Regulatory Investment Test for Distribution (RIT-D)

Addressing Reliability Requirements in the Tarampa Network Area

Notice of No Non-Network Options

11 July 2023

energex

Part of Energy Queensland

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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

Tarampa 33/11kV zone substation (SSTRP) is located approximately 25 km North-West of Ipswich. The substation is supplied from Lockrose 110/33kV Bulk Supply Substation (SST78) via 33kV feeder F3831 and backup supply from Lowood zone substation (SSLWD) via 33kV feeder F3832. SSTRP provides electricity supply to approximately 2,150 predominately domestic customers in the surrounding suburbs.

SSTRP is equipped with two 33/11kV transformers, 33kV and 11kV outdoor switchgear and a control room.

The purpose of the project is to remove and replace aged and poor condition assets in SSTRP, this includes the 33kV duo-roll and 11kV braided vertical drop isolators, expulsive drop out fuses and 33/11kV transformer TR1. It is not possible to replace the isolators in-situ 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.

The 33/11kV transformer TR1 has been in operation well beyond the recommended retirement year, has poor diagnostic readings and is exhibiting oil leaks.

It is proposed that the 33kV and 11kV outdoor switchgear will be replaced with new indoor or outdoor switchgear, the expulsive drop out fuses will be removed and the 33/11kV transformer will be replaced with a new transformer.

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 Tarampa 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

Tarampa substation provide electricity supply to approximately 2,550 predominately domestic customers in the Tarampa, Mount Trampa, Coolan, Lowood and Clarendon areas.

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

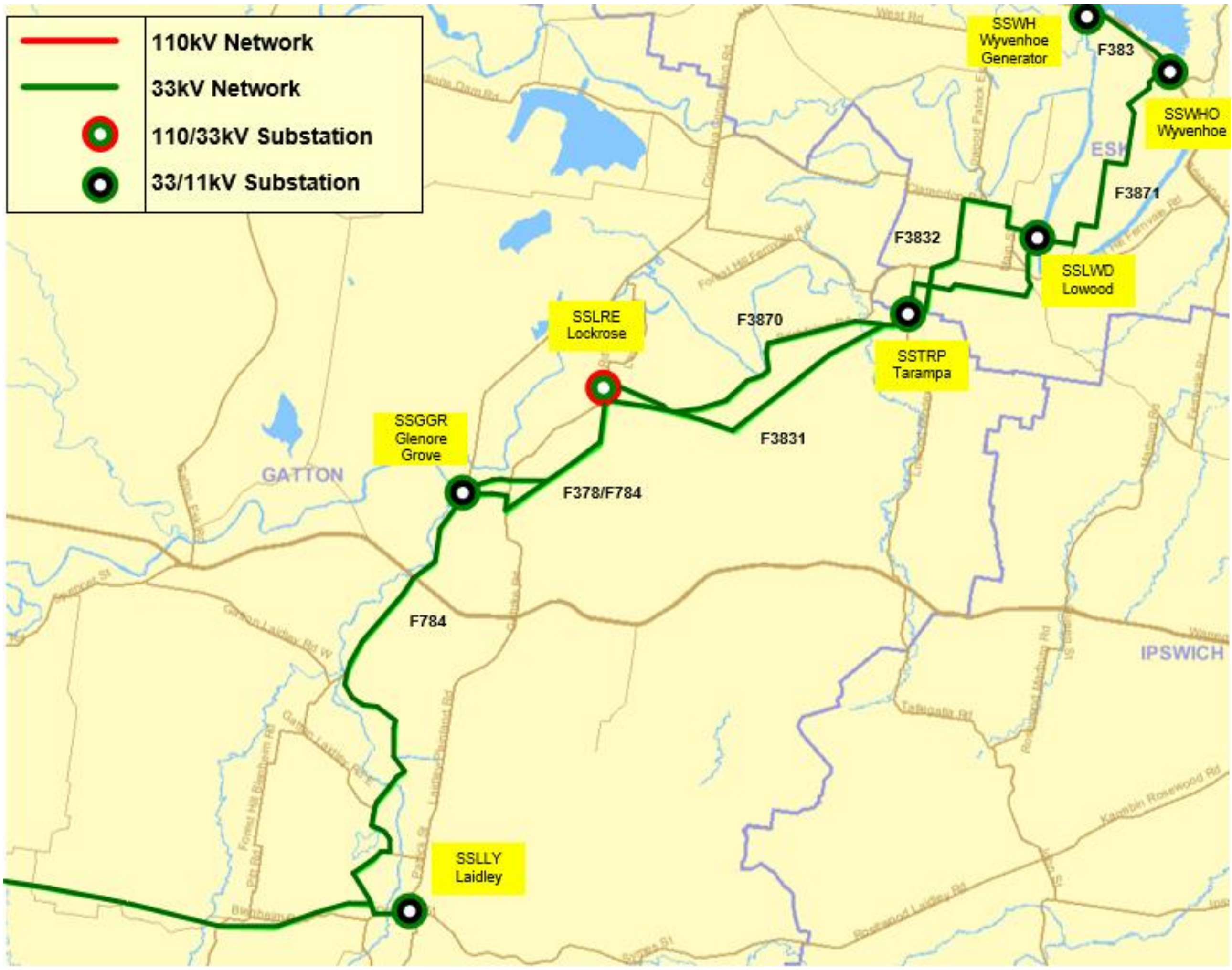


Figure 1: Existing network arrangement (geographic view)

1.2. Existing Supply System

SSTRP is supplied from Lockrose bulk supply (SST78) via 33kV feeder F3831 and backup supply from Lowood zone substation (SSLWD) via F3832. SSLWD is connected to SST78 via a 33kV feeder F3870. The substation has an outdoor 33kV and 11kV switchgear, a control room, two 5MVA 33/11kV transformers. The 11kV bus has five active feeders which supplies a total of approximately 2,550 residential, industrial, commercial, and rural customers, with a peak of 7.5MVA based on recent summer periods.

The 33kV and 11kV bus are manually switched. The 33kV and 11kV bus contains nine 33kV isolators and ten 11kV bus isolators. The 11kV bus is operated normally open, one 33/11kV transformer supplies two 11kV feeders and other transformer supplies three 11kV feeder. The 33kV circuit breaker used for 33/11kV transformer protection and there are no 11kV circuit breakers for 33/11kV transformers.

