Strategy

MEASUREMENT COMMUNICATIONS ASSET CLASS STRATEGY

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AUTHORISATION

REVIEWED BY

Name	Job Title	Signature	Date
Michael Ciavarella	Network Assets Manager		

Approved by

Name	Job Title	Signature	Date
Karl Edwards	GM Asset & Operations - Electricity		

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DOCUMENT HISTORY

Revision	Date	Author	Description of Changes
0.1	20/08/2024		Initial Draft for review
1.0	09/12/2024		Reviewed the document and removed the outdated content, and updated with current information

OWNING FUNCTIONAL GROUP & DEPARTMENT / TEAM

Electricity Distribution: Asset & Operations Electricity: Network Assets

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Executive Summary

Jemena Electricity Networks in Victoria has an Asset Management System that contains four Asset Class Strategy documents.

This ACS document pertains to JEN's Advanced Metering Infrastructure communication, a term that denotes a range of communication assets situated at various points in the network.

The first three sections of this ACS are generic to all the ACS documents. The fourth section is where AMI Communication is unpacked and divided into distinct sub-asset classes:

- Access Points
- Relays
- Micro Access Points
- Batteries
- Antenna

Each sub-asset class is described and discussed in terms of its associated risk, performance, life cycle management and budgetary forecasts.

This capital expenditure and operational expenditure data informs the business and is shared with the Australian Energy Regulator as part of the Electricity Distribution Price Review (EDPR) process. The CAPEX and OPEX forecasts below in 2024 dollars unless stated otherwise.

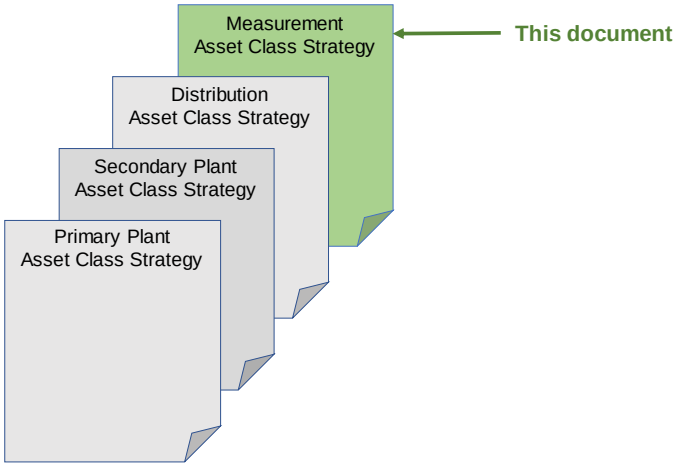
1. Introduction

This Asset Class Strategy (ACS) covers the Jemena Electricity Networks (JEN) AMI communications asset class and outlines the methods employed, analysis undertaken and actions to be taken to optimally manage the assets. The document prescribes the management of the measurement asset class.

Within JEN's Investment Framework and Asset Business Strategy (ABS), asset life cycles are considered in terms of creation (acquisition), maintenance or replacement, as applicable, and disposal. Investment decisions are made by analysing asset conditions and age profiling.

There are four Asset Class Strategy (ACS) documents. Each ACS outlines performance measures and objectives that are used to attain key performance targets. This gives visibility to the performance of the asset and, in turn, informs investment decision-making.

Figure 1-1: ACS documents hierarchy



The JEN AMI communications assets in this ACS are categorised into the following sub-asset classes located in the following sections of this document.

1.1 Purpose

This Measurement Communication ACS documents the approach and principal methods that support the delivery of JEN's overarching asset management objectives, asset activities, operational and maintenance plans, capital investment (overhaul, replacement and enhancement) plans, and financial and resource plans set out in the JEN's ABS. Below are JEN's key asset management objectives;

- Regulatory and market compliance
- Diligent and responsive customer and stakeholder management
- Energy Productivity
- Efficient asset and operations performance
- Asset and service reliability
- Proactive and effective customer and service management
- Customer and asset safety management
- Responsible environments management
- Prudent economic and financial management

This ACS is based on key information about each sub-asset (including risk, performance, life cycle management, capital expenditure and operational expenditure). Based on this information, this ACS contributes to short, medium and long-term planning.

This Measurement Communication ACS addresses:

- Measurement communications plant asset management practices alignment with the ABS
- Sub-asset risk causes and consequences
- Sub-asset performance against objectives, drivers, and service levels
- Sub-asset class specifications and life cycle management of measurement assets in-service. Asset condition, along with relative cost considerations, are the primary drivers in making asset maintenance versus asset replacement decisions
- Risk-weighted decision-making and financial estimates are used to inform operating expenditure (OPEX) and capital expenditure (CAPEX) planning.

1.2 Asset Management System

Asset Management is the coordinated activity undertaken to optimise value from management is the coordinated activity undertaken to optimise the value of our electricity network. It involves the balancing of costs, opportunities and risks against performance. An Asset Management System (AMS) enables a systematic approach to the combination of

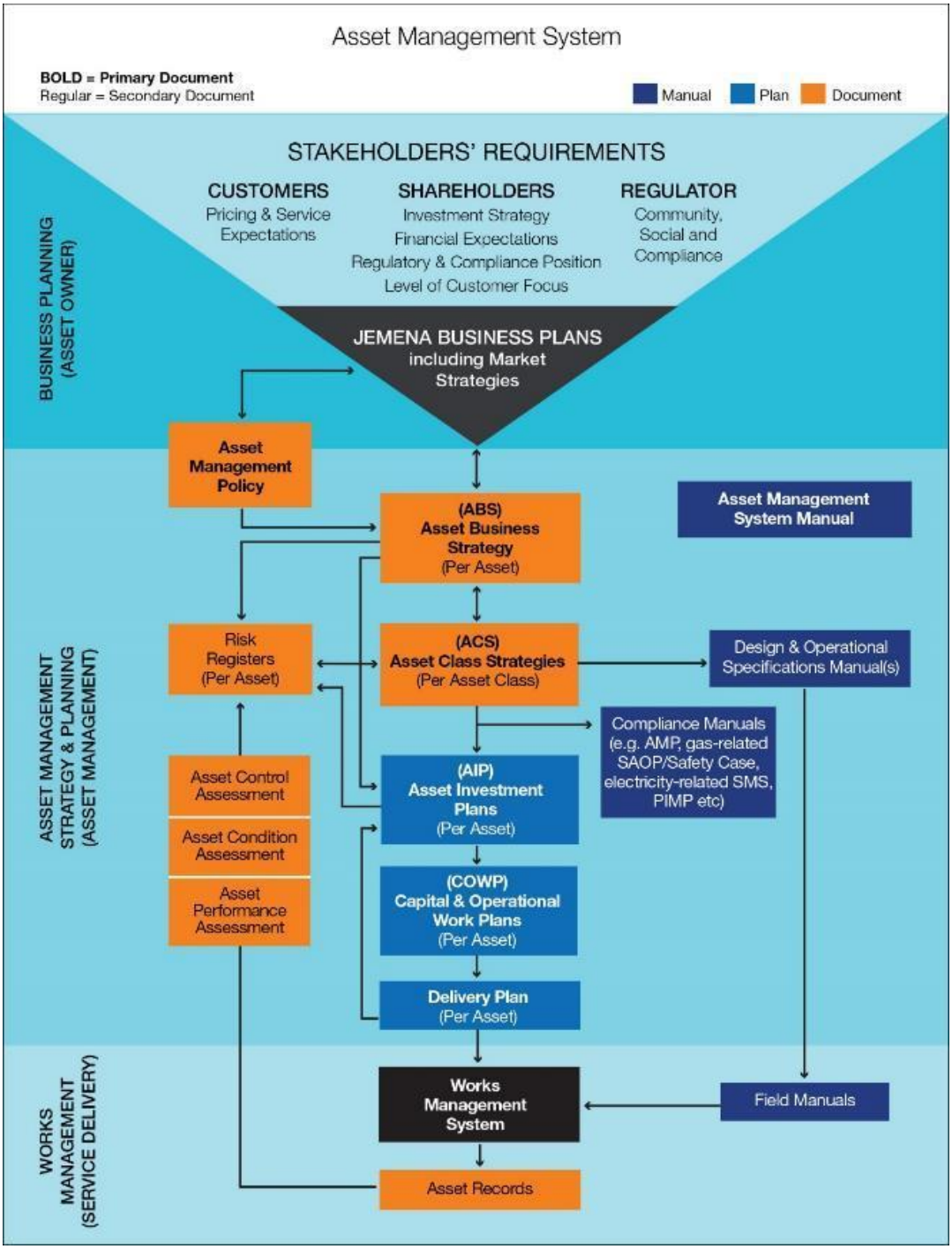
management, financial, economic, engineering, and other practices applied to physical assets to provide the required level of service in the most cost-effective manner, whilst balancing costs, opportunities, and risks against performance. An Asset Management System (AMS) enables a systematic approach to the combination of management, financial, economic, engineering, and other practices applied to physical assets to provide the required level of service in the most cost-effective manner while managing future risks.

Our AMS enables us to effectively and efficiently direct, coordinate and control asset management activities throughout an asset whole life. It facilitates an optimal mixture of capital investments, operations, maintenance, resourcing, risks, performance, sustainability and good governance.

Our AMS is accredited under the ISO55001 standard. Figure 1-2 shows the inputs and outputs of the Asset Management System, which aims to fulfil JEN's corporate strategy and objectives.

This ACS resides in JEN's AMS and creates a line of sight between the Business Plan and JEN's ABS through to the associated Asset Management Plan (AMP). The ACS ensures that the performance, risks and cost of each asset class are analysed, and optimum plans and the associated Asset Management Plan (AMP). The ACS ensures that the performance, risks, and costs of each asset class are analysed and that optimum plans are developed to align with the Business Plan.

Figure 1-2: JEN's Asset Management System

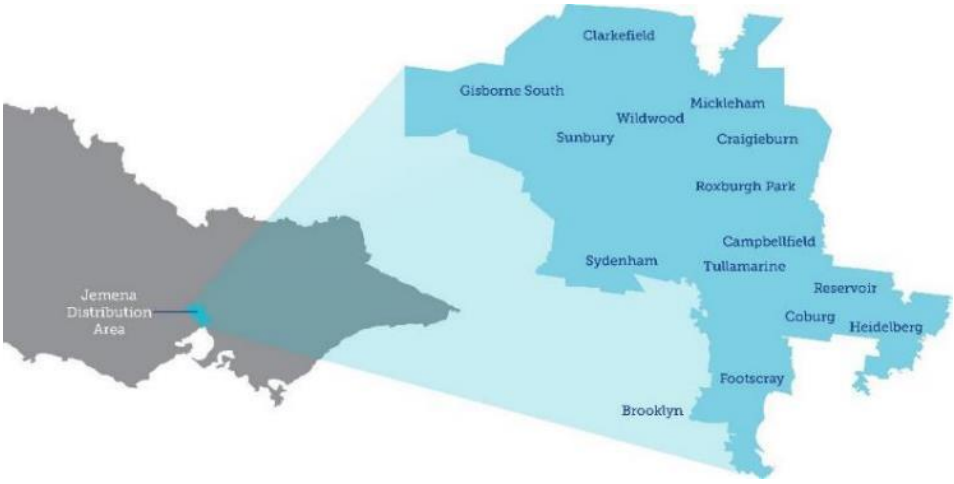


1.3 Description of Assets Covered

There are a large number of measurement communications assets, providing communications platform for the electricity measurements and network management assets. Individual failures of measuring equipment have a low immediate impact on customers.

Consequently, electricity measurement communications assets have inherent redundancy built into their configuration.

Figure 1-3: JEN's Geographical Footprint



There are five sub-assets in this Measurement ACS

- Access Points
- Relays
- Micro Access Points
- Batteries
- Antennas

1.4 Governance

1.4.1 Approval and communications

Asset Class Strategy documentation is updated every three years by the Network Assets Manager for approval by General Manager Asset and Operations. The Asset Class Strategy is reviewed every three years to ensure alignment with the Asset Management objectives and to account for any additional regulatory obligations, asset performance and risk information.

1.4.2 Responsibilities

Key stakeholder personnel are shown below in

Table 1-1.

Table 1-1: Asset Class Strategy Responsibilities

Job Title	Responsibility
Network Assets Manager	**Document Owner and Approver**

Strategic Drivers

1.5 SGSP (Australia) ASSETS PTY LTD (SGSPAA) Group Plan

Jemena's purpose is to create sustainable energy solutions with communities and our Group aspiration is to be adapting towards net zero carbon emissions by 2050 delivering a mix of fuels and services safely, reliably and affordably. To achieve our aspiration, we have several Group Objectives supported by Focus Areas, which are in turn supported by our Group Values. Figure 0-1 shows the SGSPAA Group Plan that has been designed to achieve these aspirations and Figure 0-2 shows the SGSPAA values.

Figure 0-1: SGSPAA Group Plan

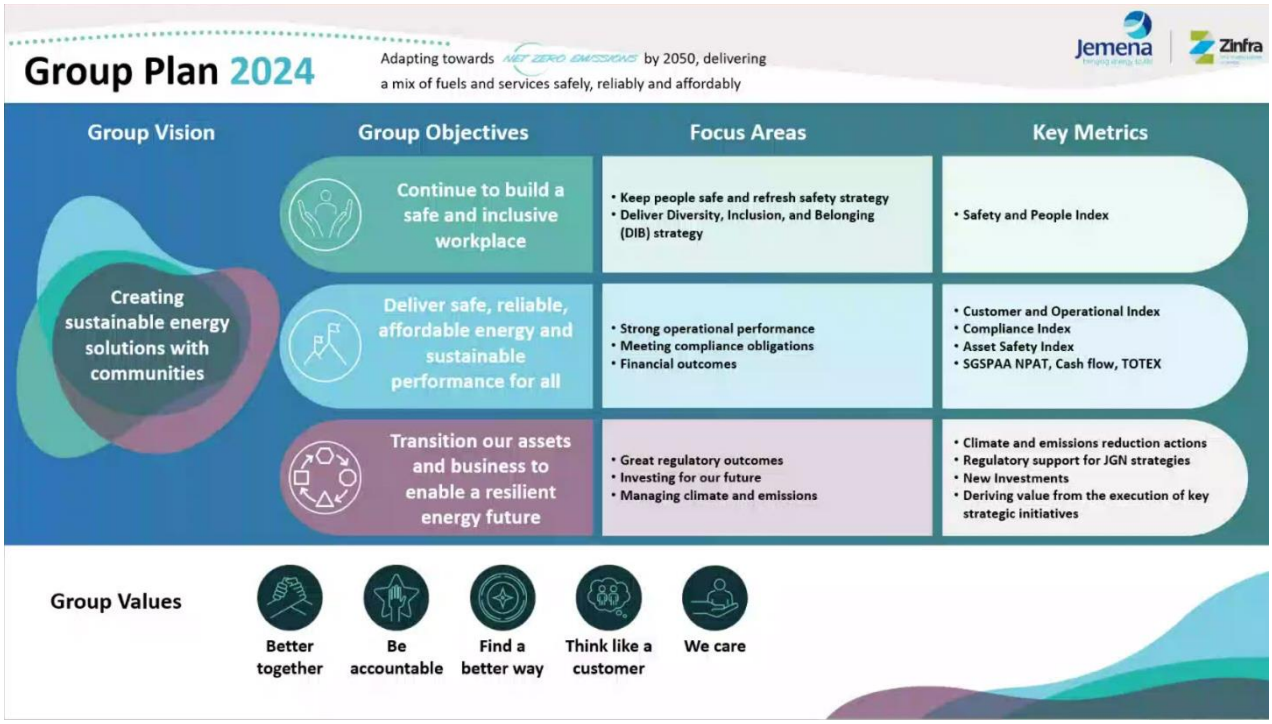
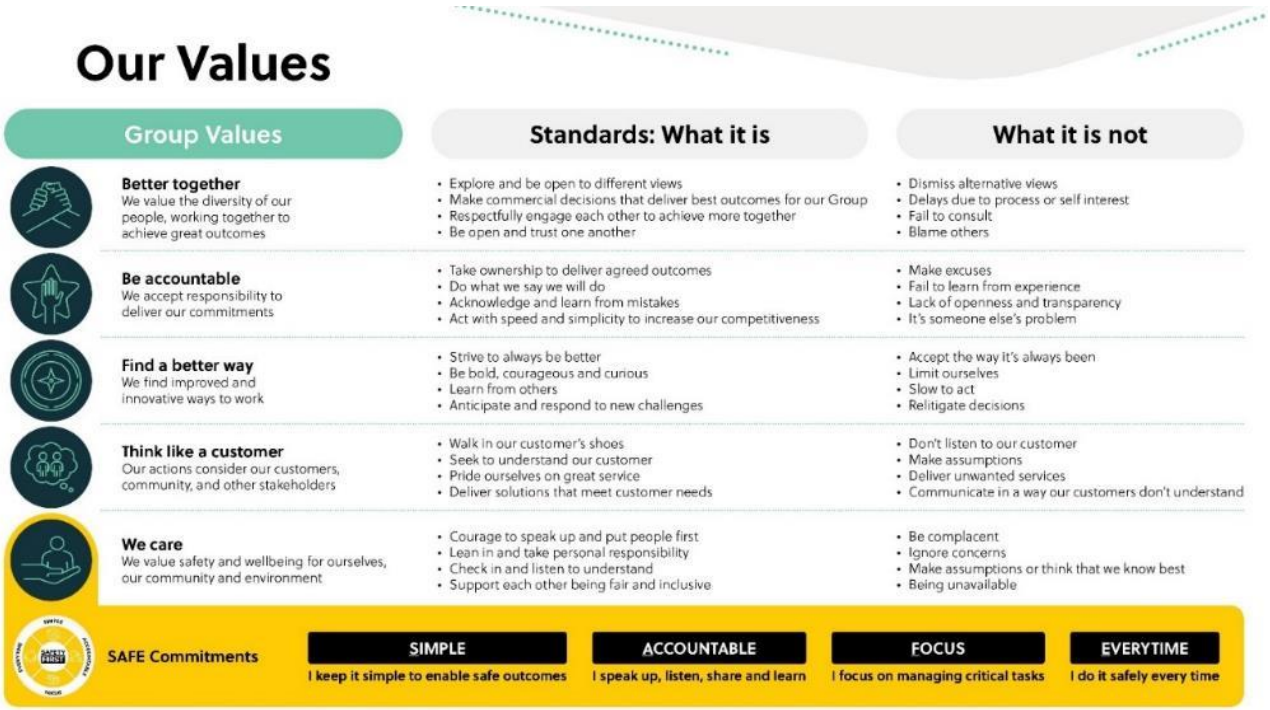


