Regulatory Investment Test for Distribution (RIT-D)

Addressing Reliability Requirements in the Ayr Network Area

Notice of Screening for Options

18 November 2024

ERGON ENERGY NETWORK

Part of Energy Queensland

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

Ayr 66/11kV zone substation (AYRZ) is located in the Burdekin area in North Queensland. The 11kV feeders from AYRZ supply approximately 1,834 customers, of which 55% are residential and 46% are commercial, industrial and agricultural. The 66kV feeders from AYRZ supply Kalamia Substation (KALA), Barratta Substation (BARR), Giru Substation (GIRU) and the Pioneer Mill Switching Station (PIMI) which provide supply to approximately 1,508 customers including a number of major customers.

Condition Based Risk Management (CBRM) analysis has identified that the two 10MVA English Electric 66/11kV transformers (YOM 1960 & 1967), two sets of 66kV current transformers (YOM 1970) and a number of the protection relays at AYRZ are reaching end of life. There are also three sets of 66kV currents transformers that have known issues and have been classified as problematic plant. The ongoing operation of these assets beyond their estimated retirement date presents significant safety, environmental and customer reliability risks.

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. Ergon Energy has obligations under the Electrical Safety Act 2002 (Qld) to eliminate electrical safety risks so far as is reasonably practicable, and where not reasonably practicable, to minimise the risks 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 AYRZ. Ergon Energy has obligations to comply with reliability performance standards specified in its Distribution Authority issued under the Electricity Act 1994 (Qld).

Substation Direct Current (DC) supply systems are critical to the safe operation of control and protection assets in the Ergon Energy network. Sufficient availability and redundancy of substation DC supplies is required in the Ergon Energy network to ensure protection and control systems

reliably operate in accordance with the requirements of schedule S5.1.9 of the National Electricity Rules (NER).

Ergon Energy is seeking to invest in the network to undertake a reliability corrective action in order to continue to meet the service standards in its applicable regulatory instruments (National Electricity Rules, Electricity Act 1994 (Qld), Electrical Safety Act 2002 (Qld)).

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 Ayr 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 no stand-alone power system (SAPS) or 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

Ayr 66/11kV zone substation (AYRZ) is located in the Burdekin area in North Queensland. The 11kV feeders from AYRZ supply approximately 1,834 customers, of which 55% are residential and 46% are commercial, industrial and agricultural. The 66kV feeders from AYRZ supply Kalamia Substation (KALA), Barratta Substation (BARR), Giru Substation (GIRU) and the Pioneer Mill Switching Station (PIMI) which provide supply to approximately 1,508 customers including a number of major customers.

The geographical location of Ergon Energy's sub-transmission network and substations in the area is shown in Figure 1.

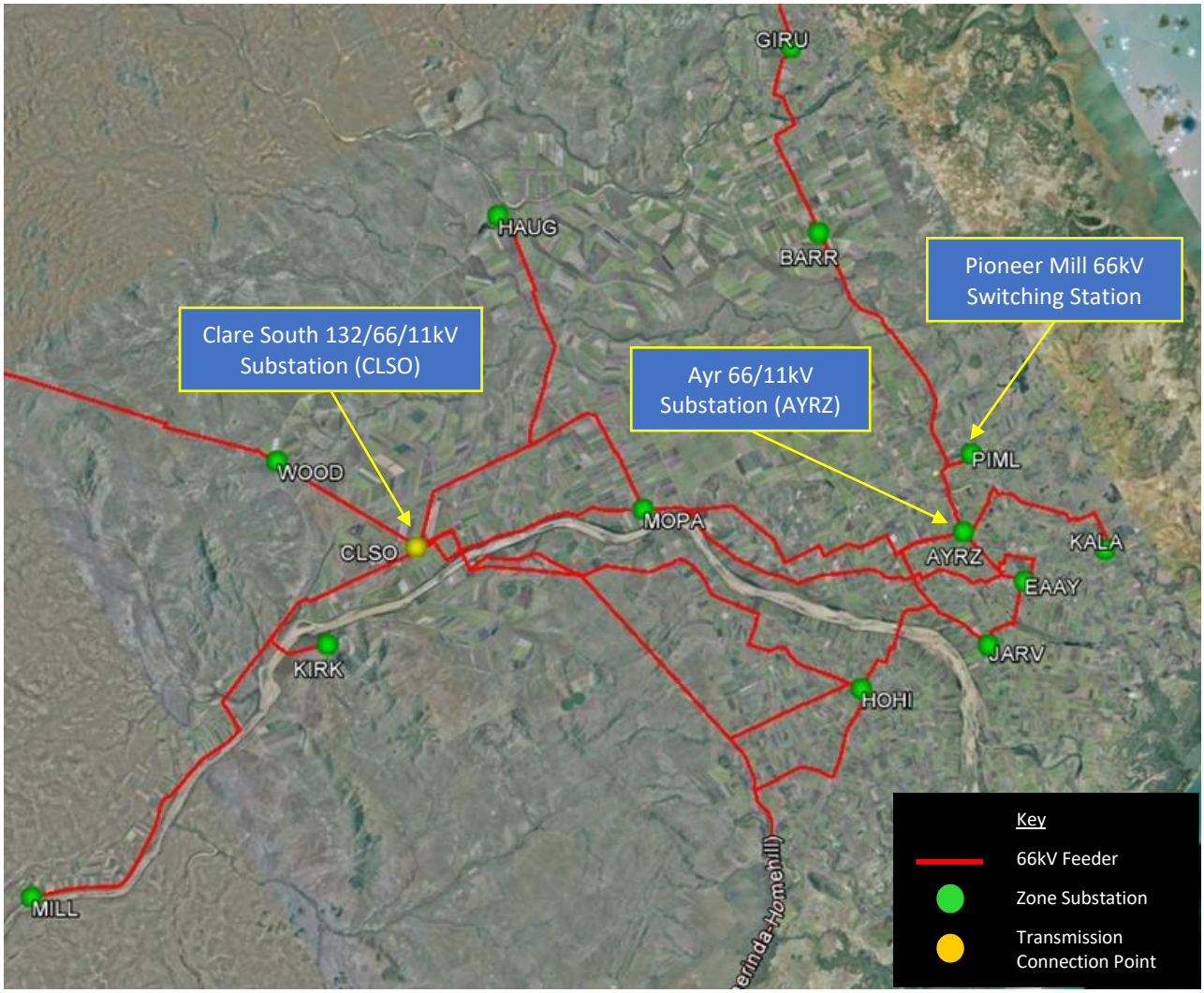


Figure 1: Existing network arrangement (geographic view)

1.2. Existing Supply System

AYRZ is located in the Burdekin area in North Queensland and is supplied via the 66kV network from T193 Clare South 132/66kV Substation.

