

STRATEGY

SUPERVISORY CONTROL AND DATA ACQUISITION AND REAL TIME SYSTEMS ASSET CLASS STRATEGY

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DOCUMENT HISTORY

Revision	Date	Description of Changes
1.0	23/12/2015	Initial Issue
2.0	5/9/2017	Updated diagrams and discontinued tracking. Added links to LCMP and Security Strategy Summaries Capex and Opex Plans
2.1	3/7/2018	Update with LCMP CAPEX & OPEX, revamp to meet the current ACS Template. Include reference to security strategy documents and increased yearly capex to include proposed Security expenditure.
3.0	31/01/2020	Review to align with other JEN network and non-network ACS

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EXECUTIVE SUMMARY

This asset class strategy (ACS) is for Jemena's Supervisory Control and Data Acquisition (SCADA) and Real Time Systems (RTS) asset class. The SCADA and RTS asset class covers the following assets:

- OSI Pi Historian and
- GENe.

Co-dependencies

Whilst this strategy covers the above it is important to note that the SCADA and RTS Asset Class includes the whole of a SCADA infrastructure including but not limited to;

- SCADA back-end: data acquisition, servers, and real-time historian infrastructures
- Human Machine Interfaces and other forms of end-user clients
- IT network Storage and Computing dependencies
- Communications infrastructures and services dependencies
- Remote Telemetry Units

For clarity, this strategy where necessary will make reference to dependent strategies such as IT network storage and computing technology and services.

Jemena's SCADA and RTS assets are critical to the achievement of its Business Plan. It is therefore necessary to ensure that these business systems are delivered in an efficient and scalable manner, with functional alignment across gas, electricity and water at the forefront of our asset management approach.

Jemena's SCADA and RTS assets are used to:

- manage safe asset control and facilitate emergency crew dispatch to maintain a safe and efficient network operations;
- validate the quality and quantities of electricity, gas and water delivered to customers;
- determine current and future plans for Jemena's networks;
- reconcile market delivery;
- capture data to facilitate performance reporting requirements and customer experience evaluations; and
- capture data to facilitate demonstration of meeting legislative requirements.

These assets interface with IT systems at the back-end such as:

- SAP,
- Cognos and
- GIS systems.

These IT assets are managed in line with the IT ACS. SCADA and RTS assets also interface with field devices. These field devices are managed under their respective ACSs. For example, SCADA field devices in JEN are managed under the Secondary Plant ACS. This ACS should therefore be read in conjunction with the IT and relevant JEN ACSs.

This document is commonly referred to as the JEN SCADA and RTS ACS. This ACS sets out the asset class objectives, lifecycle strategies for SCADA and RTS assets used by Jemena Electricity Networks (JEN) and includes a high-level 20-year forecast of capex and opex.

ASSET CLASS OBJECTIVES

While there are similarities across the asset objectives for the various Jemena businesses, there are also considerable differences. Therefore, rather than map SCADA and RTS asset class objectives directly to all the objectives defined in the JEN Asset Business Strategy (ABS), this ACS aligns the SCADA and RTS asset class objectives to the four pillars and goals outlined in the Group Strategy. Given the ABS is directly informed by the Group Strategy, this approach ensures broad alignment with JEN's needs.

The SCADA and RTS asset class objectives are presented in the following table.

Table 0-1: Jemena SCADA and RTS asset class objectives

JEN key objective	SCADA and RTS asset class objective
Customer Have our customers advocate for us based on their experience of our products	Manage SCADA and RTS assets to ensure the ongoing safe and reliable operation of Jemena's networks
	Support customers' ability to understand the service Jemena is delivering them
	Ensure all statutory requirements are met
Operational excellence Build efficient operations with the capacity to grow with us	Drive cost reductions through the provision of SCADA and RTS including upgrades where appropriate
Growth Grow profitably and sustainably	Support business development and opportunities for growth
Our people Ensure we have the right people and capability to deliver the plan	Improve the capability and engagement of the SCADA and RTS teams

A summary of performance of the asset class against these objectives is provided in section 3.3.2.

ASSET CONDITION AND RISK

The overall condition of the SCADA and RTS asset class is good. Existing risk controls are appropriate and the overall risk associated with SCADA and RTS is in line with target.

Although the SCADA system is at the end of its design life, effective processes and backup and recovery structures have been implemented to ensure the system remains stable until decommissioning. It is therefore expected that the high level of availability will continue in the near-term.

An overview of the current risk associated with the SCADA and RTS asset class is provided in section 4.1.1.

1 INTRODUCTION

Jemena's SCADA and RTS assets are critical to the achievement of its Business Plan. It is therefore necessary to ensure that these business systems are delivered in an efficient and scalable manner, with functional alignment across gas, electricity and water at the forefront of our asset management approach.

Jemena's SCADA and RTS assets are used to:

- manage safe asset control and facilitate emergency crew dispatch to maintain a safe and efficient network operations;
- validate the quality and quantities of electricity, gas and water delivered to customers;
- determine current and future plans for Jemena's networks;
- reconcile market delivery;
- capture data to facilitate performance reporting requirements and customer experience evaluations; and
- capture data to facilitate demonstration of meeting legislative requirements.

These assets interface with IT systems at the back-end such as SAP, Cognos and GIS systems. These IT assets are managed in line with the IT ACS. SCADA and RTS assets also interface with field devices. These field devices are managed under their respective ACSs. For example, SCADA field devices in JEN are managed under the Secondary Plant ACS. This ACS should therefore be read in conjunction with the IT and relevant JEN ACSs.

This SCADA and RTS strategy mirrors Jemena's IT strategy, which is to replace end-of-life systems as necessary and where economical to do so, with a preference to consolidate core technologies into single platforms where possible. This enables Jemena to be more efficient and scalable, whilst maintaining the quality, reliability and security of supply. The SCADA system is the primary operational technology (OT) that will facilitate effective investments in technology to enable efficiency and support growth across all assets.

Jemena's preference is to procure and maintain SCADA systems and RTS that leverage¹ corporate IT asset systems, strategies² and contracts. Moreover, Jemena employs corporate policies and standards to ensure that all technology is managed to continue to be fit-for-purpose. This reduces the management, procurement and maintenance costs associated with SCADA and RTS assets.

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

- Jemena has a preference for virtualisation infrastructure. This should reduce the number of servers required to manage the SCADA and RTS functionality and better support the backup and recovery processes.
- Jemena has a preference for Windows infrastructure. This allows Jemena to better utilise the purchasing contracts in place with Windows support and management.

¹ Jemena's OT network infrastructure and corporate IT network infrastructure remain separate.

² Refer to Jemena IT's submission for the Compute, Storage, Backup and Datacentre IT strategies.