A schematic view of the existing sub-transmission network arrangement is shown in Figure 2 and the geographic view of Tarampa Substation is illustrated in

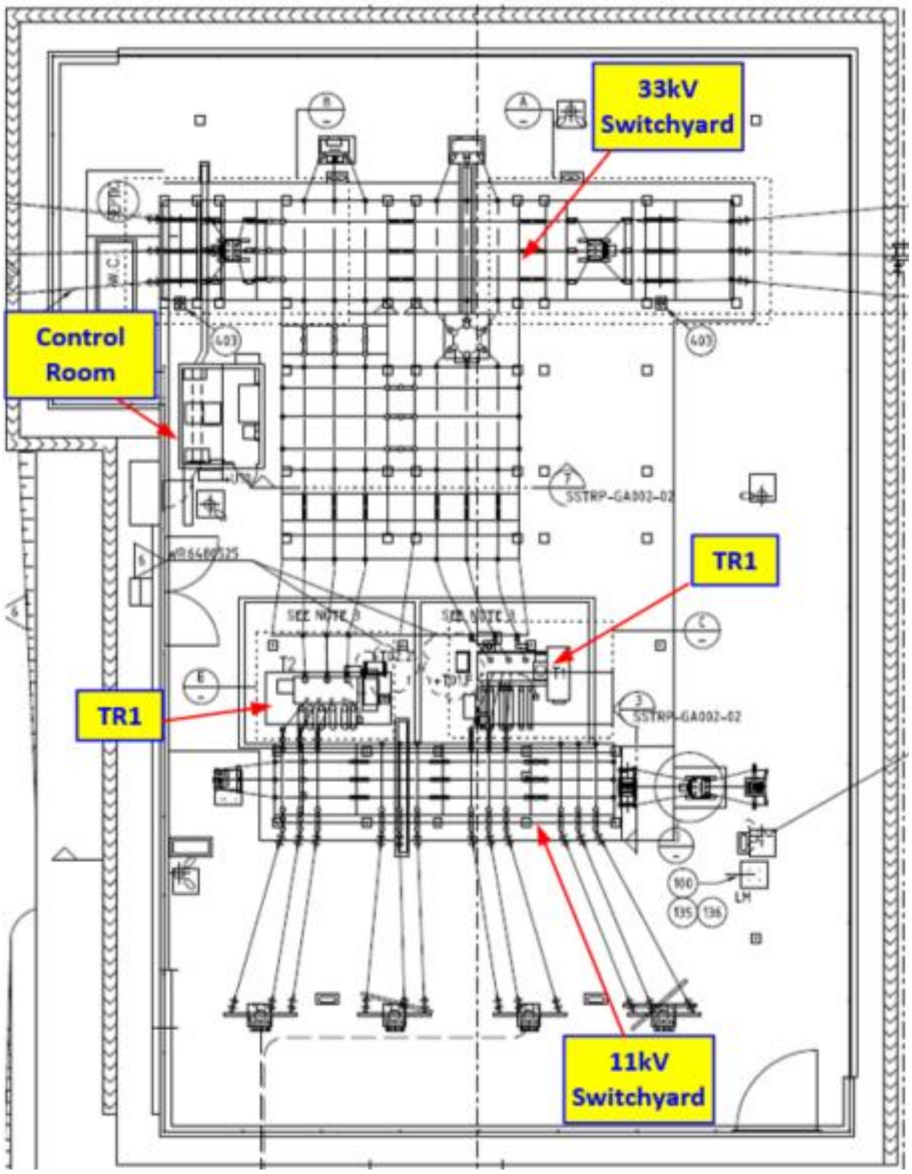


Figure 3.

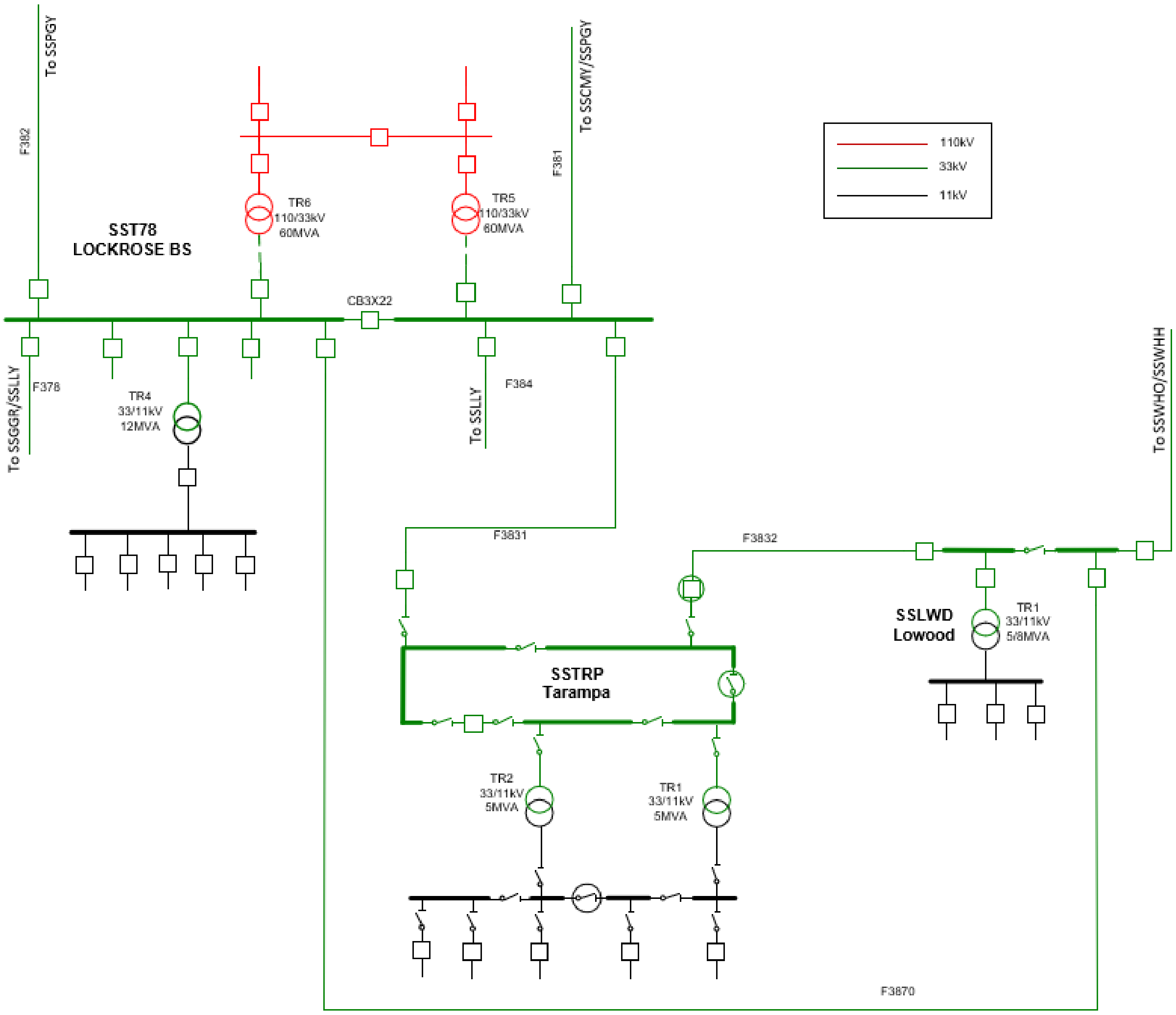


Figure 2: Existing network arrangement (schematic view)

