



Regulatory Investment Test for Distribution (RIT-D)

Rockhampton Glenmore Network Limitation

Notice of No Non-Network Options

17 September 2021

Rockhampton Glenmore Network Limitation Notice of No Non-Network Options

EXECUTIVE SUMMARY

About Ergon Energy

Ergon Energy Corporation Limited (Ergon Energy) is part of Energy Queensland and manages an electricity distribution network which supplies electricity to more than 765,000 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

Rockhampton Glenmore 66/11kV substation (ROGL) is located on the northern banks of the Fitzroy River, about 2km north of Rockhampton CBD. The substation is part of the Rockhampton 66kV sub-transmission network and takes supply from the adjacent T023 Rockhampton 132/66kV transmission substation. The 66kV bus at ROGL is the main of three (3) transmission connection points (TCPs) for the 66kV network that supplies 60,627 customers via 14 substations with a total peak load of around 200MVA, forecast to grow to around 220MVA in the next 10 years. The 66kV bus at ROGL forms a key central node in the meshed network, supplying around half of the load under system-normal network configuration. The 66/11kV transformers at ROGL supply 6,066 customers of which 84% are residential and 16% are commercial, with a peak load of approximately 20MVA.

ROGL was established circa 1966 to standards applicable at the time. There is a number of asset limitations affecting the ongoing reliable and safe operation of ROGL 66kV bus. These include six 66kV circuit breakers (CBs), nine sets of 66kV current transformers (CTs), four sets of 66kV voltage transformers (VTs), two 66kV isolation switches (ISs), four sets of 66kV surge arrestors (SAs), as well as all protection and secondary systems associated with the 66kV equipment. The ongoing operation of these assets present significant risks to safety and customer reliability.

The majority of the identified plant is on the single 66kV bus and its protection schemes at ROGL. For an outage to this bus, the remaining network can supply up to 148MVA leaving approximately 50MVA at risk, forecast to grow to 70MVA in the next 10 years. Under the same outage, the entire 11kV load at ROGL of up to 20MVA is interrupted.

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Preferred Network Option

Ergon Energy have only identified one feasible option, which is to replace the individual assets.

Upon completion of these works, the asset safety and reliability risks at ROGL Substation will be addressed. The preferred option will provide the greatest reliability benefit for customers, whilst also reducing expenditure on obsolete, non-compliant and high maintenance assets, while ensuring more efficient use of design and construction resources.

The estimated capital cost of this option inclusive of interest, risk, contingencies and overheads is \$8.736 million. Annual operating and maintenance costs are anticipated to be 0.5% of the capital cost. The estimated project delivery timeframe has design commencing in December 2021 and construction completed by November 2025.

Approach

The National Electricity Rules (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 Rockhampton supply area in a reliable, safe and cost-effective manner. Accordingly, this investment is subject to a RIT-D. An internal assessment has been conducted and it has been determined that there is not a non-network option that is potentially credible, or that forms a significant part of a potential credible option that will meet the identified need or form a significant part of the solution. This Notice has hence been prepared by Ergon Energy in accordance with the requirements of clause 5.17.4(d) of the NER.

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1. BACKGROUND

1.1. Geographic Region

Rockhampton Glenmore 66/11kV substation (ROGL) is located on the Northern banks of the Fitzroy River, approximately 2km North of Rockhampton CBD. The geographical location of ROGL in relation to Ergon Energy's sub-transmission network and other substations in the area is shown in Figure 1.

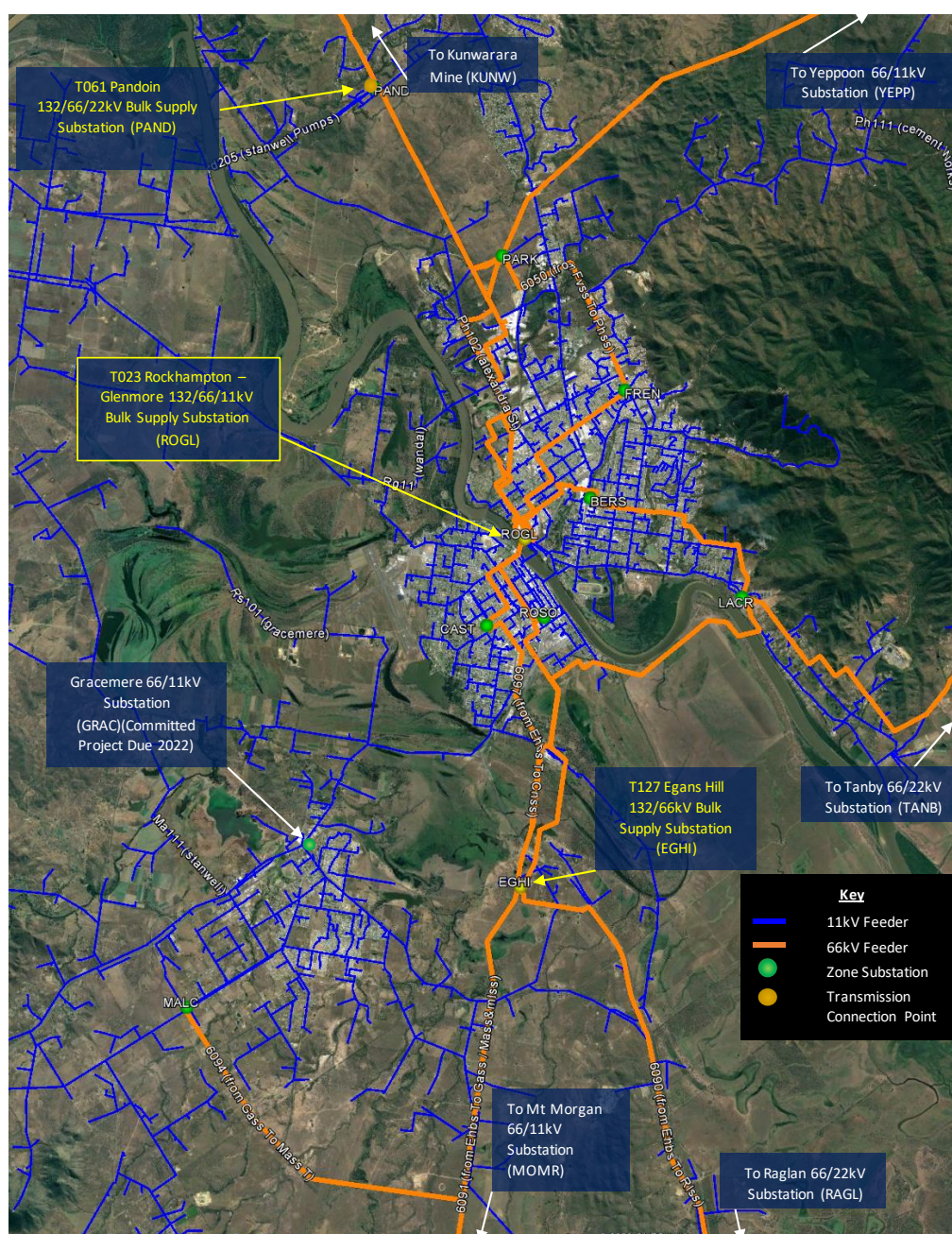


Figure 1: Existing network arrangement (geographic view)

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1.2. Existing Supply System

ROGL is the main of three (3) transmission connection points (TCPs) for the Rockhampton area. The interconnecting 66kV network supplies a total of 60,627 customers via 14 substations with total peak load of approximately 200MVA. The TCP at ROGL is supplied from two (2) Powerlink owned 100MVA transformers at the adjacent T023 Rockhampton 132/66kV substation, and normally supplies around 100MVA of the peak load. Ergon Energy's 66kV network is highly meshed, with two other single transformer TCPs supplying it: one to the north with a single 100MVA transformer - T061 Pandoin (PAND), and one to the south with a single 80MVA transformer – T127 Egans Hill (EGHI).

