STRATEGY

MEASUREMENT ASSET CLASS STRATEGY

ELE AM PL 0063

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AUTHORISATION

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INTERNAL

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DOCUMENT HISTORY

Revision	Date	Author	Description of Changes
1.0	31/10/2017		Combined measurement ACS into one document & enhanced to new template.
2.0	25/09/2018		Reviewed the document and removed the outdated content and updated with current information
3.0	02/10/2018		Updated the section 2.5 (5- Minute Settlement)
4.0	10/10/2018		Update the forecast
5.0	12/04/2019		Updated to Information Management sections and capital forecast (not yet completed)
6.0	16/12/2019		Rewritten based on feedback from GHD

OWNING FUNCTIONAL GROUP & DEPARTMENT / TEAM

Asset Management : Asset Strategy Electrical : Secondary Plant

REVIEW DETAILS

Review Period:	Review Date + 1 year (annually)
Next Review Due:	September 2020

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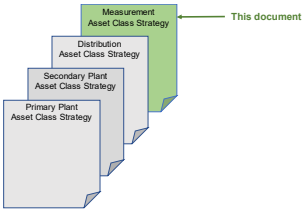


There are four ACS documents incorporated into JEN's Asset Management System

Jemena Electricity Networks (JEN) in Victoria has an Asset Management System (AMS) that contains four Asset Class Strategy (ACS) documents.

This ACS document pertains to Electricity Measurement, a term that denotes a range of meters 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 Electricity Measurement is unpacked and divided into two distinct sub-asset classes

- Electricity Advanced Metering Infrastructure (AMI) meters used at customer connection points in accordance with regulatory requirements
- Power Quality Meters (PQMs) selectively used at zone substations and end of feeder kiosks to meet regulatory requirements

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

CAPEX and OPEX forecasts in nominal AUD

The financial forecasts are the key findings of this ACS. This capital expenditure (CAPEX) and operational expenditure (OPEX) data informs the business and is shared, in commercial confidence, with the Australian Energy Regulator (AER) as part of the Electricity Distribution Price Review (EDPR) determination.

CAPEX $000 AUD	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
AMI meters	2,141	2,073	2,053	2,094	2,135	2,116
PQMs	0	835	0	0	0	0
Totals	**2,141**	**2,908**	**2,053**	**2,094**	**2,135**	**2,116**

OPEX $000 AUD	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
AMI meters	$199	$182	$181	$199	$188	$187
PQMs	$0	$24	$0	$5	$0	$0
Totals	**$199**	**$206**	**$181**	**$204**	**$188**	**$187**

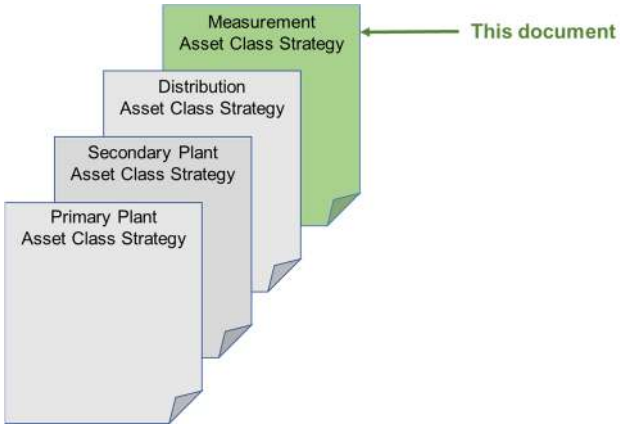
1 INTRODUCTION

This Asset Class Strategy (ACS) covers the Jemena Electricity Networks (JEN) measurement asset class and outlines the methods employed, analysis undertaken and actions to be taken to optimally manage the assets. The document serves as both an internal document to prescribe the management of the secondary plant asset class but also to support expenditure proposals as part of JEN's electricity distribution price reset (EDPR) submission process.

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 recommendations are made by analysing asset condition and age profiling.

There are four Asset Class Strategy (ACS) documents. Each ACS outlines performance measures and objectives which 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 – There are four ACS documents incorporated into JEN's Asset Management System



The Electricity Measurement assets in this ACS are categorised into the following sub-asset classes located in the following sections of this document

4.1 Electricity meters
4.2 Power Quality meters

1.1 PURPOSE/OBJECTIVES

The purpose of the Measurement ACS is to document the approach and principal methods that support the delivery of asset management objectives set out in the JEN's ABS.

The sub-class strategy encompasses

- Health Safety & Environment
- Regulatory compliance
- Customers
- Asset reliability and economic efficiency

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.

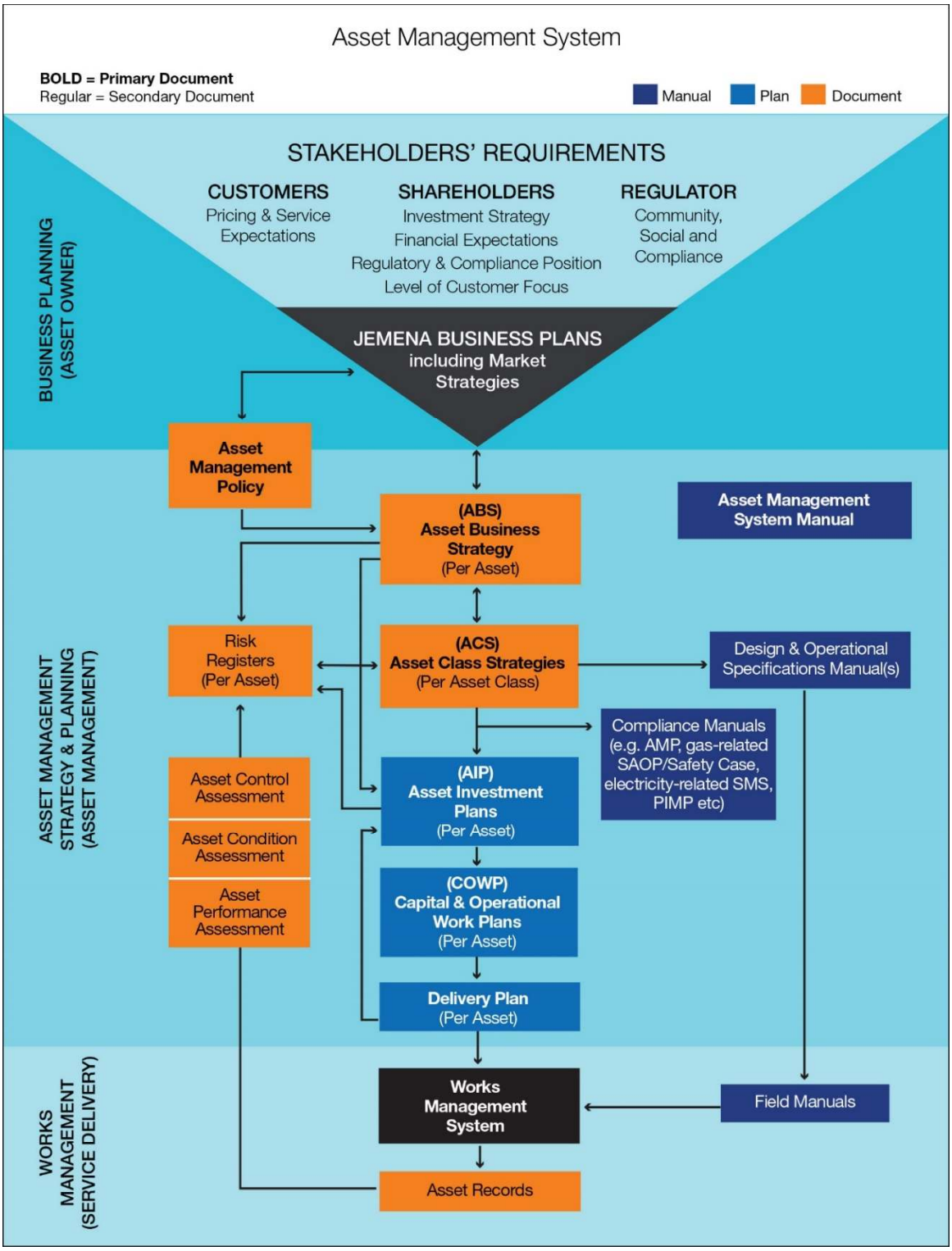
This measurement ACS addresses

- Measurement 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 used to inform Operating Expenditure (OPEX) and Capital Expenditure (CAPEX) planning

1.2 ASSET MANAGEMENT SYSTEM

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

Figure 2 – JEN's Asset Management System



1.3 DESCRIPTION OF ASSETS COVERED

There are a large number of measurement assets. Individual failures of measuring equipment have a low immediate impact on customers. Consequently electricity measurement assets do not have inherent redundancy built into their configuration.

Figure 3 – JEN geographical footprint

There are two sub-assets in this measurement ACS

- Electricity meters. JEN manages approximately 357,000 predominantly AMI meters installed at customer premises
- Power Quality Meters (PQM). JEN has four types of power quality monitoring systems spread across 26 zone sub-stations plus 25 end of feeder locations. The PQM system records:
  - Steady state RMS voltage levels;
  - Short duration voltage disturbances including sags, swell and transients;
  - Voltage harmonics;
  - Voltage unbalance; and
  - Load current (only at zone substation PQMs)

1.4 GOVERNANCE

1.4.1 APPROVAL AND COMMUNICATIONS

Asset class strategy documentation is updated annually by the Asset Analytics & Programs Manager for approval by General Manager Asset Management Electricity Distribution

The Asset Class Strategy is reviewed annually to ensure alignment with the Asset Management objectives and to account for any additional asset performance and risk information.