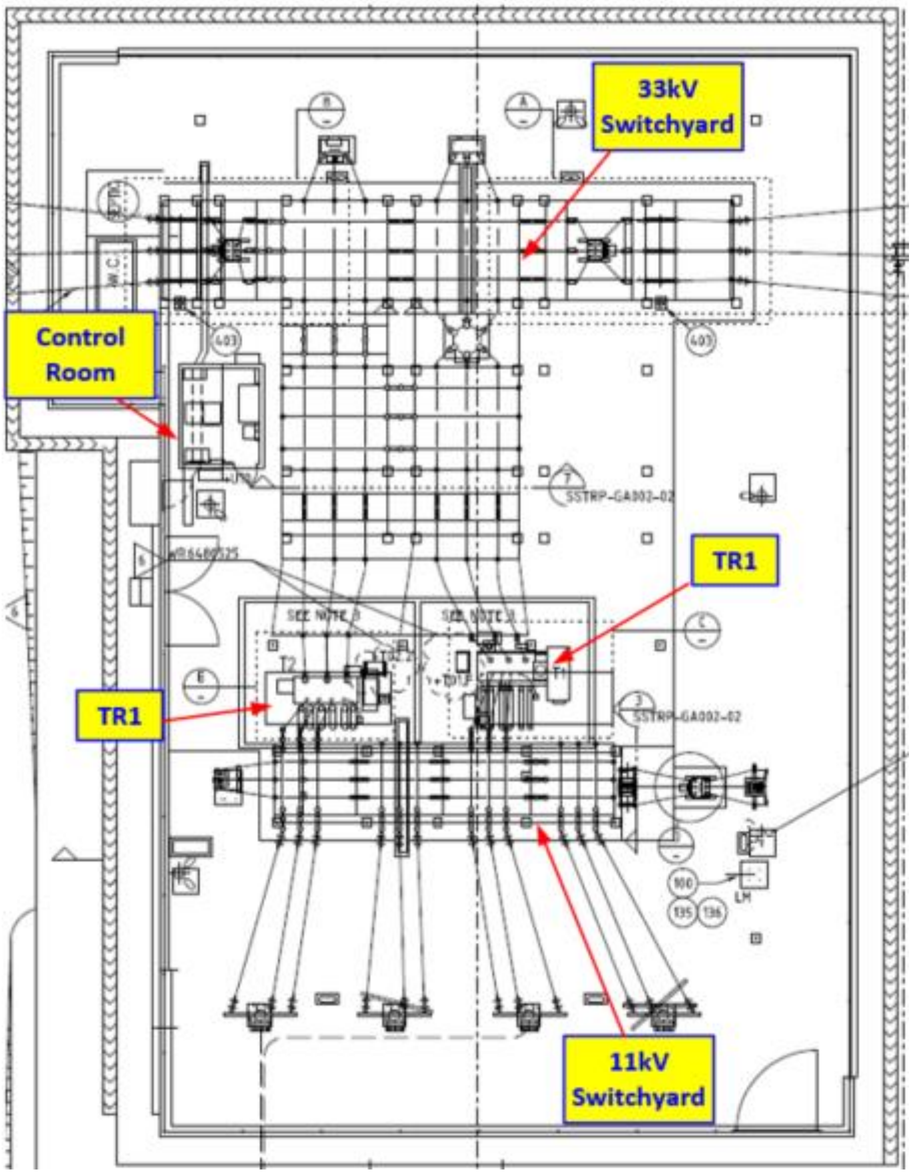


Figure 3: Tarampa Substation (geographic view)

1.3. Load Profiles / Forecasts

The load at Tarampa Substation comprises predominantly residential customers and is summer peaking.

1.3.1. Full Annual Load Profile

The full annual load profile for Tarampa Substation over the 2022/23 financial year is shown in Figure 4. It can be noted that the peak load occurs during summer.

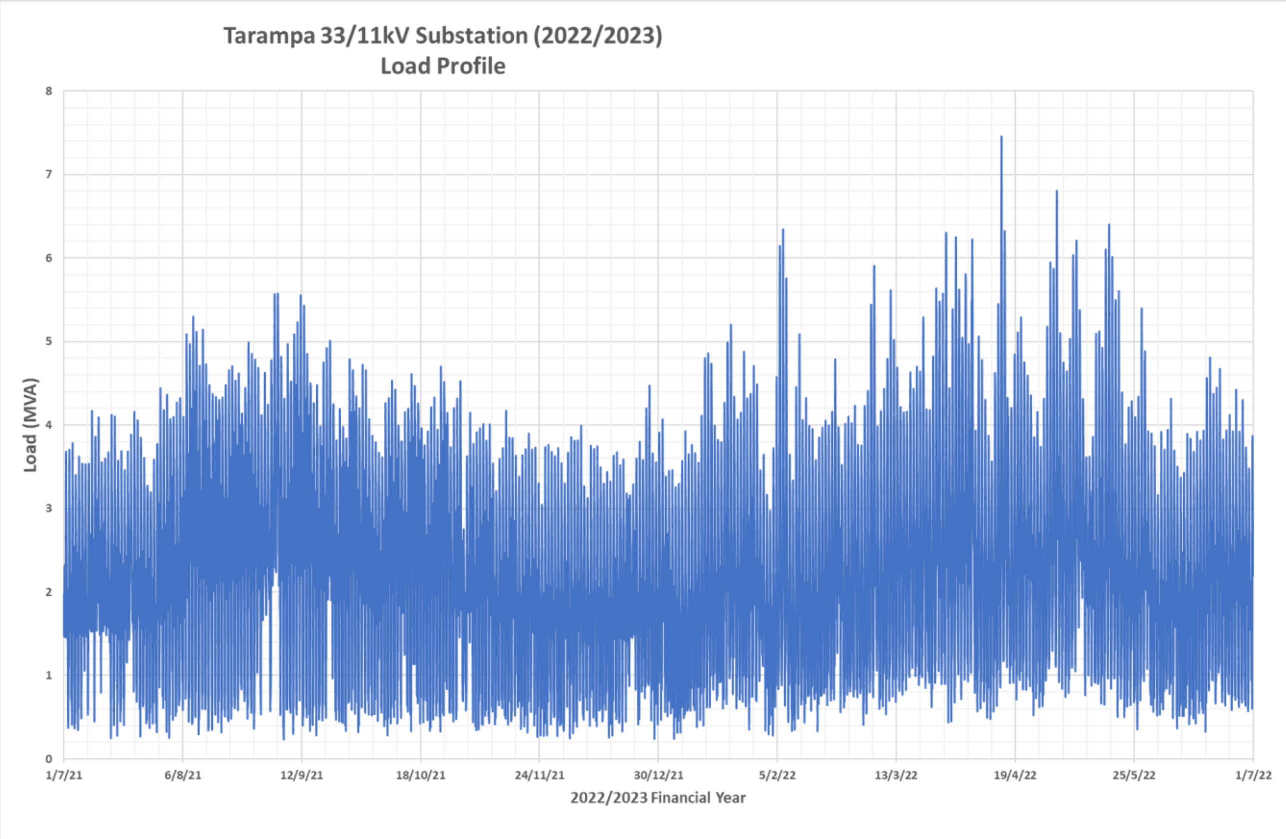


Figure 4: Substation actual annual load profile

1.3.2. Load Duration Curve

The load duration curve for Tarampa Substation over the 2022/23 financial year is shown in Figure 5.

