Jemena Electricity Networks (Vic) Ltd

JEN – RIN – 4.6.1 – Inspection of Metering Installations – Business Case – 20250131 – Public

Owning Functional Area

Business Function Owner:	Asset and Operations - Electricity

PREFACE

This business case intends to provide self-supportive, rigorous documentation to substantiate the need and prudency of investments for both Jemena Electricity Networks (Vic) Ltd. and its customers. The business case should assist in determining the strengths and weaknesses of a proposal, in comparison with its alternatives, systematically and objectively. The business case seeks endorsement and funding for the project from the appropriate Jemena Electricity Networks (Vic) Ltd. stakeholders and approval from the relevant delegated financial authority.

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ABBREVIATIONS

ACS	Alternative Control Service
AEMO	Australian Energy Market Operator
AIMRO	Advanced Interval Meter Rollout
AMI	Advanced Metering Infrastructure – includes smart meters, communications and backend systems to manage it
AMI NICs	AMI Network Interface Card for smart meters to connect to AMI communication systems
AMP	Asset Management Policy
BAU	Business as usual
DNSPs	Distribution Network Service Providers
ECMCoP	Electricity Customer Metering Code of Practice
EDCoP	Electricity Distribution Code of Practice
MAMS	Metering Asset Management Strategy
MDP	Meter data provider
NEO	National Electricity Objective
NER	National Electricity Rules
NST	Neutral Integrity Test
RFT	Request for tender
SIR or VSIR	Victorian Service and Installation Rules
VESI	Victorian Electricity Supply Industry

1. EXECUTIVE SUMMARY

1.1 BUSINESS NEED

The main business need addressed by this Business Case is to ensure that Jemena Electricity Networks (Vic) Ltd (JEN) can fulfil its obligations under the National Electricity Rules (NER), acts in accordance with the Australian Energy Market Operator's (AEMO's) relevant guidelines and JEN's AEMO-approved metering asset management strategy (MAMS) when managing its metering assets.

JEN is required to provide complaint and safe metering services for its customers. Providing smart meters and metering services for small-customer connections is a core market obligation of all Victorian distribution network service providers (DNSPs). The Victorian Electricity Distribution Code of Practice (EDCoP) and NER oblige JEN to assure the accuracy and the safety of all its metering installations, as per the AEMO metrology procedures and guidelines, which include requirements for inspection and testing of metering installations in accordance with JEN's MAMS.

In 2009, JEN embarked on mass replacement of its legacy meters, following the Victorian government's mandate for the Advanced Interval Meter Roll Out (AIMRO) and replaced over 98% of its legacy meters with Australia's first generation of smart meters. The mandated rollout program provided JEN an opportunity to inspect each installation and rectify any identified issues, fulfilling JEN's NER requirements for prescribed inspections at that time. Since then, JEN has relied on the remote monitoring features of its smart meters to assure the integrity and correct operation of its metering services; meter installation inspections were only performed as part of meter tests, which JEN conducts on a small sample of meters.

1.1.1 THE NEED FOR METERING INSTALLATION INSPECTIONS

In response to growing concerns over the safety and integrity of the metering installations following the proliferation of smart meters and increased reliance on "remote monitoring" by an increased number of metering providers (especially following the introduction of the metering competition rule change), AEMO rearticulated its view on the importance of physical inspections for achieving compliance with the NER; and that the metering installation inspections conducted remotely or conducted as part of meter tests would not be sufficient for compliance with NER and AEMO meteorology procedures.

The Position Paper: Whole Current Meter Testing and Inspection, October 2019 states that "AEMO does not consider an inspection practice based solely on remote monitoring will meet the intent of NER Schedule 7.6." In the same paper, AEMO also states that the practice of inspecting metering installations during meter tests can only be used when the entire population of meters are tested (e.g. using a time-based testing approach), not in conjunction with statistical-based testing, where only a small sample of meters are tested, as is the preferred (most cost-efficient approached) used by JEN.

Physical inspections can uncover safety, integrity and compliance issues for metering installations that would not be discovered using remote monitoring functions of existing smart meters. Hence, to assure the safety of JEN's customer metering installations to achieve compliance with the above-stated requirements, in line with JEN's current MAMS submitted to AEMO on 13 September 2024, there is an obligation to establish an inspection program for all JEN customer metering installations that have not been inspected in 15 years since their commissioning.

A consequence of the accelerated AMI rollout between 2009 and 2013 is that the scale of this required end of the design life meter inspection program is unprecedented for JEN. Given the significant expense of this compliance-driven program, this business case also investigates options to prudently co-optimise the necessary site inspections with a level of proactive and reactive (whilst already on site in the field) AMI meter replacements.

1.1.2 THE NEED FOR PROACTIVE CONDITION-BASED REPLACEMENT OF EXISTING AMI METERS

JEN's current generation of AMI meters (mostly installed between 2009 and 2013) were designed for a 15-year operational life (with a manufacturer's warranty of 5 years). Depending on the conditions of operation (including the type and position of the metering box, exposure to sunlight, and local humidity), the operational life will vary somewhat for each meter around that 15-year point.

It is recognised[1] that the semiconductor-based electronic equipment has a shorter life than conventional electromechanical meters, with more abrupt failure modes (works well until total failure, unlike conventional meters that gradually lose accuracy), factors contributing to this include that:

- The lithium-ion battery installed inside every smart meter is non-rechargeable and designed for 15-year service life under "normal supply" operation. However, the life of the meter battery is significantly reduced by the "off supply" time, the ambient temperature of the meter surroundings.
- It is not uncommon that meters installed inside a metal meter box under direct sunlight will be subjected to operating temperatures in excess of 60-70ºC. High ambient temperature also affects many other semiconductor components in the meters.
- The memory chips used in AMI meters are designed for a finite number of write/read cycles, which presents a further concern about the possibility of correlated failures of meters deployed in the same year.
- Correlated failure risk is further compounded by the fact that all AMI meters in Victoria are produced by the same two manufacturers and were installed within the same timeframe.

The communication module of the AMI meters uses AMI mesh Network Interface cards (AMI NICs) across all AMI meters in Victoria, which is also (separately) designed for an expected 15-year service life.

The risk of concurrent meter failures and excessive costs of replacing the meters under such scenarios is significant. JEN (and the Victorian industry) is not well positioned to be agile in mounting large meter replacement programs in response to concurrent failure of large numbers of meters (e.g. meter family failures). Moreover, the prescribed replacement timeframes for meters that do fail are much more onerous,[2] and therefore costly, than where replacements are proactively managed in an orderly fashion.

The meters and AMI NICs are long inventory procurement lead items with a relatively short (5-year) manufacturer's warranty. JEN's recent experience shows the current lead time is up to 12 months[3] and suppliers require advance forecast for their production capacity planning.

To mitigate these risks and enable efficient replacement of the AMI meters installed en-masse during the 2009-2013 period, a total cost of ownership and condition-driven meter replacement program is proposed. The program is, in effect, an enhancement of the required metering installation inspection program, where meters that are found to be in poor state are proactively replaced in lieu of inspections during the inspection process.

1.2 RECOMMENDATION

Based on the analysis provided in this paper, asset management recommends Option 2, as detailed in this document. This option involves a balanced mix of proactive condition-driven replacements for a portion of meters

[1] The Ontario Auditor General, in its report on Ontario's smart meter initiative, found a 15-year service life estimate for meters is likely overly optimistic given technological obsolescence considerations. Auditor General of Ontario, 2014 Annual Report of the Auditor General of Ontario, 2014, p. 391.

[2] Under NER 7.8.10(a)(3) JEN must replace a failed meter within 10 business days of the failure being detected or reported.

[3] As advised by JEN's current vendor.

that have surpassed their design life of 15 years delivered concurrently with JEN's program for NER-prescribed inspections for other meters remaining in operation beyond their design life.

This option allows JEN to:

a) fulfil its meter inspection obligations

b) mitigate the risk of meter family failures while extending the operational life of the existing meters beyond their design life through enhanced inspections during 2026-2031)

c) ensure the safe and compliant performance of JEN metering assets at the lowest cost.

1.3 REGULATORY CONSIDERATIONS

The option recommended in this business case will ensure that JEN remains compliant with its obligations relating to the provision of NER-compliant metering and inspections of metering installations.

Providing smart meters and metering services for small-customer connections is a core market obligation of all Victorian DNSPs. The Victorian Electricity Distribution Code of Practice (EDCoP) and the NER oblige JEN to assure the accuracy and the safety of all its metering installations, as per the AEMO metrology procedures and guidelines, which include requirements for inspecting and testing metering installations.