- SCADA platforms should be kept up-to-date for supportable hardware and operating systems, databases and applications. This allows cyber requirements to be met and functional changes to be supported and maintained.
- SCADA and RTS assets will be supplied in competitive tender taking advantage of bulk contracts for supply and support arrangements to reduce the total cost of ownership of these systems.
- Jemena prefers to reduce the number of applications and server sets to a minimum whilst maintaining resilience³. Implement data logging and alerting systems within existing infrastructure where possible, to reduce resource and skills management required to maintain these additional applications.
- Jemena will provide sufficient data management in line with the criticality and privacy requirements for the data. This takes into account the ring-fencing requirements and ownership of the data and meeting the storage, security and disposal requirements of that data.
- Jemena will provide supporting systems to centrally support SCADA and RTS environment to provide highly available redundant system, while maintaining cyber defences and data management responsibilities. This includes authentication, patching, backup and antivirus systems.
- Jemena Asset Management is certified to both ISO-55001 and ISO-27001.

1.1 PURPOSE / OBJECTIVES

The purpose of this ACS is to explain the approach and principal methods by which the SCADA and RTS asset class contributes to delivering the goals of the Group Strategy, and by extension, the asset objectives defined in the JEN Asset Business Strategy (ABS). The SCADA and RTS ACS is based on the following information:

- **asset profile** – includes information about the type, specifications, life expectancy and age profile of properties in service across all Jemena asset businesses;
- **asset risk** – includes identifying threats, opportunities, strengths and weakness, including asset performance objectives and measures, criticality and condition, to ensure all issues, risks and opportunities are documented;
- **asset performance** – provides information about performance objectives, drivers, and service levels, and the technical and commercial risks associated with SCADA and RTS management;
- **asset strategy** – outlines SCADA and RTS asset management practices. This includes key asset strategies that support the corporate and functional group business plan, strategies and objectives, and inform expenditure plans and programs of work;
- **asset class objectives** – the objectives and targets for the asset class, and how these contribute to the overall relevant Jemena asset objectives. These provide the essential link between Jemena's business plan, the Asset Business Strategy and Asset Investment Plan; and

³ Jemena's definition of resilience is that a system should not be disturbed from its normal functionality by the loss of a single component.

- **asset expenditure assessment** – provides information about the expenditure decision-making processes (and how expenditure options are analysed) as well as historical and forecast.

This SCADA and RTS ACS is then used in combination with the ACSs for other asset classes to develop JEN's Asset Investment Plan (AIP) and expenditure forecasts for the next seven years.

The expenditure forecasts provided in the AIP form the basis of budget planning and regulatory proposals, therefore, the SCADA and RTS ACS plays an important role in Jemena's asset management system.

The ACS covers the whole life of the assets. The asset management practices in this ACS seek to ensure reliable performance to maintain Jemena's long-term viability, while maintaining regulatory compliance and considering risk, asset condition, performance, technology, and growth.

1.2 ASSET MANAGEMENT SYSTEM

The SCADA and RTS ACS creates line of sight between the Group Strategy, the ABS, and the AIP.

A detailed description of Jemena's asset management system (AMS) and its constituent parts is available in the Jemena AMS Manual and the AMS Guidelines.

1.3 DESCRIPTION OF ASSETS COVERED

The SCADA and RTS asset class covers the following assets:

Asset	Location	Description
OSI Pi Historian	Alexandria and EDC data centres	Jemena disseminates SCADA real time data and data logged gauging information into the OSI Pi Historian. This data is utilised by Business Analysts and the JEN Emergency Load Management System (ELMS) which provides management of emergency outages.
GENe	Mitcham and Alexandria data centres	The GENe instances provide extensive electrical model and gas management calculations for Jemena's Electrical, Gas and Water Distribution assets.
RTUs	Numerous JEN electricity facilities	Remote Terminal Unit (RTU) is an Intelligent Device used to collect analogue signals from various sensors and convert these signals into digital data used to monitor and control Jemena field assets.

1.4 GOVERNANCE

This ACS is reviewed annually to ensure ongoing alignment with the Group Strategy and asset objectives outlined in the ABS, and to account for any new asset performance and risk information.

Table 1-1 sets out the high level responsibilities for this ACS.

Table 1-1: RASCI governance table for ACS

Role	Responsibilities	Group/Person
Responsibility	Who is responsible for carrying out the entrusted task?	SCADA & RTS

Role	Responsibilities	Group/Person
Accountable (Approval)	Who is responsible for the whole task and who is responsible for what has been done?	GM Asset Systems & Assurance
Support	Who provides support during the implementation of the activity / process / service?	Digital Network Operations Asset Management
Consultation	Who can provide valuable advice or consultation for the task?	Asset Investment Customer Service Regulation Strategy & Commercial
Inform	Who should be informed about the task progress or the decisions in the task?	EGM Gas Distribution EGM Electricity Distribution EGM Gas Markets EGM Electricity Markets Chief Digital Officer

2 STRATEGIC DRIVERS

As detailed in the Group Strategy and JEN's ABS, the operating environment and stakeholder expectations are crucial inputs into how we manage SCADA and RTS requirements. External factors, including regulations, technical standards, technological advance and customer requirements are regularly evolving, which means we must regularly review and monitor the strategic drivers for investment.

Jemena identifies the following strategic drivers that influence how we manage our assets:

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

A summary of how these strategic drivers relates to the SCADA and RTS asset class is provided in the following sections.

2.1 MARKET AND COMPETITIVE POSITION

As highlighted in the ABS, the energy market in Australia is changing. Energy consumers are looking for cleaner, affordable, more reliable energy, and considerable focus is being placed on whether the traditional electricity network structures in place today will be appropriate in the future.

While demand for electricity is expected to remain strong, the way in which consumers use energy – and therefore the way Jemena captures, stores and uses data – will necessarily change over the coming decades. These changes in our network businesses have a direct impact on acquisition, retention and disposal of SCADA and RTS assets.

2.2 CUSTOMER AND COMMUNITY EXPECTATIONS

As highlighted in the most recent customer engagement surveys conducted by JEN, at the most basic level customers seek a safe, reliable and affordable energy supply. However, with access to more data and greater focus on social responsibility, environmental challenges and innovation, customers' expectations have an additional degree of sophistication.

As part of a safe, reliable and affordable energy supply, our customers and communities expect:

- environmental responsibility;
- enhanced public amenity;
- timely incident response;
- quality customer service and engagement;
- consistent levels of service to all customers; and
- prudent cost management.

In relation to SCADA and RTS assets, customers told us that they were concerned about the impact of estimated meter readings and preferred the accuracy of billing based on actually consumed quantities. They expect JEN to continue to investigate and manage estimations including technology solutions as they become affordable.

There is also an increasing push from customers for more information delivered in a more timely manner. This will affect our acquisition and management strategies for our SCADA and RTS assets. In particular, this will drive a continual need for additional granularity in our data, and functionality in our collection, management and dissemination assets.

2.3 LONG TERM SUSTAINABLE COSTS AND SHAREHOLDER EXPECTATIONS

As highlighted in the Group Strategy and associated ACSs, it is vital Jemena has a long term sustainable cost structure. Like most companies and corporations, our shareholders expect a reasonable opportunity to recover their investment. The SCADA and RTS investment decisions we make today not only need to be prudent from our customers' perspective, they also need to be prudent from our shareholders' perspective.