A schematic view of the existing sub-transmission network arrangement is shown in Figure 2 below.

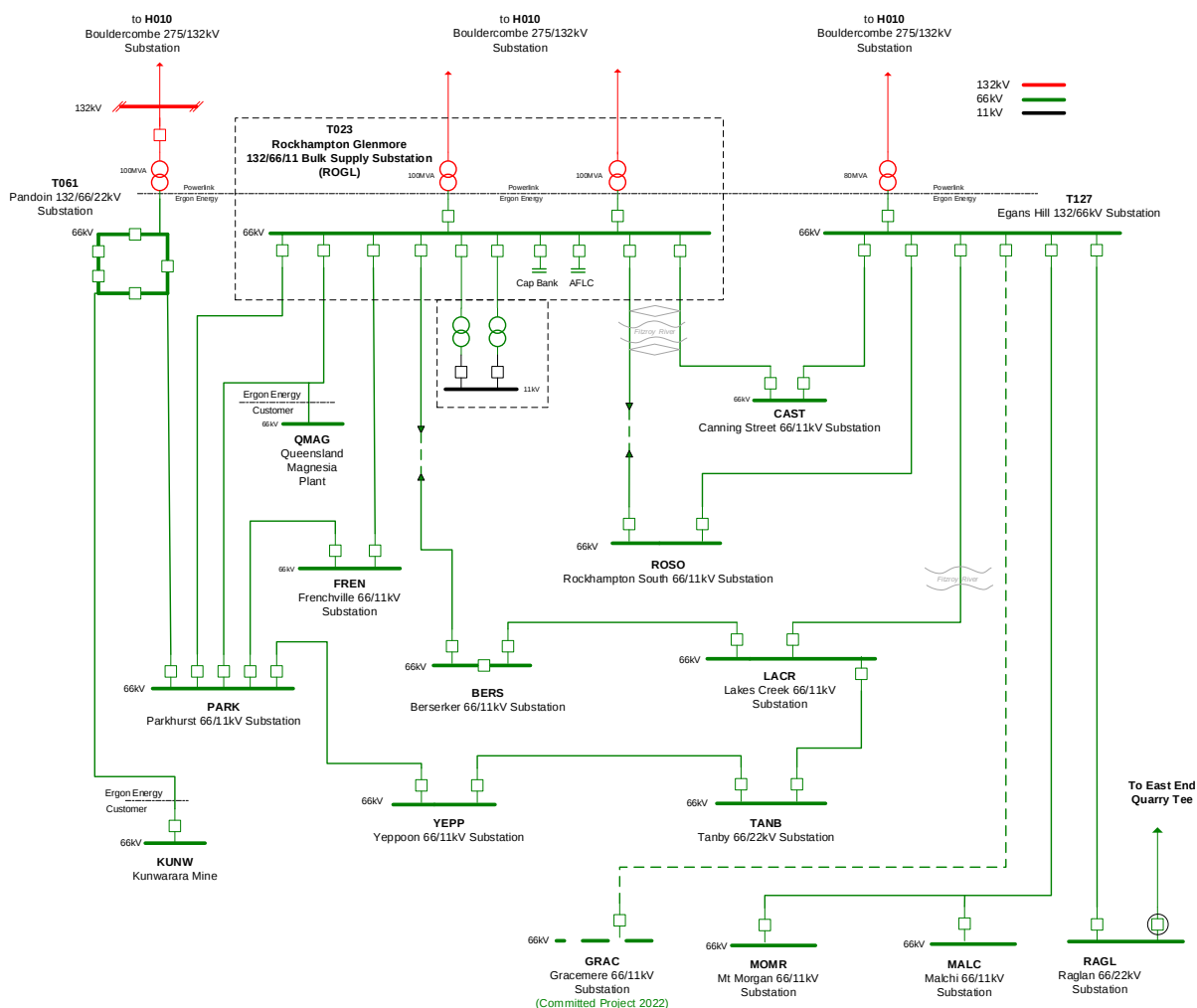


Figure 2: Existing area network arrangement (schematic view)

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The 66kV bus at ROGL is a central node in the 66kV network and normally supplies around half of the network load. ROGL has two incoming 66kV bays from the two 100MVA 132/66kV Powerlink owned transformers, two (2) 20/25MVA 66/11kV transformers and six (6) 66kV feeders. It also has a 66kV 24MVAR capacitor bank and the 66kV AFLC injection unit that services load control signal to the entire Rockhampton area. The 66/11kV transformers at ROGL supply 6,066 customers of which 84% are residential and 16% are commercial, with a peak load of around 20MVA.

A schematic view of the existing substation is shown in Figure 3, with an aerial view of the substation in Figure 4.

