Regulatory Investment Test for Distribution

Non-Network Options Report

Pittsworth Regional Reinforcement

This document describes the *identified need* for investment at Broxburn substation. It includes description of the likely network options and to the extent possible, the characteristics of non-network options which may, either alone or in combination with network or other non-network options, represent a feasible solution for addressing the identified need.

Consultation starts: **1 July 2019**

Consultation ends: **10 January 2020**

Executive Summary

Ergon Energy Corporation Limited (Ergon Energy) is responsible (under its Distribution Authority (DA)) for electricity supply to the Pittsworth area in Southwest Queensland.

Broxburn Substation (BROX) 33/11kV

BROX has two 5MVA 33/11kV transformers supplying the township of Pittsworth and surrounding rural areas including some relatively significant chicken farm loads. Peak demand was 10.46MVA in February 2018 which exceeded the substation nameplate capacity and is expected to exceed the emergency cyclic capacity by 2022.

The two transformers at BROX were manufactured in the 1960s (58yrs old) and the Condition Based Risk Management (CBRM) methodology calculates the end of life of the transformers at 2025 and 2029 respectively. Neither transformer has bunding or oil containment systems posing an environmental risk for aged transformers in poor condition. Adding to this, the transformers are of an unusually narrow configuration. This is problematic because if a failure occurs they cannot be replaced with any Ergon Energy standard transformers or contingency spares due to lack of clearance to the bus. There are also a large number of high voltage switches that have reached their end of life, and the protection scheme does not meet current standards.

Based on load forecasts, the substation is expected to exceed its emergency cyclic capacity with both transformers in service by 2022. Without addressing these emerging constraints proactively, during peak load times this will result in forced load shedding.

The first objective of the proposed investment is to ensure there is sufficient capacity to enable customers to connect new loads and to avoid customer load shedding during peak demand. Load forecasts show demand is expected to exceed the transformer capacity into the future.

The second objective is to increase the reliability of customer supply by managing the lifecycle (year of manufacture, use, end of life) of primary plant at BROX. A significant number of primary plant are at their end of life as determined by the CBRM methodology. If this aged equipment is not replaced before the nominated end of life there will be an increased likelihood of plant failure. As well as presenting safety risks, the unplanned, sporadic and uncontrolled nature of such failures increases the costs of rectification. The proposed investment under this project addresses these limitations in an economic, efficient and safe manner.

Ergon Energy has proposed to meet these objectives by installing a 10MVA skid transformer by December 2021.

This is a Non-Network Options Report, where Ergon Energy is seeking information from interested parties about possible alternate solutions to address the need for investment at BROX.

Submissions in writing (electronic preferably) are due by **10 January 2020 by 4:00 PM** and should be lodged to Ergon Energy's "Regulatory Investment Test for Distribution (RIT-D) Partner Portal". The portal is available at:

https://www.ergon.com.au/network/network-management/network-infrastructure/regulatory-test-consultations

For further information and inquiries please refer to the "Regulatory Investment Test for Distribution (RIT-D) Partner Portal".

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1. Introduction

This Non-Network Options Report has been prepared by Ergon Energy in accordance with the requirements of clause 5.17.4(e) of the National Electricity Rules (NER).

This report represents the first stage of the consultation process in relation to the application of the Regulatory Investment Test for Distribution (RIT-D) on potential credible options to address the identified replacement expenditure for BROX.

This report:

- Provides background information on the network capability limitations of the distribution network supplying the Pittsworth area.
- Identifies the need which Ergon Energy is seeking to address, together with the assumptions used in identifying and quantifying that need.
- Describes the credible options that Ergon Energy currently considers may address the identified need, including for each:
  - Its technical definitions;
  - The estimated commissioning date; and
  - The total indicative cost (including capital and operating costs)
- Sets out the technical characteristics that a non-network option would be required to deliver in order to address the identified need.
- Is an invitation to registered participants and interested parties to make submissions on credible options to address the identified need.

In preparing this RIT-D, Ergon Energy is required to consider reasonable future scenarios. With respect to major customer loads and generation, Ergon Energy has, in good faith, included as much detail as possible while maintaining necessary customer confidentiality. Potential large future connections that Ergon Energy is aware of are in different stages of progress and are subject to change (including outcomes where none or all proceed). These and other customer activity can occur over the consultation period and may change the timing and/or scope of any proposed solutions.

Submissions in writing (electronic preferably) are due by **10 January 2020 by 4:00 PM** and should be lodged to Ergon Energy's "Regulatory Investment Test for Distribution (RIT-D) Partner Portal". The portal is available at:

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For further information and inquiries please refer to the "Regulatory Investment Test for Distribution (RIT-D) Partner Portal".

2. Background

Pittsworth is a township southwest of Toowoomba known for its agricultural and animal industries. Electricity is supplied to 2,877 customers which comprises of 2,258 domestic and 619 industrial loads. These customers are supplied by substations at Broxburn and Yarranlea South. The 33kV subtransmission supply comes from Yarranlea T10 (YARA T10) 110/33kV bulk supply point that also supplies the substations Norwin (NORW), Cecil Plains (CEPL), Pampas (PAMP), and Millmerran (MILM). Figure 1 and Figure 2 provide an overview of the subtransmission network in the region and the location of Broxburn substation.

YARA T10 110/33kV and PAMP 33/11kV show capacity constraints in an N-1 contingency which are addressed in other projects outside the scope of this report. The 33kV subtransmission network is not constrained until past the 2028 forecast.

2.1 Investment Objectives

Objective 1: Ensure that there is sufficient capacity to enable customers to connect new loads and to avoid customer load shedding during peak demand. Loads at BROX are forecast to exceed the emergency cyclic capacity of its transformers in 2022 with both transformers in service. Without addressing these emerging constraints proactively, during peak load times this will result in forced load shedding as well as the inability to connect new customers.

