Regulatory Investment Test for Distribution

Final Project Assessment Report

Reliable Provision of Electricity to the Maryborough Supply Area

This document describes the *identified need* for investment at Maryborough substation and the preferred option for addressing the identified need.

Publication Date: 28 June 2021

Executive Summary

ABOUT ERGON ENERGY

Ergon Energy Corporation Limited (Ergon Energy) is part of the Energy Queensland Group and manages an electricity distribution network which supplies electricity to more than 740,000 customers. Our vast operating area covers over one million square kilometres – around 97% of the state of Queensland – from the expanding coastal and rural population centres to the remote communities of outback Queensland and the Torres Strait.

Our electricity network consists of approximately 160,000 kilometres of powerlines and one million power poles, along with associated infrastructure such as major substations and power transformers.

We also own and operate 33 stand-alone power stations that provide supply to isolated communities across Queensland which are not connected to the main electricity grid.

IDENTIFIED NEED

Maryborough 132/66kV substation (MARY) T59 is a Bulk Supply Point which supplies approximately 50,000 customers and 125MVA of peak load through connected zone substations. The 80MW Susan River Solar Farm is also connected to the 66kV network through a dedicated substation. MARY is located west of Maryborough and supplies the majority of the Fraser Coast Local Government Area, including the major regional centres of Maryborough and Hervey Bay as well as several smaller towns.

MARY has two incoming 132kV feeders originating from Aramara 132kV Switching Substation and six outgoing 66kV feeders. Maryborough and Hervey Bay are each supplied from a pair of 66kV feeders which form a ring in each town. The remaining two feeders link MARY to Kilkivan 132/66kV (KILK) T12 and Howard 66/11kV (HOWA) respectively.

MARY was constructed in approximately 1980 and a condition assessment has identified several assets that require replacement due to their condition and associated risk. A review of substation limitations has also identified that MARY is not compliant with the Safety Net provisions of its Distribution Authority (DA) No. D01 or the Network Performance requirements of the National Electricity Rules (NER).

The purpose of this project is to address limitations on aged and poor condition assets, compliance with Safety Net provisions of the DA, and compliance with performance standards as set out in the NER. The substation condition assessment report identified the assets nearing the end of their useful life. As such, replacement of these assets includes 132 and 66kV circuit breakers, 132 and 66kV voltage transformers, 132 and 66kV current transformers, and 66kV protection relays. The condition of these assets is safety-critical, the risk score is moderately high and does not satisfy as low as reasonably practicable (ALARP). Safety-critical is a system failure or malfunction resulting in serious injury or fatality, loss or damage to equipment and property, and environmental harm.

A review of MARY against Safety Net compliance has identified that in the event of a 66kV bus trip, restoration targets will not be met. MARY has no 66kV bus section circuit breakers and consequently, a 66kV bus zone fault or circuit breaker fail (CBF) protection results in instantaneous loss of supply to the 66kV network.

APPROACH

The NER require that, subject to certain exclusion criteria, network business investments for meeting service standards for a distribution business are subject to a Regulatory Investment Test for Distribution (RIT-D). Ergon Energy has determined that network investment is essential in this case for it to continue to provide electricity to the consumers in the Maryborough supply area in a reliable, safe and cost-effective manner. Accordingly, this investment is subject to a RIT-D.

Ergon Energy published a Notice of no non-network options for the above-mentioned identified needs on 26 February 2020.

As the drivers for this project are entirely replacement driven apart from the addition of bus sectioning capability, there was one feasible option which has been investigated in this report. The cost is an indicative estimate at the time when a feasible option was being determined. There will be further stages to the following options in the future as mandated by the recommended replacement of assets.

1. **Option 1** – Replace 132/66kV assets in situ ($7.012M)
   This will require the replacement of the 132 and 66kV assets in the same place, installation of two new 66kV bus tie circuit breakers, and upgrade the protection scheme.

This is now a Final Project Assessment Report, where Ergon Energy presents the technical and financial analysis of the above options and identifies the preferred solution in accordance with the requirements of clause 5.17.4(o) of the NER. Ergon Energy's preferred solution to address the identified need is Option 1 – Replace 132/66kV assets in situ.

Table of Contents

List of Figures and Tables

1. Introduction

This Final Project Assessment Report (FPAR) has been prepared by Ergon Energy in accordance with the requirements of clause 5.17.4(o) of the NER.

This report represents the final stage of the consultation process in relation to the application of the RIT-D on potential credible options to address the identified need for MARY.

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.

1.1. Structure of the report

This report:

- Provides background information of the capability limitations of the distribution network supplying the Maryborough 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)
- Quantifies costs and classes of material market benefits for each of the credible options.
- Provides the results of Net Present Value (NPV) analysis of the credible option and accompanying explanatory statements regarding the results.

1.2. Dispute resolution process

In accordance with the provisions set out in clause 5.17.5(a) of the NER, Registered Participants or Interested Parties may, within 30 days after the publication of this report, dispute the conclusions made by Ergon Energy in this report with the Australian Energy Regulator. Accordingly, Registered Participants and Interested Parties who wish to dispute the conclusions outlined in this report based on a manifest error in the calculations or application of the RIT-D must do so within 30 days of the publication date of this report. Any parties raising a dispute are also required to notify Ergon Energy. Dispute notifications should be sent to demandmanagement@ergon.com.au

If no formal dispute is raised, Ergon Energy will proceed with the preferred option to replace the 132 and 66kV assets and install two new 66kV bus section circuit breakers.

1.3. Contact details

Inquiries about this RIT-D may be sent to:

E: demandmanagement@ergon.com.au

P: 13 74 66

2. Background

Maryborough 132/66kV substation (MARY) T59 is a Bulk Supply Point which supplies approximately 50,000 customers and 125MVA of peak load through connected Zone Substations. The 80MW Susan River Solar Farm is also connected to the 66kV network through a dedicated substation. MARY is located west of Maryborough and supplies the majority of the Fraser Coast Local Government Area, including the major regional centres of Maryborough and Hervey Bay as well as several smaller towns.

MARY was constructed in approximately 1980 and a condition assessment has identified several assets that require replacement due to their condition and associated risk. A review of substation limitations has also identified that MARY is not compliant with the Safety Net provisions of its Distribution Authority (DA) No. D01 or the Network Performance requirements of the NER.

The purpose of this project is to address limitations on aged and poor condition assets, compliance Safety Net provisions of the Distribution Authority, and compliance with performance standards as set out in the NER.

