can be measured accurately.

Cost and affordability is always a factor. When incurring expenditure against these drivers, our aim is always to address the issue at the lowest practicable sustainable cost. Note this may not always mean the cheapest option. In making our investment decisions we consider the longer-term use of the assets in question, along with a suite of additional considerations.

For measurement assets, key considerations when incurring expenditure are:

- **Current or upcoming obsolescence** – can we obtain replacement parts, are the assets still supported by the original equipment manufacturer, and if so, for how long?

- **Contemporary technologies and innovations** – is a like-for-like replacement the best option? Is there an alternative technical solution or non-network solution that is a more efficient alternative. What new developments are likely to emerge during the asset's useful life?
- **Unaccounted for gas accuracy** – networks will always leak, vent, or record variances between the amount of gas being distributed and the amount of gas being consumed. Is there a way of measuring UAG more accurately?
- **Emissions reduction** – is there a lower-emissions alternative and is the incremental cost of this alternative a prudent and efficient option?

Taking these considerations, our expenditure drivers, and our asset objectives into account, we select the most prudent and efficient strategy for managing each class and sub-class of asset.

3.4 Asset strategies

Our strategy for existing meters is to prudently extend the life of measurement assets through Field Life Extension (**FLE**) programmes, and provided the assets meet operational and performance measures, we do not enforce an artificial replacement age.

To meet metering asset accuracy requirements, JGN monitors and assesses each measurement asset type by population to identify and test performance and compliance with relevant legislative requirements in accordance with *AS 4944: Gas Meters – In-service Compliance Testing*. Approximately 0.001% of JGN's measurement equipment is tested each year.

Based on the analysis of defective rates by age, the decision is to replace all residential meters at the 35-year mark without further life extension tests. It is expected to replace ~100K meters reaching this age in the 2025-2030 Access Arrangement period. The new methodology involves proactive replacement of meters to manage defects and prevent safety risks. This is a shift from the previous practice of replacing meters reactively upon defect detection. This proactive approach is designed to avoid higher costs, planning challenges, and safety risks associated with reactive management of a large volume of failing meters. The strategy change has evolved to prioritize proactive replacement of meters based on age and model-specific data, aiming to mitigate risks and manage costs more effectively.

We maintain the performance of our assets through corrective maintenance to the extent it makes economic sense to repair, rather than replace assets. As measurement assets age, the amount of expenditure required to maintain acceptable performance increases. At the point where the cost of corrective maintenance outweighs the benefits, or the asset fails, we replace our assets.

Where measurement assets are no longer fit for purpose, an assessment is undertaken to cost effectively install renewable gas ready assets or components. For measurement assets this is pertinent to those meters that may be subject to greater than a 10% hydrogen gas blend. However, greater than 10% hydrogen blend is not expected to materialise within the next 5 years, and the current fleet of meters can manage up to 10% hydrogen, as well as 100% biomethane.

Measurement equipment is ready for renewable gas in the short term, however with the increasing volume of renewable gas and the potential to have greater than 10% hydrogen in the network after 2030, we are taking prudent steps to review the equipment specifications when assets fail, or are replaced through end of life programs. If the incremental cost of replacing components or meters with hydrogen ready equipment is reasonable, then it is installed in preference to a like for like unit.

3.5 ACS planning horizons

The ACS consider three forecasting horizons when planning, with the two-year COWP being the most accurate. The AIP taking a 7-year view, and a 20-year outlook that ensures planning and project decisions are in the long term interest of customers, and do not sacrifice the long term for short term gains that are not considering whole of asset life.

Over time, planning profiles have been informed by the objectives outlined in the ABS as well as customer expectations, JGN's regulatory and operating environments, asset condition and risk. The forecast beyond two years is more subject to change as these factors evolve, and even more so beyond year seven[4]. Therefore, the (longer term) forecast is indicative only and represents the projects required for this asset class to continue to support the JGN objectives.

3.6 Governance

This ACS is reviewed to ensure ongoing alignment with the Jemena Network Strategy and the asset objectives outlined in the ABS, and to account for any additional asset performance and risk information. Table 3-3 outlines the RASCI for this ACS.

Table 3-3: RASCI Governance Table for ACS

Element	Descriptor	Group/Person
Responsibility	Who is responsible for carrying out the entrusted task?	Gas Asset & Operations - Planning and Optimisation
Accountable (Approval)	Who is responsible for the whole task and who is responsible for what has been done?	GM Gas Asset & Operations
Support	Who provides support during the implementation of the activity / process / service?	Gas Services Gas Asset & Operations - Planning and Optimisation
Consultation	Who can provide valuable advice or consultation for the task?	Customer & Markets Gas Asset & Operations - Asset Investment Gas Services Gas Asset & Operations – Risk & Assurance
Inform	Who should be informed about the task progress or the decisions in the task?	EGM Networks

[4] Seven years is the planning horizon of the AIP.

PART B: Asset performance

4. Asset quantities

The volume of measurement assets in our gas distribution network is continually changing as new connections come on board and existing assets are replaced. Table 4–1 provides an overview of measurement asset quantities as at the end of the most recent calendar year prior to developing this version of the ACS.

For the latest information on asset quantities, refer to ECMS. For further information on current asset performance, refer to the Measurement APAIR.

Table 4–1: Measurement asset quantities at 31 December 2022

Asset sub-class	Element	Quantity (2022)
Gas measurement equipment	Diaphragm meters	~1.5 million
	Rotary meters	2,566
	Turbine meters	83
	I&C Ultrasonic meters	6
	Regulators (excluding high pressure secondary pressure and boundary gas regulators)	~1.5 million
Water measurement equipment	Water meters	256,551
Data collection equipment	Tariff meter data loggers	17,000
	Modems	~5,500
	Switch connections	~434,081
	Volume correctors	300
	Commercial pulse accumulators	200
	Communications sets (includes telephone lines, wires and earthing, intrinsic safety barriers, telephone suppressors)	500
Gas quality measurement equipment	Gas chromatographs	10
	Hydrocarbon dewpoint analysers	1
	Water dewpoint analysers	1
	Odorant analysers	1

5. Asset performance

Performance across the measurement asset class is generally good. We are currently meeting or exceeding 12 out of the 13 measurement asset performance indicators, and have actions in place to address underperformance against our estimated customer reads performance measure.

Detailed information on performance in each asset class, including detailed condition assessment is provided in the Measurement APAIR. For the purpose of this ACS, Table 1-1 provides a summary of current performance against indicators across the measurement asset class.

Table 5–1: Measurement asset class performance against objectives and indicators

Asset Objectives[5]	Asset Class Objective	Measure	Target	Current performance	
Meet customers service expectations	Maintain customer read estimations within reasonable limits	Estimated customer reads	<5.93%	7.9% (RY23) Walk-by = 8.6% MDL = 5.8%	
		Consecutive estimated meter reads	4.9%	5.5% (RY23)	
Maintain asset safety, reliability and compliance	Maintain asset integrity and targeted risk levels	Risks identified in FSA – measurement assets	All risks at targeted levels	Risks identified during the 2019/20 FSAs for measurement have been reviewed annually through JCARS and are rated within current levels Actions and recommendations to the FSA - http://ecms/otcs/cs.exe?func=ll&objId=317753304&objAction=viewheader	
		Defect rate	Weighted average of sub asset classes <1.00%	• All meters: 0.4% Note - • Water meters: 1.5%	
	Maintain compliance with legislative/ regulatory requirements	Ensure measurement equipment is compliant with prevailing standards	100%	JGN meets the requirements of AS 4944 for meter accuracy compliance Current level of compliance is 100%	
		Measurement maintenance completed	≥95%	97% of planned preventative maintenance activities were completed	
		Testing plan compliance	100%	Current level of compliance is 100%	
Reduce capital	Reduce the cost of investing in	Optimised Field Life Extension	Deliver 100% of FLE	Current level of compliance is 100%	

[5] Asset Business Strategy documented objectives

Asset Objectives[5]	Asset Class Objective	Measure	Target	Current performance	
investment intensity	and maintaining measurement assets, without compromising risk		testing program	With the test data in CY23, 1,5% of the total aged meters were tested. 85.3% meters can be extended their life in the service by 3 or 5 years. Only 14.7% meters has to be replaced due to failure of the statistical sampling test according to AS4944.	
Optimise operational spend		Opex budget control	Opex costs at or below allowance level	The opex program was delivered within budget	
Facilitate Net Zero for JGN and customers	Renewable Gas readiness	Measurement assets ready for Biomethane 100% & H_2 10%	100%	Current measurement assets are ready for up to 10% hydrogen and 100% biomethane.	 New
	Renewable Gas readiness	KPI's established	Q3 2024	Renewable gas strategy establishing and KPI's to be developed once complete.	 New
	Reduce fugitive emissions	Unaccounted for gas	<3.02%	The rolling average for UAG is 2.75%[6] and performing within expectations	

5.1 Continuous improvement recommendations

As part of the annual APAIR review, a number of recommendations for improvement are developed and captured as part of the process. Below is a summary of these recommendations and helps inform continuous improvement initiatives and projects that align with the asset class objectives.

Table 5–2: Status of continuous improvements recommendations

Sub asset	Recommendation	Status
All	Promote field failure returns to the Metering Centre and increase the return rate to > 25%. In 2022 the return rate was < 10%.	Ongoing Awareness at Operational forums and a Tech Alert was released in June 2021. An initiative has been raised in CY23 to review the full E2E process and boost the return rate of field failure devices. We would like to aim for a return rate > 25%.
Residential Meters	To create a difficult to access program to address meters that are beyond their design life and need replacement.	Two new capital programs were created: RDH Difficult to access HWM RDG Difficult to access gas Specific Zinfra E2E programs are being run to improve access and replacement efficiencies.

6 At June 2023

Residential Meters	To review the assumptions of the life extension test results in correlation with the continuous monitoring of defective rates by meter model and age.	Given the significant defective rate of Email 602 after 32 years in service, it's projected to not pass the life extension 4 test and to be replaced at 30 years in service.
MDL	To review whether an internal audit of the end to end process should be conducted by Asset Risk & Assurance Review the MDL diagnosis methodology and provide recommendations to Zinfra on our requirements i.e. fault finding and reporting	In progress As part of the MDL Lifecycle project a Business Analyst will be brought in to help in process mapping and to determine the new configuration within the project. A strategic replacement solution is required in the next regulatory period to address the sole supplier risk of MDL solution.
Metretek	To develop a Metretek strategy to review the whole system and address 3G phase out. Treat as high priority Review the Power Spring platform with the Digital team to determine new solution	In progress DBRR project has been created to address the 3G obsolescence before Jun 2024. A strategic replacement solution is required in the next regulatory period to address the devices end-of-life.
Regulators	Investigate serialisation of regs and other meter assets. Ensure the reporting issue for the volume of replacement regulators is corrected. This issue is being investigated by Asset Investment.	To be actioned
Receipt and facility meters	• To determine the physical attributes such a meter model, construction year, installation year etc. for all receipt and facility meters • Review replacement strategy for receipt and facility meters	In progress All possible information on receipt and facility meters have been collected. IT ticket has been raised with the SAP team looking to add these meters into the system for tracking. A practical solution has been created and tested. Now is sitting at implementation stage. A lifecycle management strategy for these facility meters is required to develop in the next regulatory period.
I&C Diaphragm meters	• To review replacement strategy for I&C Diaphragm, rotary and turbine meters, for example, determine the maximum number of times a diaphragm/rotary/turbine meter should be refurbished before scrapping.	Action to be progressed by the Metering Centre
I&C Rotary & Turbine meters	• The strategy of analysing throughput may not be an effective approach to prolong the lifespan of a standby meter. If the meter has not had gas flowing through it for an extended period, its mechanical integrity could be compromised.	To be actioned
Residential meter	Ponds incident: • A new release of the Network Operator Rules (NOR) is planned to be released in 2024. The team working on the amendments are also considering how it should be communicated to the general public. A communication strategy is being developed and will look to target all stakeholder from builders, plumbers and architects. • New meter kit model for residential meters. Currently the sweep of meter kit models jump from	In progress by Principal Facilities Engineer