AYRZ was established in the late 1960s according to applicable design and construction standards during that time. AYRZ consists of 6 x 66kV feeder bays, 2 x 66/11kV 7.5/10MVA (ONAN/ONAF) power transformers and an indoor 11kV switchboard with 5 x 11kV feeders and 2 x 11kV capacitor banks.

A schematic view of the existing sub-transmission network arrangement is shown in Figure 2 and the geographic view of AYRZ is illustrated in Figure 3.

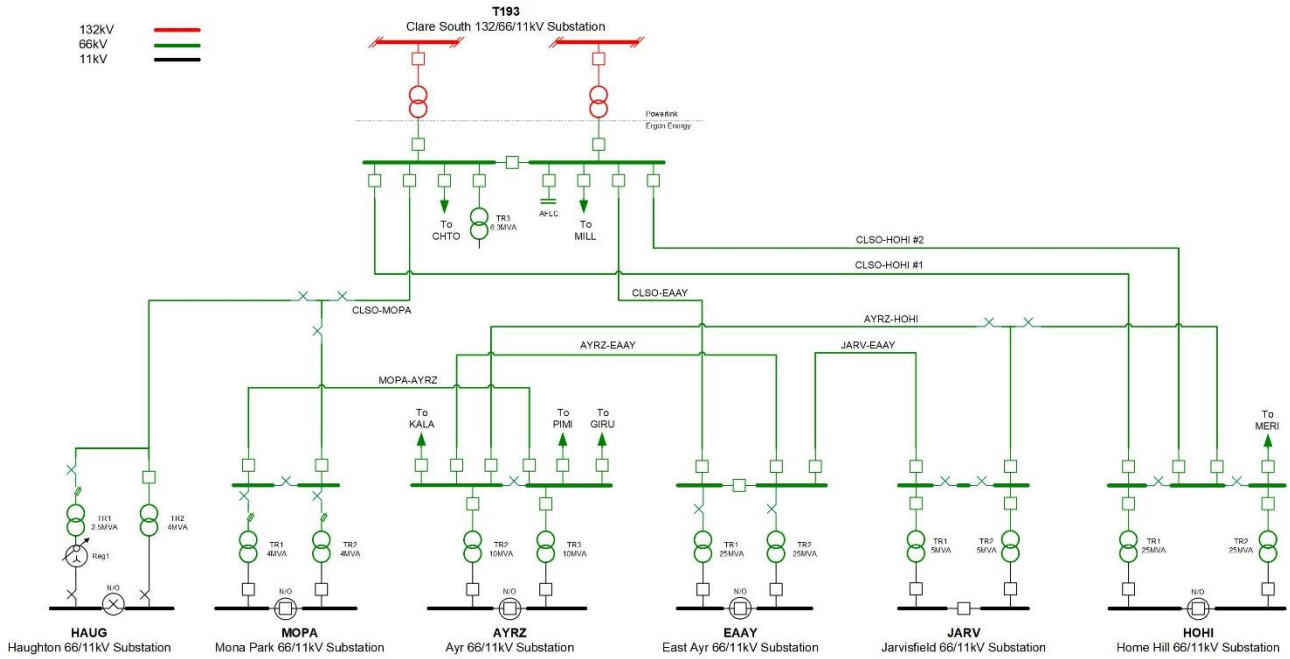


Figure 2: Existing network arrangement (schematic view)

Figure 3: Ayr Substation (geographic view)

1.3. Load Profiles / Forecasts

The 11kV load at AYRZ comprises a mix of residential and commercial/industrial/agricultural customers. The 11kV load is Summer peaking, and the annual peak loads are predominantly driven by residential customers and agricultural load. The 66kV load at AYRZ comprises a mix of residential and commercial/industrial/agricultural customers including a number of major customers. The 66kV load is Summer peaking and is influenced by the major customer loads and generation.

1.3.1. Full Annual Load Profile

The full annual 11kV and 66kV load profiles for AYRZ over the 2022/23 and 2023/24 financial years are shown in Figure 4 and Figure 5.

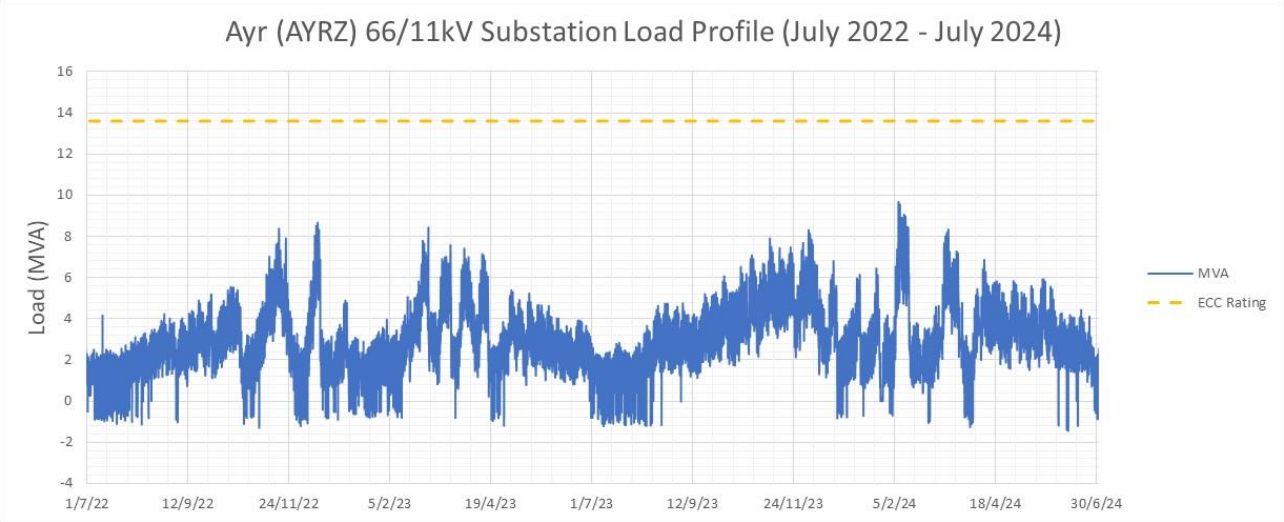


Figure 4: Substation actual annual load profile (11kV Load)

