Regulatory Investment Test for Distribution (RIT-D)

Addressing Reliability Requirements in the Geebung Network Area

Notice of Screening for Options

3 June 2024

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

Geebung 33/11kV zone substation (SSGBG) is supplied from Nudgee bulk supply substation (SSNGE BSP). SSGBG provides electricity supply to approximately 5622 customers, of which 85% are commercial and 15% are residential in the Geebung, Virginia, Nudgee and Boondall areas.

SSGBG has a 33kV ring bus configuration and is supplied via 3 x 33kV feeders from SSNGE BSP. There is an 11kV auto change over scheme (ACO) for 3 x 33/11kV transformers in the substation.

According to Energex condition-based assessment (CBRM) report, it has been identified that 11 x 33kV circuit breakers, 8 x 33kV isolators and protection relays are reaching end of life and require replacement.

The deterioration of these primary and secondary system assets poses safety risks to staff working within the switchyard, and reliability risk to the customers supplied from SSGBG.

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 Geebung 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 Energex in accordance with the requirements of clause 5.17.4(d) of the NER.

CONTENTS

1. BACKGROUND

1.1. Geographic Region

Geebung 33/11kV zone substation (SSGBG) is supplied from Nudgee bulk supply substation (SSNGE BSP). SSGBG provides electricity supply to approximately 5622 customers, of which 85% are a mix of commercial and industrial, and 15% are residential in the Geebung, Virginia, Nudgee and Boondall 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

SSGBG zone substation is being supplied by three 33kV feeders 604, 683 and 605. There is 1 x normally opened 33kV feeder to Zillmere zone substation (SSZMR) and a normally opened breaker to the 33kV tie between SSZMR and Sandgate bulk supply substation (SSSGT BSP).

SSGBG has a 33kV ring bus configuration with 3 x 33/11kV 25MVA transformers, 3 x bus section breakers, 3 x 33kV transformer circuit breakers, 6 x 33kV feeder circuit breakers and 1 x spare 33kV circuit breaker.