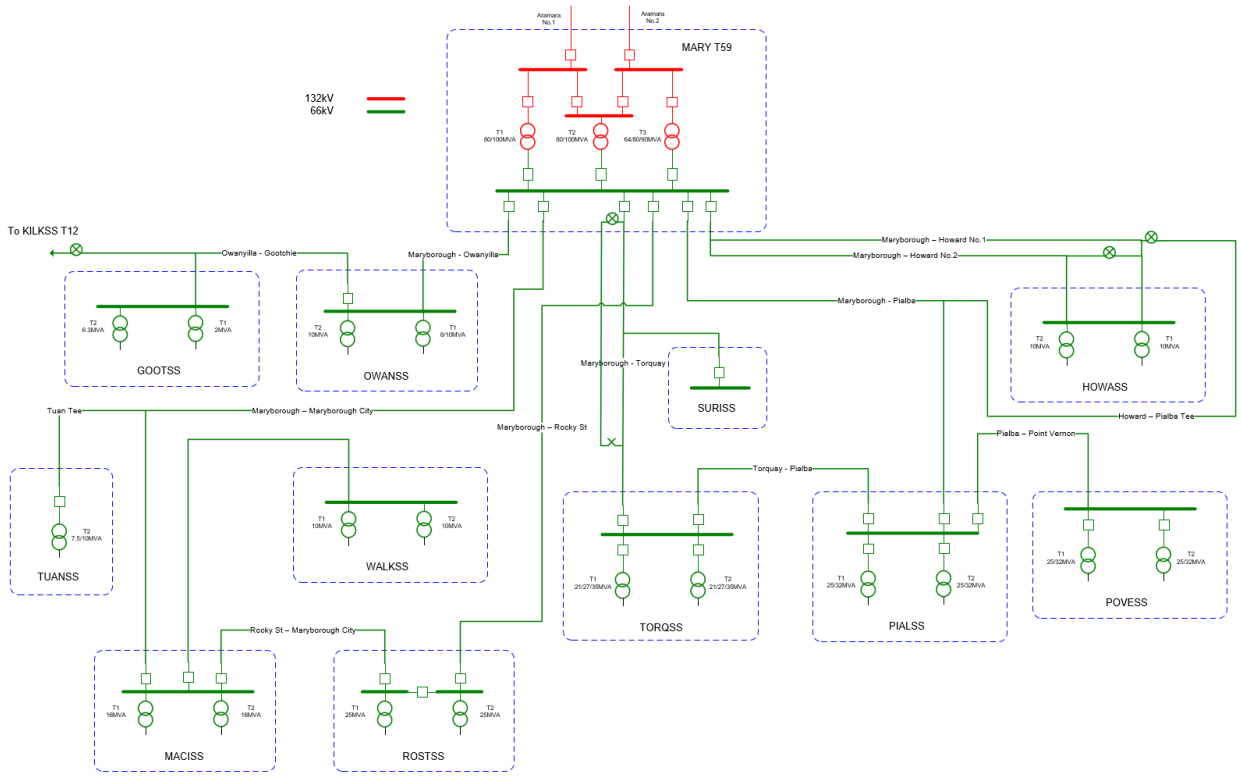


Figure 1: Maryborough Sub-transmission Network

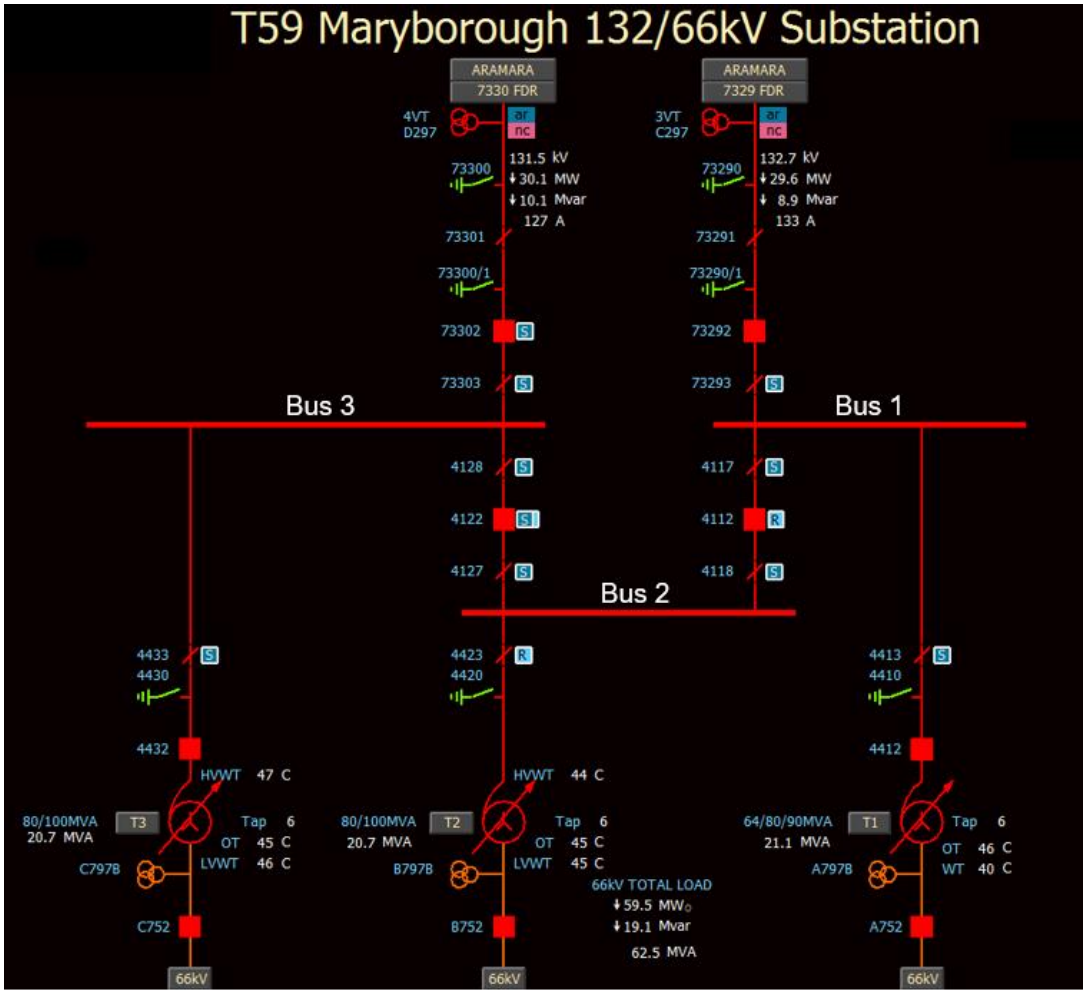


Figure 2: Single line diagram of Maryborough 132kV incoming feeders terminating at a 3-bus arrangement