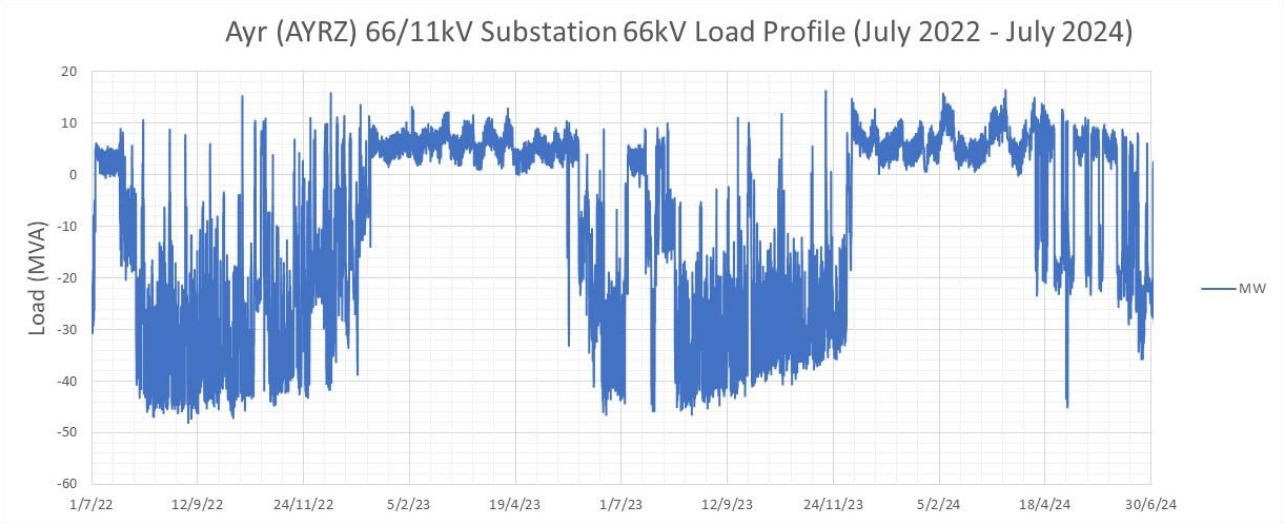


Figure 5: Substation actual annual load profile (66kV Load)

1.3.2. Load Duration Curve

The 11kV and 66kV load duration curves for AYRZ over the 2022/23 and 2023/24 financial years are shown in Figure 6 and Figure 7.

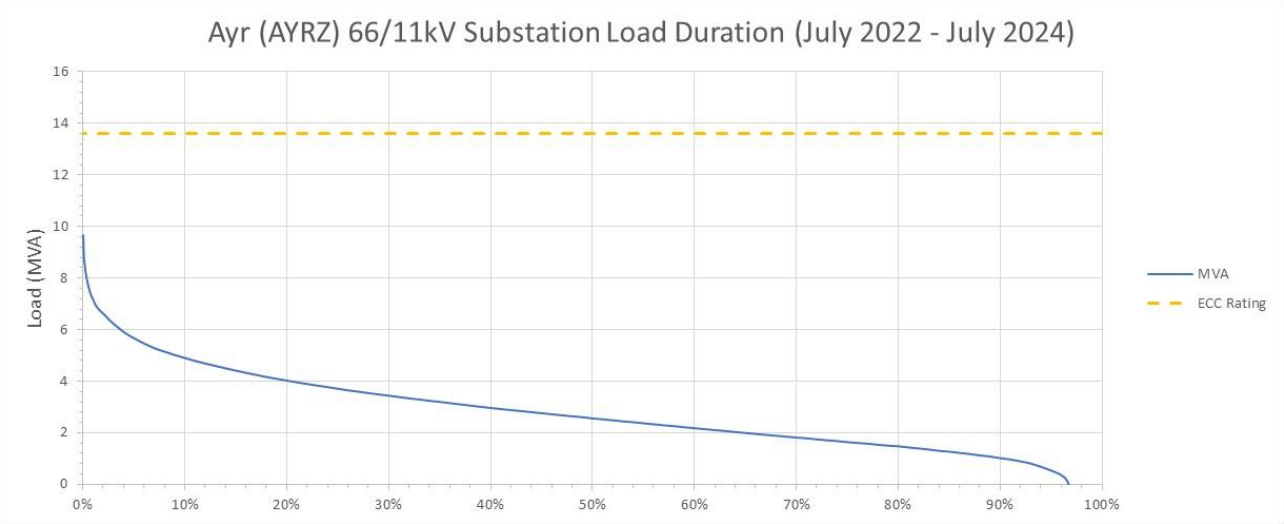


Figure 6: Substation load duration curve (11kV Load)