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

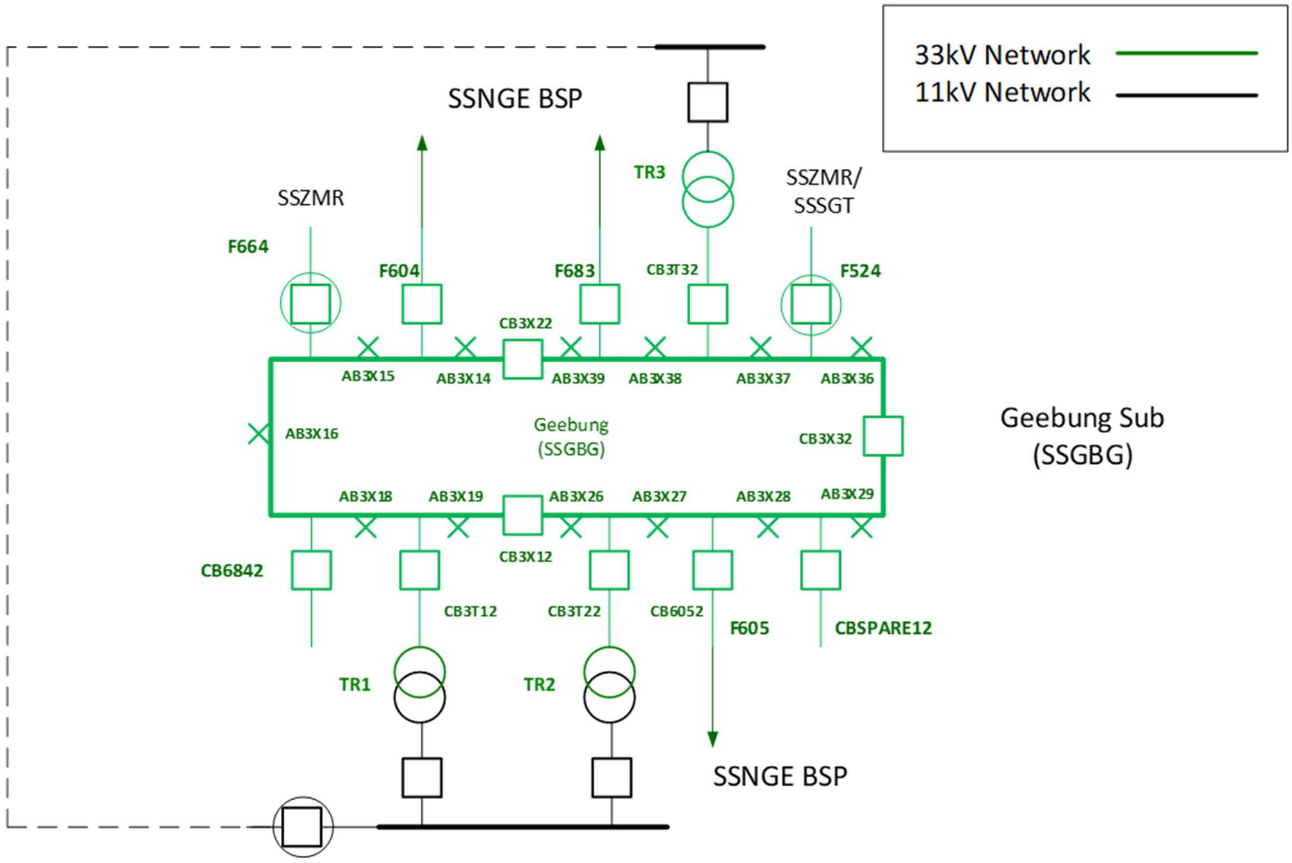


Figure 2: Existing network arrangement (schematic view)

Figure 3: Geebung Substation (geographic view)

1.3. Load Profiles / Forecasts

The load at Geebung Substation comprises a mix of residential and commercial/industrial customers. The load is summer peaking, and the annual peak loads are predominantly driven by commercial load.