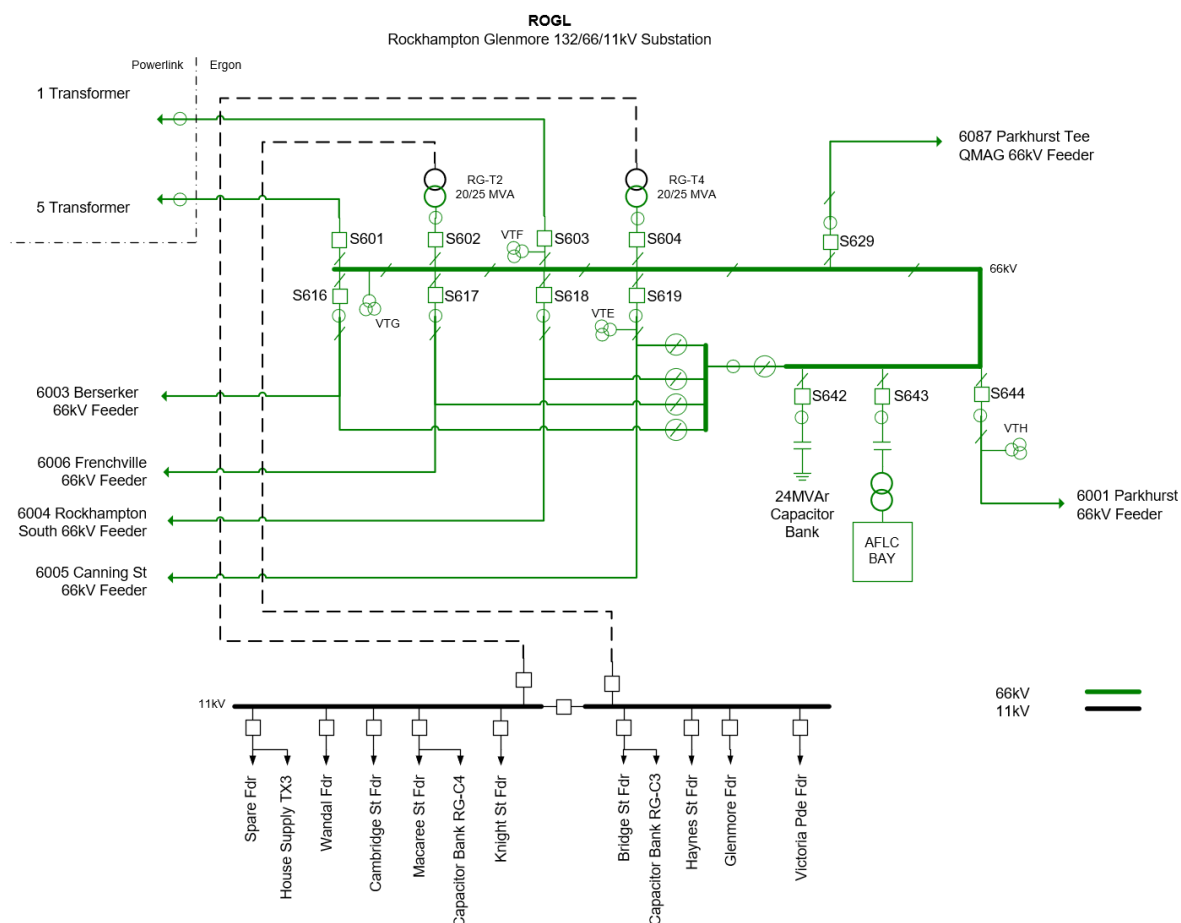


Figure 3: Existing ROGL (schematic view)

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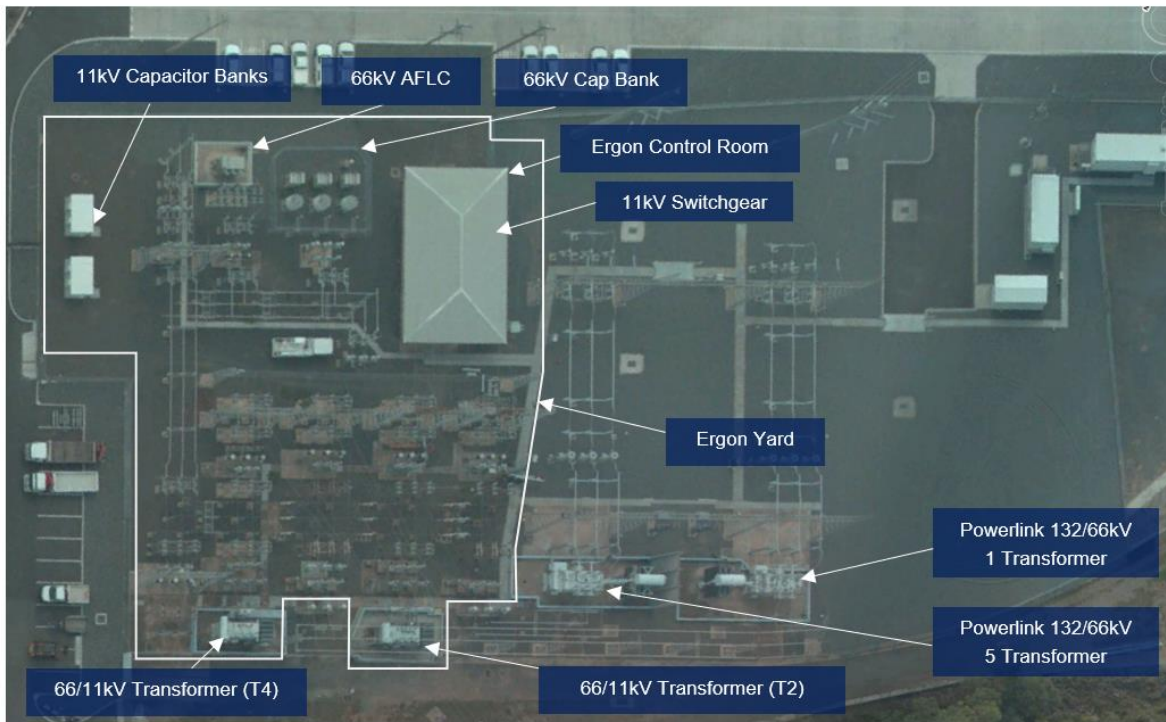


Figure 4: ROGL (Aerial View)

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1.3. Load Profiles / Forecasts

ROGL is the main of three (3) transmission connection points (TCPs) for the Rockhampton area. The 66kV bus at ROGL supplies around half of the system load for the meshed Rockhampton 66kV network in system normal configuration. The load profiles and forecasts presented here are for the entire mesh load, compared to the system capacity for an outage to the 66kV bus at ROGL.

1.3.1. Full Annual Load Profile

The full annual load profile for the Rockhampton area 66kV meshed network over the 2020/21 financial year is shown in Figure 5. It can be noted that the peak load occurs during summer and exceeds N-1 capacity for a ROGL 66kV bus outage by around 50MVA. Note that this is forecast to grow to 70MVA in the next 10 years.