1.4 PROJECT DELIVERY APPROACH

JEN will deliver this project through its approved project delivery methodology to ensure the program is delivered efficiently and safely.

This project is an end-to-end delivery that includes customer communications and management, logistics and material management, site installations and market system updates, asset management system updates, works closure, and asset disposal.

1.5 FINANCIAL INFORMATION

1.5.1 FORECAST EXPENDITURE AND BUDGET SUMMARY

This section includes a summary of forecast expenditure for the proposed.

Table 1-1: Capitalisable costs (real 2024 $M)

Cost Category	Value ($M)
Labour and Plant	31.06
Materials	31.81
IT System changes	1.30
Project Planning and Administration (replacement component)	1.57
Total Project CAPEX	**65.74**

Table 1-2: Operational costs (real 2024 $M)

Cost Category	Value ($M)
Inspections	17.00
Project Planning and Administration (inspection component)	2.45
Meter Disposal	2.37
Additional IT system licences	0.09
Total Project OPEX	**21.91**

This project is expected to be completed by June 2031. Table 1–2 provides the project budget by calendar year.

Table 1–2: Project Budget by Year

Year (FY)	Budget ($M,2024)
27	6.51
28	13.28
29	19.52
30	22.78
31	25.56
Total Budget	**87.65**

A summary of the economic evaluation of the recommended option is provided below.

Table 1-3: Economic Analysis Results Summary

Recommended option	($M,2024)
Total Project Cost	87.65

Recommended option	($M,2024)
NPV of Net Economic Benefits	1.6

1.5.2 REGULATORY ALLOWANCE VS PROJECT BUSINESS CASE VALUE

This business case relates to a forecast period for which the regulatory allowance is yet to be established via an AER revenue determination. JEN intends to include the forecast capital and operating expenditure arising from its physical inspection obligation and the chosen option in this business case within its Alternative Control Service (ACS) metering services revenue proposal for the 2026-2031 regulatory control period (next regulatory period).

2. BACKGROUND

JEN, in compliance with the Electricity Distribution Code of Practice (EDCoP) and the National Electricity Rules (NER), is obliged to ensure the accuracy and the safety of its metrology equipment. Furthermore, JEN is required to perform regular in-service meter inspections and meter testing on all its metering installations. Over 98% of JEN customer meters are semiconductor based smart meters.

JEN began replacing its fleet of old electro-mechanical meters (legacy meters) in 2009 under a series of Victorian Government Order in Councils (Vic AMI OiCs). 78% of JEN's current smart meters were installed between 2009-2013 during Victoria's mandated AIMRO program.

2.1 BUSINESS AND SOCIO-ECONOMIC CONTEXT

While the first generation of semi-conductor-based smart meters delivered significant customer benefits and convenience for Victorian consumers, compared to old electromechanical meters, they do have a significantly shorter lifespan than the mechanical accumulation meters they replaced. As with most semiconductor equipment, JEN AMI meters are expected to exhibit more binary modality of failures (e.g. working well until not working at all after a given number of memory write cycles have been made onto meter memory). Furthermore, JEN AMI smart meters are reliant on internal Li-ion batteries, whose life can be further shortened by environmental factors (e.g. ambient temperature variations).

JEN is responsible for the safety and accuracy of these meters under both national and jurisdictional obligations—including the NER, ESC's Electricity Customer Metering Code of Practice (ECMCoP)[4], Victorian Service Installation Rules (SIR)[5]. JEN is responsible for the safety and accuracy of these meters under both national and jurisdictional obligations.

2.2 ASSET RISK (OR OPPORTUNITY) ANALYSIS

2.2.1 SHORT DESCRIPTION OF THE AFFECTED JEN ASSETS

JEN manages approximately 386,000 AMI meters and (presently); and a further 4,250 legacy meters that are planned to be replaced with AMI meters before June 2026. All JEN metering assets are part of its meter-to-cash stream. The vast majority of all JEN's AMI meters (circa 300K or 78% of meters) were installed by JEN as part of the original AMI rollout between 2009 and 2014. These meters have enabled JEN to provide better services to its customers that include additional real-time safety checks, better monitoring of accuracy and integrity of the meters, real-time feedback on supply status, time-of-use tariffs, and real-time monitoring of customer consumptions. These meters and AMI technology have also enabled JEN to identify potential electricity thefts and support Victorian law enforcement agencies in their investigations of various crimes.

2.2.2 RISK ASSESSMENT

Jemena identifies and manages its risks through the OMNIA Risk and Compliance Management system in line with Jemena's Risk Management Policy. JEN Measurement Asset Class Strategy outlines the criticality of metering asset class and the key risks relating to the life cycle management of metering assets. There are significant risks of not proceeding with activities described in this business case:

1. Non-Compliance:

4 Electricity Customer Metering Code of Practice | Essential Services Commission

5 VSIR | Victorian Service and Installation Rules | Victorian Electricity Distributors (victoriansir.com.au)

a) Metering inspections are mandatory in NER; the need for these is further reiterated in AEMO meteorology procedures and guidelines[6][7][8]. Wilful non-delivery of compulsory inspections, as per the AEMO-audited Metering Asset Management plan, will risk Jemena's distribution licence and metering accreditation.

b) Not doing proactive assessments of metering installations that are beyond their nominal design life could also be viewed as wilful negligence and poor asset management practice

c) Not planning for the replacement of an estimated volume of meters that are reasonably likely to fail and compromise Jemena's ability to fulfil its performance obligations would place JEN in a position where JEN will have to pay premiums to address the malfunctions reactively (and expediently) at a later date or risk non-compliance with NER, obligations to rectify malfunctions within specified time periods, inaccurate billing, public dissatisfaction and degrade safety for JEN customers.

Refer to Appendix B for a detailed assessment.

2.3 PROJECT OBJECTIVES AND ASSESSMENT CRITERIA

2.3.1 PROJECT OBJECTIVE

Inspect JEN's metering installations that are >15 years since commissioning in accordance with JEN's MAMS obligation, and based on the assessment of its condition, replace the metering installation to ensure regulatory and market compliance with all jurisdictional and national obligations during FY26-31.

Note: individual condition assessments will be developed for each deployed meter model, taking into consideration the unique design features of the model and the empirically observed failure rate of the model. The assessment criteria will include characteristics such as (e.g. the age of the meter, degraded or faulty components, signs of exposure to heat/UV, and excessive wear and tear).

The project shall deliver:

1. Compliance with the JEN's AEMO-approved MAMS, as well as the ECMCoP, EDCoP, AEMO metrology procedures and NER
2. Enhanced customer safety at the metering box at these sites
3. Assurance of accurate customer billing
4. Better customer experience due to avoidance of unexpected failures
5. More orderly management of the expected technological obsolescence and end of life of the existing JEN smart meters.
6. Ensure JEN can continue providing effective management and monitoring of its network and customer connections.

2.3.2 REGULATORY CONSIDERATIONS

JEN's investment decisions are ultimately guided by the National Electricity Objective (**NEO**). Additionally, considerations such as the capital expenditure objectives set out in the NER (clause 6.5.7) are particularly relevant to JEN's investment decisions:

6 NER Ch 7, Schedule 7.6

7 AEMO Metrology Procedures (Part A)

8 AEMO Position Paper: Whole Current Meter Testing and Inspection, October 2019

JEN has obligations under the NER, Victorian OiCs, the Electricity Distribution Code of Practice, environmental regulations, and the SIR which cover the following:

Instrument	Description	Requirements/Risks
Victorian Government - Minimum AMI Functionality Specification Victoria	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 MC must ensure that the metering equipment purchased have a valid pattern approval.	AMI meters compliant with both NMI and Victorian metering standards are long lead order items that may not be available for larger volumes of unplanned replacements. (current lead times are circa 12 months from the time of order)
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 - JEN 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 - JEN fails to provide AEMO the new NMI number.
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 mechanisms to store and report meter data could lead to privacy breaches. JEN could incur significant legal costs if confidential customer details are not securely stored. Hence, JEN needs to have meters that are compliant with all national and jurisdictional requirements and are appropriate for the emerging cyber and technological landscape.
NER 7.8.10(a)(3)	The Metering Coordinator must, if a metering installation malfunction occurs, cause repairs to be made to the metering installation as soon as practicable but no later than 10 business days after the Metering Coordinator has been notified of the metering installation malfunction.	Requirement for 10 business day replacement of faulty meters
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	Meter data could get corrupted if the meter time clock is not synchronised

Instrument	Description	Requirements/Risks
	(+/- 20 sec) in the metrology rules for type 5-7 installation.	
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 JEN 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.
OIC	s14.3(b): “Where a distributor is the responsible person for a metering installation ….. it must install a remotely read interval meter … is operated as a remotely read interval meter” (S200-07.indd (gazette.vic.gov.au))	JEN needs reliable supply of smart meters that are compliant to jurisdictional requirements and are appropriate for use with existing systems and emerging risks
Environment Protection Act 2017/2021	Provisions for Management of Priority Industrial Waste, and General Environmental Duty	JEN needs to ensure that meters that have been removed from service are disposed of in accordance with our environmental obligations (e.g. including removal of the lithium Ion batteries from the meter). Decommissioned meter and communications assets are collected and disposed of by authorised, certified and qualified entities (e.g. Meter and Communications equipment manufacturers, their agents or subcontractors) with JEN oversights.