1.3.1. Full Annual Load Profile

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

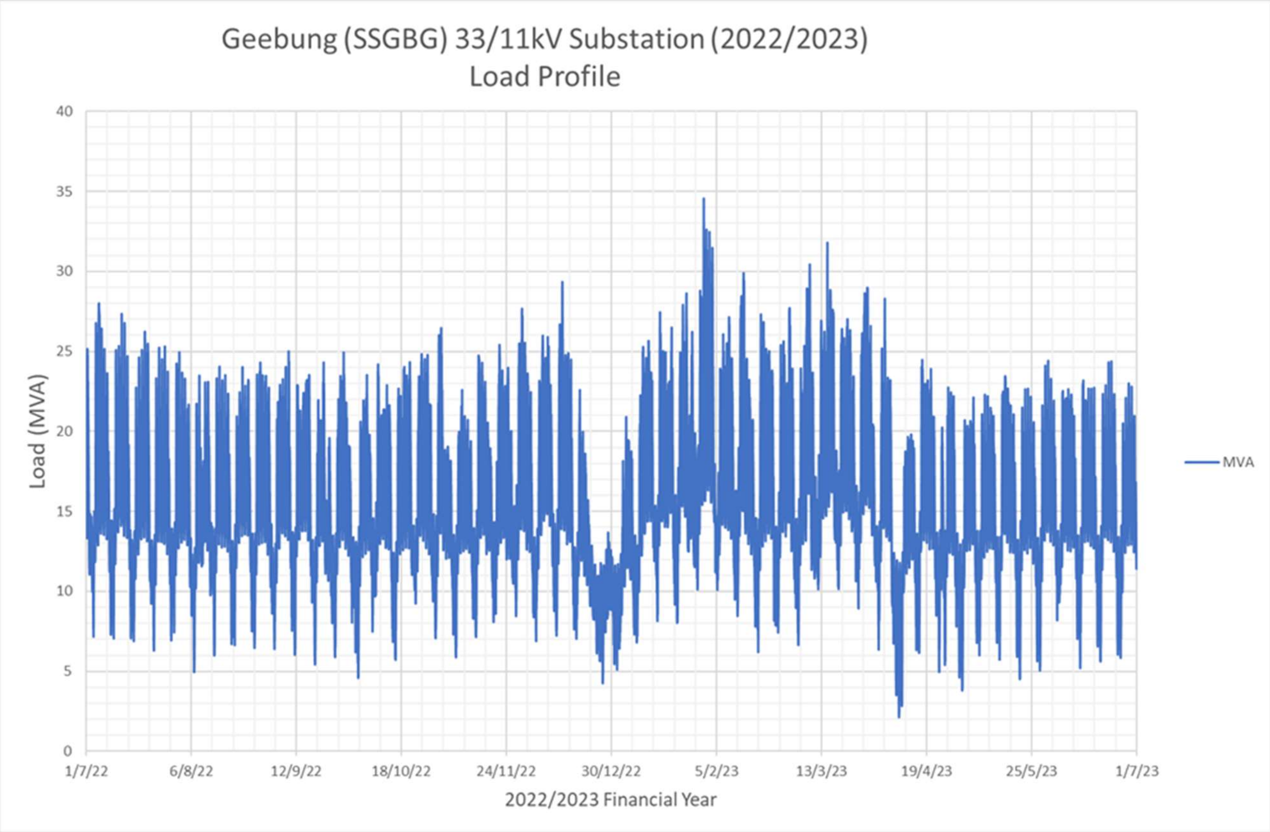


Figure 4: Substation actual annual load profile

1.3.2. Load Duration Curve

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

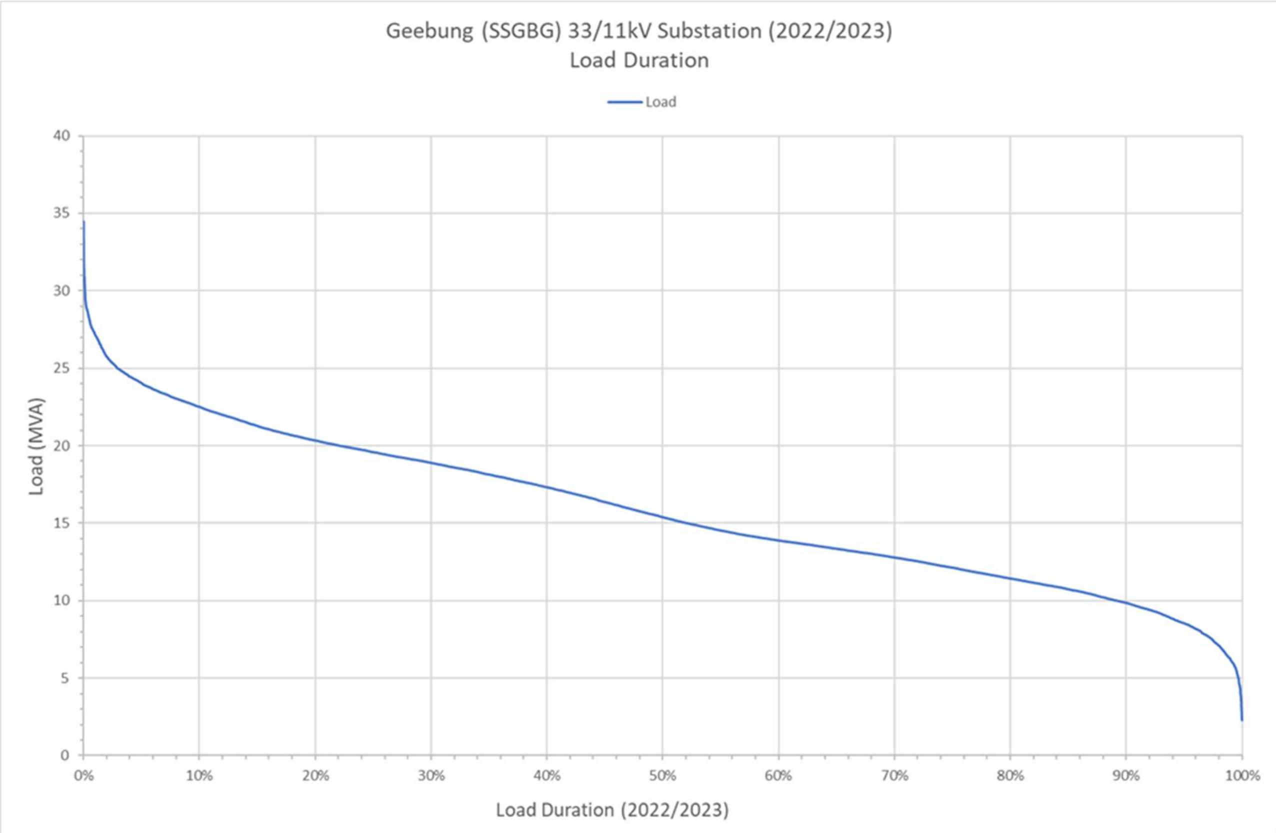


Figure 5: Substation load duration curve

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 Geebung Substation are historically experienced in the late afternoon.