1.4.2 RESPONSIBILITIES

Job Title	**Responsibility**
GM Asset Management Electricity Distribution	Approval
Asset Analytics & Programs Manager	Document owner
Metering Engineer	Electricity meters
Protection & Power Quality System Engineer	Power Quality meters

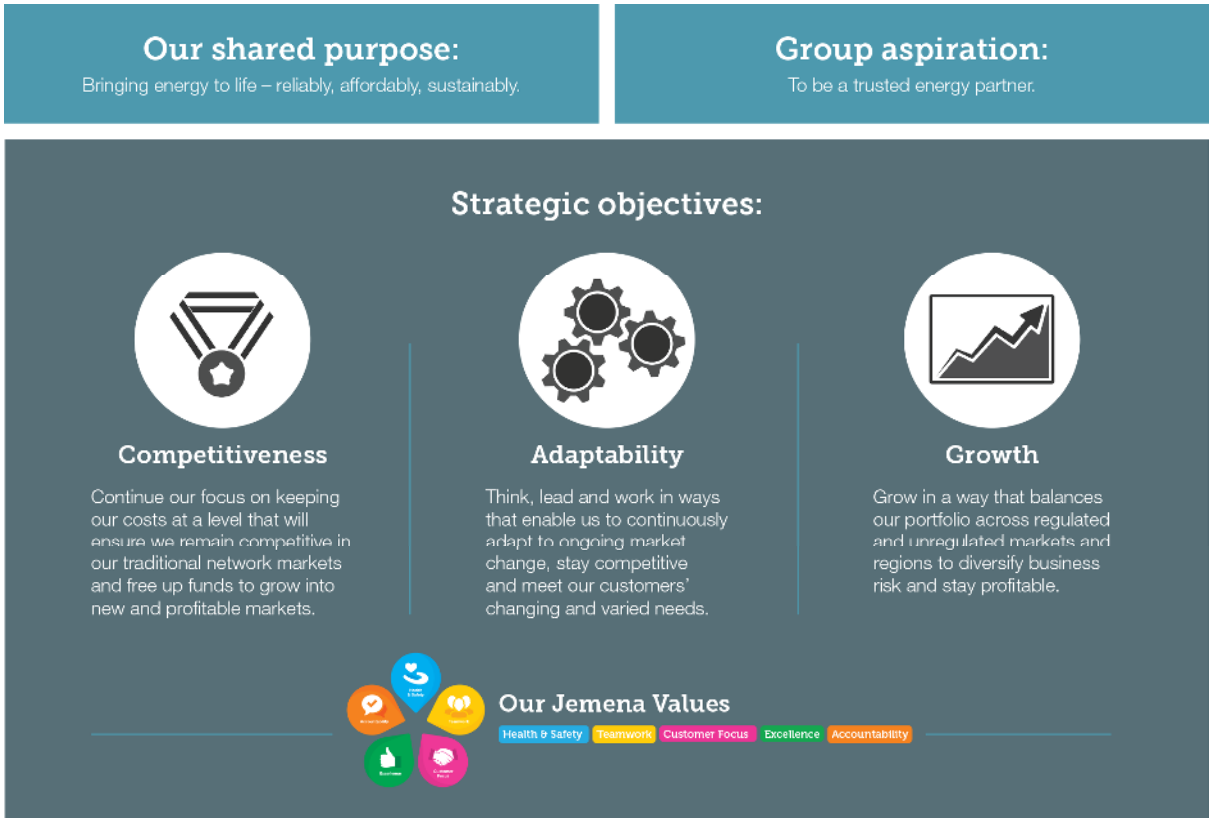
2 STRATEGIC DRIVERS

The ABS (2019) states the asset management strategic drivers are

- Market and competitive position, future growth, demand and customer connections
- Customer and community expectations (service levels)
- Stakeholder expectations
- Regulation and legislative environment
- Asset management capabilities (processes, systems, resources, knowledge)
- Technology
- Other drivers relevant for the asset such as climate change

Combined, these strategic asset management drivers ensure JEN optimises the condition, performance and associated costs over the life of each asset.

Figure 4 – Jemena's high level strategic goals informs the ABS



2.1 GROWTH

The coming 20 year period for the electricity network holds significant uncertainty. Customer behaviours are changing with the advent of new technologies which have the potential to reduce the need for the network as a source of supply, while at the same time, the demand for supply quality and growth in customer connections continue to rise. These two forces act against one another. JEN's expected position entering the next regulatory reset period is that demand growth, network wide, will continue at a similar rate as the last regulatory reset period. That stated, there are areas within the network where maximum demand growth is forecast well beyond the network average level while other parts of the network are forecast to experience reductions in maximum demand as a result, for example, of manufacturing closures. Analysis is ongoing and JEN's ABS will evolve as new insights emerge. JEN's ABS contains the ten year forecast which the business is working to. JEN is actively monitoring several dynamics which impact this forecast. Refer to the JEN ABS for further details.

2.2 STAKEHOLDERS

2.2.1 CUSTOMERS

Decision making on behalf of customers involves trade-offs. For example, our customers consistently tell us they value a safe, reliable and responsive supply of electricity. But they also tell us that rising energy prices have become a concern. These priorities are mixed, as higher service levels involve higher costs. It is a 'trilemma'

JEN's ABS states,

> *'The community expects environmental responsibility; a safe and reliable level of service; a responsive service; public amenity; equitable levels of service available to all consumers; and affordable pricing.'*

2.2.2 SHAREHOLDERS

Asset procurement and operation must support the network's ability to produce and sustain profitability for shareholders.

JEN's ABS states,

> *'Our asset management decisions need to take into account the certainty our shareholders have about recovering their significant up-front investment in the asset*.'

2.2.3 INTERNAL

Each ACS relies upon the contributions of several areas of the business. Stakeholders have business and operational insights that contribute to the effectiveness of the asset management. This includes contractors such as our Services and Projects teams. There are also reporting requirements back into the business. Section 1.2 *Asset Management System* maps stakeholder requirements.

2.3 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 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 with regard to asset management. For example, JEN provides an annual RIN to the AER for all zone substation and distribution assets so as to account for the state of the network in terms of asset cost, age, reliability and cost of operating the network.

3 ASSET OBJECTIVES

JEN's objectives

> *…provide the essential link between key strategic objectives which support the Group strategy and the JEN asset management plan that describes how the objectives are going to be achieved. The asset objectives transform the required outcomes (product or service) to be provided by JEN, into activities typically described in the JEN asset management plan. This in-turn provides the line of sight for asset management activities.*

Asset Class Strategy objectives are

- 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 contain 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 specification for purchase of electricity meters, together with regular market testing of alliterative suppliers, ensures that JEN measurement equipment is cost efficient and fit for purpose.

A table assigning KPI's to the above objectives and aligning them to the ABS is located at Appendix A.

Figure 5 - There are five key success measures and objectives

4 ASSET SUB CLASS STRATEGIES

4.1 ELECTRICITY METERS

4.1.1 INTRODUCTION

JEN manages approximately 352,000 AMI meters. JEN also manages about 5,000 legacy meters that are still to be changed out for AMI technology.

Electricity Meters must:

- Meet regulatory compliance;
- Ensure meter availability for new connections and abolishment/alterations;
- Be economical to purchase and maintain;
- Support supply investigations; and
- Support future customer experience pathways ('advanced services')

Figure 6 – There are 7 types of meter, JEN connects with 5 of them

Meter type	Volume limit per annum per connection point	Comment	JEN owned quantity
1	Greater than 1,000GWh	JEN is not responsible for operation of these (contestable) meters.[1] Back office systems receive energy data from these types of meters	Zero
2	100 to 1,000GWh		10 HV CT meters
3	750MWh to less than 100GWh		5 HV CT meters
4	Less than 750MWh		Zero
5[2]	Less than 750MWh	AIM meters. Supports 5 minute settlement regime[3]	351,468
6	Less than 750MWh	Legacy meters for accumulated data only	5,133
7	It is a 'notional' meter—the load is technically not metered	For example, public lighting	~75,000 lights assigned to ~30 NMI

JEN owned meters are sorted into categories and sub-categories at Appendix B.

Software platforms used are:

- Meter Data Management (MDM) by Itron Enterprise Edition to perform data collection of metered consumption and, depending on meter type, meter-related events:

[1] This is expected to change in 2021 if Victoria adopts AEMC's national rules on smart meters (adopted by other states in 2017)
[2] Type 5 has 6 categories covering the permutations of single and multiphase meters
[3] See Appendix E

- SAP Industry Specific – Utilities (IS-U) system supports meter installation activities from customer service to inventory management:
- Silver Spring (Itron) Network Management System (NMS) facilitates scheduled energy/event reading, configuration management (e.g. firmware, meter program/tariff, etc), remote energisation/de-energisation of network performance monitoring, communication testing (e.g. meter ping), alarm management (eg last gasp, tamper, etc) and logging system actions:
- 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)
- Oracle Outage Management System (OMS) manages planned and unplanned outages on the electricity distribution network

4.1.2 RISK

The metering is a highly regulated JEN sub-asset class. Compliance risks are detailed at Appendix C.

4.1.2.1 Criticality

Accuracy and reliability of meter operation is highly critical because of compliance, reputational and revenue risks.

4.1.2.2 Failure modes

Failure of electricity meters can manifest itself as:

1. Non-operation, such as a communications card failure or a LCD screen failure. AMI meters, tend to not exhibit signs of deterioration until the failure occurs.
2. Inaccurate operation where data recorded is outside of allowable error limits. For example, electro-mechanical devices utilise magnetic bearings that provide long operational lives. They are accumulation type meters. The failure mode for these meters relates to the weakening of the breaking magnets over time. The result is the meter runs faster and faster and consequently reaches a stage where it exceeds the error limit.

4.1.2.3 Current risks

All risks are identified and managed in the Jemena Compliance & Risk System (JCAR).

4.1.2.4 Existing controls

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

1. Architectural mitigation. Guiding principles and architectural decisions mitigate risk through design.
2. 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.

3. Contractual mitigation. Contractual mechanisms such as service level agreements, liquidated damages, defects liability periods and insurance requirements are used to reduce likelihood of sub-standard third party service delivery.

In addition, all parties involved in provision of metering services are audited by AEMO and JEN's internal teams to ensure they have the requisite training and accreditation in line with national and state-based obligations.

Figure 7 – Existing controls

#	Threat	Vulnerability	Risk	Controls
1	Over stated product reliability or unexpected environmental conditions	Inadequate product design	Increased operation & maintenance cost. Increased replacement levels may affect customer relations and business reputation	**Contractual** Extended warranty periods
3	Geographically or RF isolated customer	Limitation of LAN coverage	Increase 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 3G only.
4	Regulator change band access new data services	Meter 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
5	3G WAN service end of life	WAN solution uses 3G	Redesign/replacement of Access Points Loss of system availability	**Architectural** Design supports modem replacement in AP's
6	New HAN technology	AMI meters support only Zigbee	Stranded assets	**Architectural** Use open/widely supported communication standard
7	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
9	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

#	Threat	Vulnerability	Risk	Controls
10	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
11	Single Mesh Network supplier	End of product line or company failure	Unable to maintain and grow the LAN network Continued supply of NIC modules to Secure to support supply of new meters 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

4.1.2.5 Future risks

Emerging risks for this sub-asset class are:

- Cyber Security. Unauthorised access could compromise availability and integrity of data. In addition, any unauthorised access of customer's usage data would compromise privacy; and
- Continuously evolving regulations and standards such as smart meter contestability in 2021.

4.1.3 PERFORMANCE

4.1.3.1 Requirements

Electricity meters must:

- Support establishment of new connections and abolishment/alterations;
- Measure and record energy use by individual customers and provide billing data in accordance with regulations;
- Support remote energisation/de-energisation of premises;
- Support advanced tariffs such as Time of Use;
- Support demand management; and
- Support future 240/415V distribution network advanced monitoring at each customer connection point

4.1.3.2 Life expectancy

According to vendor warranty terms and JEN's experience with similar devices, expected design/product life is:

- AMI meters (installed since 2009) – 15 years (manufacturer's warranty is 5 years);
- Legacy meters (pre-AMI) – 15 years. These meters are gradually being phased out as their condition fails. They are no longer repaired or refurbished; and

- LVCT, HVCT/VT - 30 years

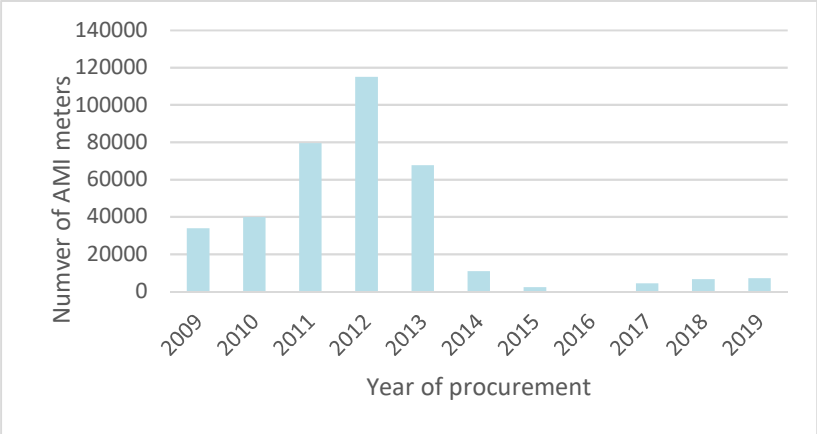
The life span of the metering installations can be impacted by the meter's operating environment (e.g. ambient temperature and electrical). If the environment is maintained within the manufacturers operating limits, and as prescribed by the Victorian Service and Installation Rules (SIR) limits, expected life should not be degraded. Where a battery is integral to the meter (e.g. AMI meters) the manufacturer's warranty is also 5 years.

