Jemena Electricity Networks (Vic) Ltd

Mitigate Risk Associated with End of Feeder Power Quality Meters on JEN

2022 Business Case

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Mitigate Risk Associated with End of Feeder Power Quality Meters on JEN

Authorisation

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Owning Functional Area

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PREFACE

The intent of this business case document is to provide self-supportive, rigorous documentation to substantiate the need and prudency of an investment for both Jemena and its customers. The business case should assist in determining the strengths and weaknesses of a proposal, in comparison with its alternatives, in a systematic and objective manner. The business case seeks endorsement and funding for the project from the appropriate Jemena stakeholders and approval from the relevant delegated financial authority.

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1. EXECUTIVE SUMMARY

Synopsis

- Purpose of this project is to meet regulatory requirement in relation to quality of supply in the Electricity Distribution Code August 2018 Clause 4.2.6 and mitigate risk of asset damage to JEN customers.
- This project proposes mitigation of risks associated with deteriorating and obsolete End of Feeder (EoF) Power Quality Meters (PQMs) installed on the JEN network.
- The project is planned to be completed in 2022, at an estimated cost of $835k (total project cost, real $2019).

1.1 BUSINESS NEED

This business case relates to mitigation of risks associated with the deteriorated and obsolete End Of Feeder (EOF) Power Quality Meters (PQM) installed on the JEN network.

The identified needs for this project is to meet a service standard obligation and is necessary to:

- Meet regulatory requirements in relation to quality of supply in the Electricity Distribution Code March 2008 Clause 4.2.6.
- Mitigate risk of asset damage to JEN customers;
- Power quality initiatives to prevent deterioration in quality of supply performance predominantly due to uptake of solar photovoltaic (PV) systems and increased use of power electronic appliances.
- The project is planned to be completed in 2022, at an estimated cost of $835k (total project cost, real $2019).

1.2 RECOMMENDATION

The proposed investment Option 2 is recommended to be endorsed. This option consists of the replacement of deteriorated and obsolete EoF PQM equipment on the JEN network, in the year 2022, at an estimated cost of $835k (total project cost, real $2019).

This option is preferred based on following considerations:

- It recognises the critical role of Power Quality Meter in maintaining the quality of supply in the JEN network.
- It enables Jemena to meet a regulatory requirement in relation to quality of supply in the Electricity Distribution Code March 2008 Clause 4.2.6.
- It is technically prudent and address the risks identified above, and it reduces the possibility that JEN would be found to have breached its general obligations associated with good asset management practice; and

- It is in accordance with JEN's Electricity Measurement Asset Class Strategy[1] and JEN's broader corporate objectives.
- It maximises the positive net benefit across the options considered, and represents the economically efficient option.

1.3 REGULATORY CONSIDERATIONS

It is a regulatory requirement to maintain the quality of supply with the requirements specified in the Electricity Distribution Code August 2018 section 4.2.6. JEN could also be found in breach of its broader obligations under section 3.1 associated with its EoF PQM's and its requirement to apply good asset management practices.

In this regard, the two most significant obligations are:

Victorian Electricity Distribution Code (Version 9A – Aug 2018), section 4.2.6, Quality of Supply

A distributor must monitor and record:

A. steady state voltages and voltage variations at each zone substation in its distribution system which are outside the limitations specified in Table 1 and Table 1A; and

B. steady state voltages and voltage variations of a duration of more than one minute which are outside the range of steady state voltages specified in Table 1 and Table 1A at the extremity of one feeder supplied from each of those zone substations.

Victorian Electricity Distribution Code (Version 9A – Aug 2018), section 3.1, 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:

a. to comply with the laws and other performance obligations which apply to the provision of distribution services including those contained in this Code;

b. to minimise the risks associated with the failure or reduced performance of assets;

c. in a way which minimises costs to customers taking into account distribution losses; and

d. 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.

[1] JEM AM Electricity Measurement Asset Class Strategy (ELE AM PL 0063)

1.4 FINANCIAL INFORMATION

1.4.1 FORECAST EXPENDITURE AND BUDGET SUMMARY

This business case proposes a total investment of $835k (total project cost, real $2019) which will require approval of the Jemena Leadership Team – Executive General Managers (Band C) approval under the SGSPAA DFA Manual, Annex 3.

This project is included in the approved budget for CY22 is required to be commissioned and completed by 2022.

The business case is prepared in relation to the regulatory submission for the period 2021-2025.