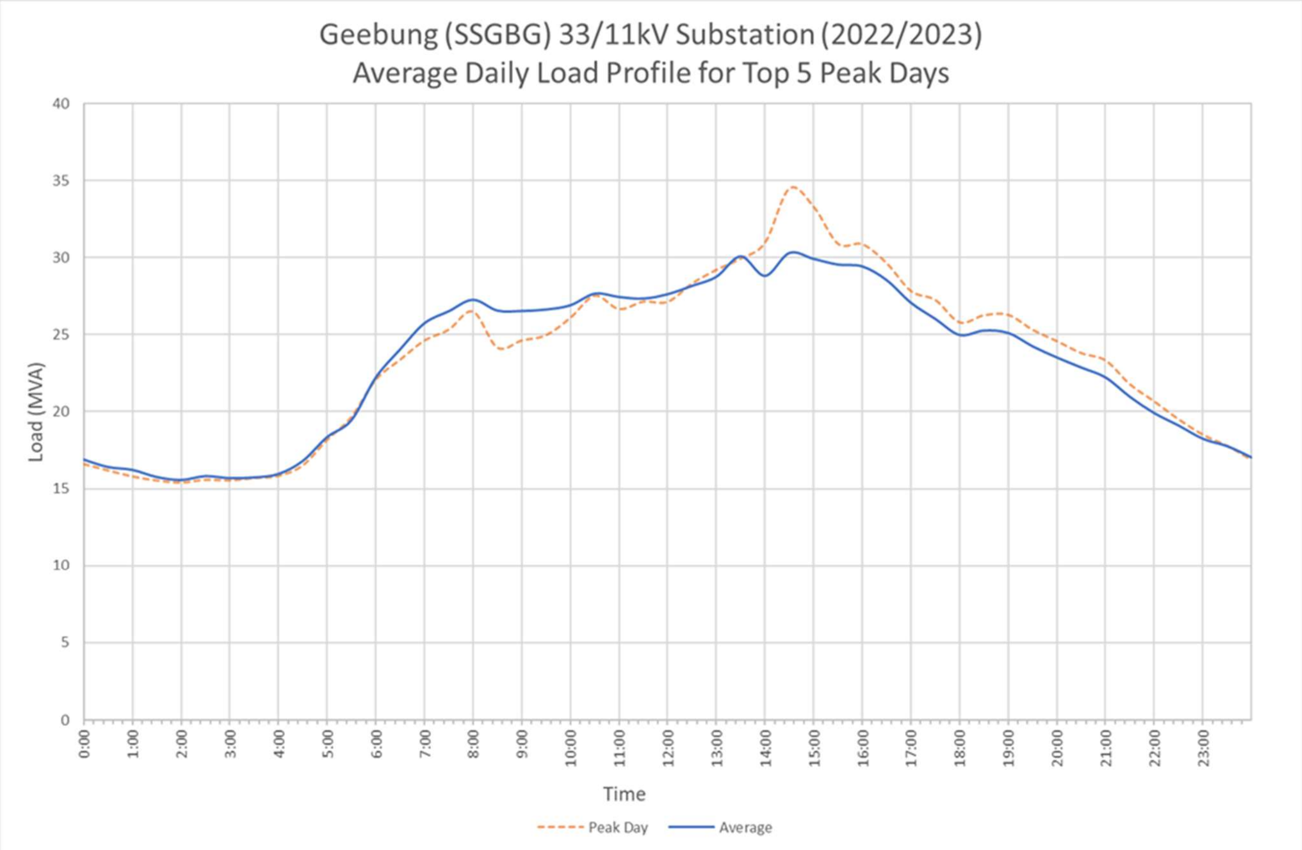


Figure 6: Substation average peak weekday load profile (summer)

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 noted that the 50% POE forecast load growth in the base case scenario does not exceed the N-1 rating and the 10% POE forecast load growth in the base case scenario does not