NB: AMI communications and battery packs are not covered by this ACS. They fall under the purview of JEN's SCADA & RTS department and covered in a different Asset Class Strategy.

4.1.3.3 Age profiles

99% of JEN's installed meter base is of the AMI variety.

Figure 8 – AMI meters by year of procurement (commencement of warranty)



4.1.3.4 Utilisation

Electricity meters are required by regulation to measure customer consumption accurately at all times.

4.1.3.5 Performance analysis

Electricity meter performance is compliant with the objectives specified by the Victorian Government's AMI minimum functionality specification (MFS) and Chapter 7 of the National Electricity Regulations (NER). Compliance is audited annually by AEMO.

End-to-end system performance and compliance monitoring is performed by network operations. Asset Management reviews that data and, together with the auditor's report, checks for any emergent performance trend that may modify the sub-asset strategy.

Figure 9 – AMI meter failures

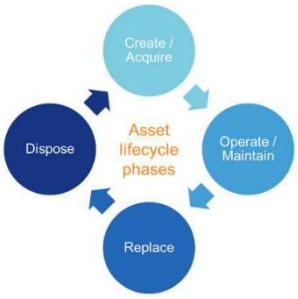
	2016	2017	2018
Condition fail	423	731	572
Approx % of pop	0.12%	0.21%	0.16%

There has been a comparatively small number of AMI meters fail before end of design/product life. These have been replaced and each failed unit evaluated by the meter supplier. LVCTs and HVCTs rarely fail.

4.1.3.6 Control effectiveness

By comparing identified risks and measuring past incidents, control effectiveness is assessed as part of the Jemena Compliance & Risk System (JCAR). The existing controls have proved Adequate or Strong. There has not been a Major or Severe incident in the last 5 years.

4.1.4 LIFE CYCLE MANAGEMENT



4.1.4.1 Creation

Sub-asset acquisition occurs 7 months ahead (to accommodate lead time). The aim is to have sufficient, but not excessive, stock to hand.

Acquisition triggers for this asset class are:

- New connection requests;
- Number of 'condition fail' units;
- Deteriorated metering installations that have reached end of life;
- Deteriorated communication installations that have reached end of life; and
- 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 (under NER Chapter 7) by failing to meter an installation;
- Minimise any communication link outage times; and
- Eliminate any loss of revenue due to unmetered energy

The optimum quantities of meters and associated communication assets required takes into account the cost of holding stock against:

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

JEN's nominated contractor monitors stock levels. The minimum stock level is seven months of projected meter consumption for each category[4] of meter (excluding legacy types).

4.1.4.2 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 maintenance program involves:

- Inspection and testing, i.e. preventative maintenance (NER prescribed periodic testing):
- Corrective maintenance (defects): and
- Reactive maintenance (faults and emergencies)

JEN undertakes inspection and testing of the metering and associated communication assets in accordance with JEN's Metering Asset Management Strategy (MAMS, December 2019) as approved by AEMO. The MAMS details JEN's approach to inspection, testing and replacement of electricity meters, as well as required accreditation of involved contractors and meter service providers. JEN Maintenance programs are reviewed annually in light of potential changes to product development, performance, present policies and regulatory requirements.

[4] Meter category details are provided at Appendix B

In the event that inspection and testing reveals widespread 'family failure' of the meters, JEN would liaise with AEMO to ensure the proposed replacement program is acceptable and compliant with the National Electricity Law. The supplier/manufacturer would be held to account to the extent commercially reasonable.

The testing and inspection of metering installations is carried out in accordance with the requirements of NER, Chapter 7.

The MAMS spells out the requirements for inspection and testing of the different categories of meters and instrument transformers, covering:

- Type tests and pattern approvals;
- Pre-installation tests;
- Meter installation inspections;
- Direct connected meter sample tests;
- HV and LV CT connected meter tests;
- LV CT sample tests; and
- HV CT & VT tests

Corrective maintenance is necessitated when sample testing of metering installations (in accordance to the MAMS) detects a 'condition fail'.

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

- A customer complaint; or
- An alert from network operations. The AMI backend Network Monitoring System (NMS) and Business Intelligence (BI) system are used for monitoring the operation, availability and conditions of metering & communication assets. Any deviation from expected operational thresholds are analysed for potential reactive maintenance.

4.1.4.3 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 the requirements of the NER, the Victorian Electricity Distribution Code (VEDC) and electricity safety regulations.

Scheduled replacement (aged-based). This mode proposes to replace electricity meters at the end of design/product life. Nominal AMI meter product life is 15 years (according to the manufacturer). The AMI rollout commenced 2009, so far there have not been any end of product life replacements. In time we may learn the product life of AMI meters is less/greater than 15 years. Whatever the case, it would seem uneconomic (wasteful) to robotically replace meters based on age alone.

Condition based replacement represents the best alternative because it excludes 'run to failure' and improves upon 'schedule based replacement' by incorporating age data into 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 vis-à-vis NER requirements. This mode is optimal because it minimises asset investment whilst meeting, or exceeding, NER compliance.

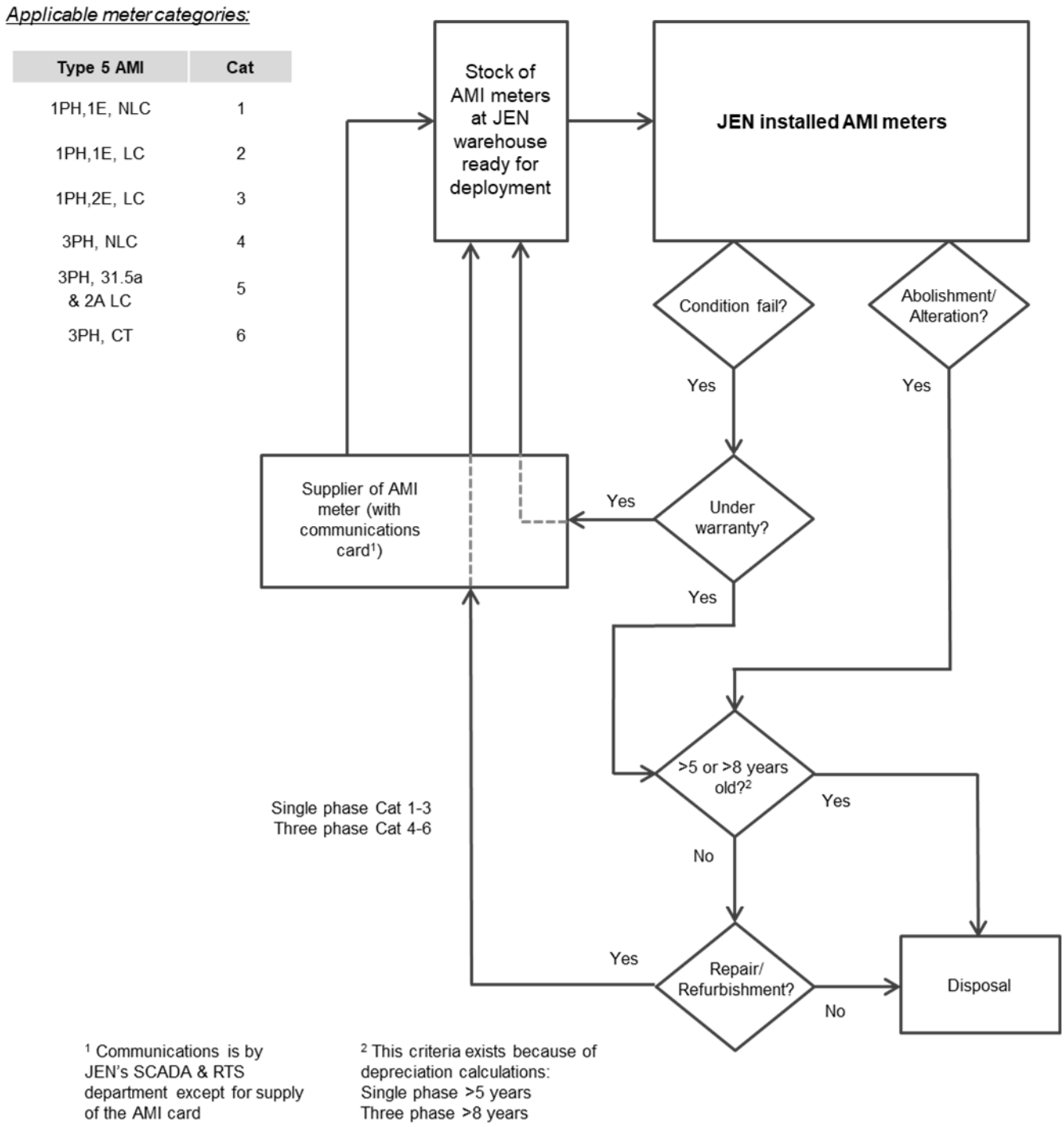
Condition-based replacement is determined by CBRM data:

- Age of asset;
- Preventative maintenance activities and record keeping;

- Performance of asset; and
- Continuous SCADA monitoring

The condition based replacement mode fits within JEN's comprehensive asset maintenance programs. Figure 10 (below) provides a diagrammatic summary of the maintenance decision making used in administering AMI meter life cycle.

Figure 10 – Maintenance decision making and costings of AMI meters



Meters removed from operation (except for non-AMI legacy to AMI upgrades) are assessed for repair/refurbishment and subsequent reuse. However, in view of the cost of the repair/refurbishment, and in view of any reduction in price of new meters, repair/refurbishment may become less and less economical.

Meanwhile, applying linear depreciation to the expected 15-year life of AMI meters, JEN has determined that:

- Single phase AMI meters removed from JEN operation older than 5 years will be written off (i.e. shall not be refurbished), since the refurbishment cost would exceed the residual depreciated value of the meter; and
- Multiphase AMI meters removed from JEN operation that are older than 8 years old will be written off (i.e. will not be refurbished), since the refurbishment cost would exceed the depreciated value of the meter.

LVCTs are robust and have no moving parts. Whenever a LVCT fails it is scrapped. In-service compliance tests and inspections (following a sampling regime) are performed as mandated by AEMO guidelines, NER and MAMS.

HVCT technology is only used at cross-boundary connections. Each instance has a unique site-based design requirement. In-service compliance tests and inspections are performed as required by NER and forecast OPEX in Section 5.