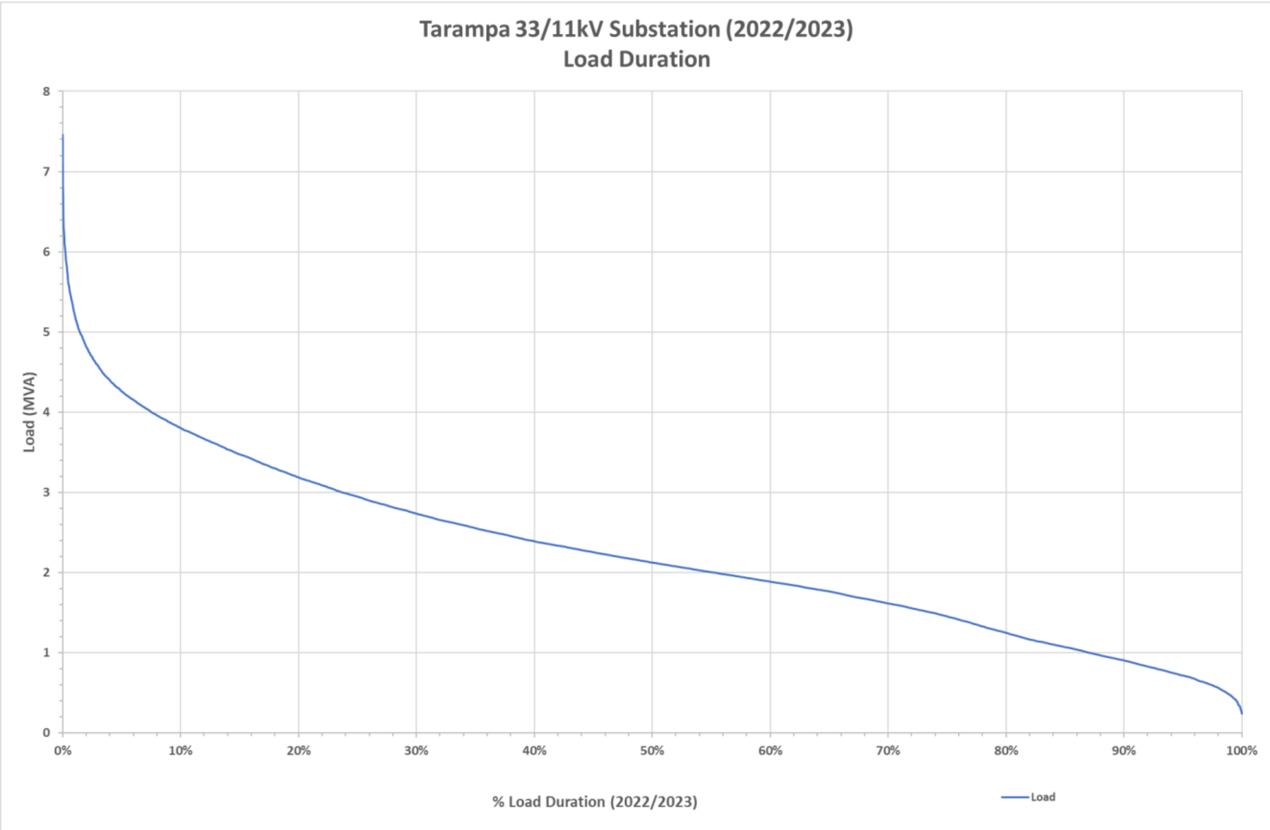


Figure 5: Substation load duration curve

1.3.3. Average Peak Weekday Load Profile (Summer)

The daily load profile for an average peak weekday during summer is illustrated below in Figure 6. It can be noted that the summer peak loads at Tarampa Substation are historically experienced in the late afternoon and evening.

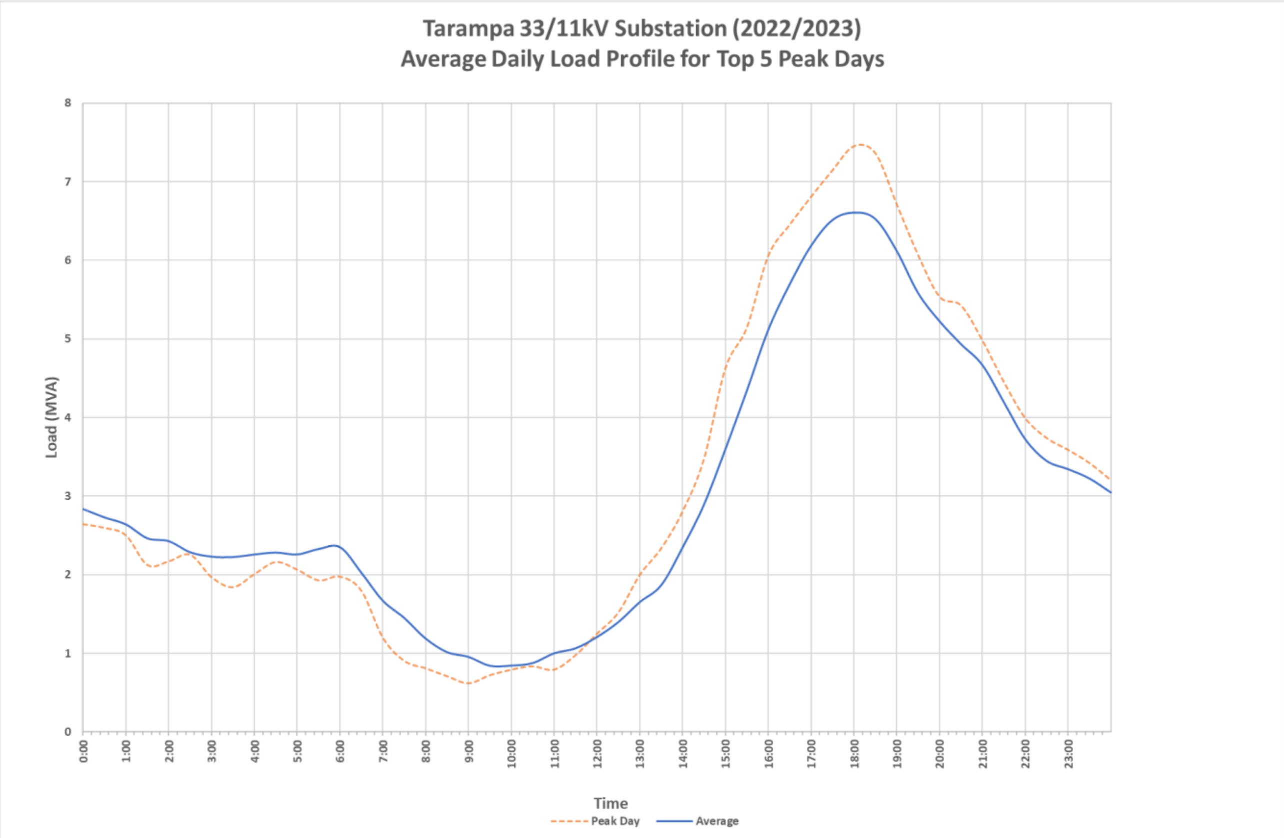


Figure 6: Substation average peak weekday load profile (summer)

1.3.4. Base Case Load Forecast

The 10 PoE and 50 PoE load forecasts for the base case load growth scenario are illustrated in 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 6 to 9MVA for previous years prior to the recent summer peak of 7.45MVA.