When making decisions on SCADA and RTS acquisition and management, consideration must be given to financial sustainability, risk and governance. Questions to be considered around financial sustainability and governance include:

- What are the upfront costs of options, maintenance and improvements, and do they outweigh the benefits for our customers?
- What are the risks?
- Have we followed Jemena procedures and meet legislative requirements?

SCADA and RTS investment is largely driven by technological obsolescence, and increased need for functionality. With Jemena's strategy to consolidate SCADA and RTS assets into one platform where possible, expenditure will only be undertaken in line with the SCADA and RTS, and IT strategies⁴, with only exceptional circumstances for investment in projects not identified in the plan.

2.4 INNOVATION AND TECHNOLOGY

Changes in technology and innovation have a direct impact on the way Jemena manages and operates its network asset businesses. Improvements in distributed energy resources, energy storage, demand management and data management are changing the way we think about electricity.

Our customers have told us they expect us, and other parts of the energy industry, to innovate and plan for the future so that they can access affordable electricity in the longer term, as we move to a zero-carbon future. This is why JEN is looking at alternative technologies and innovation trials so we can ensure our businesses remain commercially sustainable in the future.

We also consider the application of innovation in our SCADA and RTS assets, investing in assets with newer technology where practicable and economic to do so.

⁴ Refer to Jemena IT's submission for Compute, Storage, Backup and Datacentre IT strategies.

The approach to JEN SCADA and RTS innovation and technology primarily focuses upon shifting from in-house developed and maintained solutions towards off-the shelf solutions and services, and enterprise solutions and services. Where possible, such as those offered by Jemena IT for network storage and computing technologies and services. This will be achieved through a major program to replace of end of life SCADA and RTS systems, to be completed during 2020, with contemporary off the shelf technologies (hardware and software). This will enable a shift in the efficiency of supporting the SCADA and RTS technology stack. This approach enables;

- Capability to be optimised given a lesser focus will be required upon the hands-on management of self-developed software and self-managed IT infrastructures which will be more optimally delivered through off the shelf software and IT services
- Improved asset resilience through shifting to fully virtualised SCADA infrastructures which afford more resilient and responsive systems
- Reduce self-creation and support of technologies by leveraging the adaptively maintained vendor solutions which will keep pace with environmental impacts upon systems e.g. capability to ring-fence areas of networks in response to mandatory requirements to do so
- Introduce a step-change to implement strong-controls for cyber security risk through alignment with contemporary vendor technologies that include cyber security by design as opposed to the legacy technologies that are being replaced which do not provide an acceptable level of cyber security control
- Jemena are able to investigate and implement contemporary Remote Telemetry Units that include cyber security by design given the replacement SCADA solution will support secure protocols whereas the outgoing system does not

2.5 REGULATORY AND LEGISLATIVE ENVIRONMENT

SCADA and RTS acquisition, management and disposal is governed by a range of regulatory requirements. Table 2-1 summarises the key legislative requirements and technical standards relating to these assets. These requirements are factored into our asset management strategies and help inform the investments and operating activities we undertake.

Table 2-1: Summary of key legislative requirements and technical standards relating to the SCADA and RTS asset class

Legislative requirement / technical standard	Summary of requirements
Privacy Act	To promote and protect the privacy of individuals
Notifiable Data Breaches (NDB) scheme	Sets out the requirements for any organisations covered by the Privacy Act to notify affected individuals and the OAIC when a data breach is likely to result in serious harm to an individual whose personal information is involved.
Cybercrime Act	The laws relating to computer offences
Australian Copyright Act	
Victorian and National Electricity Law	Sets out the regulation of the national electricity wholesale market
Applicable Work Health and Safety (WHS) Acts	Sets out the key principles, duties and rights about OHS
Security of Critical Infrastructure Act 2018	The Security of Critical Infrastructure Act 2018 (the Act) contains a range of powers, functions and obligations that only apply in relation to specific critical infrastructure assets in the electricity, gas, water and ports sectors.
AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules)	Sets out requirements for the design, construction and verification of electrical installations, including the selection and installation of electrical equipment forming part of such electrical installations.
AS/NZS 60079.0:2012 Explosive atmospheres - Equipment - General requirements	Specifies the general requirements for construction, testing and marking of electrical equipment and Ex Components intended for use in explosive atmospheres.
AS/NZS 60079.14:2009 Explosive atmospheres - Electrical installations design, selection and erection (IEC 60079-14, Ed. 4.0(2007) MOD)	Contains requirements for the design, selection and erection of electrical installations in hazardous areas associated with explosive atmospheres.
AS/NZS 60079.17:2009 Explosive atmospheres - Electrical installations inspection and maintenance (IEC 60079-17, Ed.4.0(2007) MOD)	Applies to users and covers factors directly related to the inspection and maintenance of electrical installations within hazardous areas only, where the hazard may be caused by flammable gases, vapours, mists, dusts, fibres or flyings.
AS/NZS 2381.1:2005 Electrical equipment for explosive gas atmospheres - Selection, installation and maintenance - General requirements	Specifies general requirements, additional to those required for basic electrical safety, for the selection of electrical equipment and instruments, and associated equipment, and for the electrical equipment's installation and maintenance to ensure safe use in hazardous area.
AS/NZS 2381.6:1993 Electrical equipment for explosive gas atmospheres - Selection, installation and maintenance – Increased safety	Sets out requirements for the selection, installation and maintenance of increased safety equipment, type of protection etc.
AS/NZS 2381.7:1989 Electrical equipment for explosive gas atmospheres - Selection, installation and maintenance – Increased safety	Sets out requirements for the selection, installation and maintenance of intrinsically safe electrical equipment and systems.
Jemena Network Operator Rules	These rules are issues by Jemena and form part of Jemena's Safety and Operating Plan (SAOP) for its networks.

Legislative requirement / technical standard	Summary of requirements
Electricity Safety Cases	Describes the requirements for operating electricity assets in a safe manner.
National Electricity Rules	National Electricity Rules governs access to electricity transmission and distribution networks. It includes economic value tests that set requirements for efficient capital and operating expenditure.

3 ASSET CLASS OBJECTIVES

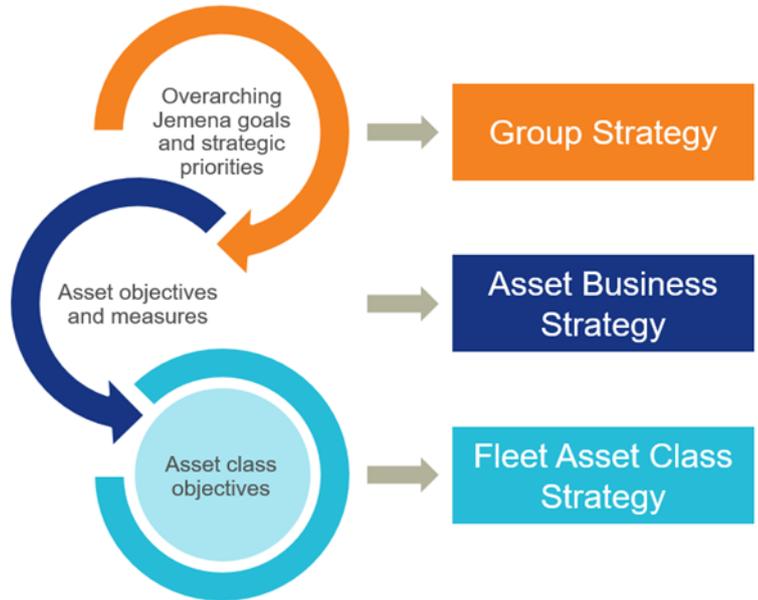
This section provides the line of sight from corporate goals through to the SCADA and RTS asset class objectives.