Figure 11 – Forecast AMI meter activity count[5]

	2020	2021	2022	2023	2024	2025	2026
Abolishment/ Service Removal	2,277	2,255	2,131	2,073	2,111	2,150	2,111
Meter Failures & Faults	693	709	724	738	753	768	784
Alterations (Removed)	343	351	358	365	372	380	387
Meters Exchanged - Non AMI to AMI	107	109	112	114	117	119	122

For privacy reasons, the memory of a meter is cleared before disposal. Any decommissioned equipment is disposed of by a certified recycling company in accordance with Jemena Environment Policy (JEM PO 0397).

4.1.5 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 set out in *Figure 12*. Current and future information

[5] New connection estimates are given in Section 5

requirements to inform value-add decision making are at *Figure 13*. A proposed improvement for future business information needs is at *Figure 14*.

Figure 12 - Electricity metering business objectives and information requirements

Business objective	Jemena information sources	Externally sourced data
BO1 (Type 5 AMI) Maintain compliance	AMI SAP ERP SAP ECMS (investigations, revenue protections, work instructions, strategies, metering information, etc) NMS • UIQ (daily reports) • SIQ Cognos (revenue protection reports) Network drive(s)	AEMC website - National Electricity Rules (AEMC) AEMO website - Metrology Procedures (AEMO) AEMO industry workgroups ENA Meter Coordinator workgroup SAI Global website – Australian standards Reports from Meter Service providers: - SECURE JIRA portal (meter vendor portal) - Monthly Report with volumes of meters 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 (compliance, and customer paid tests), ads/alts, CT meters commissioned - Meter Stock by category, currently with them - Outstanding Invoices Zinfra monthly reports: - As per above, plus volumes of non-CT AMI meters installed
BO2 Ensure meter availability (supply) for new connections 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 meters and metering services	AMI SAP ERP SAP Contract with Suppliers (ECMS)	Tender, market reports
BO4 Support JEN Network Management in provision on better customer experience	NMS • UIQ • SIQ BI/Cognos (revenue protection/reverse energy reports)	Publication from COAG CSIRO ENA forums AEMO RMCF (Retail Market Customer Forum) Local council information session.

	JEN SCADA/Outage web Energy Portal	

Figure 13 - Electricity metering 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, maintain and test meters to required standards.	AMI / ERP SAP • Meter category • Meter tariffs • Installations Data • Test dates • Location / address • Status • Serial number • Meter program ids • Maintenance records Network Drive: • 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 desperate spreadsheets from service providers)	High (required by National Electricity Rules, National Measurement Act, Vic Government legislation)
CD2a: Maintain viable meter supply contracts	AMI SAP – Meter Volumes (current meter demand) • Meters in stock by categories (1,2,3,4,5a,5b,6a,6b) ERP SAP – Meter stocks • Meters installed by date and categories • Meter currently with vendors for refurbishment • Meter failure rates(Attribute in SAP) • BI UIQ (Meter Monitoring and management system) • Test Reports	A new meter model and/or vendor might be introduced after 1 Dec 2018.	HIGH – part of JEN obligations under the Electricity Code.
CD2a: Place orders on time, as required by this asset class strategy	Monitoring current stocks: • Available volume of meters of a particular category in store (per store location) • and at JEN warehouses	A new meter model and/or vendor might be introduced after 1 Dec 2018.	HIGH – part of JEN obligations under the Electricity Code.
CD3: Periodically test the market and meter prices	Monitoring the market for • new meter manufactures • change in exchange rates	A new meter model and/or vendor might be introduced after 1 Dec 2018.	HIGH – part of JEN commitment for customer focus

CD4: actively pursue technological innovation to better leverage capabilities of AMI meters	Monitoring the market for • new technology • better use of collected data	To be assessed	HIGH – part of JEN commitment for customer focus

Figure 14 - Electricity metering information initiatives to support future business information requirements

Information initiative	Use case description	Asset class risk in not completing	Data quality requirement
CD1: • Create reports for meter consumption and meter refurbishment volumes to reflect real time demand and utilization of meters by supplier, meter category and type of installation	Monitor the monthly consumption of meters 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

4.1.5.1 Future improvements

- Cybersecurity is an emergent risk necessitating, for example, ISO/IEC 27000 controls
- Automated remote monitoring of meter integrity. Automated reports-by-exception, for example, identifying irregular meter consumption and meter operations due to:
  - Meter tampering (attempted theft);
  - Meter by-pass (theft); and
  - Safety concerns (degraded connection)

4.2 POWER QUALITY METERS

4.2.1 INTRODUCTION

Power quality metering is intended to:

- Monitor power quality levels in accordance with regulatory requirements;
- Inform power quality investigations if there is an incidence of non-compliance; and
- Inform a specific customer query concerning a possible anomalous network event

JEN power quality meters (PQMs) presently consists of four models that continuously monitor the supply at zone substations and selected end of feeder locations.

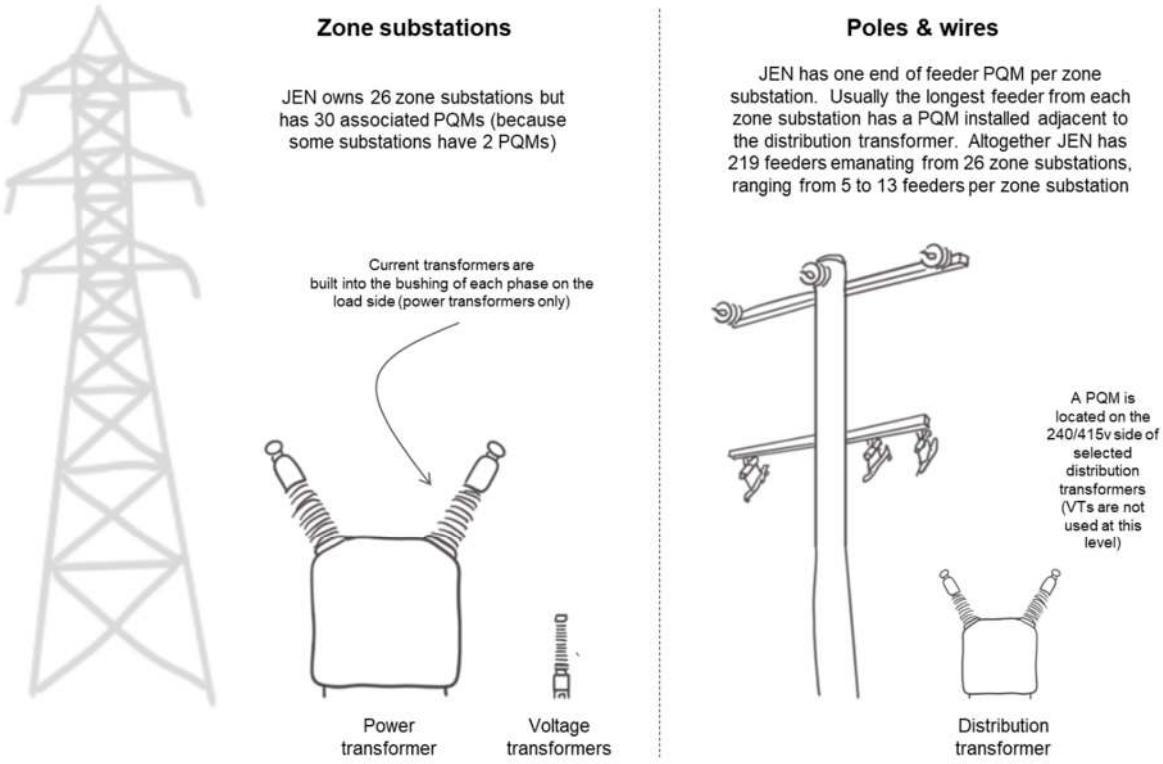
Figure 15 – Two legacy PQMs and two new models are in use

	Legacy	New
Zone substation 6.6kV, 11kV and 22kV buses	BMI 8010	ION 7650
End of feeder distribution transformer 415V/240V	EDMI Mk6	ION 7400

Each PQM measures and records:

- Steady state RMS voltage levels;
- Short duration voltage disturbances including sags, swell and transients;
- Voltage harmonics (except for the EDMI Mk6);
- Voltage unbalance; and
- Load current (only at zone substations)

Figure 16 – PQM locations



PQMs are programmed to capture voltage and current waveforms associated with a power quality excursion outside of pre-set limits. Captured waveforms provide useful information when analysing specific network power quality disturbances.

Within zone substations, PQMs monitor the network via voltage transformers (VTs) and current transformers (CTs). Meanwhile, at selected end of feeder distribution transformers, a PQM is connected directly to the low voltage network (without voltage transformers). Monitoring of load current is not implemented at end of feeder instances and there are no current transformers present at those locations.

PQMs are devices that measure and convert AC quantities of voltage and current into digital data. The PQM's micro-processor performs mathematical and/or logical operations using algorithms specific to power quality monitoring. Like all digital devices, they comprise of a number of basic components including an auxiliary power supply, analogue to digital converter, CPU, RAM, ROM and limited I/O capability.

Figure 17 – PQM present population by model

	PQM model	Quantity	Proprietary software platform on JEN host servers
Zone substation 6.6kV, 11kV and 22kV buses	BMI 8010 (legacy)	1	PASS v3.2.0 on Windows XP
	ION 7650 (new)	29	PME v8.1 on Windows Server 2012
End of feeder distribution transformer 415V/240V	EDMI Mk6 (legacy)	22	EziView v3.30 on Windows XP
	ION 7400 (new)	3	PME v8.1 on Windows Server 2012

Proprietary software collects, buffers and analyses data from its respective PQM.

Detailed lists of PQMs at each zone substation and each end of feeder location is provided, together with the associated communications method, at Appendix D.

4.2.2 RISK

4.2.2.1 Criticality

PQMs record but do not control voltages and currents and therefore, from an electricity system perspective have low criticality. However, PQM functionality is a National Electricity Regulations (NER) and Victorian Electricity Distribution Code (VEDC) compliance issue. This lifts criticality to moderate.

4.2.2.2 Failure modes

A PQM may stop operating, or appear to stop operating, because its:

- Power supply fails;
- Micro-processor fails;
- Memory becomes full (resulting in loss of data); or
- Communications link fails (copper or cellular)

4.2.2.3 Current risks

All risks are identified and managed in the Jemena Compliance & Risk System (JCAR).

The main risks related to PQMs are:

- Loss of power quality data resulting in non-compliance with NER (Schedule 5.1) and VEDC (Clause 4.2.6); and
- Inability to provide a customer with information on the quality of supply provided to that customer leading to non-compliance with VEDC Clause 9.1.5. For example, a large customer might experience an unexplained HV circuit breaker trip event and request PQM data showing a snapshot of the time-stamped waveform to assist with root cause analysis.

4.2.2.4 Existing controls

Each PQM is remotely monitored and normally checked daily (Monday to Friday).