exceed the NCC rating. It can also be noted that the peak load is forecast to remain relatively steady over the next 10 years under the base case scenario.

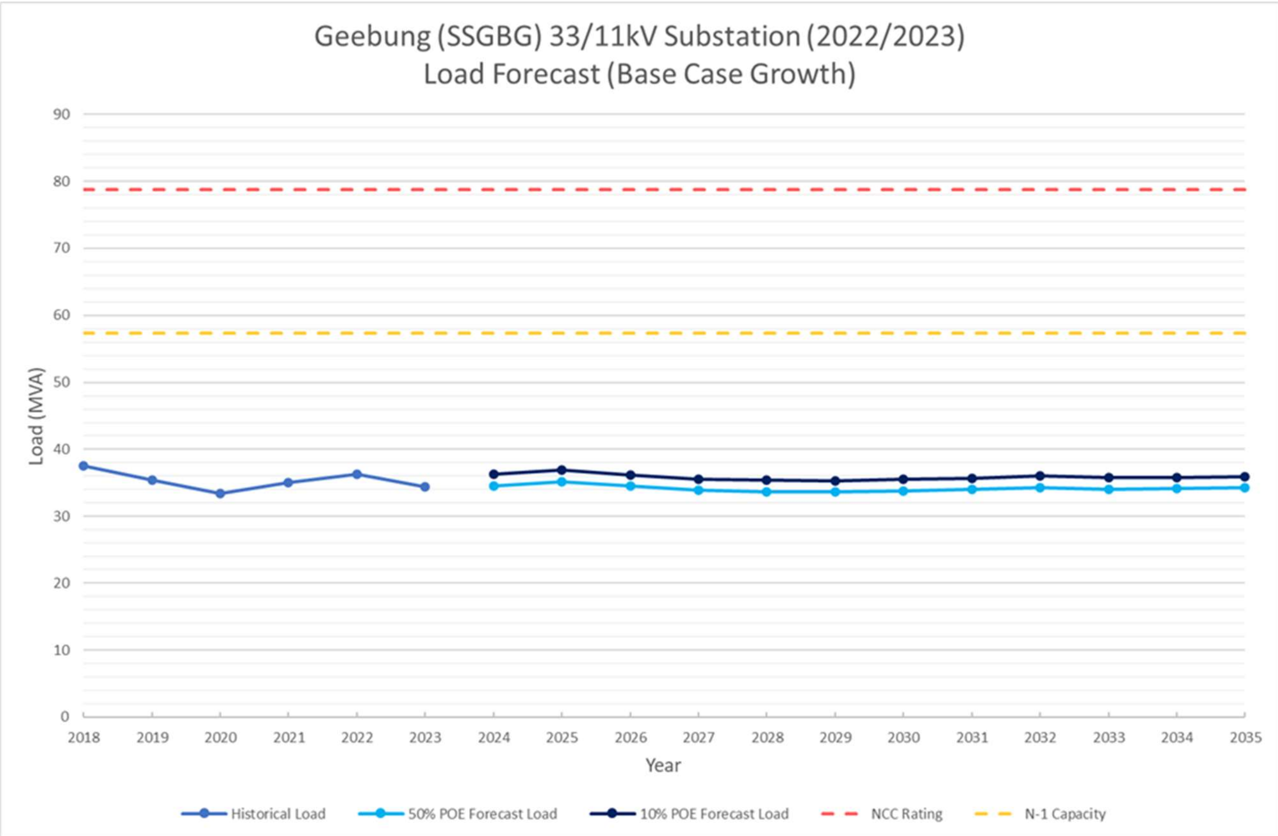


Figure 7: Substation base case load forecast

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 slightly over the next 10 years.