Figure 0-2: SGSPAA Values



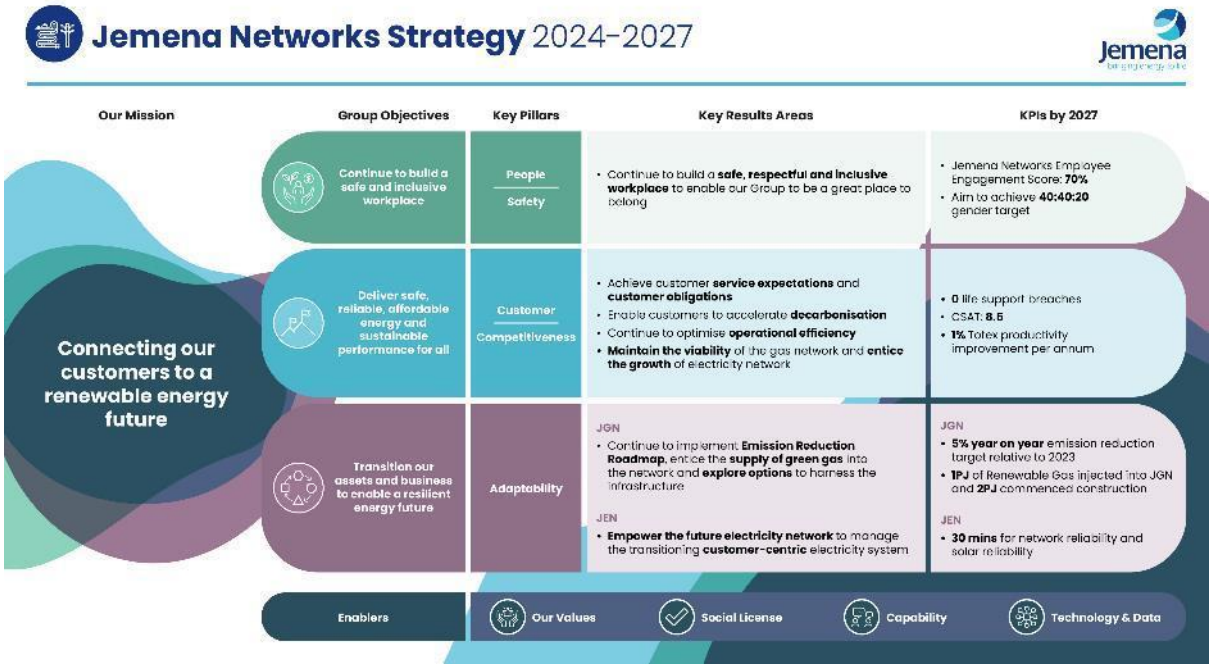
1.6 Jemena Networks Market Strategy

The Electricity Distribution market, which forms a component of Jemena Networks, is undergoing continuous change in order to play a role in shaping the future state of the energy industry.

To respond to the changes being driven by the energy transition, JEN commenced a strategic review to develop a strategy known as JEN10 in October 2022. As per its namesake, this led to the development of a 10-year strategy for the JEN that was launched in October 2023.

Jemena Networks has also developed a shorter term strategy for the 2024-2027 years which contains key focus areas and the Key Performance Indicators (KPI) associated with them. The strategy is aligned to the Group Plan in Figure 0-1 .

Figure 0-3: Jemena Networks Strategy



1.7 Regulatory and Legislative

JEN meets legal, licence and regulatory obligations so as to comply with the National Electricity Rules (NER) mandated by the Australian Energy Market Commission (AEMC) together with other rules, codes and guidelines set forth out by the:

- Australian Energy Regulator (AER);
- Australian Energy Market Operator (AEMO);
- Energy Safe Victoria (ESV); and
- Essential Services Commission of Victoria (ESCV)

The JEN ABS describes how the business complies with the requirements of each of these stakeholders in order to retain its distribution licence, adhere to the NER and meet safety obligations. There are perennial compliance, analysis and reporting requirements that JEN is required to perform to meet compliance, analysis, and reporting requirements regarding asset management. For example, JEN provides an Annual Information Order to the AER.

2. Asset Objectives

The overarching objective of the Measurement Communications Asset Class is to support the JEN objectives and strategic drivers, through:

- The practice of a Health, Safety and Environmental (HSE) culture that proactively seeks to control HSE risks.
- Optimise asset availability. Each asset failure is recorded and evaluated. Using standard risk assessment guidelines, an estimate of equipment failure rates are made. Annual probabilistic failure rates can be derived. A documented inspection, condition monitoring, maintenance and replacement strategy is included in this document for all assets to minimise the probability of failure and contains deterioration in service levels.
- Optimise asset life cycle. Defer asset replacement expenditure by use of condition monitoring. Where practical, conduct routine inspections that can increase in frequency as the asset approaches its statistical end of life. The aim is to defer capital expenditure whilst controlling the risk of failure and, thus, to the asset life cycle. Invest prudently and efficiently by deferring asset replacement expenditures through condition monitoring. Where practical, conduct routine inspections that can increase in frequency as the asset approaches its statistical end of life. The aim is to defer capital expenditure while controlling the risk of failure and, thus, constrain deterioration in service levels.
- Standardisation, application of established standards, and regular market testing to minimise the life cycle costs of assets installed. For instance, establishing robust specifications for purchasing electricity meters, together with regular market testing of alliterative suppliers, ensures that JEN measurement equipment is cost-efficient and fit for purpose.

3. Sub-Asset Class Strategies

This section provides an overview of the sub-asset classes, defines the assets they include and identifies the most appropriate strategies and plans for managing the assets over their lifecycles. Each sub-asset class strategy includes information on the asset management practices, including key strategies, options considered and plans that:

- Support the corporate business plan, strategies, and objectives; and
- Inform expenditure plans and work programs.

Specifically, the sub-asset class strategies address the following:

- Introduction - Function and Asset Description
- Asset Profile – Life Expectancy, Age Profile, and Utilisation
- Performance – Requirements and Assessment
- Risk – Criticality, Failure Modes, Current Risks, Existing Controls and Future Risks
- Life Cycle Management – Asset Creation, Asset Operation and Maintenance, Asset Replacement, Disposal and Spares; and
- Asset Information.

3.1 Electricity measurement communications

3.1.1 Introduction

JEN manages approximately 584 communication devices within the JEN's electricity network, enabling communications between AMI meters, Network Management System/s

Electricity measurement communications assets must:

- Ensure communications availability for all metering and network management communications enabling new connections and abolishment/alterations
- Be economical to purchase and maintain
- Support supply investigations; and
- Prudently support future customer experience pathways ('advanced services').

Table 3-1: JEN Measurement communications sub-classes & respective volumes

#	Sub-asset class type	Description	JEN owned quantity
1	Access Points	[redacted]	174

2	Relays	[redacted][1] Relays act as RF relay between AP and meters	309
3	Micro Access Points	[redacted] mini gateway devices	100
4	Batteries	[redacted] Gen 1.5 batteries Gen 5 batteries	310 174
5[2]	Antennas	Conical antennas with unity gain to boost RF signal where required	10,000

Software platforms

Jemena's has a mature suite of backend software platforms to support the operational management and integration of the above sub-classes. These include:

- [redacted] to perform data collection of metered consumption and, depending on meter type, meter-related events
- SAP Industry Specific – Utilities (IS-U) system supports meter installation activities from customer service to inventory management
- [redacted]
- SAP Business Intelligence (BI) analyses AMI system data such as detected meter faults, over current, bypass, etc. The BI system is connected to the following systems allowing data from multiple sources to be combined & analysed:
    - MDM
    - SAP-ISU
    - NMS
    - Customer Administration Transfer System (CATS)
    - Geographic Information System (GIS); and
    - Jemena SAP (JSAP)

[1] Generation versions are defined by the vendor.

- Oracle Outage Management System (OMS) manages planned and unplanned outages on the electricity distribution network

Figure 3-1 shows the overall architecture of the AMI and associated system.

Figure 3-1: Architecture of the AMI and associated system.

3.2 Access Points

3.2.1 Introduction

The Access Point functions as a gateway, enabling two-way connectivity between metering endpoints in the RF Mesh Network also called Local Area Network (LAN) and the utility's back-office NMS. Access Points are crucial in managing data traffic between downstream devices (e.g. meters and relays, providing network time, registration, optimal routing paths, data queues and transmitting data) and backend (e.g. NMS) via Telstra Wide Area Network (WAN) systems.

The Access Point primary role is to ensure communication between the downstream devices and the JEN backend systems, ensuring prompt delivery of:

- utility billing information
- network health data
- remote support for management and optimisation of JEN AMI comms and JEN grid.

Currently, JEN manages around 174 Gen 5 Access Points within the AMI mesh network. Each Access Point has an in-built 4G modem and communication Network Interface Card (NIC) that can transmit data at rates up to 600 kbps. Although designed to handle multiple simultaneous connections, bandwidth limitations and data queuing have led JEN to establish an optimal ratio of 3000 downstream meters per one Access Point to ensure near-reliable data collection.

This ratio needs to be reduced to approximately 1,000 devices per Access Point for real-time data exchange with downstream devices.

[redacted]

Access Points are weather-resistant and designed for outdoor installation on wooden or concrete power poles or metallic public lighting poles. They are equipped with a backup battery for 8-12 hours of operation during power outages and have provisions for 2 LTE antennas for WAN connectivity and 1 mesh antenna using female N-type connectors.

Each meter in the mesh network should register multiple connectivity paths provided by various Access Points, by using its built-in dynamic discovery and self-healing algorithms. At any given time, each meter should use the best path out of all, based on the minimum number of hops and total path loss. In addition, as an intelligent network element, Access Points offer network convergence and redundancy to every meter in the mesh network in case of an Access Point failure or unavailability.

[redacted]

3.2.2 Risk

Risk of Cyber and Physical Security Threats:

- The Access Point is a costly network device to procure. Due to their important role in the communications platform, Access Points are [redacted] These are exceptionally reliable, robust hardware made to survive in harsh environmental conditions since most installations are done in outdoor locations.
- Failures of support system infrastructure (e.g., power supply failures, and telecom infrastructure failures).
- Backend software/hardware failures, internal security system failures, operational failures (e,g. human errors).

3.2.2.1 Criticality

Performance, accuracy, reliability, and security of Access Points are critical for the compliance, reputation, and revenue protection of JEN as a whole. Investments in robust infrastructure, cybersecurity measures, and regular maintenance are necessary to maintain the functionality and efficiency of this sub-asset class.

3.2.2.2 Failure modes

Failure of an Access Point can manifest itself as:

- Non-operation, partial or total failure of Access Points, which generally occurs without exhibiting any physical signs of deterioration until the failure occurs.
- Failures in hardware such as modem, antenna, or cabling, which generally occur due to age or operational environmental stress.
- [redacted]
- Intermittent failures, generally due to power failure, cellular network outages, interference, network loading, operational applications and systems or issues.
- [redacted]
- Physical security, generally due to equipment theft, vandalism, or bird or animal activity in the vicinity.

All risks are identified and managed in the compliance and risk management system (OMNIA) that Jemena and its sub-contractors use.

3.2.2.3 Existing controls

Risk mitigation of this sub-asset class can be classified into the following types:

- **Architectural mitigation**. Guiding principles and architectural decisions mitigate risk through design.
- **Procedural mitigation**. BAU procedures, work instructions and planning (e.g. inclusion of budgetary contingencies, careful vendor selection and vendor monitoring regimes) are used to reduce the likelihood and/or impact of procedural error.
- **Contractual mitigation**. Contractual mechanisms such as service level agreements, liquidated damages, defects liability periods and insurance requirements are used to reduce the likelihood of sub-standard third-party service delivery.
- **Testing mitigation**. Extensive commissioning testing & verification

In addition, all parties and processes involved in the provision of JEN AMI communications services are audited internally and externally to comply with ISO 55001. The audits ensure

that the teams involved in the provision of JEN AMI comms asset management and operation have the requisite processes, training and accreditation in line with national and state-based obligations.

Table 3-2: Existing Controls

#	Threat	Vulnerability	Risk	Controls
1	Overstated product reliability or unexpected environmental conditions	Inadequate product design	Increased operation & maintenance cost. Increased replacement levels may affect customer relations and business reputation	Contractual: Product Warranty and vendor support agreement
2	Geographically or Radio Frequency (RF) isolated customer	Limitation of LAN coverage	Increased cost to achieve coverage. Increased probability of not meeting regulatory requirement for meter reading performance	Architectural: WAN Port under the terminal cover allows a modem to be added to replace the built-in mesh radio modem. Design support is for 4G only.
3	Regulator change band access new data services	Meter communications and LAN design ISM 100Kbps limit	Stranded meter assets because of integrated communication technology Increased maintenance/replacement cost	Architectural: WAN port under the terminal cover could be used to replace the built-in mesh radio modem. e.g. Mobile, Fibre Optic (NBN) etc. Silver Spring support to reprogram NIC
4	4G WAN service end of life	WAN solution uses 4G	Redesign/replacement of Access Point Loss of system availability	Architectural: Design supports modem replacement in AP's
5	[redacted]	[redacted]	[redacted]	[redacted]
6	Unsuitable geography & street design	LAN RF limitations	Poor coverage requiring additional equipment/costs	Procedural: Radio Surveys: Comprehensive radio survey of the distribution territory to ensure the technology selection is

#	Threat	Vulnerability	Risk	Controls
				based on sound real world and measured data. Contractual Silver Spring responsible for 100% coverage
7	New firmware/Programs	Unknown behaviour in the field	AMI system availability and integrity may be compromised. Affects operation & maintenance phases	Procedural: Testing of firmware and meter programs prior to field deployment
8	Delays in supply chain	Unknown performance	Failure to supply on time may result in availability issues	Procedural: Inventory Management: Equipment vendors must maintain 6 months inventory “in country” (lead to time for new shipment) to provide supply even in the event of delivery issues
9	Single Mesh Network supplier	End of product line or company failure	Unable to maintain and grow the LAN network. Continued supply of Access Points supports hardware and software Enhancement to support new opportunities. Continued support for NMS	Contractual: Unlikely considering number of Utilities using this product. Jemena is also protected under the legal ESCROW agreement - a contractual arrangement in which a third party receives and disburses money or documents for the primary transacting parties, with the disbursement dependent on conditions agreed to by the transacting parties, or an account established by a broker for holding funds on behalf of the broker's principal or some other person until the consummation or termination of a transaction
10	Communications devices supply reliability	Long lead time and supply shortage of communications devices	Unable to meet the communications devices demand required by business-as-usual activities and unexpected failures	Contractual: Establish and maintain contractual arrangement to ensure supply availability through guaranteed service levels and assurance. Procedural: Inventory Management: Equipment vendors must maintain 6-12 months inventory “in country” (lead to time for new shipment) to

#	Threat	Vulnerability	Risk	Controls
				provide supply even in the event of delivery issues related to high demand.

3.2.2.4 Future risks

Emerging risks for this sub-asset class are:

- [redacted]
- Disruption to global electronics supply chains affecting production and delivery of comm's equipment
- Inability to support effective technology substitution: technology obsoletions and/or vendors exiting the market which could significantly affect the network operations.

3.2.3 Performance

3.2.3.1 Requirements

Measurement communications Access Points must:

- Provide 24/7 high availability measurements communications services
- Provide a stable and secure communication network ensuring integrity and security
- Support existing and establishment of new networks and customer services
- Support on-demand network and customer management remote services.

