Jemena Electricity Networks (Vic) Ltd

2026-31 Electricity Distribution Price Review - Revised Regulatory Proposal

Supporting justification document

Replace BLTS 22kV Switchgear - Business Case

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1. Executive Summary

Synopsis

- At Brooklyn Terminal Station (BLT), two EMAIL WR 345GC type 22kV oil-filled circuit breakers (CBs) – designated MB28 and MB29 currently supply the Melbourne and Metropolitan Board of Works (MMBW) sewage pumping station on Millers Road, Brooklyn. This site is recognised as a critical load, as it delivers essential sewage services to Melbourne.
- Asset inspections have identified significant age and obsolescence risks. The EMAIL WR 345GC models installed exceed 40 years of service and are no longer supported by the original manufacturer, resulting in all repairs requiring custom or refurbishment solutions. Furthermore, two of the high voltage cable sections connected to these CBs have surpassed 55 years of operational life, raising concerns over safety, environmental impact, and the ongoing security of electricity supply to this critical customer.
- In recent years, two of three high voltage cable sections supplying the sewage pumping station have been replaced. The final cable section is approaching end-of-life and continues to age, increasing the likelihood of deterioration-related failures, compounding overall supply risk.
- To address these issues, three options were assessed. The preferred option is a stand-alone program to replace both at-risk 22kV oil-filled CBs (MB28 and MB29) and the final high voltage cable section to meet current network standards. This program will reduce operational risk, ensure environmental compliance, and secure electricity supply to this essential infrastructure.
- Project completion is targeted by the end of 2029, with an estimated capital expenditure of $6.3 million ($2026).

1.1 Business need

The 22kV oil filled circuit breakers form part of JEN distribution network. Circuit Breakers (CBs) are devices that operate automatically to interrupt current flows under network fault conditions. To maintain network reliability, it is essential that circuit breakers perform their intended functions effectively, including:

- Interrupting load current during fault conditions to protect network assets and ensure safety.
- Reclosing automatically following temporary faults to restore supply and minimise customer interruptions.
- Isolating lines and transformers as required for maintenance activities, enabling safe access and efficient network operations.

The two 22kV outdoor oil filled circuit breakers EMAIL WR 345GC type located at Brooklyn Terminal (BLT) are nearing end of life and their condition has degraded over time. This family of breakers have a history of mechanical failure and catastrophic bushing failures. The switchgear is no longer supported by the manufacturer and mechanism/bushing spare parts are depleting. The 345GC switchgear has a history of oil leaks from the circuit breaker and internal isolator compartments and this requires increasing operating expenditure to manage. These assets require replacement with modern equivalents providing improved electrical and safety performance in accordance with JEN asset class strategies.

Issues associated with BLT 22kV oil filled circuit breakers MB28 & MB29 assets are described in Table 1-1.

Table 1-1: Current Issues with BLT 22kV CB MB28 & MB29

Issue No.	Description of Issue
1	Asset age - The existing circuit breakers are over 60 years old and are nearing end of life. Historically there has been an increasing trend to failure on these type of circuit breakers, interrupting supply to customers.
2	Asset near obsolescence - This type of Circuit breaker is no longer widely supported by manufacturers with maintenance and repair works requiring external resources and bespoke materials and equipment.
3	Safety and network operational performance - This type of circuit breaker has a known history of oil leaks which, when combined with internal mechanical failure modes, presents heightened safety and operational risks.
4	Environmental impact - The oil filled circuit breakers insulating medium can be detrimental to the environment should a circuit breaker failure or defect occur.

The high-voltage underground cable system associated with circuit breakers MB28 and MB29 at Brooklyn Terminal Station (BLT) forms the primary supply to the Melbourne and Metropolitan Board of Works (MMBW) sewage pumping station, a critical load customer. A key section of this cable route consists of a 55-year-old 185 sq.mm, 3-core, 22 PLYSWS HSL paper-lead cable that has exceeded its expected service life and no longer complies with current network design standards. Continued reliance on this asset poses unacceptable safety, environmental, and reliability risks for both the network and the critical customer it supplies.

The existing cable construction type (paper-insulated, lead-sheathed) is obsolete and presents multiple performance and operational challenges. Over time, these cable types are susceptible to insulation breakdown, moisture ingress, lead sheath cracking, and partial discharge activity. As documented in recent inspections and condition assessments, ageing-related degradation significantly increases the probability of failure (POF) for cables of this vintage. Faults on this type of cable often result in extended restoration times due to the limited availability of compatible components, specialist skills required for jointing and repair, and the need for extensive excavations. These factors increase both operational risk and outage durations, directly impacting a critical service provider.

Given the cable's age, construction type, environmental hazards, and its role in supporting essential public infrastructure, continued operation of this asset is inconsistent with prudent network stewardship and regulatory obligations. The combined risk profile encompassing safety, environmental exposure, and the security of supply to a critical facility provides a clear and compelling justification for the proactive replacement of the remaining aged cable section. Upgrading this section to modern XLPE cable constructed to current standards will mitigate the identified risks, improve long-term network reliability, and ensure compliance with contemporary asset management practices.

