Regulatory Investment Test for Distribution (RIT-D)

Addressing Reliability Requirements in the Toogoolawah Network Area

Notice of No Non-Network Options

10 November 2022

energex
Part of Energy Queensland

EXECUTIVE SUMMARY

About Energex

Energex Limited (Energex) is a subsidiary of Energy Queensland Limited and manages the electricity distribution network in the growing region of South East Queensland which includes the major urban areas of Brisbane, Gold Coast, Sunshine Coast, Logan, Ipswich, Redlands and Moreton Bay. Our electricity distribution area runs from the NSW border north to Gympie and west to the base of the Great Dividing Range.

Our electricity network consists of approximately 54,200 kilometres of powerlines and 680,000 power poles, along with associated infrastructure such as major substations and power transformers.

Today, we provide distribution services to more than 1.4 million domestic and business connections, delivering electricity to a population base of around 3.4 million people.

Identified Need

Toogoolawah Zone Substation (SSTGW) is supplied from Lockrose Bulk Supply Substation (SST78) via a 33kV ring network, which also supplies Coominya Zone Substation (SSCMY), Esk Zone Substation (SSESK), Murrumba Zone Substation (SSMRB) and Somerset Dam Zone Substation (SSSDM). SSTGW provides electricity supply to approximately 1,900 predominately domestic customers in the surrounding suburbs.

SSTGW has four (4) 33/11kV transformers with three (3) of those units on hot-standby. It also consists of 33kV and 11kV outdoor switchgear and a control room.

The purpose of the project is to remove the existing problematic 33kV duo-roll goose neck and 33kV and 11kV braided vertical drop isolators as it is not possible to replace them in-situ. This is because the 11kV bus does not meet the required clearance and will require extensive staging of temporary works and generation along with staff exposure to working adjacent to energised outdoor bus. Expulsive drop out fuses will also be removed and the 33kV and 11kV outdoor switchgear will be replaced with indoor switchgear.

In addition, the three (3) aged hot-standby 33/11kV transformers TR1, TR2 and TR3 will also be removed as they have been in operation well beyond recommended retirement years and have poor diagnostic readings and are exhibiting oil leaks. Bunding for these transformers are also not compliant with current standard with potential environmental impacts associated with site proximity to the water course which feeds into the Wivenhoe Dam catchment. These transformers are being replaced with a single (second) transformer.

The ongoing operation of these assets beyond 2027 presents a significant risk to safety, environment, and customer reliability.

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). Energex has determined that network investment is essential in this case for it to continue to provide electricity to the consumers in the Toogoolawah 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 Energex in accordance with the requirements of clause 5.17.4(d) of the NER.

CONTENTS

1. BACKGROUND

1.1. Geographic Region

SSTGW provides electricity supply to predominately domestic customers in the Colinton, Harlin, Linville, Monsildale, Moore and Toogoolawah areas in the Somerset Region. The geographical location of Energex's sub-transmission network and substations in the area is shown in **Error! Reference source not found.**.

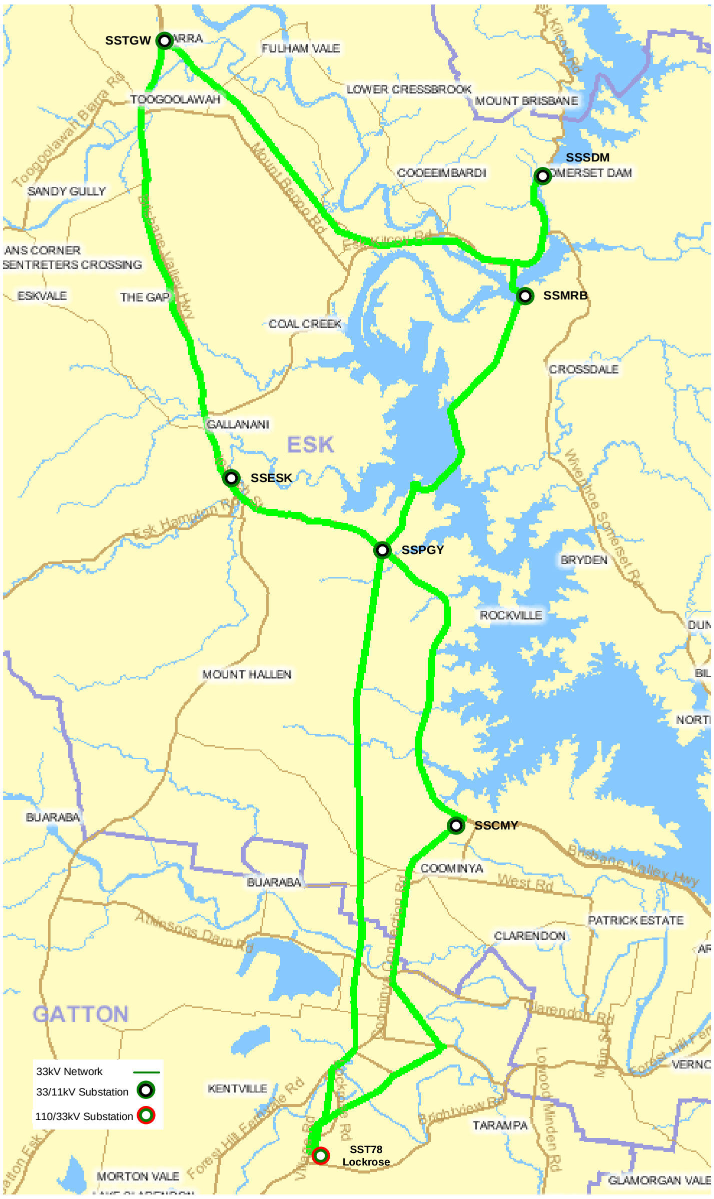


Figure 1: Existing 33kV network arrangement (geographic view)

1.2. Existing Supply System

SSTGW is supplied from SST78 (Lockrose) via 33kV feeders F3840 (to Esk Zone Substation SSESK) and F380 (to Murrumba Zone Substation SSMRB and Somerset Dam Zone Substation SSSDM). The substation has an outdoor 33kV and 11kV switchgear, a control room, one (1) 8MVA and three (3) 1.5MVA 33/11kV transformers. The 11kV bus has five (5) active feeders which supplies a total of approximately 1,900 residential, industrial, commercial, and rural customers, with a peak of 5.7MVA based on recent summer periods.