Objective 2: Increase the reliability of customer supply by managing the lifecycle (year of manufacture, use, end of life) of primary plant at BROX. Refer to Appendix A for the primary plant that is at its end of life as determined by the CBRM methodology.

Objective 3: Reduce all risks identified at BROX to As Low As Reasonably Practicable (ALARP). Refer to Appendix A for the risk assessment.

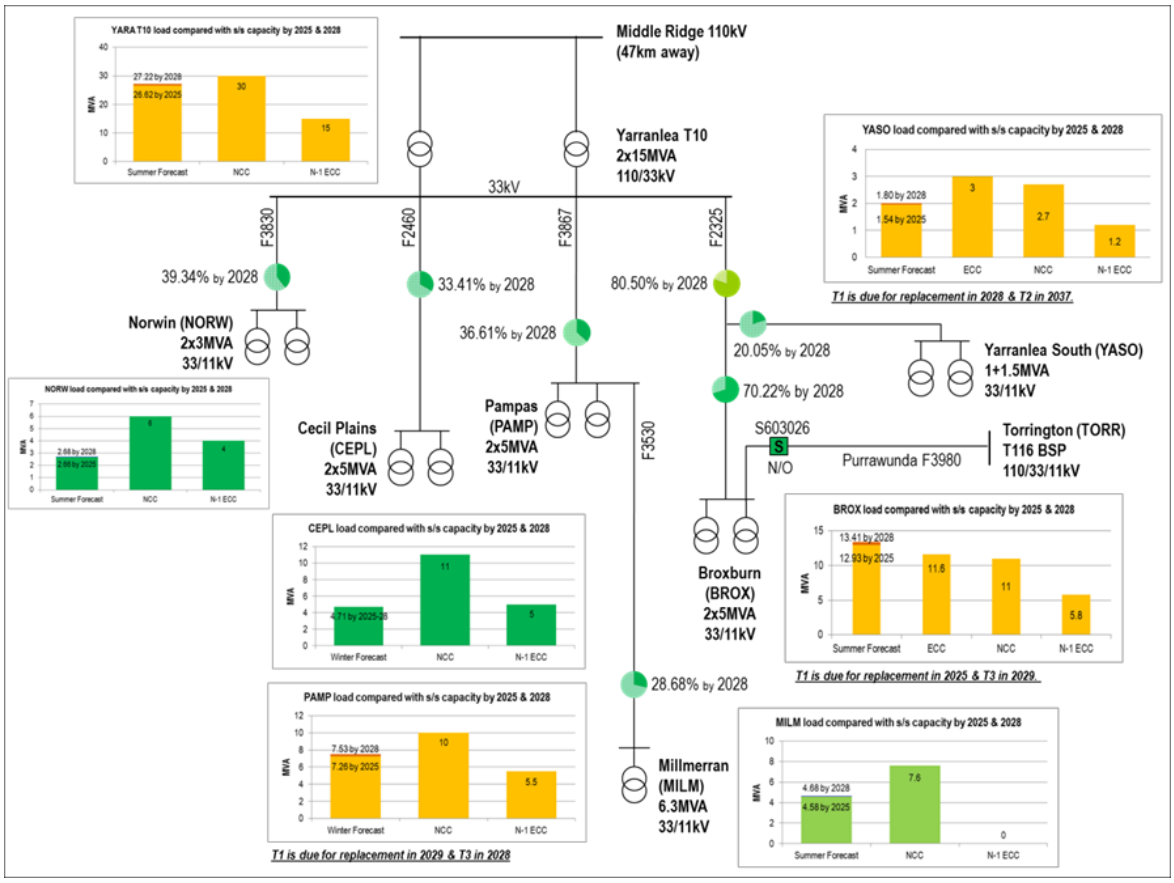

Figure 1: Overview of the 33KV subtransmission network from Yarranlea T10

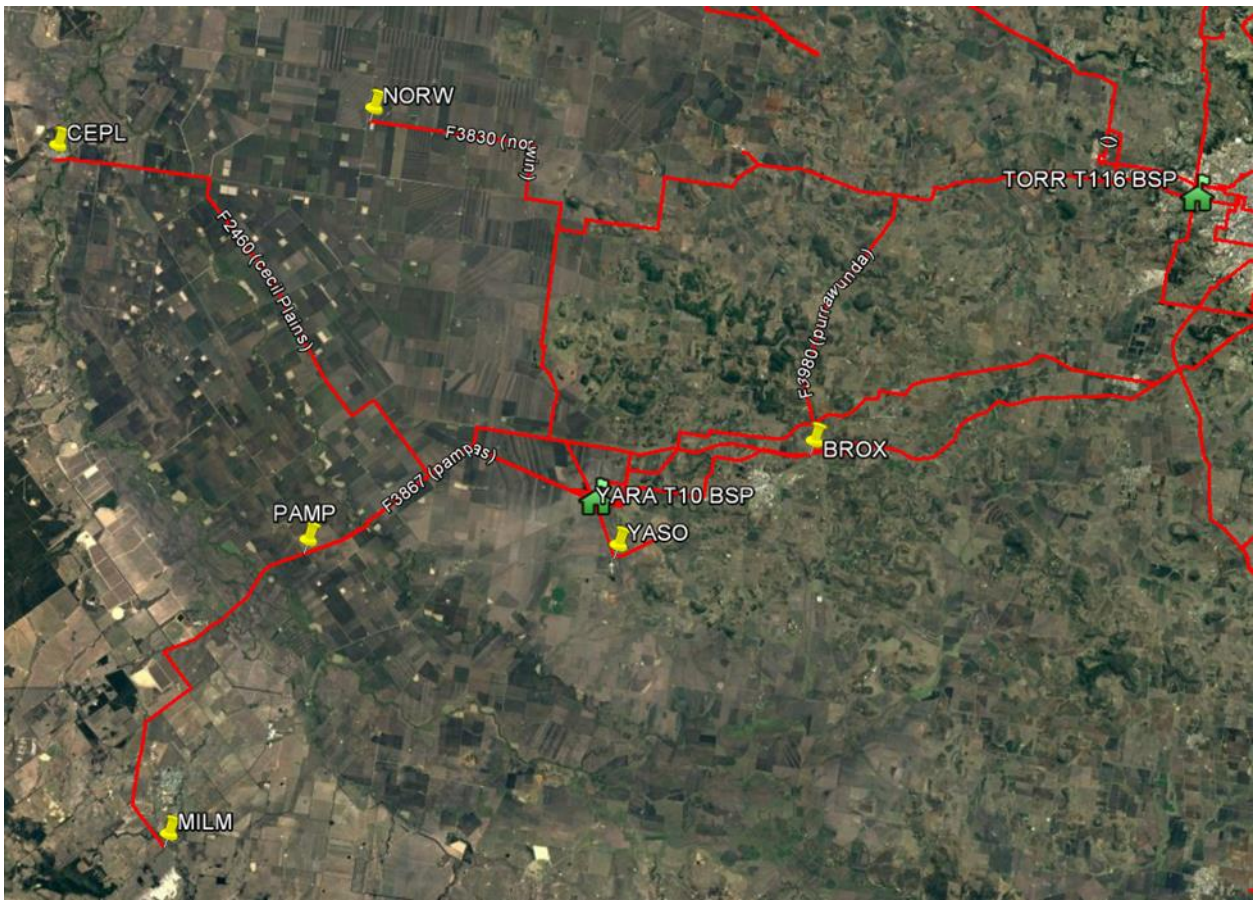

Figure 2: Geographic view of existing network arrangement

2.2 Broxburn Substation

Existing Substation Capacity BROX

Table 1: BROX transformer ratings

ZS	Transformer	Nameplate Rating (MVA)	kV	YOM	Cooling	NCC	ECC
BROX	1	5	33/11	1962	ONAN	5.5	5.8
BROX	3	5	33/11	1966	ONAN	5.5	5.8

Existing and Forecast Load BROX

As shown in Figure 3, BROX load is currently breaching N-1 ECC and is approaching substation NCC and ECC. Peak demand was 10.46MVA in February 2018.

The annual load duration curve for BROX shown in Figure 4 illustrates that currently when either transformer is out of service, substation load exceeds the N-1 ECC rating 7.5% of the time. This is equivalent to 657 hours annually.