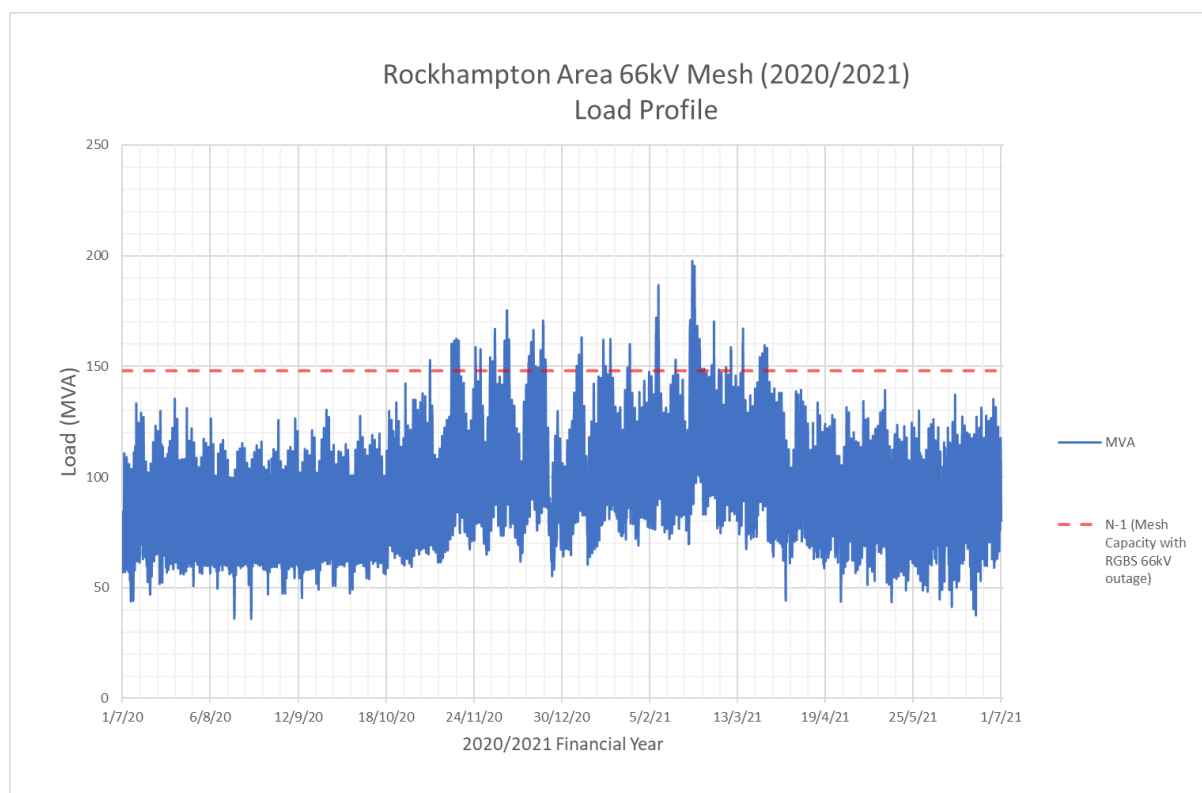


Figure 5: Rockhampton network actual annual load profile

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1.3.2. Load Duration Curve

The load duration curve for the Rockhampton area 66kV meshed network over the 2020/2021 financial year is shown in Figure 6. The load exceeds N-1 capacity for a ROGL 66kV bus outage for 2% of the year, by up to 50MVA. Note that this is forecast to grow to 70MVA in the next 10 years.

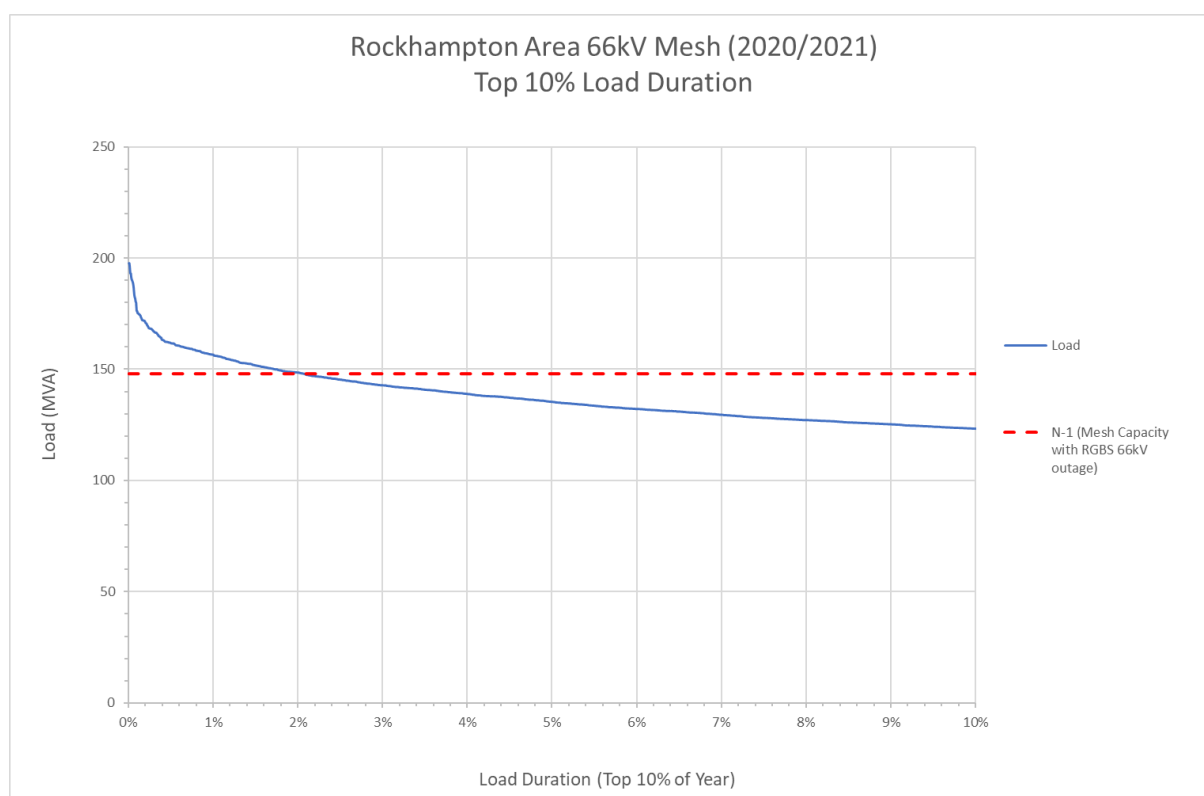


Figure 6: Rockhampton network load duration curve

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1.3.3. Average and Peak Weekday Load Profile (Summer)

The daily load profile for the average and peak weekday during summer is illustrated below in Figure 7. The summer peak loads for the Rockhampton area 66kV meshed network are historically experienced in the late afternoon and evening.