Issues associated with sections of MB28 & MB29 feeder cables are described in Table 1-12

Table 1-2: Current Issues with MB28 & MB 29 Feeder Cables

Issue No.	Description of Issue
1	Asset age & condition - Sections of the existing cables are paper-insulated lead-covered (PILC) cables over 55 years old, this type has an increased probability of failure due to moisture ingress as a result of lead sheath fatigue and electrolytic corrosion.
2	Asset near obsolescence - HSL (paper-lead) construction is obsolete and is no longer installed in Jemena networks; Cable does not align with current network design standards for 22 kV underground feeders
3	Safety and network operational performance - This type of cable hase shown increased defect rates across the network, deteriorated insulation and sheath increases the risk of partial discharge, thermal failures, and high-impedance faults. Age-related degradation further increases the risk of cable failure resulting in arc flashes, excavation hazards, and secondary damage to adjacent utility assets
4	Critical Customer Supply - The cable forms part of the supply to MMBW pumping station a critical load; failure would pose significant service, safety, and environmental risks.

All feasible options have been considered in arriving at the following credible options

1. Do nothing.
2. Opportunistic replacement with other projects.
3. Dedicated replacement program.

Any option of a non-network solution (e.g. network reconfiguration options or Demand management) does not address the existing asset condition issues.

CBRM results indicate that the MB28 and MB29 circuit breakers at Brooklyn Terminal Station are in poor condition (HI > 7) and exhibit an elevated probability of failure. In response, this business case provides the justification for initiating a project to replace both 22 kV circuit breakers, along with two remaining aged sections of high-voltage underground cable (approximately 250 m each). The proposed works address the condition, obsolescence, and operational risks associated with the EMAIL WR 345GC outdoor oil-filled circuit breaker model, and mitigate reliability and safety risks posed by the deteriorated paper-lead cable sections.

1.2 Recommendation

The existing 22 kV oil-filled circuit breakers MB28 and MB29 are obsolete, unsupported by the OEM, and increasingly difficult to maintain. Condition assessments indicate a high probability of failure due to insulation degradation, oil leaks, and mechanical wear, posing safety, environmental, and reliability risks—particularly given these feeders supply a critical customer (Melbourne Water).

The associated 185 sq.mm 3-core HSL underground cable is 56 years old and subject to known deterioration mechanisms such as insulation breakdown, water ingress, and sheath corrosion, significantly increasing the risk of fault or failure.

To mitigate these growing risks, it is recommended to replace both the circuit breakers and the ageing cable with modern JEN-standard equipment. This proactive approach reduces safety and environmental risks, improves supply reliability for critical customers, and aligns with regulatory and asset management obligations.

The total cost of this option is outlined in Table 1-1Table 1-3 This preferred solution is proposed to be completed in 2029.

1.3 Regulatory considerations

The objective of the project is to determine the most appropriate strategy for the nominated assets to maintain customer supply reliability given their current asset condition. This strategy must be consistent with other JEN strategies and plans and the project must comply with associated regulatory requirements including the National Electricity Rules (NER) (clause 6.5.7) and, the Victorian Electricity Distribution Code (EDCoP).

Three options were explored in the options analysis outlined in Section 3.3 of this document to identify a recommendation. The options have been benchmarked against the risk assessment at Appendix A to ensure that health, safety and reliability issues are addressed. Risk, cost and economic value remain primary drivers.

JEN's investment decisions are guided by the National Electricity Objective (NEO). Additionally, JEN is required to meet the requirements of the NER, EDCoP, and public and industry expectations for distribution system performance, which require capital expenditure objectives to be achieved as discussed as outlined in Section 2.4.2.

1.4 Financial information

1.4.1 Forecast expenditure and budget summary

This project is required to be implemented over the period FY28 to FY29 with total project cost shown in Table 1-3.

Table 1-3: Project Budget by Year, $2026

Year	Budget ($M)
FY28	2.95
FY29	3.36
Total Budget	**6.31**

2. Background

Switches are used to control the flow of electricity on the network. In the event of a network fault, switches are used to isolate the location of the fault and minimise the number of customers who need to remain off supply, allowing the safe restoration of supply to others. Switchgear can be considered in two groups:

- Zone substation switchgear—Circuit breakers located within zone substations, at both the high voltage and sub transmission levels

Zone substation switchgear can fail due to high resistance connections, mechanical degradation, moisture ingress (for outdoor installation) or manufacturing faults. The mechanical breakdown of a zone substation circuit breaker—and its resultant failure to operate—can, therefore, have significant customer supply consequences and pose serious safety risks.

Condition based replacement is our preferred asset replacement strategy as it ensures assets are replaced at a time in their life cycle that ensure maximum utilisation. The replacement activity is driven by the asset inspection programs and JEN's policies relating to the management and maintenance of obsolete oil-filled circuit breakers.

This document outlines the business case for the replacement of 2 x EMAIL WR 345GC type 22kV oil filled circuit breakers at Brooklyn Terminal Station (BLT) including its alignment with the JEN Asset Class Strategies.

The 22kV Oil Filled Circuit Breaker Replacement includes:

- 2 x EMAIL WR 345GC type circuit breakers to be replaced
- 2 x new 22kV vacuum type circuit breaker to be installed
- 2 x new 22kV Overhead connections to connect to existing 22kV bus & isolators

2.1 Asset Details

The EMAIL/WR 345GC oil filled circuit breaker installed in JEN is listed in **Error! Reference source not found.** & shown in

and Figure 2-2.