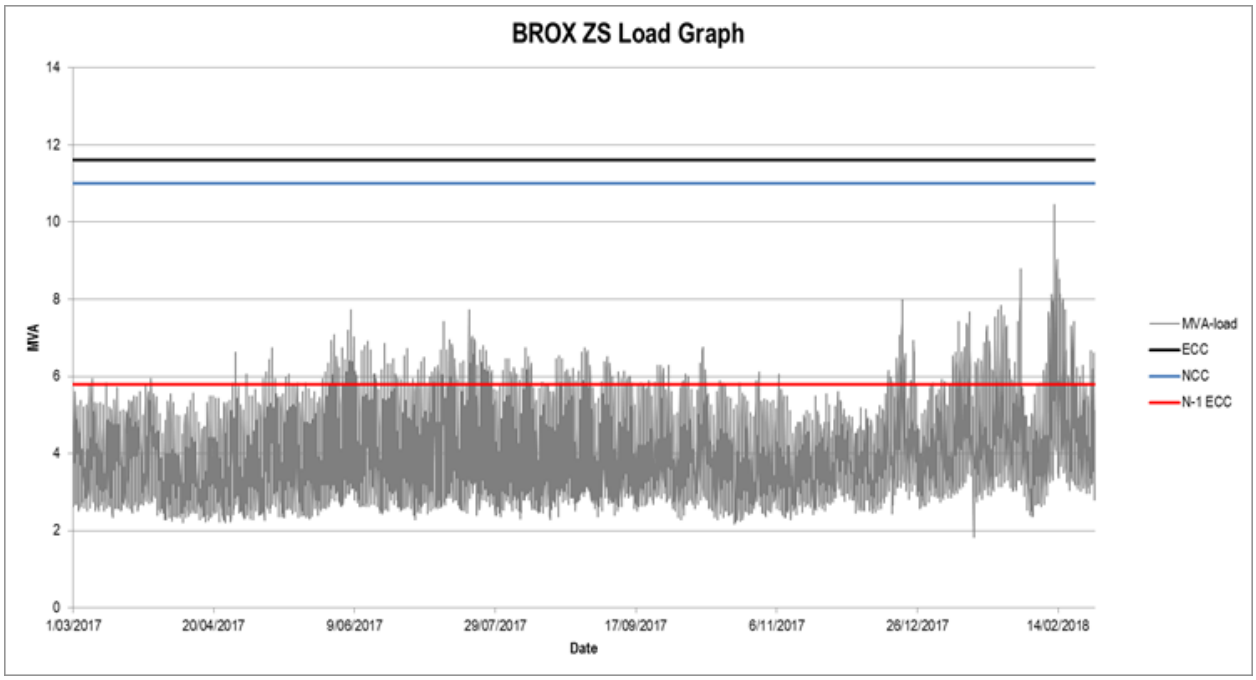

Figure 3: BROX substation historical load

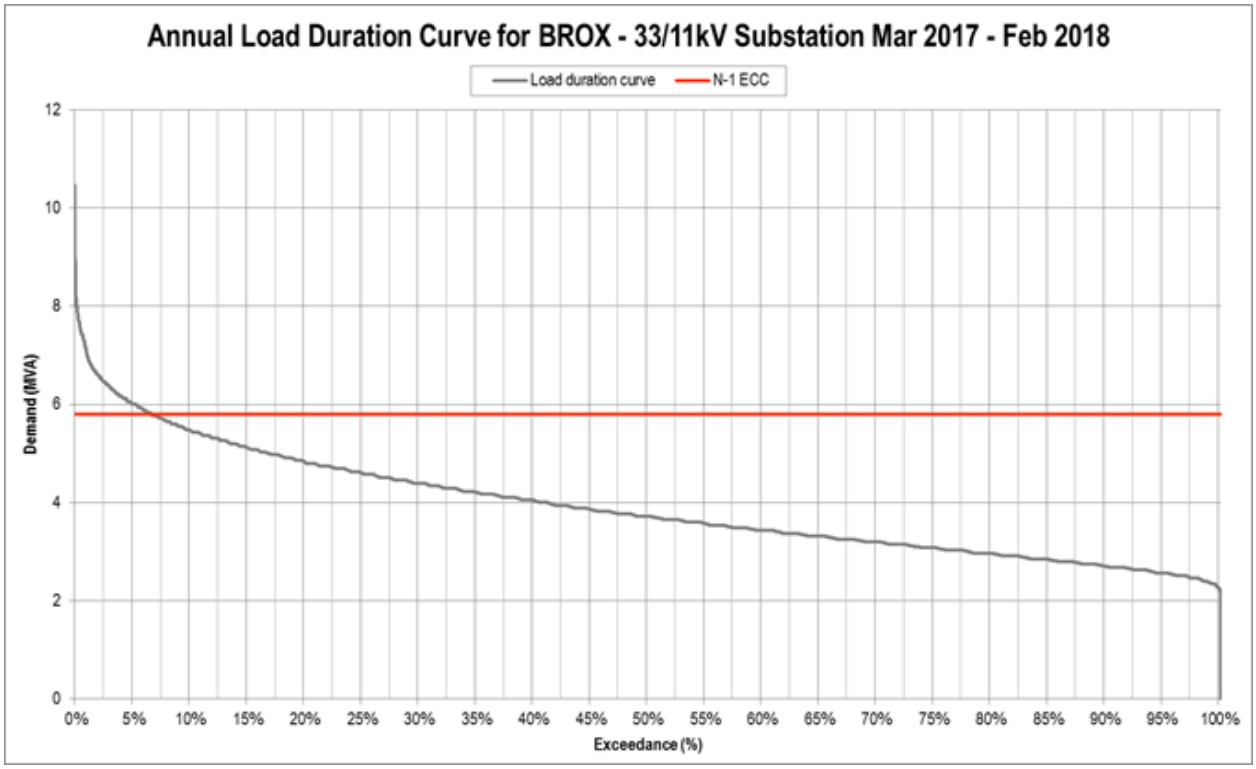

Figure 4: BROX load duration curve

Figure 5 is the load forecast at BROX and shows an abrupt increase in demand in 2019 and 2022 due to two customer connection applications.

It can be seen that the N-1 ECC rating of the substation is currently being exceeded and that by year 2022, the NCC and ECC (with both transformers in service) ratings will be exceeded as well.

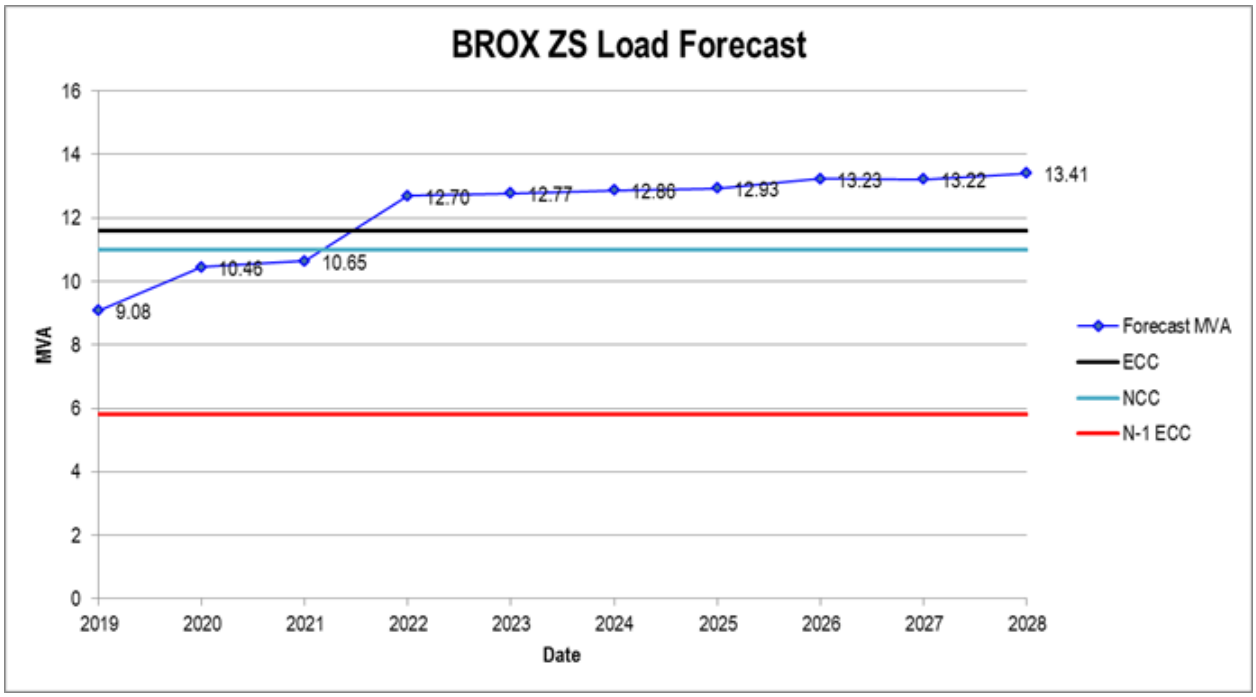

Figure 5: BROX substation forecast

3. Technical requirements of the solution

A suitable solution to meet Ergon Energy's operational requirements should address the limitations in substation capacity, aging plant and equipment and identified network and safety risks at BROX. Ergon Energy is willing to consider other possible solutions which may be identified as part of the RIT-D process. The alternate non-network solutions must comply with a number of Ergon Energy standards which include, but are not limited to, Safety Net reliability standards, quality of supply, design and safety standards.