The three (3) 1.5MVA transformers have been operating as hot standby well past the recommended retirement year and are therefore deemed to be unreliable to supply load during a contingency.

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

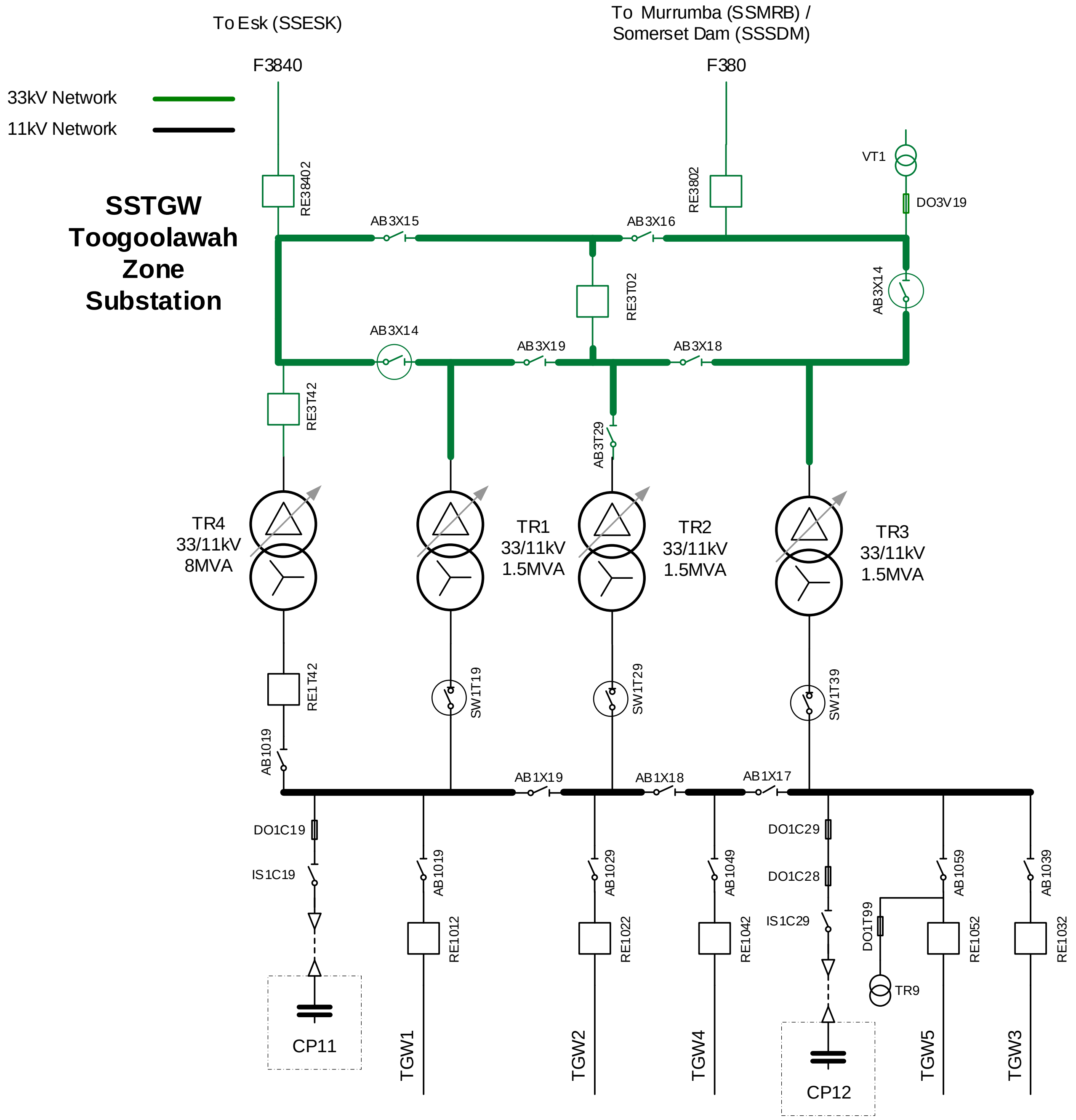


Figure 2: Existing network arrangement (schematic view)