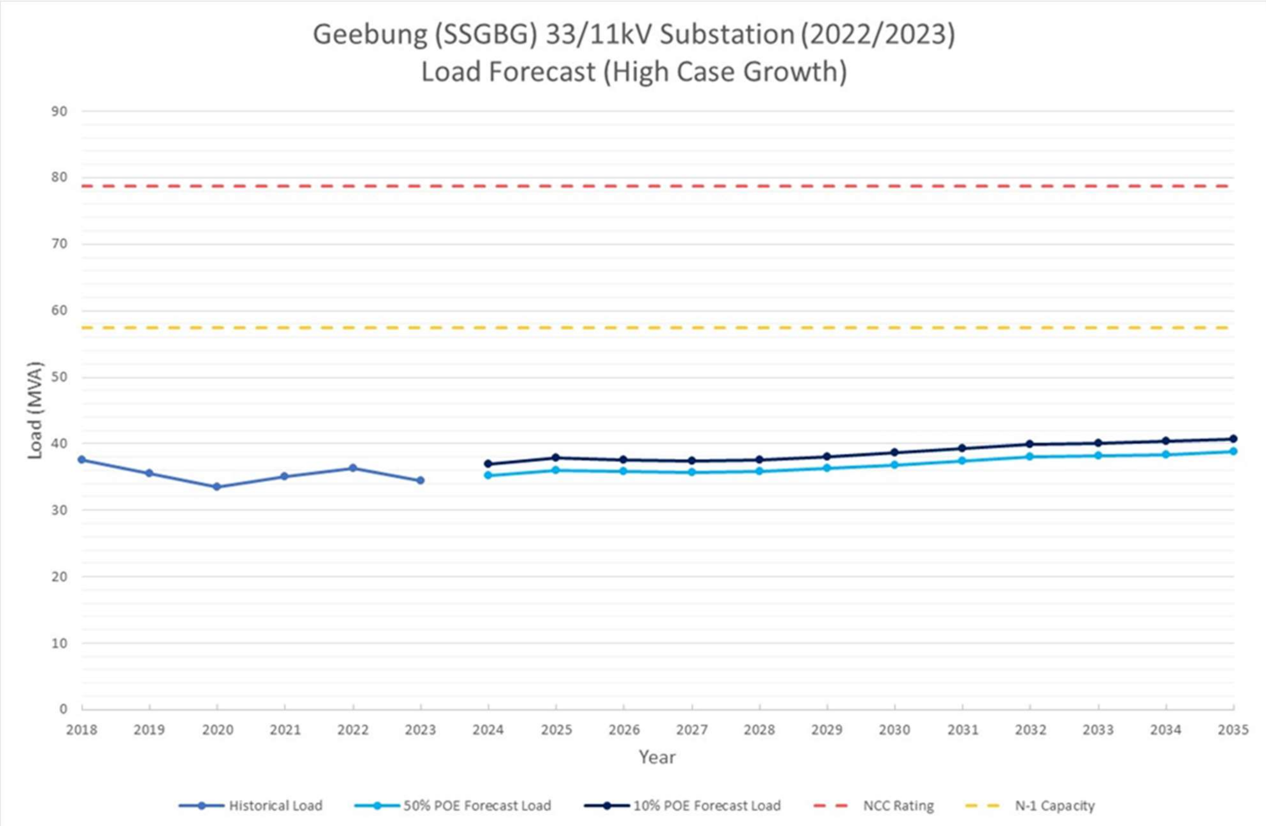


Figure 8: Substation high growth load forecast

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 to decrease slightly over the next 10 years.