The following are general parameters to which a non-network option must comply with. It is expected that any proposed solution is in accordance with good electricity industry practices, such that a high reliability and availability solution is delivered.

3.1. Substation Capacity

The following pertains to substation capacity for any non-network solution:

1. Transformer capacity (or capacity) will be available to accommodate demand, large customer applications, and load forecast.
2. Capacity will be available in the event of transformer failure.
3. Capacity will be adequate when transferring load to another substation and/or source during contingency.

3.2. Aging Plant and Equipment

The existing plant at Broxburn is mostly 1960s era. A non-network option must address the risk to the network and plant and personnel from operating such plant which is at the end of its lifecycle (year of manufacture, use, end of life).

3.3. Service Standards

3.3.1 Minimum Service Standards

Under its DA Ergon Energy is responsible for electricity supply to the Pittsworth area. The DA requires that Ergon Energy must:

- Comply with the Guaranteed Service Levels regime notified by the Queensland Regulator which includes reliability of supply to customers;
- Plan and develop its supply network in accordance with good electricity industry practice, having regard to the value that end users of electricity place on the quality and reliability of electricity services;
- Use all reasonable endeavours to ensure that it does not exceed in a financial year the Minimum Service Standards (System Average Interruption Duration Index and System Average Interruption Frequency Index limits) applicable to its feeder types; and
- Ensure, to the extent reasonably practicable, that it achieves its Safety Net targets. Refer to Table 2.

3.3.2 Safety Net

The non-network option must satisfy the Safety Net reliability standard and meet the restoration times for loads not supplied during contingencies. Refer to Table 2 below.

Table 2: Safety Net restoration times. BROX is classified rural area.

Safety Net – Load not supplied and maximum restoration time following a credible contingency	
Regional Centre	**Rural Area**
Less than 20MVA (5000 customers) after 1 hour; Less than 15MVA (3600 customers) after 6 hours; Less than 5MVA (1200 customers) after 12 hours; and Fully restored within 24 hours.	Less than 20MVA (7700 customers) after 1 hour; Less than 15MVA (5800 customers) after 8 hours; Less than 5MVA (2000 customers) after 18 hours; and Fully restored within 48 hours

3.4. Land and proximity to Substation

Ergon Energy owns some additional land at BROX. Refer to Figure 6. Ergon Energy is open to discussions around the use of these lands as part of the non-network solution.

Figure 6: Broxburn substation land and site dimensions.

4. Feasible vs Non Feasible Options

4.1. Potentially Feasible Options

The identified need presented in this RIT-D report is driven by the limitation in transformer capacity and the near end of life of plant which are necessary for the reliable supply of electricity. As such, solutions that cost-effectively address the capacity and end-of-life plant at BROX through augmentation and/or replacement within the required parameters are likely to represent reasonable options. Any option must also address the objectives to reduce environmental and safety risks to ALARP.

A non-exhaustive list of potentially feasible options includes:

- Additional transformer capacity to supply the forecast demand for the next 40-50 years.
- Replacement of plant nearing end-of-life.
- Providing demand management or generation strategies that postpone the required augmentation/replacement expenditure.

4.2. Options that are unlikely to be feasible

Without attempting to limit a potential proponent's ability to innovate when considering opportunities, some technologies/approaches are unlikely to represent a technically or financially feasible solution. Unproven, experimental or undemonstrated technologies are unlikely to be feasible if the:

- Option does not meet all of the objectives stated in Section 2.1
- Option requires completion beyond December 2021.
- Options that do not meet or are unable to demonstrate they can meet the Service Standards of Ergon Energy.

4.3. Timing of feasible options

The consequence of not addressing aging plant and equipment and not meeting Safety Net is significant. As a result of this it is expected that for an option to be considered feasible it will be required to be completed, commissioned, accepted by Ergon Energy, and fully operational by December 2021.

5. Internal Options Identified

Ergon Energy's preferred internal option is to install a skid transformer at BROX which will address capacity and aged plant limitations. The target year for completion is December 2021 because by 2022 demand will exceed the normal cyclic capacity at BROX.

Table 3 provides the approximate anticipated cost for the proposed solution. It is noted at the time of writing the RIT-D more detailed cost estimates are being performed which may cause some change to the below figures.

Table 3: Ergon Energy's internal cost for the preferred option

Internal option	10MVA skid at Broxburn Substation
ACP	$6,865,316

6. Submission and Next Steps

6.1. Submissions from Solution Providers

Ergon Energy invites written submissions to address the identified need in this report from registered participants and interested parties. With reference to Section 3 and Appendix A, all submissions should include sufficient technical and financial information to enable Ergon Energy to undertake comparative analysis of the proposed solution against other options. The proposals shall include, but are not limited to, at least the following:

- Full costs of completed works.
- Whole of life costs including losses.
- Project execution strategy including design, testing and commissioning plans.
- Engineering network system studies and study reports.
- Verified and approved engineering designs.