Table 1-1: Project Budget Information

Budget Value	Total ($'000s, $2019)
CAPEX Budget	726
Overheads	109
Total Budget Value	**835**

2. BACKGROUND

2.1 BUSINESS AND SOCIO ECONOMIC CONTEXT

Jemena Electricity Network (JEN) is required to comply with the requirement of the Victorian Electricity Distribution Code and The National Electricity Rules. In accordance with the Victorian Electricity Distribution Code, it is mandatory to monitor the end of feeder power quality to monitor the voltage variation at the end of feeder.

JEN has over 20 End of Feeder (EOF) Power Quality Meters (PQM) installed across the network to monitor the end of feeder voltages. These PQMs enable JEN to comply with the Electricity Distribution Code August 2018 Clause 4.2.6 (identified above), providing voltage monitoring to JEN's.

Existing End of Feeder Power Quality Meters (EOF PQM) are legacy equipment which is no longer support by the manufacturer. The proprietary software (EziView V3.30) required to access the PQ data is no longer supported by the vendor. Furthermore this software cannot be installed on the current Windows Operating systems.

2.2 ASSET RISK (OR OPPORTUNITY) ANALYSIS

2.2.1 SHORT DESCRIPTION OF THE AFFECTED JEMENA ASSETS

EoF Power quality meters are digital devices and the measured AC quantities of voltage are converted into numeric data. Like all digital devices, they comprise a number of basic components including an auxiliary power supply, analogue to digital converter, CPU, RAM, ROM and limited I/O capabilities. These meters are necessary to maintain the quality of supply on our network at its current level of performance and to meet our regulatory, legislative and licence obligations.

The objective of the EoF PQM installation is to identify and target particular areas of the JEN network where known or emerging power quality regulatory compliance issues have been identified. Following detailed and modelling and analysis of the measured EoF PQM data, corrective measures will be applied to enable JEN to maintain power quality.

2.2.2 RISK ASSESSMENT

A Project Risk Assessment has been carried out following Jemena's Networks Projects Business Cases Risks Budgeting and Assessment Guidelines document JEN GU 2502. This risk assessment highlights the current issues associated with the EoF PQMs and the risks to JEN business emanating from these risks, as well as initiation of the proposed project capital expenditure as an action to mitigate these risks.

Refer Appendix C.

EoF PQM failure can lead to the following consequences:

- Loss of power quality data which may result in Non-Compliance with Electricity Distribution Code (Section 4.2.6) National Electricity Rules (Schedule 5.1).
- Inability to identify voltage concerns on the network leading to customer complaints.
- Potential damage to customer assets resulting from undetected high system voltages.

There is a business requirement to address above issues of deteriorating condition of EoF PQM infrastructure.

The optimal timing for the commencement of the project is 2021 and completion by 2022.

2.3 PROJECT OBJECTIVES AND ASSESSMENT CRITERIA

Project objectives

This project seeks to meet the key objective of maintaining the standard control services as set out in the Electricity Distribution Code and NER.

The proposed capital expenditure will meet the following objectives, as set forth in the Electricity Distribution Code

- Meet regulatory requirement in relation to quality of supply in the Electricity Distribution Code March 2008 Clause 4.2.6.
- Continuous monitoring of the voltage at the End of Feeder.

In summary, this project aims to mitigate risk of breaching regulatory requirements.

Assessment criteria

The assessment criteria by which the project will be assessed against are the extent to which each of the identified options addresses the risks, as described in Section 2.2. Valid options that address the critical issues described therein are then analysed from both net present value and network risk perspective, in order to determine the preferred option.

2.4 CONSISTENCY WITH JEMENA STRATEGY AND PLANS

JEN's focus is to improve its competitiveness and adaptability in the following ways:

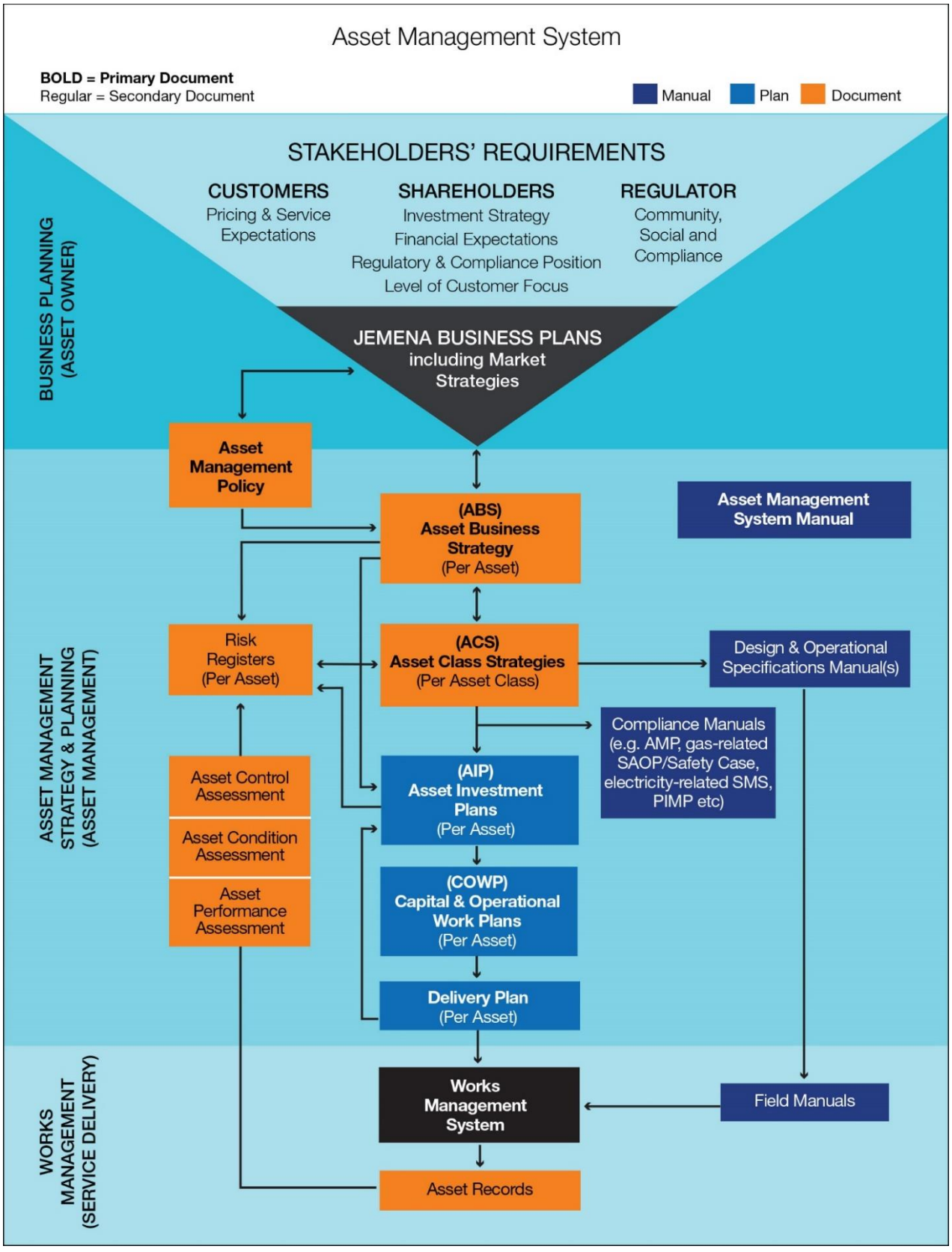
1. Efficiently and safely deliver affordable and reliable energy;
2. Make the customer experience easier and more valuable through digital and performance improvements; and
3. Modernise the grid to prepare for a connected future.

This project is based on guidelines and principles enshrined in the JEM AM Secondary Plant Asset Class Strategy.

Figure 2–1 outlines the Jemena asset management system and where the Asset Management Plan (AMP) is positioned within it. The AMP covers the creation, maintenance and disposal of assets including investment planned to augment network capacity to meet increasing demand and to replace degraded assets to maintain reliability of supply to meet Jemena Business Plan requirements.

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

Figure 2–1: The Jemena Asset Management System



3. CREDIBLE OPTIONS

This section discusses how credible options have been identified and developed. The credible options are considered for their commercial and technical feasibility, abilities to address the identified needs, deliverability, economic and financial benefits, as well as legal and regulatory implications.

3.1 IDENTIFYING CREDIBLE OPTIONS

The following feasible options were considered to address the business need including continued operation of the existing EoF PQMs:

3.1.1 OPTION 1 – DO NOTHING

Option 1 represents a continuation of the existing regime of maintenance and replacement upon failure, without any further actions. There are increasing risks with this option.

3.1.2 OPTION 2 – PLANNED AND PROACTIVE REPLACMENT OF EOF PQM'S

Option 2 involves proactive and planned replacement of the EoF PQM infrastructures to reduce the identified risks. Reference: Appendix A Project Scope and Delivery Information.

3.2 DEVELOPING CREDIBLE OPTIONS COSTS & BENEFITS

3.2.1 OPTION 1: DO NOTHING

Option 1 represents Do Nothing scenario - that is, maintaining the status quo.