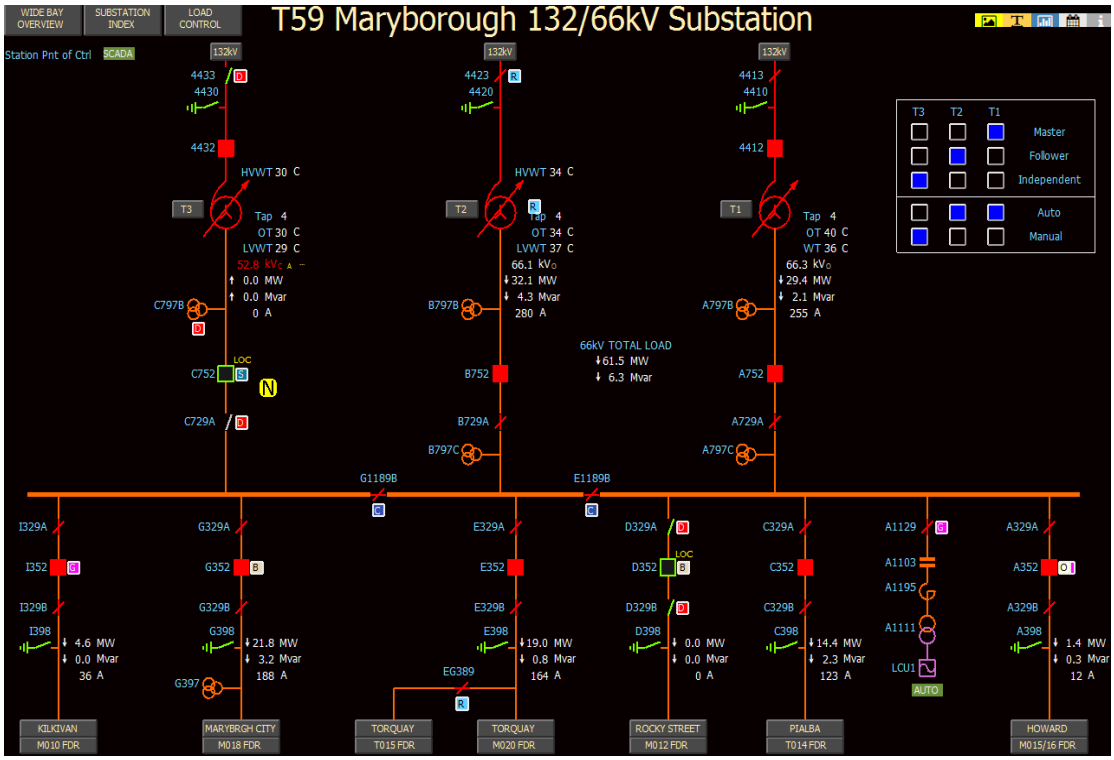


Figure 3: Single line diagram Maryborough 132/66kV

2.1 Existing Supply System

MARY has two incoming 132kV feeders originating from Aramara 132kV Switching Substation and six outgoing 66kV feeders. Maryborough and Hervey Bay are each supplied from a pair of 66kV feeders which form a ring in each town. The remaining two feeders link MARY to Kilkivan 132/66kV (KILK) T12 and Howard 66/11kV (HOWA) respectively.