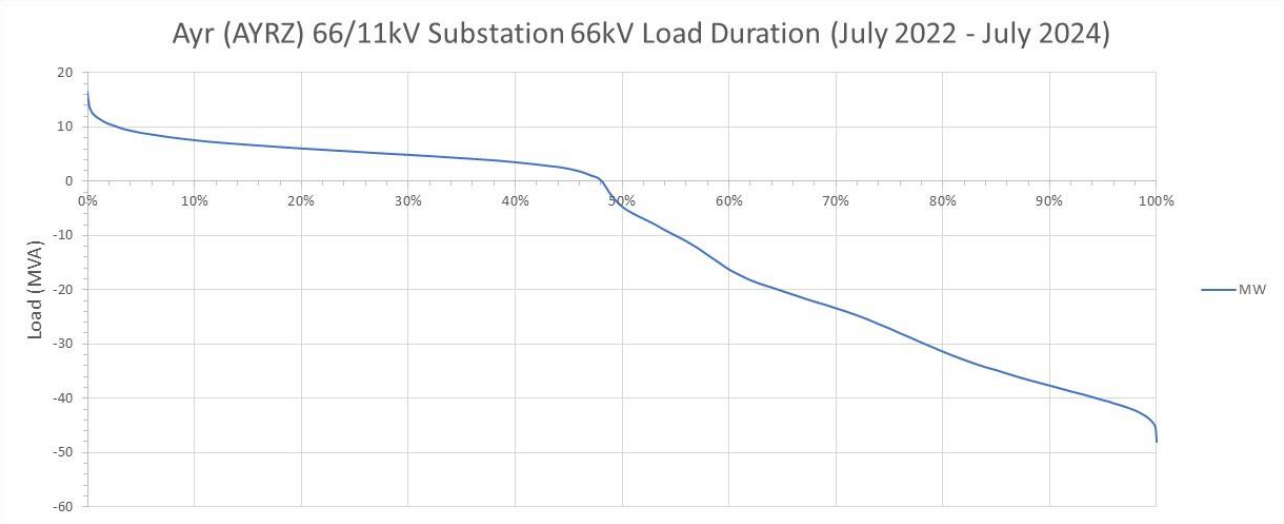


Figure 7: Substation load duration curve (66kV Load)

1.3.3. Average Peak Day Load Profile (Summer)

The daily 11kV load profile for an average peak day during Summer is illustrated below in Figure 8. It can be noted that the Summer peak 11kV loads at AYRZ are historically experienced in the late afternoon and evening.

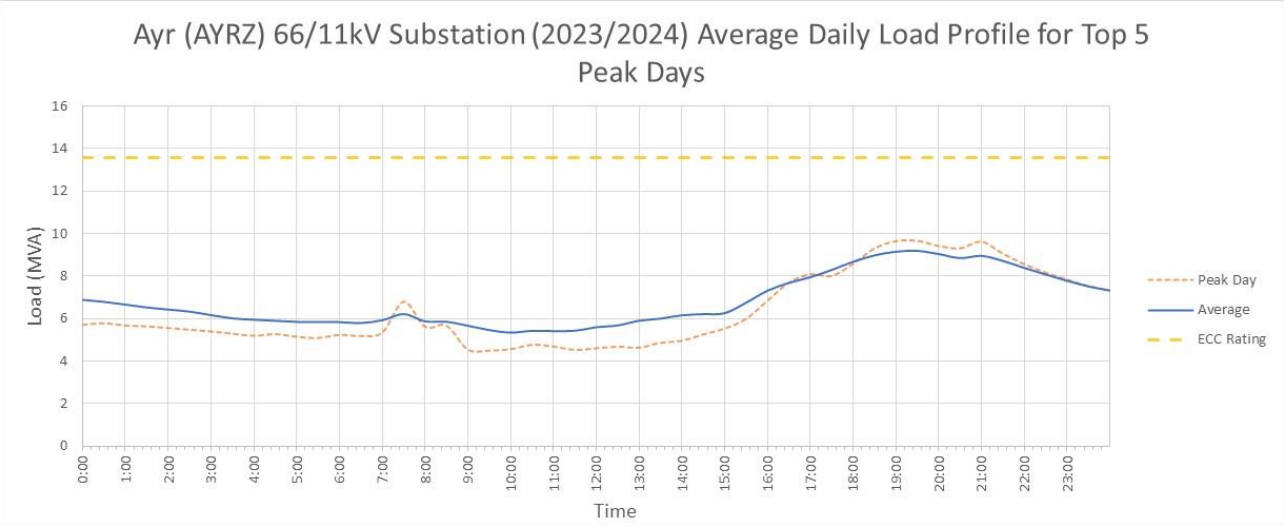


Figure 8: Substation average peak day 11kV load profile (summer)

1.3.4. Base Case Load Forecast

The 10 PoE (50% probability of exceedance) and 50 PoE (50% probability of exceedance) 11kV load forecasts for the base case load growth scenario are illustrated in Figure 9. The historical peak 11kV load for the past six years has also been included in the graph.

It can be noted that the historical annual peak loads have fluctuated over the past five years, primarily due to seasonal variation in pumping and irrigation load due to the quantity and timing of rainfall in the area. It can also be noted that the peak load is forecast to increase slightly over the next 10 years under the base case scenario.

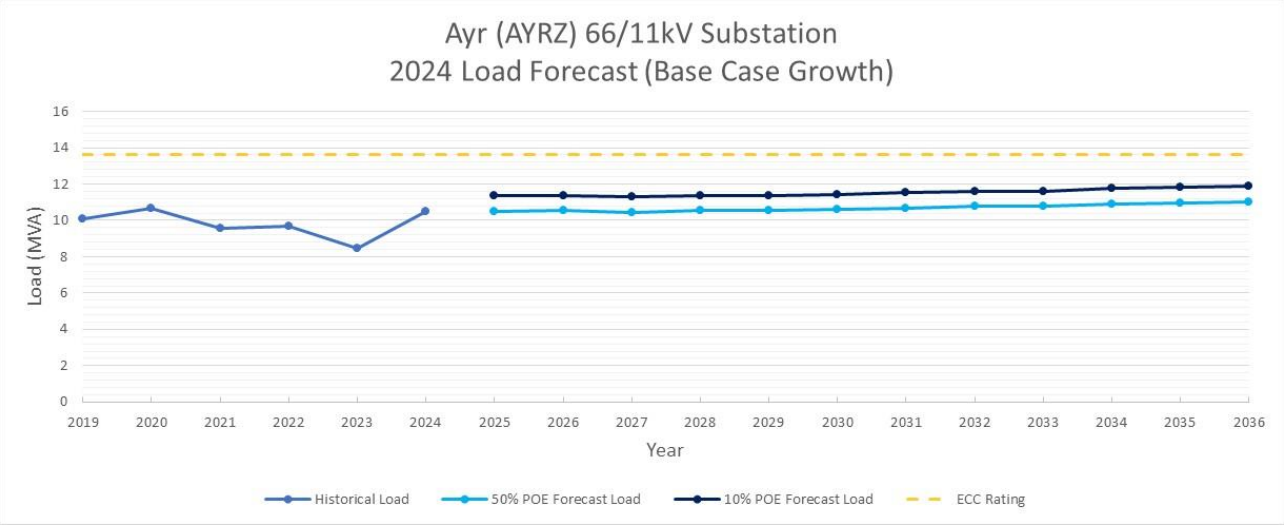


Figure 9: Substation base case load forecast (11kV Load)

1.3.5. High Growth Load Forecast

The 10 PoE and 50 PoE 11kV load forecasts for the high load growth scenario are illustrated in Figure 10. With the high growth scenario, the peak load is forecast to increase over the next 10 years.