2.3.2.1 Meter Compliance

- Order in council, S200, 28 August 2007, s14.3(b): "Where a distributor is the responsible person for a metering installation ….. it must install a remotely read interval meter … is operated as a remotely read interval meter" (S200-07.indd (gazette.vic.gov.au))
- Chapter 7 - Metering type 4,5 and 6 metering installations compliance
- Sections 15A and 46D of the Electricity Industry Act (EIA) create the head of power under the Governor in council to make orders regarding AMI meters. This power was used to direct the installation of remotely read AMI meters in Victoria under a series of ministerial orders. The relevant orders include:
- Order in council, S263, 5 August 2014, s8: reinforces the obligation to install remotely read AMI meters and non-reversion (gazette.vic.gov.au) These orders were made in order to improve the efficiency of the electricity network, provide more accurate data for billing and other purposes, and enable new services such as time-of-use pricing. The order is in place and applicable under the Victorian derogation.

2.3.2.2 Metering Data Compliance

- The rule 11.103.4- Metering Coordinator at a connection point must ensure that all new or replacement metering installations installed from 1 December 2018 are capable of recording and providing trading interval energy data i.e. the DNSPs must ensure the meters can achieve the 5-minutes interval data recording and sending the data to the NEM

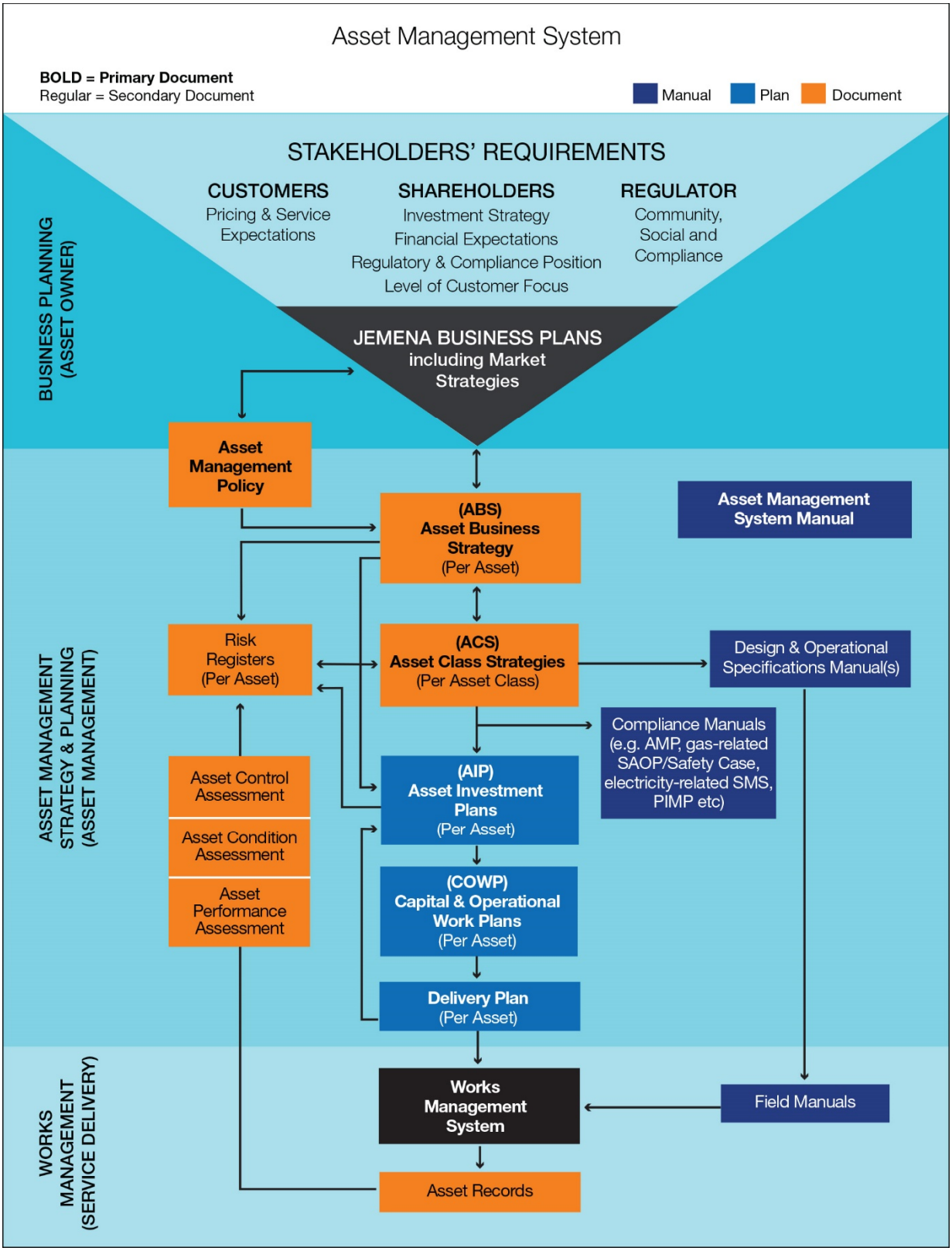
2.4 CONSISTENCY WITH JEN STRATEGY AND PLANS

This program is in line with the ISO 55001 audited strategy for managing JEN's measurement assets (JEN Measurement asset class strategy), which is based on Jemena's expertise in network and customer safety, prudent financial management and ISO 55001 accredited methodology for asset management.

Figure 1 outlines the JEN asset management system and the position of the Asset Management Policy (AMP) within it. The AMP covers the creation, maintenance, and disposal of assets, including investment planned to augment network capacity to meet increasing demand and replace degraded assets to maintain the reliability of supply and meet JEN Business Plan requirements.

This strategic framework facilitates the planning and identification of business needs that require network investment documented via business cases.

Figure 1: The JEN Asset Management System



3. CREDIBLE OPTIONS

This section discusses how credible options are identified and developed. Credible options are considered for their commercial and technical feasibility, ability to address the identified needs, deliverability, economic and financial benefits, and legal and regulatory implications.

As per the JEN obligations and Metering Asset Management Strategy submitted to AEMO, all JEN customer metering installations that have not been inspected for the last 15 years (e.g. the design life of a smart meter) shall be inspected or replaced.

3.1 IDENTIFYING OPTIONS

The following options have been considered to address the business need:

- Option 1: Achieve minimum compliance through the required age-based site inspections and only reactive replacement of faulty meters
- Option 2: Deliver the required metering inspections, enhanced with proactive replacements of the aged meters found to be in poor condition during inspection (Recommended)
- Option 3: Replace all aged meters requiring inspection and are beyond their design life

Other (non-credible) options considered include meter repairs and/or replacement of meter components in lieu of meter replacements

3.2 DEVELOPING CREDIBLE OPTIONS COSTS AND BENEFITS

Table 3-1 shows the extent to which each option addresses the identified issues. All options would address our age-based AMI meter inspection obligation.

Table 3-1: Options Analysis

Issues	Option 1	Option 2	Option 3
Issue 1 **Non-compliant metering services**	●	●	●
Issue 2 **Assure the health and safety of metering installations**	●	●	●
Issue 4 **Providing accurate billing & with minimal customer complaints**	◑	●	●
Issue 5 **Risk of unplanned failure of a large number of meters or family failures**	○	●	●
Issue 8 **Financial Viability and Cost Efficiency**	○	●	○

●	Fully addressed the issue
◑	Partially addressed the issue
○	Did not address the issue

Note: while the Option 1 may have the lowest initial costs, the costs of unplanned replacement of large quantity of meters could be significantly higher than the costs of proactive orderly replacement.