4.2.2.5 Future risks

Cybersecurity. A breach could result in:

- A backdoor into Jemena's network; or
- No PQM data; corrupted or malicious data

4.2.3 PERFORMANCE

4.2.3.1 Requirements

PQMs need to measure and store network supply events around the clock. Typically a power quality metering scheme comprises a meter, associated AC and DC wiring and communications equipment to permit the uploading of collected data to the host server. PQMs are required to:

- Monitor each zone substation as per regulatory requirement under the NER (Schedule 5.1) and VEDC (Clause 4.2.6);
- Provide specific power quality data in response to customer requests per VEDC Clause 9.1.5; and
- Monitor network power quality performance to help identify problem areas or worsening trends

4.2.3.2 Life expectancy

The nominal life of a PQM is 20 years. This is consistent with other solid-state secondary plant equipment, such as IEDs. PQM life expectancy considerations are:

- Age and condition:
- Meter technology (e.g. solid-state):
- Availability of replacements:
- Manufacturer Mean Time Between Failure (MTBF) ratings: and
- Availability of manufacturer technical support

4.2.3.3 *Age profiles*

Figure 18 – Zone substation PQM in-service years

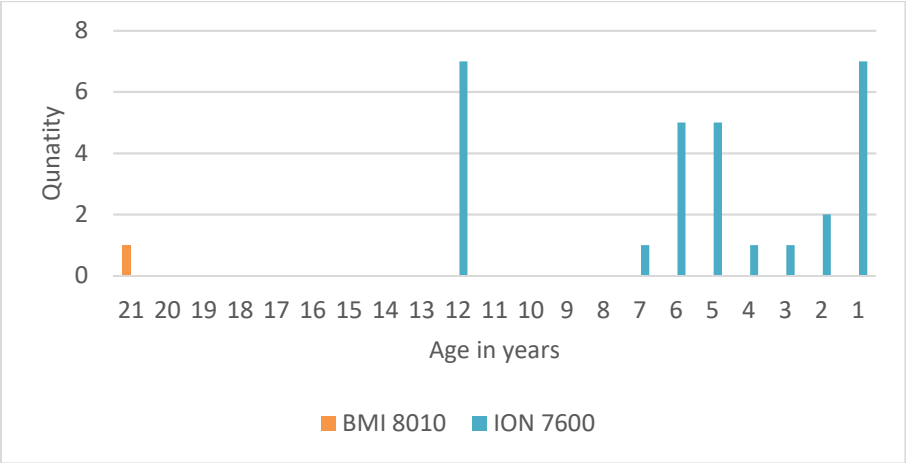
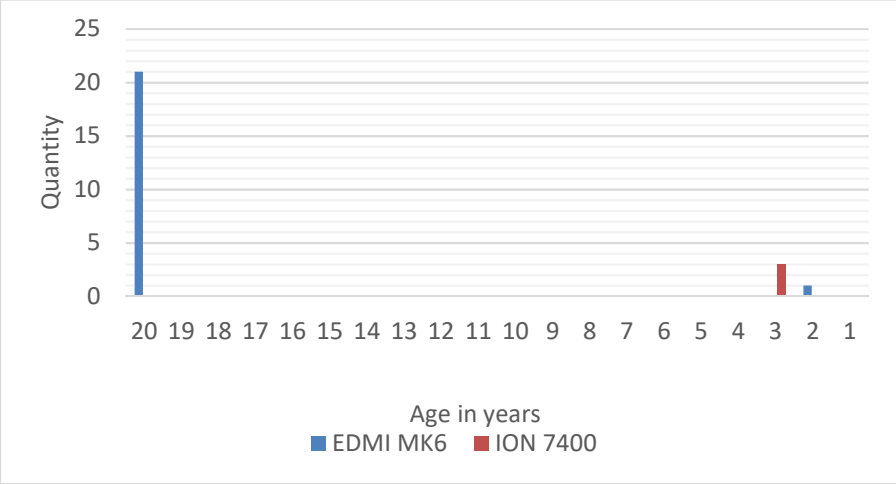


Figure 19 – End of feeder PQM in-service years



4.2.3.4 *Utilisation*

Continuous operation of each PQM is fundamental to JEN's capability to continuously monitor power quality.

4.2.3.5 *Performance analysis*

JEN reports power quality performance through the annual Regulatory Information Notice (RIN). During 2018 hundreds of minor voltage excursions were recorded (in keeping with the historical trends) and this is regarded as operationally normal. JEN's Distribution Annual Planning Report (DAPR, 2019) mentions occurrence of some higher voltage excursions outside of VEDC limits. These incidents are investigated so that future occurrences are avoided.

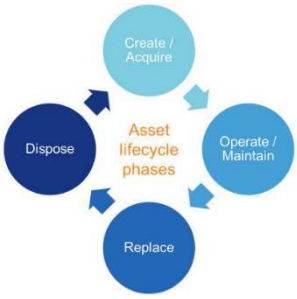
JEN also voluntarily participates in the University of Wollongong's annual Power Quality Compliance Audit (benchmarking JEN against other Australian electricity distributors).

4.2.3.6 Control effectiveness

Manual PQM health checks of the communications infrastructure from the host server through to each PQM is performed each day (normally Monday to Friday) and is an adequate control.

4.2.4 LIFE CYCLE MANAGEMENT

4.2.4.1 Creation



Above all, the need for a PQM is a regulatory requirement. Once installed and commissioned they tend to have long lives. In 2012, JEN conducted an evaluation of various PQM suppliers. The ION brand met JEN's criteria and, to date, all but one of the zone substations has been changed to this brand. The one remaining old meter is planned to be changed during zone substation upgrade works in 2021.

A program of works to replace each and every end of feeder PQM with a ION 7400 is proposed for 2021 and is reflected in the CAPEX at Section 5.

PQM equipment procurement must comply with:

- Zone substation secondary design standard (JEN ST 0600); and
- Protection and control settings manual (ELE AM MA 0003)

The standard types and acquisition triggers for this asset class are:

- As part of a new zone substation development;
- Condition based replacement of power quality meters that have reached end of life; and
- Technological improvement driven change

Spares are held in stock to enable minimal outage time. ION PQM supplier lead times are 2-4 weeks. JEN retains one ION 7650 in stock as a spare for every 13 ION 7650 in service, i.e. 2 in total. The same ratio shall apply to the ION 7400s spares once they have been deployed.

4.2.4.2 Operation and maintenance

Generally there are three maintenance modes available for asset life cycle management. The alternative sub-asset replacement modes are:

- Run to failure (reactive);
- Schedule-based replacement; and
- Condition-based replacement (hybrid)

PQMs do not readily fall into any single mode. PQMs have no moving parts and are housed so as to be protected from the elements. Because of their low criticality, PQMs have been allowed to run until they individually fail. Incidence of running to failure, in recent years, is one end of feeder PQM per annum. Experience has shown it is more likely that new technology shall drive a scheduled replacement program as it has with ION 7650s at the zone substations since 2012. The end of feeder EDMI MK6 meters will be replaced by ION 7400 meters in 2021 because of the need for additional harmonics capture capability and the need to move away from Windows XP.

The PQM maintenance program involves reactive replacement, scheduled replacement and periodic inspection (as part of site audits). Whilst it is rare for a PQM to fail, when it occurs it is detected by the daily manual check. Scheduled replacement depends on technological advances and project initiatives, for example the retirement of the end of feeder EDMI MK6 meters scheduled for 2021.

Zone substation PQMs are inspected annually consisting of:

- Visual inspection of PQMs for cleanliness; and
- Visual inspection of all secondary wiring, terminals, test links & meter LEDs

In addition to the daily remote manual tests and the annual secondary plant inspections, each installed PQM is physically inspected and tested every 8 years by:

- Checking power supplies of PQMs and modems;
- Checking all terminals, connections and cabling;
- On-load testing to verify that instrument transformers (CTs and VTs) and measuring transducers are providing the correct signals to the meter; and the voltages and currents are accurate in the host software; and
- Testing Sag/Swell trigger monitoring in the PQM

4.2.4.3 Replacement/disposal

Replacement stratagems are given in the foregoing section *Operation and maintenance*. CAPEX and OPEX forecasts are given below and in Section 5.

Figure 20 – CAPEX calculation

Item	Timeframe	Reason for replacement	Comments
End of Feeder PQM	2021	▪ Condition/age ▪ Need for harmonics capture ▪ Need to get clear of Windows XP	▪ Meter has exceeded its end of life which has caused the deterioration of electronic components in the meter ▪ In addition, there is also limited functionality within the EDMI MK6 meter to perform power quality analysis

OPEX calculation: The cost of the 8 yearly inspection and test of PQMs is $1,600 per meter for the ION 7400s and 7650s.

Any decommissioned equipment is disposed of by a certified recycling company in accordance with Jemena Environment Policy (JEM PO 0397).

4.2.5 INFORMATION

JEN's AMS (Section 1.2 above) 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 PQM sub-asset class identified two business objectives together with the business information required to support these objectives set out in *Figure 21*. Current and future information requirements to inform value-add decision making are at *Figure 22*. A proposed improvement future business information need is at *Figure 23*.

Figure 21 – PQM business objectives

PQM business objective	Jemena information sources	Externally sourced data
BO1 (PQ Meters) Maintain compliance	ERP SAP ECMS (investigations, work instructions, strategies, PQ metering information) PME 8.1 (reports, data extracts for fault analysis) PASS v3.2.0 (reports, data extracts for fault analysis) EDMI v3.2.0 (reports, data extracts for fault analysis) Network drive (manuals, data reports)	AEMC website - National Electricity Rules (AEMC) AEMO website - Metrology Procedures (AEMO) ENA strategy update SAI Global website – Australian standards Reports from external PQ data analysis firm (University of Wollongong): - Yearly data analysis reports of voltage events
BO2: Support JEN Network in investigation of faults and provision on better customer experience	ERP SAP ECMS (investigations, work instructions, strategies, PQ metering information) PME 8.1 (reports, data extracts for fault analysis) PASS v3.2.0 (reports, data extracts for fault analysis) EDMI v3.2.0 (reports, data extracts for fault analysis) Network drive (manuals, data reports)	N/A.

Figure 22 - PQM decisions business information requirements

Critical business decision	Current information usage	Future information requirement	Value to asset class (High, Medium, Low with justification)
CD1: install, maintain and test meters to required standards.	ERP SAP • Category of meters • Installations Data • Status • Serial number • Test dates • Maintenance records Network Drive: • Maintenance Condition Reports (testers folders)	Most of the maintenance data is already in SAP and given the small volume of meters here, there is no requirements of specific BI reports. However, in the future, require historic test data can be stored in BI warehouse for predicative fault analysis (currently stored in SAP)	High Required by National Electricity Rules, National Measurement Act and Vic Electricity Distribution Code)

CD2: Maintain the quality of data and consistency of data the meters collect	ERP SAP PM system logs and performance reports. PQ data collected with correct timestamps PME 8.1 (logs, reports, voltage waveforms, data extracts and backups) PASS v3.2.0 (logs, reports, voltage waveforms, data extracts and backups) EDMI v3.2.0 (logs, reports, voltage waveforms, data extracts and backups) Network drive (PQ data reports)	Automate monitoring of PQ meters (e.g. via watch dog)	High Assist in network fault investigations Required by National Electricity Rules, National Measurement Act and Vic Electricity Distribution Code

Figure 23 – PQM information initiatives to support future business information requirements

Information initiative	Use case description	Asset class risk in not completing	Data quality requirement
Centralised collection of all PQ data across different PQMs at ZSS, end of feeders and connection points	Automate monitoring of PQ meters (e.g. via watch dog) • Create the reports • Ensure the test data is in server	Medium (mitigated by manual practices)	All the information attributes are complete and accurate in SAP

4.2.5.1 Future improvements

- Automation of PQM status and data. Currently an Asset Management engineer logs onto each PQM individually to validate their respective integrity (at zone substations and distribution kiosks). An automated 24/7 email notification system by exception would be more timely and less labour intensive.
- More regulatory requirements may be imposed for power quality monitoring due to factors like ‘embedded’ generation. ‘Smart grid’ design implications may result.