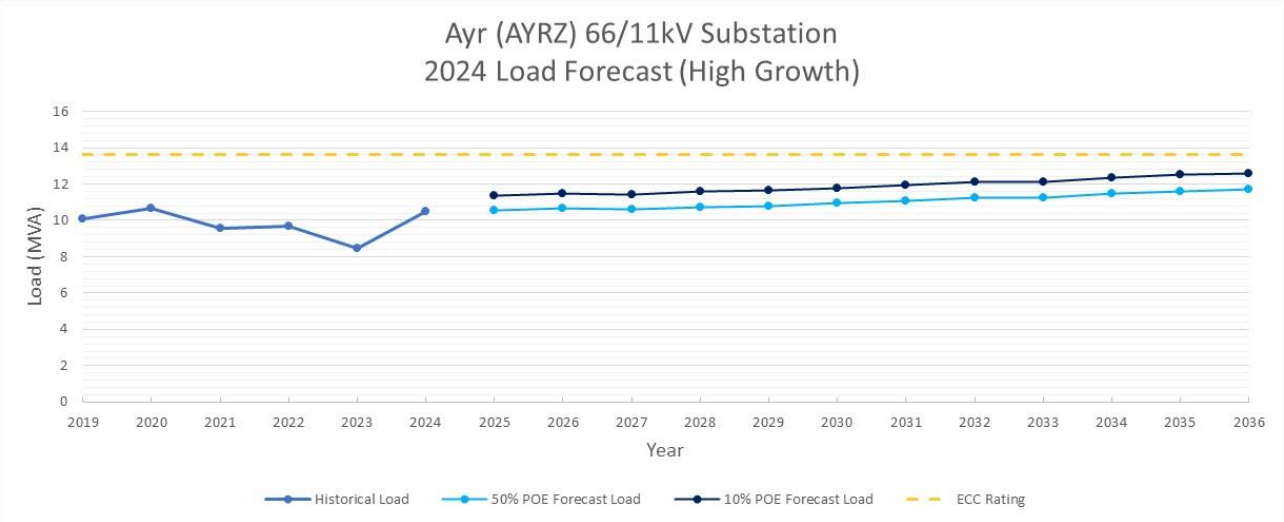


Figure 10: Substation high growth load forecast (11kV Load)

1.3.6. Low Growth Load Forecast

The 10 PoE and 50 PoE 11kV load forecasts for the low load growth scenario are illustrated in Figure 11. With the low growth scenario, the peak load is forecast to remain relatively steady over the next 10 years.

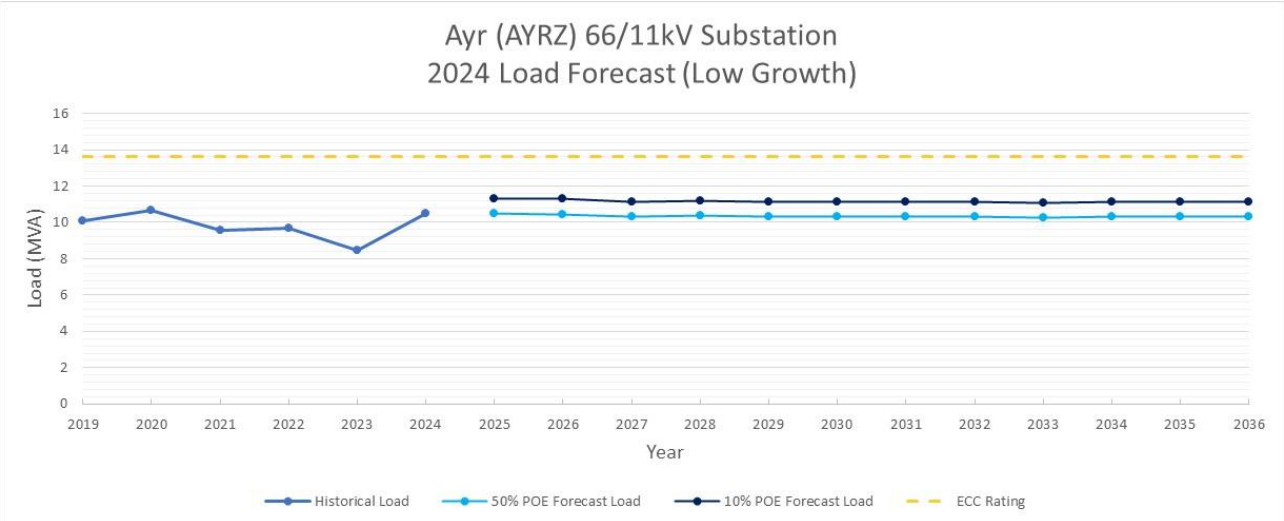


Figure 11: Substation low growth load forecast (11kV Load)

2. IDENTIFIED NEED

2.1. Description of the Identified Need

2.1.1. Reliability Corrective Action

Condition Based Risk Management (CBRM) analysis has identified that the two 10MVA English Electric 66/11kV transformers (YOM 1960 & 1967), two sets of 66kV current transformers (YOM 1970) and a number of the protection relays at AYRZ are reaching end of life. There are also three sets of 66kV currents transformers that have known issues and have been classified as problematic plant. The ongoing operation of these assets beyond their estimated retirement date presents a significant risk to safety, environment and customer reliability.