3.3 OPTIONS ANALYSIS

3.3.1 OPTION 1

Option 1 involves conducting the prescribed age-based metering inspections of every metering installations in operation, as per NER and AEMO's approved Meter Asset Management Strategy. This option will also deliver the prescribed meter accuracy tests on all deployed meters as per the NER and AEMO-approved MAMS. However, no proactive/pre-emptive replacements of meters are envisaged under this option. The replacement of meters will only be carried out reactively after the meters are reported to be faulty. That is, this option does not allow for any quantity of age-based or condition-based replacement of the existing JEN AMI meter fleet.

Given the age of JEN AMI meters and the more binary nature of failures of modern semiconductor components, this option exposes JEN to the risk of meter family failure (the event requiring immediate replacement of large quantities of meters of the same category) because the category is no longer deemed reliable by the market. Furthermore, given no proactive age and/or condition-based replacement is provided under this option, it is expected that a large volume of meters will need to be replaced reactively within the 10 day replacement obligation for reactive replacement, as meter faults are being discovered and reported.

Inherently, this option carries the risk that a large meter replacement program may need to be staged in a short period, likely at a time when other Victorian Metering Providers are experiencing the same issues with this meter category and are in the process of staging similar replacement programs. Such risks lead to significant consequences due to unplanned labour and equipment constraints, as well as managing significant lead time in manufacturing and the delivery of meters.

Option 1 delivers on the compliance aspect of the project objectives outlined in Section 2.3.1; and business needs outlined in Section 1.1. However, this option does not avoid the costs of the separately mandated (prescribed) metering installation inspections and testing for the sites that have not had their meters replaced. These activities will still need to be delivered under this option. Furthermore, it does not meet project objectives 4 and 5.

This option consists of the following activities and costs:

Cost Category	Value ($2024, M)	Type
Physical inspection of all metering installations that remain in operation beyond 15 years (as per NER, AEMO Guidelines and JEN MAMS)	27.99	OPEX
Reactive meter replacements (e.g. meters reported faulty by customers or inspectors through BAU reports & processes) – Labour	27.89	CAPEX
Reactive meter replacements (e.g. reported faulty by customers or inspectors through BAU reports & processes) – Materials	26.29	CAPEX
Disposals of removed meters / equipment	1.96	OPEX
IT System changes to support a consistent approach to executing inspections at high volume	1.30	CAPEX
Additional IT licences for high-volume transactions	0.10	OPEX
Project Planning and Administration	4.02	OPEX
total OPEX	*34.05*	
total CAPEX	*55.48*	
Total Option Cost	**89.53**	**TOTEX**

The issues and benefits of this option are listed below:

Issues:

- AMI Meters have a relatively short finite life. If not replaced proactively based on the assessed condition during the mandatory meter inspection, the meters will need to be replaced reactively at a later date
- Reactive replacements are more expensive and challenging to manage for DNSPs within mandated 10 day replacement window
- Given the nature of semiconductor technology used in current AMI meters, there is a risk of unpredicted time-correlated failures of multiple meters (e.g. due to the end of life of one common component across multiple meters when a specific number of memory write cycles is reached on the meter chips)
- Possible meter family failure has a significant risk for JEN as reactive replacement of a larger number of meters is challenging to execute, given meters are long-lead items to procure (circa 12 months wait time for un-forecasted new orders)
- Given that most AMI meters in Victoria (and 78% of JEN's smart meter fleet) were mass-rolled out during the same short 2009-2014 period, there is a likelihood that family failures, once they begin to occur, will occur across multiple DNSPs, compounding the issues of the availability of meters and labour to carry out such replacements.

Benefits:

- Lowest initial spend (no upfront CAPEX).
- Physical inspections of metering installations will still be delivered under this option, as required per NER, AEMO guidelines and JEN's AEMO-approved MAMs

3.3.2 OPTION 2

Option 2 involves providing age-based metering installation inspections (as per NER and AEMO's approved Meter Asset Management Strategy) supplemented with an additional (manufacture-specific) in-filed assessment of meter conditions to identify and replace the meters with failed components or degraded conditions (e.g. signs of excessive wear and tear, failed battery test, etc). Meter replacement (if needed) will take place at the time of inspection, addressing all incidental safety hazards and/or non-compliances found at the metering site (e.g. damaged meter enclosers, degraded conductors damaged from weather conditions to the meters and/or meter box).

All sites with replaced meters will be subject to prescribed safety tests (e.g. earth, neutral conduct/NST tests) to ensure a safe and correct connection to the network and to the customer switchboard, as per relevant regulations and VESI procedures.

Successful implementation of this option can be defined as:

1) Requirements for physical metering installation inspections are fulfilled as per NER, AEMO guidelines and JEN's AEMO-approved MAMS

2) All meters remaining in operation beyond their design life have gone through condition assessment; All meters with failed components or exhibiting signs of excessive wear and tear are identified and replaced with a new generation of smart AMI meters that is future-proofed (modular, cyber safe, delivers new convenient and safety features while allowing for longer life and easier maintenance)

3) No safety incidents to the customer or subcontractors during metering installation inspection and/or replacements

4) Minimised customer impact (e.g. reduced incidence of fault reporting), customer inconvenience

5) Effective customer communication and publicity of benefits of current generation of AMI meters

6) Delivered within the managed timeframes and optimised inspection versus replacement costs, thereby supporting the lowest total cost across both capex and opex solutions.

This option will deliver on all the project objectives (outlined in Section 2.3.1) and business needs (outlined in Section 1.1). It will ensure delivery of all required metering compliance activities and will deliver additional confidence in JEN's metering services by replacing a prudent volume of aged metering installations that are found to exhibit signs of degraded safety, likely imminent failure and/or reliability issues.

This option also allows JEN to leverage additional efficiencies and travel time savings since the proactive replacements are performed only as needed and as part of the prescribed age-based metering installation inspection program. The costs of metering installation replacements (where performed) will be capitalised and recovered over the life of the new meter, avoiding the expense of the metering installation inspection.

Given that a notable volume of meters is expected to be found requiring replacement under this option, there is an opportunity to consider a generational upgrade of AMI meters and AMI technology, delivering new features, better safety, data protection and new features to all customers.

Appendix D explains how the assumed rate of expected replacement has been developed for the purpose of this business case.

This option consist of the following activities and cost:

Cost Category	Value ($2024, M)	Type
Physical inspection of all metering installations that remain in operation beyond 15 years (as per NER, AEMO Guidelines and JEN MAMS)	17.00	OPEX
Meter replacements (e.g. condition-based planned replacements 87%, with some reactive replacements due to reported fault 13%) – Labour	31.06	CAPEX
Meter replacements (e.g. condition-based planned replacements 87%, with some reactive replacements due to reported fault 13%) – Labour	31.81	CAPEX
Disposals of removed meters / equipment	2.37	OPEX
IT systems changes to support a consistent approach to executing inspections at high volume	1.30	CAPEX
Additional IT licences for high-volume transactions	0.10	OPEX
Project Planning and Administration (physical inspections)	2.45	OPEX
Project Planning and Administration (physical inspections and reactive meter replacements)	1.57	CAPEX
total OPEX	*21.91*	
total CAPEX	*65.74*	
Total Option Cost	**87.65**	**TOTEX**

The issues and benefits of this option are listed below:

Issues:

Concerted efforts and effective customer relations and project management will be required for delivery within the set 5 year timeframe.

Benefits:

- Compliance with NER/Metrology procedures and ability to perform the prescribed maintenance activities as well as prudent mitigation of the possibility of coordinated meter failures.
- JEN is required to conduct a program of metering installation inspections; this option allows leveraging these inspections with an additional manufacturer-specific conditions-based assessment of meters to proactively replace meters with failed components or meters exhibiting signs of imminent failures.
- Cost savings as reactive (unplanned) replacements due to meter failure is likely to cause significant customer inconvenience and cost-inefficiencies due to additional special coordination and travel.
- Provides a prudent trade-off of opex and capex solutions as the site visit costs of inspections that before proactive replacements will be capitalised instead of expensed, thereby supporting lower meter charges for JEN's customers.

3.3.3 OPTION 3

This option involves the replacement of all aged metering installations that remained in operation beyond their original design life and are due for prescribed inspections with new AMI meters.