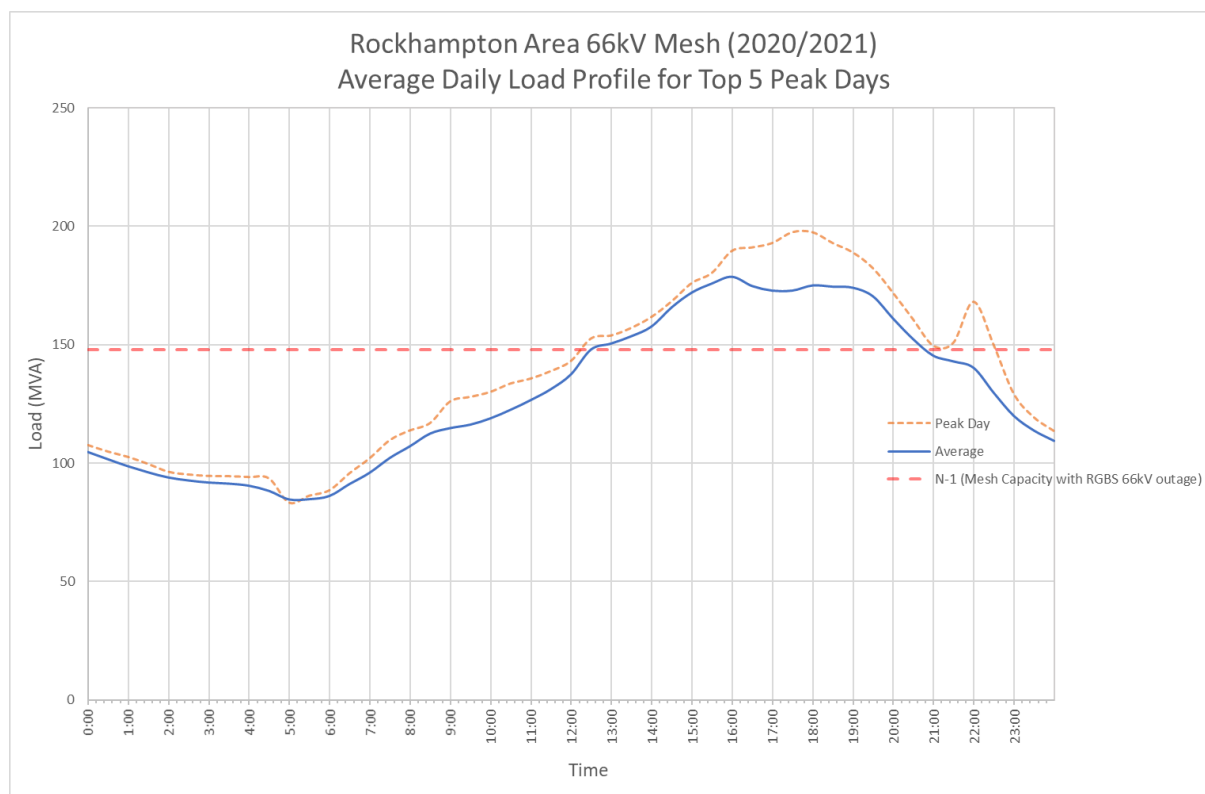


Figure 7: Network average and peak weekday load profile (Summer)

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1.3.4. Base Case Load Forecast

The 10 PoE and 50 PoE load forecasts for the base case load growth scenario are illustrated in Figure 8. The historical peak load for the past five years has also been included in the graph.

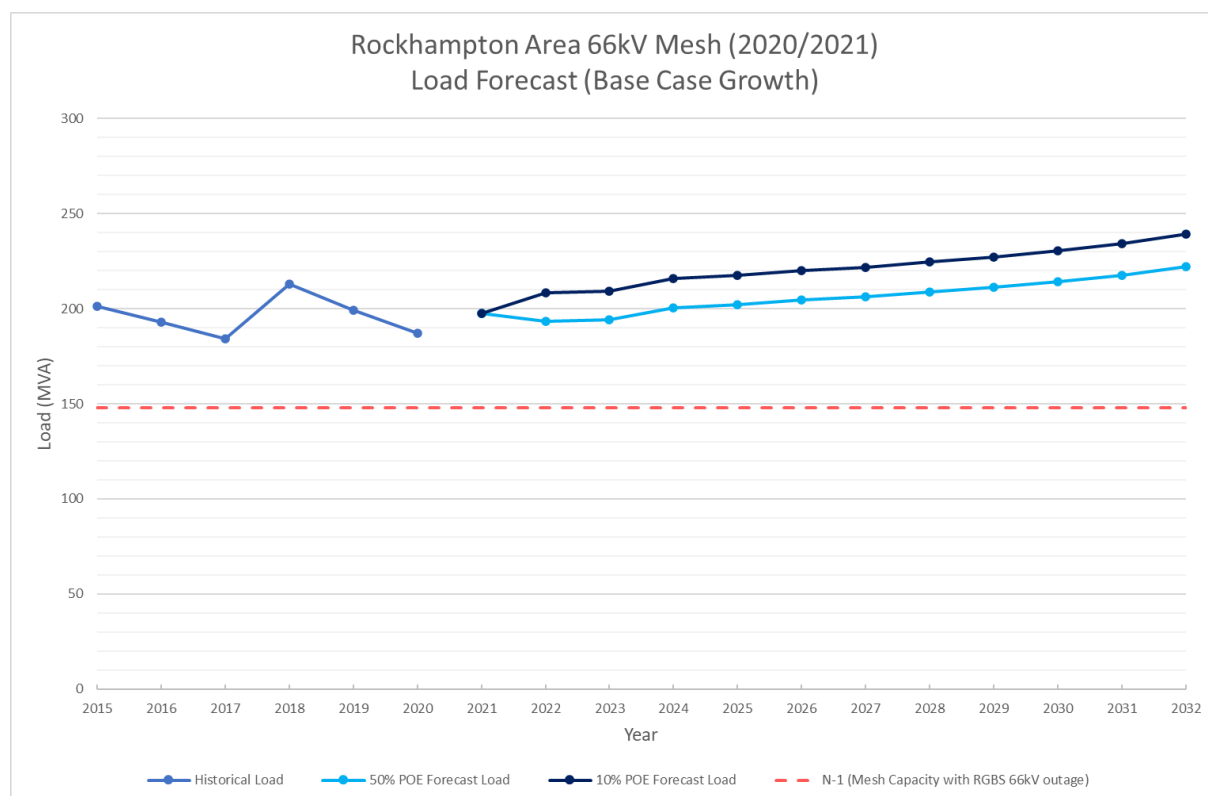


Figure 8: Network base case load forecast

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1.3.5. High Growth Load Forecast

The 10 PoE and 50 PoE load forecasts for the high load growth scenario are illustrated in Figure 9. With the high growth scenario, the peak load is forecast to increase over the next 10 years.