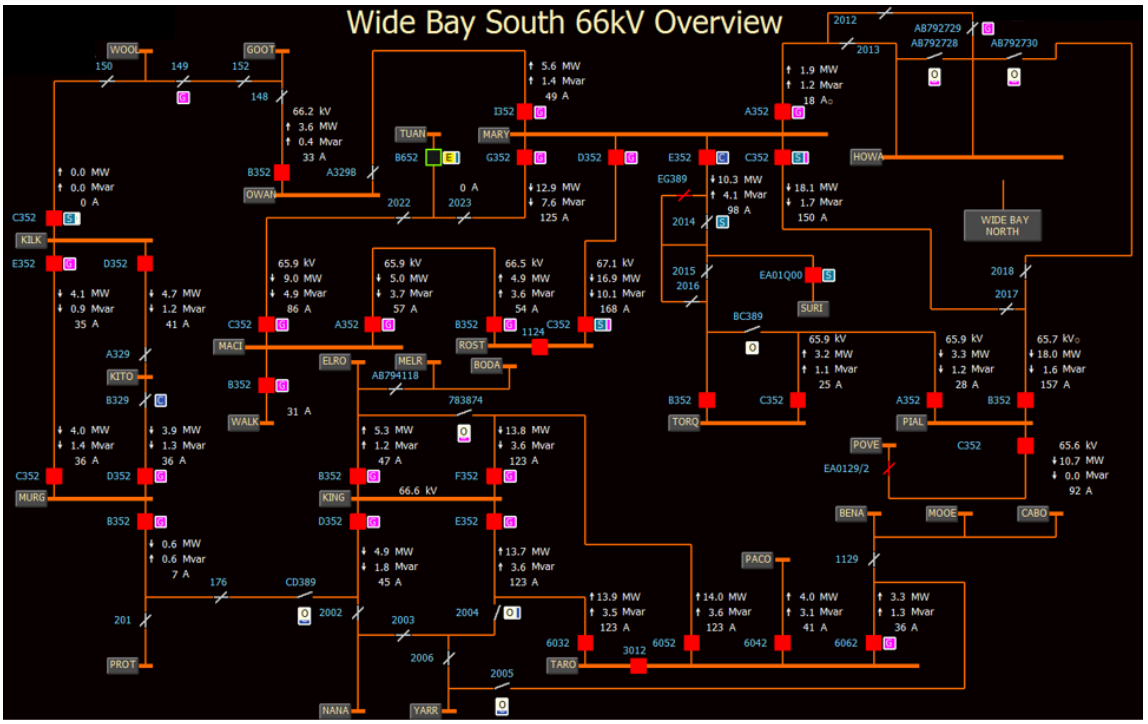


Figure 4: Maryborough 66kV ring network

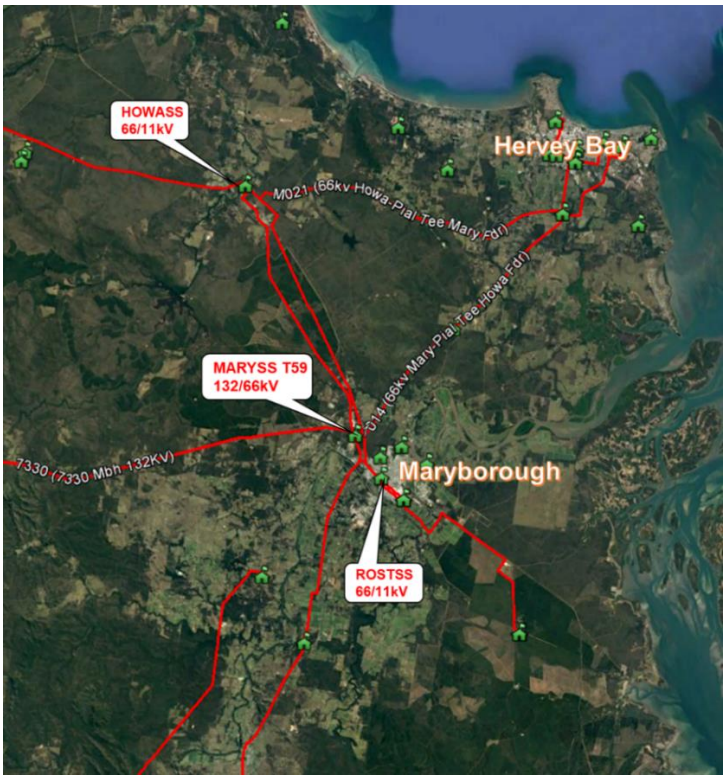


Figure 5: Geographic view of Maryborough network

2.2 Load profile and demand forecast

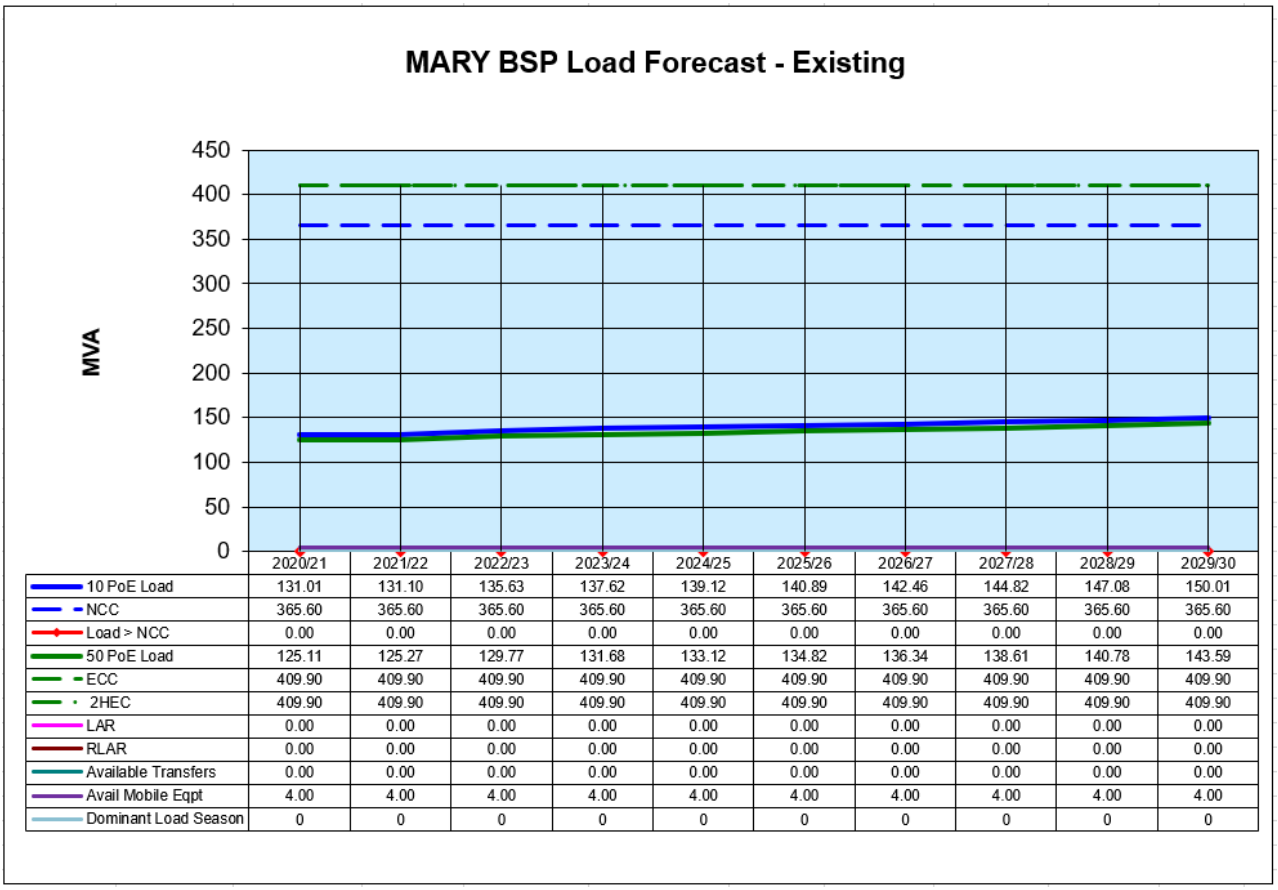
MARY is historically Summer Evening peak with a typical residential load profile. The 2018 peak demand was 124.39MVA[1].

Table 1 below shows the transformer ratings at MARY substation. The load can be supplied by the substation with three transformers T1, T2, and T3 operating in parallel. The load has not historically breached the N-1 capacity.

Table 1: MARY transformer ratings

ZS	Tx	Nameplate Rating (MVA)	kV	YOM	Cooling	NCC	ECC
MARY	1	80/90	132/66	2003	ONAN/ONAF	118.7	133.4
MARY	2	80/100	132/66/11	1967	ONAN/ONAF	122.2	136.7
MARY	3	80/100	132/66/11	1967	ONAN/ONAF	124.7	139.8

The demand forecast[2] in Figure 6 shows there is no forecast exceedance of the N-1 ECC for the next 9 years.



	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30
10 PoE Load	131.01	131.10	135.63	137.62	139.12	140.89	142.46	144.82	147.08	150.01
NCC	365.60	365.60	365.60	365.60	365.60	365.60	365.60	365.60	365.60	365.60
Load > NCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50 PoE Load	125.11	125.27	129.77	131.68	133.12	134.82	136.34	138.61	140.78	143.59
ECC	409.90	409.90	409.90	409.90	409.90	409.90	409.90	409.90	409.90	409.90
2HEC	409.90	409.90	409.90	409.90	409.90	409.90	409.90	409.90	409.90	409.90
LAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RLAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Available Transfers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Avail Mobile Eqpt	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Dominant Load Season	0	0	0	0	0	0	0	0	0	0

Figure 6: MARY substation forecast

[1] SIFT 50-2021 Base Forecast, 2018 SN 124.39MVA as per data 2 June 2021.
[2] Substation Information Forecast Tool (SIFT) @ 10POE 50-2021 Base Forecast

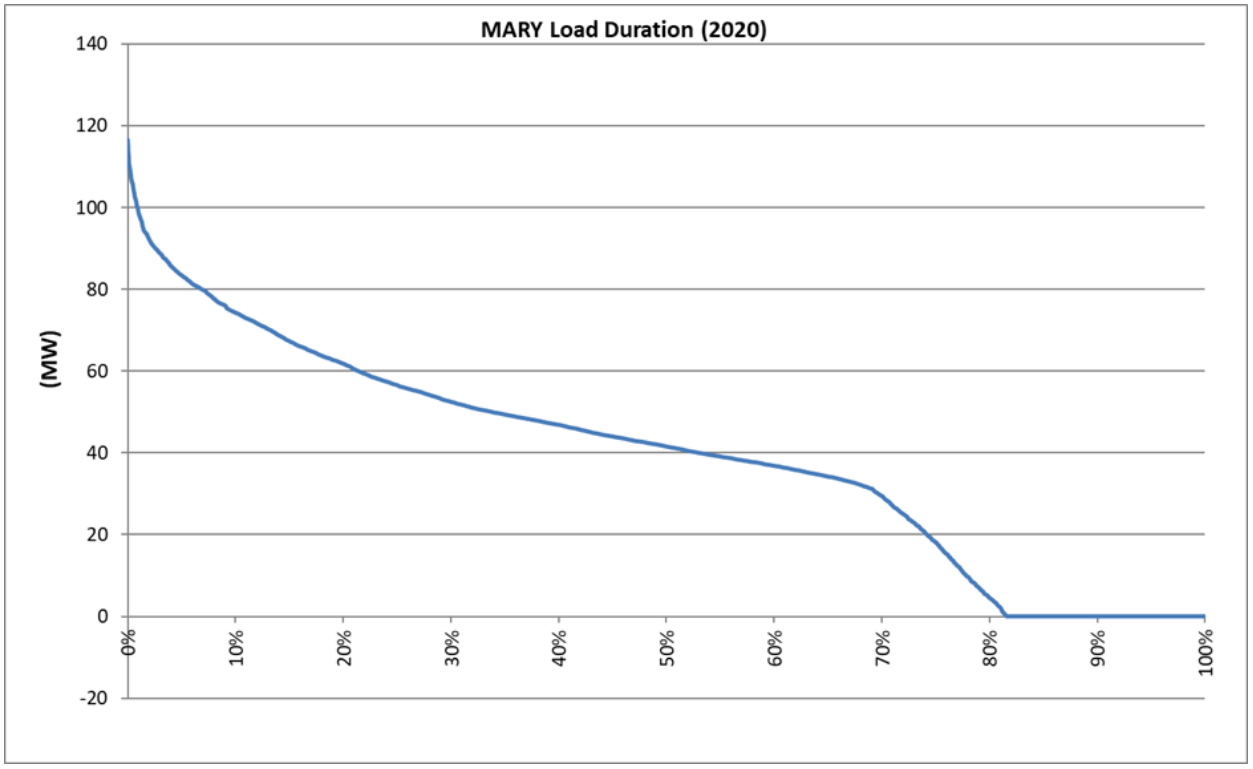


Figure 7: MARY typical load duration curve

3. Identified Need

3.1 Description of the Identified Need

The identified need for investment is to address the risk of non-compliance with Safety Net targets as a result of assets approaching their end of life in order to maintain the reliable and safe supply of electricity in the Maryborough area.