Table 2-1: Circuit Breaker Information

Designation	Make	Type	Voltage (kV)	Current	Station	Year	Qty
MB28	EMAIL/WR	345GC	22	1,200A	Brooklyn Terminal Station	1961	1
MB29		345GC	22	1,200A	Brooklyn Terminal Station	1962	1

The 345GC CBs are outdoor dead tank bulk oil CBs. The load break mechanism is via heavy copper contacts that are suspended via wood pull rods. The 345GC CBs are also installed at zone substations AW (Airport West), BD (Broadmeadows) and CN (Coburg North).

Figure 2-1: 22kV Oil Filled Circuit Breaker EMAIL/WR 345GC Type (MB28)

Figure 2-2: 22kV Oil Filled Circuit Breaker EMAIL/WR 345GC Type (MB29)

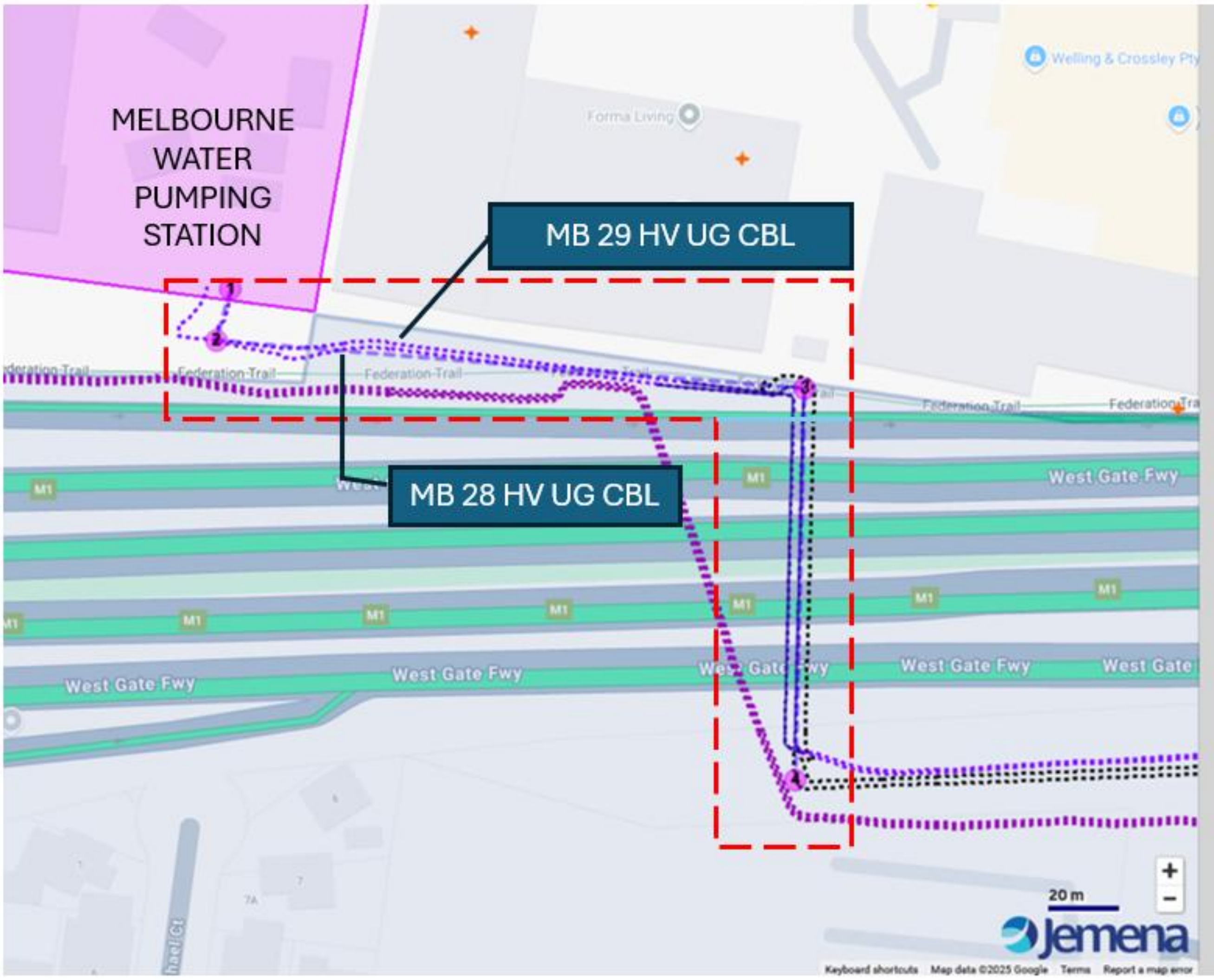
The section of high voltage cable proposed for replacement in JEN is listed in Table 2-2 & shown in Figure 2-3.

Table 2-2: High Voltage Underground Cable Information

Designation	Cable Size	Type	Voltage (kV)	Proposed replacement Section	Year Installed	Length
MB28	185 mm^2 3 Core	PLYSWS HSL*	22	Melbourne Water Sewage Pumping station – Federation Trail – West Gate Freeway Crossing (North side to South Side)	1969	250m
MB29						250m

* Paper insulated lead alloy sheath single wire armoured, Hessian served

Figure 2-3: Proposed replacement Section of MB29 & MB28 HV Underground Cable



2.2 Business and socio-economic context

Beneficiary of the proposed project is listed on the table below.