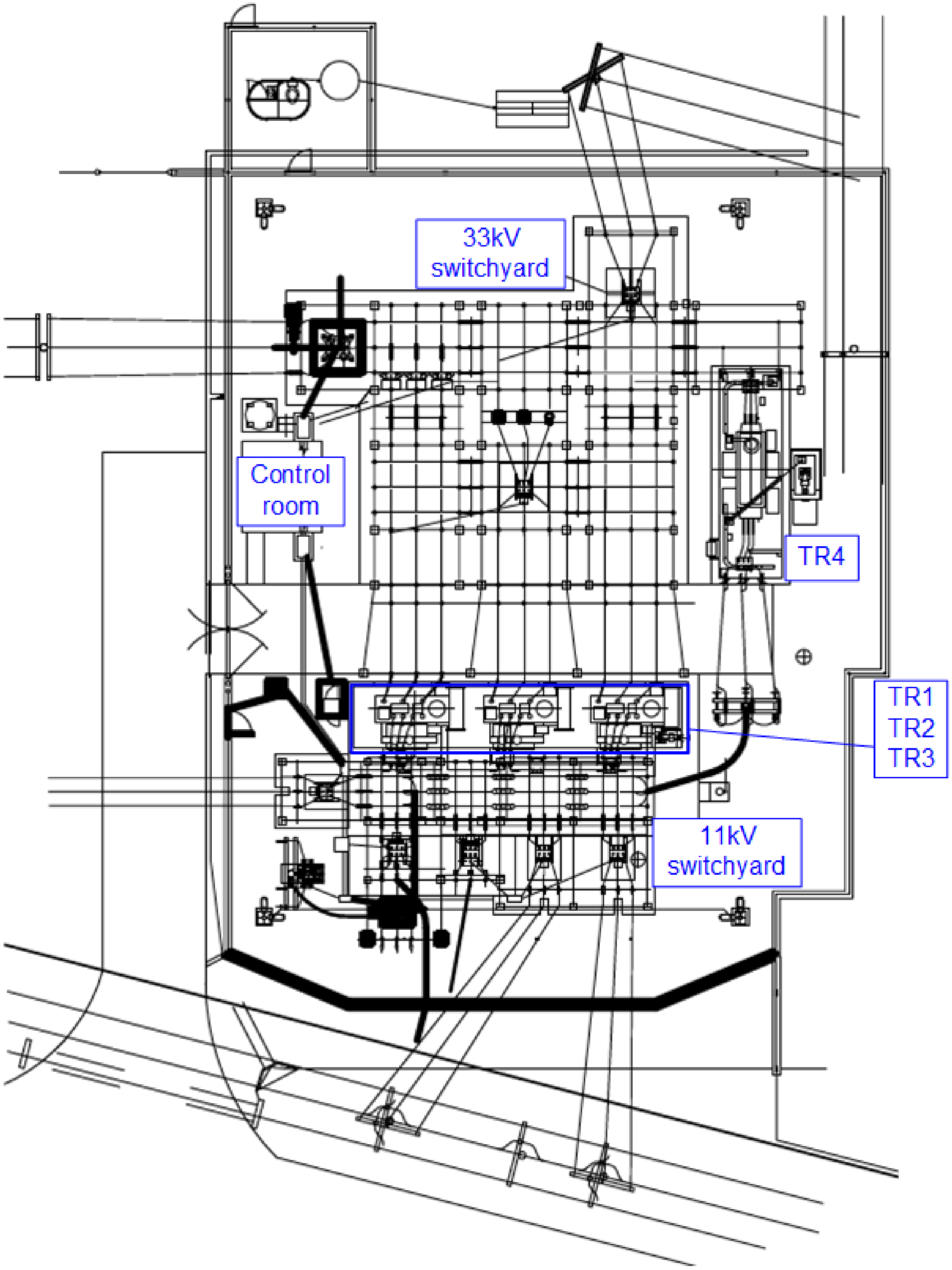


Figure 3: Toogoolawah Substation (general arrangement)

1.3. Load Profiles / Forecasts

The load at SSTGW comprises of predominantly residential customers and is summer peaking.

1.3.1. Full Annual Load Profile

The full annual load profile for Toogoolawah 33/11kV zone substation for 2021/22 financial year is shown in Figure 4. The peak occurs through the summer period. There are no capacity limitations at SSTGW as for the loss of TR4, the 3 x transformers (TR1, TR2, & TR3) on hot standby can supply all the load at SSTGW. However, given the condition of TR1, TR2 and TR3 there is significant risk of these transformers failing as soon as they are required to take load, putting the entire substation load at risk.

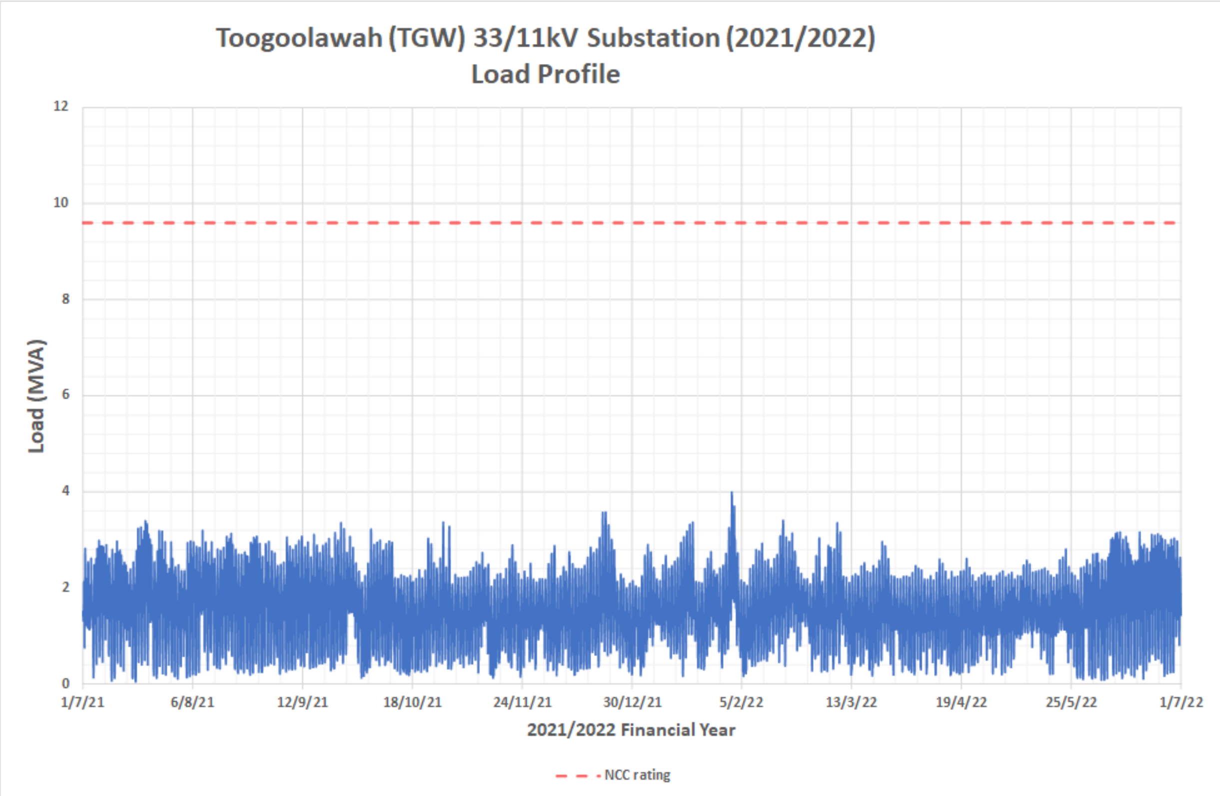


Figure 4: SSTGW actual annual load profile

1.3.2. Load Duration Curve

The load duration curve for Toogoolawah load for 2021/22 is shown in Figure 5**Error! Reference source not found.**. The load does not exceed the NCC capacity of 9.6MVA.