The SCADA and RTS asset class supports the JEN asset business. Each of these asset businesses produces an ABS, which outlines that business’ asset objectives. The asset objectives are in turn informed by the goals described in the Group Strategy and relevant gas and electricity market strategies.

This SCADA and RTS ACS considers the asset objectives detailed in the ABS, along with current performance data on relevant assets. It then defines a series of asset class objectives that apply to the assets.

These asset class objectives then help determine the appropriate SCADA and RTS management strategies to support the gas and electricity businesses.

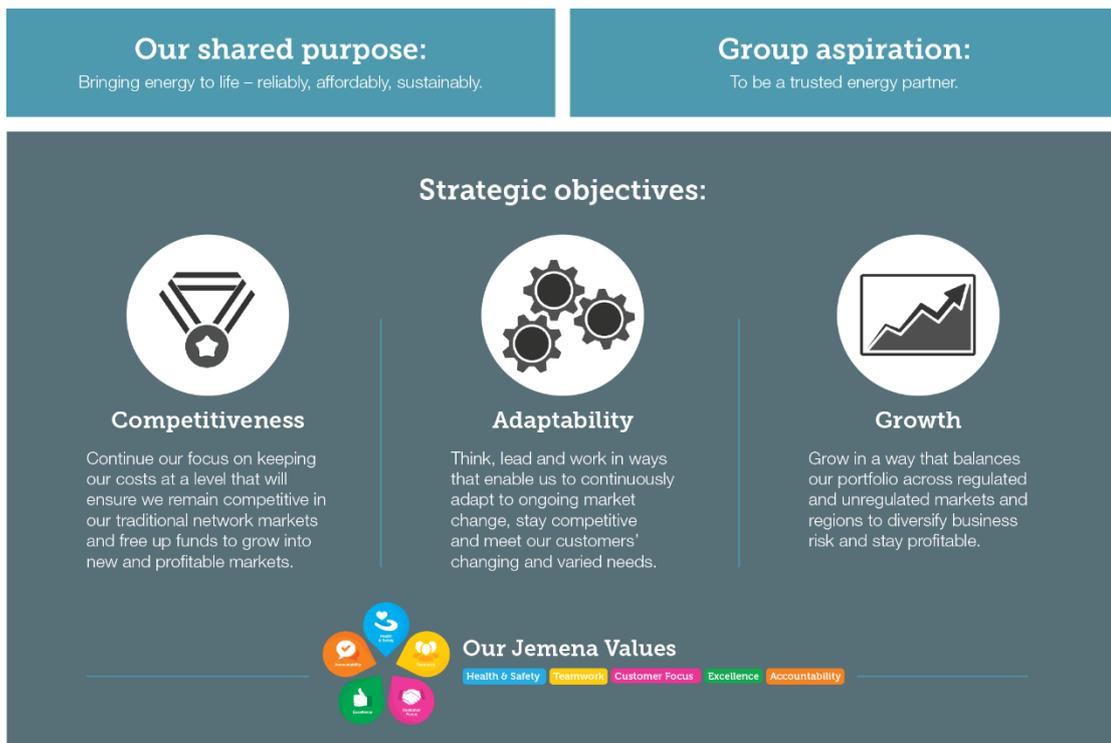
Figure 3-1: Documents that contain the various corporate and asset-specific goals, pillars and objectives.



3.1 GROUP STRATEGY

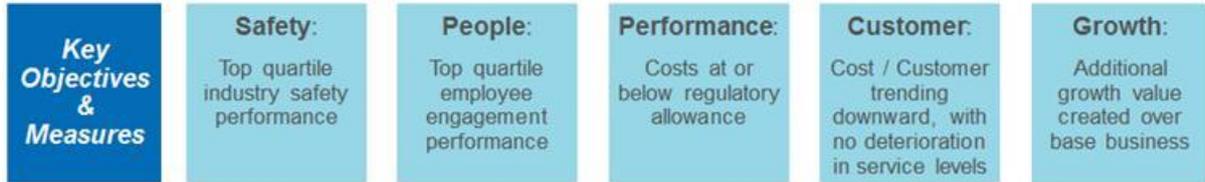
The Group Strategy is presented in Figure 3-2 below.

Figure 3-2: Overview of Group Strategy



The three pillars under the Strategic Objectives of the Group Strategy are overarching goals that apply to JEN, and are used to inform the specific SCADA and RTS asset class objectives through several key objectives shown in figure 4-3 below.

Figure 3-3: Key success measures and objectives



3.2 ASSET CLASS OBJECTIVES

This JEN SCADA and RTS ACS aligns the SCADA and RTS asset class objectives to key strategic objectives (as shown above) which support the Group Strategy. Given the JEN ABS is directly informed by objectives which support our Group Strategy this approach ensures broad alignment with JEN’s needs. The SCADA and RTS asset class objectives are presented in Table 3-1 below.

Table 3-1: Jemena SCADA and RTS asset class objectives

JEN Key Objective	SCADA and RTS asset class objective	Measure	Target
Customer Have our customers advocate for us based on their experience of our products	Manage SCADA and RTS assets to ensure the ongoing safe and reliable operation of Jemena’s networks	Provide 24/7 operation of SCADA and RTS capability	100% availability
		Ensure sufficient resilience ⁵ of SCADA and RTS assets in relation to cyber security, supply security, availability and business continuity	No SCADA and RTS incidents affecting supply
		SCADA and RTS risks updated in JCARS	All newly identified or closed out risks captured in JCARS by end of relevant quarter
	Support customers’ ability to understand the service Jemena is delivering them	Minimise customer complaints about service performance	No complaints directly related to SCADA and RTS functionality
	Ensure all statutory requirements are met	All statutory requirements met	No breaches
Performance Build efficient operations with the	Drive cost reductions through the provision of SCADA and RTS including upgrades where appropriate	Support business growth at minimal marginal cost	All SCADA and RTS business cases explicitly assess scalability as a key criterion for investment

⁵ Jemena’s definition of resilience is that a system should not be disturbed from its normal functionality by the loss of a single component.