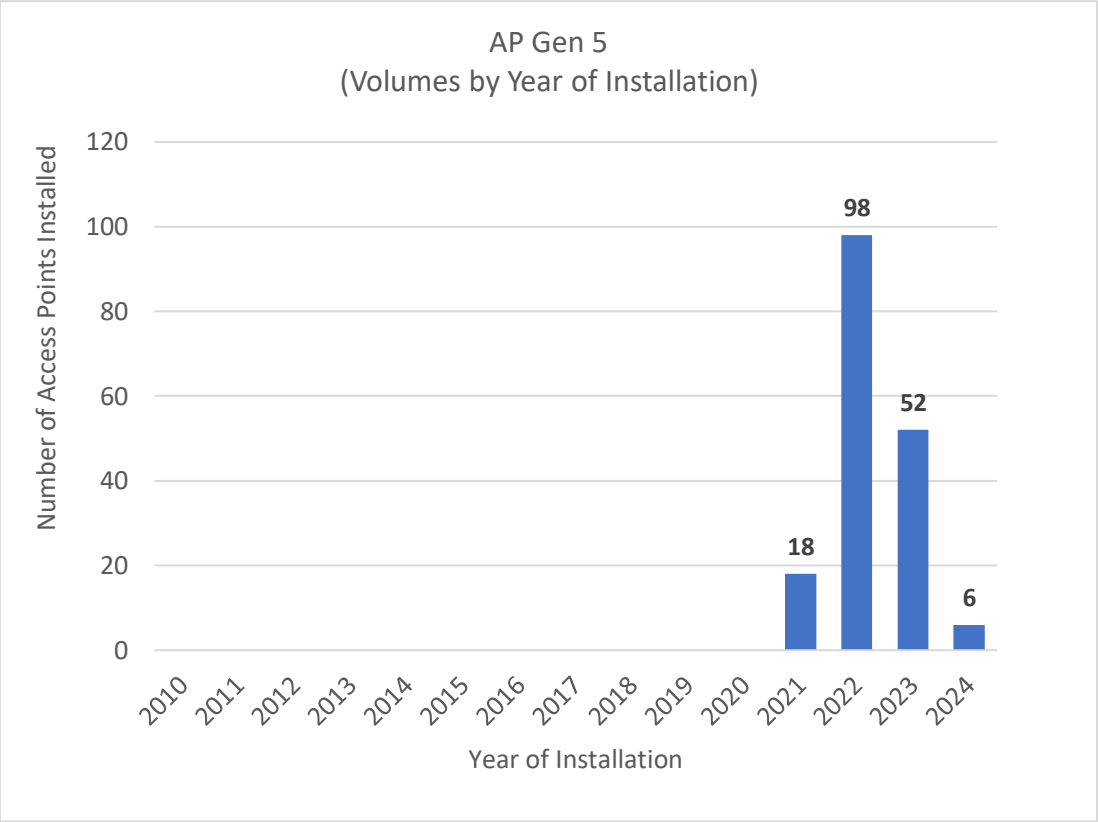
3.2.3.2 Life expectancy

According to vendor warranty terms and JEN's experience with similar devices, the expected design/product life is that Access Points have a 7-year design life - (manufacturer's warranty is 12 months).

NB: The life span of the Access Points can be impacted by the operating environment (e.g. ambient temperature and environmental conditions).

3.2.3.3 Age profiles

Figure 3-2: Access Points by Installation Year



3.2.3.4 Utilisation

Measurement communications devices, including Access Points, are required by regulation to provide a platform to connect and enable measurement devices and equipment (Meters, etc.) to the back-end network management applications and systems.

3.2.3.5 Performance analysis

Measurement communications devices', including Access Points', performance must be compliant with the service levels specified in the Victorian Government's AMI minimum functionality specification (MFS) and market system delivery requirements.

JEN perform end-to-end performance and compliance monitoring of the Access Points. They collect, collate, and review the data, together with the proactive monitoring and maintenance program reports, to determine any emergent performance trends or issues that require medication, corrective actions, or modification to the sub-asset management strategy.

Table 3-3: Access Points Failures

Description	2016	2017	2018	2019	2020	2021	2022	2023
Condition fail (Total/Partial)	-	-	-	-	-	-	Total	Total
Approx % of pop	0	0	0	0	0	0	0.9	3.0

There has been a comparatively small number of Access Points failures before the end of design/product life. These have been replaced and each failed unit evaluated by the supplier.

3.2.3.6 Control Effectiveness

By comparing identified risks and measuring past incidents, control effectiveness is assessed as part of the Jemena Compliance & Risk System (OMNIA).

3.2.4 Life Cycle Management

JEN has a well established asset life cycle management process and procedures, below diagram is displaying JEN's asset lifecycle phases.

3.2.4.1 Creation

Sub-asset acquisition is planned annually, and the procurement and logistics process commence ahead (to accommodate for lead time). The aim is to have sufficient, but not excessive, stock to manage the required supply. Acquisition triggers for this asset class are:

- Network growth
- Number of 'condition fail' units
- Deteriorated of the installations that have reached end of life

- LAN functional and/or performance improvement driven change of the metering installation.

Availability of spares is a critical aspect of this sub-asset class strategy. Spares are held as stock to:

- Mitigate risk of regulatory non-compliance by failing to perform Comm's device installation
- Minimise any communication link outage times; and
- Eliminate any loss of revenue due to failure to perform regulatory and market functions.

The optimum quantities of communication assets take into account the cost of holding stock balanced against:

- Purchase lead times
- Anticipated network growth
- Abolishment/alteration churn; and
- Projected 'condition fail' rates

JEN monitors stock levels, ensuring the minimum stock level is seven months of projected Access Point deployment. This is the level at which JEN can manage the restocking and address deployment needs.

3.2.4.2 Asset Operation and Maintenance

Based on asset condition and risk-based assessment (i.e. CBRM), assets are:

- Monitored by NMS and BI systems
- Subject to preventative maintenance inspection and testing; and
- Replaced when necessary.

This sub-asset category's maintenance program involves:

- Inspection and testing, i.e. preventative maintenance
- Corrective maintenance (defects); and
- Reactive maintenance (faults and emergencies)

JEN undertakes inspection and testing of the communication assets in accordance with the cyclic maintenance programs set for each category of the communications devices (Access Points), which are performed by JEN's accredited resources. JEN maintenance programs are reviewed annually in light of potential changes to product development, performance, failures, changes in policies and regulatory requirements.

In the event that inspection and testing programs, reveal widespread 'family failure' of the Access Points, JEN would initiate its failure management procedures in consultation with the suppliers to ensure the proposed replacement program is acceptable and compliant with the market and regulatory requirements. The supplier/manufacturer would be held to account to the extent commercially reasonable.

Corrective maintenance is necessitated when cyclic testing of Access Points installations detects a 'condition fail'.

Reactive maintenance is characterised by awareness of 'condition fail' because of an alert from network operations. The AMI backend NMS and Business Intelligence (BI) systems are used to monitor the operation, availability, and conditions of communication assets. Any deviation from expected operational thresholds is analysed for potential reactive maintenance.

3.2.4.3 Replacement/Disposal

Generally, there are three replacement modes pertinent to this sub-asset life cycle management. The alternative sub-asset replacement modes are:

- Run to failure (reactive)
- Schedule-based replacement (age-based)
- Condition-based replacement (the most cost-effective)
- TCO optimised condition-based replacement.

Run to failure. This mode would compromise JEN's ability to meet its regulatory and market obligations and requirements.

Scheduled replacement (aged based). This mode proposes to replace Access Points at the end of design/product life. Nominal Access Points design product life is 7 years (according to the manufacturer). JEN has not experienced a large failure as such the maintenance and monitoring programs are in place to identify any aged or performance-based failures. Currently, JEN considers age-based replacement uneconomic.

Condition-based replacement represents the best alternative because it excludes 'run to failure' and improves upon 'schedule-based replacement' by incorporating age data into the overall condition monitoring of the asset. This facilitates the optimal trade-off of CAPEX and OPEX performance. Sub-assets are replaced at the end of their useful life when their condition has deteriorated below acceptable performance requirements. This mode is optimal because it minimises asset investment whilst meeting, or exceeding, market and regulatory compliance requirements.

Condition-based replacement is determined by CBRM data:

- Age of asset
- Preventative maintenance activities and record keeping

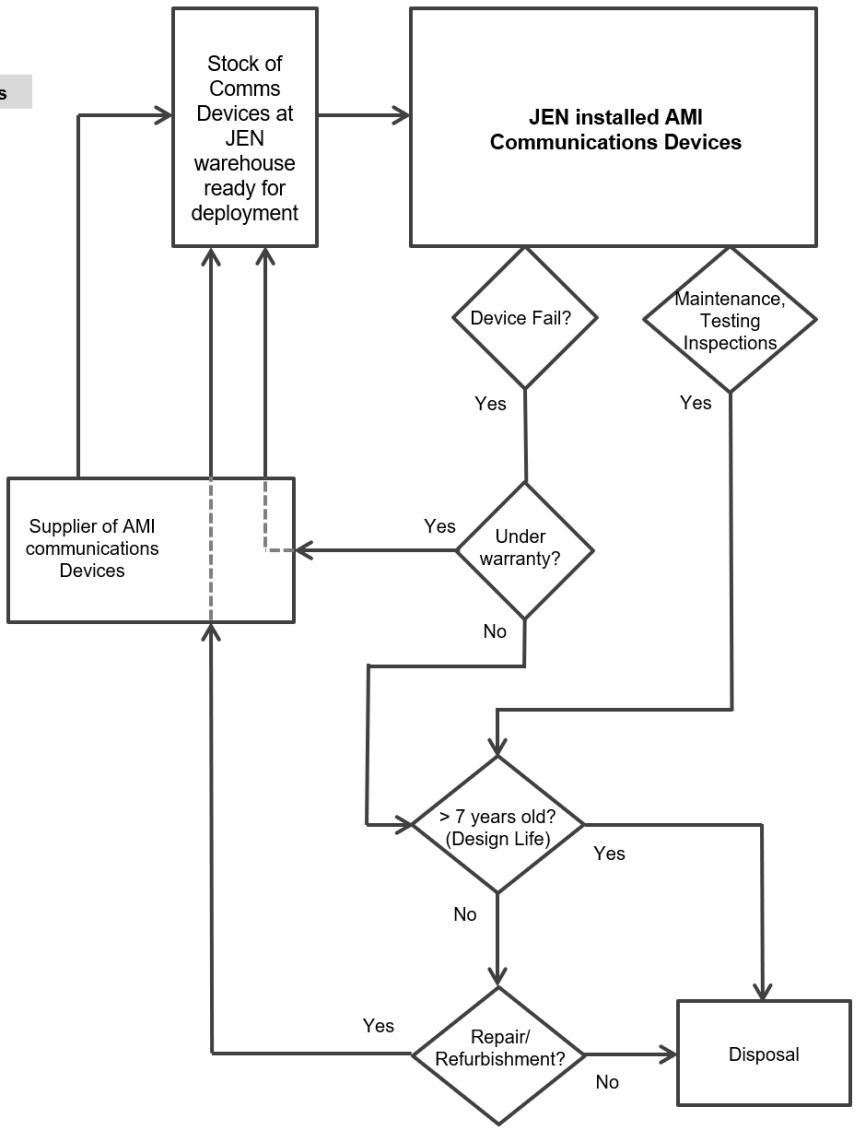
- Performance of asset; and
- Continuous monitoring of the assets.

TCO-optimised condition-based replacement represents another effective and optimal alternative because it excludes ‘run to failure’ and improves upon ‘Condition-based replacement’ by incorporating an increase in maintenance cost into overall condition monitoring of the asset. This facilitates the optimal trade-off between CAPEX versus OPEX when it is no longer economical to maintain the asset.

Figure 3-3: Maintenance decision-making and costings of Access Points

Applicable AMI Communications devices:

Devices	Types
Access Points	1



3.2.5 Information

JEN's AMS (refer to Section 1.2 of this document) 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 to determine the information required to deliver the sub-asset class business outcomes.

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. The electricity meters sub-asset class identified four business objectives together with the business information required to support these objectives as set out in Table 3-4. Current and future information requirements to inform value-added decision-making are in

Table 3-5. A proposed improvement for future business information needs is at Table 3-6.

Table 3-4: Access Points business objectives and information requirements

Business Objective	Jemena Information Sources	Externally Sourced Data
BO1 (Support delivery of customer consumption and other critical measurements Data) Maintain compliance	AMI SAP ERP SAP ECMS (investigations, revenue protections, work instructions, strategies, metering information, etc) [redacted] [redacted] Business Objects (Measurement Efficiency)	AEMC website - National Electricity Rules (AEMC) AEMO website - Metrology Procedures (AEMO) AEMO industry workgroups ENA Meter Coordinator workgroup SAI Global website – Australian standards ACMA Website, news and updates from Australian Communications and Media Authority ACSC Cyber Security Website, news and updates from Australian Cyber Security Centre Reports from AP's Service providers: • [redacted] • Monthly Report with volumes of Access Points refurbished, repaired, faults & fault analysis invoices Mondo (specialised service provider) monthly reports (excel and pdfs), include: • Summary of completed training & accreditations. • Summary of activities conducted on JEN, including number of tests and commissioned. • Access Points Stock by category, currently with them • Outstanding Invoices Contractor monthly reports: As per above, plus volumes of Access Point installed.

Business Objective	Jemena Information Sources	Externally Sourced Data
BO2 Ensure measurements of communications assets availability (supply) for network growth and/or alterations	AMI SAP ERP SAP (population of legacy meters, purchase orders) ECMS	Vendor Reports and reports as per external data for BO Public announcements and vendor notifications (e.g. Merger and Acquisitions, EOL/EOS announcements).
BO3 Ensure competitive pricing for the measurement's communications assets	AMI SAP ERP SAP Contract with Suppliers (ECMS)	Tender, market reports.
BO4 Support JEN Network Management in provision of better customer experience	[redacted] [redacted] Business Objects (Measurement Efficiency) JEN SCADA/Outage web Energy Portal	Publication from COAG CSIRO ENA forums AEMO RMCF (Retail Market Customer Forum) Local council information session.

Table 3-5: Access Points critical decisions business information requirements

Critical Business Decision	Current Information Usage	Future Information Requirement	Value to Asset Class (High, Medium, Low with justification)
CD1: install and test measurements communications assets to required standards.	AMI / ERP SAP • Access Points category • Installations Data • Test dates • Location / address • Status • Serial number • Access Points program ids • Maintenance records New Connections Reports (growth trends) Vendor status reports Maintenance Condition Reports	• Require BI reports for asset life management for better pre-emptive maintenance. • Require historic test data be stored in BI warehouse for predicative fault analysis (currently stored in separate spreadsheets from service providers).	• High (required by ACMA , ACSC, AS and Vic Government legislation)
CD2a: Maintain viable measurements of communications	AMI SAP – Volumes (current Access Points demand) ERP SAP – Stocks	• Enhanced Comm's management and supply/inventory management system	• High – part of JEN obligations under the Electricity Distribution Code of Practice.

assets supply contracts	Installed by date and categories. Status - Eg with vendors for refurbishment Failure rates (Attribute in SAP) BI UIQ (Monitoring and management system) • Assess Reports		
CD2a: Place orders on time, as required by this asset class strategy	Monitoring current stocks: • Available volume of Access Points of a particular category in store (per store location) • at JEN warehouses	• Enhanced Comm's management and supply/inventory management system	• High – part of JEN obligations under the Electricity Distribution Code of Practice.
CD3: Periodically test the market and prices	Monitoring the market for: • New manufacturers • Change in exchange rates	• Enhanced Access Points management and supply/inventory management system	• High – part of JEN obligations under the Electricity Distribution Code of Practice.
CD4: actively pursue technological innovation to better leverage capabilities of measurement communications	Monitoring the market for: • New technology • Better use of collected data	• On going architectural and market review	• High – part of JEN commitment for customer focus

Table 3-6: Access Points information initiatives to support future business information requirements.

Information Initiative	Use Case Description	Asset Class Risk	Data Quality Requirement
Create reports for measurements of communications assets consumption and refurbishment volumes to reflect real-time demand and utilization of measurements of communications assets by supplier, category and type of installation	Monitor the monthly consumption of Access Points to ensure are in line with stated projections and forecasts	Over/under budgeting Running out of stock	All the information attributes are complete and accurate in SAP

3.2.5.1 Future improvements

Measurement communications technologies are a fast-evolving systems as the performance and security requirements changes, JEN regularly reviews and assesses the new threats and opportunities to ensure the measurement communications systems are up to the required standards, followings are key risks and opportunities monitored and assessed:

- Cybersecurity is an emergent risk necessitating monitoring and management through ISO/IEC 27000 controls
- Larger bandwidth and reduced latency requirements to support new network innovations, such as:
    - Enhanced communications for electricity network monitoring and management
    - Distributed energy generation management
    - Distributed network intelligence and management
- Requirements to support of diverse backhaul technologies and backend systems.

3.3 Relays

3.3.1 Introduction

The relays function as a network transfer medium, as per the name they are enabling two-way connectivity between communications endpoints in the RF Mesh Network and the utility's back-office NMS Relays are crucial in managing data traffic for downstream devices such as meters and AP's. Relays also are also critical for providing network time, registration, optimal routing paths, data queues, and transmitting data to Access Points.

Currently, JEN manages approximately 310 Gen 1.5 relays within the AMI mesh network area. The number of meters connected to a relay is typically much lower than to an Access Point, as it depends on the location, height of the device, and the presence of other devices such as Access Points and relays in the vicinity.

Relays are weather-resistant and designed for outdoor installation on wooden or concrete power poles or metallic public lighting poles. They are equipped with a backup battery that provides 8-12 hours of operation during power outages and have provisions for a mesh antenna using female N-type connectors.

Each meter in the mesh network should register multiple connectivity paths provided by various relays using its built-in dynamic discovery and self-healing algorithms. At any given time, each meter should use the best path based on the minimum number of hops and total

path loss. In addition, as an intelligent network element, relays offer network convergence and redundancy to every meter in the mesh network in case of a relay failure or unavailability.

[redacted]

3.3.2 Risk

The communication relays are costly network devices to procure. [redacted] Relays are designed and fabricated with high reliability to survive in outdoor harsh environmental conditions.

3.3.2.1 Criticality

Accuracy, reliability and security of equipment operation is highly critical due to compliance, reputational and revenue risks. Investments in robust infrastructure, cybersecurity measures, and regular maintenance are necessary to maintain the functionality and efficiency of these equipment.

3.3.2.2 Failure modes

Failure of communications relays can manifest itself as:

- Non-operation, partial or total failure of relays generally occurs without exhibiting any physical signs of deterioration until the failure occurs. Failures in hardware such as modem, antenna, or cabling are generally due to age and operational environment stress.
- [redacted]
- Intermittent failures, generally due to power failure, cellular network outages, interference, network loading, operational applications and systems or issues.
- [redacted]
- Physical security, generally equipment theft, vandalism, bird or animal activity in the vicinity.

All risks are identified and managed in the compliance and risk management system (OMNIA).