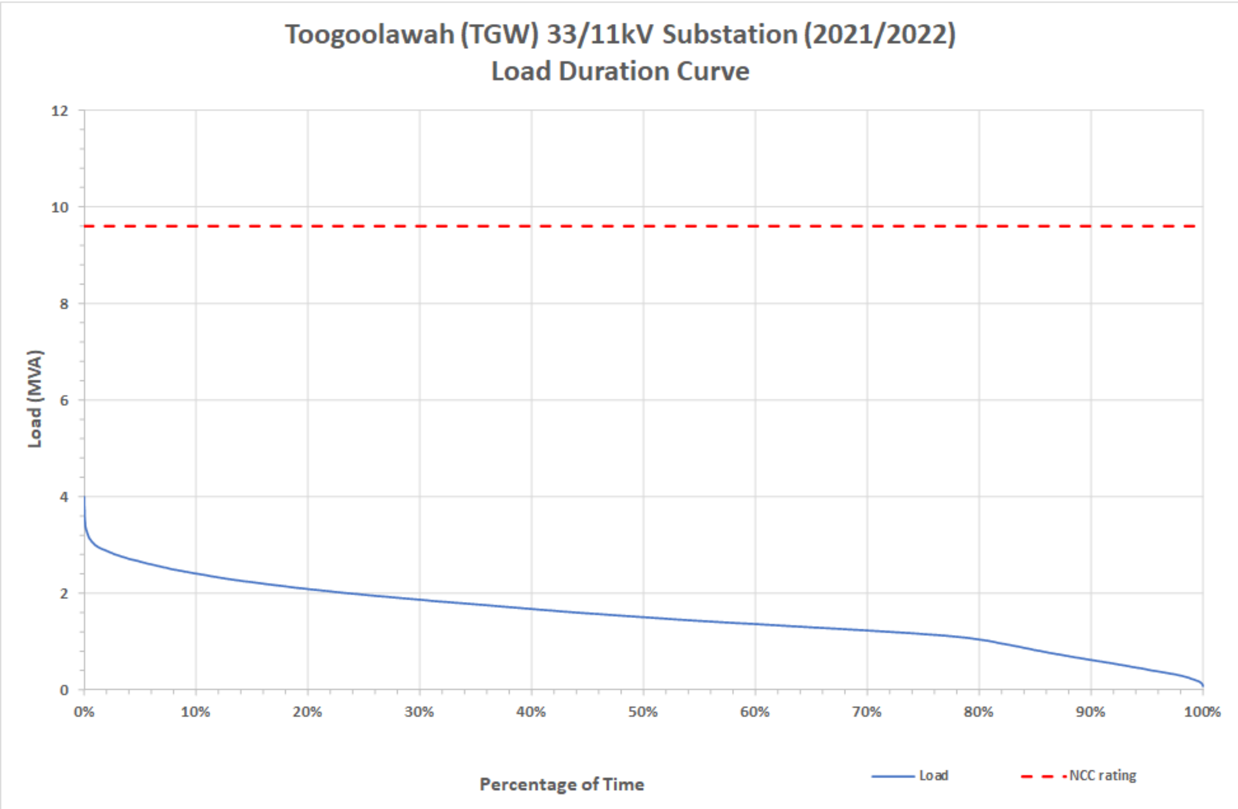


Figure 5: Substation load duration curve for SSTGW

1.3.3. Average Peak Weekday Load Profile (Summer)

The daily load profile for the average and peak weekday during summer is illustrated below in Figure 6**Error! Reference source not found.**. The summer peak loads for Toogoolawah are historically experienced in the late afternoon and evening.

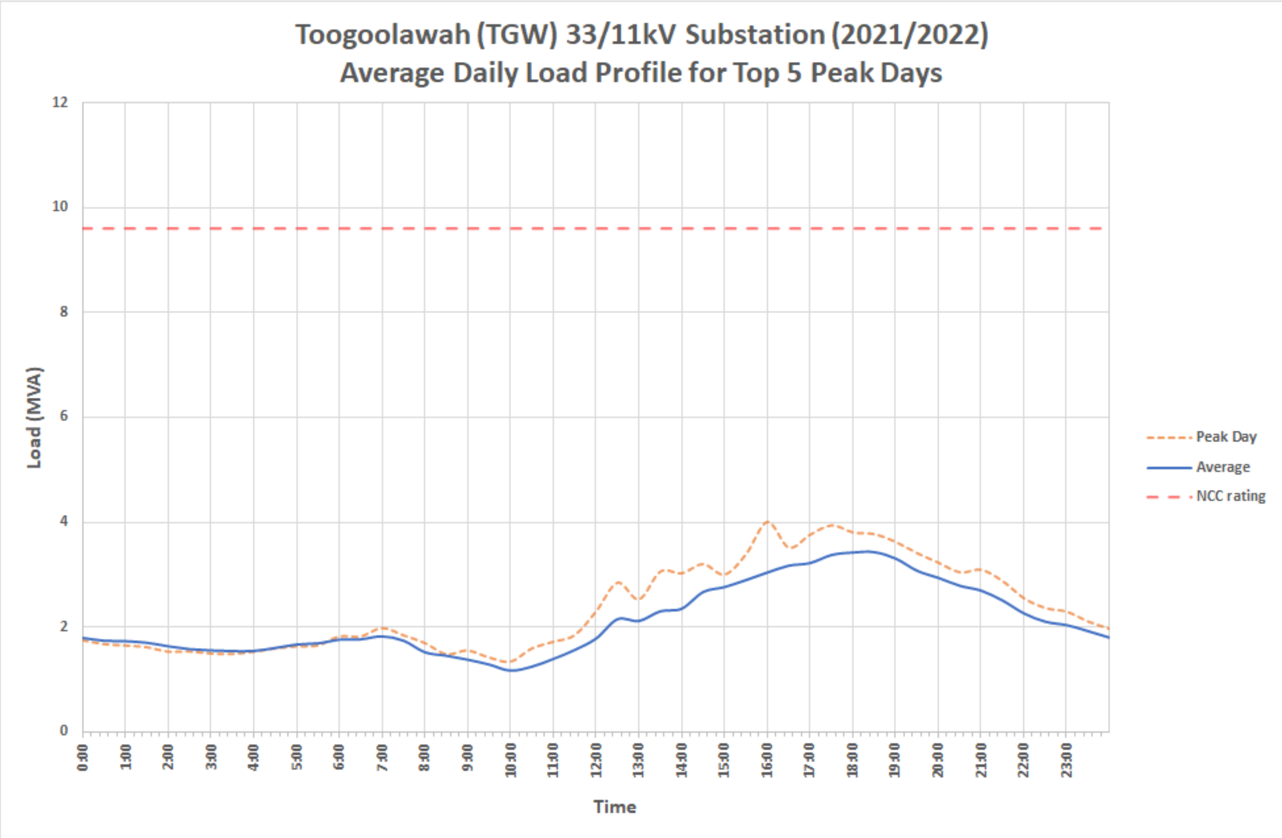


Figure 6: Average Daily and Maximum Load Profiles (Summer)

1.3.4. Base Case Load Forecast

The 10 PoE and 50 PoE load forecasts for the base case load growth scenario are illustrated Figure 7. The historical peak load for the past six years has also been included in the graph. It can be seen that peak loads were between 5 to 6MVA for previous years prior to the recent summer peak of 4MVA.