The deterioration of these primary and secondary system assets poses safety risks to staff working within the substation. It also poses a safety risk to the general public, through the increased likelihood of protection relay mal-operation. Ergon Energy has obligations under the Electrical Safety Act 2002 (Qld) to eliminate electrical safety risks so far as is reasonably practicable, and where not reasonably practicable, to minimise the risks 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 AYRZ. Ergon Energy has obligations to comply with reliability performance standards specified in its Distribution Authority issued under the Electricity Act 1994 (Qld).

Where Ergon Energy identifies an imminent asset safety risk, immediate temporary measures are put in place to ensure safety of staff and public until permanent remediation can be performed.

Substation Direct Current (DC) supply systems are critical to the safe operation of control and protection assets in the Ergon Energy network. Sufficient availability and redundancy of substation DC supplies is required in the Ergon Energy network to ensure protection and control systems reliably operate in accordance with the requirements of schedule S5.1.9 of the National Electricity Rules (NER).

3. POTENTIAL CREDIBLE OPTIONS

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 address the identified need. Further discussion of non-network options is included at section 4.

3.2. Network Options Identified

Ergon Energy has identified two potential credible network options that would address the identified need.

3.2.1. Option A: Duplicate DC supply and replace 66kV CTs, protection relays, TF2 & TF3 in 2027

This option is commercially and technically feasible, can be implemented in the timeframe identified, late-2027 and would address the identified need by replacing deteriorated assets at AYRZ ensuring Ergon Energy continues to adhere to the applicable regulatory instruments.

This option involves duplication of the substation DC supply system, replacement of both TF2 & TF3 with standard 66/11kV 10MVA Dyn1 transformers including upgrades to the bunding, oil containment system and blast walls, replacement of the A196, B196, D196, E196 & F196 66kV CTs, replacement of protection relays and removal of 11kV Cap Bank No.1 at AYRZ in order to address the identified need.

The estimated capital cost of this option is $8.7 million, which has been factored into the NPV to be incurred in 2027.

A schematic diagram of the proposed network arrangement for Option A is shown in Figure 12.

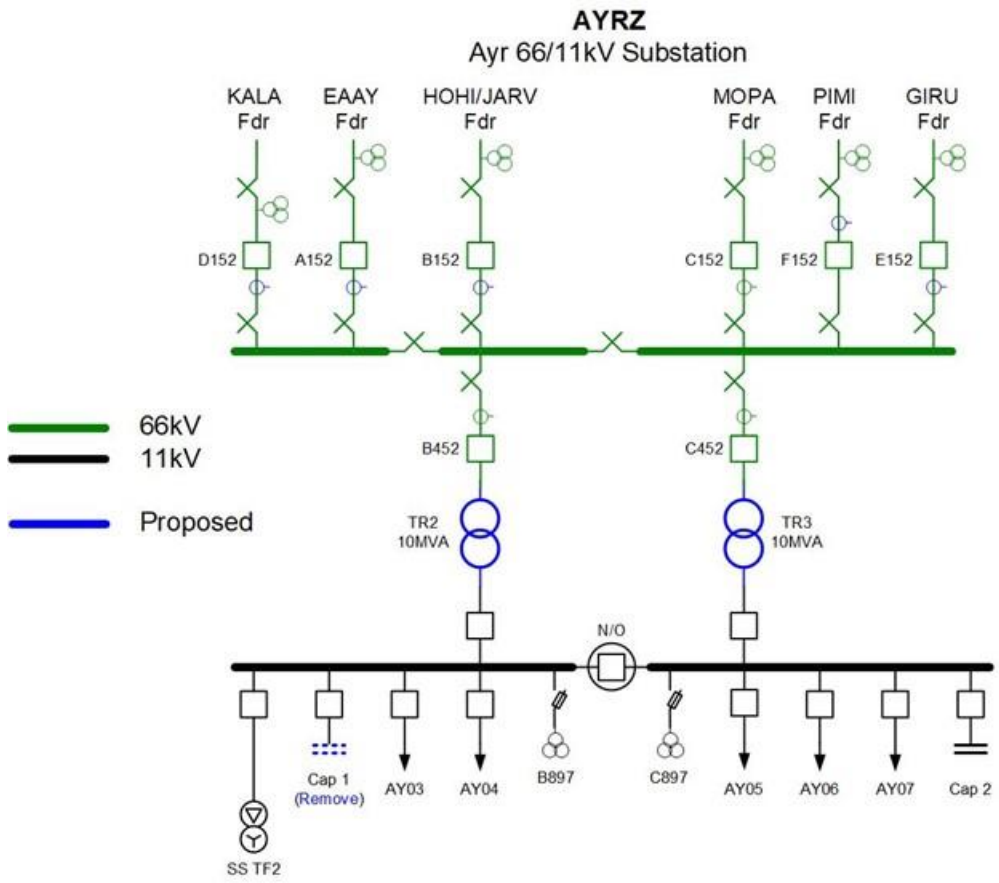


Figure 12: Option A proposed network arrangement (schematic view)

3.2.2. Option B: Duplicate DC supply and replace 66kV CTs, protection relays, TF3 in 2027 and TF2 in 2034

This option is commercially and technically feasible, can be implemented in the timeframe identified, late-2027 and would address the identified need by replacing deteriorated assets at AYRZ ensuring Ergon Energy continues to adhere to the applicable regulatory instruments.

This option involves duplication of the substation DC supply system, replacement of TF3 with a standard 66/11kV 10MVA Dyn1 transformer including upgrades to the bunding, oil containment system and blast walls, replacement of the A196, B196, D196, E196 & F196 66kV CTs, replacement of protection relays and removal of 11kV Cap Bank No.1 at AYRZ in order to address the identified need. The replacement of TF2 would be part of a future project.

The estimated capital cost of this option is $7.3 million, which has been factored into the NPV to be incurred in 2027. The replacement of the second transformer with an estimated capital cost of $2.1 million has been factored into NPV calculations to be incurred in 2034.

A schematic diagram with the proposed network arrangement for Option B is shown in Figure 13.