This option consists of the following activities and cost:

Cost Category	Value ($2024, M)	Type
Physical inspection of metering installations that remain in operation beyond 15 years (as per NER, AEMO Guidelines and JEN MAMS)	0	OPEX
Proactive replacement – Labour	72.25	CAPEX
Proactive replacement – Materials	74.55	CAPEX
Disposals of removed meters / equipment	5.54	OPEX
IT System changes to support a consistent approach to executing inspections at high volume	1.30	CAPEX
Additional IT licences for high-volume transactions	0.10	OPEX
Project Planning and Administration	4.02	CAPEX
total OPEX	*5.63*	
total CAPEX	*152.11*	
Total Option Cost	**157.75**	**TOTEX**

Option 3 involves all metering installations requiring prescribed inspections to be replaced with new AMI meters instead of the prescribed metering installation inspections at those sites.

This option is credible and will provide the required compliance and the opportunity for the generational upgrade of AMI meters and meter technology. However, this option is also the most expensive of the options considered, as it foregoes the opportunity to extend the life of the JEN AMI meters in service beyond their nominal design life.

Successful implementation of this option can be defined as:

1) All meters remaining in operation beyond their design life and due for the prescribed metering installation inspections are replaced in lieu of the age-based inspections

2) No safety incidents to the customer or subcontractors during the replacements of metering installations

3) Minimised customer impact (e.g. reduced incidence of fault reporting), customer inconvenience – noting that all customer outages for proactive meter replacements would be supported through customer planned outage notifications using the customer's preferred communications method in accordance with JEN's EDCoP obligations

4) Effective customer communication and publicity of benefits of the current generation of AMI meters

5) Delivered within the managed timeframes and avoids inspection costs in favour of replacement costs, thereby supporting the lowest opex costs, but highest overall cost among the options.

This option avoids the opex costs of prescribed aged-based metering inspections by replacing the aged meters with new generation AMI meters (a capex cost), in lieu of inspection activities.

Given the large volume of replacements to be delivered under this option, there is an opportunity for a considered generational upgrade for AMI meters and AMI technology, delivering new features, better safety, data protection and new features to all customers.

The issues and benefits of this option are listed below:

Issues:

- Higher costs of delivery, as we replace all meters in operation beyond their design life without consideration to specific conditions of the meter.

Benefits:

- Opportunity for a generational upgrade for AMI meters and AMI technology, delivering new features, better safety, data protection and new features to all customers

Lower future operating costs due to avoided increase in future failure rate, and new meter feature (e.g. modular design) allowing for some type of faults to be addressed in the field.

3.3.4 OPTION 4: REPAIR FAULTY METERS (NON-CREDIBLE)

This option entails repairing and/or replacing faulty parts within the meters to extend meter use in lieu of meter replacement. This option was considered but found to be inadequate in providing efficient cost outcomes for our customers. The concept for this option is that if a meter is found to be faulty and the faulty part/s can be identified (e.g. replacement of the internal battery, communication card, memory units, LCD screen or damaged meter casing) then the meter is to be removed and sent for repairs and re-certification and to be re-enter the meter fleet after the re-certification.

For safety and integrity reasons, the AMI meters installed on JEN during the AMI rollout were designed to be fully integrated and enclosed units. The design of these meters deliberately do not support any component replacements in the field environment. This was a deliberate design choice to deliver on Vic AMI meter specification that seeks to avoid meter tampering or exposing if customers to safety risks.

As a result, any part replacements (including replacement of the internal batteries) for JEN AMI meters must be performed in a factory environment, subsequent to meter removal from operational service. Given that any repairs and part replacements on JEN meters would require opening of meter main cover (hence, breaking of metrology seals); this requires JEN meters to be sent to an approved verification authority to be re-verified for trade following any repairs.[9]

Any meter that is identified with broken, missing or tampered metrology seals, at any point in meter operational lifecycle, must be removed from service and sent to an approved verification authority to be re-verified for trade (National Measurement Act).

Hence, this option is considered not credible due to:

a) The cost of labour involved in the process is significantly higher than the costs of the meter units itself:

Total cost = cost of meter removal + cost of meter repair + cost of the failed component (varies depending on component) + costs of meter re-verification + costs of meter redeployment

b) The failed component is likely to be the first identifiable indicator of the deteriorated condition of the metering installation overall, and failures of other components are likely to follow (given all components were designed to provide a similar lifespan in a given environment). That is, the failed component represents the lead indicator of the deteriorated condition of the meter in that metering installation.

c) Replacement of the failed component is not likely to significantly extend the expected residual life of the meter, given all other (remaining) components would normally be designed for the same life expectancy and are likely to have similar life expectancy in a given installation.

d) The key risk of multiple correlated meter failures is not addressed.

[9] We understand that some Vic DNSP have meters with modular design, allowing for in-field replacement of certain components (e.g. meter communication module) without having to access the main compartment of the meter (i.e. with no need to break the meteorology seals). These are not the meters used by JEN in its original rollout.

3.3.5 COMPARISON OF CREDIBLE OPTIONS PERFORMANCE AGAINST PROJECT OBJECTIVES

This section reviews the extent to which each option addresses the project objectives identified in section 2.3.1. The following Table 3–2 show each options performance

Table 3–2: Option Performance vs Project Objectives

Objective	Option 1	Option 2	Option 3
1. Compliance with the JEN's AEMO-approved MAMS, as well as the ECMCoP, EDCoP, AEMO metrology procedures and NER	●	●	●
2. Enhanced customer safety at the metering box at these sites	◑	●	●
3. Assurance of accurate customer billing	◑	●	●
4. Better customer experience due to avoidance of unexpected failures	○	●	●
5. More orderly management of the expected technological obsolescence and end of life of the existing JEN smart meters.	○	●	●
6. Ensure JEN can continue providing effective management and monitoring of its network and customer connections.	○	●	●

●	Fully address the issue
◑	Partially address the issue
○	Did not address the issue

4. OPTION EVALUATION

This section discusses the economic and financial analysis that was done to identify the most efficient investment option – the preferred option.

4.1 ECONOMIC ANALYSIS

This section describes the economic (cost-benefit) analysis that was performed to identify the option that maximises the present value of the net economic benefit to the electricity market – the preferred option.

We note that while the calculated value of the net market benefits (presented below) is positive, representing net benefit to the customers, there are also a number of other customer benefits that were not quantified and captured in this analysis.

These “not quantified” benefits include:

- Avoided inconvenience from unplanned meter malfunctions through the planned proactive replacement
- Benefits of new product features that will become available with the new generation of AMI meters (e.g. improved data security, additional insights into customer consumption, support for modern connectivity of consumer devices to the meter)
- Better power quality and supply safety monitoring capabilities, delivering additional safety to the customer
- Modern meter design philosophy allowing for more reliable and sustainable operation in the future (e.g. modular design allowing for in-field replacement of some meter components, better safety features of the meter).

4.1.1 SUMMARY OF CREDIBLE OPTIONS' EXPECTED COSTS & MARKET BENEFITS

Expected costs and expected market benefits associated with each of the credible options used in the ensuing economic and financial evaluations are summarised in the following tables.

Table 4–1: Costs of Options ($ June 2024, M)

Expected Costs of Options ($’M, 2024)	Option 1	Option 2	Option 3
Options total investment cost (Jemena)	89.53	87.65	157.75

Table 4–2: Market Benefits of Options

Expected Market Benefits of Options ($’M, 2024)	Option 1	Option 2	Option 3
Net market benefits	0	1.6	(57.4)

5. RECOMMENDATION

Based on the analysis provided in this paper, Asset Management recommends Option 2. This is the most cost-effective approach to mitigating the risks of the aging population of AMI meters. It involves supplementing the prescribed metering installation inspections with additional (manufacture-specific) assessments to help identify the meters most likely to fail based on degraded meter conditions, failed components and meter age. Such meters will be replaced at the time of the inspection, avoiding additional travel time and customer disruptions and addressing all incidental safety hazards and/or non-compliances. Thus, this option will deliver the physical inspections of all installations due for inspections, supplemented by the meter replacements where assessed as necessary (or prudent).

Given that a notable volume of meters is expected to require replacement under this option, there is an opportunity to consider a generational upgrade of AMI meters and AMI technology, delivering new features, better safety, data protection, and new features to all customers.

This business case proposes a total investment of $87.65M.

6. EXCLUSIONS

This project's costs include deployment of the current generation of smart meters which have enhanced functionality relative to the first generation deployed during AMRO to meet new metering obligations, namely the changes that came about from the 5-minute settlement rule change.

This project's costs do exclude any further upgrade to a future generation of advanced Intelligence/AMI technologies and/or advanced customer features not currently required by the Victorian AMI specification.

The opportunities to deliver advanced metering technology with analytics that are not yet available in the current generation of AMI meters will be reviewed and considered at the time of delivery but are not costed in this business case.