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.

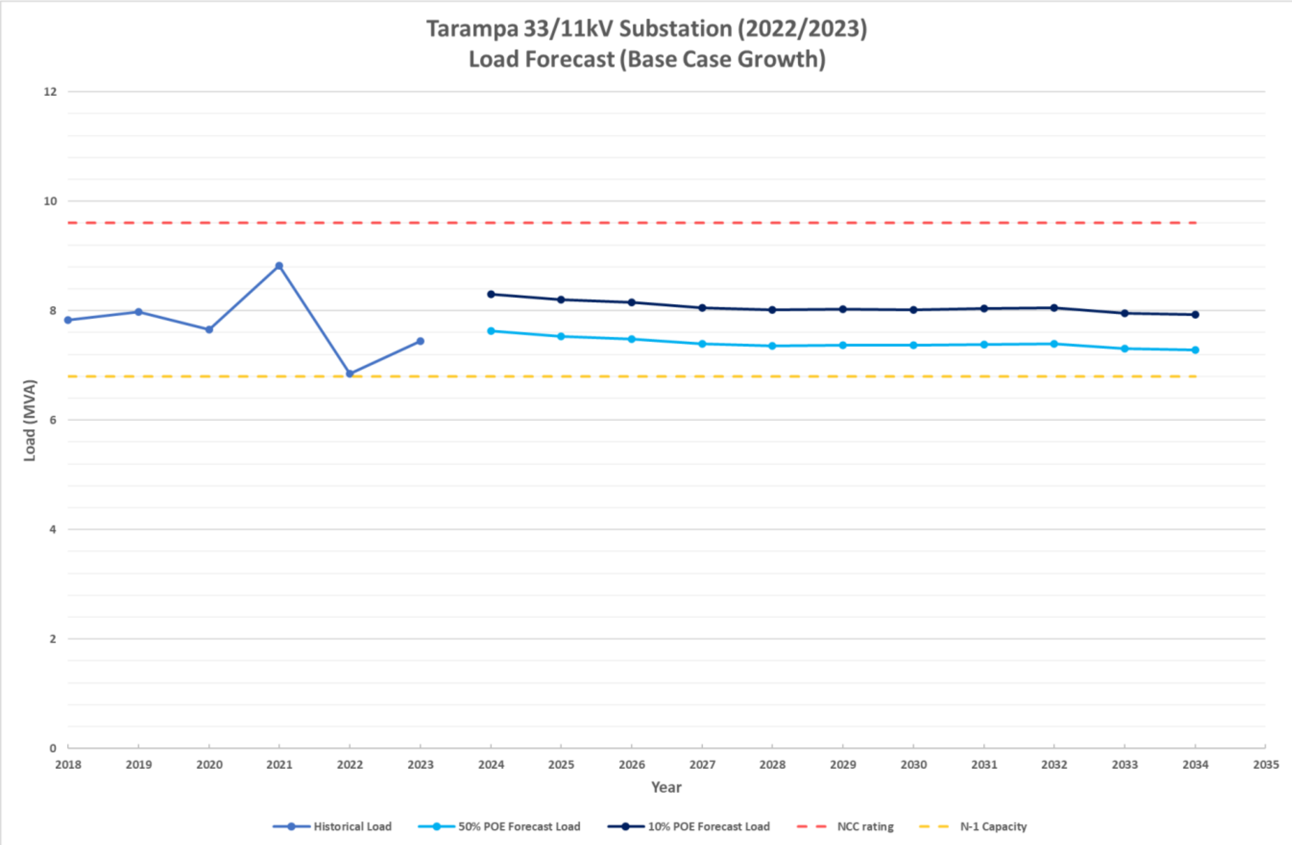


Figure 7: Substation base case load forecast

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.

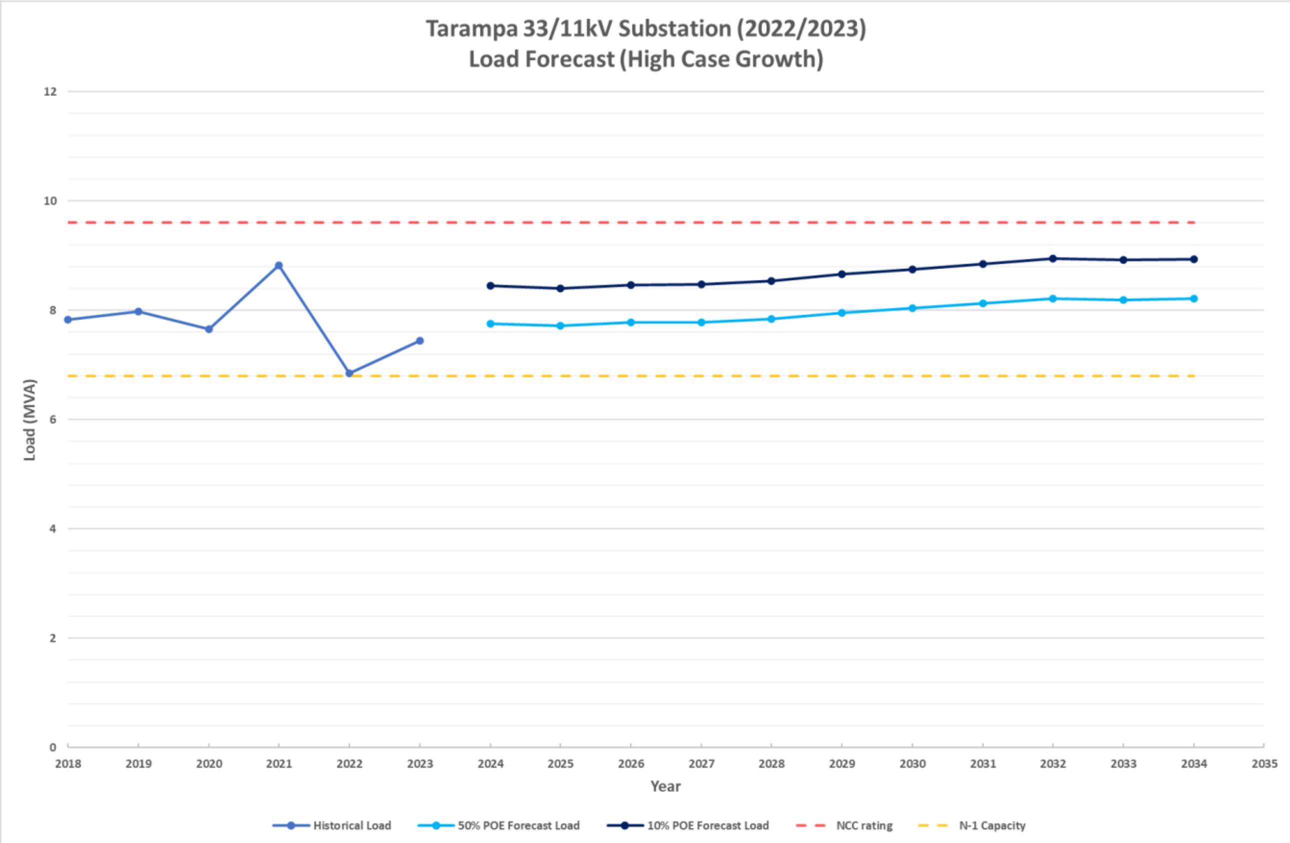


Figure 8: Substation high growth load forecast

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 slightly reduce over the next 10 years.