3.3.2.3 Existing controls

Risk mitigation of this sub-asset class can be classified into the following types:

- **Architectural mitigation**. Guiding principles and architectural decisions mitigate risk through design.
- **Procedural mitigation**. BAU procedures, work instructions and planning (e.g. inclusion of budgetary contingencies, careful vendor selection and vendor monitoring regimes) are used to reduce the likelihood and/or impact of procedural error.
- **Contractual mitigation**. Contractual mechanisms such as service level agreements, liquidated damages, defects liability periods and insurance requirements are used to reduce the likelihood of sub-standard third-party service delivery.
- **Operational Mitigation.** Support system infrastructure failures, power failures, and telecom infrastructure failures. backend software/hardware failures, internal security system failures, operational failures.

In addition, all parties and processes involved in the provision of measurement communications services are audited annually by external (ISO55001) and JEN's internal teams to ensure that all have the requisite processes, training and accreditation in line with national and state-based obligations.

Table 3-7: Existing Controls

#	Threat	Vulnerability	Risk	Controls
1	Overstated product reliability or unexpected environmental conditions	Inadequate product design	Increased operation & maintenance cost. Increased replacement levels may affect customer relations and business reputation	Contractual: Product Warranty and vendor support agreement
2	Geographically or Radio Frequency (RF) isolated customer	Limitation of LAN overage	Increased cost to achieve coverage. Increased probability of not meeting regulatory requirement for meter reading performance	Architectural: WAN Port under the terminal cover allows a modem to be added to replace the built-in mesh radio modem. Design support is for 4G only.
3	Regulator change band access new data services	Meter communications and LAN design ISM 100Kbps limit	Stranded meter assets because of integrated communication technology Increased maintenance/replacement cost	Architectural: WAN port under the terminal cover could be used to replace the built-in mesh radio modem. e.g. Mobile, Fibre Optic (NBN) etc. Silver Spring support to reprogram NIC

#	Threat	Vulnerability	Risk	Controls
4	4G WAN service end of life	WAN solution uses 4G	Redesign/replacement of Relays Loss of system availability	Architectural: Design supports modem replacement in Relays
5	[redacted]	[redacted]	[redacted]	[redacted]
6	Unsuitable geography & street design	LAN RF limitations	Poor coverage requiring additional equipment/costs	Procedural: Radio Surveys: Comprehensive radio survey of the distribution territory to ensure the technology selection is based on sound real world and measured data. Contractual Silver Spring responsible for 100% coverage
7	New firmware/Programs	Unknown behaviour in the field	AMI system availability and integrity may be compromised. Affects operation & maintenance phases	Procedural: Testing of firmware and meter programs prior to field deployment
8	Delays in supply chain	Unknown performance	Failure to supply on time may result in availability issues	Procedural: Inventory Management: Equipment vendors must maintain 6 months inventory “in country” (lead to time for new shipment) to provide supply even in the event of delivery issues
9	Single Mesh Network supplier	End of product line or company failure	Unable to maintain and grow the LAN network. Continued supply of Relays Enhancement to support new opportunities. Continued support for NMS	Contractual: Unlikely considering number of Utilities using this product. Jemena is also protected under the legal ESCROW agreement - a contractual arrangement in which a third party receives and disburses money or documents for the primary transacting parties, with the disbursement

#	Threat	Vulnerability	Risk	Controls
				dependent on conditions agreed to by the transacting parties, or an account established by a broker for holding funds on behalf of the broker's principal or some other person until the consummation or termination of a transaction.
10	Communications devices supply reliability	Long lead time and supply shortage of communications devices	Unable to meet the communications devices demand required by business-as-usual activities and unexpected failures	Contractual: Establish and maintain contractual arrangement to ensure supply availability through guaranteed service levels and assurance. Procedural: Inventory Management: Equipment vendors must maintain 6-12 months inventory “in country” (lead to time for new shipment) to provide supply even in the event of delivery issues related to high demand.

3.3.2.4 Future risks

Emerging risks for this sub-asset class are:

- Cyber Security and unauthorised access could compromise the availability and integrity of data. In addition, any unauthorised access to customer usage data would compromise privacy
- Disruption to the global electronics supply chain affecting production and delivery of Comm’s equipment
- Inability to support effective technology substitution: technology obsoletions and/or vendors exiting the market which could significantly affect the network operations.

3.3.3 Performance

3.3.3.1 Requirements

Measurement communications relays must:

- Provide 24/7 high-availability measurement communications services.
- Provide a stable and secure communication network, ensuring integrity and security.

- Support existing and establishment of new networks and customer services.
- Support on-demand network and customer management remote services

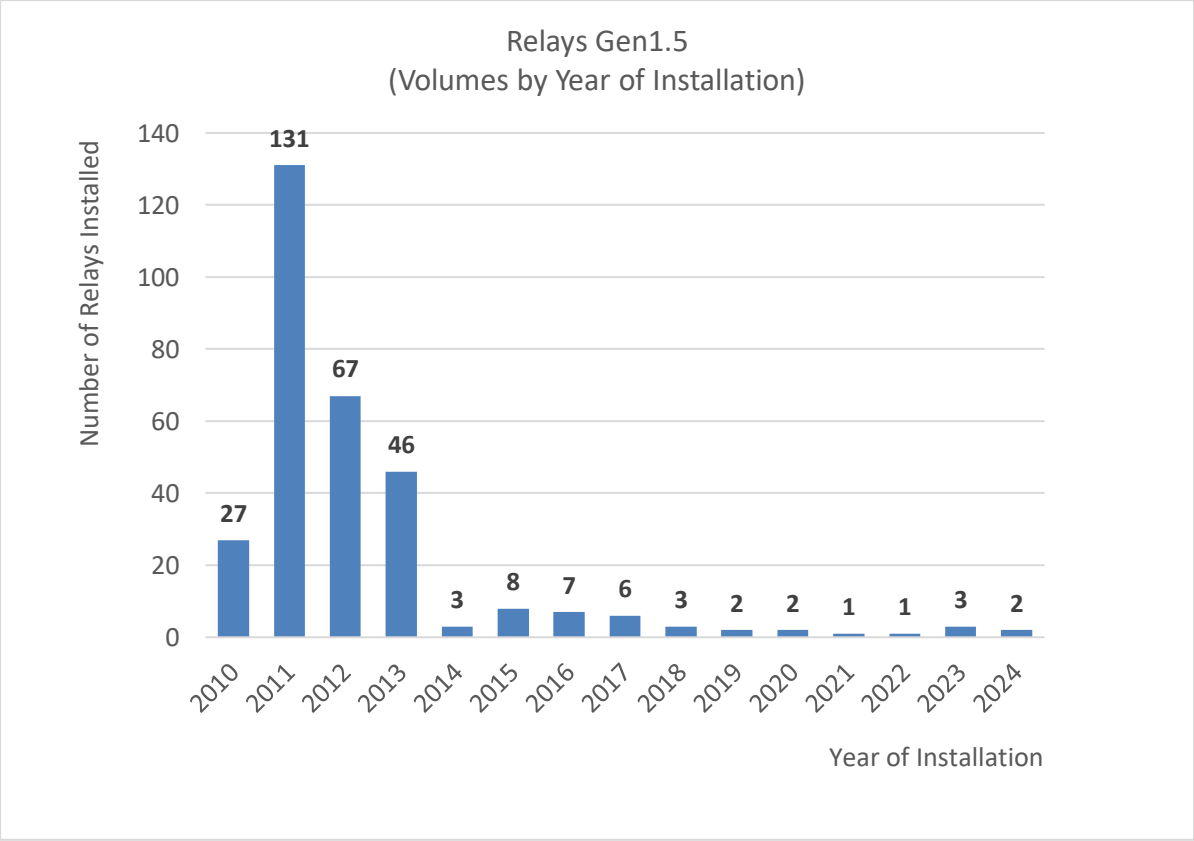
3.3.3.2 Life expectancy

According to vendor warranty terms and JEN's experience with similar devices, the expected design/product life for relays have a 7-year design life - (manufacturer's warranty is 12 months).

NB: Life span of the relays can be impacted by the operating environment (e.g. ambient temperature and environmental conditions).

3.3.3.3 Age profiles

Figure 3-4: Relays by year of installation



3.3.3.4 Utilisation

Measurement communications devices including relays are required by regulation to provide a platform to connect and enable measurements devices and equipment (Meters, Etc) to the back-end networks management applications and systems.

3.3.3.5 Performance analysis

Measurement communications devices including relays performance must be compliant with the service requirement specified by the Victorian Government's AMI minimum functionality specification and market system delivery requirements.

End-to-end performance and compliance monitoring of the relays is performed by network operations teams within Jemena asset management which collects, collates and reviews the data, together with the proactive monitoring and maintenance program reports, determining any emergent performance trend or issues that requires medication, corrective actions or modification to the sub-asset management strategy.

Table 3-8: Communications Relay Failures

Description	2016	2017	2018	2019	2020	2021	2022	2023
Condition fail (Total/Partial)	-	Total	-	Total	Total	Total	-	Total
Approx % of pop	0	0.6	0	0.3	0.6	0.3	0	0.3

There has been a comparatively small number of relays fail before end of design/product life.

3.3.3.6 Control effectiveness

By comparing identified risks and measuring past incidents, control effectiveness is assessed as part of the Jemena Compliance and Risk System (OMNIA). Life Cycle Management

JEN has a well established asset life cycle management process and procedures, below diagram is displaying JEN's asset lifecycle phases.

3.3.3.7 Creation

Sub-asset acquisition is planned annually, and the procurement and logistics process commences ahead (to accommodate for lead time). The aim is to have sufficient, but not excessive, stock to manage the required supply.

Acquisition triggers for this asset class are:

- Network growth
- Number of 'condition fail' units
- Deteriorated of the installations that have reached end of life
- LAN functional and/or performance improvement driven change of the metering installation.

Availability of spares is a critical aspect of this sub-asset class strategy. Spares are held as stock to:

- Mitigate risk of regulatory non-compliance by failing to perform Comm's device installation
- Minimise any communication link outage times; and
- Eliminate any loss of revenue due to failure to perform regulatory and market functions.

The optimum quantities of communication assets take into account the cost of holding stock balanced against:

- Purchase lead times
- Anticipated network growth
- Projected 'condition fail' rates.

JEN monitors stock levels and maintains the minimum stock level for seven months of projected relays consumption.

3.3.3.8 Asset Operation and maintenance

Based on asset condition and risk-based assessment (i.e. CBRM), assets are:

- Monitored by NMS and BI systems
- Subject to preventative maintenance inspection and testing; and
- Replaced when necessary.

This sub-asset category's maintenance program involves:

- Inspection and testing, i.e. preventative maintenance
- Corrective maintenance (defects); and

- Reactive maintenance (faults and emergencies).

JEN undertakes inspection and testing of the communication assets in accordance with the cyclic maintenance programs set for each category of the communications devices (Relays) and performed by JEN's accredited resources. JEN Maintenance programs are reviewed annually in light of potential changes to product development, performance, failures, changes in policies and regulatory requirements.

In the event that inspection and testing programs reveal widespread 'family failure' of the Relays, JEN would initiate its failure management procedures in consultation with the suppliers to ensure the proposed replacement program is acceptable and compliant with the market and regulatory requirements. The supplier/manufacturer would be held to account to the extent commercially reasonable.

Corrective maintenance is necessitated when cyclic testing of relays installations detects a 'condition fail'.

Reactive maintenance is characterised by awareness of 'condition fail' triggered by:

- An alert from network operations systems. The AMI backend (NMS) and Business Intelligence (BI) systems are used to monitor the operation, availability, and conditions of communication assets. Any deviation from expected operational thresholds are analysed for potential reactive maintenance.

3.3.3.9 Replacement/disposal

Generally, there are three replacement modes pertinent to this sub-asset life cycle management. The alternative sub-asset replacement modes are:

- Run to failure (reactive);
- Schedule-based replacement (age-based); and
- Condition-based replacement (the most efficient cost).

Run to failure. This mode would compromise JEN's ability to meet its regulatory and market obligations and requirements.

Scheduled replacement (aged-based). This mode proposes replacing relays at the end of design/product life. The nominal relay product design life is 7 years (according to the manufacturer). JEN has not experienced a large failure, so maintenance and monitoring programs are in place to identify any aged or performance-based failures. Currently, JEN considers age-based replacement uneconomic.

Condition-based replacement represents the best alternative because it excludes 'run to failure' and improves upon 'schedule-based replacement' by incorporating age data into the overall condition monitoring of the asset. This facilitates the optimal trade-off of CAPEX and OPEX performance. Sub-assets are replaced at the end of their useful life when their condition has deteriorated below acceptable performance requirements. This mode is

optimal because it minimises asset investment whilst meeting or exceeding market and regulatory compliance requirements.

Condition-based replacement is determined by CBRM data:

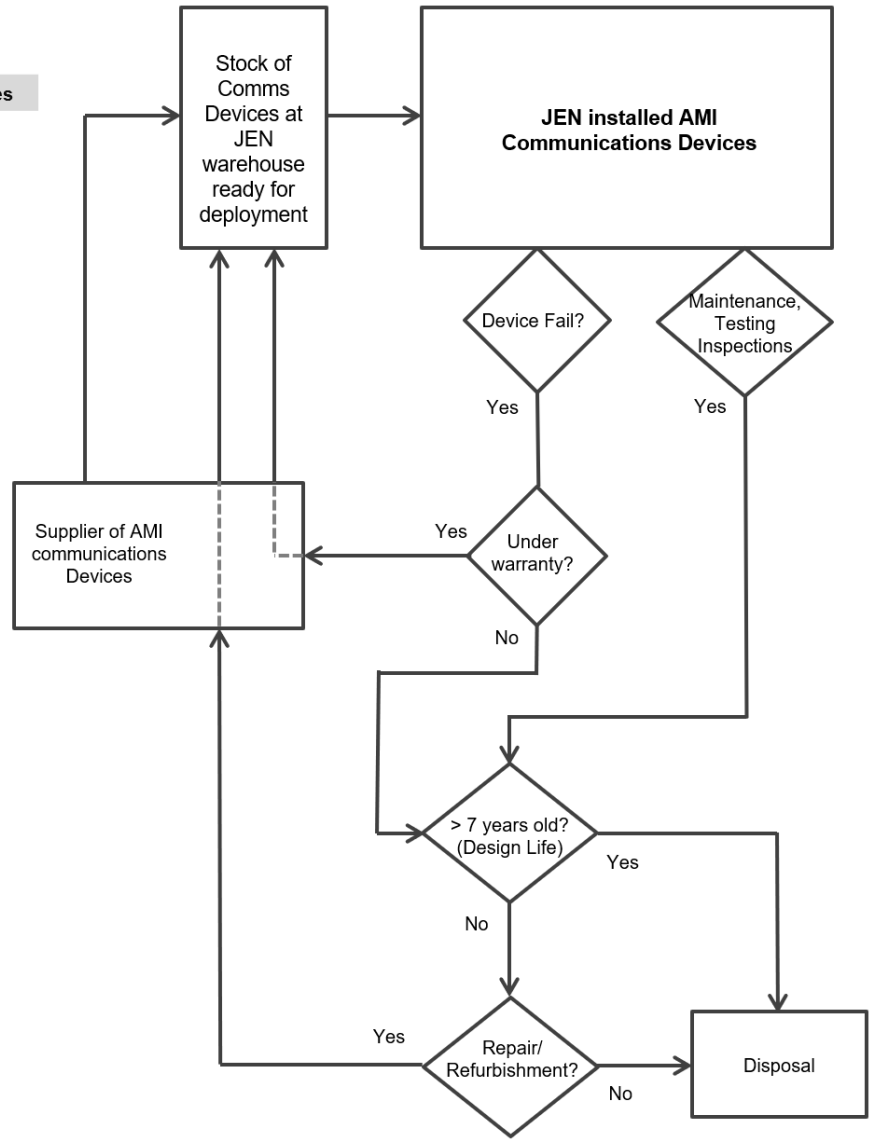
- Age of asset
- Preventative maintenance activities and record-keeping
- Performance of asset; and
- Continuous monitoring of the assets.

TCO-optimised condition-based replacement represents another effective and optimal alternative because it excludes 'run to failure' and improves upon 'Condition-based replacement' by incorporating asset value into the overall condition monitoring of the asset. This facilitates the optimal trade-off between CAPEX versus OPEX when it is no longer economical to maintain the asset.

Figure 3-5: Maintenance decision-making and costings of Communications Relays

Applicable AMI Communications devices:

Devices	Types
Relays	1



3.3.4 Information

JEN's AMS (refer to Section 1.2 of this document) 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 to determine the information required to deliver the sub-asset class business outcomes.

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. The electricity meters sub-asset class identified four business objectives together

with the business information required to support these objectives as set out in Table 3-9. Current and future information requirements to inform value-added decision-making are in Table 3-5. A proposed improvement for future business information needs is at Table 3-11.

Table 3-9: Communications Relay business objectives and information requirements

Business Objective	Jemena Information Sources	Externally Sourced Data
BO1 (Support delivery of customer consumption and other critical measurements Data) Maintain compliance	AMI SAP ERP SAP ECMS (investigations, revenue protections, work instructions, strategies, metering information, etc) [redacted] [redacted] Business Objects (Measurement Efficiency)	AEMC website - National Electricity Rules (AEMC) AEMO website - Metrology Procedures (AEMO) AEMO industry workgroups ENA Meter Coordinator workgroup SAI Global website – Australian standards ACMA Website, news and updates from Australian Communications and Media Authority ACSC Cyber Security Website, news and updates from Australian Cyber Security Centre Reports from relay Service providers: • SSN - Itron JIRA portal (Comm's vendor portal) • Monthly Report with volumes of relays refurbished, repaired, faults& faults analysis. • invoices Mondo (specialised service provider) monthly reports (excel and pdfs), include: • Summary of completed training & accreditations. • Summary of activities conducted on JEN, including number of tests and commissioned. • Relay Stock by category. • Outstanding Invoices Contractor monthly reports As per above, plus volumes of relays installed.