The project costs also exclude the costs of a community and customer communications program to accompany the large-scale customer liaison program that will touch 78% of our customers over the next regulatory period. A separate business case for these activities will be prepared as these activities would be required under all 3 options. This would be developed in consultation with DEECA, the ESC and our DNSP peers.

Appendix A
Financial Evaluation Spreadsheets

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A1. FINANCIAL EVALUATION SPREADSHEETS

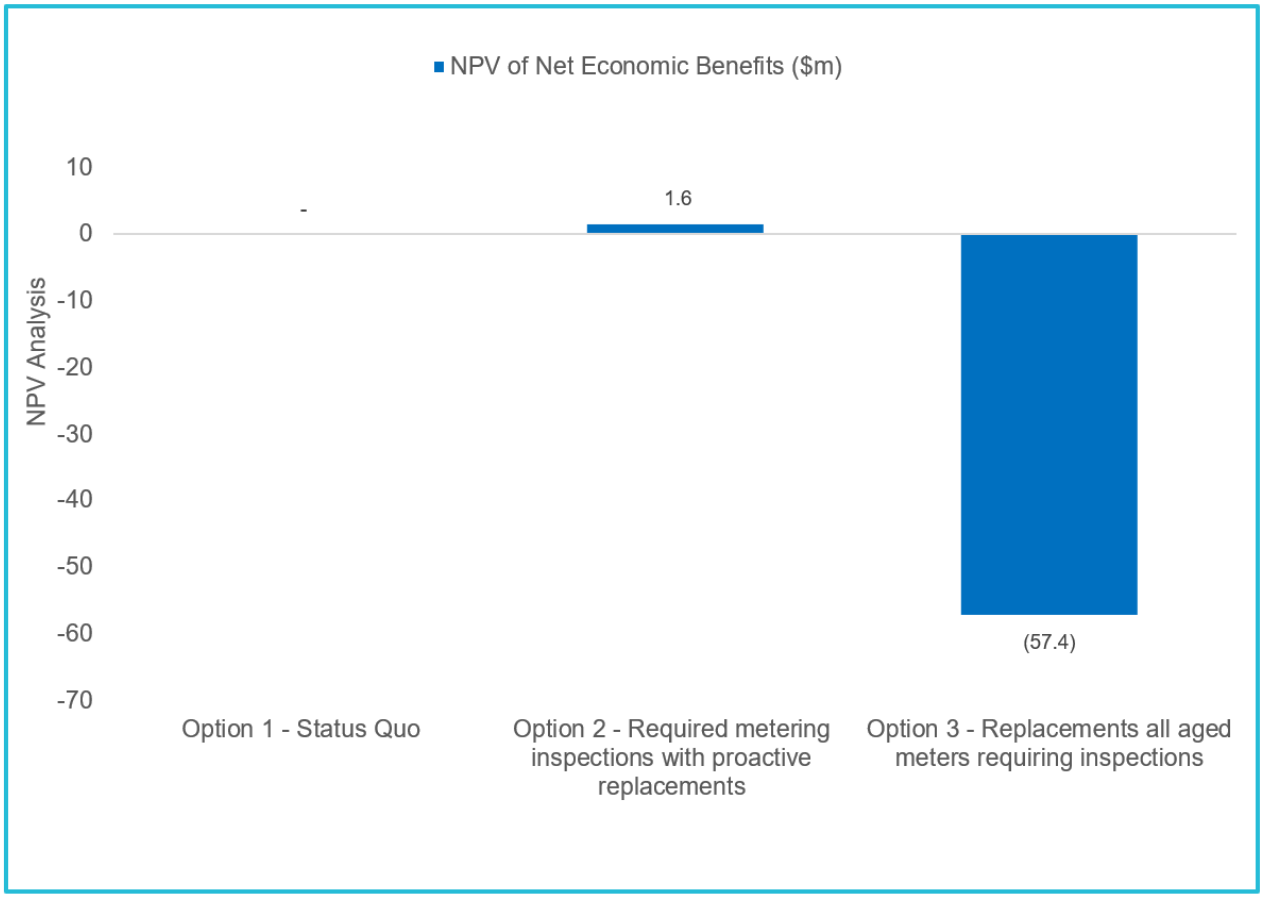
Costs and Benefits Analysis Model

Output|Tables

Option 1 | Option 2 | Option 3

Output | Options Analysis

Overview of Options Analysis			
Options	**Option 1 - Status Quo**	**Option 2 - Required metering inspections with proactive replacements**	**Option 3 - Replacements all aged meters requiring inspections**
Recommended Option		✓	
NPV of Net Economic Benefits ($m)	**-**	**1.6**	**(57.4)**
NPV of Total Economic Benefits ($m)	-	-	-
Avoided cost at asset failure	-	-	-
Improved energy reliability	-	-	-
Reduced energy losses	-	-	-
Other Economic Benefits	-	-	-
NPV of Incremental Total Costs ($m)	-	(1.6)	57.4
Total Incremental Net Capex	-	*8.5*	*81.2*
Total Incremental Opex - One-off	-	*(1.0)*	*(0.4)*
Total Incremental Opex - Ongoing	-	*(9.1)*	*(23.4)*
Sensitivity on Economic Benefit NPV ($m)			
Economic Benefits turn out to be 10% lower	-	1.6	(57.4)



Appendix B
Network Risk Assessment Summary

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B1. NETWORK RISK ASSESSMENT SUMMARY

Risk Type	Strategic	Health, Safety & Environment	Regulatory & Compliance	Financial	Operational	Brand / Reputation / Stakeholders
Risk Title (Identified Risk)	Supporting evolving consumer expectations and technological trends	Risk to physical fire, electric shocks, electricity theft, data privacy and cyber attacks	Non-Compliance with metering obligations	Management of the aged meters and inspection obligations in most economical fashion	Reliable supply of meters from diverse vendors	Customers are not billed correctly Meter functionality lags customer and market expectations from current generation of smart meters
Business Objective	Customers	Safety	Asset Management	Return on Investment	Asset Management	Customers
Risk Description	The current generation of AMI meters technology has limited support for customer-focused interfaces (e.g. no wi-fi), and do not enable participation in advanced CER management & frequency control schemes.	◦ Aging metering installations can pose threats of fire and electrical shocks ◦ The first generation of AMI meters is based on dated technology with known cybersecurity weaknesses.	Correlated failure of metering installations (family failures) will cause significant challenges to address, affecting JEN compliance, the accuracy and safety of JEN's metering equipment.	Risks of multiple customer interruptions, wasted visits, multiple visits	Existing metering technology is only provided by a limited number of vendors.	Customers complain about inaccurate readings or lack of services. Other customers may complain of inequitable billing,
Root Causes (Contributing Factors)	Aging technology no longer supports modern use cases and customer expectations.	◦ Degraded hardware, insulation, rodent holes, tempering, loose screens, and wiring can pose threats of fire and electrical shocks. ◦ Aging technology no longer supports modern cyber security use cases. ◦ Semiconductor-based electronic equipment has a shorter life than conventional electromechanical meters, with more abrupt failure modes	Smart meters are likely to start exhibiting failures in a coordinated fashion beyond certain operating life. All first-generation smart meters in Victoria were installed during a concerted effort in the years 2009-2013. Smart meters have a long lead time of 12 months, and VicAMI-compliant meters can only be procured with components from a single comms supplier and two-meter suppliers.	◦Unplanned meter replacements due to failure ◦Multiple customer visits due to separate delivery of inspection and replacement programs	Smart meters based on the original AMI technology are only available from a limited number of vendors. The prospect of wholesale upgrade to AMI infrastructure (including larger than growth volume of meters) will entice new meter vendors to enter the market with new technology.	Deteriorating hardware with no effective way to assure accuracy, integrity or provide new customer-focused functions
Suggested Control	Upgrade to the latest technology	◦ Timely inspections and replacements of meters. ◦ Upgrade to latest technology	Timely inspections and replacements of meters.	Uncoordinated approach to prescribed inspection and replacements	RFT for BAU supply	replace when the opportunity presents

Appendix C
Delivery approach

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C1. HOW WE WILL DELIVER THE PROJECT

This section explains our approach and planning process we have and will undertake to ensure we can deliver our planned AMI metering installations inspections and meter replacement program.

Delivery Program Management

In line with our strategic and operational network planning and delivery model, we will establish a governance structure entailing Steering Committee, Program Management and Operational Management committees to govern and manage the delivery of the program.