JEN Key Objective	SCADA and RTS asset class objective	Measure	Target
capacity to grow with us		Provide functional alignment across SCADA and RTS assets	Reduce the number of SCADA and real time systems
		Develop and implement technology master plan	All SCADA and RTS programs delivered within total budget
Growth Grow profitably and sustainably	Support business development and opportunities for growth	Continual improvement initiatives implemented	3 initiatives implemented in 2019/20
People Ensure we have the right people and capability to deliver the plan	Improve the capability and engagement of the SCADA and RTS teams	Ensure all SCADA and RTS personnel understand procurement, and approval process, and reporting requirements	Provide initial or refresher training for 100% of SCADA and RTS personnel each year
		Provide functional alignment across SCADA and RTS assets to provide economies of scale where possible	80% of SCADA and RTS personnel providing services to multiple customer bases

A summary of performance of the asset class against these objectives, as well as key projects identified to address and/or maintain performance is provided in the following section.

3.3 ASSET CLASS FUNCTION AND PERFORMANCE

This section provides an overview of performance across SCADA and RTS asset class, measured against the asset class objectives. It includes a high level description of the asset class function, current performance and condition requirements.

More detailed information of performance, risk and specific projects at the asset sub-class level is provided in section 4 of this ACS.

3.3.1 FUNCTION

Jemena's SCADA and RTS assets are critical to the achievement of its Business Plan. It is therefore necessary to ensure that these business systems are delivered in an efficient and scalable manner, with functional alignment across gas, electricity and water at the forefront of our asset management approach.

Jemena's SCADA and RTS assets are used to:

- manage safe asset control and facilitate emergency crew dispatch to maintain a safe and efficient network operations;
- validate the quality and quantities of electricity, gas and water delivered to customers;
- determine current and future plans for Jemena's networks;
- reconcile market delivery;
- capture data to facilitate performance reporting requirements and customer experience evaluations; and

- capture data to facilitate demonstration of meeting legislative requirements.

These assets interface with IT systems at the back-end such as SAP, Cognos and GIS systems. SCADA and RTS assets also interface with field devices such as meters. SCADA and RTS assets are therefore managed with consideration of the function, performance and requirements of those asset classes.

3.3.2 PERFORMANCE

Although the SCADA system is at the end of its design life, effective processes, backup and recovery structures have been implemented to ensure the system remains stable until decommissioning. It is expected that the high level of availability will continue in the near-term.

The following tables present an overview of performance against the asset class objectives, including commentary on initiatives/activities required to maintain or improve performance against these objectives.

3.3.2.1 *Manage SCADA and RTS assets to ensure the ongoing safe and reliable operation of Jemena's networks*

Measure	Target	Current performance
Provide 24/7 operation of SCADA and RTS capability	100% availability	As of June 2019, there have been no reported loss of visibility or control incidents recorded against the JEN SCADA system.
Ensure sufficient resilience of SCADA and RTS assets in relation to cyber security, supply security, availability and business continuity	No SCADA and RTS incidents affecting supply	At 30 June 2019, there were no incidents relating to SCADA that have impacted customer supply.
SCADA and RTS risks updated in JCARS	All newly identified or closed out risks captured in JCARS by end of relevant quarter	As 30 June 2019, all risks were update in JCARS as required for action.

3.3.2.2 *Support customers' ability to understand the service Jemena is delivering them*

Measure	Target	Current performance
Minimise customer complaints about service performance	No complaints directly related to SCADA and RTS functionality	As at 31 May 2019, there were no reported customer complaints directly related to SCADA and RTS functionality.

3.3.2.3 *Ensure all statutory requirements are met*

Measure	Target	Current performance
All statutory requirements met	No breaches	As at 30 June 2019, there were no breaches of statutory requirements.

3.3.2.4 *Drive cost reductions through the provision of SCADA and RTS including upgrades where appropriate*

Measure	Target	Current performance
Support business growth at minimal marginal cost	All SCADA and RTS business cases explicitly assess scalability as a key criterion for investment	All business cases are on track to be submitted into Jemena's AIP for 2019.
Provide functional alignment across SCADA and RTS assets	Reduce the number of SCADA and real time systems	As an outcome of the successful delivery of the SCADA DMS OMS and GMS replacement program, it is expected that a total reduction of 4 FTE will be realised across Jemena distribution assets. As of the end of June 2019, a reduction of 1 FTE has been realised.
Develop and implement technology master plan	All SCADA and RTS programs delivered within total budget	Relevant information has been input into Jemena budgets.

3.3.2.5 *Improve the capability and engagement of the SCADA and RTS teams*

Measure	Target	Current performance
Ensure all SCADA and RTS personnel understand procurement, and approval process, and reporting requirements	Provide initial or refresher training for 100% of SCADA and RTS personnel each year	100% of team members participated in at least 1 session during 2019.
Cyber Security responsiveness	Participate in 1 x cyber security exercise per year	Planning for 2020 includes all levels of the SCADA and RTS

3.3.3 INITIATIVES TO IMPROVE/MAINTAIN PERFORMANCE AGAINST SCADA AND RTS ASSET CLASS OBJECTIVES

The following key initiatives have been identified for implementation in the near-term to help improve and/or maintain performance against the SCADA and RTS asset class objectives:

- **SCADA and RTS Program** – This project was established in 2017 as a multi-phased approach toward replacing the end-of-life SCADA and outage management systems. The end-of-life GENE system poses a significant risk to the operation of the gas network if not replaced. We are expecting the project to be completed in 2019
- **RTU end-of-life replacement program** – This program of work is designed to ensure the real-time systems of JEN are kept in an evergreen state.
- **SCADA security infrastructure program** – This program of work is designed to continue to improve JEN's cyber security to mitigate the ever increasing cyber security presence in the resources industry.

4 ASSET CLASS STRATEGIES

The following sections provide information on lifecycle management of SCADA and RTS assets, from asset creation through to disposal.

4.1 SCADA AND RTS ASSETS

4.1.1 RISK

SCADA and RTS assets are subject to the Jemena Risk Management Policy (and the Group Risk Management Manual), which alongside the AMS risk practices and processes provides the robust framework for managing risk.

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

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

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

4.1.1.1 Criticality

Given the significance of SCADA and RTS actions and reliance on data gathered for the operation of the networks, it is prudent that these assets meet functional and industry standards, and up to date with current technology to ensure accuracy and reliability. In particular, it is critical to have equipment that provides reliable information in times when outage management is required or to model network performance.

SCADA and RTS assets must achieve a high level of availability and reliability. Failure of key SCADA and RTS assets could result in catastrophic consequences. Using the corporate risk matrix, the SCADA and RTS asset class overall would be 'High' given the 'Unlikely' likelihood of a catastrophic failure.

4.1.1.2 Failure modes

The following table outlines the typical failure modes for SCADA and RTS assets as well as the controls in place to help prevent failure.