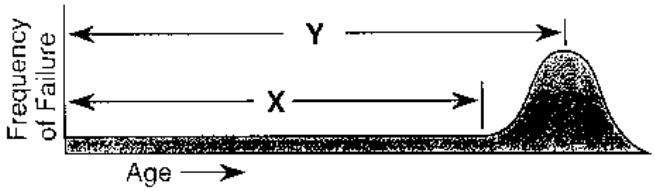
3.2.1.1 Scope, costs & timelines

Option 1 is the base case and represents the Do Nothing option, which means, continue current routine maintenance and replace complete PQM units upon failure. Under this option, PQM equipment will undergo routine maintenance every 8 years and will be replaced only when a meter fault is detected.

Replacing PQM upon failure will require the EoF PQM to be replaced with a new PQM type meter. This requires design modification which would take considerable time to implement (8 weeks) while the PQM is faulty, and non-compliance with Victorian Electricity Distribution Code as voltage levels will not be monitored at the affected end of feeder.

The proprietary software (EziView V3.30) required to access the PQ data is no longer supported by the vendor. Furthermore this software cannot be installed on the current Windows Operating System which may lead to cyber security threats.

Probability of failure of PQM is expected to increase as per a Weibull failure distribution, as shown below:



The failure rate of PQM will increase steeply as the relays reach end of useful life.

This option has following consequences:

- Non-compliance with Victorian Electricity Distribution Code as voltage levels will not be monitored at the affected zone substation. The benefit is in not incurring the expenditure of replacement upfront; and
- Potential damage to customer assets leading from high voltage.

3.2.1.2 Market & financial benefits

This section is not necessary as the project is considered mandatory for meeting Jemena's regulatory obligations.

3.2.2 OPTION 2: PLANNED & PROACTIVE REPLACEMENT OF EOF PQM'S

3.2.2.1 Scope, costs & timelines

Option 2 proposes the replacement of following EoF PQM's installed across the JEN network.

Feeder	Existing EoF PQM Type	Existing Communication Method	Distribution Substation Location	Voltage	New EoF Meter	Proposed Communication Method
AW7	EDMI MK6	IP modem over Telstra NEXT-G network	Tulla-Park Prima	22 kV/415 V	ION 7400	4G
BD10	EDMI MK6	IP modem over Telstra NEXT-G network	Broadmeadows-Townhall	22 kV/415 V	ION 7400	4G
BY14	EDMI MK6	IP modem over Telstra NEXT-G network	Wood-Raglan	22 kV/415 V	ION 7400	4G
CN5	EDMI MK6	IP modem over Telstra NEXT-G network	Bakers Audrey	22 kV/415 V	ION 7400	4G
COO21	EDMI MK6	IP modem over Telstra NEXT-G network	Barrymore-Lamark	22 kV/415 V	ION 7400	4G
CS12	EDMI MK6	IP modem over Telstra NEXT-G network	Attercliff-Sussex	22 kV/415 V	ION 7400	4G

Feeder	Existing EoF PQM Type	Existing Communication Method	Distribution Substation Location	Voltage	New EoF Meter	Proposed Communication Method
EP16	EDMI MK6	IP modem over Telstra NEXT-G network	Reserve-Huntsman	6.6 kV/415 V	ION 7400	4G
EP3	EDMI MK6	IP modem over Telstra NEXT-G network	Murray-NorthlandHomeCentre	6.6 kV/415 V	ION 7400	4G
ES3	EDMI MK6	IP modem over Telstra NEXT-G network	Anderson-Monash	11 kV/415 V	ION 7400	4G
FE6	EDMI MK6	IP modem over Telstra NEXT-G network	Vic-University No.1	22 kV/415 V	ION 7400	4G
FF89	EDMI MK6	IP modem over Telstra NEXT-G network	Yarrabend-Fairfield Institute	6.6 kV/415 V	ION 7400	4G
FT09	EDMI MK6	IP modem over Telstra NEXT-G network	Bank-MtAlexander	11 kV/415 V	ION 7400	4G
FW9	EDMI MK6	IP modem over Telstra NEXT-G network	Ashley-CentWest1	22 kV/415 V	ION 7400	4G
HB12	EDMI MK6	IP modem over Telstra NEXT-G network	Russell-Pine	11 kV/415 V	ION 7400	4G
NH9	EDMI MK6	IP modem over Telstra NEXT-G network	Waterdale-Crissane	22 kV/415 V	ION 7400	4G
NS9	EDMI MK6	IP modem over Telstra NEXT-G network	Dean-MtAlexander	22 kV/415 V	ION 7400	4G
NT3	EDMI MK6	IP modem over Telstra NEXT-G network	Nelson-Kanowana	22 kV/415 V	ION 7400	4G
PV24	EDMI MK6	IP modem over Telstra NEXT-G network	BoxForest-Yooralla	11 kV/415 V	ION 7400	4G
SBY31	EDMI MK6	IP modem over Telstra NEXT-G network	Evans-Brook	22 kV/415 V	ION 7400	4G
SHM14	EDMI MK6	IP modem over Telstra NEXT-G network	Gourlay-Grevilla	22 kV/415 V	ION 7400	4G