Table 2-3: Serviced Areas and Customers

Station	Customer Serviced	Customers (domestic)	Customers (business)
Brooklyn Terminal Station	Melbourne Water Sewage pumping station, Millers Road, Brooklyn	N/A	1

2.3 Asset risk (or opportunity) analysis

2.3.1 Short description of the affected assets

2.3.1.1 22kV Oil filled Circuit Breaker

Historically, the 345GC CBs suffer from several issues, the predominant issue being bushing defects. The bushings sometimes leak pitch. A program was initiated to refurbish all bushings on the 345GC CBs on the JEN. In more recent years the main contact pull rods have experienced failures. These pull rods were made from Permali wood, which is no longer available. In 2014 a project was initiated to replace pull rods with fibre glass pull rods on all transformer and cap bank CBs on JEN.

There has been multiple recorded defects associated with the Email 345GC 22kV switchgear.26 recorded defects have occurred at ZSS CN (Coburg North) 32 defects have occurred at ZSS AW (Airport West) and 24 defects have been reported for ZSS BD (Broadmeadows). AW, BD and CN all have the Email 345GC switchgear on the JEN Network.

There is evidence to indicate that new failure modes are emerging as the asset continues to age beyond the expected serviceable life. Engineering new components can mitigate the failure of some existing components, but this process is costly, and it does not mitigate the age-related failure of other components within the CB. The manufacturer of this type of CB no longer provides spare parts or engineering support, and JEN engineering expertise is limited.

2.3.1.2 22kV Underground Cable

A section of feeder MB28 & MB29 supplying the Melbourne Water sewage pumping station at Millers Road Brooklyn is an old 185 mm^2 3 Core paper insulated high voltage cable. This cable type was predominantly installed on the 11kV and 22kV networks prior to the 1970’s, however, was still used up to the 1990s. The cable utilises mass impregnated (MI) paper as the insulating medium. The early cable designs used oil impregnated paper, but these suffered oil migration leading to the drying out of the papers.

There appear to be two main causes of failure on this cable type namely:

- Failure of paper insulation due to oil migration over the life of the cable, leaving paper dry and brittle. Failure is particularly evident in existing cable joints or when new joints are installed. Due to the condition of the insulation in these cables, the risk of failure is significantly increased when cables are physically disturbed or handled.

- Failure due to moisture ingress resulting from lead sheath fatigue and corrosion. This problem is particularly evident in the inner suburban areas that are prone to electrolytic corrosion due to the proximity of tram and rail systems.

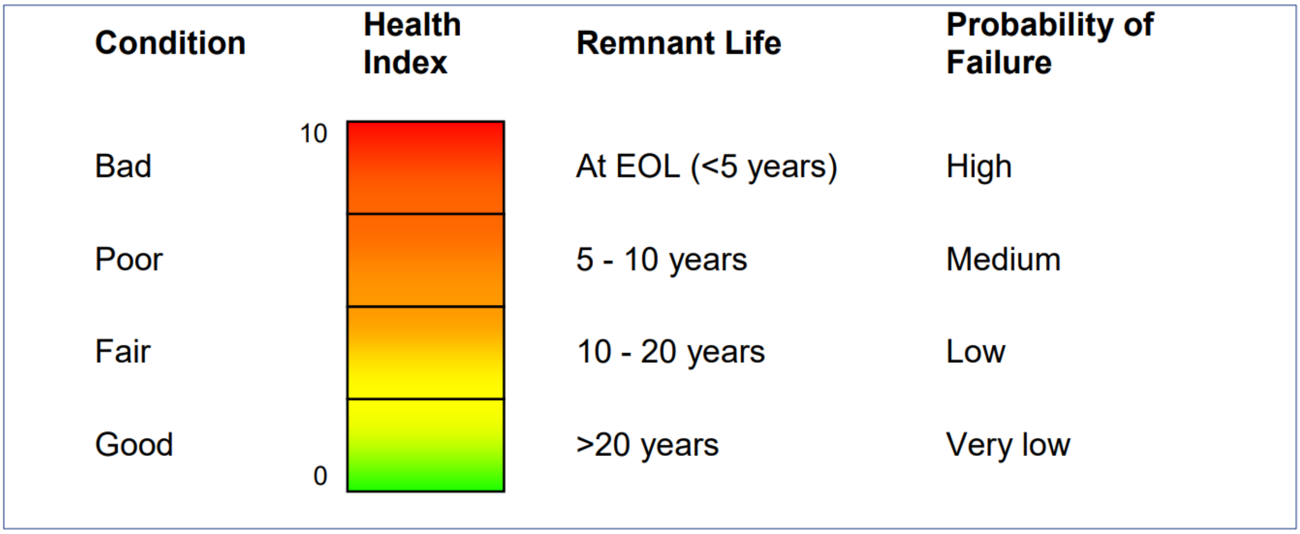
Some sections of this type of cable on the Jemena network have been identified as having excessive failure rates. For instance, some cable has experienced failures attributed to moisture ingress as a result of lead sheath fatigue and electrolytic corrosion.

2.3.2 Risk assessment

From Jemena's Asset Class Strategies (ACS) and with the application of Jemena's Condition Based Risk Management (CBRM) modelling using inputs from condition testing and monitoring, the above assets at BLT are assessed to be at a 'high' risk of failure.