5 CONSOLIDATED PLAN

This section provides information about:

- Forecast capital expenditure; and
- Forecast operational expenditure

5.1 CAPITAL FORECAST

5.1.1 ELECTRICITY METERS

5.1.1.1 Electricity meter procurement

New connections (new permanent and temporary supplies) represent by far the biggest component of JEN's AMI metering CAPEX. The most common new connection type requires deployment of Category 1 meter (single phase, low voltage) for residential and small business customers with less than 160MWh per annum consumption. The total forecast for AMI metering CAPEX, however, also takes into account the number of expected supply upgrades (e.g. upgrades from single to three phase), meter faults and legacy to AMI upgrades.

Figure 24 – AMI meters to be procured

Meter	Category	2020	2021	2022	2023	2024	2025	2026
1PH,1E, NLC	1							
1PH,1E, LC	2							
1PH,2E, LC	3							
3PH, NLC	4							
3PH, 31.5a & 2A LC	5							
3PH, CT	6							

Figure 25 – AMI meter CAPEX

Meter	Category	2020	2021	2022	2023	2024	2025	2026
1PH,1E, NLC	1							
1PH,1E, LC	2							
1PH,2E, LC	3							
3PH, NLC	4							
3PH, 31.5a & 2A LC	5							
3PH, CT	6							
CAPEX totals		**$2,106,530**	**$2,141,304**	**$2,072,757**	**$2,053,362**	**$2,093,629**	**$2,134,537**	**$2,115,948**

5.1.2 POWER QUALITY METERS

There is no CAPEX provision for zone substation PQMs in the foreseeable future. The end of feeder PQMs, however, are scheduled for a major upgrade.

Figure 26 - End of Feeder PQM CAPEX

End of feeder	Timeframe	Quantity	CAPEX
[redacted]	2021	[redacted]	**$835,083**

5.2 OPERATING AND MAINTENANCE FORECAST

5.2.1 ELECTRICITY METERS

5.2.1.1 AMI meter refurbishment

Meters that are removed from operation, but assessed as having residual value greater than the cost of refurbishment, will be refurbished and returned to stock to be used in new connections / meter upgrades.

Figure 27 - AMI meter refurbishment quantities

Meter	Category	2020	2021	2022	2023	2024	2025	2026
1PH,1E, NLC	1							
1PH,1E, LC	2							
1PH,2E, LC	3							
3PH, NLC	4							
3PH, 31.5a & 2A LC	5							
3PH, CT	6							

Figure 28 - AMI meter refurbishment OPEX

Meter	Category	2020	2021	2022	2023	2024	2025	2026
1PH,1E, NLC	1							
1PH,1E, LC	2							
1PH,2E, LC	3							
3PH, NLC	4							
3PH, 31.5a & 2A LC	5							
3PH, CT	6							
OPEX totals		**$34,671**	**$24,650**	**$23,495**	**$23,872**	**$26,889**	**$27,656**	**$27,534**

5.2.1.2 Meter disposal

Figure 29 - Meter disposal quantities

Meter	Category	2020	2021	2022	2023	2024	2025	2026
1PH,1E, NLC	1							
1PH,1E, LC	2							
1PH,2E, LC	3							
3PH, NLC	4							
3PH, 31.5a & 2A LC	5							
3PH, CT	6							

Figure 30 - Meter disposal OPEX

Meter	Category	2020	2021	2022	2023	2024	2025	2026

1PH,1E, NLC	1							
1PH,1E, LC	2							
1PH,2E, LC	3							
3PH, NLC	4							
3PH, 31.5a & 2A LC	5							
3PH, CT	6							
OPEX totals		**$85,049**	**$87,881**	**$85,285**	**$84,105**	**$84,901**	**$86,435**	**$86,052**

5.2.1.3 Cross boundary HV metering

JEN is responsible to fund the cross-boundary HV metering installations as part of its standard control services[6]. However, JEN is not an accredited metering provider / coordinator for such installations. Approved metering providers and metering coordinators (responsible for maintenance & technical compliance of these installations) are appointed for these installations as per AEMO prescribed process.

Figure 31 - Cross-boundary HV metering quantities

Asset	Type	2020	2021	2022	2023	2024	2025	2026
Meter (EDMI, Mk6)	Type 2							
HV CT	Class 0.5							
HV VT	Class 0.5							

Figure 32 - Cross boundary HV metering OPEX

Asset	2020	2021	2022	2023	2024	2025	2026
Meter (EDMI, Mk6)[7]							
HV CT&VT 10-yearly testing							
Totals	**$121,100**	**$86,100**	**$73,500**	**$73,500**	**$87,600**	**$73,500**	**$73,500**

[6] AER, *Final framework and approach for the Victorian electricity distributors, Regulatory control period commencing 1 January 2021*, January 2019

5.2.2 POWER QUALITY METERS

Figure 33 – Zone substation PQM 8 yearly inspection and test

Zone substations	Timeframe	Quantity	OPEX
[redacted]	2022	[redacted]	$24,000

**NB: Zone substation PQMs were replaced in 2019. Hence no inspection is required in this period*

Figure 34 – End of feeder PQM 8 yearly inspection and test

Feeders	Timeframe	Quantity	OPEX
[redacted]	2024	[redacted]	$4,800

**NB: EDMI meters will be replaced with ION meters in 2021. Hence no inspection is required for these meters in this period*

6 GLOSSARY

6.1 ZONE SUBSTATION ABBREVIATIONS

Substation	Suburb
AW	Airport West
BD	Coolaroo
BMS	Broadmeadows
BY	Maidstone
CN	Coburg Nth
COO	Coolaroo
CS	Coburg Nth
EP	Preston
EPN	Preston
ES	Essendon
FE	Yarraville
FF	Fairfield
FT	Flemington
FW	Yarraville
HB	Heidelberg
MAT	Melbourne Airport[11]
NEI	Heidelberg West[11]
NH	Macleod
NS	Essendon
NT	Newport
PTN	Preston[12]
PV	Pascoe Vale
SBY	Sunbury
SHM	Sydenham
SSS	Somerton[11]
ST	Somerton
TH	Tottenham
TMA	Tullamarine
VCO	Coolaroo[11]
YVE	Yarraville

[11] Customer substations instead of zone substations
[12] Preston completion is expected in the first half of 2020

6.2 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
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
EDPR	Electricity Distribution Price Review
ENA	Energy Networks Association
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)
JCAR	Jemena Compliance & Risk System
JEN	Jemena Electricity Networks (Vic) Ltd
JSAP	Jemena SAP
KPI	Key Performance Indicator
kV	kilovolt
KVAR	kilo-Amps-Volts-Reactive
KW	kilowatt
LCD	Liquid Crystal Display
LV	Low Voltage
MAMS	Metering Asset Management Strategy
MDM	Meter Data Management
MTBF	Mean Time Between Failure
MW	Megwatt
NER	National Electricity Regulator
NIC	Network Interface Card
NMS	Network Management Systems
PQCA	Power Quality Compliance Audit
PQM	Power Quality Meter

RAM	Random Access Memory
RIN	Regulatory Information Notice
ROM	Read Only Memory
RTS	Real Time System
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

6.3 TERMS AND DEFINITIONS

capital expenditure (CAPEX)	Expenditure to buy fixed assets or to add to the value of existing fixed assets to create future benefits.
operating expenditure (OPEX)	Expenditure (ongoing) for running a product, business, or system.
Asset	Refers to the collection of tangible and non-tangible assets required to provide a product or service to its customers. Jemena consists of the following Assets: Jemena Electricity Network (JEN), Jemena Gas Network (JGN), Queensland Gas Pipeline (QGP), Eastern Gas Pipeline (EGP), Colongra Gas Pipeline (CGP), ActewAGL and Northern Gas Pipeline (NGP).
Asset Class	A separation of the Assets into smaller manageable components that enable decision-making relating to implementing broader strategies in a meaningful way. Example is Energy Distribution.
Asset Management Plan (AMP)	The Asset Management Plan provides the optimised plan to manage the assets, understanding the existing and future customer requirements and operating environments, balancing the competing requirements of financial constraints, commercial & business objectives, regulatory requirements, and asset condition (including risk/opportunities). It informs the 7 year operational and capital expenditure and the two-year plan of work.
Asset Management Policy	A short statement that sets out the principles by which Jemena intends to apply asset management to achieve its objectives.
Sub-asset Class	A separation of an asset class into smaller manageable components that enable decision-making relating to implementing broader strategies in a meaningful way. Example is Poles.
Sub-asset Class Element	A further separation of an sub asset class into smaller manageable components that enable decision-making relating to implementing broader strategies in a meaningful way. An example is a Boric Acid Fuse.

7 APPENDICES

7.1 APPENDIX A - ASSET OBJECTIVES KPI ALIGNMENT (3 PAGES)

Business objective and targets (by 2025)	ABS policy directives	ACS objectives and KPIs	Strategy to deliver objectives	Performance assessment
Safety top quartile industry safety performance	▪ Never compromising employees', contractors' and the public's safety; ▪ Apply the Jemena risk management approach; and ▪ Facilitate continual improvement in asset safety and performance.	Meet network service levels including safety indicators (annually) ▪ No death or injury[13] to a person (Alert Level: death or injury > 0) ▪ No significant disruption[14] to the community (Alert Level: major disruption > 0) ▪ Secondary Plant initiated fires (Alert Level: ZONE SUBSTATION fires > 0) ▪ Maintain public safety by maintaining ZONE SUBSTATION physical security, visibility and warnings to public	▪ For all assets in the asset class: ▪ Asset Inspection, condition monitoring and maintenance ▪ Asset replacement programs ▪ For specific assets: ▪ Provide adequate protection for JEN assets ▪ Protection & Control Online Monitoring	ACS objectives and KPIs are supported through establishment of **Polices and plans** ▪ Incident Investigation Process ▪ Electricity Safety Management Scheme (ESMS) **Analysis and reporting** ▪ Asset performance monitoring ▪ RIN reporting ▪ ESV reporting ▪ Incident investigation reporting ▪ ESMS reporting ▪ OHS&E reporting ▪ Field auditing ▪ ESV audit reports ▪ Budget reporting **Performance review committees** ▪ Asset performance monitoring ▪ ESMS management ▪ OHS&E These policies, plans, reports and committees are used to assess the performance of the asset to support the delivery of the ACS Objectives and KPIs.
	▪ Comply with applicable law, regulations, codes and reporting requirements at all times	▪ Comply with Electricity Distribution Code ▪ Comply with NER requirement ▪ Leverage F-factor scheme	▪ Management commitment for Jemena to meet all legal and regulatory obligations ▪ Establishment of ESMS	

[13] Injury to a person means bodily harm requiring or appearing likely to require medical attention

[14] Any event that: (i) qualifies for exemption under "S" factor scheme or (ii) results in supply interruption that has significant media interest or (iii) asset failure resulting in significant disruption to vehicle or public transport traffic or (iv) results in interruption to 50,000 customers or 100 MW due to an outage event.