The program management team will assess, develop and establish delivery plans in line with our networks' policies, standards and procedures, entailing the following:

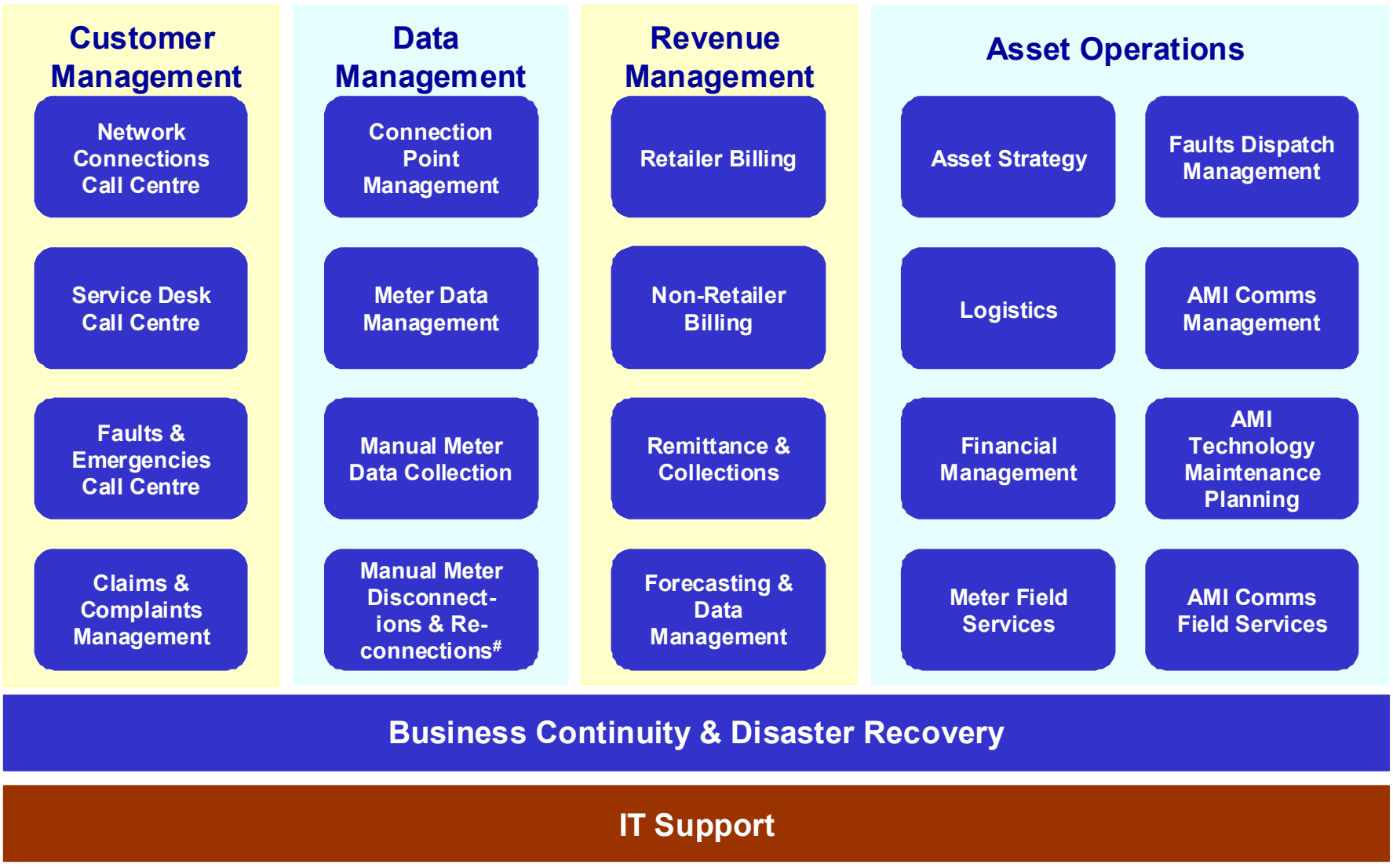
- Customer Management Plan
- Financial Management Plan
- Quality Management Plan
- Environmental Management Plan
- Logistic Management Plan
- Operational Management Plan
- Business Continuity Plan
- Risk Management Plan

Business Functional Impact Assessment and Management Model

We have undertaken an assessment of the current business and support model we have in place to provide our metering services obligations to assess the areas of our operations that are likely to be impacted. The diagram below displays our current service provision model, which depicts the four key areas we identified as impacted by the delivery of the proposed AMI metering installations inspection and replacement program. We discuss each of these functions and sub-activities below.

Note: We anticipate that the large-scale program (impacting 78% of Jemena's small customers over the next regulatory period) will require additional program resources for customer engagement and smooth delivery at a large scale. Separate plans for these activities will be developed in consultation with DEECA, the ESC and our DNSP peers, as this business case currently excludes these costs. The exclusion of these costs, however, would not affect the recommendation (and option analysis) of this business case since these activities are equally applicable under all three options outlined in this business case.

Figure 2: Key Areas Impacted



Customer Communications & Management

The proposed inspections/replacement program requires JEN field resources to attend the customer sites to inspect or replace the meters or ancillary equipment; this may require customers to be taken off supply for a short period of time, requiring customer notifications (4 days prior to attending the site). JEN will prepare a clear customer communications plan in alignment with other program delivery plans, drawing on lessons from our past experience. We will establish a dedicated program communications and response team with our operational groups to manage customer notifications and enquiries.

Given the scale of the proposed inspection/replacement program (touching 98% of our small customers), we intend to set up a dedicated phone line within our call centre to address program-related customer enquiries. We anticipate that all four key functional areas involved in supporting customer metering will be impacted by the proposed program.

The following functions will likely require additional resourcing to support large metering inspection and replacement program:

- Program Communications Call Centre
- Network Connections Call Centre
- Service Desk Call Centre
- Faults and Emergency Call Centre
- Claims and Complaints Management

Data & Revenue Management

The proposed large-scale inspections/replacement program will produce a large number of data updates and transactions for internal and market systems. This will be managed by JEN's network connections compliance team to ensure meter churn and billing data accuracy to maintain full compliance with the market requirements. The revenue management team will require additional resources and system enhancement to address network and customer billing enquiries, issues and disputes that may arise.

The following functions will likely require additional resourcing to support large metering inspection and replacement program:

- Connections Point Management
- Meter Data Management and Billing

Asset Management

JEN's Asset management team is responsible for technical, financial and program delivery. The proposed large-scale inspections/replacement program will likely produce additional customer queries and requests for guidance and explanations on issues relating to technical compliance, work practice, OH&S and the overall management of the program.

The following functions will likely require additional resourcing to support large metering inspection and replacement program:

- Asset Management support and reporting
- Technical standards and metering compliance support

Procurement and Logistics Management

JEN currently has contracts in place for the BAU supply of meters and ancillary equipment required for the provision of metering services. As the program envisages larger quantities of meters and related ancillary equipment to be replaced, these contracts may need to be revised and subjected to an updated open tender processes.

The following functions will likely require additional resourcing to support large metering inspection and replacement program:

- Tender preparation and assessments (technical and commercial views)
- Logistics management at store and distribution

Meter Field services

JEN intends to utilise its current metering field services to perform the inspections/replacement program. Consultation with our service provider has taken place, and planning is in progress to prepare operational plans and develop required processes, procedures and field management structures and resources to manage the larger volume of work.

The following functions will likely require additional resourcing to support large metering inspection and replacement program:

- Field Services Delivery Management and Planning
- Network Compliance and field technicians
- OH&S and work practice compliance and auditing
- Customer issues and conflict resolution officers

AMI Communications Field services

JEN will be utilising its current AMI Communications field services to perform the required communications faults and maintenance associated with the inspections/replacement program. Consultation with our service provider has taken place and planning is in progress to prepare operational plans and develop required processes, procedures and field management structures and resourcing to manage the larger volume of works.

The following functions will likely require additional resourcing to support large metering inspection and replacement program:

- AMI Comms compliance and field technicians
- Backend communication system support and reporting

Fault Dispatch Management

JEN will be utilising its existing faults and emergency management team to perform the required faults and maintenance associated with the inspections/replacement program. Additional non-compliance, revenue protection and/or safety related issues could be discovered or reported in the course of the program. Planning is in progress to prepare operational plans and develop required processes, procedures and field management structures and resources to manage additional request that eventuate during the course of a large scale inspection/replacement program.

The following functions will likely require additional resourcing to support large metering inspection and replacement program:

- Fault technicians

IT Support Services & Management.