- Manufacture and supply of all plant, equipment and materials.
- Delivery to site, receiving and off-loading of all plant, equipment and materials.
- Assembly and installation on site.

Whereas the above-listed requirements are not exhaustive, it may not be possible for some of these details to be available for certain non-network alternatives. It is, however, the responsibility of the interested parties and non-network providers to provide sufficient supporting information to establish the technical and financial credibility and competitiveness of their proposed solution.

Ergon Energy will not be legally bound in any way or otherwise obligated to any person who may receive this RIT-D report or to any person who may submit a proposal. At no time will Ergon Energy be liable for any costs incurred by a proponent in the assessment of this RIT-D report, any site visits, obtainment of further information from Ergon Energy or the preparation by a proponent of a proposal to address the identified need specified in this RIT-D report.

The RIT-D process is aimed at identifying a technically feasible alternative to the internal option that has greater net economic benefits. However, the selection of the solution provider to implement the preferred option will be done in accordance with Ergon Energy's standards for procurement.

Submissions in writing are due by **10 January 2020 by 4:00 PM** and should be lodged to Ergon Energy's "Regulatory Investment Test for Distribution (RIT-D) Partner Portal" through the link:

https://www.ergon.com.au/network/network-management/network-infrastructure/regulatory-test-consultations .

6.2. Next Steps

Ergon Energy intends to carry out the following process to assess what action should be taken to address the identified need at Broxburn substation:

Table 4: Timetable for this RIT-D

Step 1	Publish Non Network Options Report (this report) inviting non-network options from interested participants	Date Released: **1 Jul 2019**
Step 2	Consultation period	**1 Jul 2019 – 10 Jan 2020**
Step 3	Deadline for Submission of proposals for non-network alternatives	**4pm 10 Jan 2020**
Step 4	Release of Draft Project Assessment Report (DPAR)	Anticipated to be released by: **24 Jan 2020**
Step 5	Consultations in response to the Draft Project Assessment Report	**24 Jan 2020 – 6 Mar 2020**
Step 6	Publish the Final Project Assessment Report (FPAR)	**13 Mar 2020**
Ergon Energy reserves the right to revise this timetable at any time. The revised timetable will be made available on the Ergon Energy RIT-D website.		

Ergon Energy will take all reasonable efforts to maintain the consultation schedule listed above. Due to various circumstances the schedule may change, however, up-to-date information will be available on the Partner Portal.

During the consultation period, Ergon Energy will review, compare and analyse all internal and external solutions. At the end of the consultation and review process Ergon Energy will publish a final report which will detail the most feasible option and proceed to implement that option.

7. Appendix A

Condition Based Risk Management BROX

Asset Class	Substation	Asset Name	CBRM Group	Plant Type	YOM / Inferred YOM	Age (yrs)	Estimated Retirement Year
IE	BROX	SW BROX AB13921 - IE92179859 1981 33kV 400A TAPLIN > D751/C894/8 (###)	Sub-transmission		1981	36	
IS	BROX	SW BROX AB10439 - IS92510625 yyyy 11kV ##A ### > ### (###)	Distribution		1966	51	2016
IS	BROX	SW BROX AB13919 - IS92555342 1981 33kV 400A TAPLIN > D751/C894/8 (###)	Sub-transmission		1981	36	
IS	BROX	SW BROX AB13920A - IS92555505 1981 33kV 400A TAPLIN > D751/C894/8 (###)	Sub-transmission		1981	36	
IS	BROX	SW BROX AB13922 - IS92451397 1981 33kV 400A TAPLIN > D751/C894/8 (###)	Sub-transmission		1981	36	
IS	BROX	SW BROX AB13923 - IS92291308 1981 33kV 400A TAPLIN > D751/C894/8 (###)	Sub-transmission		1981	36	
IS	BROX	SW BROX AB13924 - IS92286773 1981 33kV 400A TAPLIN > D751/C894/8 (###)	Sub-transmission		1981	36	
IS	BROX	SW BROX AB13978 - IS91733925 yyyy 11kV ##A ### > ### (###)	Distribution		1966	51	2016
IS	BROX	SW BROX AB14391 - IS92463057 1986 11kV 630A TAPLIN > D169H/1C (###)	Distribution		1986	31	
IS	BROX	SW BROX AB7140 - IS91809680 yyyy 11kV ##A ### > ### (###)	Distribution		1966	51	2016
IS	BROX	SW BROX AB7141 - IS91817505 yyyy 11kV ##A ### > ### (###)	Distribution		1966	51	2016
IS	BROX	SW BROX AB7142 - IS92326620 yyyy 11kV ##A ### > ### (###)	Distribution		1966	51	2016
IS	BROX	SW BROX AB8541 - IS91725468 yyyy 11kV ##A ### > ### (###)	Distribution		1966	51	2016
IS	BROX	SW BROX AB8542 - IS92319036 yyyy 11kV ##A ### > ### (###)	Distribution		1966	51	2016
IS	BROX	SW BROX AB8543 - IS92526361 yyyy 11kV ##A ### > ### (###)	Distribution		1966	51	2016
IS	BROX	SW BROX AB8546 - IS91733173 yyyy 11kV ##A ### > ### (###)	Distribution		1966	51	2016
IS	BROX	SW BROX AB8547 - IS91730027 yyyy 11kV ##A ### > ### (###)	Distribution		1966	51	2016
TR	BROX	SW BROX T1 - TR92985647 1962 33/11 kV 5MVA AEI (38340)	Type XS	On Load TapChanger	1962	55	2025
TR	BROX	SW BROX T1 - TR92985647 yyyy 33/11 kV 5MVA AEI (38340)	Type XS	On Load TapChanger			
TR	BROX	SW BROX T3 - TR92596009 1966 33/11 kV 5MVA AEI (45109)	Type XS	On Load TapChanger	1966	51	2029