	M10 to M25D and it has been identified in conjunction with capacity planning that there would be benefit in creating a meter kit that is in-between these sizes.	
Maintenance Plans	To address the risk of meter sets not on maintenance plans, the following must be carried out: • Immediate issuing of a tech alert to all about the issue • Form a working group to determine next steps with the aim of addressing: – Immediate issue of meter sets with no maintenance plans includes; identification and action plan to address each site on an individual level Review End to End processes and implement steps to prevent further occurrences.	The following has been carried out: • Issue of a tech alert • Working group formed to address immediate need of adding maintenance plans back these sites. The following steps were agreed on: – Scoping of all sites to determine the type of planned maintenance needing to be carried out. Detailed in BC – Maintenance service orders to be raised in CY23 and CY24. Next steps: • Working group needed to review end to end process and ensure all new meter sets have maintenance plans • Before an effective solution in place, conduct a scan to check any more meter set missing the maintenance plan annually.
Maintenance Plans	Talavera Rd meter set, inadequate corrosion repair <12 months prior to new corrosion being found. • Additional audits should be carried out to provide a better picture on maintenance performance gaps • Discuss with field technicians why corrosion is left on a meter set after rectification works are completed • Determine what actions are needed to communicate the importance of routine maintenance and ensure works are carried out to a sufficient standard. It has been suggested that a training course could be provided on corrosion control, inspection and repair. There is also the possibility for auditing/works completed review prior to payment of the contractors completing the painting works	COMPLETED 1. In November 2021 a report was issued to Asset Management detailing the audit findings from 7 inspected sites. All 7 sites showed signs of corrosion. 2. In April 2022 a second audit on secondary meter sets inlet pipe work was completed. The report was issued and detailed the findings from 4 inspected sites. Of the 4 sites, 1 was found with corrosion on the flange and pipe work. IN PROGRESS: Communication to technicians on maintenance activities and their importance
Meter failure	Bargo POTs meter failure due to low temperatures: - To look for a long term solution and investigate available options such as heating or capturing the liquids/wax	Completed Bargo POTS has been installed with a catalytic heater to raise the temperature of the meter body due to freezing issue in the winter in 2022.
Secondary meter sets	Specific types of slam shuts that are obsolete. They need to be removed and replaced for safety reasons.	Since last year the Engineering Support team have implemented a process of replacing failed regulators when they are found. The regulator is replaced with a Dival 600 where the inventory have been requested to maintain a stock level of 1 at all times in the warehouse.
I&C Customers	In 2021 an improvement opportunity was implemented that involved installing a blanking plate or blind and	• A Tech Alert was released of this change

no longer consuming gas	communication tags for I&C meter sets that are no longer in use but the customer's service remains active. The installation of a blind ensures I&C meters are not replaced unnecessarily and enables a level of isolation and communication to trigger the customer to call Jemena if they would like their gas supply to be reactivated	• List of meter blinds as of 24/10/22. **Recommendation:** To include a flag or way of identification in SAP for sites that have a blind installed.
Meter estimation	65,000 meters are identified as chronic no access meters due to 3 or more consecutive estimates. Within these 65,000 meters, there are 31,420 meters located inside the customers' premise. In the RY21-RY25 period, a trial project was established to trial a few different types of digital smart meters for the business to pick the best solution for the digital metering rollout of these 31,420 chronic no access internal meters. The digital meters can address the problem of consecutive estimates and potentially leverage the capability of remote disconnection.	Plan the digital meter rollout to 8,000 aged chronic no access meters in the next regulatory period as a pilot project to balance the need for accurate meter readings with the goal of minimising costs for customers. This approach will allow us to deliver our modern meter reading service to those who need it most and evaluate the benefits of digital metering before considering a more extensive rollout. A broader implementation will be possible after 2030, subject to the outcomes of the pilot project and further consultation with our customers.

5.2 Unaccounted for gas (UAG)

Unaccounted for gas (**UAG**) calculation and reporting is carried out on a monthly basis to ensure irregularities are picked up and investigated immediately. UAG is a key indicator on the health of the measurement systems and emissions, and a large component of the overall operational costs of JGN. Management of UAG to keep values within the regulatory target are critical for the efficient operation of the gas network.

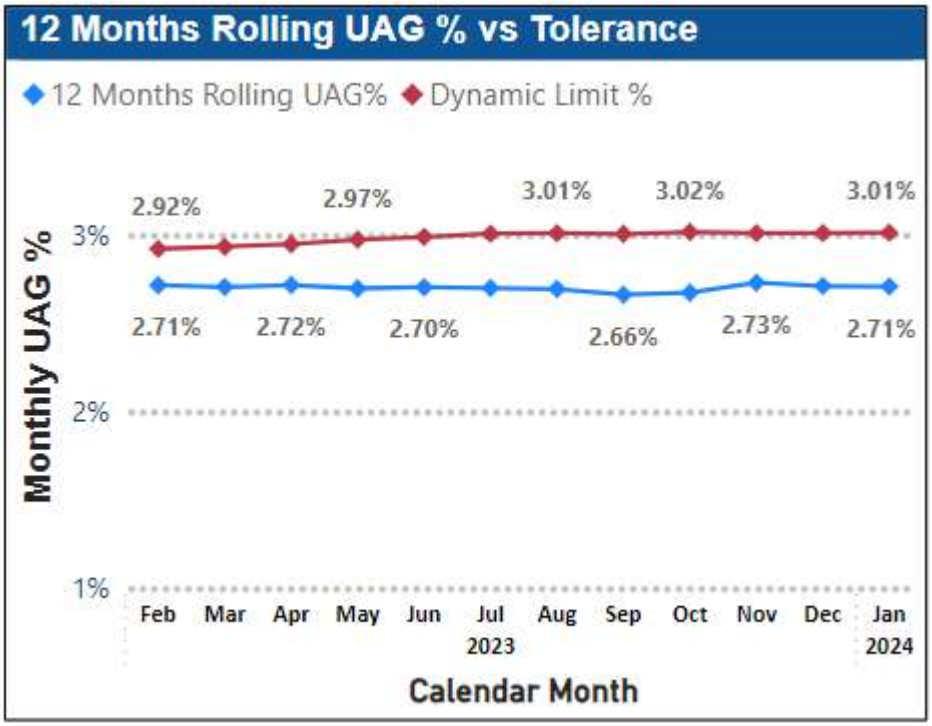
Managing UAG levels has previously been a concern. An UAG taskforce was put together in 2021 to monitor UAG levels and troubleshoot issues and identify heightened exposures that may lead to an increase in UAG. During the same period the End to End Asset Management (E2E AM) project started and an initiative was created to look and optimise the full end to end process of estimating UAG. The E2E project finished in 2023 delivering benefits and improving the management of UAG. The UAG taskforce is still in operation on an ongoing basis.

5.2.1 UAG Performance

The 12 months rolling UAG reported up to September 2023[7] is shown in Figure 5–1. The current average of 2.60% is below the dynamic limit of 3.01%. The E2E project has resulted in optimisation of the UAG calculation which as seen an improvement in the UAG reported for JGN.

[7] UAG reporting is limited to September 2023 as the readings for mass meters contains a 3-month delay with quarterly meter readings

Figure 5–1: UAG 12 month rolling against regulatory allowance



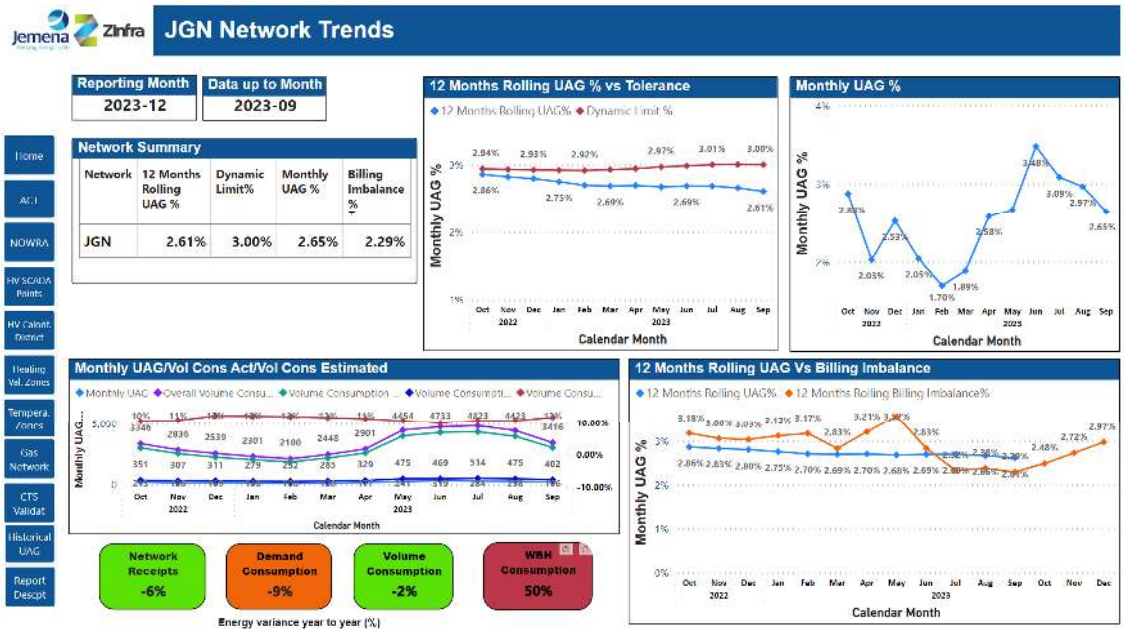
5.2.2 Continuous Improvement - UAG

There are two initiatives developed to monitor and review UAG, these are:

- **UAG Taskforce**: Stakeholders from across the business participate in a monthly meeting as part of business as usual. The attendees include the following business areas; SAP, finance, billing, operational, engineering support, metering and asset management.
- **E2E AM Initiative (2021-2023)**: This project was broken into three keys areas:
- UAG calculation, key input parameters and dashboard. Carry out a detailed investigation and analysis into the UAG calculation from meters to SAP. Review the key input parameters and ensure they are reasonable. Create a dashboard to show the varying network UAG trends for simple irregularity identification.
- Physical gas leakage in the network. Determine and understand the networks with the highest amount of leakage. Look at methods for limiting gas leakage e.g. network pressure reduction and main repair/rehabilitation.
- Emissions reduction. Review methods for measuring UAG emissions to help improve identification of high leakage areas and emissions reporting.

This dashboard also facilitates the examination of other attributes contributing to UAG and direct resources in an efficient matter. The dashboard has been built and was released for internal business use in July 2023. Figure 5.2 shows a snapshot of the UAG dashboard for the JGN:

Figure 5–2: UAG dashboard:



6. Current asset condition, risks and controls

The purpose of this section of the ACS is to provide a high-level overview of asset condition, and to highlight the highest priority risks associated with each sub-class. This section is indicative only and is designed to provide an annual snapshot of the key asset condition and risk issues that need to be managed.

The criticality of any measurement asset is proportional to the size of the associated meter and the total demand of the customer. In the event of a failure of a single asset, the revenue impact is typically low and the impact on the total customer base is also low. Therefore, the risk rating is low. However, where an asset relates to a high-volume customer, the risk is increased proportionally to the potential revenue impact on the customer and JGN.

Similarly, there are a number of asset sub-classes that have a large population of individual asset types, or that rely on a single piece of infrastructure. The failure of an entire population or shared asset (such as a data collection server) could have major consequences resulting in significant capital replacement costs, potential loss of revenue and reputational damage.

More detailed information on asset condition is available in the Measurement APAIR. The full suite of asset risks, along with a more contemporary view of the risk status is recorded in the Measurement asset risk register.

6.1 Gas measurement equipment

6.1.1 Condition assessment

The gas measurement assets are generally in good condition. The ongoing testing and reactive replacement programs are considered sufficient to maintain service in the short to medium-term. To ensure the condition does not deteriorate beyond as acceptable threshold we conduct ongoing monitoring and performance testing. JGN's performance requirement is that the weighted average defective rate remains below 1.0% of the population.