JEN will be utilising its existing IT support services and management team to perform the required systems and applications enhancements and developments required to support large volumes of transactions and data capturing and management associated with the inspections/replacement program. Discussions and planning are in progress with the system and applications suppliers to address potential limitations and ensure support for the required volume and types of transactions.

The following functions will likely require additional resourcing to support large metering inspection and replacement program:

- System architects (SAP, MSI, AM, MDM)
- Security architect
- Field mobility and process development
- Infrastructure and Communications architect
- Design, built, testing (FAT, SAT and UAT) and commissioning support for new meters

Appendix D
Forecasting meter failure rates

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D1. OUR FORECAST SMART METER FAILURE RATES

This section provides our projected meter replacement rates by year over the period to 2031 and explains the information we have considered when projecting these failure rates.

The forecasts are based on Jemena's historical trends and align with the specially commissioned study of JEN meter faults by Frontier-Economics (provided in Attachment 10-07)[10], and the publicly available studies of international experience with similar first generation smart meters.

Table D1–1: Proposed JEN AMI meter replacement volumes for the next EDPR period

	2026-27	2027-28	2028-29	2029-30	2030-31	Total
Meter population	401,921	408,796	415,793	422,913	430,156	**430,156**
Expected meter malfunctions as % of population	0.74%	3.03%	4.93%	6.02%	7.27%	**22.00%**
The volume of meters planned for replacements	3,204	13,042	21,193	25,902	31,290	**94,632**

D2. OUR FORECASTING APPROACH

We have forecast our end-of-design life meter failure rates with regard to:

- The trends of smart meter failures in our installed first-generation smart meters
- The trends observed in international jurisdictions that commenced their first-generation smart meter deployments before Victoria
- Meter vendor information
- Failure observations and insights from our Victorian DNSP peers.

The following sections explain each of these.

D2.1 OUR EXPECTED SMART METER FAILURE RATES

It is important to note that notwithstanding the proactive replacements advocated by this business .case in its recommended options, JEN expects to experience a number of unplanned meter malfunctions, albeit a much smaller number than otherwise would have been the case.

The volume of unplanned meter malfunctions, given the pre-emptive replacement of circa 82,000 meters, is given by the following table:

Table D2–1: JEN forecast of unplanned meter failures under the recommended scenario (Option 2)

	2026-27	2027-28	2028-29	2029-30	2030-31	Total
Expected volume of meter malfunctions	1,294	1,582	2,093	2,981	4,549	12,499

[10] JEN - Frontier Economics Att 10-07 - 2024-12-20 Forecast replacement of smart meters – 20241220.

The analysis by Frontier Economics suggests that under a similar scenario, an even higher volume of pre-emptive replacements (circa 93,000 meters) should be expected by JEN during the next EDPR period, refer to Table D2–2 below.

Table D2–3: Frontier Economic forecast of Jemena's unplanned meter failures under a higher pre-emptive replacement rate than Option 2

	2026-27	2027-28	2028-29	2029-30	2030-31	Total
Expected volume of meter malfunctions	2,136	3,239	4,555	5,799	7,113	22,841

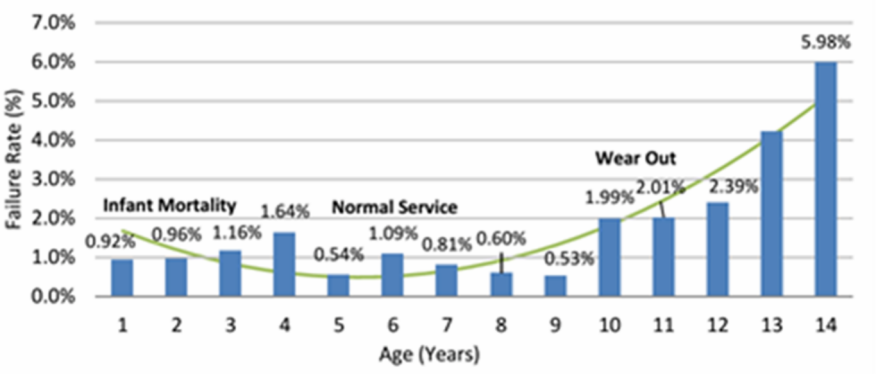
Note: JEN's meter failure rate forecasted by Frontier Economics (table D24) is nearly double JEN's forecast used for the purpose of this Business Case (table D2–5) even with the lower proposed pre-emptive replacement volume (lower compared to the pre-emptive replacement volumes recommended by Frontier Economics. JEN has decided to use the lower (internal) forecast for this business case. We will revisit this assumption if additional insights and trend confidence can be derived from 2025 actual failure data when >5% of JEN's first-generation smart meter fleet will have exceeded their design life.

D2.2 INTERNATIONAL EXPERIENCE WITH FIRST-GENERATION SMART METER FAILURE RATES

Distributors in Canda[11] and Italy[12] who commenced their first-generation smart meter deployments ahead of Victoria's in 2007 and 2008, respectively, have already commenced their smart meter end-of-life replacements.

In proposing its meter replacement program back in 2021, Canadian distribution network business Hydro One provides data on the rapid end-of-life increase in smart meters in years 13 and 14 of their 15-year design life as shown below.

Figure D2–1: Canadian first-generation smart meter failure data by meter age as of 2020



Source: Hydro One Networks Inc. (Hydro One), Distribution System Plan for the 2023 to 2027 period – Exhibit B-3-1 Section 3.0, 5 Aug 2021, Section 3.2 Figure 75 p.97.

This trend of failure before the end of the design life is exacerbated by technical obsolescence in the first-generation smart meters and their electronic componentry. The Ontario Auditor General, in its report on Ontario's smart meter initiative, found a 15-year service life estimate for meters is likely overly optimistic given technological obsolescence considerations.[13]

[11] Hydro One Networks Inc. (Hydro One), Distribution System Plan for the 2023 to 2027 period – Exhibit B-3-1 Section 3.0, 5 Aug 2021.

[12] Smart Energy International, Italy's SET Distribuzione launches second-generation smart meter programme, 22 Sep 2021.

[13] Auditor General of Ontario, 2014 Annual Report of the Auditor General of Ontario, 2014, p. 391.

D2.3 METER VENDOR CONSULTATION

JEN consulted with the meter manufacturer, who confirmed that the metering product supplied to JEN was designed to have an operational life of 15 years only, with an anticipated rate of failures circa 15% for meters over that age, suggesting an expected volume of malfunctions to be over 48,000 meters for the period to 2031 (again higher than what is currently proposed in this business case).

D3. HOW FAILURE RATES ARE USED IN THE BUSINESS CASE OPTIONS

D3.1.1 OPTION 1

Option 1 uses the base forecasted failure rate to calculate the cost of unplanned meter replacements upon in-service meter failures. We estimated that meters assessed (during the course of the prescribed metering inspection program) as "likely to fail soon" will, in fact, fail by 2031 with a probability of 80%. Under this option, there are no proactive replacements for such meters. The failed meters will fail randomly.

Table D3–1: JEN forecast of unplanned meter failures under Option 1

	2026-27	2027-28	2028-29	2029-30	2030-31	Total
Expected volume of replacements due to unplanned (random) meter malfunctions	2,822	10,750	17,373	21,318	25,942	78,206

D3.1.2 OPTION 2

Assumes the base level of forecasted failure, plus an additional volume of pre-emptive replacements for the meters assessed as "likely to fail soon". Under this option, the replacements will delivered as part of a coordinated program of metering installation inspections (e.g. no additional visitation costs in most cases)

Table D3–2: JEN planned meter replacements under Option 2

	2026-27	2027-28	2028-29	2029-30	2030-31	Total
Expected volume of replacements due to unplanned (random) meter malfunctions	1,294	1,582	2,093	2,981	4,549	12,499
Pre-emptive (condition-based)meter replacements	1,910	11,460	19,101	22,921	26,741	82,133

D3.1.3 OPTION 3

Option 3 assumes full replacement of first-generation AMI meters that are over 15 years old; hence, it does not rely on a failure rate forecast. Rather, the total replacement volume in this option is set by the age of the meters (e.g. meters exceeding their design life of 15 years). Under this option, there is no need for meters to be inspected, as all meters requiring inspection (after 15 years in operation) will be replaced with new-generation meters. The vast majority of replacements under this option are expected to be planned replacements.

Table D3–3: Meters to be replaced under Option 3

	2026-27	2027-28	2028-29	2029-30	2030-31	Total
Pre-emptive (age-based) meter replacements	24,284	34,302	51,868	56,560	54,743	221,758