Table 4-1: SCADA and RTS failure mode assessment

Asset	Failure type	Failure mode	Controls
SCADA	Asset failure	Equipment failure or degradation due to inadequate lifecycle management	SCADA, RTS and IT strategy Asset management under ACS Project governance framework IT/OT security policy and protocols

Asset	Failure type	Failure mode	Controls
			Periodic asset replacement / upgrades Periodic fit for purpose and end of life assessments Condition based risk management Backup configurations
	Operational	Inconsistent service resilience due to gaps in service model (failure to fully implement projects)	Change management process Project governance framework Asset data governance approach
	Operational	Third party interference (cyber attack)	Security governance framework IT/OT security policy and protocols Access restriction Corporate cyber security awareness training
	Operational	Third party interference (physical security breach)	Security governance framework IT/OT security policy and protocols Access restriction
	Operational	Inappropriate use of assets (human error)	Security governance framework IT/OT security policy and protocols Operations manual Training Operational staff rostering
	Regulatory	Technical / regulatory obsolescence	Monitoring relevant Australian Standards and Legislation Periodic asset replacement / upgrades

Current risks associated with SCADA and RTS assets, many of which are related to the above failure modes, are summarised in the following section.

4.1.1.3 Current risks

Risks related to SCADA and RTS assets are recorded in JCARS. There are no current risks that have been identified as not at target levels.

4.1.1.4 Existing controls

Current controls are listed in Table 4-1.

Controls are effective and mostly at target whilst areas for strengthening include;

- Having an adaptively maintained SCADA system (to be addressed by the replacement program)
- Cyber security whereby Jemena will pursue a range of improvements including some investment in new technologies. This is necessary in order for Jemena to maintain an effective suite of layered cyber security controls in order to best control ongoing cyber security threats and vulnerabilities

Condition maintenance of the SCADA system will need to be attended during the period by way of 1x system upgrade through the period. This involves the application of the vendors updated versions of the core system. This is necessary because the application of vendor releases addresses the requirement to have an adaptively maintained SCADA and RTS system which is material to the confidentiality and integrity risks of the SCADA and RTS systems and as such a critical dependency of the 99.96% availability KPI for the SCADA and RTS.

4.1.1.5 Future risks

No future risks have been identified. Emerging risks as a result of business/environmental/market changes are monitored on an ongoing basis. Any new risks identified will be recorded in JCARS.

4.1.1.6 Performance

Performance against the current asset class objectives is provided in section 3.3.2.

4.1.1.7 Requirements

Investment in, and maintenance of SCADA and RTS assets is largely a function of business and legislative requirements in relation to the collection, storage and dissemination of network data.

The following table outlines the requirements of the various functions of SCADA and RTS assets.

Table 4-2: Jemena SCADA and RTS asset requirements

Function	Electricity requirements
Telemetry and control type	SCADA + DMS
Data acquisition performance	<ul style="list-style-type: none"> • 2-4 seconds polling; • 20 second response; • Dedicated fibre, Radio, • 3G communications. • Provides the ability to rapidly react to dynamic conditions
Protocols used	IEC 61870 – DNP3 standard (unsolicited and polled), Conitel (polled)
Volume of data (per day)	>31 B measurements
Resolution of data	Millisecond time series accuracy
Assets monitored and controlled	Equipment at HV and MV level
Impact	>300,000 customers
Volume of alarms	>1,000's per day (during storms)
Resolution of alarms	Device and attribute level
Quality of analogue measurements	Instrumentation grade, MIL spec, highly reliable
Operational Management Systems	SCADA, OMS, DMS, Historian
Data required	Network Operational Model (connected network with asset attributes & properties). GIS, CIS internal configuration, SCADA configuration.
Decision support tools	Advanced User Interface, Power Flow, State Estimator, Load Forecast, Contingency Analysis, Study Mode
Operational modes	Configurable depending on number of faults

Function	Electricity requirements
Operating diagrams	<ul style="list-style-type: none"> • Need to 100% accurate • Diagrams continually change throughout the day
Availability required	Minimum 99.97% High Availability hardware configuration
Performance	Application performance response time specified in seconds
Security	NERC-CIP, NISTIR 7628, ISO-27001
Scalability	>10 Millions of customers
AMI integration	Current

4.1.1.8 Life expectancy

The life expectancy of SCADA and RTS assets varies depending on the asset type.

The industry accepted design life for SCADA and RTS assets is around five 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 SCADA and RTS assets include:

- manufacturing / build quality;
- model design;
- quality assurance;
- number of previous refurbishments;
- supportability;
- maintainability; and
- obsolescence.

SCADA and RTS assets deemed to be at the end of their design life are assessed to determine their fit for purpose. A staged replacement approach allows the spreading of capital expenditure managing the work force and allowing for increased longevity of equipment that is performing past the 5-year period.

4.1.1.9 Assessment

4.1.1.9.1 Age profile

The age profile of SCADA and RTS assets varies by asset type. Assets are replaced or upgraded periodically to ensure they continue to be fit for purpose. Information on the design life and age of each of the SCADA and RTS assets is provided in Table 4-4 together with commentary on any recent replacements and/or upgrades.

Table 4-3: Jemena SCADA and RTS asset age and condition assessment

Asset	Design life	Age	Commentary
OSI Pi Historian	5 years	<1 years	[Upgrade in early 2019 to facilitate SCADA Replacement Project
GENe	End of life	12 years	The end of life GENe is the focus of an existing SCADA Replacement program due to be commissioned in late 2019

4.1.1.9.2 Condition assessment

SCADA and RTS assets are maintained in an evergreen status, being fully patched and configured to reflect best practise strategies. Daily checks for issues with hardware, operating systems, database, SCADA and RTS applications and all supporting applications are also undertaken, with six-monthly testing of all high availability and DR/BCS systems. As such, the condition of the asset class is generally good.

Information on specific asset condition is recorded in the Life Cycle Management Plan for OSI Pi System (JEM AM PL 0022) for each asset function listed in Table 4-4.

4.1.2 LIFE CYCLE MANAGEMENT

JEN manages the life cycle integrity of assets as outlined in section 7 of the AMS Manual.

The preferred asset lifecycle management approach is to maintain existing SCADA and RTS assets in an evergreen status, being fully patched and configured to reflect best practise strategies. Jemena then replaces end-of-life systems as necessary and economical to do so, with a preference to consolidate core technologies into single platforms where possible.

All SCADA and RTS assets due for replacement must have been included in Jemena's SCADA and RTS Lifecycle Management Plans and the AIP.

4.1.2.1 *Creation*

The requirement for new or upgraded SCADA and RTS assets is assessed as new functionality is required. This is driven by changes to requirements largely as a result of changing legislation, but also in response to customer demand for network information.

Investment is undertaken through procurement, in collaboration with IT and in line with the SCADA and RTS strategy and principles in this ACS.

4.1.2.2 *Asset operation and maintenance*

SCADA and RTS assets are operated and maintained in accordance with the SCADA and RTS Operations Manual.

All assets will be maintained based on manufacturer's guidelines until which time Jemena has a better historical record and trending data available and understood. Trend data and calibration or validation results will be utilised to improve the existing maintenance and operation methodology as required.