Business Objective	Jemena Information Sources	Externally Sourced Data
BO2 Ensure measurements of communications assets availability (supply) for network growth and/or alterations	AMI SAP ERP SAP (population of legacy meters, purchase orders) ECMS	Vendor reports and reports as per external data for BO. Public announcements and vendor notifications (e.g. Merger and Acquisitions, EOL/EOS announcements).
BO3 Ensure competitive pricing for the measurement's communications assets	AMI SAP ERP SAP Contract with Suppliers (ECMS)	Tender, market reports.
BO4 Support JEN Network Management in the provision of better customer experience	[redacted] [redacted] Business Objects (Measurement Efficiency) JEN SCADA/Outage web Energy Portal	Publication from COAG CSIRO ENA forums AEMO RMCF (Retail Market Customer Forum) Local council information session.

Table 3-10: Communications Relay critical decisions business information requirements

Critical Business Decision	Current Information Usage	Future Information Requirement	Value to Asset Class (High, Medium, Low with justification)
CD1: install and test measurements of communications assets to the required standards.	AMI / ERP SAP • Relay's category • Relay's tariffs • Installations Data • Test dates • Location / address • Status • Serial number • Relay's program ids • Maintenance records New Connections Reports (growth trends) Vendor status Reports Maintenance Condition Reports	• Require BI reports for asset life management for better pre-emptive maintenance. • Require historic test data be stored in BI warehouse for predicative fault analysis (currently stored in separate spreadsheets from service providers)	• High (required by ACMA , ACSC, AS and Vic Government legislation)
CD2a: Maintain viable measurements of communications assets supply contracts	AMI SAP – Volumes (current Relay demand) Relays in stock by ERP SAP – Stocks	• Enhanced Comm's management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.

Critical Business Decision	Current Information Usage	Future Information Requirement	Value to Asset Class (High, Medium, Low with justification)
	Installed by date and categories Status - Eg with vendors for refurbishment Failure rates (Attribute in SAP) BI UIQ (Monitoring and management system) • Assess Reports		
CD2a: Place orders on time, as required by this asset class strategy	Monitoring current stocks: • Available volume of relays of a particular category in store (per store location) • at JEN warehouses	• Enhanced Comm's management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.
CD3: Periodically test the market and prices	Monitoring the market for: • New manufacturers • Change in exchange rates	• Enhanced meter management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.
CD4: actively pursue technological innovation to better leverage capabilities of measurement communications	Monitoring the market for • New technology • Better use of collected data	• On going architectural and market review	• High – part of JEN commitment for customer focus

Table 3-11: Communications Relay information initiatives to support future business information requirements

Information Initiative	Use Case Description	Asset Class Risk	Data Quality Requirement
Create reports for measurements of communications assets consumption and refurbishment volumes to reflect real-time demand and utilization of measurements of communications assets by supplier, category and type of installation	Monitor the monthly consumption of Relay**'s** to ensure are in line with stated projections and forecasts	Over / under budgeting Running out of stock	All the information attributes are complete and accurate in SAP

3.3.4.1 Future improvements

Measurements communications technologies are a fast evolving systems as the performance and security requirements changes, JEN is regularly review and assess the new treats and opportunities to ensure the measurements communications systems are up to the required standards, followings are key risks and opportunities monitored and assessed:

- [redacted]
- Larger bandwidth and reduced latency to support new network innovations, such as:
  - Enhanced communications for electricity network monitoring and management
  - Distributed energy generation management
  - Distributed network intelligence and management
- Support of diverse backhaul technologies and backend systems

3.4 Micro Access Points

3.4.1 Introduction

The micro Access Point functions as a gateway, enabling two-way connectivity between the metering and the back-end system. The micro Access Point is an upstream WAN-enabled mesh NIC inserted inside a meter. It functions as a mini gateway or Access Point, enabling two-way connectivity between a small number of neighbouring downstream meters and the utility's back-office NMS. Unlike a relay, the micro Access Points provide the same services as an Access Point and can be used in hard-to-reach locations with direct 4G LTE upstream connectivity.

Micro Access Points are cost-effective, flexible, and agile solutions with lower risk compared to standard assets like micro Access Points and relays. They are crucial for managing data traffic for downstream devices with higher hops and intermittent or no connectivity, thereby supporting mesh redundancy management and optimisation.

Currently, JEN is in the early stages of deploying Gen 5[3] micro Access Points in the AMI mesh network. Each Gen 5 micro Access Point includes a built-in 4G modem card and communication NIC that fits within the form factor of the L&G meter NIC. These NICs can transmit data at rates up to 600 kbps. The micro Access Points are designed to handle up to 500 simultaneous connections, but to ensure near real-time communication and avoid longer data queues, it is recommended to maintain a ratio of 25-100 meters per micro Access Point.

The micro Access Points are manufactured to meet the same standards as the Access Points, with the addition of new micro mesh technology introduced by [redacted] to serve a reduced number of meters per Access Point connectivity. Since they are installed inside

[3] Generation versions are defined by the vendor. Gen 5 are 4G communications protocol.

meters, they do not have backup batteries to operate during power outages. Each micro Access Point has two SMA-female connections: one for LTE WAN connectivity and the other for mesh connectivity.

[redacted]

[redacted]

3.4.2 Risk

Risk of cyber and physical security threats:

- Micro Access Points are highly secured equipment due to the important role they have in the communications platform, and they are required to ensure no access breaches, hacking, and attacks could occur both physically and electronically. Micro Access Points provide the collection of customer supply-related data. Hence, data privacy is important. It is exceptionally reliable, robust hardware made to survive in harsh environmental conditions.
- Failures of support system infrastructure (e.g power supply failures, and telecom infrastructure failures).
- Backend software/hardware failures, internal security system failures, operational failures (e.g. human error).

3.4.2.1 Criticality

Performance, accuracy, reliability, and security of micro Access Points are critical for the compliance, reputation, and revenue protection of JEN as a whole. Investments in robust infrastructure, cybersecurity measures, and regular maintenance are necessary to maintain the functionality and efficiency of this sub-asset class.

3.4.2.2 Failure modes

Failure of micro Access Points can manifest itself as:

- Non-operation, partial or total failure of the micro Access Points; generally, occurs without exhibiting any physical signs of deterioration until the failure occurs.
- Failures in hardware such as modem, antenna, or cabling; generally due to age, operational environmental stress.
- [redacted]

- Intermittent failures, generally due to power failure, cellular network outages, interference, network loading, operational applications and systems or issues.
- [redacted]
- Physical security, generally equipment theft, vandalism, bird or animal activity in the vicinity.

All risks are identified and managed in the compliance and risk management system.

3.4.2.3 Existing controls

Risk mitigation of this sub-asset class can be classified into the following types:

- **Architectural mitigation**. Guiding principles and architectural decisions mitigate risk through design.
- **Procedural mitigation**. BAU procedures, work instructions and planning (e.g. inclusion of budgetary contingencies, careful vendor selection and vendor monitoring regimes) are used to reduce the likelihood and/or impact of procedural error.
- **Contractual mitigation**. Contractual mechanisms such as service level agreements, liquidated damages, defects liability periods and insurance requirements are used to reduce the likelihood of sub-standard third-party service delivery.
- **Operational mitigation**. Extensive commissioning testing & verification.

In addition, all parties and processes involved in the provision of JEN AMI communications services are audited internally and externally to comply with ISO 55001. The audits ensure that the teams involved in the provision of JEN AMI comms asset management and operation have the requisite processes, training and accreditation in line with national and state-based obligations.

Table 3-12: Existing Controls

#	Threat	Vulnerability	Risk	Controls
1	Overstated product reliability or unexpected environmental conditions	Inadequate product design	Increased operation & maintenance cost. Increased replacement levels may affect customer relations and business reputation	Contractual: Product Warranty and vendor support agreement
2	Geographically or Radio Frequency (RF) isolated customer	Limitation of LAN coverage	Increased cost to achieve coverage. Increased probability of not meeting regulatory requirement for meter reading performance	Architectural: WAN Port under the terminal cover allows a modem to be added to replace the built-in mesh radio modem. Design support is for 4G only.

#	Threat	Vulnerability	Risk	Controls
3	Regulator change band access new data services	Meter communications and LAN design ISM 100Kbps limit	Stranded meter assets because of integrated communication technology Increased maintenance/replacement cost	Architectural: WAN port under the terminal cover could be used to replace the built-in mesh radio modem. e.g. Mobile, Fibre Optic (NBN) etc. Silver Spring support to reprogram NIC
4	4G WAN service end of life	WAN solution uses 4G	Redesign/replacement of Micro Access Points Loss of system availability	Architectural: Design supports modem replacement in AP's
5	[redacted]	[redacted]	[redacted]	[redacted]
6	New firmware/Programs	Unknown behaviour in the field	AMI system availability and integrity may be compromised. Affects operation & maintenance phases	Procedural: Testing of firmware and meter programs prior to field deployment
7	Delays in supply chain	Unknown performance	Failure to supply on time may result in availability issues	Procedural: Inventory Management: Equipment vendors must maintain 6 months inventory "in country" (lead to time for new shipment) to provide supply even in the event of delivery issues
8	Single Mesh Network supplier	End of product line or company failure	Unable to maintain and grow the LAN network. Continued supply of micro Access Points Enhancement to support new opportunities. Continued support for NMS	Contractual: Unlikely considering number of Utilities using this product. Jemena is also protected under the legal ESCROW agreement - a contractual arrangement in which a third party receives and disburses money or documents for the primary transacting parties, with the disbursement dependent on conditions agreed to by the transacting

#	Threat	Vulnerability	Risk	Controls
				parties, or an account established by a broker for holding funds on behalf of the broker's principal or some other person until the consummation or termination of a transaction.
10	Communications devices supply reliability	Long lead time and supply shortage of communications devices	Unable to meet the communications devices demand required by business-as-usual activities and unexpected failures	Contractual: Establish and maintain contractual arrangement to ensure supply availability through guaranteed service levels and assurance. Procedural: Inventory Management: Equipment vendors must maintain 6-12 months inventory “in country” (lead to time for new shipment) to provide supply even in the event of delivery issues related to high demand.

3.4.2.4 Future risks

Emerging risks for this sub-asset class are:

- [redacted]
- Disruption to global electronics supply chain affecting production and delivery of Comm’s equipment
- Inability to support effective technology substitution: technology obsoletions and/or vendors exiting the market which could significantly affect the network operations.

3.4.3 Performance

3.4.3.1 Requirements

Measurement communications micro Access Points must:

- Provide 24/7 high availability measurements communications services.
- Provide a stable and secure communication network ensuring integrity and security.
- Support existing and establishment of new networks and customer services.
- Support on demand network and customer management remote services.

3.4.3.2 Life expectancy

According to vendor warranty terms and JEN's experience with similar devices, expected design/product life for micro Access Points are 7-year design life - (manufacturer's warranty is 12 months).

NB: Life span of the micro Access Points can be impacted by the operating environment (e.g. ambient temperature and environmental conditions).

3.4.3.3 Age profiles

JEN is currently in the process of deploying micro Access Points.

3.4.3.4 Utilisation

Measurement communications devices including micro Access Points are required by regulation to provide a platform to connect and enable measurements devices and equipment (meters, etc) to the back-end networks management applications and systems.

3.4.3.5 Performance analysis

Measurement communications devices, including micro Access Points performance, are compliant with the service requirements specified by the Victorian Government's AMI MFS and market system delivery requirements.

End-to-end performance and compliance monitoring of the relays is performed by network operations teams within Jemena asset management, which collects, collates and reviews the data, together with the proactive monitoring and maintenance program reports, determining any emergent performance trend or issues that require medication, corrective actions or modification to the sub-asset management strategy.

Table 3-13: Micro Access Points Failures

Description	2016	2017	2018	2019	2020	2021	2022	2023
Condition fail (Total/Partial)	-	-	-	-	-	-	-	-
Approx % of pop	0	0	0	0	0	0	0	0

Note: There have been no micro Access Points fail as JEN is currently undertaking the installations of these devices.

3.4.3.6 Control effectiveness

By comparing identified risks and measuring past incidents, control effectiveness is assessed as part of the Jemena Compliance & Risk System (OMNIA).

3.4.4 Life Cycle Management

JEN has a well established asset life cycle management process and procedures, below diagram is displaying JEN's asset lifecycle phases.

3.4.4.1 Creation

Sub-asset acquisition is planned annually, and the logistics process commences ahead (to accommodate for lead time). The aim is to have sufficient, but not excessive, stock to manage the required supply.

Acquisition triggers for this asset class are:

- Network growth
- Number of 'condition fail' units
- Deteriorated of the installations that have reached end of life
- LAN functional and/or performance improvement driven change of the metering installation.

Availability of spares is a critical aspect of this sub-asset class strategy. Spares are held as stock to:

- Mitigate risk of regulatory non-compliance by failing to perform Comm's device installation
- Minimise any communication link outage times; and
- Eliminate any loss of revenue due to failure to perform regulatory and market functions.

The optimum quantities of communication assets take into account the cost of holding stock balanced against:

- Purchase lead times
- Anticipated network growth

- Projected ‘condition fail’ rates.

JEN’s nominated contractor monitors stock levels. The minimum stock level is seven months of projected micro Access Points consumption.

3.4.4.2 Asset Operation and maintenance

Based on asset condition and risk-based assessment (i.e. CBRM), assets are:

- Monitored by NMS and BI systems
- Subject to preventative maintenance inspection and testing; and
- Replaced when necessary.

This sub-asset category's maintenance program involves:

- Inspection and testing, i.e. preventative maintenance
- Corrective maintenance (defects); and
- Reactive maintenance (faults and emergencies).

JEN undertakes inspection and testing of the communication assets in accordance with the cyclic maintenance programs set for each category of the communications devices (Micro Access Points) and performed by JEN's accredited resources. JEN Maintenance programs are reviewed annually in light of potential changes to product development, performance, failures, changes in policies and regulatory requirements.

In the event that inspection and testing programs reveal widespread 'family failure' of the micro Access Points, JEN would initiate its failure management procedures in consultations with the suppliers to ensure the proposed replacement program is acceptable and compliant with the market and regulatory requirements. The supplier/manufacturer would be held to account to the extent commercially reasonable.

Corrective maintenance is necessitated when cyclic testing of micro Access Points installations detects a 'condition fail'.

Reactive maintenance is characterised by awareness of 'condition fail' because of:

- An alert from network operations. The AMI NMS and BI systems are used to monitor the operation, availability, and conditions of communication assets. Any deviation from expected operational thresholds are analysed for potential reactive maintenance.

3.4.4.3 Replacement/disposal

Generally, there are three replacement modes pertinent to this sub-asset life cycle management. The alternative sub-asset replacement modes are:

- Run to failure (reactive);
- Schedule-based replacement (age-based); and
- Condition-based replacement (the most cost effective).

Run to failure. This mode would compromise JEN's ability to meet its regulatory and market obligations and requirements.

Scheduled replacement (aged based). This mode proposes to replace micro Access Points at the end of design/product life. Nominal micro Access Points design product life is 7 years (according to the manufacturer). JEN have not experienced a large failure as such the maintenance and monitoring programs are in place to identify any aged or performance-based failures. Currently, JEN considers age-based replacement uneconomic.

Condition-based replacement represents the best alternative because it excludes 'run to failure' and improves upon 'schedule-based replacement' by incorporating age data into the overall condition monitoring of the asset. This facilitates the optimal trade-off of CAPEX and OPEX performance. Sub-assets are replaced at the end of their useful life when their condition has deteriorated below acceptable performance requirements. This mode is optimal because it minimises asset investment whilst meeting, or exceeding, market and regulatory compliance requirements.

Condition-based replacement is determined by CBRM data:

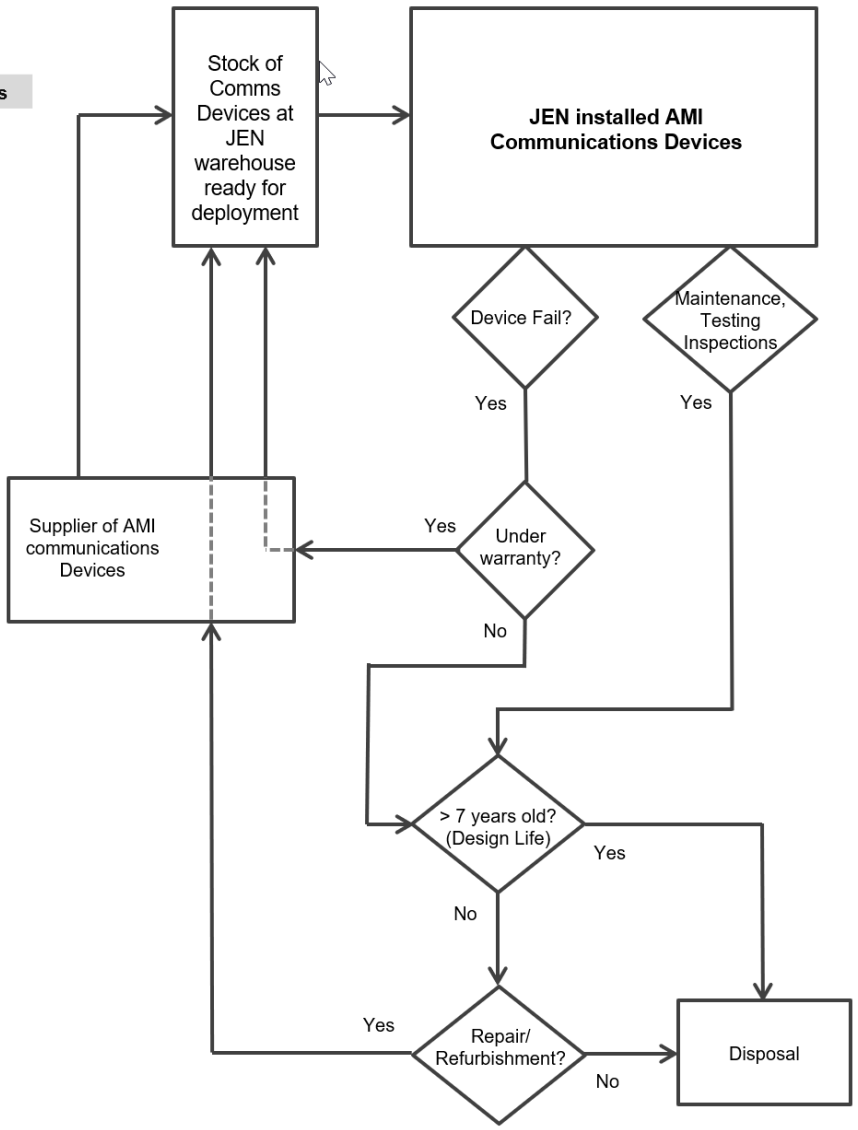
- Age of asset.
- Preventative maintenance activities and record keeping.
- Performance of asset; and
- Continuous monitoring of the assets

TCO optimised condition-based replacement represents another effective and optimal alternative because it excludes 'run to failure' and improves upon 'Condition-based replacement' by incorporating asset value into the overall condition monitoring of the asset. This facilitates the optimal trade-off between CAPEX versus OPEX when it is no longer economical to maintain the asset.