Risk Assessment at Broxburn substation

Risk Category	Equipment	Risk Scenario	Inherent / Untreated Risks			Target (Residual)	
			C	L	Risk Score	L	Risk Score
Customer	Other	Substation ECC breach at BROX results in > 1min changeover outage > 3 times in one week during high load times to allow Nomad load support connection.	3	5	15 (Moderate)	1	3 (Very Low) ALARP
			C	L	Risk Score	L	Risk Score
Customer	Transformer	Fault or Non-Spurious Trip on 33/11kV Transformer at BROX results in interruption >24 hours.	4	4	16 (Moderate)	1	3 (Very Low) ALARP
			C	L	Risk Score	L	Risk Score
Environment	Transformer	Catastrophic failure of a 33/11kV transformer at BROX results in an oil spill > 1000 litres that extends beyond the property boundary (transformers not bunded).	4	3	12 (Moderate)	1	4 (Very Low) ALARP
			C	L	Risk Score	L	Risk Score
Safety	Isolator / Insulator	Catastrophic failure of 33kV isolator at BROX results in serious injuries to multiple field workers or members of public.	4	2	8 (Low)	1	4 (Very Low) ALARP
			C	L	Risk Score	L	Risk Score
Safety	Transformer	Catastrophic failure of 33/11kV transformer at BROX results in serious injuries to multiple field workers or members of public. Likelihood based on condition, loading and history	4	4	16 (Moderate)	1	4 (Very Low) ALARP

Pittsworth Regional Reinforcement
Internal Assessment for Non-network Alternatives

Non Network Alternatives (NNA)

BROXBURN SUBSTATION (BROX) 33/11kV

CI has assessed the potential demand management options required to defer the identified BROX network option and determine if there is a viable non network option to replace or reduce the need for the proposed Network option. CI has reviewed the customer base and considered a number of demand management technologies based on the primary project driver of augmentation to meet a growth forecast to exceed the emergency cyclic capacity by 2022. It is unclear that demand management could assist in any way with addressing the secondary project driver of aged asset replacement. The DM goal would be to extend the life of the transformers by de-loading them at peak times.

There are 2131 residential customers and 581 business customers connected to BROX (refer Figure 1.) 36 business customers are classified as Large, 8 of these sites have significant (> 200 kVA) maximum demand.

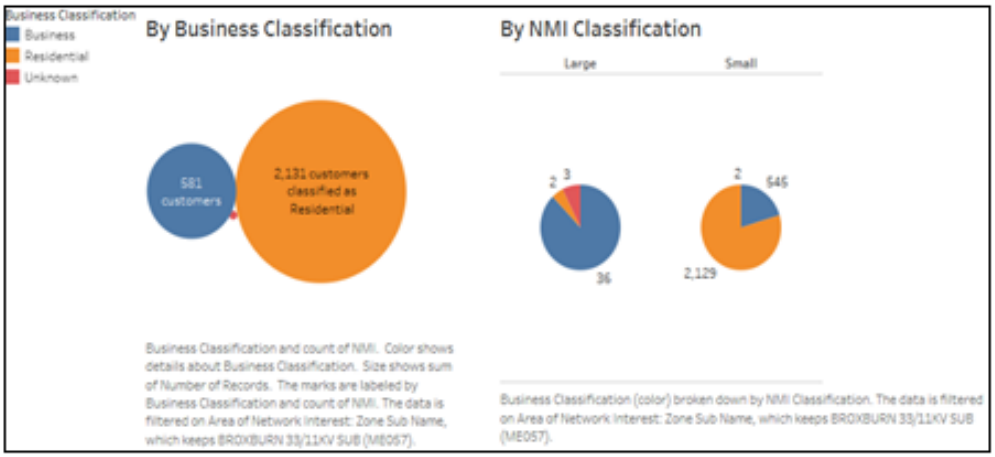

Figure 1

Residential

Residential customers appear to drive the daily peak of demand which occurs between 4.00pm-7.30 pm, (Figure 2) the summer period producing the highest yearly demand. BROX has 1599 customers on tariff T31 and T33 hot water load control (LC); the estimated demand reduction value of which is 959 kVA+. Broxburn substation LC signals are controlled from Yarranlea BSP 110/33 kV substation. The Tariff 33 and 31 Hot water LC channels are dynamic (i.e. respond to exceedance settings not on a timetable) currently LC is scheduled to activate when the BSP exceeds 23.5 MVA; this strategy does not directly address peaks experienced at BROX. Tariff 33 Air-conditioning channels are under manual control of the control room and used as required.