Jemena uses preventive maintenance to manage operational risk in that it is safety and reliability focused consistent with the appropriate safety case. Each maintenance plan has associated activities that encompass logical work packages. Preventive tasks include all maintenance actions intended to retain the integrity of the asset. Preventive maintenance is a variable volume activity that includes inspection, testing and monitoring.

The criteria for initiating preventive maintenance may be time-based, condition based, or usage based, but always takes account of risk. These non-intrusive checks are used to confirm the safety and integrity of assets, to provide information for continued operations or determining corrective maintenance and renewal needs.

4.1.2.3 Asset replacement/disposal

Asset replacement includes projects or work programmes to replace ageing and damaged (end-of-life) assets to ensure the ongoing safety and reliability of the network. Jemena forecasts long-term renewal of SCADA equipment using a programme-based approach.

Assets may also be replaced subject to ongoing performance and condition assessments.

4.2 INFORMATION

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 ABS and various ACSs all provide the context for and determine the information required to deliver the Jemena SCADA and RTS asset class objectives.

As presented in section 3.2, the SCADA and RTS asset class objectives are as follows:

- Manage SCADA and RTS assets to ensure the ongoing safe and reliable operation of Jemena's networks
- Support customers' ability to understand the service Jemena is delivering them
- Ensure all statutory requirements are met
- Drive cost reductions through the provision of SCADA and RTS including upgrades where appropriate
- Support business development and opportunities for growth
- Improve the capability and engagement of the SCADA and RTS teams

From these business objectives, it is possible to identify at a high-level the business information systems' content required to support these objectives (Table 4-4).

Table 4-5 identifies the current and future information requirements to support the asset class's critical decisions and their value to the asset class.

Table 4-6 provides the information initiatives required to provide the future information requirements identified in Table 4-5. Included within this table is the risk to the asset class from not completing the initiative.

Summary

All of the information required by the SCADA and RTS asset class is available within Jemena's current business systems.

Table 4-4: SCADA and RTS asset class objectives and information requirements

Business objective	Jemena information sources	Externally sourced data
Manage SCADA and RTS assets to ensure the ongoing safe and reliable operation of Jemena's networks	<ul style="list-style-type: none"> • Group Strategy • JEN market strategies • JEN ABS • JEN AIP • Jemena Compliance and Risk System (JCARS) • AMS Manual 	<ul style="list-style-type: none"> • AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules) • AS/NZS 60079.0:2012 Explosive atmospheres - Equipment - General requirements • AS/NZS 60079.14:2009 Explosive atmospheres - Electrical installations design, selection and erection (IEC 60079-14, Ed. 4.0(2007) MOD)

Business objective	Jemena information sources	Externally sourced data
		<ul style="list-style-type: none"> • AS/NZS 60079.17:2009 Explosive atmospheres - Electrical installations inspection and maintenance (IEC 60079-17, Ed.4.0(2007) MOD) • AS/NZS 2381.1:2005 Electrical equipment for explosive gas atmospheres - Selection, installation and maintenance - General requirements • AS/NZS 2381.6:1993 Electrical equipment for explosive gas atmospheres - Selection, installation and maintenance – Increased safety • AS/NZS 2381.7:1989 Electrical equipment for explosive gas atmospheres - Selection, installation and maintenance – Increased safety • AS 3439.1-2002 Low-Voltage Switchgear and Control gear Assemblies - Type-Tested and Partially Type-Tested Assemblies • Jemena Network Operator Rules • National Electricity Rules
<p>Support customers’ ability to understand the service Jemena is delivering them</p>	<ul style="list-style-type: none"> • Group Strategy • JEN market strategies • JEN ABS • JEN AIP 	<ul style="list-style-type: none"> • AER benchmarking • Published audit reports / regulatory reviews
<p>Ensure all statutory requirements are met</p>	<ul style="list-style-type: none"> • Group Strategy • JEN market strategies • JEN ABS • JEN AIP • JEM PO 0026 Procurement Policy 	<ul style="list-style-type: none"> • AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules) • AS/NZS 60079.0:2012 Explosive atmospheres - Equipment - General requirements • AS/NZS 60079.14:2009 Explosive atmospheres - Electrical installations design, selection and erection (IEC 60079-14, Ed. 4.0(2007) MOD) • AS/NZS 60079.17:2009 Explosive atmospheres - Electrical installations inspection and maintenance (IEC 60079-17, Ed.4.0(2007) MOD) • AS/NZS 2381.1:2005 Electrical equipment for explosive gas atmospheres - Selection, installation and maintenance - General requirements • AS/NZS 2381.6:1993 Electrical equipment for explosive gas atmospheres - Selection, installation and maintenance – Increased safety • AS/NZS 2381.7:1989 Electrical equipment for explosive gas atmospheres - Selection, installation and maintenance – Increased safety • AS 2360.1.3:1993 Measurement of Fluid Flow in Closed Conduits – Pressure Differential Devices • Jemena Network Operator Rules • National Electricity Rules
<p>Drive cost reductions through the provision of SCADA and RTS</p>	<ul style="list-style-type: none"> • Group Strategy • JEN market strategies • JEN ABS • JEN AIP 	<ul style="list-style-type: none"> • Industry/peer analysis • RIN information

Business objective	Jemena information sources	Externally sourced data
including upgrades where appropriate	<ul style="list-style-type: none"> JEM PO 0026 Procurement Policy 	
Support business development and opportunities for growth	<ul style="list-style-type: none"> Group Strategy JEN market strategies JEN ABS JEN AIP 	<ul style="list-style-type: none"> Industry/peer analysis
Improve the capability and engagement of the SCADA and RTS teams	<ul style="list-style-type: none"> Group Strategy JEN market strategies JEN ABS JEN AIP 	<ul style="list-style-type: none"> Industry/peer analysis

Table 4-5: SCADA and RTS assets critical decisions business information requirements

Critical business decision	Current information usage	Future information requirement	Value to asset class (High, Medium, Low with justification)
Operational SCADA performance	Direct system feedback	Maintain/adapt	High. Essential real-time feedback on the performance of the SCADA goes directly to support 99.96% availability
SCADA availability to KPI	Analysis of system uptime indicators	Maintain/adapt	High. Essential feedback on the performance pattern of the SCADA goes directly to support 99.96% availability
Cyber security anomalies	SIEM alerting and logging	Maintain/adapt	High. Essential real-time and near-real time feedback on the cyber security posture. Goes directly to support 99.96% availability and confidentiality
Cyber security condition assessment	Security assessments	Maintain/adapt	High. Essential assessment of cyber security posture. Goes directly to support 99.96% availability and confidentiality
Cyber security vulnerability and threat management	Security data feeds and networks	Maintain/adapt	High. Essential input to threat and vulnerability management of cyber security. Goes directly to support 99.96% availability, confidentiality and asset control
SCADA patch management	Maintain awareness of SCADA software patches (operating systems and applications)	Maintain/adapt	High. Essential input to vulnerability management of cyber security. And also essential to the ongoing fitness of the SCADA