Feeder	Existing EoF PQM Type	Existing Communication Method	Distribution Substation Location	Voltage	New EoF Meter	Proposed Communication Method
ST34	EDMI MK6	IP modem over Telstra NEXT-G network	Northbourne 202-Ainslie	22 kV/415 V	ION 7400	4G
TH12	EDMI MK6	IP modem over Telstra NEXT-G network	Quarry-Sunshine	22 kV/415 V	ION 7400	4G
YVE15	EDMI MK6	IP modem over Telstra NEXT-G network	Rosemond-HighpointMye r2	22 kV/415 V	ION 7400	4G

This option has the consequence of capital investment; nevertheless this option provides following benefits:

- Risk of non-compliance with Victorian Electricity Distribution Code is avoided.
- Risk of cost associated with damage to customer appliance is avoided.
- Risk of cyber security threats leading from unsupported Windows Operating System is avoided.

This option shall be delivered by the end of 2022, at an estimated cost of $835k (total project cost, real $2019), inclusive of overheads.

3.2.2.2 Market & financial benefits

This section is not necessary as the project is considered mandatory for meeting Jemena's regulatory obligations.

3.2.2.3 Regulatory considerations

The replacement of all remaining EoF PQM in JEN shall be fully compliant to the current rules and regulations.

Table 3–1: Summary of Options and their technical feasibility

Option #	Description of Option	Further sub-options	Whether technically feasible or not (Yes/No)	Whether selected for further evaluation (Yes/No)
1	Base Case – Do Nothing		Yes	Yes
2	Planned and proactive PQM replacement		Yes	Yes

On the basis of above, Options 1, & 2 were considered for further evaluation.

4. OPTION EVALUATION

From above, it is noted that:

- Option 1 (Do Nothing) does not address the risks and issues related to EoF PQM failure; it does not require any additional intervention costs to the current maintenance and replacement practice (CAPEX or OPEX).
- Option 2 mitigates the identified risks (i.e. increasing failure rates and unavailability of data recording) associated with obsolete and deteriorating EoF PQMs.

4.1 ECONOMIC ANALYSIS

This section is not necessary as the project is considered mandatory for meeting Jemena's regulatory obligations at the lowest cost.

5. RECOMMENDATION

This business case recommends adopting Option 2 among the available options. This option is to replace obsolete and deteriorating EoF PQM infrastructure installed across JEN, at a total investment of $835,000 (total project cost, real $2019) which will require approval of the Jemena Leadership Team – Executive General Managers (Band C) approval under the SGSPAA DFA Manual, Annex 3.

Appendix A
Project Scope and Delivery Information

A1. HIGH LEVEL SCOPE

High level summary of scope of works for this project is to:

a) Replace all remaining (Refer to Section 3.2.2) EoF PQM with new ION 7400 PQM.

b) Once all existing EoF meters have been replaced with the new ION 7400 PQM, existing PQM database shall be archived in a safe location for future reference.

c) Once it has been archived, the old server shall be decommissioned properly.

d) Any equipment associated with the old server shall be removed from site and disposed accordingly.

A2. PROJECT COST ESTIMATE

Estimated cost - $835,000 including overheads.

Appendix B
Network Risk Assessment Summary

Jemena

B1. NETWORK RISK ASSESSMENT SUMMARY

Click here for INSTRUCTIONS

Business Case Summary JEN Asset Specific (Strategic)
Context statement: Project Name: Mitigate Risk Associated with Protection Relays at Braybrook (BY) Zone Substation
Participants: Kopee Vaikundan
Workshop Date: 27/09/18

Update Inserted / Deleted Cells

Identified Risk	Hazard Effect	Operational Risk Category	Before Implementing Strategy			Risk Treatment	After Implementing Strategy	
			Consequence	Likelihood	Risk Rating	Control / Minimisation	Expected Likelihood	Expected Risk Rating
Failure of the EoF power quality meter	Risk associated with the failure of the power quality meter are: (1) Loss of power quality data which will result in Non-Compliance with Electricity Distribution Code (Clause 4.2.6) and National Electricity Rules (Schedule 5.1).	Regulatory & Compliance (JEN)	Severe	Possible	Significant	Initiate a project to replace all remaoing EoF PWM's.	Rare	Moderate