Meter failure rates are shown in Table 6-1. The results show most sub asset classes are performing within expectation. This is with the exception of turbine meters where the defective rate is ~2.5%.

Table 6-1: Failure rates for gas meters

Asset	2017	2018	2019	2020	2021	2022
Residential diaphragm meters	0.5%	0.3%	0.4%	0.3%	0.4%	0.4%
Industrial and commercial diaphragm meters	0.2%	0.3%	0.3%	0.2%	0.3%	0.4%
Rotary meters	0.5%	1.8%	1.3%	0.8%	0.5%	1.2%
Turbine meters	0.7%	0.0%	2.5%	2.5%	2.5%	4.6%

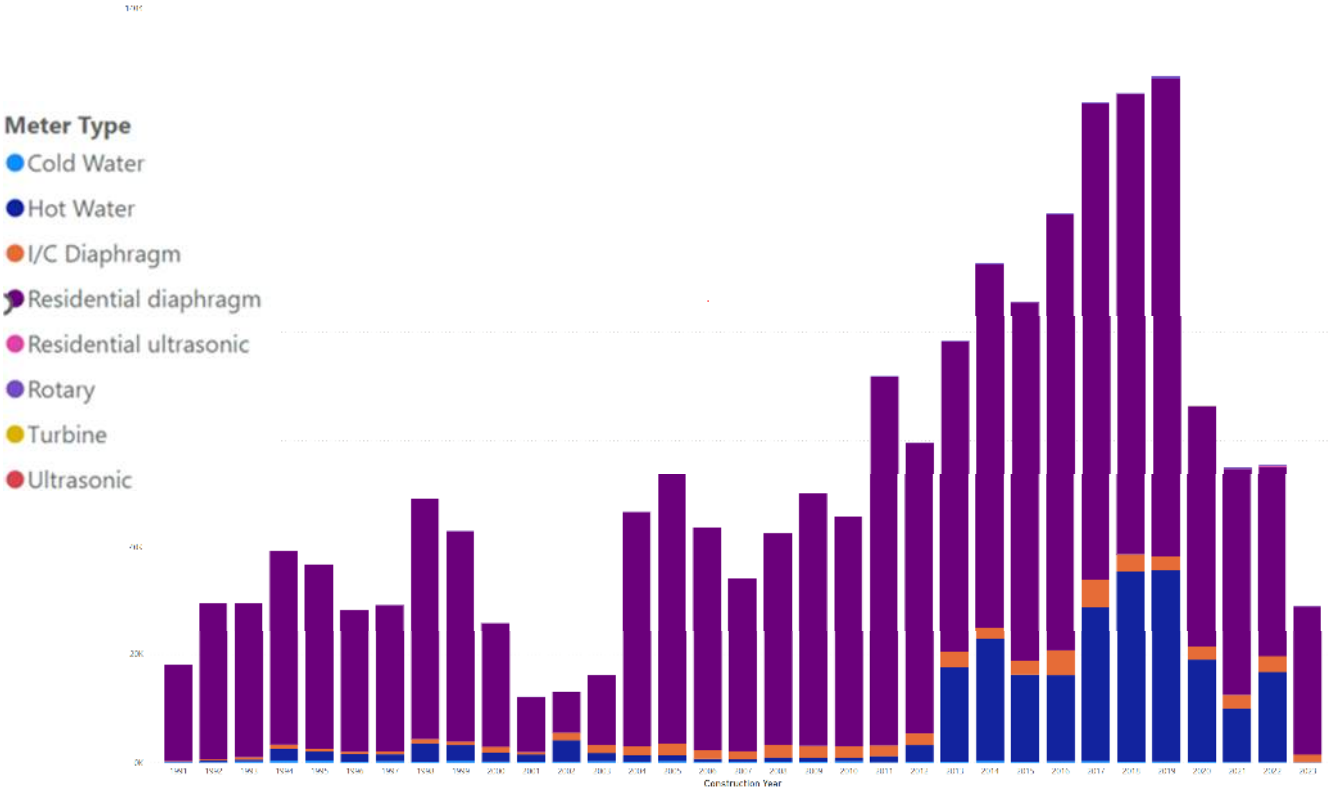
Regulators are not serial numbered and therefore difficult to determine the true performance through a reliability, availability and maintainability program or data. Performance data is limited to approximate values obtained through analysis from SAP reporting codes. Approximately 9,200 regulators are replaced each year under the defective asset program.

There is a large unknown quantity of 1800 Series regulators installed on medium pressure meters sets as well as outside medium density properties as boundary regulators[8], that are not compliant (1813 and 1883). These regulators are being removed and replaced with compliant 1843 regulators when located.

[8] The boundary regulators are not within the scope of this ACS. They are included in the Distribution ACS, but referenced here for completeness.

6.1.1.1 Age profile

Figure 6–1: Age profile of meters 1991-2023



It should be noted gas regulators are not serial number tracked. Therefore, with available information it is problematic to identify the age and precise volumes of individual types of gas regulators installed. Our current estimation has been included for the purposes of this ACS and is used to manage the assets.

6.1.2 Risks

Risks related to measurement assets are captured in the risk register in Enterprise Content Management System ECMS. The following table summarises the current risks associated with gas measurement equipment that were identified as inadequate/not at target levels in the most recent Formal Safety Assessment (FSA). These risks should be prioritised for mitigation.

The metering team reviews the asset risk register annually to ensure risks are being acted upon or to capture any new risks.

Table 6-2: Gas Measurement equipment risks and controls identified as being below target and prioritised for action

Risk Identifier	Description of specific asset sub-class Risk	Current		Target		Status / action	OB ID (where applicable)
		Jemena Risk rating	Control effectiveness	Jemena Risk rating	Control effectiveness		
PI.27	Internal I&C meter sets that are not hazardous area compliant can lead to safety issues resulting in gas explosions in the meter rooms.	Significant	Fair	Moderate	Adequate	A project has been set up to identify hazardous sites as maintenance is undertaken and a process is being worked through to address sites: - Periodic inspections of meter sets are to be carried out - The Network Operator Rules are to be kept with the meter kits and electronic copy downloaded from the Jemena website. - Technical bulletin is to be published emphasising the need to comply with the NOR - Development of a sealed box that the meter kit can be contained in	
PI.28	Sites with redundant meter set components that fail.	Significant	Fair	Moderate	Adequate	-Identify all sites that contain the same component involved in the incident. - Expand SAP's reporting capabilities to include collection of relevant component data from the field and the ability to track non-compliance notices. -For more information see: GAS-9899-SW-GD-001: SAP Modification for Gas Distribution Maintenance Activities.	
PI.29	Legacy horizontal regulators can result in pressure relief failure. Regulators installed prior to 2000 had the horizontal design	Significant	Fair	Moderate	Adequate	- The failure was attributed to the malfunction of relief mechanism caused by freezing water contained above the diaphragm. - Meters that require replacement and have an existing horizontal regulator in the Sydney, Newcastle and Wollongong areas will have their regulator proactively replaced. The replacement of these regulators is based upon 20% of annual residential gas meter replacements and reflective in the Capital program	

M.3	-Maintenance plans with missing functional locations and; - Meter sets with no maintenance plans	High	Poor	Moderate	Adequate	An audit conducted in March 2024 confirmed 85 meter sets > 15kPa were not on maintenance plans. This error needs to be rectified as there are safety concerns if internal meter sets operating a higher pressures are not maintained. The following needs to be carried out: - Recirculate the tech alert to all about the issue - Create a program to survey the condition of these meter sets not on maintenance plans - Attach the correct maintenance plan based on the findings from the survey - Prioritise the maintenance on these 85 meter sets based on the condition - Replace the components inspected in poor condition - Conduct regular audit to identify the meter sets missing the maintenance plan once every 6 months.	

6.1.3 Controls

Existing controls in place to mitigate risks associated with gas measurement assets include:

- risk assessments;
- supportability and obsolescence checks;
- corrective maintenance for critical assets;
- field failure testing;
- meter validations;
- in-service compliance testing
- statistical life extension sampling;
- quality assurance testing;
- investigations;
- maintainability assessments; and
- asset spares for critical assets.

The following table summarises current metrics for control measures that apply specifically to gas measurement.

Field failure testing status is amber due to the low volume of defective units being returned to the metering centre in 2020 and 2021. There has been an increased focus to improve this control including; continual reminding in operational forums, Tech Alert and reporting of defective volumes against volume returned to the Metering Centre.

Table 6-3: Existing control metrics – gas measurement

Performance measure	Target	Status	Previous year	Commentary
Field Failure Testing Investigation.	25%	10%	Not reported 	Data stored on the Jemena Meter Centre Database as per the National Association of Testing Authorities (NATA) testing and quality requirements. The control status amber due to lower than specified volumes of defective units being returned to the Metering Centre for testing.
Quality Assurance Testing	100%	100%		Data stored on the Jemena Meter Centre Database as per NATA testing and quality requirements.
Statistical sampling (residential and I&C)	100%	100%		Data stored on the Jemena Meter Centre Database as per NATA testing and quality requirements. Planning and Contracting monthly and annual program completion monitoring.
Meter validations	100%	100%		Data stored on the Jemena Meter Centre Database as per NATA testing and quality requirements.

No further additional controls have been identified as being required prior to the next update.

6.2 Water measurement equipment

6.2.1 Condition assessment

Water meters overall are in reasonable condition, however, as shown in Table 6-4, the rate of defective water meters, while low, has increased in recent years. The most recent APAIR shows that approximately half of the defective hot water meters were from Schlumberger TDb with an age range between 19 and 27 years old.

Water meters are typically replaced at 20-25 years. Therefore the increasing failure rates may suggest we are not replacing the meters at the correct time and the replacement age could potentially be brought forward. We will continue to monitor these meter types closely.

JGN's performance requirement is that the defective rate is above our new target of 0.5% of the population. The reasons for an increase in the defective rate is being investigated.

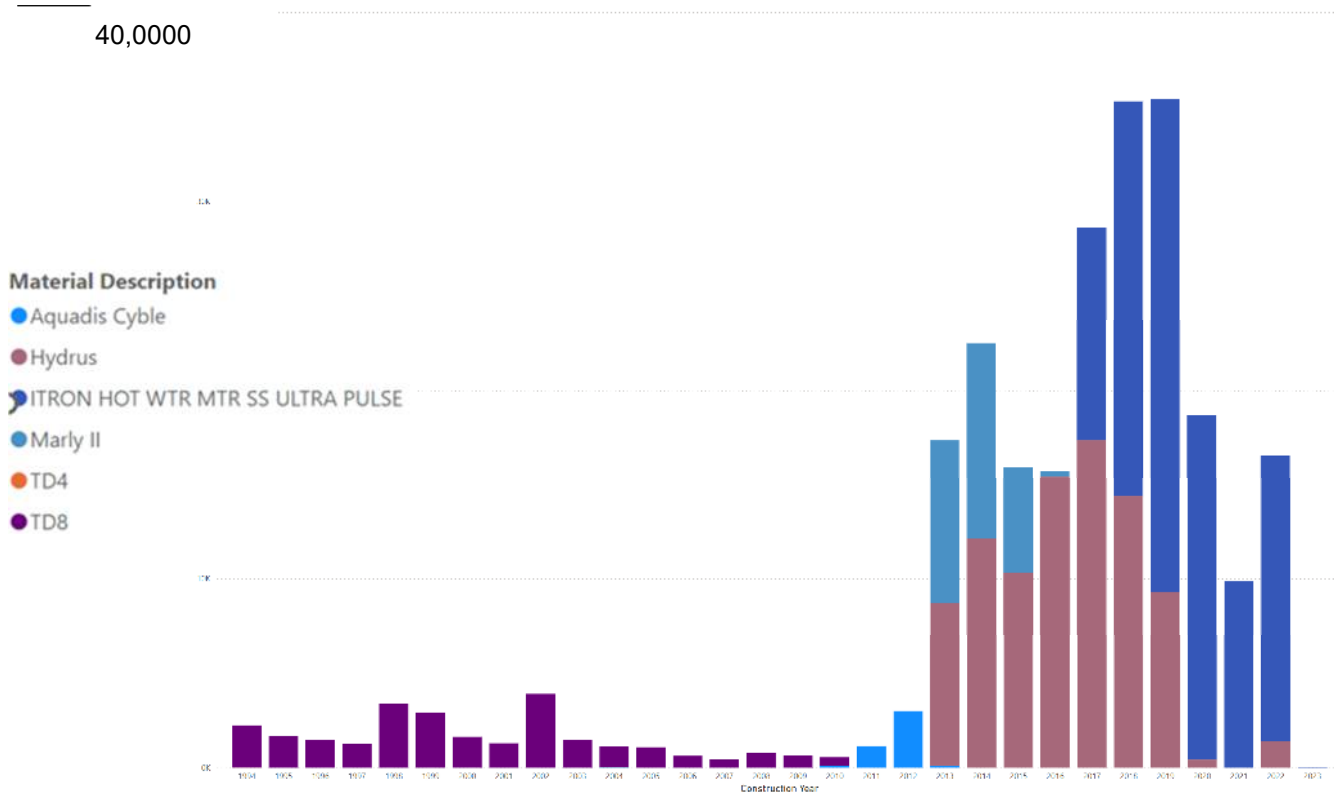
Table 6-4: Total defective rates for water meters over the last four years

2019	2020	2021	2022
1.3%	2.1%	2.3%	1.9%

6.2.1.1 Age profile

The current age profile of hot water meters is shown below.