+.Hot water diversified demand saving estimated at 0.6KVA per system

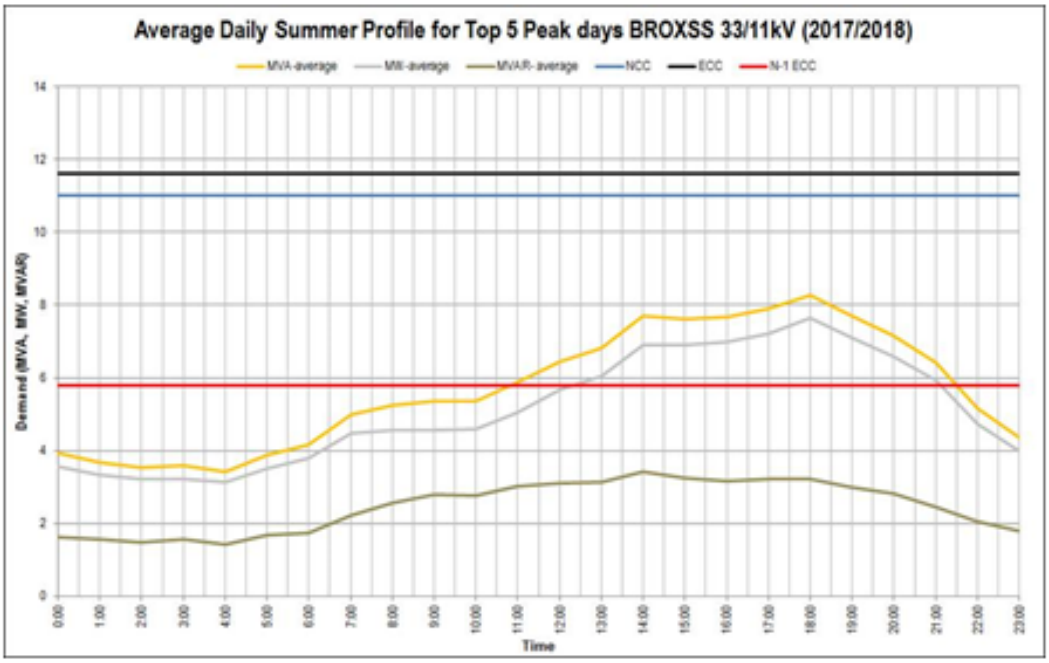

Figure 2

Business

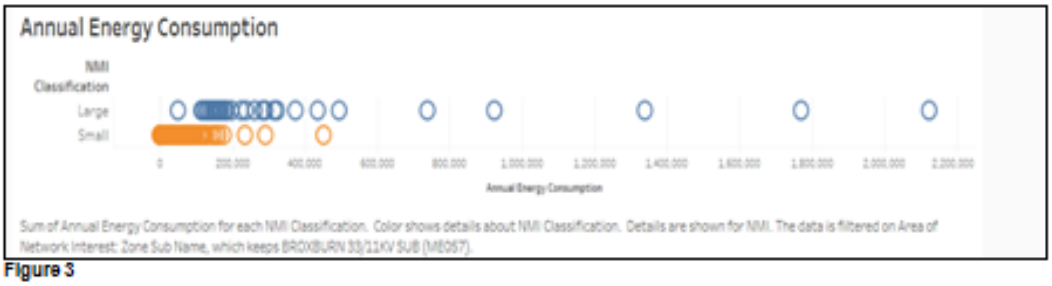

Figure 3

Further analysis of the business customers (seen in Figure 3) shows that 4 of the 8 highest consumption sites have maximum demands of 860 kVA, 674 kVA, 285 kVA, and 65 kVA respectively for a total demand of 1.88MVA. Other notable demands are 355 kVA, 260kVA and 320 kVA. New connection with a demand of 1.5MVA is forecast in 2019 and 2MVA in 2021.

Solar

665 business and residential customers have solar PV systems with a connected kW capacity of 2198 kW's. Pittsworth, Linthorpe, Southbrook and Springside Feeders are registered as at risk of experiencing reverse power flows*.

* Using the total installed capacity of Micro EG Units (with 20% diversity) and Estimated Light Load (20% of Daily Maximum Demand) a rough estimate can be made as to whether generation will exceed the consumption on a feeder.

Demand management – BROX

The customer base has a significant industrial and commercial presence interspersed with small business and residential customers. There is opportunity for demand savings in all these customer market segments. The most cost effective demand reduction measure for the residential market in a short timeframe could be increased utilisation of the existing LC measure (which is currently around 959 kVA) on customers by Ergon to de-load BROX.

The large amount of customer solar PV (2198 kW) adds potential for a BESS offering in future.

Commercial incentives for lighting and power factor could be offered for demand reductions but would take a longer term to be realised.

Demand response – BROX

Demand response through customer embedded generation, call off load and load curtailment contracts has been assessed as technically viable as there is significant business customer opportunity with the top existing 7 customer sites. They have significant diesel generation assets and have previously indicated their interest in entering into commercial arrangements for this generation. If the new connection of 1.5MVA is included to the current total demand, the demand reduction would be 3.3MVA.

Other DR opportunities may exist with sites with > 200 kVA maximum demand sites at the Hospital etc.

Summary - BROX

- 665 customers have 2198 kW's PV on the Network
- 4 feeders registered as at risk of experiencing reverse power flows*.
- 959 kVA (est.) of potential T31 and T33 hot water load control.
- Peak demand occurs in summer 4 pm to 7.30 pm driven by residential market
- Significant Industrial and commercial business customers with > 200kVA and existing diesel generation available
- The new connection is willing to enter into NSA for diesel generation

Conclusion

Based on the demand management options considered above, it is deemed that sufficient demand management measures could be feasibly implemented to contribute to technically and economically deferring the network investment required at BROX. Particularly as the primary investment drivers are augmentation triggered by growth with aged asset replacement, reliability, environmental risk, safety and standards compliance listed as secondary drivers.

CI believes there could be financial benefits from seeking expressions of interest from the market for a Non Network Alternative to proposed Network investment suggested in the Planning Report.

8. Glossary of Terms

Abbreviation	Description
ACP	Approved Cost Plan
BROX	Broxburn substation 33/11kV
CBRM	Condition Based Risk Management
CEPL	Cecil Plains substation 33/11kV
ECC	Emergency cyclic capacity
MILM	Millmerran substation 33/11kV
N-1 ECC	Capacity available when the largest transformer fails
NCC	Normal cyclic capacity
NORW	Norwin substation 33/11kV
ONAN	Oil Natural Air Natural
PAMP	Pampas substation 33/11kV
RIT-D	Regulatory Investment Test for Distribution
YARA T10	Yarranlea (T10) 110/33kV bulk supply point
YOM	Year of manufacture
ZS	Zone Substation (or simply substation)