The 10% POE forecast load growth in the base case scenario does not exceed the NCC rating of 9.6MVA. It can also be noted that flat growth in the peak load is forecast over the next 10 years under the base case scenario.

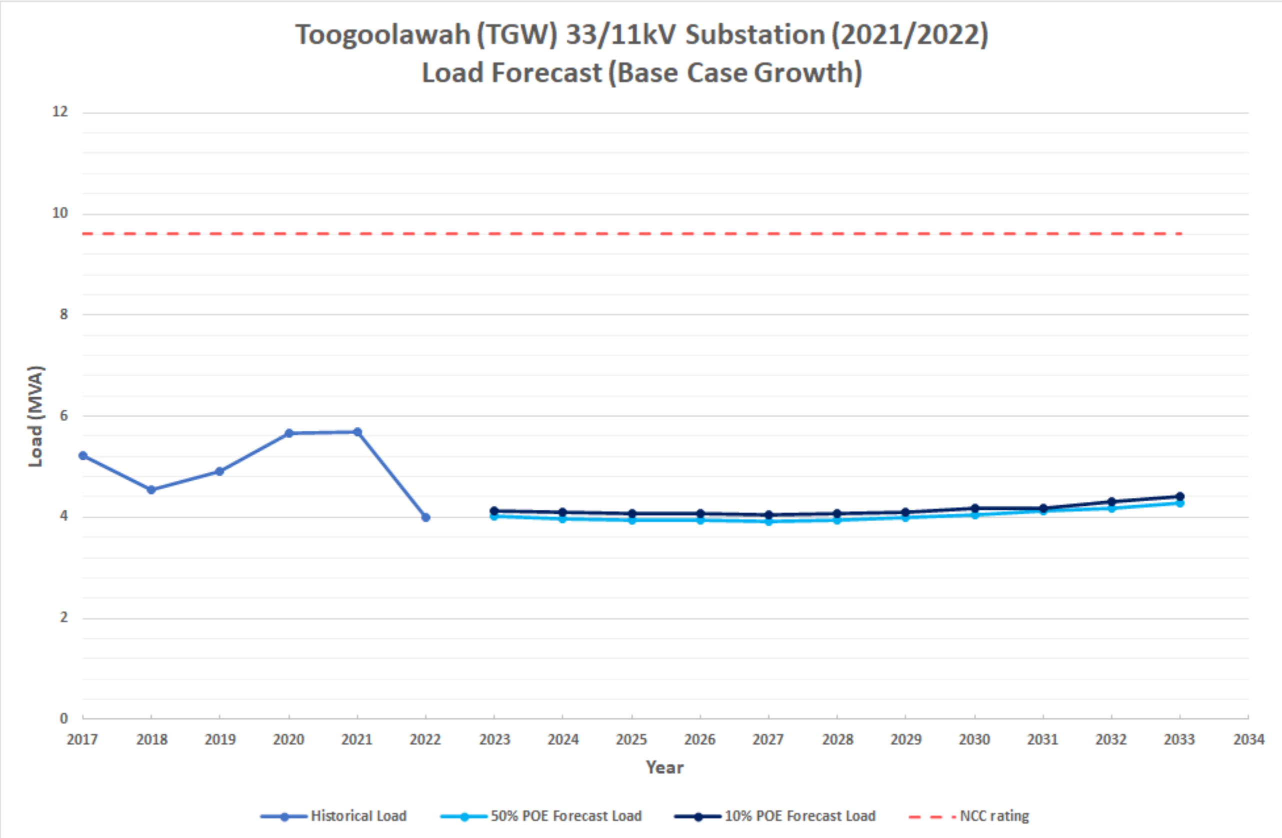


Figure 7: Network Base case load forecast

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 8. With the high growth scenario, the peak load is forecast to increase over the next 10 years.