Figure A1–1: Age profile – water meters 1994-2023



6.2.2 Risks

Risks related to water meters are captured in the risk register in ECMS. No risks have been identified as not meeting target levels.

6.2.3 Controls

Existing controls in place to mitigate risks associated with water meters include:

- quality assurance testing;
- administrative monitoring of non-registering hot water meters;
- field failure testing;
- risk assessments; and
- monitoring through meter disposal reports.

The following table summarises current metrics for control measures that apply specifically to water meters.

Field failure testing status is amber due to the low volume of defective units being returned to the metering centre in 2020 - 2022. There has been an increased focus to improve this control this includes; continual reminding in operational forums, Tech Alert and reporting of defective volumes against volume returned to the Metering Centre.

Table 6-5: Existing control metrics – water meters

Performance measure	Target	Status	Previous year	Commentary
Field Failure Testing Investigation	25%	<10%	Not reported	Data stored on the Jemena Meter Centre Database as per NATA testing and quality requirements. The control status amber due to low volumes of defective units being returned to the Metering Centre for testing.
Quality Assurance Testing	100%	100%		Data stored on the Jemena Meter Centre Database as per NATA testing and quality requirements

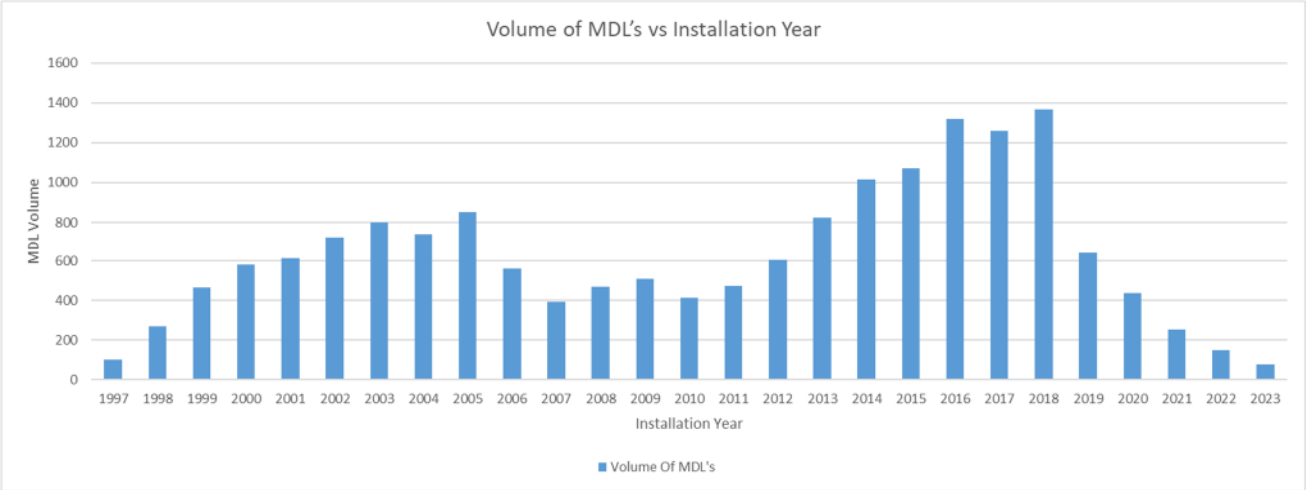
No further additional controls have been identified as being required prior to the next update

6.3 Data collection equipment

6.3.1.1 Age profile

The current age profile of our meter data logger population is shown below.

Figure 6–2: Volume of MDLs 1997-2023



Jemena has around 500 industrial and commercial customers. Industrial and commercial customers divide into the largest customers, who pay on volume and have access to daily gas flow data, and smaller customers.

These customers are metered via either a rotary or turbine meter with a wired pulse output. For larger customers (> 10TJ/year), the meter is connected to a Honeywell gas volume corrector (GVC) and then to a data logger. Smaller industrial and commercial customer installations are connected directly to a data logger.

For communications, the data logger is fitted with either an analogue modem and PSTN line, or a 3G mobile device. This enables the transmission of daily gas volume data to Jemena servers in Melbourne. In response to the NBN rollout ~80% of Jemena's industrial and commercial customers have been converted from their existing analogue modem and PSTN line to a mobile device.

The meter data loggers in-service are, on average, 10 years old.

6.3.2 Risks

Risks related to measurement assets are captured in the risk register in ECMS. The following table summarises the current risks associated with data collection equipment that were identified as inadequate/not at target levels in the most recent Formal Safety Assessment (FSA). These risks should be prioritised for mitigation.

The metering team reviews the asset risk register annually to ensure risks are being acted upon or to capture any new risks.

Table 6-6: Extract from measurement asset sub-class register

Risk Id	Description of specific asset sub-class Risk	Current		Target		Future	Status	OB ID (where applicable)
		Jemena Risk Rating	Control Effectiveness	Jemena Risk rating	Control Effectiveness	Forecast Risk if no Action		
M.1	MDL uses 3G communications and will be redundant in 2024 and the backend system is outdated and unsupported	Moderate	Poor	Moderate	Adequate	High	A pilot project is being deployed in 2022 to replace 500 modems to NB-IoT. This will firm up the requirements needed to replace the MDL system. A strategy is also being developed to enable for the full replacement of MDL modems.	Inquiry: 10049605 Project: BAB-RA5-000009
M.2	Metretek equipment operating on 3G will be upgraded by June 2024.	Moderate	Fair	Moderate	Adequate	High	A solution to address the 3G redundancy issue will be prioritized by the Digital team in Q1 of 2022. A market scan will be completed in preparation.	Project: BAB-RA6-000007
M.4	Customers with radio frequency devices installed on their metering equipment have their meter reads manually uploaded from Enware software into the SAP billing system. This is labour/resource intensive	Moderate	Fair	Moderate	Adequate	High	Review RF module life cycle and management strategy. Assess cost vs benefit of automating this functionality	N/A To be acted in 2024.

6.3.3 Controls

Existing controls in place to mitigate risks associated with data collection equipment include:

- administrative asset monitoring and validation activities;
- maintain strategic spare assets and parts;
- field failure testing;
- maintain adequate redundancy;
- alternative technology testing;
- risk assessments (particularly for obsolescence); and
- monitoring defects, maintenance and repairs.

The following table summarises current metrics for control measures that apply specifically to data collection equipment.

Table 6-7: Existing control metrics – data collection equipment

Performance measure	Status	Against previous year	Commentary
Percentage of successful reads			Estimated reads 5.90% as per CESS target. MDL system requires a full upgrade as identified in risk M1. A solution to address this is being worked on

No further additional controls have been identified as being required prior to the next update

6.4 Gas quality management

6.4.1 Condition assessment

Gas quality measurement equipment is in good condition. Failure rates are shown in Table 6-8.

Table 6-8: Failure rates for gas quality measurement equipment

Asset	2018	2019	2020	2021	2022
ABB 8206 gas chromatograph	None reported	None reported	None reported	None reported	None reported
Ametek 3050 water dewpoint analyser	None reported	None reported	None reported	None reported	None reported
Michele Cordumax hydrocarbon dewpoint analyser	N/A	N/A	N/A	N/A	N/A
Odour Easy Odorant Analyser	N/A	N/A	N/A	N/A	N/A

6.4.1.1 Age profile

The age of each gas quality measurement asset is shown in Table 6-9.

Table 6-9: Gas quality measurement equipment

Asset	Location	Volume	Date installed	Age (years)
ABB 8206 gas chromatograph	Horsley Park TRS	2	2014	9
ABB 8206 gas chromatograph	Plumpton TRS	2	2014	9
Ametek 3050 water dewpoint analyser		1	2010	13
ABB 8206 gas chromatograph	West Hoxton TRS	2	2010	13
Odour Easy Odorant Analyser				6
ABB 8206 gas chromatograph	Hexham TRS	2		8
ABB 8206 gas chromatograph	Wyong TRS	2		8
Michele Cordumax hydrocarbon dewpoint analyser	Wilton TRS	1	2008	15
Odour Easy Odorant Analyser	Hexham TRS	1		6
Moisture Analyser	Colongra	1		

The hydrocarbon dewpoint analyser at Wilton TRS is obsolete and redundant due to analysers being installed at Longford and Moomba. The location of these dewpoint analysers (at the start of the pipeline) provide sufficient time to rectify the out of specification gas.

The water dewpoint analysis at Plumpton is greater than 10 years old and is being currently investigated to determine if we need to replace the unit.

The gas chromatographs at West Hoxton are operating satisfactory and do not need replacement. These units will be reviewed again in five years' time.

6.4.2 Risks

Risks related to gas quality measurement are captured in the risk register in ECMS. No risks have been identified as not meeting target levels.

6.4.3 Controls

Existing controls in place to mitigate risks associated with gas quality measurement equipment include:

- administrative asset monitoring and validation activities;
- maintain strategic spare assets and parts;
- maintain adequate redundancy;
- field failure testing;
- risk assessments (particularly for obsolescence); and
- monitoring maintenance and repairs.