Safety Net non-compliant

As a condition of its DA Ergon Energy must ensure, to the extent reasonably practicable, that it achieves the Safety Net restoration targets as specified in the DA. The purpose of the Safety Net is to seek to effectively mitigate the risk of low probability high consequence network outages to avoid unexpected customer hardship and/or significant community or economic disruption.

A review of MARY against Safety Net compliance has identified that in the event of a 66kV bus trip, restoration targets will not be met. MARY has no 66kV bus section circuit breakers and consequently, a 66kV bus zone fault or CB Fail protection operation trips all three 66kV transformer circuit breakers resulting in instantaneous loss of supply to the 66kV network.

In a scenario where the 66kV bus trips, the expected time to restore unsupplied load to below 20MVA is 2 hours. This is above the 1-hour restoration target as specified in the DA, and MARY is therefore not compliant. This scenario is illustrated in Appendix 9.1.

3.1.2 Asset near end of service life

A substation condition assessment report (SCAR) was completed on MARY which identified that several assets require replacement as soon as practical.

Table 2: Primary plant recommended for replacement as soon as practical.

Bay	kV	Asset	Asset ID	Make
Aramara fdr 7329	132	CB	CB73292	Oerlikon
	132	CT	ØA 73292	Tyree
	132	CT	ØB 73292	Tyree
	132	CT	ØC 73292	Tyree
	132	VT	ØA 7329	Trench Electric
	132	VT	ØB 7329	Trench Electric
	132	VT	ØC 7329	Trench Electric
Aramara fdr 7330	132	CB	CB73302	Oerlikon
2-3 Bus section	132	CB	CB4122	Oerlikon
TX01 bay	66	CB	A752	Asea
TX02 bay	66	CB	B752	Asea
Marybh City fdr	66	CB	G352	Asea
Torquay-SURI fdr	66	CB	E352	Asea
Pialba fdr	66	CB	C352	Asea
	66	CT	ØA C396	Tyree
	66	CT	ØB C396	Tyree
	66	CT	ØC C396	Tyree
Howard fdr	66	CB	A352	Asea
	66	CT	ØA A396	Tyree
	66	CT	ØB A396	Tyree
	66	CT	ØC A396	Tyree
66kV bus	66	VT	ØA A797C	Asea
	66	VT	ØB A797C	Asea
	66	VT	ØC A797C	Asea
	66	VT	ØA B797C	Asea
	66	VT	ØB B797C	Asea
	66	VT	ØC B797C	Asea

Table 3: Relays recommended for replacement as soon as practical.

Panel	Protection Relay	Protection	Make	Function
P14	PR94284116	66kV bus	EMAIL	751/64 Bus Inst OC/EF
	PR93224090		EMAIL	1194A BZ Mtr 1
	PR93229836		EMAIL	1194B BZ Mtr 2
	PR93226023		GEC	GEC TDR
P18	PR93229881	66kV Kilkivan Y pro	EMAIL	OCCHK ELCHK I351/64
	PR93229935		GEC	GEC TIMER TDR
	PR94284114		EMAIL	TSR
P6	PR93224401	66kV Pialba Y pro	EMAIL	OCCHK ELCHK
	PR93229927		GEC	TIME DELAY RELAY
	-		EMAIL	TSR

3.2 Quantification of the Identified Need

- **Safety Net non-compliant**

The primary objective of this investment is to address the Safety Net non-compliance.

- **Ageing plant**

The second objective of this investment is to address the risk to the network, plant and personnel from operating such plant which is at the end of its lifecycle (lifecycle of an asset being the year of its manufacture, operational conditions and its condition assessment towards the recommended end of service life).

- **Risk management**

The final objective of the investment in this part of the network is to mitigate all risks identified to ALARP. Refer to Appendix 9.1.

3.3 Assumptions in Relation to Identified Need

Below is a summary of key assumptions that have been made when the identified need has been analysed and quantified. It is recognised that the below assumptions may prove to have various levels of correctness, and they merely represent a 'best endeavours' approach to predict the future identified need.

- **Load Profile**

Characteristic day load profiles shown in section 2 are unlikely to change significantly from year to year, i.e. the shape of the load profile will remain virtually the same with increasing maximum demand.

- **Forecast Maximum Demand**

It has been assumed that peak demand at MARY will grow as per the base case load forecast.

Factors that have been considered when the demand forecast has been developed include the following:

- load history
- known future developments (new major customers, network augmentation, etc.)
- temperature corrected start values (historical peak demands)
- forecast growth rates for organic growth

- **System Capability – Transformer capacity**

Transformer ratings are normally specified by a continuous rating, supplied by the manufacturer on the nameplate. This corresponds to the load that will cause the oil and winding temperature rise to meet the specified limit, assuming a constant temperature and a constant rated load.

Cyclic ratings in excess of nameplate ratings are possible because the typical load cycle is not continuous, nor is the daily temperature cycle. All three transformers also have a typical thermal time constant of a few hours. All these factors are combined to enable cyclic loading of a transformer in excess of the nameplate rating before the temperature limits are reached.

All three transformers have two cyclic ratings for both summer and winter, based on the load profile and the ambient temperature for that transformer location.

- **System Capability – Transfer Capacity**

In times of contingency, for example when one transformer is faulty, load may be transferred to another substation via the distribution network. The distribution network transfer capability is largely determined by the capacity of the powerlines to carry the transferred load as well as their ability to maintain system voltages.

4. No Non-Network Alternatives

Ergon Energy has determined there is no non-network alternative that would be technically viable to address the network risk associated with the poor condition of the existing assets, i.e. Safety Net non-compliance, assets near end of service life and insufficient protection scheme.

The following non–network solutions have been assessed for either deferring or replacing the network investment required in the Maryborough supply area:

- Demand Management (Demand Reduction) such as power factor correction, energy efficiency, load control.
- Demand Response through customer embedded generation, call off load and load curtailment contracts.

The above solutions have been assessed as not technically viable as they will not address the network risk associated with poor condition of the assets.

5. Internal Option Identified

Ergon Energy's preferred internal option is to replace 132kV and 66kV assets including circuit breakers, voltage transformers, current transformers, and protection relays in situ and install two new 66kV bus section circuit breakers. The completion of this is required by 2025. There will be further investments required in the following regulatory periods to replace other assets which will reach end of life in the future.

Operating expenses for new infrastructure are typically 1% - 2% of the capital cost. Table 44 provides the approximate anticipated capital cost for the preferred option.

Table 4: Ergon Energy's internal cost for the preferred option.