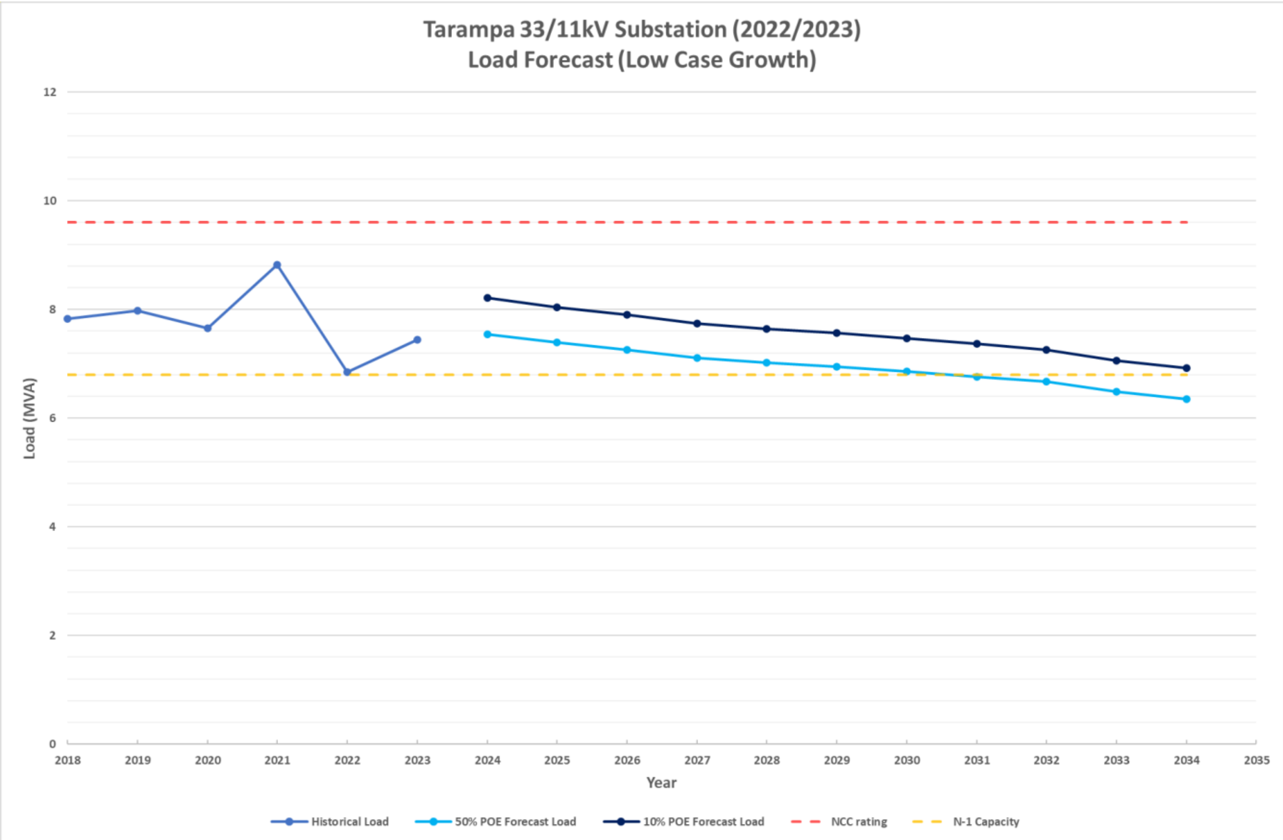


Figure 9: Substation low growth load forecast

2. IDENTIFIED NEED

2.1. Description of the Identified Need

2.1.1. Aged and Poor Condition Assets

A recent condition assessment has highlighted that a number of critical assets are at end of life and are in poor condition. The condition of these assets presents a considerable safety, environmental and reliability risk. These assets include:

- One 33/11kV transformer
- One 33kV Circuit Breaker
- Two 33kV Isolators
- Eight 11kV Isolators
- Three sets of expulsive drop out fuses
- One 33kV VT
- Two sets of 11kV Surge Arrestors
- One 11kV/433V local supply transformer
- One 30V DC battery charger

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.

Additionally, 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 Tarampa Substation.

Where Energex 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.

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 Tarampa area to address the identified need.

3.2. Network Options Identified

Energex has identified two credible network options 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 A: Replace end of life transformer (TR1) with 1 x 5/8 MVA 33/11kV transformer and replace outdoor 33kV and 11kV switchgear with indoor switchgear

This option involves replacing TR1 with a new 5/8 MVA transformer, and also upgrading all end-of-life 33kV and 11kV outdoor switchgear in order to address the identified need.

This option involves the following works:

- Extend substation fence and earth grid to accommodate proposed construction. Leave existing substation fence to delineate construction zone from existing substation site
- Install new 33kV termination pole and install new UG 33kV section on F3832 to remove OH section from proposed construction zone
- Construct new substation building outside existing substation fence and within existing property boundary
- Construct new transformer foundation and firewalls for new 33/11kV transformer and install new transformer. Connect new bund to existing oil containment system
- Install new 33kV switchgear, 11kV switchgear and protection panels inside new substation building
- Run 33kV UG cable from new indoor switchgear to F3832 termination pole and 33kV bus-tie cable and commission.
- Run 11kV UG cable from new indoor switchgear to new transformer. Run 11kV bus-tie cable.
- Commission new TR and 11kV switchgear
- Cutover 11kV feeders to new 11kV switchgear
- Cutover 33kV F3831 to new 33kV switchgear

- Recover and scrap all existing 33kV outdoor switchgear and isolators. Recover and scrap existing 33/11kV transformer TR1
- Install new 33kV cable termination structure for TR2. Run new 33kV UG cable from 33kV switchgear to new termination structure.
- Install new 11kV cable termination structure for TR2. Run new 11kV UG cable from 11kV switchgear to new termination structure
- Recover and scrap all existing 11kV outdoor switchgear and isolators.
- Remove internal portion of substation fence