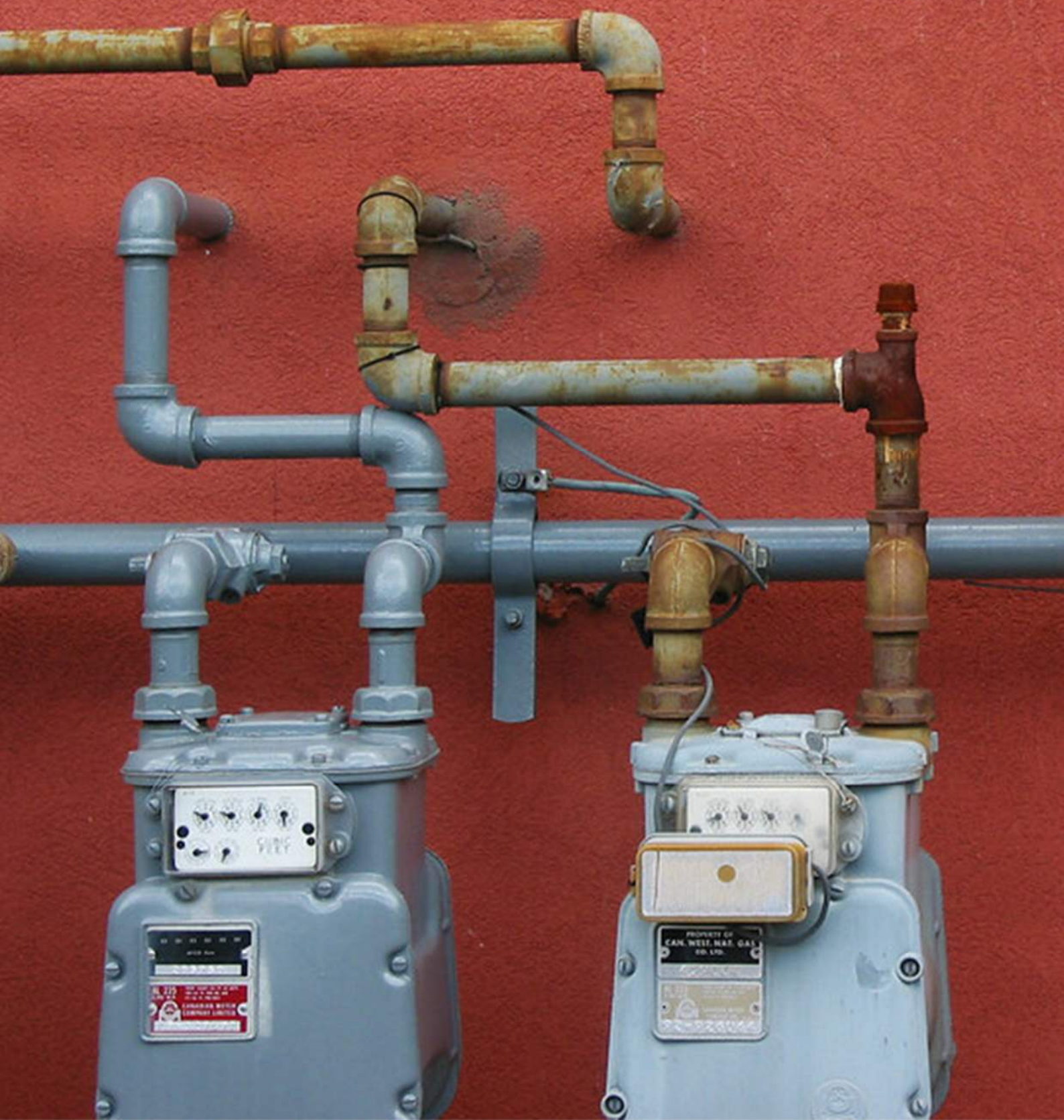
The following table summarises current metrics for control measures that apply specifically to gas quality measurement equipment.

Table 6-10: Existing control metrics – gas quality measurement equipment

Performance measure	Status	Against previous year	Commentary
Measurement Validations (As per planned maintenance quarterly)			Annual network measurement performance report
Availability for billing ie: daily heating values			Billing daily monitoring

No further additional controls have been identified as being required prior to the next update.

Part C: Emerging issues and priorities



7. Emerging risks and priorities

This section highlights the key emerging and priorities for the measurement asset class. This is not an exhaustive list, and any new risks or priorities that emerge during the year should be captured in the asset class risk register, and then documented in the following year's ACS and captured in the ECMS.

7.1 Gas measurement

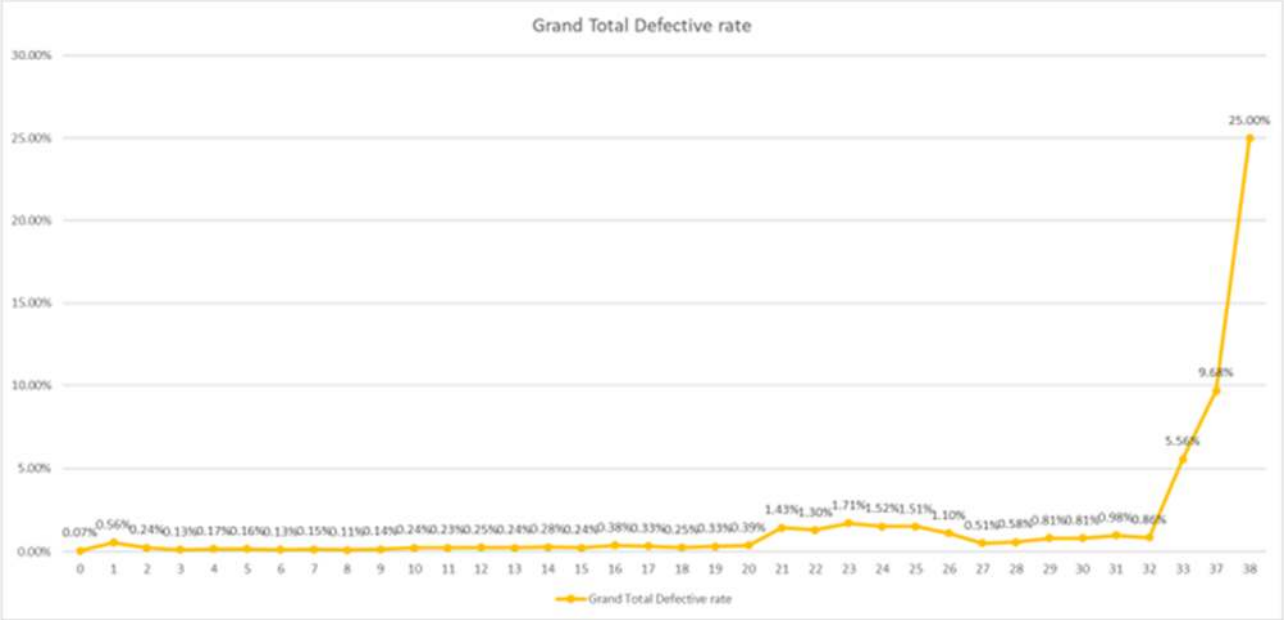
JGN's measurement equipment is already capable of facilitating net zero when renewable gas is 100% biomethane, including up to 10% Hydrogen. The is the potential to impact hazardous areas as hydrogen content in the gas mix increases and is therefore considered an emerging risk to be aware of in design.

JGN is currently investigating transformative technologies available through hydrogen with the 'Western Sydney Green Gas Trial' project. This trial forms part of the planning for new fuels, creating a future risk with the potential incompatibility of metering equipment with hydrogen. We plan to investigate the effects hydrogen has on metering equipment and aim to make it part of the research with future fuels Cooperative Research Centre (CRC).

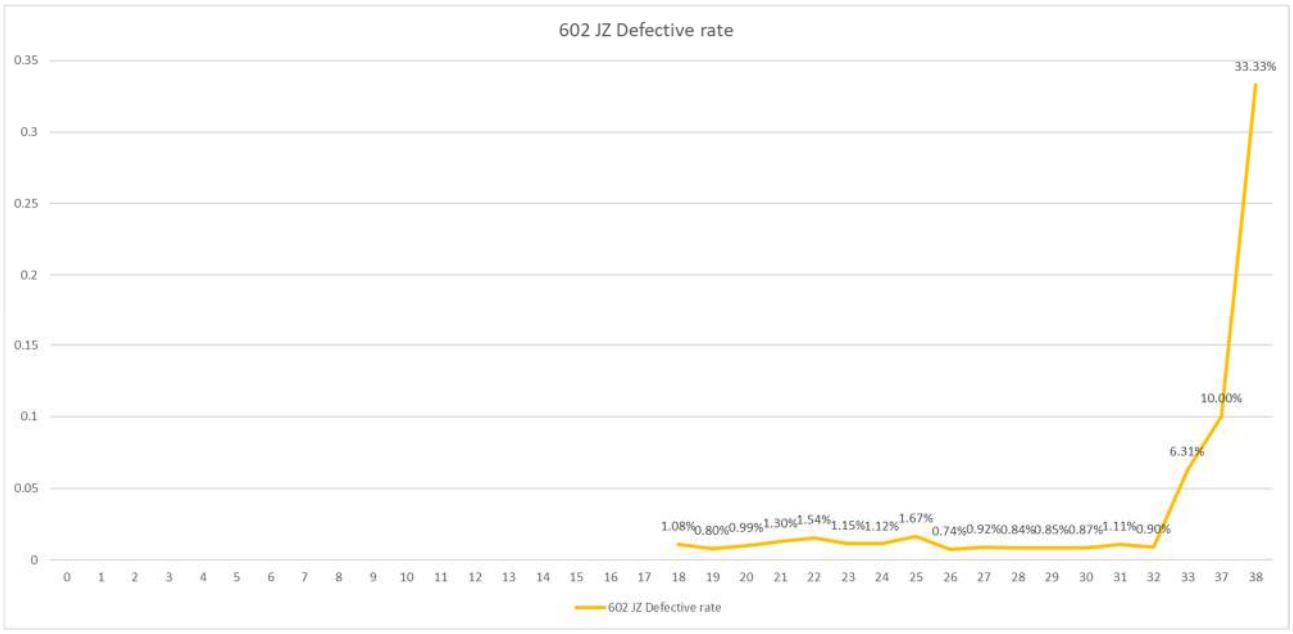
Sole suppliers of meters is an emerging risk, and therefore we will start investigating opportunities to diversify our providers.

7.1.1 Replacement of Residential Meters at 35 years

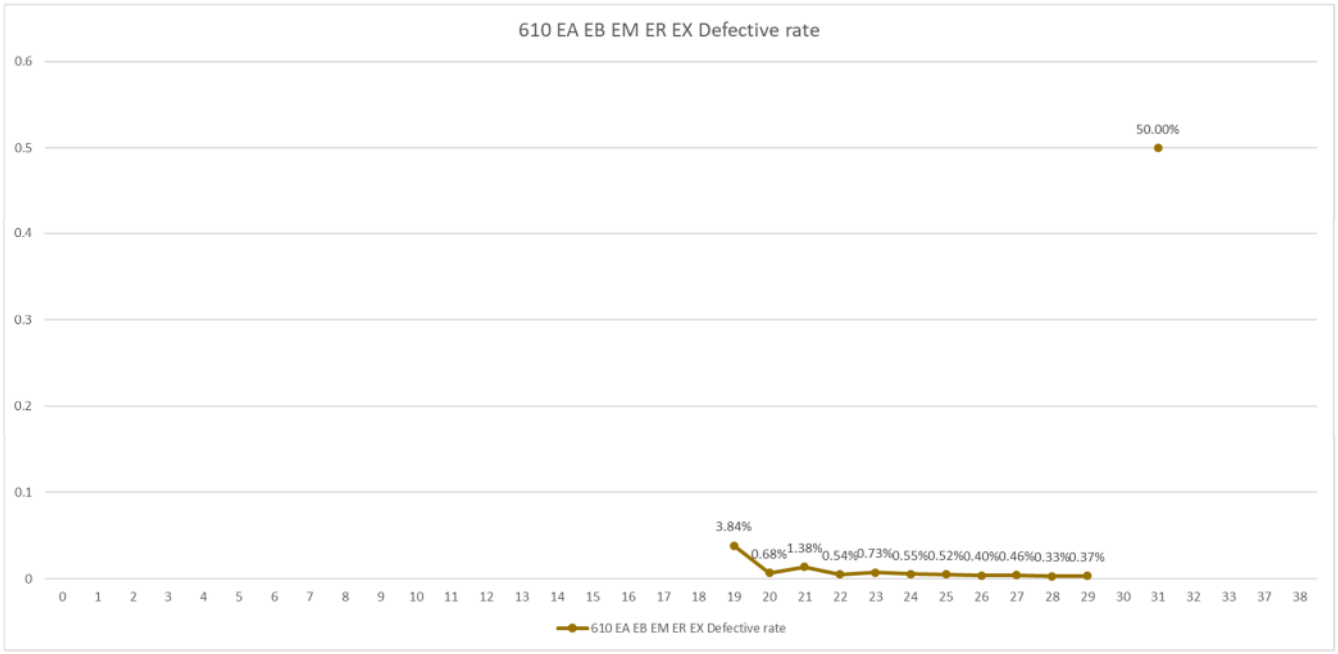
The provided graphs underscore our ongoing strategy of extending the lifespan of meters only until their performance becomes unsatisfactory, with the assumption that such extensions are reasonable. These graphs show the total defective rate according to meter age, reinforcing our decision to replace all residential meters at the 35-year mark without further life extension tests.



For the Email 602 meter model, the specific defective rate aligns with our hypothesis that all life extension tests for this model fail at 30 years. Therefore, we will not pursue further life extension for these meters.