Business objective and targets (by 2025)	ABS policy directives	ACS objectives and KPIs	Strategy to deliver objectives	Performance assessment
		▪ Meet all of JEN's statutory obligations required under the Electricity Safety Act 1998 ▪ ESMS regulation	▪ Audit and compliance programs ▪ Report any serious and other incidents according to the ESV reporting guidelines	
Performance Cost at or below regulatory allowance	Achieve annual targets for Customer reliability/responsiveness: 1. Unplanned System Average Interruption Duration Index 2. Unplanned System Average Interruption Frequency Index 3. Unplanned Momentary Average Interruption Frequency	▪ Maintain network SAIDI, SAIFI, MAIFI annual targets (monitor monthly performance reports for asset failures) ▪ Maintain the time taken to respond to faults/incidents (Average Dispatch Time, Average Onsite Time) ▪ Complete incident investigations within 20 business days ▪ Complete all scheduled asset inspection and maintenance plans within documented intervals ▪ Review Electricity Secondary Plant ACS at least every 3 years	▪ Identification and timely replacement of end-of-life secondary plant assets ▪ Monthly performance monitoring ▪ Incident investigations and follow up actions to improve performance of secondary plant assets ▪ Deliver secondary plant asset replacement program in line with the budget ▪ Deliver secondary plant asset inspection, condition monitoring, checking & testing programs as per sub-class strategies	
	▪ Ensure capital program for each Jemena asset is within budget while also delivering planned or equivalent scope of work	▪ Successfully deliver asset replacement and/or reinforcement (as applicable) program ▪ Deliver asset replacement programs to agreed budget	▪ Jemena portfolio management ▪ Annual review of projects to be included in COWP ▪ Business case approval process	
Customer Cost per customer trending downward,	▪ Incorporate Customer expectations and outcomes into our Asset Management plans and documents	▪ Meet all above mentioned safety and performance measures	▪ Attendance at customer forums to obtain feedback ▪ Review and consideration of	In addition to the above, ACS objectives and KPIs are supported through establishment of ▪ Customer Charters ▪ Customer Focus Groups

Business objective and targets (by 2025)	ABS policy directives	ACS objectives and KPIs	Strategy to deliver objectives	Performance assessment
with no deterioration in-service levels	▪ Ensure Customer service levels and customer obligations are met	▪ Engage with customer focus groups ▪ Perform Regulatory Investment Tests for Electricity Primary Plant Investment (RIT-D) ▪ Review equipment and design specification to improve procurement options to reduce asset life cycle costs	RIT-D submissions ▪ Review of relevant design, testing and commissioning standards within documented intervals	▪ Regulatory Investment Tests ▪ Customer Relations Team
Growth Additional growth value created over base business	▪ Support business development projects	▪ Procure, build, maintain and dispose of, any new assets required due to growth, in accordance with this ACS	▪ Project Management Methodology ▪ Demand forecasting and Customer Initiated Capital (CIC) forecasting methodologies	ACS objectives and KPIs are supported through establishment of ▪ Timely delivery of customer projects and network augmentations ▪ Meeting budget requirements ○ Budget reporting ○ Jemena Portfolio Management Governance
People Employee engagement performance	▪ Improve the linkage of people development activity to succession planning needs and skills gaps in Asset Management	▪ Identify people development opportunities to address any skill gaps in Asset Management ▪ Promote continual improvement initiatives through training, knowledge sharing and mentoring	▪ Employee engagement surveys ▪ Employees are encouraged to contribute to development of improvement initiatives (forums, management updates etc.) ▪ Performance Management and Development Plans ▪ Secondments and rotation opportunities ▪ Training and development programs and courses ▪ Succession Planning	ACS objectives and KPIs are supported through review of ▪ Employee Engagement Survey Results ▪ Performance reviews occur bi-annually including regular management feedback

7.2 APPENDIX B – JEN OWNED METERS BY CATEGORY AND SUB-CATEGORY (2 PAGES)

Category	Connection type	Current	Voltage	Manufacturer/product name	NIC hardware version	Product code
1	1ph, 2 wire / Direct Connect (single phase, single element)	I_b- 15 A I_{max}-100 A	240V50Hz	i-Credit 500 (SECURE)	224 224 324	E1E100-021 E1E100-031* E1E100-048†
				U1300 (Landis & Gyr)	422	U1310DSG2NBN001JEM
2	1ph, 2 wire / Direct Connect (single phase, single element, with 31.5A load control)	I_b- 15 A I_{max}-100 A	240V50Hz	i-Credit 500 (SECURE)	224 224 324	E1E100-022 E1E100-032* E1E100-049†
				U1300	422	U1315DSG2NBN001JEM
3	1ph, 2 wire / Direct Connect (single phase, two element, with 31.5A load control)	I_b- 10 A I_{max}-100 A	240V50Hz	i-Credit 500 (SECURE)	224 324	E1E102-042* E1E102-050†
				U1300	422	U1325DSG2NBN001JEM
4	3ph, 4 wire / Direct Connect (3 phases with no load control)	I_b- 15 A I_{max}-100 A	415 V 50Hz	Sprint 200 (SECURE)	224 224 324	SPD100-027 SPD100-034* SPD100-047†
				U3400	422	U3400DSGNNBS001JEM
5a	3ph, 4 wire / Direct Connect (3 phases with 31.5A load control)	I_b- 15 A I_{max}-100 A	415 V 50Hz	Sprint 200 (SECURE)	224 224 324	SPD100-028 SPD100-035* SPD100-048†
				U3400	422	U3401DSGNNBS001JEM
5b	3ph, 4 wire / Direct Connect (3 phases with 31.5A and 2A load control)	I_b- 15 A I_{max}-100 A	415 V 50Hz	Sprint 200 (SECURE)	224 224 324	SPD100-029 SPD100-036* SPD100-049†
6a	3ph, 4 wire Low Voltage Transformer Connect (3 phase CT connect)	I_n- 5A I_{max}- 15A	415 V 50Hz	Premier 200 (SECURE)	224 324	P3T5B0-FHL P3T5B0-FHN†
				U3350	422	U3351NSGNNNN001JEM
6b	3ph, 3 wire High Voltage Transformer Connect (3 phase CT connect and VT connect)	I_n- 5A I_{max}- 15A	110 V 50Hz	Premier 200 (SECURE)	224	P3V5B0-FIL
ZSS Type 2-4	3ph, 3 wire High Voltage Transformer Connect Meter (3 phase CT and VT connect for ZSS cross	I_n- 5A I_{max}- 15A	EDMI Mk6	5-15A	110V	N/A

	boundary metering)					

* Note due to the introduction of an enhanced power supply used in new meters to improve 'last gasp' performance required new product codes to permit differentiation between meters with the standard power, and the enhanced power supply. Thus product codes have been changed to reflect the variation by replacing the 2nd least significant digit, "2" with a "3". Hence Meter Cat 1 with the enhanced power supply is marked with product code E1E100-031. (Only applies to DC meter variants from SECURE)

†These product codes have been introduced to reflect the change from NIC 224 to NIC 324.

Notes

- JEN's non AMI Type 5 & 6 meters are not included in the table
- AMI meters incorporate a SSN communication interface. This interface is maintained as part of the SCADA & RTS communication system

7.3 APPENDIX C – METERING COMPLIANCE RISKS (2 PAGES)

Compliance reference	Requirement	Risk
DPI MFS	Meter Categories Minimum Function & Performance	Functional & Performance requirements are not met
NER S7.2.6.1(f)(1)	Metrology Procedure Part A. 2.4.4 Compliance to Standards	Purchase of new meter model or type without with pattern approval
NER S7.2.6.1(f)(2)	Meter Pattern Approval	Purchase of new meter model or type without pattern approval
NER S7.2.6.1(g)	Transformer Pattern Approval	Purchase of CT's and VT's without pattern approval
Metrology Procedure Part A 2.4.1	Standards compliance: For type 1, 2, 3, 4 & 5 metering installations; AS 62052.11, AS 62053.21 & AS 62053.22. For type 6; AS 1284.1, AS 62053.21 & AS 62052.11.	Purchase of non-compliant meters
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 7.3.1	The metering coordinator must ensure that the equipment comprised in a purchased metering installation has been tested to the required class accuracy set out in Table S7.3.1 of the NER. The metering coordinator should retain the appropriate test certificates.	Testing is not complete Certificates are lost
	Refer to installation requirements	New connection rates Contestability Unexpected failures Vendor delivery delays
NER 7.2.3	The Market Participant must request an offer from the LNSP with standard terms and conditions to act as the metering coordinator for any type 5-7 metering installations.	Non Compliance - Jemena fails to respond back to the Market Participant within 15 working days
NER 7.2.3	The metering coordinator must provide AEMO with the NMI for the metering installation within 10 business days of entry into a connection agreement with the Market Participants	Non-compliance - Jemena fails to provide AEMO the new NMI number.
NER 7.3.1	The metering coordinator must ensure that the equipment comprised in a purchased metering installation has been tested to the required class accuracy set out in Table S7.3.1 of the NER. The metering coordinator should retain the appropriate test certificates.	No test results provided by Secure.

Compliance reference	Requirement	Risk
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 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.
SIR 8.8	According to the Victorian Service Installation Rules, the maximum current rating of direct connected meters is 100A per phase. Where the maximum demand of electrical installations cannot be limited accordingly, CT metering shall be required.	Inaccurate result- Meter accuracy will deteriorate once the load current is over 100A. Site Safety- The maximum current rating for an AMI meter is 100A. Going above the threshold is a risk for the entire site.