Internal option	Replace 132 and 66kV assets and install two bus section circuit breakers.
ACP	$ 7,011,868

5.1 Option considered

- **Option 1 – Replace 132 and 66kV equipment in situ and install two bus section circuit breakers by 2025**

Due to the predominately asset replacement nature of this project there was only a single option considered which requires the replacement of 132 and 66kV assets in the same place, installing two new 66kV bus tie circuit breakers, and upgrade the protection scheme.

5.2 Scope of the Preferred Internal Option

The following works are proposed to be carried out as part of the preferred network solution at MARY.

Replace 132 and 66kV yard equipment in situ and install two new 66kV bus section circuit breakers by

- Replace 132kV feeder 7329 bay aged circuit breaker CB73292, current transformers, and voltage transformers;
- Replace Transformer T1 66kV bay aged circuit breaker A752 and 66kV voltage transformers A797C;
- Replace Transformer T2 132kV bay aged circuit breaker 4122 and 66kV bay aged circuit breaker B752 and 66kV voltage transformers B797C;
- Replace 132kV feeder 7330 bay aged circuit breaker CB73302;
- Replace 66kV Maryborough City feeder bay aged circuit breaker G352;
- Replace 66kV Torquary Tee Suri feeder bay aged circuit E352 and current transformers;
- Replace 66kV Pialba feeder bay aged circuit breaker C352 and current transformers;
- Replace 66kV Howard feeder bay aged circuit breaker A352 and current transformers;
- Replace 66kV single bus aged protection relay;
- Replace 66kV Kilkivan feeder aged protection relay;
- Replace 66kV Pialba feeder aged protection relay;
- Replace 66kV Rocky Street feeder aged protection relay;
- Replace 66kV Maryborough City feeder aged protection relay;
- Replace 66kV Howard feeder protection relay upgraded to comply with standards;
- Replace T2 and T3 transformer Y protection CBF relays installation;
- Install new 240/415V substation AC supply;
- Install new 415V AC supply change-over board;
- Install two new bus section circuit breakers to comply with safety net;
- Upgrade110V DC distribution board to comply with standards.

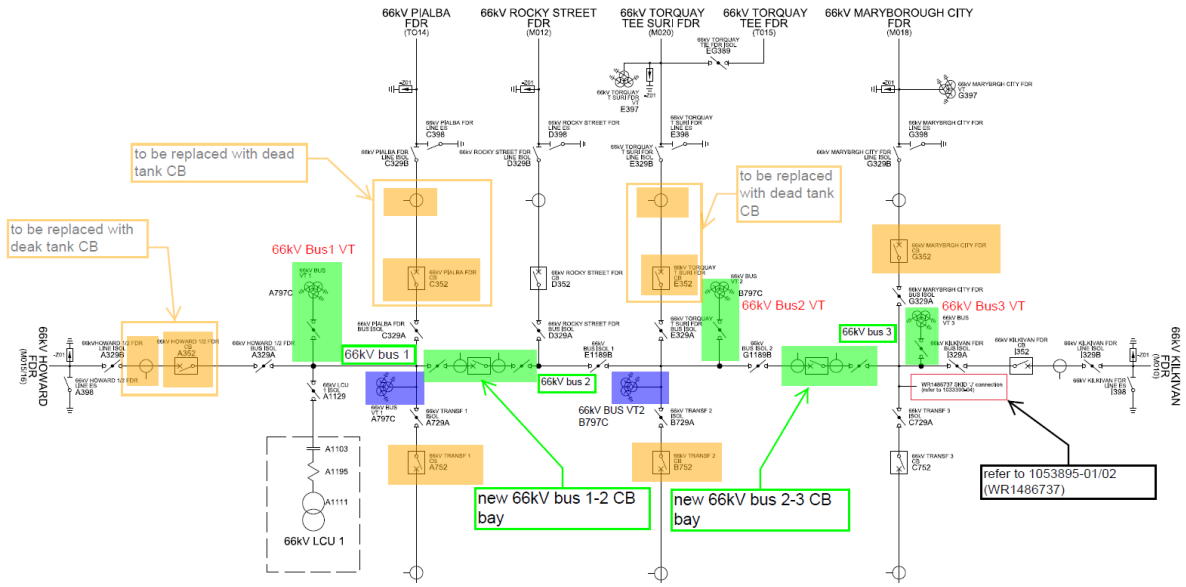


Figure 8: MARY single line diagram with the new and replacement 66kV equipment.

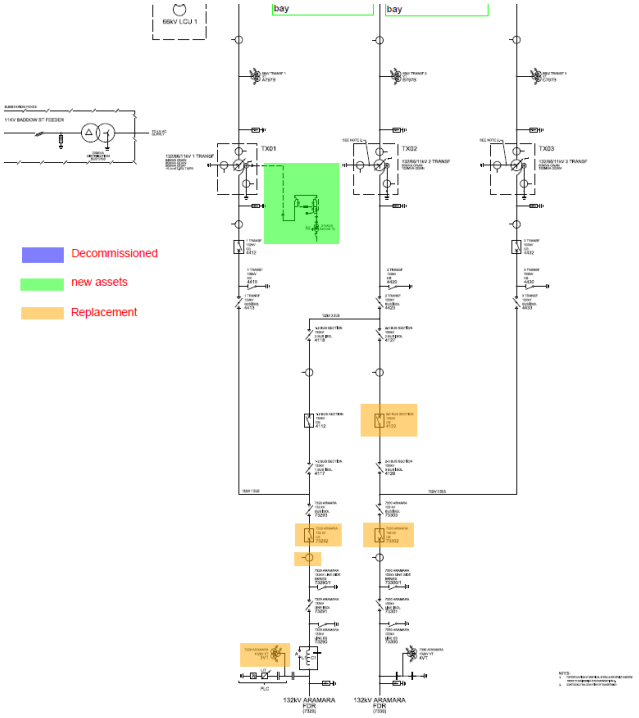


Figure 9: MARY single line diagram with the new and replacement 132kV equipment.

Table 5: Indicative cost of Option 1.

Option 1			$7,011,868
Year	Capex	Opex	Cost
2022	$1,053,383	$27,010	$1,080,393
2023	$4,293,487	$110,089	$4,403,576
2024	$1,157,345	$29,676	$1,187,021
2025	$332,356	$8,522	$340,878

5.3 Financial Analysis

No Net Present Value analysis was carried out as only a single option has been identified. The estimate for this option is in current dollar value therefore the NPV of this option is $7.012M.

6. Market Benefits

The purpose of the RIT-D is to identify the option that maximises the present value of net market benefits to all those who produce, consume and transport electricity in the National Electricity Market (NEM). Consistent with NER clause 5.17.1(c)(4), Ergon Energy has considered the following classes of market benefits:

- Changes in voluntary load curtailment;
- Changes in involuntary load shedding and customer interruptions caused by network outages using a reasonable forecast of the value of electricity to customers;
- Changes in costs for parties other than the RIT-D proponent due to differences in the timing of new plant, capital costs, and operating and maintenance costs;
- Differences in the timing of expenditure;
- Changes in load transfer capacity and the capacity of embedded generators to take up

load;
- Any additional option value (where this value has not already been included in the other classes of market benefits) gained or foregone from implementing the credible option with respect to the likely future investment needs of the NEM;
- Changes in electrical energy losses.