Regarding the Email 610 model, we lack data on the defective rate for meters older than 30 years. Consequently, we will operate under the assumption that these meters pass the life extension 4 test (at 30 years) and will remain operational for an additional 5 years.



Moreover, due to meters passing accuracy tests, a significant number will reach 25 to 35 years of age between 2025 and 2030. We anticipate these meters will soon become unreliable in measuring gas usage. Currently, our test data for meters within this age range is limited, as we are encountering meters of this age for the first time. Despite the possibility that these meters might continue to perform accurately while in service, there is a high likelihood of failure within this age group, necessitating their replacement. To manage the defects and expected inaccuracies, and to mitigate safety risks, we have revised our meter replacement forecast methodology. This new approach includes the proactive replacement of certain meters, a shift from our usual practice of only replacing meters reactively when they become defective. Addressing the anticipated large volume of failing meters proactively is crucial. Reactively managing such a large number of defective meters would result in higher replacement costs, lack of coordinated planning, and prolonged safety risks due to the expected time delays in replacing the meters.

7.2 Water measurement

Battery failure is the main future risk for water measurement. It is a risk that JGN has started proactively measuring and will continue to do so. As such, there are mitigation strategies in place that will continue to be refined. There is also an opportunity that battery risk learning be applied to gas meters as digital meters become more prevalent.

7.3 Data collection equipment

JGN's current supplier of gas volume electronic control interfaces has stopped producing analogue interfaces and has replaced them with products with digital communications and the rollout of the national broadband network (NBN) and subsequent decommissioning of the 3G network by June 2024 has created new interface challenges and risks for data collection processes. We are introducing NB-IoT digital gateways integrated with the existing MDL solution, transforming it into an IoT solution.

The introduction of the NBN has provided challenges to both residential and I&C customers connected to remote billing sites. Previously, remote billing customers were connected to devices that were predominately designed for the public switched telephone network (PSTN). The roll-out of the NBN, including the ownership of previously owned communication lines has led to the strategy of primarily using the mobile network to ensure customer billing information is collected in line with the retailer market procedures. We are now seeing the effects of mobile technology evolution with a firm date for 3G shutdown for June 2024. This has impacts to both our data collection networks for residential and commercial customers

Avoiding the replacement of all meter data loggers in the short term[9] by replacing only a single component of meter data loggers to enable the use of mobile communications, rather than rely on obsolete copper wire. A strategic replacement solution for the meter data loggers is required to mitigate the risk of single source supplier who is facing financial challenges and operation problem.

Similar to gas measuring equipment our data collection equipment becoming part of a hazardous area due to the change of gas being transported and its potential to extend current hazardous area proximity. The increasing hazardous areas are a future risk when hydrogen blends in the gas are >10%. This is not expected within the next 5 year period. However it is being monitored as more renewable gas is transported through the network.

Customers have indicated a desire for more timely data, which will require a review of the suitability of the current technology and to understand the costs associated with meeting such a requirement.

7.4 Gas quality management

Construction and management of multiple new distribution injection points supporting the connection of renewable gas is an emerging risk. New injection sites will change flow dynamics that will need to be understood and modelled, and equipment suitably placed to best reflect data used to calculate energy usage by customers. Multiple site installation may also impact resource plans.

Other than the impacts of a significant roll out of the equipment, there are no other future risks identified in relation to gas quality measurement equipment.

[9] We note that the introduction of the national broadband network (NBN) and 3G obsolescence have and will continue to provide challenges to customers connected to remote billing sites. This significant change in communication technology presents a risk to the currency and connectivity of specific customer billing platforms supported by manufacturers and suppliers.

8. Projects and asset management initiatives

8.1 Ongoing projects and initiatives

This section provides a high-level overview of the key asset management and initiatives underway. The full list of projects can be found in the Asset Investment Plan (**AIP**) and the Capital and Operating Work Plan (COWP).

Table 8–1 presents a summary of the predominant types of projects that are being undertaken by JGN networks to meet the requirements of the Measurement ACS.

Table 8–1: Summary of ongoing measurement asset class key projects and initiatives

Asset sub-class	Ongoing project/initiative	Description (what and why)
Gas Measurement	Installation of new meters	The installation of new meters to new customers at industrial, commercial and residential locations. This work is essential to keep pace with demand and grow the network. JGN is obligated to connect new customers that make a compliant request.
	Replacement of end-of-life meters	The replacement or refurbishment of existing meters at industrial, commercial and residential locations that have reached their end of life.
	Field Life Extension testing	The removal of meters for the purposes of testing to enable the extension of life for meters within the same family. This work is critical to help us reduce capital intensity and optimise our ongoing maintenance costs.
	Replacement of defective meters and Field Failure testing	The replacement of meters that have failed in service. Safety and accuracy are priorities, therefore we must replace any unsafe or inaccurate meters as soon as reasonably practicable. The faulty meters are required to be sent to the Meter Centre for field failure testing (refer to Tech Alert-GD FTC 00104).
	Replacement of end-of-life meter kits	Field technicians and managers to send photos and details of site to Asset Management. Asset Management collect sites over 12 months and document it into the APAIR. All sites are raised in one business case for replacement.
	Replacement of non-compliant meters	Replacement of meters that do not meet requirements such as “Metering Hazardous Areas on Gas Networks (AS(60079)”, and certain regulators installed on medium pressure meters sets and outside medium density properties as boundary regulators [10]. JGN has a suite of compliance obligations that it must address on an ongoing basis.
	Functional checks and planned maintenance	Undertaking proactive maintenance and functional checks on meters to ensure they are fit for purpose. This is essential to allow us to maintain safety, asset integrity, and performance standards.
	Reactive maintenance	Undertaking reactive maintenance in response to faults
Water Measurement	Installation of new meters	The installation of new meters at residential properties as well as boundary meters to service high density living buildings.

[10] The boundary regulators are not within the scope of this ACS. They are included in the Distribution ACS, but referenced here for completeness.

Asset sub-class	Ongoing project/initiative	Description (what and why)
	Replacement of end-of-life meters	The replacement of existing water meters at residential locations that have reached their end of life
	Replacement of defective meters	The replacement of meters that have failed in service. Safety and accuracy are priorities, therefore we must replace any unsafe or inaccurate meters as soon as reasonably practicable. The faulty meters will require to send to Meter Centre for field failure testing (refer to Tech Alert-GD FTC 00104).
	Replacement of non-compliant meters	Replacement of meters that do not meet requirements such as “Metering Hazardous Areas on Gas Networks (AS(60079)”. JGN has a suite of compliance obligations that it must address on an ongoing basis.
	Reactive maintenance	Undertaking reactive maintenance in response to faults
Data Collection Equipment	Installation of new equipment	The installation of new equipment to new customers at industrial, commercial and residential locations.
	Replacement of defective equipment	The replacement of faulty data collection equipment at industrial, commercial and residential locations.
	Upgrading of obsolete and EOL equipment	The removal of equipment that is no longer fit for purpose, with the installation of contemporary equipment. E.g. 3G communications network shutdown.
	Functional checks and planned maintenance	Undertaking proactive maintenance and functional checks on equipment to ensure they remain fit for purpose.
	Reactive maintenance	Undertaking reactive maintenance in response to faults
Gas Quality Measurement	Installation of new equipment	The installation of new equipment at strategic locations to ensure accurate gas quality measurement.
	Replacement of existing equipment	Replacement of equipment that has reached its EOL.
	Functional checks and planned maintenance	Undertaking proactive maintenance and functional checks on equipment to ensure they remain fit for purpose.
	Reactive maintenance	Undertaking reactive maintenance in response to faults.

8.2 New projects and initiatives

This section provides a high-level overview of new initiatives designed to help address emerging risks and meet our asset objectives. Projects/initiatives in this section will commence within the next 5-10 years.

Further information on these new/proposed initiatives is available in the COWP and in the individual businesses cases.

Table 8–2: Summary of new measurement asset class key projects and initiatives

New project / initiative	Description (what and why)
Improving meter reading in chronic no access locations	Installing radio frequency (RF) technology or other better remote reading solution to allow us to read these meters without entering each dwelling. The new remote reading solution can also mitigate the current single source supply risk of the MDL solution.
	In the next AA period, rollout a digital meter solution to the aged chronic no access meters located inside the customers’ premise due to Jemena’s old practice.

Ultrasonic metering strategy	Move to ultrasonic metering to replace turbine and rotary meters where possible, therefore ready for multiple blends of renewable gas and increasing accuracy
Demand Billing Remote Reading Strategic solution	In the next AA period, look for a strategic replacement solution for the current Metretek solution that's reaching EOL.
Digital metering/smart metering installations	Moving towards digital metering to enable greater volumes of hydrogen in renewable gas whilst also meeting customer needs of usage feedback and readability.
Diversify metering risk	Currently single supplier - introducing multiple metering suppliers to the business
Connection of Renewable Gas suppliers	The installation of up to 15 new measurement sites over the next few years to help facilitate net zero for our customers
Hydraulic network modelling for renewable gas injection sites	Hydraulic modelling and preferential locations for renewable gas to understand network hydraulics and measurement and data requirements that enables accurate energy usage information for our customer.
>10% H2 ready meters & Hazardous areas	Studies to understand the progressive change towards H2 ready metering solutions to enable renewable gas distribution.

Appendix A Regulatory and legislative environment

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A1. Summary of key legislative requirements

This section summarises the key legislative requirements and technical standards relating to measurement assets. These requirements are factored into our asset management strategies and help inform the investments and operating activities we undertake to manage asset performance.

Table A1–1: Summary of key legislative requirements and technical standards relating to metering and gas quality measurement

Legislative requirement / technical standard	Summary of requirements
Gas Supply Act 1996 No 38 (NSW)	Sets out the overarching objectives to promote the efficient use of gas and deliver a safe and reliable supply of gas. Specifies requirements to facilitate the continuity of supply of natural gas to customers.
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. JGN's key output under this Regulation is the JGN Safety and Operating Plan (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.
National Measurement Act 1960	Establishes the national system of measurement for physical quantities, and provides a system for uniform use of the units and standards as well as a system of trade measurement
AEMO Retail Market Procedures (NSW and ACT)	AEMO procedures defines reasonable endeavours as "In deciding whether a person has used reasonable endeavours, regard must be had to all relevant factors including whether the person has acted in good faith and has done what is reasonably necessary in the circumstances." The Network Operator has a "Reasonable Endeavours" obligation to complete routine meter reading and provide at least one actual meter read per annum. The industry good practice and benchmark for Gas and Water metering routine meter actual reads is widely accepted as 95% and generally achieved for most utilities with a requirement for at least one actual read per annum.
Gas Supply (Consumer Safety) Regulation 2012	Establishes provisions relating to the: • certification and labelling of gas appliances; • powers of investigators in relation to unsafe gas appliances; • qualifications to be held by persons carrying out gas fitting work or auto gas work and the standards for such work; • testing of gas installations and auto gas installations; • sale, use and supply of certain gas installations and equipment; • metering of gas supplied by means of a gas network; • testing of gas meters and gas meter testing equipment; and • fees for services provided under the Gas Supply Act 1996.
AS 4564:2011 Specification for general purpose natural gas	This Standard sets out requirements for the safe composition, transportation and supply of general purpose natural gas for use in natural gas appliances and equipment, and for use as fuel in natural gas vehicles.
AS 4645:1:2018 Gas Distribution Networks Part 1: Network Management	Specifies requirements for safe, reliable and sustainable management of gas distribution networks operating less than or equal to 1050 kPa that