7.4 APPENDIX D – POWER QUALITY METERS PER ZONE SUBSTATION AND END OF FEEDER DISTRIBUTION TRANSFORMER (3 PAGES)

Figure 35 - PQM model and communication method by zone substation

Zone substation	Node name	PQM model	Communication method	VT location
Airport West (AW)	AW_1	ION 7650	Ethernet	22kV Bus
	AW_3	ION 7650	Ethernet	22kV Bus
Broadmeadows (BD)	BD_2	ION7650	Ethernet	22kV Bus
	BD_3	ION 7650	Ethernet	22kV Bus
Broadmeadows South (BMS)	BMS_12	ION 7650	Ethernet	22kV Bus
Braybrook (BY)	BY	ION 7650	Ethernet	22kV Bus
Coburg North (CN)	CN_1	ION 7650	Ethernet	22kV Bus
	CN_23	ION 7650	Ethernet	22kV Bus
Coolaroo (COO)	COO_12	ION 7650	Ethernet	22kV Bus
Coburg South (CS)	CS	ION 7650	Ethernet	22kV Bus
East Preston (EP)	EP	ION 7650	Ethernet	6.6kV Bus
East Preston New (EPN)	EPN	ION 7650	Ethernet	22kV Bus
Essendon (ES)	ES	ION 7650	Ethernet	11kV Bus
Footscray East (FE)	FE	BMI 8010	Dial-Up Modem	22kV Bus
Fairfield (FF)	FF	ION 7650	Ethernet	6.6kV Bus
Flemington (FT)	FT	ION 7650	Ethernet	11kV Bus
FW (Footscray West)	FW	ION 7650	Ethernet	22kV Bus
HB (Heidelberg)	HB	ION 7650	Ethernet	11kV Bus
NH (North Heidelberg)	NH_123	ION 7650	Ethernet	22kV Bus
NS (North Essendon)	NS	ION 7650	Ethernet	11kV Bus
NT (Newport)	NT	ION 7650	Ethernet	22kV Bus
PV (Pascoe Vale)	PV_12	ION 7650	Ethernet	11kV Bus
	PV_3	ION 7650	Ethernet	11kV Bus
SBY (Sunbury)	SBY	ION 7650	Ethernet	22kV Bus

SHM (Sydenham)	SHM	ION 7650	Ethernet	22kV Bus
SHM (Sydenham)	SHM REFCL	ION 7650	Ethernet	22kV Bus
ST (Somerton)	ST	ION 7650	Ethernet	22kV Bus
TH (Tottenham)	TH	ION 7650	Ethernet	22kV Bus
TMA (Tullamurraine)	TMA	ION 7650	Ethernet	22kV Bus
YVE (Yarraville)	YVE_12	ION 7650	Ethernet	22kV Bus
	YVE_4	ION 7650	Ethernet	22kV Bus

Figure 36 - PQM model and communication method by end of feeder distribution transformer

End of feeder	PQM model	Communication method	Distribution transformer location	Voltage
AW11	EDMI MK6	IP modem over Telstra NEXT-G network	Tulla-Park Prima	22kV/415V
BD10	EDMI MK6	IP modem over Telstra NEXT-G network	Dimboola TAFE Co.	22kV/415V
BMS23	ION 7400	IP modem over Telstra 3G network	Johnstone-Bamburgh	22kV/415V
BY14	EDMI MK6	IP modem over Telstra NEXT-G network	Wood-Raglan	22kV/415V
CN5	EDMI MK6	IP modem over Telstra NEXT-G network	Bakers Audrey	22kV/415V
COO21	EDMI MK6	IP modem over Telstra NEXT-G network	Barrymore-Lamark	22kV/415V
CS2	EDMI MK6	IP modem over Telstra NEXT-G network	Attercliff-Sussex	22kV/415V
EP16	EDMI MK6	IP modem over Telstra NEXT-G network	Reserve-Huntsman	6.6kV/415V
EPN34	ION 7400	IP modem over Telstra 3G network	Sheehan40-Northern	22kV/415V
ES22	EDMI MK6	IP modem over Telstra NEXT-G network	Anderson-Monash	11kV/415V
FE6	EDMI MK6	IP modem over Telstra NEXT-G network	Vic-University No.1	22kV/415V

FF89	EDMI MK6	IP modem over Telstra NEXT-G network	Yarrabend-Fairfield Institute	6.6kV/415V
FT9	EDMI MK6	IP modem over Telstra NEXT-G network	Bank-MtAlexander	11kV/415V
FW9	EDMI MK6	IP modem over Telstra NEXT-G network	Ashley-CentWest1	22kV/415V
HB15	EDMI MK6	IP modem over Telstra NEXT-G network	Russell-Pine	11kV/415V
NH9	EDMI MK6	IP modem over Telstra NEXT-G network	Waterdale-Crissane	22kV/415V
NS9	EDMI MK6	IP modem over Telstra NEXT-G network	Dean-MtAlexander	22kV/415V
NT15	EDMI MK6	IP modem over Telstra NEXT-G network	Breakwater - Pier	22kV/415V
PV24	EDMI MK6	IP modem over Telstra NEXT-G network	BoxForest-Yooralla	11kV/415V
SBY31	EDMI MK6	IP modem over Telstra NEXT-G network	Evans-Brook	22kV/415V
SHM14	EDMI MK6	IP modem over Telstra NEXT-G network	Gourlay-Grevilla	22kV/415V
ST34	EDMI MK6	IP modem over Telstra NEXT-G network	Northbourne 202-Ainslie	22kV/415V
TH12	EDMI MK6	IP modem over Telstra NEXT-G network	Quarry-Sunshine	22kV/415V
TMA14	ION 7400	IP modem over Telstra 3G network	Annadale-Willoware	22kV/415V
YVE15	EDMI MK6	IP modem over Telstra NEXT-G network	Rosemond-HighpointMyer2	22kV/415V

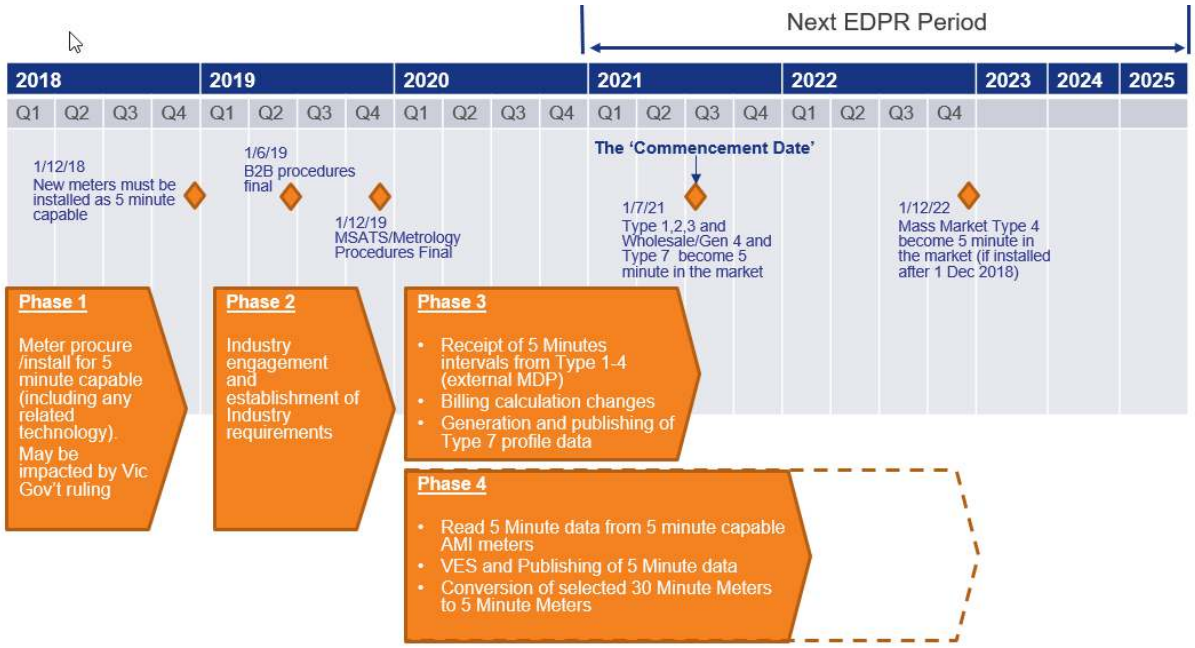
7.5 APPENDIX E – MARKET RULES: 5-MINUTE SETTLEMENT NOTES (3 PAGES)

Overview

On 28 Nov 2017, the AEMC made a final rule change to align dispatch and financial settlement of the wholesale electricity market in five-minute intervals. The spot price will therefore be determined for each five-minute trading interval instead of the time-weighted averaging of dispatch prices across a 30-minute interval. This change requires significant efforts from Jemena to update its system and processes, ensuring Jemena's ability to meet new obligations.

The AEMC have mandated the following key compliance dates, by which specific regulatory requirements must be met (refer below). Jemena have reviewed these and proposed a program of work, split into the following phases

Figure 37 – 5-minute Settlement Program



Program Phases & Costs

The AEMC have mandated the following key compliance dates, by which specific regulatory requirements must be met (refer below). Jemena have reviewed these and propose a program of work, split into the following phases

- ***Phase 1: 5 Min Capable Meters by 1 Dec 2018***

  From 1 December 2018, all new or replacement metering—including JEN's AMI metering fleet—installations must be capable of recording and providing five-minute data (Rule 11.103.4).

  During 2018, to support the installation of new meters, Jemena tendered for, tested and implemented a new variant of AMI meters.

- ***Phase 2: Amend Procedures and Document Requirements for 5MS Implementation***

  From July 2021, AEMO is required to convert (profile) the metering data into five-minute trading interval data where metering installations do not provide five-minute metering data (Rule Clause

7.16.3). AEMO was tasked with review and amendment of metrology procedures by 1 December 2019, which has now been completed.

- ***Phases 3 & 4: Implement System changes and Market Testing***

All new or replaced AMI meters (installed since 1 Dec 2018), will need to record and provide five-minute data no earlier than 1 July 2021 and no later than 1 December 2022 (Rule 11.103.5). Additionally, Jemena will need to bill upon receipt of 5 minute meter data from Type 1,2,3 & wholesale 4 meters; and generate and publish Type 7 meter data in five-minute intervals from 1 July 2021.

Phase 1 Objectives

- Meter Tender

  Issue a tender for provision of new AMI meters that meet the current Victorian AMI-OIC and are capable of recording, storing and providing 5 minute interval data. Jemena's pre-existing AMI meter fleet was not capable of providing 5 minutes interval data and the timeframes required to tender for alternative meters required immediate action by the business.

  These activities and resources are categorised as Enterprise OPEX costs.
- Meter Testing

  In order to technically evaluate responses to the meter tender, the AMI Meter Testing team documented a test plan to a) ascertain that the meters are five-minute capable, and b) are compatible with our current AMI solution (Silver Springs Network).

  These activities and resources are categorised as Enterprise OPEX costs.
- IT Detailed Design, Project Plan and Business Case

  Regardless of which AMI meter would have been selected, a new variant of meter required to be configured in Jemena's Metering systems (SSN UIQ, Itron, SAP ISU, WebMethods, MSI and AMI DW). The business requirements and Detailed Design for the changes to Jemena's Metering systems has been documented.

  A Project Plan and Business Case has been developed to procure, test and install new AMI meters and achieve compliance for 1 December 2018. This includes: meter testing of the selected meter vendor, award of the meter tender, purchase and receipt of initial meter equipment, field readiness and training activities, and implementation of changes to JEN Metering systems.

  These activities and resources are categorised as Enterprise IT CAPEX costs.

Phase 2 Objectives

This phase is responsible for engaging with AEMO and the rest of the market to develop the requirements to implement 5 Minute Settlement and Global Settlement by July 2021. The project will allow Jemena to influence the way 5 Minute Settlement is implemented and will document the requirements for change to processes, systems and assets to support the introduction of 5 minute settlement.

The primary benefits will be:

- Ability to influence the way 5 minute settlement is implemented in the National Energy Market;
  2. Early visibility of the requirements for change to inform cost estimates for the implementation phase of 5 Minute Settlement and the EDPR submission; and
  3. High level designs and impact assessments to properly scope the next phase of the project currently planned to commence in 2020 and to identify any dependencies on our software vendors to implement the changes.

Phase 3 & 4 Objectives

Phase 3 and 4 of 5MS is currently planned to commence in 2020. These phases are likely to be run in parallel and will involve making the necessary changes to Jemena systems, processes and assets to prepare for the introduction of 5 MS in July 2021. It will involve a period of industry testing commencing November 2020 and reaccreditation before July 2021 of our MDP, MPB & RP if required.