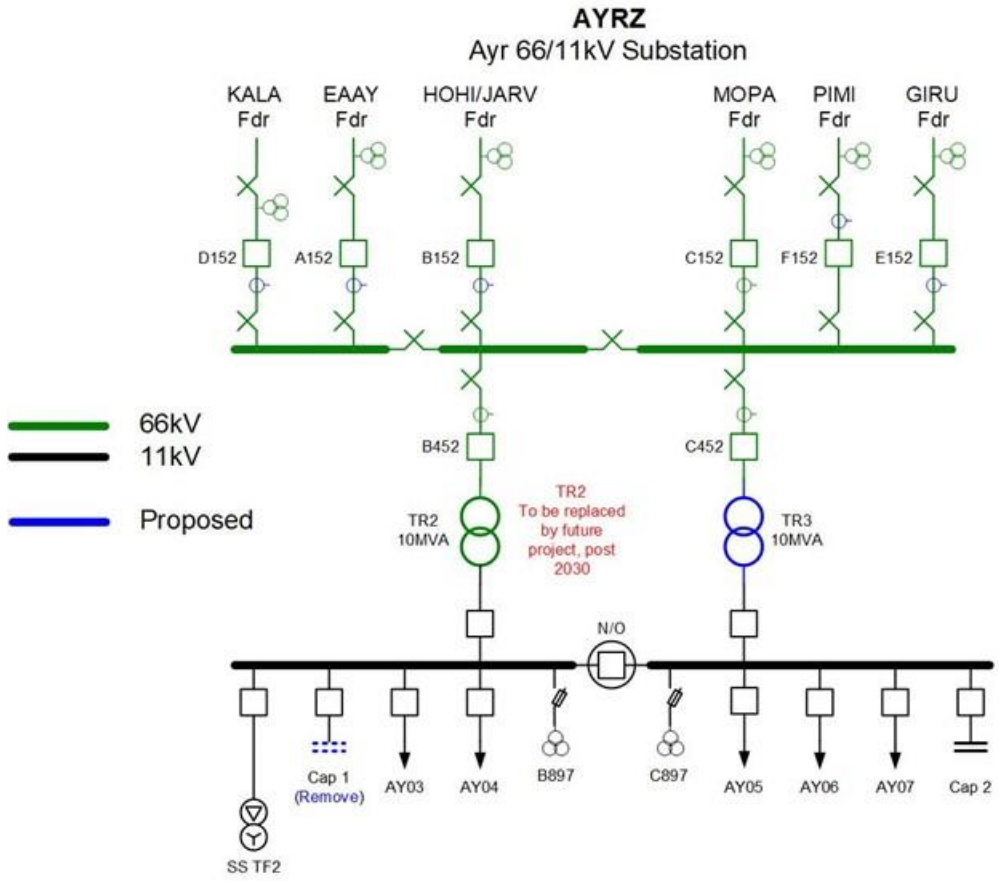


Figure 13: Option B proposed network arrangement (schematic view)

3.3. Preferred Network Option

Ergon Energy's preferred internal network option is Option A, to duplicate the DC supply system, replace both aged 66/11kV transformers, replace the aged and problematic 66kV CTs, replace the aged protection relays and remove 11kV Cap Bank No.1 at AYRZ.

Upon completion of these works the identified need would be addressed by replacing deteriorated assets at AYRZ ensuring Ergon Energy continues to adhere to the applicable regulatory instruments. The preferred option will provide the greatest reliability benefit for customers, whilst also reducing expenditure on obsolete and non-compliant assets while ensuring more efficient use of design and construction resources.

The estimated capital cost of this option is $8.7 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 mid-2026 and construction completed by December 2027.

4. ASSESSMENT OF SAPS AND NON-NETWORK SOLUTIONS

Ergon Energy has considered SAPS and demand management solutions. Each of these are considered below.

4.1. Consideration of SAPS Options

Ergon Energy considers there is no SAPS option that could form a potential credible option on a standalone basis, or that could form a significant part of the credible option. In particular the load requirements, per the forecast in the Ayr region could not be supported by a network that is not part of the interconnected national electricity system. Therefore, a SAPS option is not technically feasible.

4.2. Demand Management (Demand Reduction)

Ergon Energy's Demand & Energy Management (DEM) team has assessed the potential non-network alternative (NNA) options required to address the identified need.

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.

The DEM team has completed a review of the AYRZ customer base and considered the suitability of a number of demand management technologies. However, as the identified need is for reliability corrective action, it has been determined that demand management options would not be viable propositions for the following reasons.

4.2.1. Network Load Control

The residential customers and agricultural load appear to drive the daily peak demand which generally occurs between 6:00pm and 10:00pm.

There are 834 customers on tariff T31 and T33 hot water load control (LC) connected to the AYRZ 11kV feeders and a further 568 customers on tariff T31 and T33 hot water load control (LC) connected to the other zone substations in the area supplied via the AYRZ 66kV feeders. An estimated demand reduction value of 841kVA[1] is available.

AYRZ LC signals are controlled from T193 Clare South 132/66kV Substation (CLSO). The Tariff 33 and 31 hot water LC channels are dynamic (that is, it responds to exceedance settings not on a timetable) and the current control strategy only calls LC when the 66kV load at CLSO exceeds 81MW. This strategy does not directly address demand peaks experienced at AYRZ. Tariff 33 air-conditioning channels are under manual control of the operational control centre and are used as required. Therefore, network load control would not sufficiently address the identified need.

[1] Hot water diversified demand saving estimated at 0.6kVA per system

4.3. Demand Response

Four methods utilising demand response technology for deferring network investment are: Call Off Load (COL), Customer Embedded Generation (CEG), Large Scale Customer Generation (LSG) and customer solar power systems.

4.3.1. Customer Call Off Load (COL)

COL is an effective technique for deferring network investment where the need is for a short time period. However, in this instance, the need is required on a long-term permanent basis. There are a small number of large customers in the catchment area but the $/kVA funding available for demand reduction is low therefore customer call off load has been assessed as not a viable proposition as it will not address the identified need, nor benefit the community.

4.3.2. Customer Embedded Generation (CEG)

CEG is an effective technique for deferring network investment where the need is for a short time period. The primary driver for investment in this instance is asset safety and performance. A short-term deferral of network investment by using CEG is not a technically or financially feasible option (due to the number of contracts required to be negotiated and managed).