Legislative requirement / technical standard	Summary of requirements
	reticulates gas to customers. Requirements apply to the lifecycle of assets and covers operations, maintenance, repair, decommissioning, gas quality and risk assessment.
AS/NZS 5601.1:2013 Gas Installation – General Installations	Contains the requirements and methods of compliance for the design, installation and commissioning of gas installations that are associated with the use of intended use of fuel gases such as natural gas, LP gas or biogas.
AS/NZS 4944: 2006 Gas Meters – In-service Compliance Testing	Provides a basis for the maintenance of the metrological performance (in-service compliance) of gas meters by utilities and metering providers. It forms the basis for a performance-based asset management scheme.
AS 4647:2011 Diaphragm gas meters	Provides basic requirements for diaphragm gas meters. Covers the working environment, materials of construction and performance required of diaphragm meters of Qmax up to 8m3/h when tested at standard conditions on air.
AS 1199:2003 Sampling procedures for inspection by attributes	Details the sampling plans and procedures, for inspection by attributes, to be used primarily for a continuing series of batches or lots, or, under certain conditions, isolated batches or lots for life extension testing of gas meters.
AS 3565.4:2007 Meters for cold and heated drinking water and non-drinking water supplies, Part 4: In-service compliance testing	Specifies requirements for the timely sampling, testing, and assessment of in-service compliance of populations of water meters and individual meters.
NMI R 49-2 Water Meters Intended for the Metering of Potable Water and Hot Water, Part 2: Test Methods	Specifies the metrological and technical requirements for the pattern approval of water meters used to measure the volume of cold potable and hot water flowing through fully charged, closed conduits.
National Measurement Institute R 137 Gas Meters	Specifies the metrological and technical requirements for the pattern approval of gas meters used to measure the quantity of gas that has passed through the meter at operating conditions. The quantity of gas can be expressed in units of volume or mass.
Jemena Network Operator Rules	These rules are issues by Jemena and form part of Jemena's Safety and Operating Plan (SAOP) for its Networks in NSW. The SAOP and these rules are prepared in accordance with the Gas Supply Regulation.
Safety Case (SAOP) of Jemena Gas Assets (NSW)	This Safety Case describes the operation and maintenance of gas assets in a safe and reliable manner. The arguments and evidence for safety is assured by an appropriate Asset Management System operating under a controlled environment in accordance with the applicable gas legislation and regulatory instruments across various Australian jurisdictions.
National Gas Rules	National Gas Rules governs access to natural gas pipeline services and elements of broader natural gas markets. It includes economic value tests (specifically Rules 79 and 91) that set requirements for efficient capital and operating expenditure.
National Greenhouse and Energy Reporting Act 2007	Covers the obligations for reporting and disseminating company information about greenhouse gas emissions, energy production, energy consumption and other information, and includes the obligations to reduce emissions under the safeguard mechanism.

Appendix B Asset overview

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B1. Gas measurement

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;
- rotary, turbine and ultrasonic meters; and
- regulators[11].

Each residential or commercial and industrial customer has a gas meter installed when they are connected to the network. JGN has over 1.4 million connections, and therefore meters. Typically diaphragm meters are installed for standard domestic and commercial and industrial customer connections.

Rotary and turbine meters are installed to provide data on network flows, which is a key input into the modelling tools that inform decisions about network reinforcement and capacity management activities to connect new customers and to meet changing network load profiles. They are also used for collecting key data for the calculation of UAG. JGN has 28 turbine and rotary meters at packaged off-take stations (POTS) providing gas measurement.

Regulators provide filtration and pressure control for the volumetric measurement 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. Approximately 80% of residential meters and regulators are installed outside of residential dwellings, while the remaining 20% are inside.

Our regulators do not have individual serial numbers and therefore cannot be identified in SAP. As a consequence, past replacement projects to remove faults regulators e.g. Schlumberger (1999(and Email 106 (2009) relied on residential gas meter data and field inspections/audits to determine the locations. There are five predominant residential regulators within JGN, these are: Email 104, 106, 107, 300 and EDMI TR143.

The asset specifications for:

- diaphragm meters are in GAS-1700-SP-GM-001 for the Specification for New Diaphragm and Equivalent Non-Mechanical Meters;
- rotary meters are in GAS-1700-SP-GM-001 for the Specification for New Rotary and Equivalent Non-Mechanical Meters;
- turbine meters are in GAS-1700-SP-GM-002 for the Specification for New Turbine and Equivalent Non-Mechanical Meters; and
- regulators[12] are in GAS-960-SP-ME-016 for the Specification for Indoor Gas Regulators and in GAS-960-SP-ME for the Specification for Outdoor Gas Regulators.

B1.1 Risks associated with these assets

JGN is subject to the Jemena Risk Management Policy (and the Group Risk Management Manual) for the management of the measurement assets, which alongside the AS4645 Formal Safety Assessment (FSA) process provides the robust framework for managing risk.

[11] High pressure, secondary pressure and boundary gas regulators are included in the Facilities and Networks Asset Class Strategies.

[12] High pressure, secondary pressure and boundary gas regulators are included in the Facilities and Networks Asset Class Strategies.

The risk register for JGN network is stored in Jemena Compliance and Risk System (JCARS), with specific asset risks captured and tracked via the metering asset class risk register.

The primary types of risk that impact measurement assets are:

- asset failure (e.g. corrosion, leakage, mechanical failure, electronic failure);
- operational risks (e.g. human error);
- environmental conditions;
- regulatory or reputational risks; and
- asset lifecycle risks (obsolescence of equipment).

B1.2 Criticality

The criticality of any individual gas meter is proportional to the size of the meter and the total demand of the customer. Due to the relatively low capacity of diaphragm meters, in the event of a failure of a meter the revenue impact is low and the impact on the total customer base is also low. Most meters have a short lead time for repair or replacement.

However due to the large number of meters and the relatively few types of meters in the network a class failure of any of the meters in the network could have major consequences resulting in significant capital replacement costs, potential loss of revenue and reputational damage.

All network receipt meters and demand contract customer meters are deemed to be critical due to the high volume of gas measured through these meters.

Residential and Industrial and commercial gas regulators have a low criticality due to their low consequence of failure and impact on customer supply.

B1.3 Failure modes

Table B1–1: Gas meter and regulator failure mode assessment <Caption text>

Asset	Failure type	Failure mode	Controls
Gas meters and regulators	Integrity	Equipment failure or damage leading to inaccurate measurement	Replace meters as per Metering Policy
	Integrity	Equipment failure or damage leading to loss of supply	Replace meters as per Metering Policy
	Integrity	Equipment failure or damage leading to loss of containment	Gas Safety Awareness Program Replace meters as per Metering Policy Emergency Management System (EMS)
	Regulatory	Non-compliance of meter sets with mandated standards	Replacement program
	Regulatory	Breach of licence requirements leading to loss of license to operate	Licence audits

Life expectancy, performance requirements, condition assessment and other aspects are detailed in the relevant asset specifications.

B1.4 Life expectancy

The expected minimum design life for gas measurement assets is between 15 and currently up to 35 years. A critical assumption when defining the design life is the effectiveness of controls which ensure the asset's integrity. Effective integrity management can extend the operating life beyond the technical design life.

Factors affecting the life expectancy of gas measurement assets include:

- manufacturing / build quality;
- model design;
- quality assurance;
- volume throughput;
- number of previous refurbishments;
- availability of spares;
- supportability;
- maintainability;
- obsolescence; and
- environmental factors (e.g. corrosion).

Measurement assets deemed to be at the end of their design life are assessed for fitness of purpose. The design lives for JGN's measurement assets are in the following table.

B2. 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.

There are more than 250,000 water meters installed in the JGN. A small portion of these meter include cold water master meters that operate within medium density high rise buildings. They are used as the reference meter for customer billing.

The asset specification for the hot water meter asset is located within Schedule 3 of the Instrument for Agreement for Meter Procurement [13] and[14].

B2.1 Risks associated with these assets

JGN is subject to the Jemena Risk Management Policy (and the Group Risk Management Manual) for the management of the measurement assets. Hot water meters are not included in the AS4645 FSA process. However, risks are identified by the JGN Asset Management, Measurement team, who use a similarly robust framework for managing risk.

The risk register for JGN network is stored in JCARS, with specific asset risks captured and tracked via the metering asset class risk register.

The primary types of risks that impact water meters are:

- asset failure (e.g. corrosion, leakage, mechanical failure, electronic failure, battery failure);
- operational risks (e.g. human error);
- regulatory or reputational risks; and
- asset lifecycle risks (obsolescence of equipment).

B2.2 Criticality

Water meters have a low criticality due to the relatively low number and capacity. In the event of a failure of a meter, there is no impact on customer supply, and revenue over the total customer base is low.

B2.3 Failure modes

Table B2–1: Water meter failure mode assessment

Asset	Failure type	Failure mode	Controls
Water meters	Integrity	Equipment failure or damage leading to inaccurate measurement	Replace meters as per ACS
	Integrity	Equipment failure or damage leading to hot water supply interruption	Replace meters as per ACS
	Integrity	Equipment failure or damage leading to water leakage / scald risk	Replace meters as per ACS

[13] ITRON - Instrument of Agreement for Supply of Hot Water Flow Measurement Meters Procurement

[14] Enware - Instrument of Agreement for Meter Procurement

	Regulatory	Non-compliance of meter sets with mandated standards	Replacement program
	Regulatory	Breach of licence requirements leading to loss of license to operate	Licence audits

B2.4 Life expectancy

Water meters' useful life is dependent on the type and model of water meter:

- Mechanical hot water meters have a 20 year design life and some models are still functioning adequately after over 25 years of service. This type of meter is progressively being replaced.
- Marly meters are assumed to have a life of 20 years, though concerns with these assets has been raised (see section 4.3.3.2.2).
- Cyble head fitted Itron meters must be replaced prior to the end of the battery life, which is estimated at 12 years.
- Ultrasonic meters must be replaced prior to the end of the battery life, which is estimated at 15 years. However, it should be noted that new models of ultrasonic meters are expected to have replaceable batteries which will extend the meter life considerably.

Factors affecting the life expectancy of water meters include:

- manufacturing / build quality;
- model design;
- quality assurance;
- volume throughput;
- obsolescence; and
- environmental factors (e.g. corrosion).

B3. Data collection equipment

JGN uses data collection equipment to record and transmit metering and gas quality data across the network

The data collection equipment for Contract customers 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 TJs or where meters are upstream of gas regulators such as POTS meters.
- Data loggers – 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 TJs. 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.

The data collection equipment for Volume customers includes:

- Meter data loggers (MDLs) – The MDL system records gas and water usage via pulsed signals from the meter to the MDL. MDLs are remote electronic devices installed in the JGN and Evoenergy networks to record and transmit the consumption of gas and or hot water meters in apartment blocks. The gas and hot water meters typically installed within a customer's unit. Data is accumulated in the data loggers and transmitted to the "MDL Server" through a communications system.
- Radio Frequency (RF) modules – RF modules are installed in medium density and high-rise dwellings that have no meter data loggers or meters that are inaccessible by meter readers. The modules are installed on existing Hydrus or Ultramax hot water meters of Email 750 gas meters and are read through the following equipment of Bluetooth receiver, opto head and tablets. The RF modules are able to be read by walking outside the front of the building and using the RF equipment listed above. Enware supply the meter reading devices.

JGN's data collection equipment is shown in the following tables. Refer to ECMS for the latest volumes.

Table B3–1: Contract customer data collection equipment

Asset	Sub-asset	Description
Gas volume corrector	Gas volume corrector (ECAT or Mini-AT's)	Mercury product supplied by Honeywell. Mini-AT is the newer version
	Electronic corrector interface (ECI-2/IMU)	ECIs installed with Mercury corrector (connection between the two use copper telephone lines). Mercury corrector records pressure and temperature to get standard volume. Metretek product supplied by Honeywell.
Data logger	Commercial pulse accumulator (CPA)	CPAs are integrated modem and data logger, collect actual volume from the meters. The units communicate actual volume to data collection device using copper telephone lines. The pressure and temperature and correction is applied in the SAP billing system to convert to standard volume. These devices are being replaced with CNI2's to address the NBN roll out and communicate over 3G Metretek data logger and modem in built
Other	Communications equipment (including lines, wires and earthing, intrinsic safety barriers, telephone suppressors)	Equipment to ensure the safe and reliable operation of data equipment

Table B3–2: Volume customer data collection equipment

Asset	Sub-asset	Description
Meter data logger	Meter data logger	Epitomy product that has versions 4-6 in the field
	Communications equipment	3G modems are supplied by RFI. Currently looking for a new modem that using NB-IoT in our MDL network Cables are installed by developer through the building
	Meter Data Logger Secure Messaging System (MDL-SMS)	Used to carried out meter realignments and maintenance
	Connections to a meter	Mainly reed switch connections to a meter
Manual meter reading device	Handheld devices for manual meter reading.	To carry out meter reading
	Enware tablets	Download data

RF reading equipment	Bluetooth receivers	To receive the data
	Opto read head	Diagnostics tool

The asset specifications for gas volume correctors are in ECMS[15]. Asset specifications for meter data loggers are in GAS-1799-SP-ME-002, while the specification for manual meter reading devices is under development.