CBRM develops a Health Index for each asset on a scale from 0 to 10. Values of health index above '7' represent serious deterioration and a need to plan for replacement before failure occurs is necessary. The CBRM Health Index is a numeric representation of the condition of each asset. Essentially, the Health Index of an asset is a means of combining information that relates to its age, environment, and duty, as well as specific condition and performance information to give a comparable measure of condition for individual assets in terms of proximity to the end of life and probability of failure (POF). The concept is illustrated schematically below in Figure 2–4.

Figure 2-4: CBRM Health index



Due to the age and condition of the Email 345GC 22kV Outdoor oil filled switchgear, the annual cost of risk will continue to increase until the deteriorated assets are removed from service.

2.3.2.1 CBRM Health and Risk Analysis for Email/WR 345GC 22kV CBs at BLT

CBRM results indicate that the current (Year 0) health index is as shown in Table 2-4. The 2 x Email/WR 345GC 22kV CBs at BLT have been identified to be in poor condition (HI > 7) with a higher probability of failure.

Figure 2-5: CBRM Output (poor condition (HI > 7)) for Circuit Breakers – Year 0 as at 2024

ZSS	Voltage (kV)	Qty	Manuf.	Model	HI Range
BLT (BLTS)	22	2	EMAIL/WR	345GC	8.25

If circuit breaker replacement is deferred until 2028 (Year 5) the health index changes as shown in Table 2-5

Figure 2-6: CBRM Output (poor condition (HI > 7)) for Circuit Breakers – Year 5 as at 2024

ZSS	Voltage (kV)	Qty	Manuf.	Model	HI @ Year 5
BLT (BLTS)	22	2	EMAIL/WR	345GC	9.59 – 9.62

If circuit breaker replacement is deferred until 2033 (Year 10) the health index changes as shown in Table 2-6

Figure 2-7: CBRM Output (poor condition (HI > 7)) for Circuit Breakers – Year 10 as at 2024

ZSS	Voltage (kV)	Qty	Manuf.	Model	HI @ Year 10
BLT (BLTS)	22	2	EMAIL/WR	345GC	11.15 – 11.21

The health index results from the above table indicates that replacement of these circuit breakers should be undertaken in the 2026-2031 regulatory period in order to manage the risks associated with the poor condition of them.

2.3.2.2 Risk Associated With the Aged 22 kV Paper-Lead Underground Cable

The sections of the 185 sq.mm 3-core paper-lead (HSL) high-voltage underground cable supplying the Melbourne water pumping station present a significant risk to network reliability and safety. Jemena's asset criticality assessment has assigned this cable class an AC3 (Significant) rating, reflecting the high consequence of failure and the organisation's limited ability to respond to certain fault types due to the specialised skills required for paper-lead cable jointing and repair.

Maintenance records confirm multiple historical failures on similar cable types, attributed to component deterioration, electrical insulation breakdown, and mechanical degradation of the lead sheath. Given its age over 55 years in service and known deterioration mechanisms such as moisture ingress, insulation brittleness, and lead sheath fatigue, continued operation of this obsolete cable type materially increases the probability of in-service failure. Such failures typically result in prolonged outages, complex excavation works (bore under West Gate Freeway), environmental handling risks, and extended restoration times, particularly for a feeder supplying a critical load.

If these assets were to fail during the 2026-2031 regulatory period, the failure or maloperation of the primary equipment or the high voltage underground cable can lead to major consequences, which can be categorised as follows:

- **Health and safety:** Severe damage to HV apparatus and loss of supply (outages), potentially causing extreme HSE incidents to personnel and environment
- **Operational:** Limits business operations of the distribution network, enforcing contingency plans due to the loss of supply (outages)
- **Financial:** Loss of supply (outages) can result in financial penalties based on frequency of occurrence, and duration
- **Reputation:** Negative perception from industry and customer stakeholders if reliability and safety performance is reduced
- **Regulatory:** Breaches of obligations under legislation, regulation, rules and codes.

The recommendation proposed in this business case is intended to mitigate these identified risks.

2.4 Project objectives and assessment criteria

2.4.1 Project objective

In line with the NEO, JEN's investment decisions aim to maximise the net present value to electricity consumers. The objective of this project is to maintain the reliability of supply to customers given the current condition of the assets. This strategy must align with other JEN strategies and plans and the project must comply with associated regulatory requirements.

2.4.2 Regulatory considerations

JEN's investment decisions are ultimately guided by the 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:

a) *A building block proposal must include the total forecast capital expenditure for the relevant regulatory control period which the Distribution Network Service Provider considers is required in order to achieve each of the following (the capital expenditure objectives):*

   (1) *Meet or manage the expected demand for standard control services over that period*

   (2) *Comply with all applicable regulatory obligations or requirements associated with the provision of standard control services*

   (3) *To the extent that there is no applicable regulatory obligation or requirement in relation to:*

      (i) *The quality, reliability or security of supply of standard control services; or*

      (ii) *The reliability or security of the distribution system through the supply of standard control services,*

   to the relevant extent:

      (iii) *Maintain the quality, reliability and security of supply of standard control services*

      (iv) *Maintain the reliability and security of the distribution system through the supply of standard control services.*

   (4) *Maintain the safety of the distribution system through the supply of standard control services.* [1]

Additionally, the EDCoP sets out provisions relevant to JEN's planning, design, maintenance, and operation of its network, most notably section 19.2 (Good Asset Management) and section 13.3 (Reliability of Supply):

Section 19.2 – Good Asset Management

A distributor must use best endeavours to:

a) *Assess and record the nature, location, condition and performance of its distribution system assets*

b) *Develop and implement plans for the acquisition, creation, maintenance, operation, refurbishment, repair and disposal of its distribution system assets and plans for the establishment and augmentation of transmission connections:*

   - *To comply with the laws and other performance obligations which apply to the provision of distribution services including those contained in this Code*

[1] NER, cll 6.5.6(a), 6.5.7(a).