Figure 3-6: Maintenance decision-making and costings of Micro Access Points

Applicable AMI Communications devices:

Devices	Types
Micro Access Points	1



3.4.5 Information

JEN's AMS (refer to Section 1.2 of this document) 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 to determine the information required to deliver the sub-asset class business outcomes.

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. The electricity meters sub-asset class identified four business objectives together with the business information required to support these objectives as set out in Table 3-14. Current and future information requirements to inform value-added decision-making are in Table 3-15. A proposed improvement for future business information needs is at Table 3-16.

Table 3-14: Micro Access Points business objectives and information requirements

Business Objective	Jemena Information Sources	Externally Sourced Data
BO1 (Support delivery of customer consumption and other critical measurements Data) Maintain compliance	AMI SAP ERP SAP ECMS (investigations, revenue protections, work instructions, strategies, metering information, etc) [redacted] [redacted] Cognos (revenue protection reports)	AEMC website - National Electricity Rules (AEMC) AEMO website - Metrology Procedures (AEMO) AEMO industry workgroups ENA Meter Coordinator workgroup SAI Global website – Australian standards ACMA Website, news and updates from Australian Communications and Media Authority ACSC Cyber Security Website, news and updates from Australian Cyber Security Centre Reports from AP's Service providers: • [redacted] • Monthly Report with volumes of micro Access Points refurbished, repaired, faults& fault analysis • invoices Mondo (specialised service provider) monthly reports (excel and pdfs), include: • Summary of completed training & accreditations. • Summary of activities conducted on JEN, including number of tests and commissioned. • Micro Access Points Stock by category, currently with them • Outstanding Invoices • As per above, plus volumes of Micro Access Points installed.
BO2 Ensure measurements of communications assets availability (supply) for network growth and/or alterations	AMI SAP ERP SAP (population of legacy meters, purchase orders) ECMS	Vendor Reports and reports as per external data for BO

Business Objective	Jemena Information Sources	Externally Sourced Data
		Public announcements and vendor notifications (e.g. Merger and Acquisitions, EOL/EOS announcements).
BO3 Ensure competitive pricing for the measurement's communications assets	AMI SAP ERP SAP Contract with Suppliers (ECMS)	Tender, market reports.
BO4 Support JEN Network Management in provision of better customer experience	[redacted] BI/Cognos (revenue protection/reverse energy reports) JEN SCADA/Outage web Energy Portal	Publication from COAG CSIRO ENA forums AEMO RMCF (Retail Market Customer Forum) Local council information session

Table 3-15: Micro Access Points critical decisions business information requirements

Critical Business Decision	Current Information Usage	Future Information Requirement	Value to Asset Class (High, Medium, Low with justification)
CD1: install and test measurements communications assets to required standards.	AMI / ERP SAP • Micro Access Points category • Installations Data • Test dates • Location / address • Status • Serial number • Micro Access Points program ids • Maintenance records New Connections Reports (growth trends) Vendor status Reports Maintenance Condition Reports	• Require BI reports for asset life management for better pre-emptive maintenance. • Require historic test data be stored in BI warehouse for predicative fault analysis (currently stored in separate spreadsheets from service providers)	• High (required by ACMA , ACSC, AS and Vic Government legislation)
CD2a: Maintain viable measurements of communications assets supply contracts	AMI SAP – Volumes (current micro access demand) Micro Access Points in stock by categories ERP SAP – Stocks Installed by date and categories.	• Enhanced Comm's management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.

Critical Business Decision	Current Information Usage	Future Information Requirement	Value to Asset Class (High, Medium, Low with justification)
	Status - Eg with vendors for refurbishment Failure rates (Attribute in SAP) BI UIQ (Monitoring and management system) • Assess Reports		
CD2a: Place orders on time, as required by this asset class strategy	Monitoring current stocks: • Available volume of micro Access Points of a particular category in store (per store location) • at JEN warehouses	• Enhanced Comm's management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.
CD3: Periodically test the market and prices	Monitoring the market for: • New manufacturers • Change in exchange rates	• Enhanced meter management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.
CD4: actively pursue technological innovation to better leverage capabilities of measurement communications	Monitoring the market for • New technology • Better use of collected data	• On going architectural and market review	• High – part of JEN commitment for customer focus

Table 3-16: Micro Access Points information initiatives to support future business information requirements.

Information Initiative	Use Case Description	Asset Class Risk	Data Quality Requirement
Create reports for measurements of communications assets consumption and refurbishment volumes to reflect real-time demand and utilization of measurements of communications assets by supplier, category and type of installation	Monitor the monthly consumption of Micro Access Points to ensure are in line with stated projections and forecasts	Over / under budgeting Running out of stock	All the information attributes are complete and accurate in SAP

3.4.5.1 Future improvements

Measurements communications technologies are a fast-evolving systems as the performance and security requirements changes, JEN is regularly review and assess the new treats and opportunities to ensure the measurements communications systems are up to the required standards, followings are key risks and opportunities monitored and assessed:

- Cybersecurity is an emergent risk necessitating, for example, ISO/IEC 27000 controls
- Larger bandwidth and reduced latency to support new network innovations, such as:
    - Enhanced communications for electricity network monitoring and management
    - Distributed energy generation management
    - Distributed network intelligence and management
- Support of diverse backhaul technologies and backend systems.

3.5 Batteries

3.5.1 Introduction

The batteries are utilised to provide backup power (typically 8-12 hours) to measurement communications devices (Access Points, relays) to ensure continuations of operations during any power outages or power supply failures.

Batteries are cost-effective, flexible, and agile solutions. They are crucial for maintaining the operations and reliability of the measurement communications network supporting redundancy management and optimization.

Currently JEN manages approximately 484 batteries including 174 Gen 5 batteries and 310 Gen 1.5 batteries within the communications network area.

Gen 1.5 batteries are older, heavier types of batteries manufactured from sealed lead acid technology and have 8-hour capacity, whereas Gen 5 batteries are manufactured using Lithium-Iron technology and come with a longer capacity of around 12 hours.

Measurement communications devices (Access Points, relays) have been designed and built with built-in battery chargers which can charge the batteries during normal operation, the batteries then can be used when there is any power failures to the device.

The battery has a built-in protection mechanism to monitor and manage the integrity and reliability of the batteries undercharging and supply operations conditions and to prevent and manage any temperature rise which could lead to the failure of the batteries.

Measurement communications network management system is designed and configured to perform monitoring and cyclic daily tests and check the batteries' health and provide reports and notifications.

3.5.2 Risk

The batteries are critical and costly network devices to procure and maintain. Batteries are highly critical equipment due to the important role they play in the reliability of the communications platform, hence it is prudent to ensure they are protected both physically and electronically and maintained. Batteries are responsible for ensuring the measurement communications network remains in operation during any power outage to assist with the electricity network management. Batteries are reliable, robust hardware made to survive in outdoor harsh environmental conditions.

3.5.2.1 Criticality

Performance, accuracy reliability and security of equipment operation is highly critical due to compliance, reputational and revenue risks. Investments in robust infrastructure, cybersecurity measures, and regular maintenance are necessary to maintain the functionality and efficiency of these equipment.

3.5.2.2 Failure modes

Failure of batteries can manifest itself as:

- Non-operation, partial or total failure of batteries generally occurs without exhibiting any physical signs of deterioration until the failure occurs. Failures in hardware such as modem, antenna, or cabling are generally due to age and operational environment stress.
- [redacted]
- Intermittent failures, generally due to power failure, cellular network outages, interference, network loading, operational applications and systems or issues.
- [redacted]
- Physical Security, generally equipment theft, vandalism, bird or animal activity in the vicinity.

All risks are identified and managed in the compliance and risk management system.

3.5.2.3 Existing controls

Risk mitigation of this sub-asset class can be classified into the following types:

- **Architectural mitigation**. Guiding principles and architectural decisions mitigate risk through design.
- **Procedural mitigation**. BAU procedures, work instructions and planning (e.g. inclusion of budgetary contingencies, careful vendor selection and vendor monitoring regimes) are used to reduce the likelihood and/or impact of procedural error.
- **Contractual mitigation**. Contractual mechanisms such as service level agreements, liquidated damages, defects liability periods and insurance requirements are used to reduce the likelihood of sub-standard third-party service delivery.
- **Operation Mitigation.** Support system infrastructure failures, power failures, and telecom infrastructure failures. backend software/hardware failures, internal security system failures, and operational failures

In addition, all parties and processes involved in the provision of measurement communications back up supply are audited annually by external (ISO55001) and JEN's internal teams to ensure that all have the requisite processes, training and accreditation in line with national and state-based obligations.

Table 3-17: Existing Controls

#	Threat	Vulnerability	Risk	Controls
1	Overstated product reliability or unexpected environmental conditions	Inadequate product design	Increased operation & maintenance cost. Increased replacement levels may affect customer relations and business reputation	Contractual: Product Warranty and vendor support agreement
2	New firmware/Programs	Unknown behaviour in the field	AMI system availability and integrity may be compromised. Affects operation & maintenance phases	Procedural: Testing of firmware and communications devices program connected to batteries prior to field deployment
3	Delays in supply chain	Unknown performance	Failure to supply on time may result in availability issues	Procedural: Inventory Management: Equipment vendors must maintain 6 months inventory “in country” (lead to time for new shipment) to provide supply even in the event of delivery issues
4	Batteries supply reliability	Long lead time and supply shortage of batteries	Unable to meet the batteries demand required by business-as-usual activities and unexpected failures	Contractual: Establish and maintain contractual arrangement to ensure supply availability through guaranteed service levels and assurance. Procedural: Inventory Management: Equipment vendors must maintain 6-12 months inventory “in country” (lead to time for new shipment) to provide supply even in the event of delivery issues related to high demand.

3.5.2.4 Future risks

Emerging risks for this sub-asset class are:

- Disruption to the global electronics supply chains affecting production and delivery of Comm’s equipment.
- Inability to support effective technology substitution: technology obsoletions and/or vendors exiting the market which could significantly affect the network operations.

3.5.3 Performance

3.5.3.1 Requirements

Batteries must:

- Provide 24/7 high availability back up supply to measurements communications services.

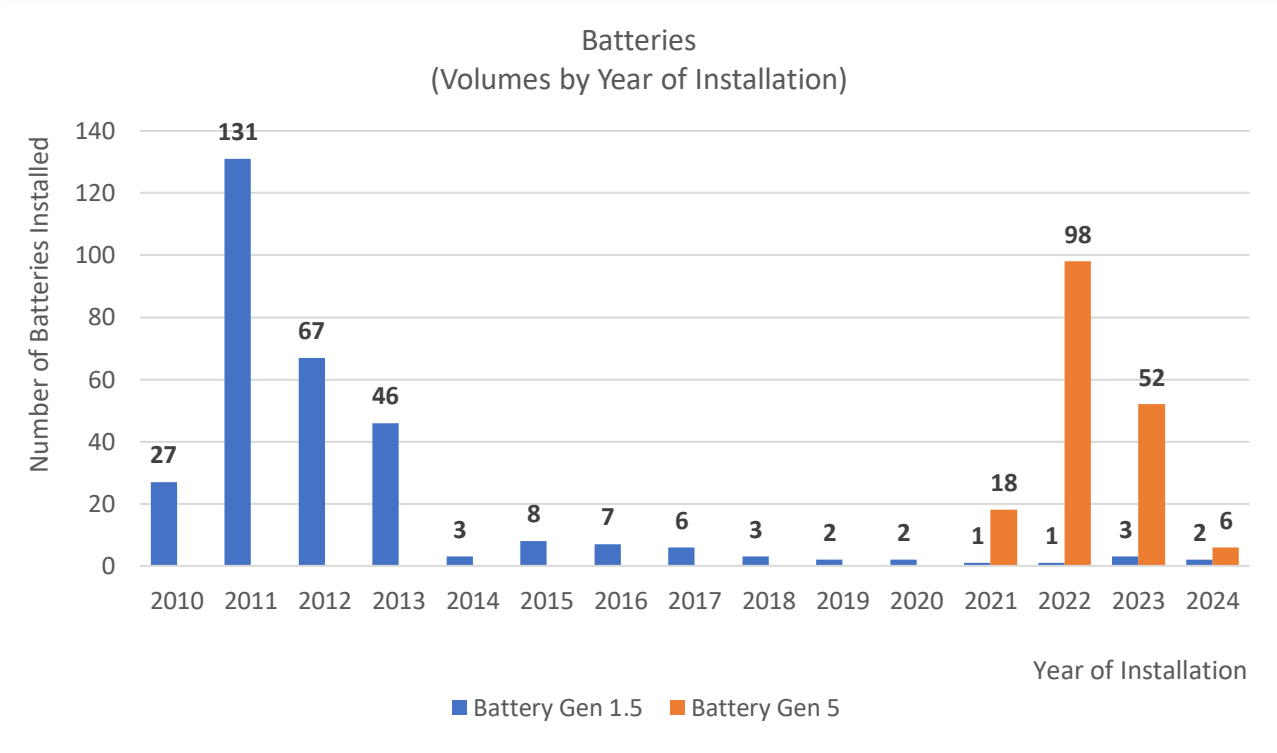
3.5.3.2 Life expectancy

According to vendor warranty terms and JEN's experience with similar devices, the expected design/product life of batteries is a 5-year design life - (manufacturer's warranty is 12 months).

NB: Life span of the batteries can be impacted by the operating environment (e.g. ambient temperature and environmental conditions).

3.5.3.3 Age profiles

Figure 3-7: Batteries by year of installation



3.5.3.4 Utilisation

Batteries are required by regulation to provide a 24/7 available back up supply to communications devices to enable measurements devices and equipment (meters Access Points, relays, etc) to continue their operations without any disruptions.

3.5.3.5 Performance analysis

Battery performance must be compliant with the Jemena design specifications to support market system delivery requirements set by the Victorian Government.

End-to-end performance and compliance monitoring of the batteries is performed by network operations teams within Jemena asset management, which collects, collates and reviews the data, together with the proactive monitoring and maintenance program reports, determining any emergent performance trend or issues that require medication, corrective actions or modification to the sub-asset management strategy.

Table 3-18: Batteries Failures

Description	2016	2017	2018	2019	2020	2021	2022	2023
Condition fail (Total/Partial)	-	-	-	-	-	-	-	-

Approx % of pop	0	0	0	0	0	0	0	0

Note: No critical battery failures were experienced to date. Low-performing battery units are proactively identified and sent back to the manufacturers for replacements under the warranty terms.

3.5.3.6 Control effectiveness

By comparing identified risks and measuring past incidents, control effectiveness is assessed as part of the Jemena Compliance & Risk System (OMNIA).

3.5.4 Life Cycle Management

JEN has a well established asset life cycle management process and procedures, below diagram is displaying JEN's asset lifecycle phases.

3.5.4.1 Creation

Sub-asset acquisition is planned annually, and the logistics process commences ahead (to accommodate for lead time). The aim is to have sufficient, but not excessive, stock to manage the required supply.

Acquisition triggers for this asset class are:

- Network growth
- Number of 'condition fail' units
- Deteriorated of the installations that have reached end of life

Availability of spares is a critical aspect of this sub-asset class strategy. Spares are held as stock to:

- Mitigate risk of regulatory non-compliance by failing to perform Comm's device backup supply installation
- Eliminate any communication link outage times; and
- Eliminate any loss of revenue due to failure to perform regulatory and market functions.

The optimum quantities of batteries take into account the cost of holding stock balanced against:

- Purchase lead times
- Anticipated network growth; and
- Projected 'condition fail' rates

JEN's nominated contractor monitors stock levels. The minimum stock level is six months of projected battery consumption.

3.5.4.2 Asset operation and maintenance

Based on asset condition and risk-based assessment (i.e. CBRM), assets are:

- Monitored by NMS and BI systems
- Subject to preventative maintenance inspection and testing; and
- Replaced when necessary.

This sub-asset category's maintenance program involves:

- Inspection and testing, i.e. preventative maintenance
- Corrective maintenance (defects); and
- Reactive maintenance (faults and emergencies).

JEN undertakes inspection and testing of the batteries in accordance with the cyclic maintenance programs set for each category of the batteries and performed by JEN's accredited resources. JEN Maintenance programs are reviewed annually in light of potential changes to product development, performance, failures, changes in policies and regulatory requirements.