Critical business decision	Current information usage	Future information requirement	Value to asset class (High, Medium, Low with justification)
			functions. Goes directly to support 99.96% availability and confidentiality
SCADA architecture	SCADA design and change-management	Maintain/adapt	High. Accurate understanding of the SCADA architecture is essential to the maintenance of the integrity of the SCADA
Strategy development	Research and be connected to emerging best-practice and innovative trends	Continue	High. A fundamental input to the strategy development and continuous improvement processes

Table 4-6: Information initiatives to support business information requirements

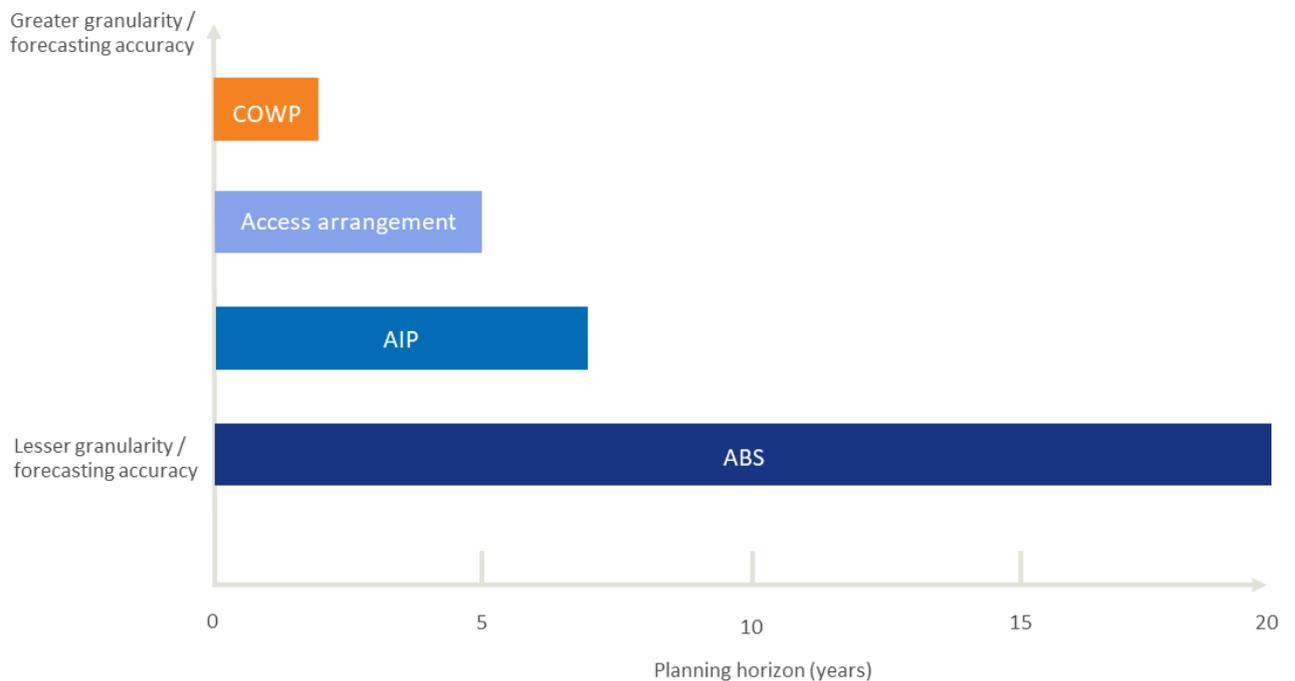
Information initiative	Use case description	Asset class risk in not completing	Data quality requirement
Maintain the SCADA Program of Work (PoW)	The SCADA PoW includes those repetitive activities that provide the information identified in Table 4-6 . Current requirements are met, but PoW is designed to maintain Fit for purpose.	High	Maintain as a minimum, and improve adaptively
Maintain security assessment program	Network penetration tests serve to assure and also provide continuous improvement opportunities	High	Maintain as a minimum, and improve adaptively
Maintain records of SCADA system architecture	Change-management of SCADA systems includes maintenance of system architectures	High	Maintain as a minimum, and improve adaptively
Security Networking	Through security networks maintain understanding of threats and approach to controls as an input to assessments of vulnerability and actions arising	High	Maintain as a minimum, and improve adaptively
Research and be connected to emerging best-practice and innovative trends	Input to strategy development	High	Maintain as a minimum, and improve adaptively

5 CONSOLIDATED PLAN

The expenditure profiles as per The high-level long-term general tools and equipment capex forecast for JEN is presented in the following table.

Table 5-1 provides a high level estimate of capex expected to be incurred over the next two to seven years. The expenditure profiles in this ACS are one of four forecasting horizons JEN considers when incurring expenditure, with the two-year Capital and Operation Work Plan (COWP) being the most accurate.

Figure 5-1: JEN expenditure planning horizons



The capex forecast is indicative only and represents the projects required for this asset class to continue to support the JEN objectives. The opex profile is designed as a basis for forward financial planning and to help test if actual expenditure incurred deviates from historical levels. The opex profile is also used to continually refine and optimise the cost of mitigating risk using opex solutions.

Over time, these profiles have been informed by the objectives outlined in the ABS as well as customer expectations, JEN's regulatory and operating environments, asset condition and risk. The forecast beyond two years is therefore subject to change as any of these factors change, and even more so beyond year seven⁶.

⁶ Seven years is the planning horizon of the AIP.

5.1 CAPITAL FORECAST

The high-level long-term general tools and equipment capex forecast for JEN is presented in the following table.

Table 5-1: Forecast JEN long term capital expenditure

Project	Forecast capex (\$'000s, \$2019)						Total
	2020	2021	2022	2023	2024	2025	
SCADA and RTS Security Management	410	205	206	207	207	208	1,443
SCADA DMS OMS Lifecycle Upgrades	328	206	648	0	0	0	1,654
SCADA DMS OMS Replacement	1,755	0	0	0	0	0	1,755
Network Data Historian Consolidation	0	21	181	0	0	0	201
Transition of ADMS FLISR function from advisory mode to auto-mode	185	185	0	0	0	0	370
Total	2,678	617	1,035	207	207	680	5,424

Note: ADMS enhancements (DPF, DERMS, VVC) are included in the Future Grid Investment Proposal.

6 TERMS AND DEFINITIONS

ABS	Asset Business Strategy
ACS	Asset Class Strategy
AER	Australian Energy Regulator
AIP	Asset Investment Plan
AMS	Asset management system
Capex	Capital expenditure. Expenditure to buy fixed assets or to add to the value of existing fixed assets to create future benefits.
COWP	Capital and Operation Work Plan
ECMS	Electronic content management system
ELMS	Emergency Load Management System
IT	Information technology
JCARS	Jemena Compliance and Risk System
JGN	Jemena Gas Networks
KPI	Key performance indicator
MDL	Meter data logger
Opex	Operating expenditure. Expenditure (ongoing) for running a product, business, or system
OT	Operational technology
RTS	Real time systems
RTU	Remote terminal unit
SCADA	Supervisory control and data acquisition