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

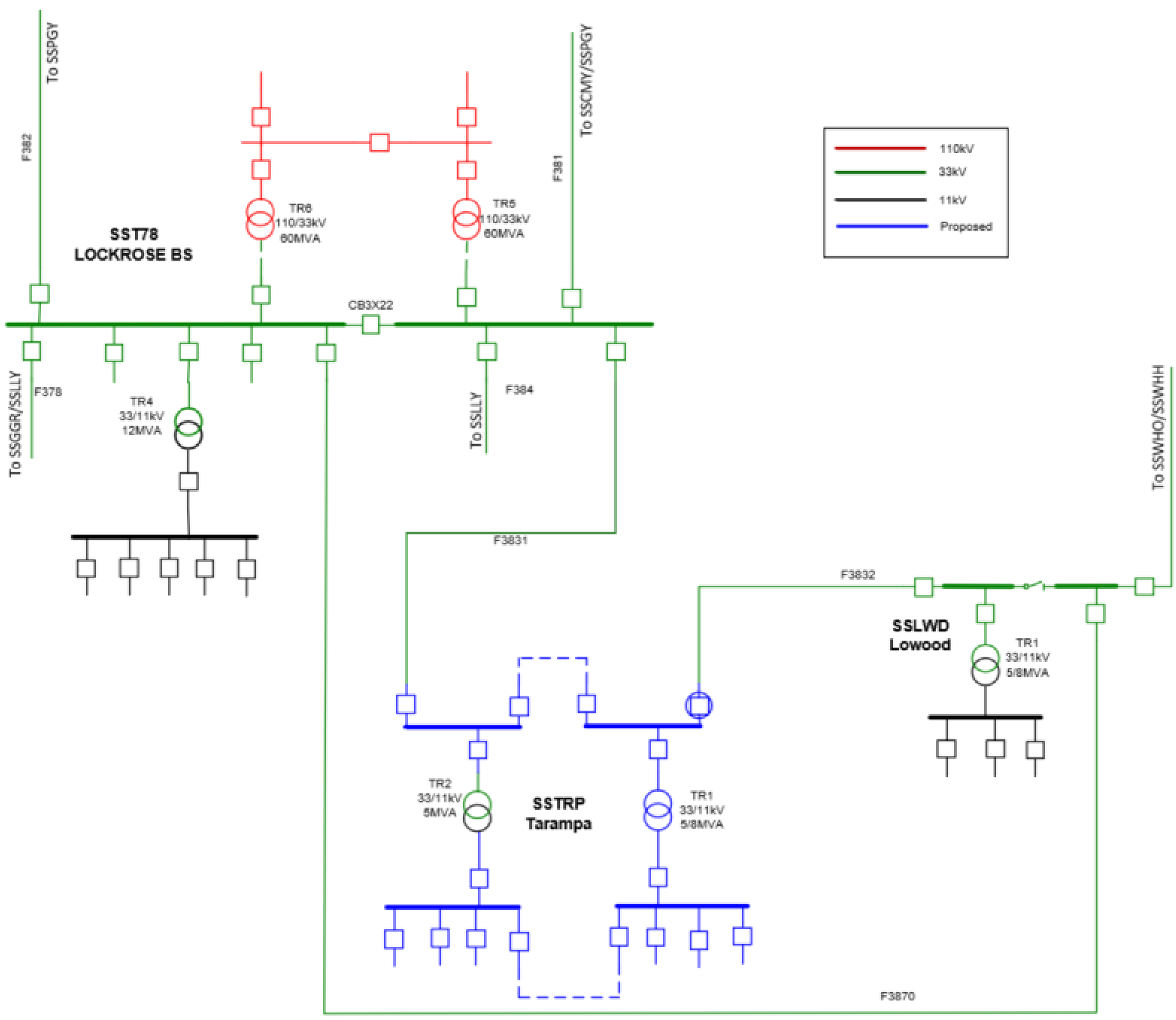


Figure 10: Option A proposed network arrangement (schematic view)

3.2.2. Option B: Remove problematic plant items, replace the 33kV and 11kV outdoor switchgear and recover 1 x 5MVA 33/11kV aged transformer and install a mobile kiosk

This option involves the following works:

- Same as option 1 except that the 1 x 5MVA 33/11kV aged transformer would be replaced with a mobile kiosk connection and upgrade approximately 10km of 11kV feeder Tarampa zone substation to Lowood zone substation

A schematic diagram with the proposed network arrangement for Option B is shown in Figure 11.

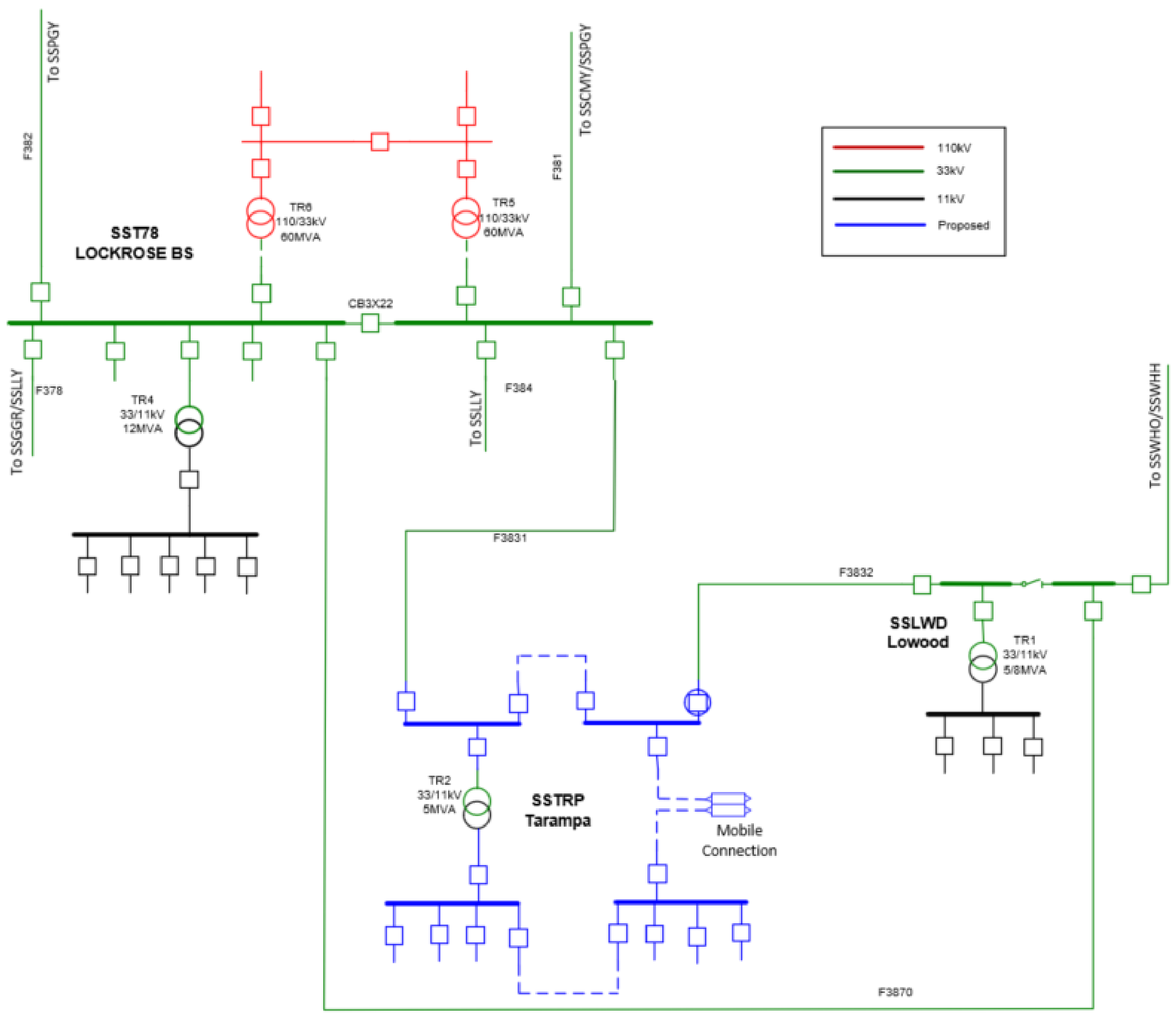


Figure 11: Option B proposed network arrangement (schematic view)