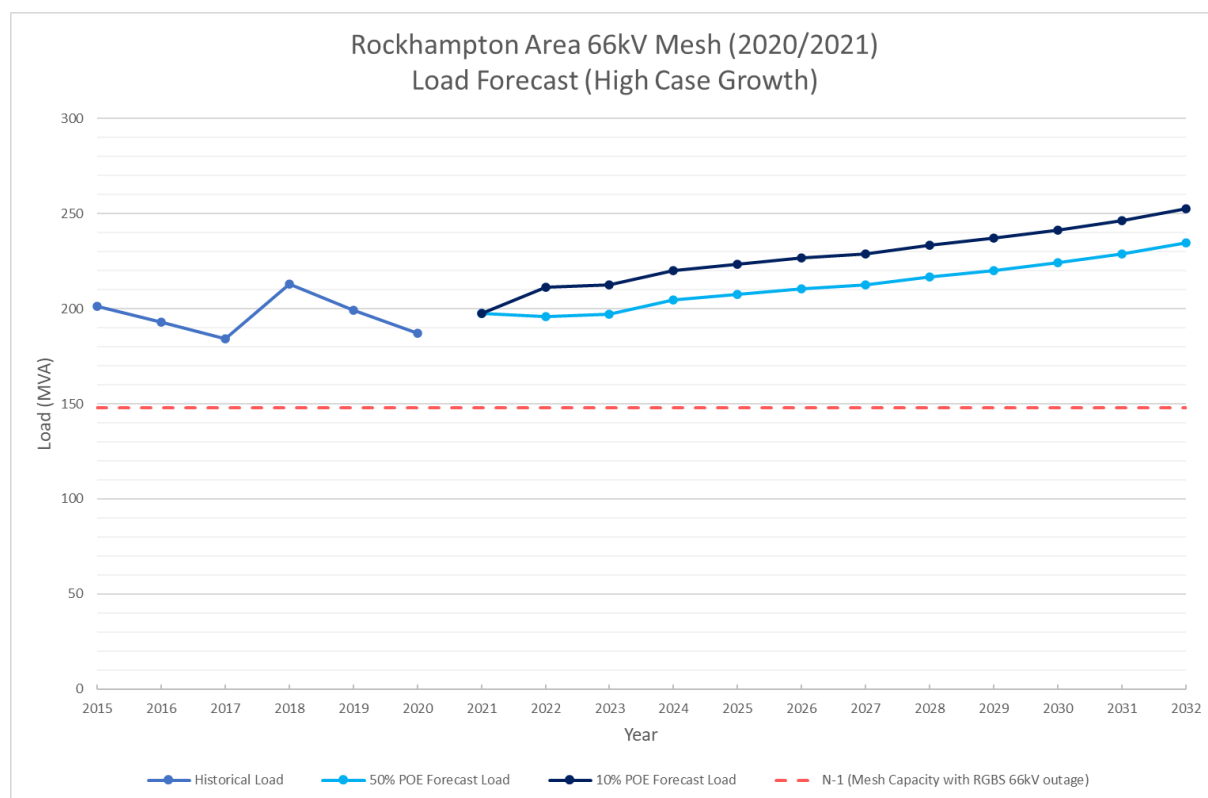


Figure 9: Network high growth load forecast

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1.3.6. Low Growth Load Forecast

The 10 PoE and 50 PoE load forecasts for the low load growth scenario are illustrated in Figure 10. With the low growth scenario, the peak load is forecast to remain relatively steady over the next 10 years.

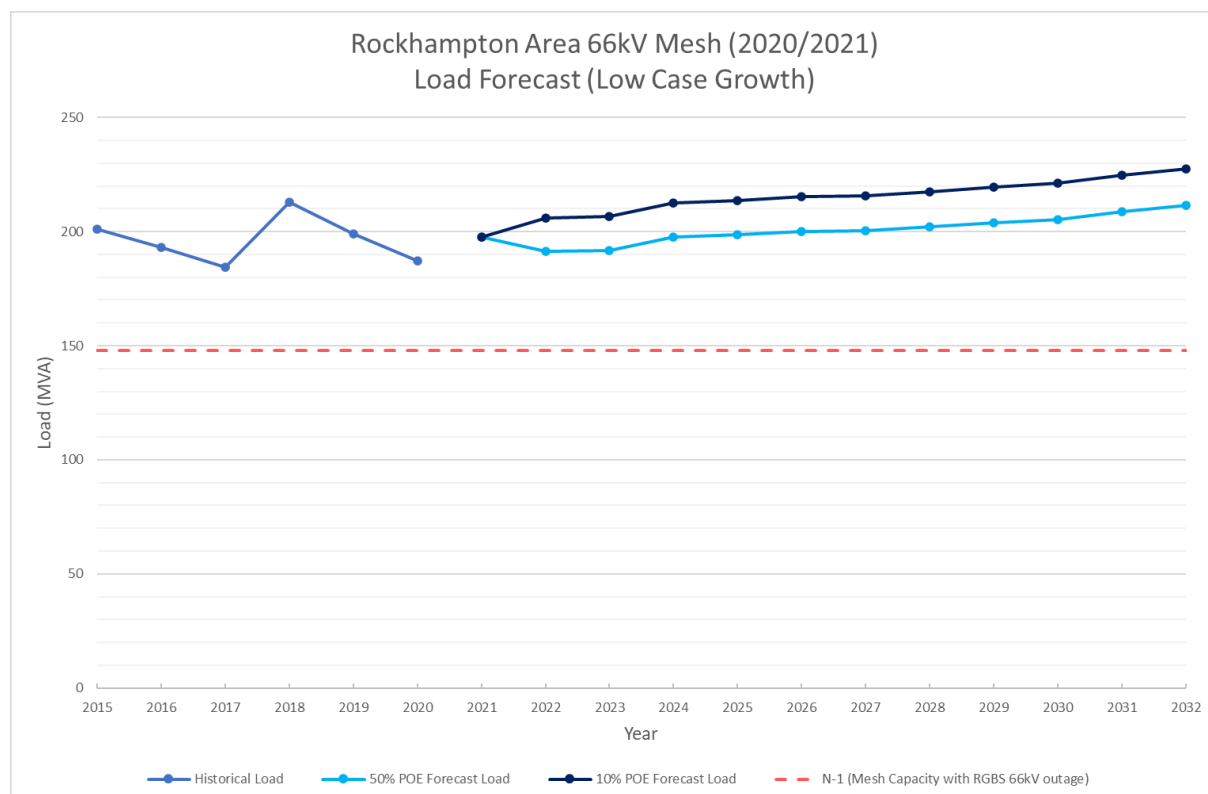


Figure 10: Network low growth load forecast

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2. IDENTIFIED NEED

2.1. Description of the Identified Need

2.1.1. Aged and Poor Condition Assets

ROGL was established circa 1966 to standards applicable at the time. A recent condition assessment has highlighted that a number of critical assets are at the end of their serviceable life, are in poor condition, or are targeted for removal from the network due to premature failure modes. The condition of these assets presents considerable safety and customer reliability risk. These assets include:

- Thirty (30) 66kV current transformers
- Six (6) circuit breakers
- Four (4) 66kV voltage transformers
- Six (6) bus VTs
- Two (2) 66kV isolators
- Four (4) surge arrestors
- Twenty-three (23) protection relays
- 66kV bus zone protection relays; aged obsolete or problematic
- The 66kV AFLC protection scheme is not duplicated to current protection standards
- Two (2) voltage regulation relays for the 66/11kV transformers (T2 and T4); aged, obsolete and do not support remote operation
- SCADA system is aged with limited control capability and system spares
- The DC supply for the substation is not duplicated for redundancy of protection system supply
- The AC supply for the substation is not duplicated for redundancy of battery charging and CB spring charging
- The HVAC system in the control room is not suitable for the electronic relays and RTUs
- The substation security arrangement does not comply with current security standard STNW3039.

The SCADA, DC and AC supplies are not satisfactory and increase the risks associated with maloperation of protection devices. Additionally, a civil assessment of the structures on site also identified that the substation security fence is not compliant with AS2067 and AS1725.