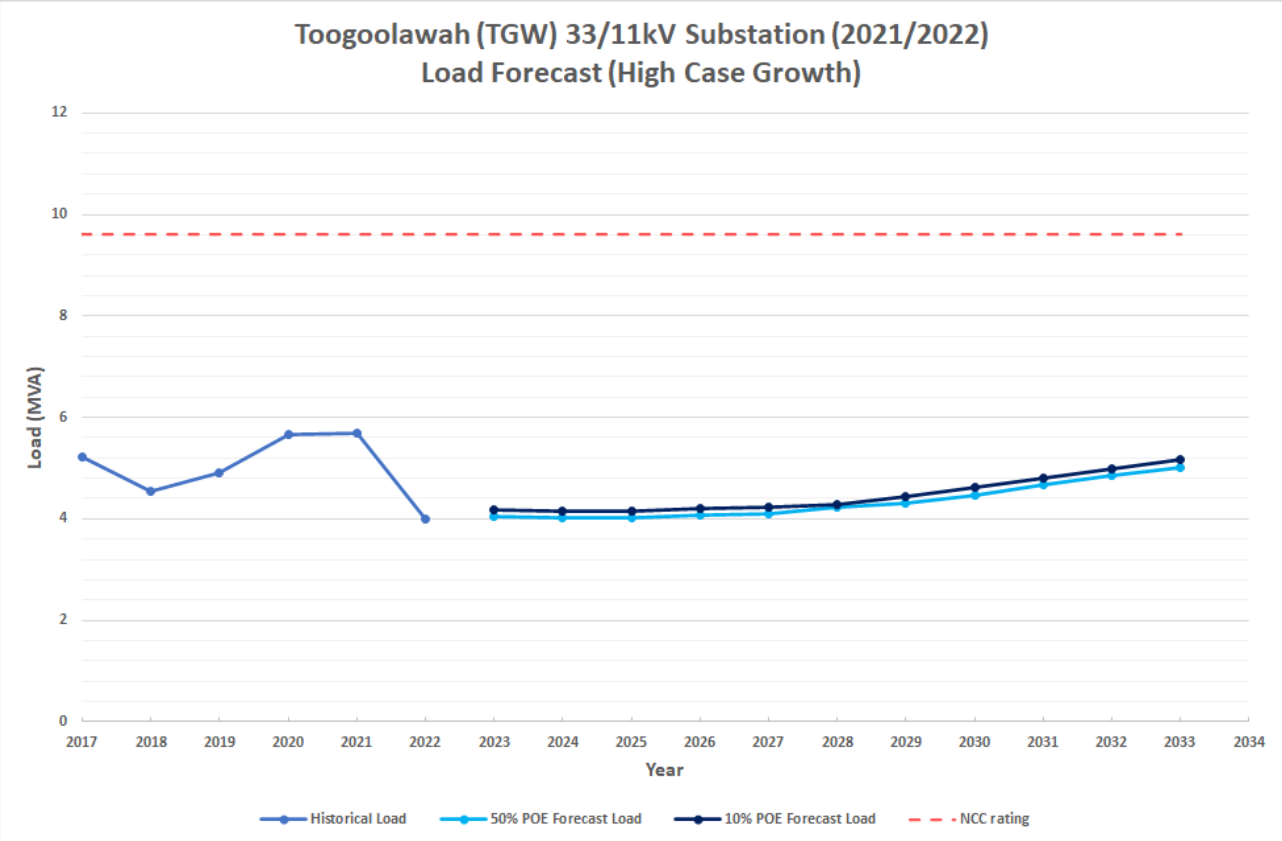


Figure 8: Network High Growth Load Forecast

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 9. With the low growth scenario, the peak load is forecast to flatline over the next 10 years.

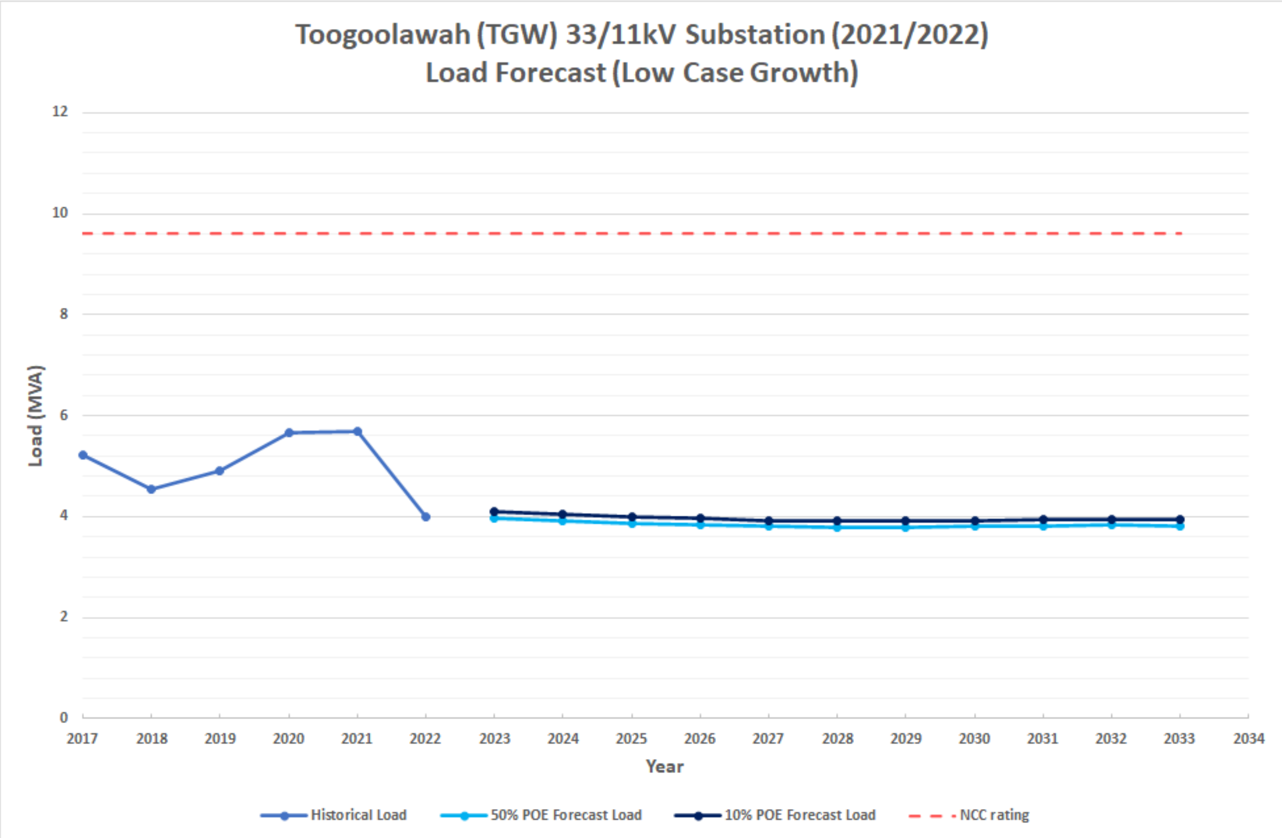


Figure 9: Network Low Growth Load Forecast

2. IDENTIFIED NEED

2.1. Description of the Identified Need

2.1.1. Poor Condition Assets

A recent condition assessment and substation works have highlighted a number of critical assets are at the end of their serviceable life, are in poor condition or are targeted for removal. The condition of these assets presents considerable safety and customer reliability risk. These assets include:

- Three (3) 33/11kV transformers
- Six (6) 33kV Isolators
- Three (3) 11kV Isolators
- Four (4) sets of expulsive drop out fuses
- One (1) 33kV VT
- One (1) set of LV Surge Arrestors

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, Energex views that the safety risk to the public and its staff to not be reduced to So Far As Is Reasonably Practicable.

The problematic isolators and the poor condition of the assets significantly increases the likelihood of outages, resulting in a reduction in the level of reliability experienced by the customers supplied from Toogoolawah Substation.

In addition, the three (3) aged hot-standby 33/11kV transformers TR1, TR2 and TR3 will also be removed as they have been in operation well beyond recommended retirement years and have poor diagnostic readings and are exhibiting oil leaks. Bunding for these transformers are also not compliant with current standard with potential environmental impacts associated with site proximity to the water course which feeds into the Wivenhoe Dam catchment.

3. INTERNAL OPTIONS CONSIDERED

3.1. Non-Network Options Identified

Energex 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 Toogoolawah area to address the identified need.