3.3. Preferred Network Option

Energex's preferred internal network option is Option A, to replace end of life transformer (TR1) with 1 x 5/8 MVA 33/11kV transformer and replace outdoor 33kV and 11kV switchgear with indoor switchgear.

Upon completion of these works, the asset safety and reliability risks at Tarampa Substation will be addressed. 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 inclusive of interest, risk, contingencies and overheads is $10.09 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 November 2023 and construction completed by April 2027.

4. ASSSESSMENT 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.

4.1. Demand Management (Demand Reduction)

The DEM team has completed a review of the Tarampa customer base and considered a number of demand management technologies. Asset safety and performance risks are the key project drivers (i.e. the need) at Tarampa. It has been determined that most demand management options will not be viable propositions and have been explored in the following sections.

4.1.1. Network Load Control

The residential customers and business customers appear to drive the daily peak demand which generally occurs between 4:00pm and 8:00pm.

There are 1058 customers on tariff T31 and T33 hot water load control (LC). An estimated demand reduction value of 391kVA[1] is available.

Tarampa Substation LC signals are controlled from T78 Lockrose Bulk Supply Substation (SST78). 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 load at Lockrose Bulk Supply Substation exceeds 85MW. This strategy does not directly address demand peaks experienced at Tarampa. 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.

4.2. 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.

4.2.1. 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

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

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.

4.2.2. 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.

4.2.3. 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 could potentially address the identified need, however, has been assessed as technically not viable as there is no known existing or proposed LSG demand response available.

4.2.4. Customer Solar Power Systems

A total of 1,274 customers have solar photo voltaic (PV) systems for a connected inverter capacity of 7,195kVA.

The daily peak demand is driven by residential customer demand and the peak generally occurs between 4:00pm and 8:00pm. 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.

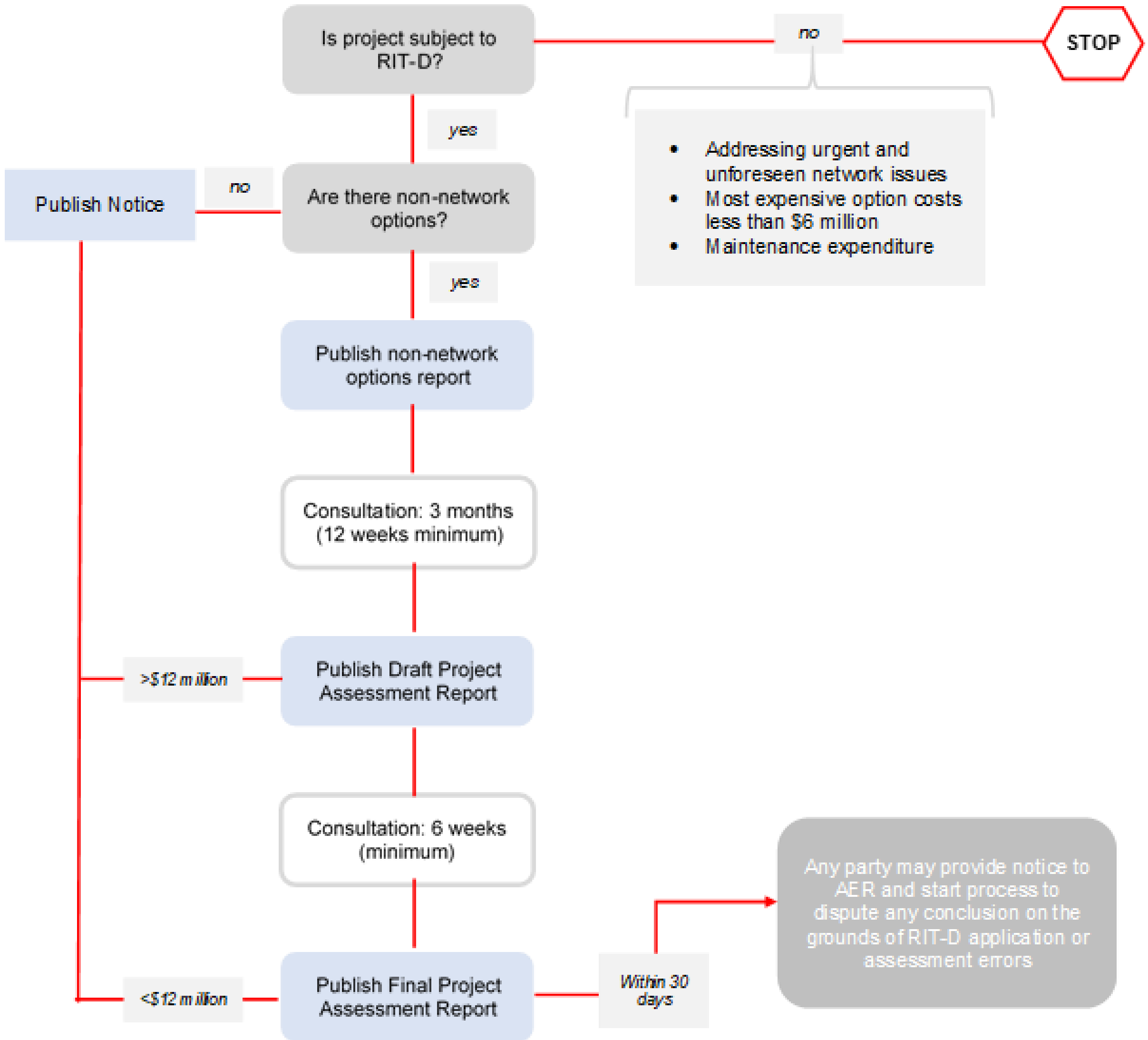
However, only a small percentage of customers in this supply area have solar PV systems and possibly none have a BESS. PV systems with BESS present a future portfolio opportunity for potential demand response but currently this supply area has a very limited solar/BESS. Solar customers without a BESS 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

The internal investigations undertaken on the feasibility of the non-network solutions revealed that it is unlikely to find a complete non-network solution or a hybrid (combined network and non-network) solution to provide the magnitude of network support required in the Tarampa area to address the identified need.

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 National Electricity Rules. 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.