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The deterioration of these primary and secondary system assets poses safety risks to staff working within the switchyard. It also poses a safety risk to the general public, through the increased likelihood of protection relay mal-operation. Without remediation, Ergon Energy views that the safety risk to the public and its staff to not be reduced So Far As Is Reasonably Practicable.

Additionally, the poor condition of these assets significantly increases the likelihood of outages, resulting in a reduction in the level of reliability experienced by the customers supplied from Rockhampton Glenmore Substation.

Furthermore, the majority of the identified plant is on the single 66kV bus and its protection schemes at ROGL. For an outage to this bus, the remaining network can supply up to 148MVA leaving approximately 50MVA at risk, forecast to grow to 70MVA in the next 10 years. Under the same outage, the entire 11kV load at ROGL of up to 20MVA is interrupted, however the majority of the load is able to be transferred to other substations via the 11kV network.

Although the remaining bulk supply transformer capacity is 180MVA, for a single bus outage at ROGL the remaining meshed network can only supply up to 148MVA before interconnecting lines are overloaded. This leaves approximately 50MVA load at risk, forecast to grow to 70MVA in the next 10 years. Since the AFLC unit is connected to the 66kV bus at ROGL, load reduction via this mechanism is lost under this contingency.

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3. INTERNAL OPTIONS CONSIDERED

3.1. Non-Network Options Identified

Ergon Energy has not identified any viable non-network solutions internally that will provide a complete or a hybrid (combined network and non-network) solution to provide the magnitude of network support required in the Rockhampton area to address the identified need.

3.2. Network Options Identified

Ergon Energy has identified one (1) credible network option that will address the identified need.

3.2.1. Option A: ROGL Asset Replacement

This option involves primary plant, secondary systems, remote end and substation security works.

Substation works at ROGL are summarised as follows:

- Summary of Primary Plant Works
 - replace six (6) 66kV circuit breakers
 - replace thirty (30) 66kV current transformers with twenty-seven (27)
 - replace twelve (12) 66kV voltage transformers
 - replace six (6) 66kV isolators
 - replace twelve (12) 66kV surge arrestors
- Summary of Secondary Systems Works
 - replace the singular 66kV Bus Zone protection relay with duplicate scheme
 - replace 6004 Rockhampton South 66kV feeder main protection relay and pilot wire comms with standard line differential protection relay and fibre comms (see remote end works below)
 - replace 6005 Canning Street 66kV feeder main protection relay and pilot wire comms with standard line differential protection relay and fibre comms (see remote end works below)
 - replace 66kV capacitor bank main and backup protection schemes with current standard protection relays
 - replace T2 66/11kV power transformer main and backup protection relay schemes with current standard protection relays
 - replace T4 66/11kV power transformer main and backup protection relay schemes with current standard protection relays
 - replace right and left 11kV bus protection schemes and neutral check scheme with current standard protection relays
 - add Y protection relay to the 66kV AFLC bay
 - install Cisco Edge router to suit new line differential relays
 - install duplicated DC system and associated distribution

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- install a second AC station services transformer on the alternate bus from the existing transformer
 - install AC changeover scheme and associated LV distribution
 - perform a HVAC study for the control room and install HVAC systems to ensure the longevity of all equipment therein, including modern electronic protection, comms and SCADA equipment, batteries and the 11kV switchgear
 - remove all redundant control and LV cabling
 - remove redundant pilot wires, isolation equipment, and isolation cabinets
 - all included works to current substation standards
- Remote End Works
 - replace 6004 66kV feeder main protection relay at Rockhampton South Substation (ROSO) with current standard protection relay
 - replace 6005 66kV feeder main protection relay at Canning Street Substation (CAST) with current standard protection relay
- Substation Security Works
 - According to the asset classifications of STNW3039, ROGL is classified as a category “high” site. This will require additional security features listed in Section 8.2 below.

Figure 11 shows a schematic highlighting the primary plant identified for replacement.

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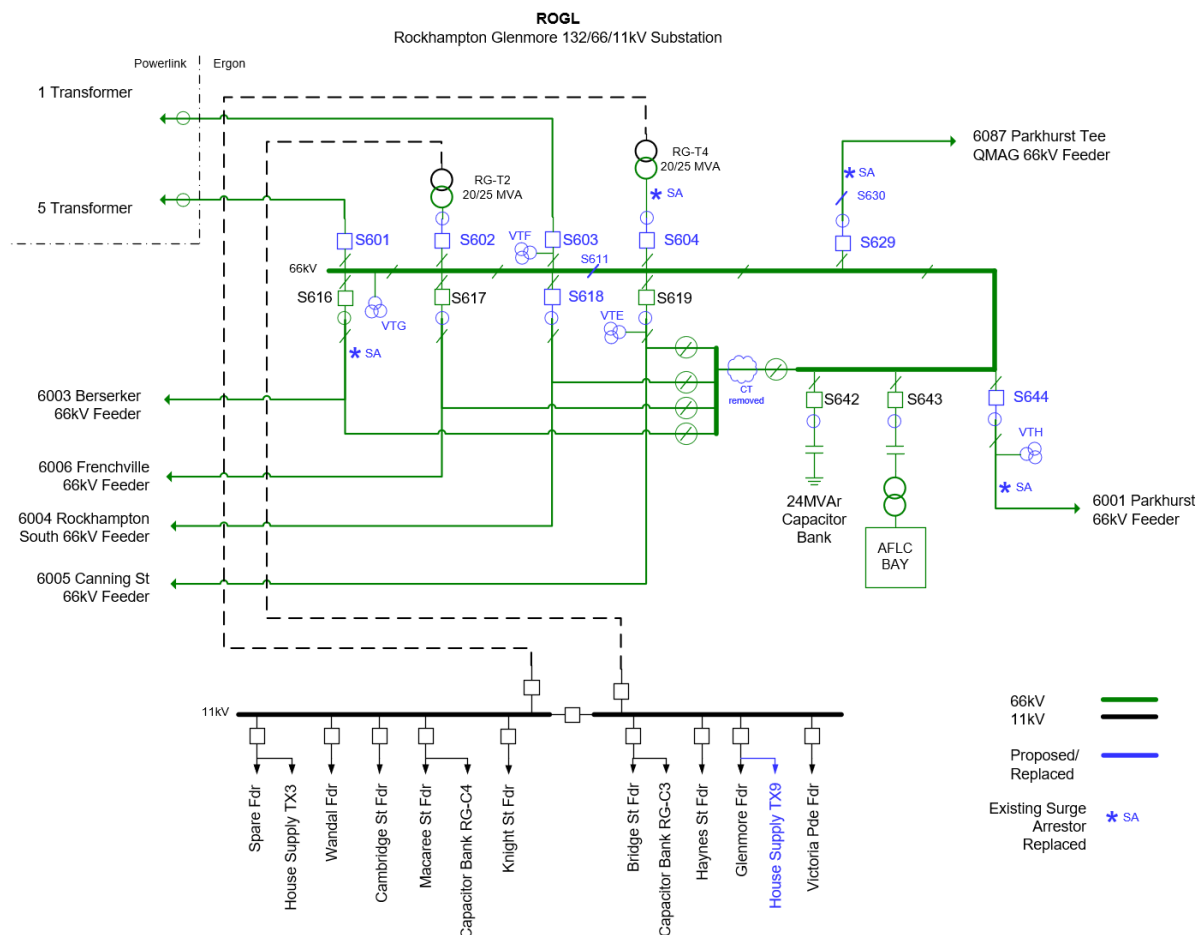


Figure 11: Option A proposed network arrangement

3.3. Preferred Network Option

Ergon Energy's preferred internal network option is Option A: ROGL Asset Replacement.