3.2. Network Options Identified

Energex has identified two (2) credible network option that will address the identified need. The option of replacement of the problematic and end of life assets in-situ was considered but rejected, because of the following:

- Clearance between the 11kV feeder bays is inadequate, thus, to replace the isolators most of the bus would have to be out of service. Therefore, replacement in-situ would require extensive temporary works and significant generation as there are limited load transfers available.
- In-situ replacement of disconnectors does not address existing low terminations.
- Uncertainty regarding remaining life of the galvanised steel "pipework" structures given its age and condition.
- Current contract isolators are not compatible with existing “pipework” structures.
- Sub-standard protection schemes for the outdoor bus and transformers, with inadequate space on the outdoor bus to install required CTs to deploy current standard protection schemes.
- Safety risk exposure to staff working adjacent energised outdoor bus for considerable period due to complex staging plan required to replace assets in-situ.
- Increased network risk due to longer outages required for staging.

3.2.1. Option 1: Remove problematic plant items, replace the 33kV and 11kV outdoor switchgear with indoor switchgear and replace 3 x 1.5MVA 33/11kV aged transformers with 1 x 5/8MVA unit

This option involves the following works:

- Replace outdoor bus with new 33kV switchgear (2 x 3-way RMU switchgear) & 11kV switchgear (2 x 5-way RMU switchgear) and control building
- Recover 3 x 1.5 MVA 33/11 kV transformers
- Install 1 x 5 MVA 33/11 kV transformer
- Remove problematic and aged 11kV and 33kV outdoor isolators
- Replace 4 sets of Expulsive drop out fuses (EDO) which are spark emitting type with HRC sparkless fuses

- Epoxy resin LV surge arresters on TR9 are to be replaced with non-shattering arresters
- Install NEXs on TR4 & new transformer
- Install new panels for 2 x 33kV feeder protection
- Install new panels for 2 x 33/11kV transformer protection
- Install new battery bank and charger, AC & DC boards

A schematic diagram of the proposed network arrangement for Option 1 is shown in Figure 10.

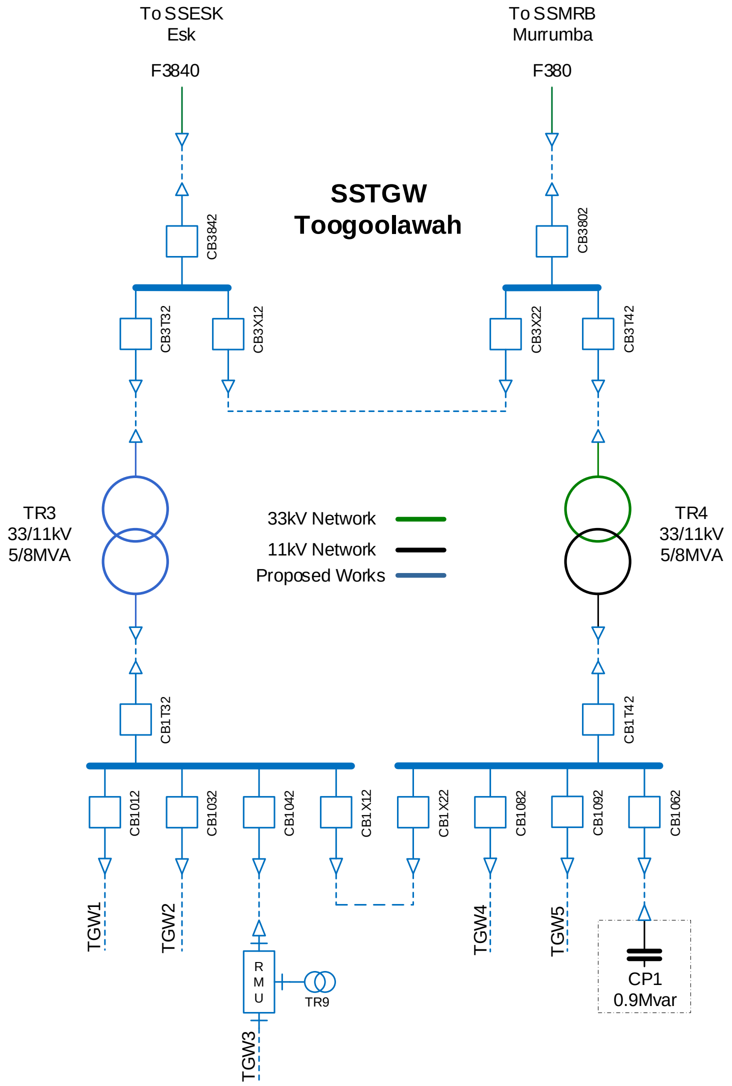


Figure 10: Option 1 proposed network arrangement (schematic view)

3.2.2. Option 2: Remove problematic plant items, replace the 33kV and 11kV outdoor switchgear with indoor switchgear and recover 3 x 1.5MVA 33/11kV aged transformers and install a mobile kiosk

This option involves the following works:

- Same as option 1 except that the 3 x 1.5MVA 33/11kV aged transformers would be replaced with a mobile kiosk connection

A schematic diagram of the proposed network arrangement for Option 2 is shown in Figure 11.

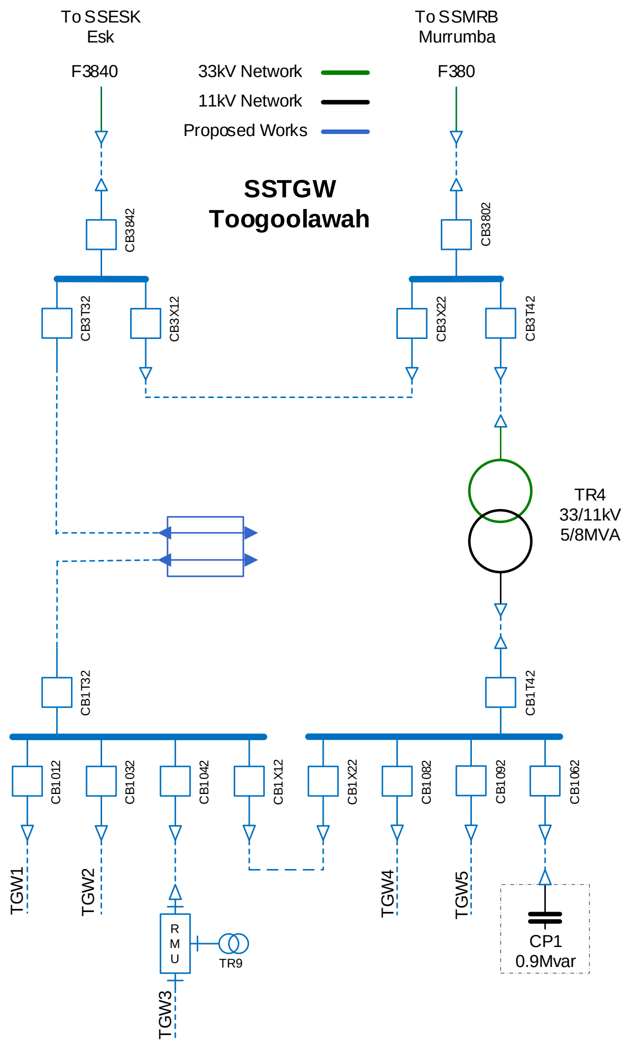


Figure 11: Option 2 proposed network arrangement (schematic view)