  - *To minimise the risks associated with the failure or reduced performance of assets*
  - *In a way which minimises costs to customers taking into account distribution losses.*

c) *Develop, test or simulate and implement contingency plans (including where relevant plans to strengthen the security of supply) to deal with events which have a low probability of occurring, but are realistic and would have a substantial impact on customers.*

Section 13.3 – Reliability of Supply

A distributor must use best endeavours to meet targets determined by the AER in the current distribution determination and targets published under clause 13.2.1 and otherwise meet reasonable customer expectations of reliability of supply.

When making decisions to invest, JEN must comply with these obligations.

2.5 Consistency with strategy and plans

This section describes how this project is consistent with JEN's objectives and strategies:

- **Provision of Service Levels and Reliability**: Ensuring service levels and reliability that meet customer expectations.
- **Modern Capabilities**: Deployment of modern equivalent capabilities in the network to remain relevant to customers in the longer term.
- **Prudent and Efficient Expenditure**: Ensuring expenditure is prudent and efficient, aligning with customer expectations regarding affordability.

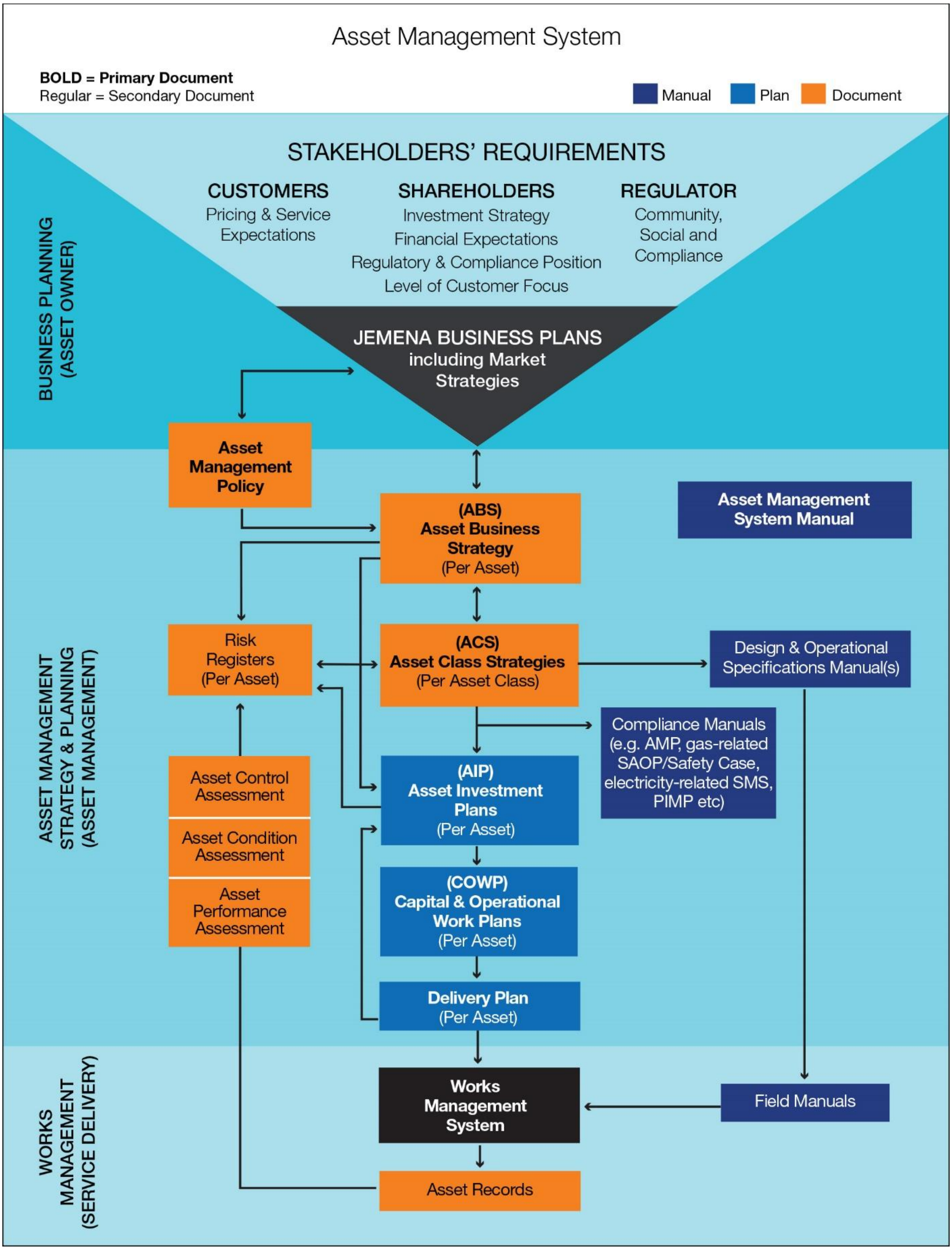
JEN seeks to ensure that lifecycle costs are both efficient and effective. This business case is consistent with this requirement and aligns with the long term vision of the network, as set out in the AMP and annual planning reports.