6.1 Changes in Voluntary Load Curtailment

The option considered in this RIT-D does not include any voluntary load curtailment. There are no customers on such arrangements in the Maryborough area at the moment. Any market benefits associated with changes in voluntary load curtailment have not been considered.

6.2 Changes in Involuntary Load Shedding

A reduction in involuntary load shedding is expected the credible option presented in this report. The fact is that the aged substation assets present an area wide level of risk to the supply network. The benefits from changes in involuntary load shedding have not been quantified and considered in this report.

6.3 Changes in costs to Other Parties

Ergon Energy does not anticipate that the credible option included in this RIT-D assessment will affect costs incurred by other parties.

6.4 Differences in Timing of Expenditure

The credible option included in this RIT-D assessment is not expected to affect the timing of other distribution investments for unrelated identified needs.

6.5 Changes in Load Transfer Capacity

The option included in this RIT-D assessment is not expected to affect the load transfer capacity in the Maryborough area.

6.6 Option Value

The AER's view is that option value is likely to arise where there is uncertainty regarding future outcomes, the information that is available in the future is likely to change, and the credible options considered by the RIT-D proponent are sufficiently flexible to respond to that change.

Ergon Energy does not consider that the identified need for the options included in this RIT-D would be affected by uncertain factors about which there may be more clarity in the future.

6.7 Changes in Network Losses

Ergon Energy does not anticipate that the credible option included in the RIT-D assessment will lead to any significant change in network losses.

7. Conclusion

This FPAR represents the final stage of the RIT-D process to address the identified need at MARY.

Ergon Energy intends to take steps to progress the recommended solution(s) to ensure any statutory non-compliance is addressed and undertake appropriately justified network reliability improvements as necessary.

7.1 Preferred Option

Ergon Energy's preferred internal solution is to **r**eplace 132/66kV assets in situ, install two new 66kV bus tie circuit breakers, and upgrade the protection scheme.

These works are required to be completed by 2023. The estimated total capital cost is $7.012M.

7.2 Satisfaction of the RIT-D

The proposed preferred option satisfies the RIT-D. This statement is made on the basis of the detailed analysis set out in this report. The proposed preferred option is the only credible option that addressed the risks at MARY substation.

8. Compliance Statement

This FPAR complies with the requirements of NER section 5.17.4(r) as demonstrated below:

Requirement	Report Section
(1) a description of the identified need for investment;	3.1
(2) the assumptions used in identifying the identified need (including, in the case of proposed reliability corrective action, why the RIT-D proponent considers reliability corrective action is necessary);	3.3
(3) if applicable, a summary of, and commentary on, the submissions received on the NNOR;	NA
(4) a description of each credible option assessed	5.1
(5) where a *Distribution Network Service Provider* has quantified market benefits in accordance with clause 5.17.1(d), a quantification of each applicable market benefit of each credible option	NA
(6) a quantification of each applicable cost for each credible option, including a breakdown of operating and capital expenditure	5.1
(7) a detailed description of the methodologies used in quantifying each class of costs or market benefit	NA
(8) where relevant, the reasons why the RIT-D proponent has determined that a class or classes of market benefits or costs do not apply to a credible option	0
(9) the results of an NPV analysis of each credible option and accompanying explanatory statements regarding the results	5.35.3
(10) the identification of the proposed preferred option	5.1, 7.1
(11) or the proposed preferred option, the RIT-D proponent must provide:	
(i) details of the technical characteristics;	5,5.1,5.2
(ii) the estimated construction timetable and commissioning date (where relevant);	
(iii) the indicative capital and operating costs (where relevant);	5.1

(iv) a statement and accompanying analysis that the proposed preferred option satisfied the RIT-D; and (v) if the proposed preferred option is for reliability corrective action and that the option has a proponent, the name of the proponent	**7.2**
(12) contact details for a suitably qualified staff member of the RIT-D proponent to whom queries on the draft report may be directed.	**0**

9. Appendices

9.1 Safety Net Assessment

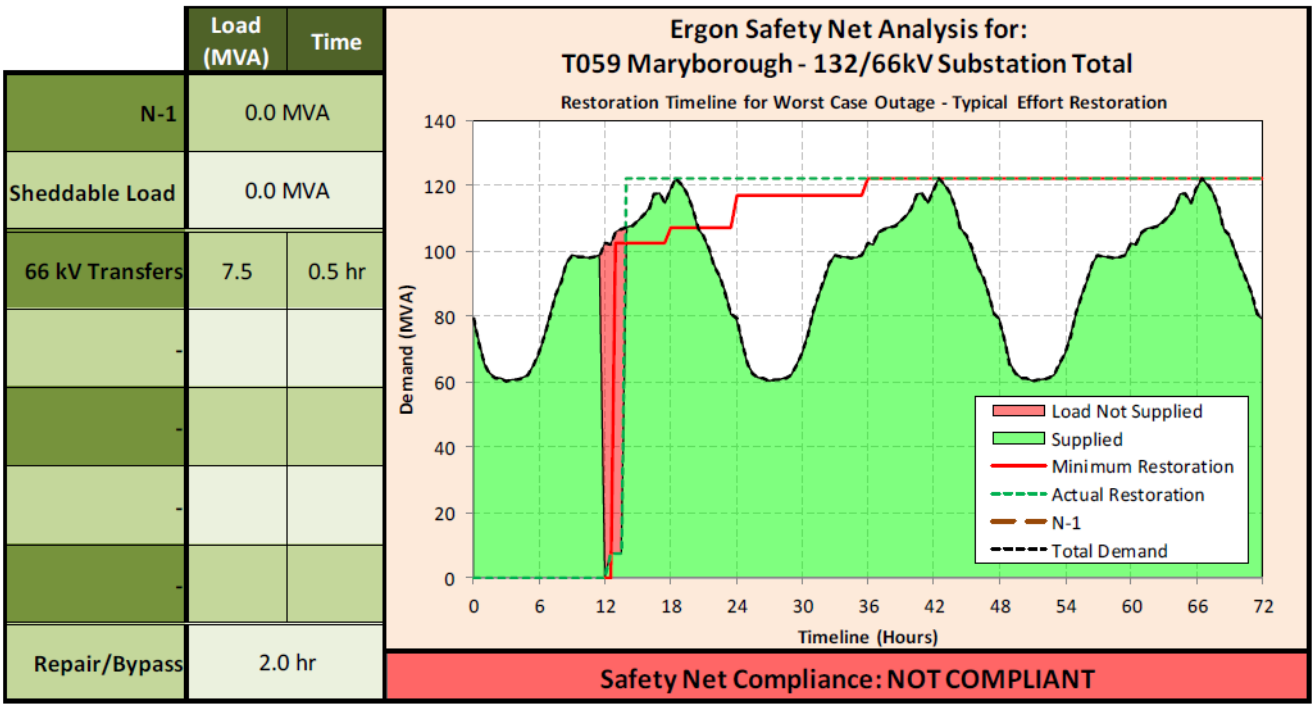


Figure 10: MARY Safety Net assessment.

9.2 Risk Assessment at MARY

Table 6: Risk assessment at MARY sourced from the project scope statement.