3.3. Preferred Network Option

Energex's preferred internal network option is Option 1: Remove problematic plant items, replace 33kV and11kV outdoor switchgear with indoor switchgear and replace 3 x 1.5MVA 33/11kV aged transformers with 1 x 5/8MVA unit.

Upon completion of these works, the asset safety and reliability risks at Toogoolawah 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 $9.208 million. Annual operating and maintenance costs are anticipated to be the same as the existing network as a result of this option. The estimated project delivery timeframe has design commencing in February 2023 and construction completed by May 2027.

4. ASSESSMENT OF NON-NETWORK SOLUTIONS

Energex's Demand & Energy Management (DEM) team has assessed the potential non-network alternative (NNA) options required to defer the network option and determine if there is a viable demand management (DM) 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/ problematic, identified 11kV and 33kV assets at SSTGW 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 Energex.

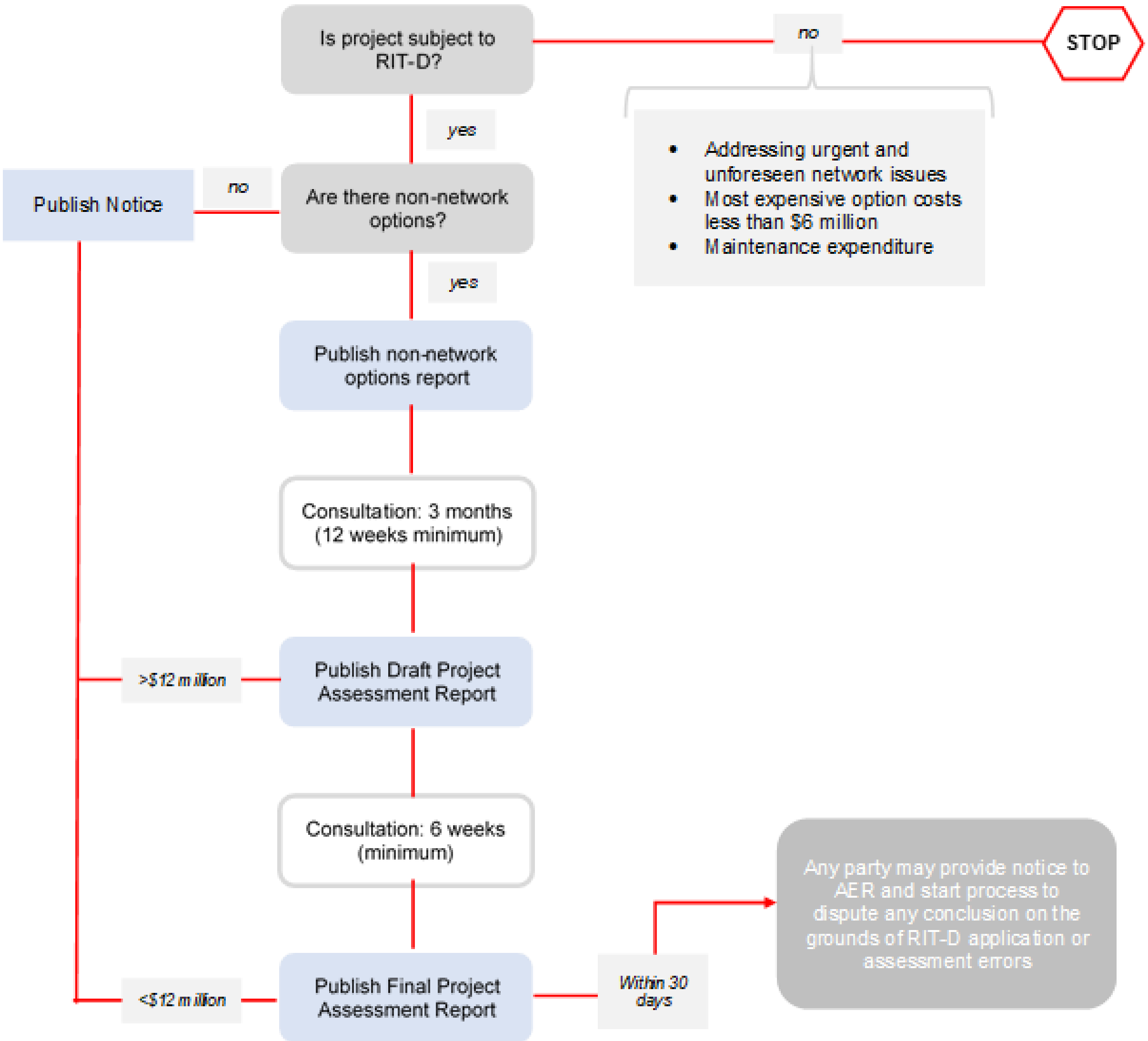
It is considered that no available demand management products or strategies can provide sufficient demand support at SSTGW to address the identified need. It is evident that an economically feasible non-network option would not be available to defer or eliminate the requirement to remove the problematic plant items and replace the 33kV and 11kV outdoor switchgear with indoor switchgear at SSTGW and continue to provide a safe, sufficient and reliable supply to customers in the Toogoolawah 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, Energex has determined that there are no credible non-network options to address the identified need at SSTGW.

The preferred network option is Option 1: Remove problematic plant items, replace the 33kV and 11kV outdoor switchgear with indoor switchgear, and replace 3 x 1.5 MVA 33/11kV aged transformers with 1 x 5/8MVA unit. 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, Energex will now proceed to 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.