B3.1 Risks associated with these assets

JGN is subject to the Jemena Risk Management Policy (and the Group Risk Management Manual) for the management of the measurement assets, which alongside the AS4645 FSA process provides the robust framework for managing risk.

The risk register for JGN network is stored in JCARS, with specific asset risks captured and tracked via the metering asset class risk register.

The primary types of risk that impact data collection measurement assets are:

- asset failure (e.g. corrosion, leakage, mechanical failure, electronic failure);
- operational risks (e.g. human error, communications failure);
- Operating environment (environmental conditions and hazardous areas);
- single supplier reliance;
- regulatory risks; and
- asset lifecycle risks (obsolescence of equipment including integration with NBN).

B3.2 Criticality

The criticality of any individual data collection measurement assets is proportional to the size of the meter and the total demand of the customer. Due to the large number of meter data loggers, failure of any shared data collection asset (such as the server) could have major consequences resulting in significant capital replacement costs, potential loss of revenue and reputational damage.

All gas volume correctors are deemed to be critical due to the high volume of gas measured through these meters.

B3.3 Failure modes

Table B3–3: Data collection equipment failure mode assessment

Asset	Failure type	Failure mode	Controls
Data collection equipment	Integrity	Equipment failure or damage leading to inaccurate measurement	Regular review of defects Replacement program
	Regulatory	Non-compliance of meter sets with mandated standards	Replacement program
	Operation	Sole supplier ceases operations	Sufficient stock levels of product/assets

[15] Custody Transfer Flow Computer Requirements Specification is an historical version that hasn't been released into a new template. Scope is unchanged.

	Operation	NBN rolled out to a large number of sites at the same time	Installation of 3G and 4G communications, which is compatible with future devices
	Regulatory	Breach of licence requirements leading to loss of license to operate	Licence audits

B3.4 Life expectancy

The life expectancy of data collection equipment is estimated to be at a minimum 10 years. This is based on supportability of the asset with spares availability and upgrades to hardware as required. JGN's experience has indicated this equipment could last more than 10 years, however, require on going monitoring and analysis of failures.

Factors affecting the life expectancy of data collection equipment include:

- manufacturing / build quality;
- model design;
- quality assurance;
- volume throughput;
- obsolescence; and
- environmental factors (e.g. corrosion).

B4. 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.

The gas quality measuring equipment includes:

- Gas chromatographs (GCs-6) – instruments which analyse the components of gas and give gas composition ranging from Methane to Hexane. They use the gas composition to calculate the specific gravity, heating value and Wobbe index of the gas. This is important for billing and for UAG and in particular when there are different sources of gas supplied into a pipeline and/or network.
- Hydrocarbon and water dewpoint analysers – instruments which analyse the hydrocarbon and water content of gas. Gas which is out of specifications could lead to water and liquid hydrocarbons dropping out of the gas into the pipeline and during delivery to customers when the gas pressure is regulated and reduced. This could lead to corrosion, blockage of regulators and pipes and interruption of gas supply to townships and end users.

JGN is required to ensure the quality of gas entering and leaving their systems meets national and/or contractual specifications. The asset specifications for:

- gas chromatographs are in GAS-0.02; and
- hydrocarbon and water dewpoint analysers are in development.

There are no asset specifications for odorant analysers. However, the current supplier manufactures the analysers to meet current regulatory standards.

B4.1 Risks associated with these assets

JGN is subject to the Jemena Risk Management Policy (and the Group Risk Management Manual) for the management of the measurement assets, which alongside the AS4645 FSA process provides the robust framework for managing risk. The risk register for JGN network is stored in JCARS, with specific asset risks captured and tracked via the metering asset class risk register.

The primary types of risk that impact gas quality measurement assets are:

- asset failure (e.g. corrosion, leakage, mechanical failure, electronic failure);
- operational risks (e.g. human error, communications failure);
- maintainability;
- environmental conditions;
- regulatory risks; and
- asset lifecycle risks (obsolescence of equipment).

B4.2 Criticality

Gas quality measurement on the distribution network has a low criticality due to the relatively low impact on customer supply. Failure of gas quality measurement assets primarily affects regulatory and contract compliance.

B4.3 Failure modes

Table B4–1: Gas quality assessment failure mode assessment

Asset	Failure type	Failure mode	Controls
Gas quality measurement equipment	Integrity	Equipment failure or damage leading to inaccurate measurement	Planned maintenance SCADA active monitoring with alarms
	Regulatory	Non-compliance of meter sets with mandated standards	Replacement program
	Regulatory	Breach of licence requirements leading to loss of license to operate	Licence audits

B4.4 Life expectancy

Gas quality measurement equipment's life expectancy is estimated to be at a minimum 10 years. This is based on supportability of the asset with spares availability and upgrades to hardware as required.

Factors affecting the life expectancy of gas quality measurement equipment include:

- manufacturing / build quality;
- model design;
- quality assurance;
- volume throughput;
- obsolescence; and
- environmental factors (e.g. corrosion).

Appendix C
Information requirements

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C1. Information requirements

Jemena's AMS provides a hierarchical approach to understanding the information requirement to achieve Jemena's business objectives at the Asset Class. In summary, the combination of Jemena's Business Plan, the individual Asset Business Strategy (ABS) and Asset Class Strategy (ACS) all provide the context for and determine the information required to deliver an Asset Class's business.

The high-level information requirements to achieve the ACS's business objectives and inform its critical decisions were identified at a facilitated workshop during the ACS definition process.

From identified business objectives it is possible to identify at a high-level the business information systems' content required to support these objectives.

C1.1 Summary

All of the information required by the Measurement Asset Class is available within Jemena's current business systems.

Table C1–1: Measurement's Business Objectives and Information Requirements

Business objective	Jemena information sources	Externally sourced data
Maintain customer KPIs	SAP ERP Business Objects Reports Meter Centre Test Data and Test Rigs (external hosted application) Work Scopes ECMS Network Drive SCADA	AER Network Performance Reports Other gas network's regulatory proposals and public planning/performance reports AER Consumer Challenge Panel reports
Maintain asset safety and reliability KPIs and comply with regulations and legislative instruments	SAP ERP Business Objects Reports Meter Centre Test Data and Test Rigs (external hosted application) Work Scopes ECMS Network Drive SCADA Power BI Flow Kelton – FLOWCALC ROUTINE DATA Report ZINFRA DASHBOARD	Gas Supply Act 1996 No 38 (NSW) Gas Supply (Safety and Network Management) Regulation 2013 AS 4564:2011 Specification for general purpose natural gas AS 4645:1:2018 Gas Distribution Networks Part 1: Network Management AS/NZS 4645.2:2018 Gas distribution networks Part 2: Steel pipe systems AS/NZS 4645.3:2018 Gas distribution networks Part 2: Plastic pipe systems AS/NZS 5601.1:2013 Gas Installation – General Installations AER Network Performance Reports Other gas network's regulatory proposals and public planning/performance reports
Reduce capital investment intensity	SAP Metering forecasting model	AER benchmarking AER regulatory determinations Other gas network's regulatory proposals and public planning/performance reports Market testing – unit rates
Optimise operational spend	ECMS	AER benchmarking

	Network Drive SAP SCADA Power Spring	AER regulatory determinations Other gas network's regulatory proposals and public planning/performance reports Market testing – unit rates
Facilitate net zero	ECMS GPA hydrogen readiness repot JGN-10	ENA reports Other gas network's regulatory proposals and public planning/performance reports Competitor analysis Future fuel CRC Report
Increase investment scrutiny, to ensure the expenditure is prudent and costs can be recovered within a reasonable timeframe	Jemena Investment Governance Framework SAP ECMS	
Increase long term competitiveness of networks through higher asset utilisation and by connecting profitable new customers	Networks APaIR SAP	AER benchmarking AER regulatory determinations Other gas network's regulatory proposals and public planning/performance reports

Table C1–2: Measurement's Critical Decisions Business Information Requirements

Critical business decision	Current information usage	Future information requirement	Value to asset class (High, Medium, Low with justification)
Maintain lifecycle of asset integrity (meters) Diaphragm Meters; Large I&C Gas Meters; and Water Measurement	SAP: Certification date Lot Number Maintenance Plant Metering pressure Asset type Serial number Metering pressure Address Asset location (physical description) Customer contact Installation date Non-conformance certificates and rectification tracking Capture meter set components and monitoring of redundant parts ECMS: Folder Audit maintenance reports	Require modification to BO report to include site access issues or difficult access site (description or comments) field Update bulk report to include the following: Date last tested Connected to MDL Postcode search Meter type Meters showing not installed to be cleansed. Accurate data search function Overall system cleanse High pressure and transmission meters not currently managed in SAP and does not exist in the RAB. Business Objects doesn't have the following: Metering pressure	High

	Specifications & Standards Business Case (CAPEX & OPEX) Conditions reports Standards Regulatory information SCADA (gas meters and regulators only): Flows Alarms Log data All stations & pipelines	Network pressure Test /next inspection year Customer contact information Lot numbers Date last tested	
Maintain lifecycle of asset integrity (Regulators)	Business Objects: Performance of regulator Service orders ECMS: Field failure testing report Condition report Routine Data Report (RDR) APaIRS Gas Measurement Audit maintenance reports Specifications & Standards Business Case (CAPEX & OPEX) Standards Regulatory information	Require Regulators to be managed in SAP and to include the following data: Serial number (only regulators purchased after 2016 have serial numbers) For regulators without a serial number, they need to be shown in IQ09 (bulk meter) report. Address Asset location (physical description) Customer contact Installation and construction date/year Model Inlet and outlet pressure Relevant maintenance dates and information Connection to meter	High
Maintain lifecycle of asset integrity (data collection equipment) MDL, Metretek	MDL Locations Spreadsheet Business Objects: Service order reports ECMS: APAIRs Gas Measurement Audit maintenance reports Specifications & Standards Business Case (CAPEX & OPEX) Conditions reports Standards Regulatory information	Require MDL & Meterek managed in SAP and to include the following date: Address Asset location (physical description) Customer contact Installation date Require future report for MDL & Metretek: SAP: Date last tested Connected to MDL Postcode search Accurate data search function For MDL & Metretek	High

		Require Battery installation date and comms type: E.g. 3g, 4g, Business Objects: dependant on SAP inclusion of MDL & Metreteks Metering pressure Network pressure Test /next inspection year Customer contact information Date last tested	
Maintain lifecycle of asset integrity (gas quality measurement equipment) Chromatographer & Odour analyser	SCADA: (Voyager) GC Item ID Trending Alarms	SAP: Capture equipment in SAP (Currently does not exist) Require a report for Chromatograph & Adour with to monitor performance. Technology to assist in analysing data to trends and performance.	Medium

Table C1–3: Information Initiatives to Support Business Information Requirements

Information initiative	Use case description	Asset class risk in not completing	Data quality requirement
Further SAP & Business Objects Report functionality.	SAP and BO Report Metering Data Meter functional location information such as: Physical location Metering pressure Network pressure Customer contact details Apartment and unit details Test date Installation date Mains pressure Next scheduled change date	Medium	Complete (70%)
Management of MDL & Metretek in SAP	Jemena has some 15,000 data loggers on High Rise developments and 500 Metretek data loggers used for industrial customers. Jemena will be purchasing data loggers from various suppliers. The requirement is to create data loggers as	High	Completeness to 95%

	an asset in SAP and to be able to differentiate models supplied in a manner similar to gas meters.		
Chromatograph & Adour analyser. Validation certificate	Implement Validation certificate. Will determine if equipment is within the allowed tolerance.	High	Completeness, Attribute accuracy 95%