This proposal aligns with Asset Management Strategies, Plans and Policies contributing to a safe workplace for JEN employees and contractors. By addressing identified issues, JEN can reduce the risk of injury or environmental incident.

Figure 2-4 outlines the Jemena Asset Management System and shows where the Asset Management Plan (AMP) is positioned within it. The AMP covers the creation, maintenance and disposal of assets, including investment planning to augment network capacity and replace degraded assets to maintain reliability of supply.

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

Figure 2-8: The Jemena Asset Management System



3. Credible Options

3.1 Identifying credible options

The following options are available to address the business need, problem or opportunity.

1. Option 1 – Do nothing.
2. Option 2 – Dedicated Replacement program.

It is Jemena's view that there are no credible non-network options for the following reasons:

- While the deployment of a mobile 22 kV circuit breaker unit provides a viable temporary measure to manage emergency situations, site constraints at Brooklyn Terminal Station (BLTS) and the comparatively high implementation costs render this option unsuitable as a sustainable long-term solution.
- Demand management options will not reduce the required asset and associated works as it does not address the asset condition risk of the aged and deteriorated sub-transmission cables.

3.2 Developing credible options

Table 3-1 shows the extent to which each option addresses the identified issues.

Table 3-1: Options Analysis

Issue	Option 1 Do Nothing	Option 2 Dedicated replacement program
Issue 1 Asset age	○	●
Issue 2 Asset near obsolescence	○	●
Issue 3 Safety and network operational performance	○	●
Issue 4 Environmental impact	○	●

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

3.3 Options analysis

3.3.1 Option 1: Do nothing

The ‘do nothing’ option assumes business as usual, continuing current maintenance activities such as inspections, condition monitoring, preventive maintenance and defect repairs. However, this option does not address any of the identified condition issues. The probability of failure for this equipment would continue to increase over time, potentially leading to catastrophic failure while in service. Given the criticality of these issues and the lack of risk mitigation, this option is not considered credible.

3.3.2 Option 2: Dedicated staged replacement program

The dedicated staged replacement program is a proactive asset renewal approach that focuses on replacing both the obsolete EMAIL WR 345GC 22 kV outdoor oil-filled circuit breakers (MB28 and MB29) at Brooklyn Terminal Station, together with the remaining aged sections of the associated high-voltage underground cable. This option directly addresses all identified condition, safety, reliability, and obsolescence risks associated with the existing circuit breakers and the 55year old 185 sq.mm, 3-core paper-lead (HSL) cable sections that continue to supply the critical Melbourne Water pumping station.

Under this program, the oil-filled circuit breakers would be replaced with modern JEN-standard 22 kV outdoor vacuum circuit breakers, ensuring compliance with current design, safety, and performance requirements. In parallel, the remaining two sections of high-voltage cable (approximately 250 m each) would be replaced with new XLPE cable meeting current network standards, thereby eliminating ongoing failure risks, improving restoration capability, and strengthening supply security to this critical customer.

Option 2 remains the preferred option, as it resolves all condition-related issues, aligns with JEN’s broader asset management strategies, and supports long-term reliability for a key section of the network. The total forecast capital cost for this option is outlined in Table 1-2, based on project commencement in FY29.

4. Option Evaluation

4.1 Economic evaluation

An economic evaluation has not been undertaken for this project. This is primarily due to the nature of the asset and the elevated risk profile involved, where a failure would result in significant operational, customer and reputational consequences that cannot be fully captured through a conventional economic assessment. Given the criticality of supply to the Melbourne Water sewage pumping station and the deteriorated condition of the existing assets, the decision to proceed is driven by risk mitigation and service reliability obligations rather than economic optimisation.

Furthermore, undertaking proactive replacement is consistent with good industry practice and regulatory expectations for prudent network asset management. The AER requires network businesses to maintain safe, reliable, and secure supply, particularly where the probability of failure is high and the consequences are severe. In this context, delaying action to undertake a full economic evaluation would expose Jemena to unacceptable operational, safety, and reputational risks. The recommended investment therefore reflects a prudent and efficient response to a clearly defined asset risk, even in the absence of a quantified economic assessment

4.2 Financial analysis

A detailed financial analysis has not been undertaken for this option. This is intentional and appropriate given the nature of the asset and the risk profile involved. The decision to progress with a proactive replacement is driven by the criticality of the supply to the Melbourne Water pumping station, the unacceptable operational and reputational risk to Jemena in the event of a failure, and the known condition and age-related vulnerabilities of the existing oil-filled circuit breakers and associated cable. In this context, a traditional financial evaluation is not the determining factor; ensuring secure and reliable supply to a high-priority customer is the overriding consideration.

Table 4-2 summarises the cost of the preferred option, which represents a prudent, efficient, and risk-mitigating investment that safeguards supply to critical infrastructure and avoids more costly reactive responses in the event of asset failure.

Table 4-1: Preferred Option Cost Summary, $2026

Preferred Option Option 3: Dedicated staged replacement	($M)
Total Project Cost:	6.3

4.2.1 Disposals

An assessment has been made on the equipment which will be replaced as part of this project. The equipment has no written-down value due to its age.

5. Recommendation

This business case proposes a total capital investment of $6.31M as shown in Table 1-3.