Risk Scenario (Untreated)	Risk Type	Inherent/Untreated Risk			Target (Residual)		Risk Year
		C	L	Risk Score	L	Risk Score	
Multiple serious injuries to staff as a result of the explosive failure of the 66kV CB's to be replaced ejecting porcelain debris due to insulation breakdown.	Safety	4	2	8 (Low Risk)	1	4 (Very Low) ALARP	2022
Due to the lack of bus sectioning a fault on the 66kV bus, causes loss of supply to 50,000 customers	Customer Impact	5	3	15 (Moderate Risk)	1	5 (Very Low) ALARP	2022
Oil spill (~200L) from the CB tank and/or from the bushings causing environmental consequence.	Environment	2	2	4 (Low Risk)	1	2 (Very Low) ALARP	2022
Slow clearing time due to aged and non-standard protection schemes causes damage to primary equipment which needs prolonged time to repair and replacement.	Customer Impact	4	2	8 (Moderate Risk)	1	4 (Very Low) ALARP	2022
Absence of adequate protection of 66kV and11kV buses, power transformers, 11kV feeders and capacitor results in breach of legislation.	Legislated Requirements	4	4	16 (Moderate Risk)	1	4 (Very Low) ALARP	2022

9.3 Ergon Energy's Minimum Service

The legislated System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) limits from Ergon Energy's Distribution Authority are detailed in Table 7.

Table 7: SAIDI (minutes per customer) and SAIFI (interruptions per customer) limits.

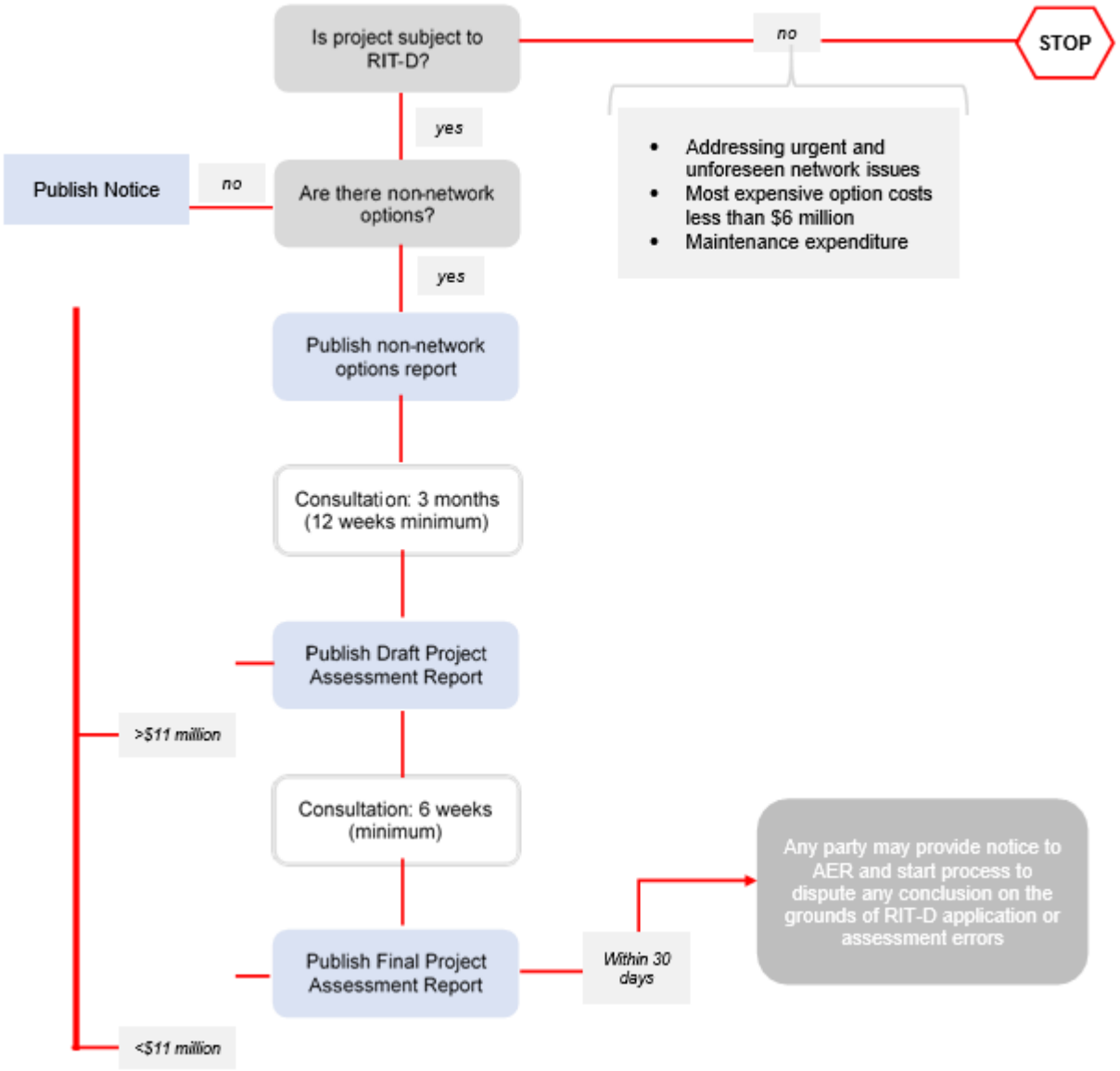
Feeder Category	SAIDI MSS Limit	SAIFI MSS Limit
Urban	149	1.98
Short Rural	424	3.95
Long Rural	964	7.40

The legislated Safety Net Targets from Ergon Energy's Distribution Authority are provided in **Table 8**. Maryborough is classified a 'Rural Centre'.

Table 8: Ergon Energy Safety Net Targets

Area	**Targets (for restoration of supply following an N-1 Event)**
Regional Centre	Following an N-1 event, load not supplied must be: ○ Less than 20 MVA after 1 hour; ○ Less than 15 MVA after 6 hours; ○ Less than 5 MVA after 12 hours; and ○ Fully restored within 24 hours.
Rural Areas	Following an N-1 event, load not supplied must be: ○ Less than 20 MVA after 1 hour; ○ Less than 15 MVA after 8 hours; ○ Less than 5 MVA after 18 hours; and ○ Fully restored within 48 hours.
Note: All modelling and analysis will be benchmarked against 50 POE loads and based on credible contingencies. 'Regional Centre' relates to larger centres with predominantly urban feeders. 'Rural Areas' relates to areas that are not Regional Centres.	

9.4 The RIT-D Process



9.5 Glossary of Terms

Abbreviation	Description
ACP	Approved Cost Plan
ALARP	As Low as Reasonably Practicable
ASEA	Allmänna Svenska Elektriska Aktiebolaget (or General Swedish Electrical Limited Company)
CB	Circuit Breaker
CBRM	Condition Based Risk Management
DGA	Dissolved Gas Analysis
MARY	Maryborough substation 132/66kV
ECC	Emergency cyclic capacity
kV	kilovolts
MVA	Megavolt-ampere
N-1 ECC	Capacity available when the largest transformer fails
NCC	Normal cyclic capacity
NEF	Neutral earth fault
NER	National Electricity Rules
ONAF	Oil natural air forced
ONAN	Oil natural air natural
POE	Probability of exceedance
ppm	Parts per million
REF	Restrictive earth fault
RIT-D	Regulatory Investment Test for Distribution
SCAR	Substation Condition Assessment Report
SEF	Sensitive earth fault
VT	Voltage transformer
YOM	Year of manufacture
ZS	Zone Substation (or simply substation)