This option has been assessed as technically not viable as it will not address the identified network requirement.

4.3.3. Large-Scale Customer Generation (LSG)

LSG sites such as renewable energy generation, solar or wind farms of multiple MW's capacity constitute an opportunity to support substation investment by reducing demand on, and potentially providing reactive power support for substation assets.

This option has been assessed as technically not viable as the existing LSG or proposed LSG will not address the identified network requirement. AYRZ provides connectivity that enables the existing LSG to export energy into the national electricity system.

4.3.4. Customer Solar Power Systems

The AYRZ 11kV feeders have a total of 548 customers with solar photo voltaic (PV) systems for a connected inverter capacity of 4,789kVA. The other zone substations in the area supplied via the AYRZ 66kV feeders have a total of 435 customers with solar photo voltaic (PV) systems for a connected inverter capacity of 4,948kVA.

The daily peak demand is driven by residential customers and agricultural load and the peak generally occurs between 6:00pm and 10:00pm. As such customer solar generation does not coincide with the peak load period.

Business customers with large solar arrays are deemed to present a significant opportunity for targeted load control or load curtailment if coupled with a Battery Energy Storage System (BESS). Contracting such customers is attractive as they represent a larger load across fewer customers and therefore are cheaper and easier to engage and contract.

PV systems with BESS present a future portfolio opportunity for potential demand response but currently this supply area has a very limited solar/BESS. Solar customers without a BESS will not meet the technical needs of the demand reduction as their solar contribution may not be available when the network un-met need is required.

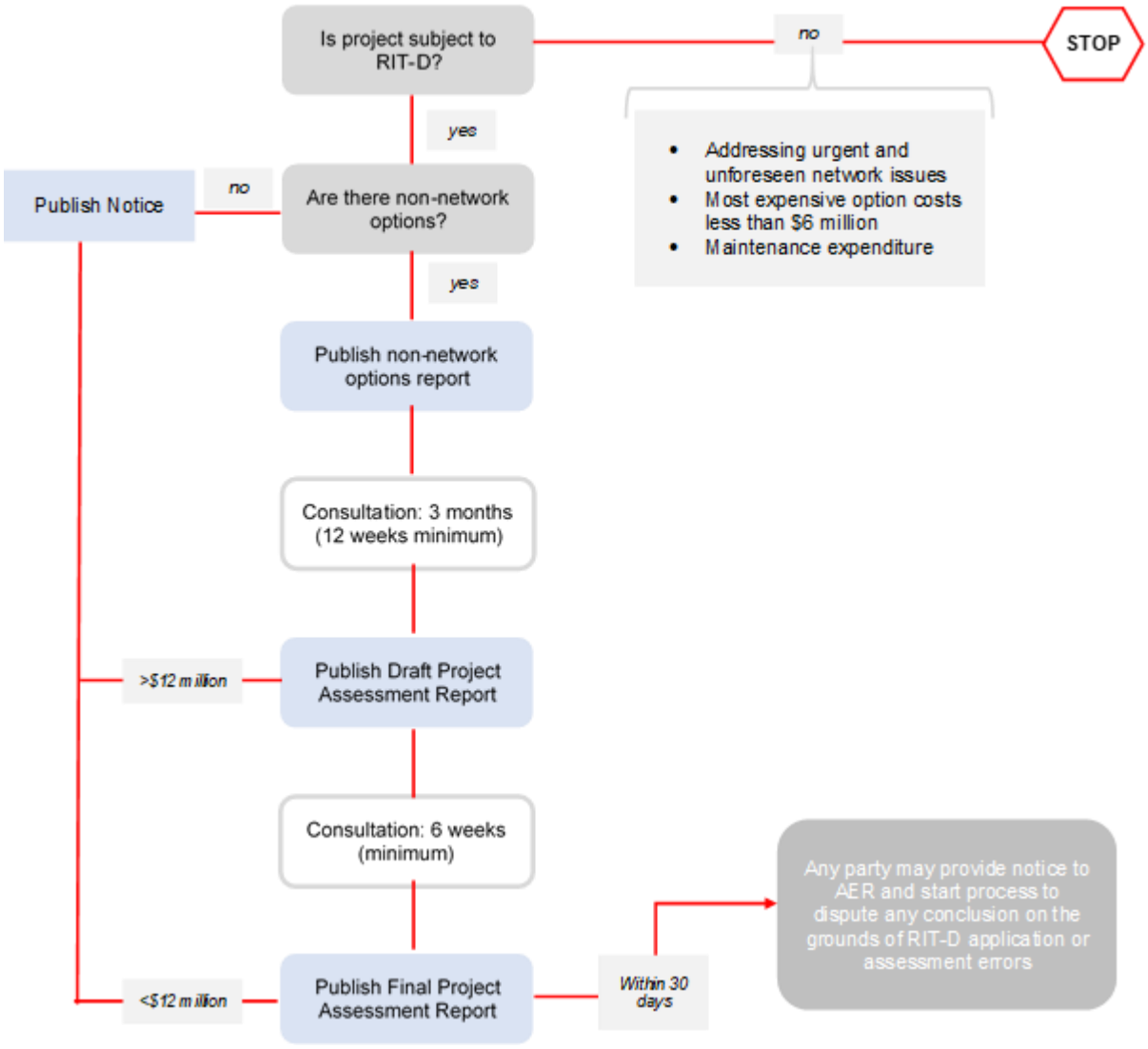
5. CONCLUSION AND NEXT STEPS

Ergon Energy has determined that there would not be a non-network option or SAPS option that is a potential credible option, or that forms a significant part or a potential credible option, to address the identified need.

The preferred credible option is network Option A, to duplicate the DC supply system, replace both aged 66/11kV transformers, replace the aged and problematic 66kV CTs, replace the aged protection relays and remove 11kV Cap Bank No.1 at AYRZ.

This Notice of Screening for options is published in accordance with rule 5.17.4(d) of the National Electricity Rules. As the next step in the RIT-D process, Ergon Energy will publish a Final Project Assessment Report.

APPENDIX A – THE RIT-D PROCESS



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