Upon completion of these works, the asset safety and reliability risks at ROGL Substation will be addressed. The preferred option will provide the greatest reliability benefit for customers, whilst also reducing expenditure on obsolete, non-compliant and high maintenance assets, while ensuring more efficient use of design and construction resources.

The estimated capital cost of this option inclusive of interest, risk, contingencies and overheads is \$8.736 million. Annual operating and maintenance costs are anticipated to be 0.5% of the capital cost. The estimated project delivery timeframe has design commencing in December 2021 and construction completed by November 2025.

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4. ASSESSMENT OF NON-NETWORK SOLUTIONS

Ergon Energy has assessed the potential non-network alternative options required to defer the network option and determine if there is a viable option to replace or reduce the need for the network options proposed.

Credible options must be technically and commercially viable and must be able to be implemented in sufficient time to satisfy the identified risk to the public and/or the network due to the identified constraints.

Once the aged, identified 66kV assets at ROGL reach their retirement age and can no longer be safely operated, the existing load would need to be supplied via non-network alternative solutions while satisfying the Service Safety Net Targets as specified in the Distribution Authority issued to Ergon Energy.

It is considered that no available demand management products or strategies can provide sufficient demand support at ROGL to address the identified need. It is evident that an economically feasible non-network option would not be available to defer or eliminate the requirement to replace the aged 66kV outdoor buses/switchgear at ROGL with and continue to provide a safe, sufficient and reliable supply to customers in the Rockhampton Area.

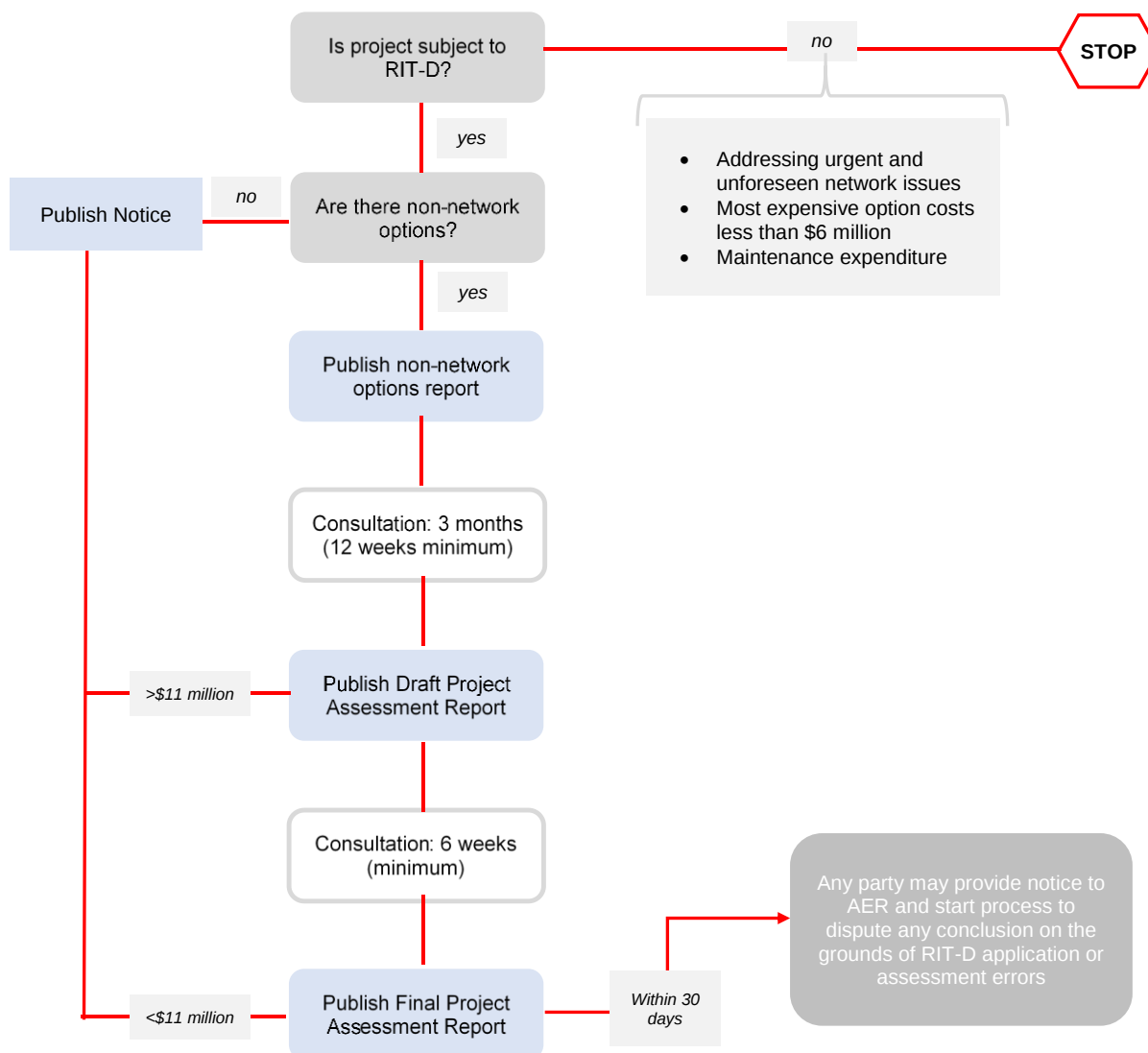
5. CONCLUSION AND NEXT STEPS

Considering the nature of the project, being the safety risk from failure of aged assets and as per clause 5.17.4(c) of the NER, Ergon Energy has determined that there are no credible non-network options to address the identified need at ROGL.

The preferred network option is Option A - to replace the assets in poor condition. This Notice of No Non-Network Options is therefore published in accordance with rule 5.17.4(d) of the NER. As the next step in the RIT-D process, Ergon Energy will now proceed to publish a Final Project Assessment Report.

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APPENDIX A – THE RIT-D PROCESS



Source: AEMC, *Rule determination: National Electricity Amendment (Replacement expenditure planning arrangements) Rule 2017*, July 2017, p. 64.