In the event that inspection and testing programs, reveal widespread 'family failure' of the batteries, JEN would initiate its failure management procedures in consultations with the suppliers to ensure the proposed replacement program is acceptable and compliant with the market and regulatory requirements. The supplier/manufacturer would be held to account to the extent commercially reasonable.

Corrective maintenance is necessitated when cyclic testing of batteries installations detects a 'condition fail'.

Reactive maintenance is characterised by awareness of 'condition fail' triggered by:

- An alert from network operations systems. The AMI NMS and Business Intelligence (BI) systems are used to monitor the operation, availability, and conditions of communication assets. Any deviation from expected operational thresholds are analysed for potential reactive maintenance.

3.5.4.3 Replacement/Disposal

Generally, there are three replacement modes pertinent to this sub-asset life cycle management. The alternative sub-asset replacement modes are:

- Run to failure (reactive);
- Schedule-based replacement (age-based); and
- Condition-based replacement (the most cost-effective)

Run to failure. This mode would compromise JEN's ability to meet its regulatory and market obligations and requirements.

Scheduled replacement (aged based). This mode proposes to replace batteries at the end of design/product life. Nominal batteries design product life is 7 years (according to the manufacturer). JEN have not experienced a large failure as such the maintenance and monitoring programs are in place to identify any aged or performance-based failures. Currently, JEN considers age-based replacement uneconomic.

Condition-based replacement represents the best alternative because it excludes 'run to failure' and improves upon 'schedule-based replacement' by incorporating age data into the overall condition monitoring of the asset. This facilitates the optimal trade-off of CAPEX and OPEX performance. Sub-assets are replaced at the end of their useful life when their condition has deteriorated below acceptable performance requirements. This mode is optimal because it minimises asset investment whilst meeting, or exceeding, market and regulatory compliance requirements.

Condition-based replacement is determined by CBRM data:

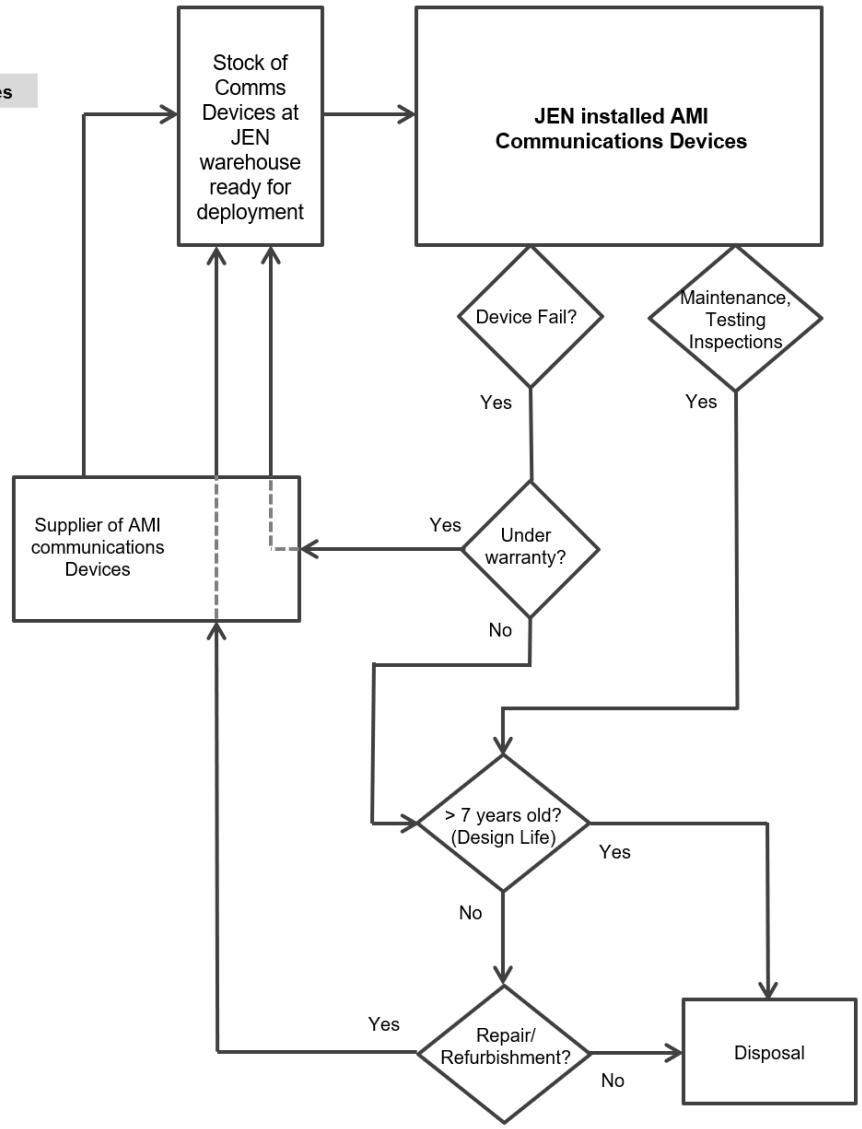
- Age of asset.
- Preventative maintenance activities and record keeping.
- Performance of asset; and
- Continuous monitoring of the assets

TCO optimised condition-based replacement. represents another effective and optimal alternative because it excludes 'run to failure' and improves upon 'Condition-based replacement' by incorporating asset value into overall condition monitoring of the asset. This facilitates the optimal trade-off between CAPEX versus OPEX when it is no longer economical to maintain the asset.

Figure 3-8: Maintenance decision making and costings of Communications Batteries

Applicable AMI Communications devices:

Devices	Types
Batteries	2



3.5.5 Information

JEN's AMS (refer to Section 1.2 of this document) 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 to determine the information required to deliver the sub-asset class business outcomes.

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. The electricity meters sub-asset class identified four business objectives together

with the business information required to support these objectives as set out in Table 3-19. Current and future information requirements to inform value-added decision-making are in Table 3-5. A proposed improvement for future business information needs is at Table 3-21.

Table 3-19: Batteries business objectives and information requirements

Business Objective	Jemena Information Sources	Externally Sourced Data
BO1 (Support delivery of customer consumption and other critical measurements Data) Maintain compliance	AMI SAP ERP SAP ECMS (investigations, revenue protections, work instructions, strategies, metering information, etc) [redacted] [redacted] Business Objects (Measurements Efficiency)	AEMC website - National Electricity Rules (AEMC) AEMO website - Metrology Procedures (AEMO) AEMO industry workgroups ENA Meter Coordinator workgroup SAI Global website – Australian standards ACMA Website, news and updates from Australian Communications and Media Authority ACSC Cyber Security Website, news and updates from Australian Cyber Security Centre Reports from relay Service providers: • SSN - Itron JIRA portal (Comm's vendor portal) • Monthly Report with volumes of batteries refurbished, repaired, faults& faults analysis. • invoices Mondo (specialised service provider) monthly reports (excel and pdfs), include: • Summary of completed training & accreditations. • Summary of activities conducted on JEN, including number of tests and commissioned. • Battery Stock by category. • Outstanding Invoices • As per above, plus volumes of batteries installed.

Business Objective	Jemena Information Sources	Externally Sourced Data
BO2 Ensure measurements of communications assets availability (supply) for network growth and/or alterations	AMI SAP ERP SAP (population of legacy meters, purchase orders) ECMS	Vendor Reports and reports as per external data for BO. Public announcements and vendor notifications (e.g. Merger and Acquisitions, EOL/EOS announcements).
BO3 Ensure competitive pricing for the batteries	AMI SAP ERP SAP Contract with Suppliers (ECMS)	Tender, market reports.
BO4 Support JEN Network Management in provision of better customer experience	[redacted] [redacted] Business Objects (Measurements Efficiency) JEN SCADA/Outage web Energy Portal	Publication from COAG CSIRO ENA forums AEMO RMCF (Retail Market Customer Forum) Local council information session

Table 3-20 Batteries critical decisions business information requirements

Critical Business Decision	Current Information Usage	Future Information Requirement	Value to Asset Class (High, Medium, Low with justification)
CD1: install and test Batteries to required standards.	AMI / ERP SAP • Battery's category • Battery's tariffs • Installations Data • Test dates • Location / address • Status • Serial number • Relay's program ids • Maintenance records New Connections Reports (growth trends) Vendor status Reports Maintenance Condition Reports	• Require BI reports for asset life management for better pre-emptive maintenance. • Require historic test data be stored in BI warehouse for predicative fault analysis (currently stored in separate spreadsheets from service providers)	• High (required by ACMA , ACSC, AS and Vic Government legislation)
CD2a: Maintain viable measurements of batteries supply contracts	AMI SAP – Volumes (current Batteries demand) Batteries in stock by ERP SAP – Stocks	• Enhanced Comm's management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.

Critical Business Decision	Current Information Usage	Future Information Requirement	Value to Asset Class (High, Medium, Low with justification)
	Installed by date and categories. Status - Eg with vendors for refurbishment Failure rates (Attribute in SAP) BI UIQ (Monitoring and management system) • Assess Reports		
CD2a: Place orders on time, as required by this asset class strategy	Monitoring current stocks: • Available volume of batteries of a particular category in store (per store location) • at JEN warehouses	• Enhanced Comm's management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.
CD3: Periodically test the market and prices	Monitoring the market for: • New manufacturers • Change in exchange rates	• Enhanced batteries management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.
CD4: actively pursue technological innovation to better leverage capabilities of batteries	Monitoring the market for • New technology • Better use of collected data	• On going architectural and market review	• High – part of JEN commitment for customer focus

Table 3-21: Batteries information initiatives to support future business information requirements

Information Initiative	Use Case Description	Asset Class Risk	Data Quality Requirement
Create reports for measurements of batteries consumption volumes to reflect real-time demand and utilization of batteries by supplier, category and type of installation	Monitor the monthly consumption of batteries to ensure are in line with stated projections and forecasts	Over / under budgeting Running out of stock	All the information attributes are complete and accurate in SAP

3.5.5.1 Future improvements

Measurements communications technologies along with backup battery supply are fast evolving systems as the performance and security requirements changes, JEN is regularly

review and assess the new treats and opportunities to ensure the measurements communications back up batteries are up to the required standards.

3.6 Antennas

3.6.1 Introduction

These antennas are designed and manufactured to enhance the radio frequency propagation at locations where there are physical or electronic signal barriers disrupting communications.

Antennas' play a crucial role, especially at metropolitan and rural areas where distance and physical barriers are most likely to disrupt the communications between meters, Access Points and relays. JEN's AMI measurement communications platform is using a mesh connections methodology which works on communications between devices that will utilise neighbouring devices to find a communication path back to the Access Points. This is called 'hopping'. In areas with a high device hop count, antennas are used to reduce the hop count and decrease latency in data transfer.

Antennas are also very effective in high density areas where the communications can be obstructed by structures, buildings or vegetation, where these antennas can be used to enhance RF mesh connectivity.

Antennas are designed in two forms:

- Cabinet top mounted type
- Cabinet door mounted type.

Cabinet top mount is the most commonly used type. The cabinet door mounted type is only useful where the device cabinet is embedded in the wall cavity and only the door is accessible for antenna installation.

Currently JEN has 10,000 meter antennas, installed within the JEN's AMI mesh network area.

When an RF signal from an internal meter antenna is mostly shielded by a metallic cabinet, installing an antenna outside the cabinet is the best solution. This allows for stronger radiated power to reach greater distances, rather than losing all effective power within the cabinet.

In high-rise buildings in the JEN area, where many meter cabinets are installed in locations like basements, external antennas are a strong candidate for achieving connectivity with the rest of the RF mesh network.

Antennas are cost-effective, flexible, and agile solutions in overcoming communications issues related to geographical locations. They are crucial for managing data traffic for downstream devices with higher hops and intermittent or no connectivity, thereby supporting mesh redundancy management and optimization.

3.6.2 Risk

The antennas are an important network device, but their location means they are easily accessible and can be subjected to unintentional damages and vandalism. Antennas are responsible for enabling the communication of the meter/s to the network management systems. Antennas are exceptionally reliable, robust hardware made to survive in the harsh environmental conditions since most installations are done in the outdoor locations.

3.6.2.1 Criticality

Accuracy reliability and security of equipment operation is highly critical due to compliance, reputational and revenue risks. Investments in robust infrastructure and regular maintenance are necessary to maintain the functionality and efficiency of these equipment.

3.6.2.2 Failure modes

Failure of antennas can manifest itself as:

- Non-operation, partial or total failure of antennas generally occurs without exhibiting any physical signs of deterioration until the failure occurs. Failures in antenna, or cabling are generally due to age and operational environment stress.
- Inaccurate operation where data transfers and or delivery of data payloads is outside of allowable error limits or timeframe.
- Physical security, generally equipment theft, vandalism, bird or animal activity in the vicinity.

All risks are identified and managed in the compliance and risk management system.

3.6.2.3 Existing controls

Risk mitigation of this sub-asset class can be classified into the following types:

- **Architectural mitigation**. Guiding principles and architectural decisions mitigate risk through design.
- **Procedural mitigation**. BAU procedures, work instructions and planning (e.g. inclusion of budgetary contingencies, careful vendor selection and vendor monitoring regimes) are used to reduce the likelihood and/or impact of procedural error.
- **Contractual mitigation**. Contractual mechanisms such as service level agreements, liquidated damages, defects liability periods and insurance requirements are used to reduce the likelihood of sub-standard third-party service delivery.

In addition, all parties and processes involved in the provision of measurement communications services are audited annually by external (ISO55001) and JEN's internal teams to ensure that all have the requisite processes, training and accreditation in line with national and state-based obligations.

Table 3-22 Existing Controls

#	Threat	Vulnerability	Risk	Controls
1	Overstated product reliability or unexpected environmental conditions	Inadequate product design	Increased operation & maintenance cost. Increased replacement levels may affect customer relations and business reputation	Contractual: Product Warranty and vendor support agreement
2	Geographically or Radio Frequency (RF) isolated customer	Limitation of LAN coverage	Increased cost to achieve coverage. Increased probability of not meeting regulatory requirement for meter reading performance	Architectural: WAN Port under the terminal cover allows a modem to be added to replace the built-in mesh radio modem.
3	Unsuitable geography & street design	LAN RF limitations	Poor coverage requiring additional equipment/costs	Procedural: Radio Surveys: Comprehensive radio survey of the distribution territory to ensure the technology selection is based on sound real world and measured data. Contractual Silver Spring responsible for 100% coverage
4	New firmware/Programs	Unknown behaviour in the field	AMI system availability and integrity may be compromised. Affects operation & maintenance phases	Procedural: Testing of firmware and meter programs prior to field deployment
5	Delays in supply chain	Unknown performance	Failure to supply on time may result in availability issues	Procedural: Inventory Management: Equipment vendors must maintain 6 months inventory “in country” (lead to time for new shipment) to provide supply even in the event of delivery issues
6	Communications devices supply reliability	Long lead time and supply shortage of antennas	Unable to meet the antennas demand required by business-as-usual activities and unexpected failures	Contractual: Establish and maintain contractual arrangement to ensure supply availability through guaranteed service levels and assurance. Procedural: Inventory Management: Equipment vendors must maintain 6-12 months inventory “in country” (lead

#	Threat	Vulnerability	Risk	Controls
				to time for new shipment) to provide supply even in the event of delivery issues related to high demand.

3.6.2.4 Future risks

Emerging risks for this sub-asset class are:

- Disruption to the global electronics supply chains affecting production and delivery of Comm's equipment.
- Inability to support effective technology substitution: technology obsoletions and/or vendors exiting the market which could significantly affect the network operations.

3.6.3 Performance

3.6.3.1 Requirements

Antennas must:

- Provide 24/7 high availability measurement communications services
- Support existing and establishment of new networks and customer services.

3.6.3.2 Life expectancy

Antennas are subject to warranty terms that are similar to other electronic components (12-month warranty / 15-year design life). However, given the simplicity of antenna design and construction, they are widely expected to outlast the electronic devices they are connected to unless physically removed or damaged.

NB: The life span of the antenna can be affected by the operating environment conditions e.g. ambient temperature and environmental conditions).

3.6.3.3 Age profiles

All antennas were procured in bulk during the original rollout program (2009) and did not require further purchases.

3.6.3.4 Utilisation

Measurement communications devices, including antennas, are required by regulation to provide a platform to connect and enable measurement devices and equipment (meters, etc) to the back-end network management applications and systems.

3.6.3.5 Performance analysis

Measurement communications devices, including antenna performance, are compliant with the service requirements specified by the Victorian Government's AMI MFS and market system delivery requirements.

The antennas are low-cost network devices, and as they are easily accessible, they can be subjected to unintentional damage and vandalism. Antennas are responsible for enabling the communication of the meter/s to the network management systems. Antennas are exceptionally reliable, robust hardware made to survive in harsh environmental conditions since most installations are done in outdoor locations.

Table 3-23: Antennas Failures

Description	2016	2017	2018	2019	2020	2021	2022	2023
Condition fail (Total/Partial)	-	-	-	-	-	-	-	-
Approx % of pop	0	0	0	0	0	0	0	0

Note: There have been no reported failures of the antennas.

3.6.3.6 Control effectiveness

By comparing identified risks and measuring past incidents, control effectiveness is assessed as part of the Jemena Compliance & Risk System (OMNIA).

3.6.4 Life Cycle Management

JEN has a well established asset life cycle management process and procedures, below diagram is displaying JEN's asset lifecycle phases.

3.6.4.1 Creation

Sub-asset acquisition is planned annually, and the procurement and logistics process commences ahead (to accommodate for lead time). The aim is to have sufficient, but not excessive, stock to manage the required supply.

Acquisition triggers for this asset class are:

- Network growth
- Number of 'condition fail' units
- Deteriorated of the installations that have reached end of life
- LAN functional and/or performance improvement driven change of the metering installation.

Availability of spares is a critical aspect of this sub-asset class strategy. Spares are held as stock to:

- Mitigate risk of regulatory non-compliance by failing to perform Comm's device installation
- Minimise any communication link outage times; and
- Eliminate any loss of revenue due to failure to perform regulatory and market functions.