The existing 22kV outdoor oil-filled circuit breakers MB28 & MB29 are an obsolete asset type that is neither manufactured nor supported by the original equipment manufacturer (OEM). The lack of OEM support and limited availability of genuine spare parts has required reliance on salvaged components from decommissioned units, leading to increasing operational and maintenance challenges. This reality compromises the asset's long-term serviceability and introduces heightened uncertainty regarding ongoing reliability and compliance with contemporary safety and performance standards.

Recent condition assessments have identified an elevated probability of failure (POF) for the circuit breaker due to well-documented deterioration mechanisms, including oil leaks, insulation degradation, and mechanical wear. These issues are consistent with the known failure history of this asset class and represent increased safety risks to personnel, potential environmental hazards, and supply reliability concerns. Given that this circuit breaker supplies a critical customer (Melbourne Water), any failure may result in unplanned outages, disruptions to customer supply, and broader impacts to network security and reliability performance outcomes.

Additionally, the associated high voltage underground cable a 185 sq.mm 3-core, 22 plysws HSL type has now reached 55 years of service. Condition assessments have identified multiple material risks in this type of cable including insulation degradation, water ingress, metallic sheath corrosion, and general obsolescence of the cable design. These factors are known to increase the likelihood of dielectric failure, earth faults, or progressive insulation breakdown, especially in cables of advanced age and legacy construction. As a result, the cable presents an increased risk of failure and continued use would further expose the network to operational, environmental, and compliance risks.

It is therefore recommended that both the existing oil-filled circuit breaker and the 185 sq.mm 3-core high voltage cable be replaced with equipment that meets current JEN Standards. This includes installation of a modern 22kV outdoor vacuum circuit breaker and new high voltage cable, both to current specifications. These replacements will significantly mitigate present safety and environmental risks, enhance fault interruption reliability, and protect supply continuity for critical customers. This investment will also ensure compliance with reliability and security-of-supply obligations under the regulatory framework and align with contemporary Australian and industry standards.

This option is recommended because it addresses all identified condition issues for both the circuit breaker and associated high voltage cable, while minimizing risks to network performance, safety, and environmental compliance. The proposed solution is consistent with the National Electricity Objective and is in the long-term interests of Jemena's customers.

6. Exclusions

There are no exclusions within this business case.

Appendix A
Asset Criticality Assessment Worksheet

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A1. Asset Criticality Assessment Worksheet

ASSET CRITICALITY ASSESSMENT WORKSHEET

ASSET AND BACKGROUND INFORMATION	
Site Name	General
Asset Class	Primary Plant
Sub-Asset Class	All
Date of Original Assessment	15-May-18
Date of Last Review	19-Jul-18
Reviewed By (where applicable):	

Risk Ref. No.	Description of Asset or Asset Grouping	Description of Risk	Consequence Category (Operational, HSE, Reputation etc.)	Description of Consequences	Current Controls	Criticality Score	Criticality Rating
1	Zone Substation Transformer	The risk associated with failure of zone substation transformers i.e. fails to insulate and/or carry load, resulting in: • Injury • Plant damage • Environmental damage (oil spill) • Loss of supply	Operational, HSE	Consequence: Health, Safety & Environment / Operational **Major** due to: • Potential loss of life to staff or contractor • Loss of electricity supply to >2% customers (6,500) > 24 hours	As per ACS	AC4	High
2	Zone Substation Grounds	Potential for unauthorised access within Jemena zone substations, resulting in trip hazards, equipment failure due to vandalism, initiation of fire and/or oil spill	Operational, HSE	**Major** due to: - total permanent disability (staff or contractors), multiple hospitalisations, permanent disability and/or life-threatening injuries affectic member(s) of the public - Loss of electricity supply to >2% customers (6,500) > 24 hours Likelihood: Rare due to lack of incidents occuring within the last 10 years within the JEN network	As per ACS	AC4	High
3	Disconnectors and Buses	The risk associated with the failure of disconnector and buses i(.e. fails to insulate, etc.) resulting in • Plant fails to insulate • Plant fails to open or close, High resistance connection • Catastrophic plant failure (Porcelain) • Plant rating (overload or under-rated)	Operational, HSE	**Major** due to: • Potential life threatening injury to staff, contractors or public • Loss of electricity supply to >2% of customers (6,500) > 24 hours Likelihood: Rare due to lack of incidents occurring within the last 10 years within the JEN network	As per ACS	AC4	High
4	Switchgear	The risk associated with the failure of switchgear i.e. operation malfunction or explosive failure, resulting in: • Injury • Plant damage • Environmental damage (oil spill) • Loss of supply • Financial impact varies based on consequence and can be between $200K	Operational, HSE	**Major** due to: • Potential loss of life to staff or contractor • Regulatory investigations or government review • Loss of electricity supply to >2% of customers (6,500) > 24 hours Likelihood: Rare due to lack of incidents occurring within the last 10 years within the JEN network.	As per ACS	AC4	High
5	Capacitor bank failure	The risk associated with failure of capacitor bank, resulting in: • Poor power factor and regulatory non-compliance • Explosion of capacitor unit and tank rupture, resulting in expulsion of porcelain fragments and shrapnel • Explosion of reactor unit and tank rupture, resulting in oil leak (may also contain PCB) and possible fire start	Operational, HSE	**Minor** due to: • General regulatory queries regarding supply quality • No violation, breaches, fines or penalties Likelihood: Likely due frequent loss of capacitor banks	As per ACS	AC1	Low