The optimum quantities of communication assets take into account the cost of holding stock balanced against:

- Purchase lead times
- Anticipated network growth
- Projected 'condition fail' rates.

JEN's nominated contractor monitors stock levels. The minimum stock level is six months of projected antennas consumption.

3.6.4.2 Asset Operation and maintenance

Based on asset condition and risk-based assessment (i.e. CBRM), assets are:

- Monitored by NMS and BI systems
- Subject to preventative maintenance inspection and testing; and
- Replaced when necessary.

This sub-asset category's maintenance program involves:

- Inspection and testing, i.e. preventative maintenance
- Corrective maintenance (defects); and
- Reactive maintenance (faults and emergencies).

JEN undertakes inspection and testing of the communication assets in accordance with the cyclic maintenance programs set for each category of the communications devices (antennas) and performed by JEN's accredited resources. JEN Maintenance programs are reviewed annually in light of potential changes to product development, performance, failures, changes in policies and regulatory requirements.

In the event that inspection and testing programs, reveal widespread 'family failure' of the antennas, JEN would initiate its failure management procedures in consultations with the suppliers to ensure the proposed replacement program is acceptable and compliant with the market and regulatory requirements. The supplier/manufacturer would be held to account to the extent commercially reasonable.

Corrective maintenance is necessitated when cyclic testing of relays installations detects a 'condition fail'.

Reactive maintenance is characterised by awareness of 'condition fail' triggered by:

- An alert from network operations systems. The AMI **NMS** and **BI** systems are used to monitor the operation, availability, and conditions of communication assets. Any deviation from expected operational thresholds are analysed for potential reactive maintenance.

3.6.4.3 Replacement/disposal

Generally there are three replacement modes pertinent to this sub-asset life cycle management. The alternative sub-asset replacement modes are:

- Run to failure (reactive);
- Schedule-based replacement (age-based); and
- Condition-based replacement (the most cost effective).

Run to failure. This mode would compromise JEN's ability to meet its regulatory and market obligations and requirements.

Scheduled replacement (aged based). This mode proposes to replace antennas at the end of design/product life. Nominal antennas design product life is 10 years (according to the manufacturer). JEN have not experienced a large failure as such the maintenance and monitoring programs are in place to identify any aged or performance-based failures. Currently, JEN considers age-based replacement uneconomic.

Condition-based replacement represents the best alternative because it excludes 'run to failure' and improves upon 'schedule-based replacement' by incorporating age data into the overall condition monitoring of the asset. This facilitates the optimal trade-off of CAPEX and OPEX performance. Sub-assets are replaced at the end of their useful life when their condition has deteriorated below acceptable performance requirements. This mode is optimal because it minimises asset investment whilst meeting, or exceeding, market and regulatory compliance requirements.

Condition-based replacement is determined by CBRM data:

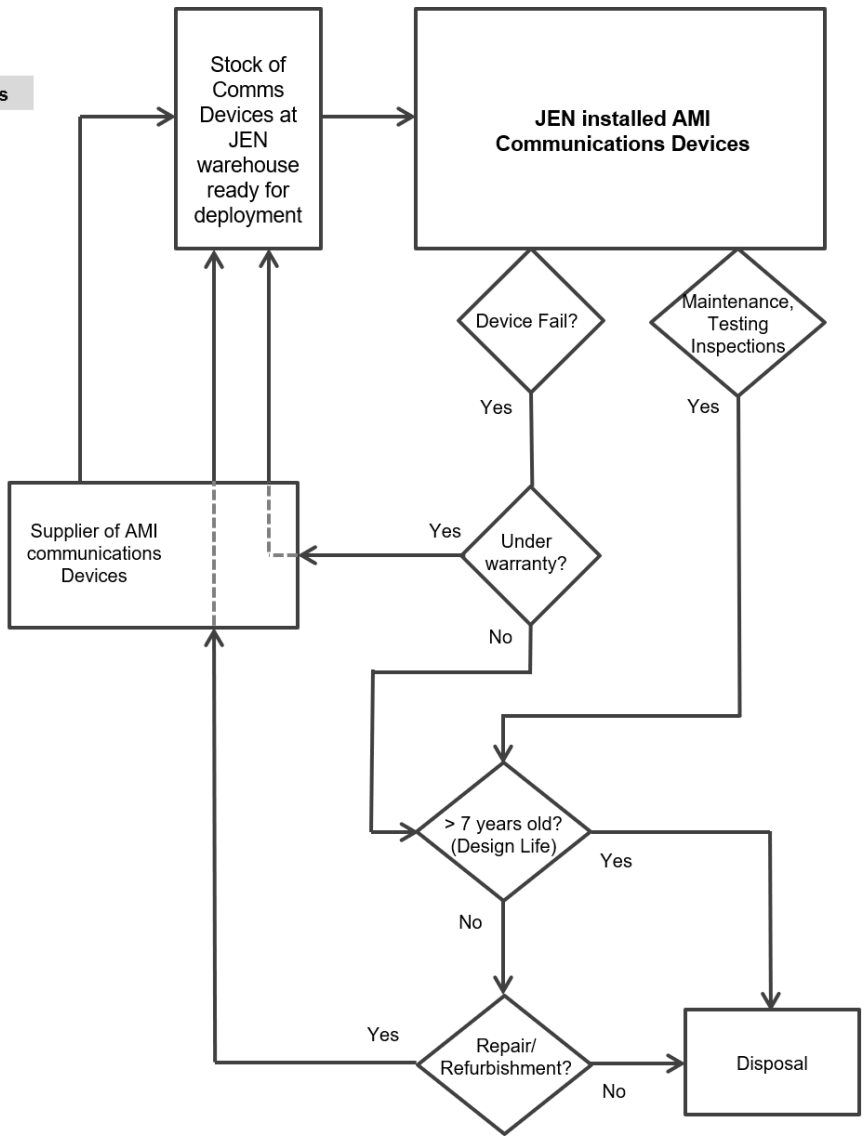
- Age of asset.
- Preventative maintenance activities and record keeping.
- Performance of asset; and
- Continuous monitoring of the assets

TCO optimised condition-based replacement. represents another effective and optimal alternative because it excludes 'run to failure' and improves upon 'Condition-based replacement' by incorporating asset value into overall condition monitoring of the asset. This facilitates the optimal trade-off between CAPEX versus OPEX when it is no longer economical to maintain the asset.

Figure 3-9: Maintenance decision-making and costings of Communications Relays

Applicable AMI Communications devices:

Devices	Types
Antennas	2



3.6.5 Information

JEN's AMS (refer to Section 1.2 of this document) 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 to determine the information required to deliver the sub-asset class business outcomes.

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. The electricity meters sub-asset class identified four business objectives together with the business information required to support these objectives as set out in Table 3-24. Current and future information requirements to inform value-added decision-making are in Table 3-25. A proposed improvement for future business information needs is at Table 3-26.

Table 3-24: Antennas business objectives and information requirements

Business Objective	Jemena Information Sources	Externally Sourced Data
BO1 (Support delivery of customer consumption and other critical measurements Data) Maintain compliance	AMI SAP ERP SAP ECMS (investigations, revenue protections, work instructions, strategies, metering information, etc) [redacted] [redacted] Business Objects (Measurement Efficiency)	AEMC website - National Electricity Rules (AEMC) AEMO website - Metrology Procedures (AEMO) AEMO industry workgroups ENA Meter Coordinator workgroup SAI Global website – Australian standards ACMA Website, news and updates from Australian Communications and Media Authority ACSC Cyber Security Website, news and updates from Australian Cyber Security Centre Reports from relay Service providers: • [redacted] • Monthly Report with volumes of batteries refurbished, repaired, faults& faults analysis. • invoices Mondo (specialised service provider) monthly reports (excel and pdfs), include: • Summary of completed training & accreditations. • Summary of activities conducted on JEN, including number of tests and commissioned. • Antennas Stock by category • Outstanding Invoices. • As per above, plus volumes of relays installed.

Business Objective	Jemena Information Sources	Externally Sourced Data
BO2 Ensure measurements of communications assets availability (supply) for network growth and/or alterations	AMI SAP ERP SAP (population of legacy meters, purchase orders) ECMS	Vendor Reports and reports as per external data for BO. Public announcements and vendor notifications (e.g. Merger and Acquisitions, EOL/EOS announcements).
BO3 Ensure competitive pricing for the measurement's communications assets	AMI SAP ERP SAP Contract with Suppliers (ECMS)	Tender, market reports.
BO4 Support JEN Network Management in provision of better customer experience	[redacted] Business Objects (Measurement Efficiency) JEN SCADA/Outage web Energy Portal	Publication from COAG CSIRO ENA forums AEMO RMCF (Retail Market Customer Forum) Local council information session.

Table 3-25: Antennas critical decisions business information requirements

Critical Business Decision	Current Information Usage	Future Information Requirement	Value to Asset Class (High, Medium, Low with justification)
CD1: install and test measurements communications assets to required standards.	AMI / ERP SAP • Antenna's category • Antenna's tariffs • Installations Data • Test dates • Location / address • Status • Serial number • Antenna's program ids • Maintenance records New Connections Reports (growth trends) Vendor status Reports Maintenance Condition Reports	• Require BI reports for asset life management for better pre-emptive maintenance. • Require historic test data be stored in BI warehouse for predicative fault analysis (currently stored in separate spreadsheets from service providers)	• High (required by ACMA , ACSC, AS and Vic Government legislation)
CD2a: Maintain viable measurements of communications	AMI SAP – Volumes (current Antennas demand) Antennas in stock by	• Enhanced Comm's management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.

Critical Business Decision	Current Information Usage	Future Information Requirement	Value to Asset Class (High, Medium, Low with justification)
assets supply contracts	ERP SAP – Stocks Installed by date and categories. Status - Eg with vendors for refurbishment Failure rates (Attribute in SAP) BI UIQ (Monitoring and management system) • Assess Reports		
CD2a: Place orders on time, as required by this asset class strategy	Monitoring current stocks: • Available volume of antennas of a particular category in store (per store location) • at JEN warehouses	• Enhanced Comm's management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.
CD3: Periodically test the market and prices	Monitoring the market for: • New manufacturers • Change in exchange rates	• Enhanced meter management and supply/inventory management system	• High – part of JEN obligations under the Electricity Code.
CD4: actively pursue technological innovation to better leverage capabilities of measurement communications	Monitoring the market for • New technology • Better use of collected data	• On going architectural and market review	• High – part of JEN commitment for customer focus

Table 3-26: Antennas information initiatives to support future business information requirements

Information Initiative	Use Case Description	Asset Class Risk	Data Quality Requirement
Create reports for measurements of communications assets consumption and refurbishment volumes to reflect real-time demand and utilization of measurements of communications assets by supplier, category and type of installation	Monitor the monthly consumption of antennas to ensure are in line with stated projections and forecasts.	Over / under budgeting Running out of stock	All the information attributes are complete and accurate in SAP

3.6.5.1 Future improvement

Measurement communications technologies are a fast-evolving systems as the performance and security requirements changes, JEN regularly reviews and assess the new threats and opportunities to ensure the measurement communications systems are up to the required standards.

The followings are key risks and opportunities monitored and assessed:

- Larger bandwidth and reduced latency to support new network innovations, such as:
  - Enhanced communications for electricity network monitoring and management
  - Distributed energy generation management
  - Distributed network intelligence and management
- Support of diverse backhaul technologies and backend systems.

4. Consolidated Plan

4.1 Asset Investment Plan

The Asset Investment Plan (AIP) provides a snapshot of how JEN's AMI measurement communications assets will be managed to achieve its Asset Management Plan (AMP) objectives and consequently Jemena's strategic objectives. It also outlines the key asset strategies supporting Jemena's goals and objectives and informs the proposed expenditure plans and programs of work. The purpose of the AIP is to:

- Detail the investment plan for the next seven years for the Capex and Opex programs of work including the drivers for expenditure, current issues and the strategies for managing current issues; and
- Outline the current and emerging financial risks and opportunities impacting on JEN and describe how JEN is positioned to mitigate or take advantage of the identified risks and opportunities.

The AIP defines the nature of the works to take place to manage JEN within the constraints of cost and risk whilst at the same time maintaining current levels of regulatory compliance, network reliability and safety. A high level view of program deliverables is provided that encompasses the major projects to be delivered to ensure supply security for our customers is maintained.

It also contains the rationale for asset management activities, operational and maintenance plans and capital investment (overhaul, renewal, replacement and enhancement) plans.

4.2 Capital and Operational Work Plan

The Capital and Operational Work Plan (COWP) contains details on optimised capital and operational expenditures over a two year period. It aggregates the required actions emanating from the JEN AMP and maintains a line of sight through to the Jemena Business Plan via the AMP as well as various ACS and the JEN ABS.

The COWP aids development of the JEN Delivery Plan, the purpose of which is for Service Providers to critically evaluate field resource availability with the program of work required to be delivered. Refer to Figure 1-2 for the Jemena Asset Management System (AMS) which identifies where the COWP is positioned within the AMS document hierarchy.

5. Glossary

5.1 Acronyms

ABS	Asset Business Strategy
AC	Alternating Current
ACS	Asset Class Strategy
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AMI	Advanced Metering Infrastructure
AMS	Asset Management System
AP	Access Point
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
BAU	Business As Usual
BI	Business Intelligence
CATS	Customer Administration Transfer System
CBRM	Condition Based Risk Management
COWP	Capital Operating Works Program
CPU	Central Processing Unit
CT	Current Transformer
DAPR	Distribution Annual Planning Report
DC	Direct Current
DNSP	Distribution Network Service Provider
DPI	Department of Primary Industry
EDPR	Electricity Distribution Price Review
ENA	Energy Networks Australia
EOL	End of Life
EPA	Environment Protection Authority
ERP	Enterprise Resource Planning
ESCV	Emergency Services Commission of Victoria

ESMS	Energy Safe Management Scheme
ESV	Energy Safe Victoria
EUSE	Expected Unserved Energy
GPS	Global Positioning System
HSE	Health, Safety and Environment
HV	High Voltage
I/O	Input/Output
IED	Intelligent Electronic Device (typically a digital protection relay)
JEN	Jemena Electricity Networks (Vic) Ltd
Jemena	Jemena Asset Management
JSAP	Jemena SAP
KPI	Key Performance Indicator
kV	kilovolt
KVAR	kilo-Amps-Volts-Reactive
KW	kilowatt
LAN	Local Area Network
LCD	Liquid Crystal Display
LNSP	Local Network Service Provider
LV	Low Voltage
MAMS	Metering Asset Management Strategy
MDM	Meter Data Management
MDP	Meter Data Provider
MTBF	Mean Time Between Failure
MW	Mega watt
NER	National Electricity Regulator
NIC	Network Interface Card
NMS	Network Management Systems
OMNIA	Jemena Compliance & Risk System
PQCA	Power Quality Compliance Audit
PQM	Power Quality Meter

RAM	Random Access Memory
RIN	Regulatory Information Notice
ROM	Read Only Memory
RTS	Real-Time Systems
RTU	Remote Terminal Unit
SAP	Proprietary name for ERP software
SCADA	Supervisory Control and Data Acquisition
VEDC	Victorian Electricity Distribution Code
VT	Voltage Transformer
ZSS	Zone Substation
ACR	Automatic Circuit Recloser
SMR	Switch Mode Rectifier
VESC	Victorian Electricity System Code
WAN	Wide Area Network

APPENDIX A – Metering and measurement communications assets compliance risks

Compliance reference	Requirement	Risk
DPI MFS	Meter Categories Minimum Function & Performance	Functional & Performance requirements are not met
Metrology Procedure Part A 2.4.4	The RP must ensure that metering equipment purchased must have a valid pattern approval	MPB, Field operations and contract manager are not aware of obligations
NER 7.8.1	The metering coordinator must ensure that a metering installation is secure and the associated links, circuit and information storage and processing systems are protected by security mechanisms acceptable to AEMO	Health and Safety- Inability to secure a metering installation can affect the safety of general public. Privacy- Inadequate security mechanism to store and report meter data could lead to privacy breach. Jemena could incur significant legal cost if confidential customer details are not securely stored.
NER 7.12	Metering Provider must set the times of clocks of all metering installations with reference to the Eastern Standard time to an accuracy mentioned (+/- 20 sec) in the metrology rules for type 5-7 installation.	Meter data could get corrupted if the meter time clock is not synchronised
SIR 8.3	Metering and communications equipment shall be supplied, installed and maintained by the Meter Provider and shall, unless otherwise agreed in writing, remain the property of the Meter Provider.	Loss of Asset -Unauthorized personnel replacing Jemena meters without getting formal written approval.
Security – Department of Energy (AMI-SEC System Security Requirements)	The AMI system shall provide security and privacy in accordance to all regulatory and jurisdictional requirements. AMI system is defined as follow: ▪ hardware and software and associated system and data management software that creates a network between advanced meters and utility business systems and which allows collection and distribution of information to customers and other parties such as competitive retail providers, in addition to providing it to the utility itself. AMI is further defined as: 1) The hardware and software residing in, on, or closest to the customer premise for which the	Risk of bridging customer and data privacy act

Compliance reference	Requirement	Risk
	utility or its legal proxies are primarily responsible for proper operation; and 2) The hardware and software owned and operated by the utility or its legal proxies which has as its primary purpose the facilitation of Advanced Metering.	
ARPANSA - 2002 Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields 3 kHz to 300 GHz	• Mandatory basic restrictions for both occupational and general public exposure involving all or part of the human body. • Corresponding reference levels for measurable quantities derived from the basic restrictions. • Approaches for verification of compliance with the Standard. • Requirements for management of risk in occupational exposure and measures for protection of the general public.	Non-Compliance with ARPANSA exposure requirements