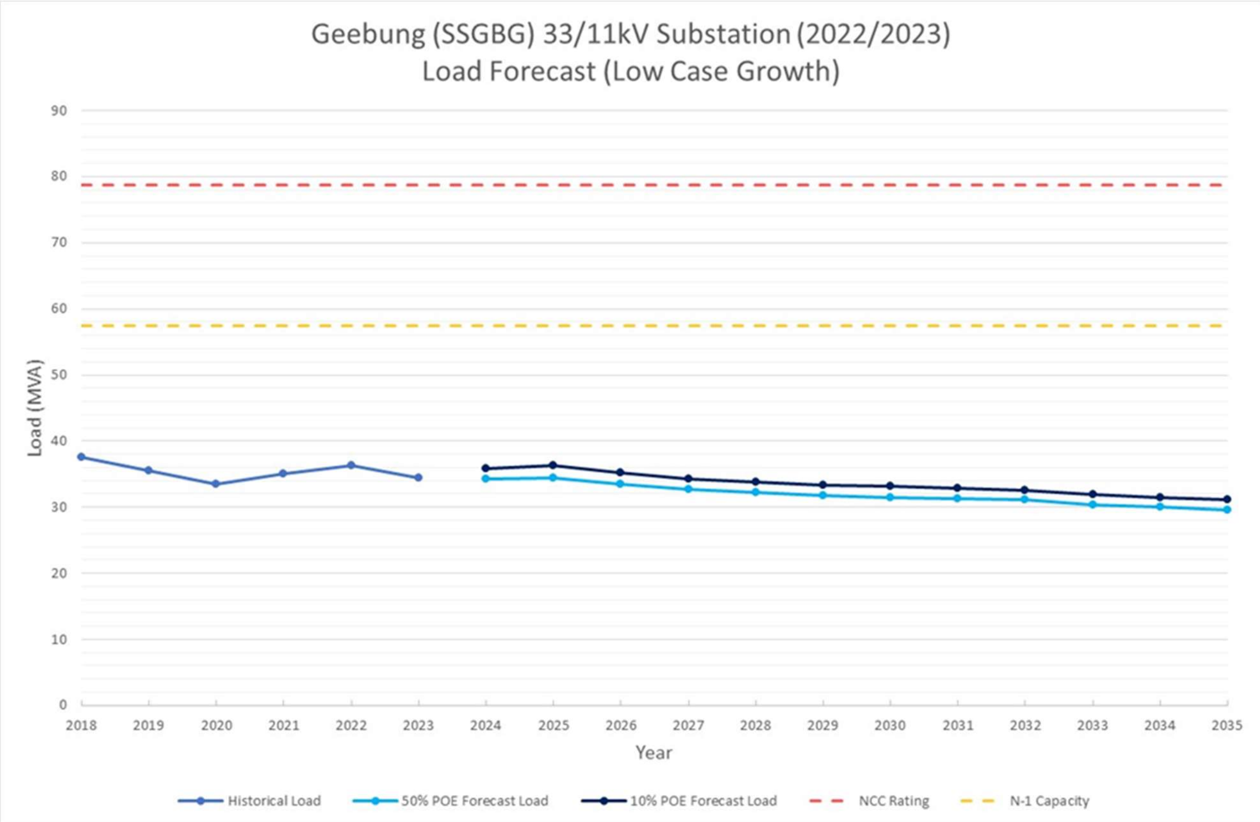


Figure 9: Substation low growth load forecast

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:

- 11 x 33kV circuit breakers
- 8 x 33kV isolators
- 31 x protection relays

The deterioration of these primary and secondary system assets poses safety risks to staff working within the switchyard. It also poses a safety risk the general public, though the increased likelihood of protection relay mal-operation and failure of the circuit breakers. There is also a considerable risk of environmental harm due to tank rupture and oil spill from the circuit breakers, which would require clean up and rectification.

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 Geebung 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 Geebung area to address the identified need.

3.2. Network Options Identified

Energex has identified one credible network options that will address the identified need.

3.2.1. Option 1: Replace 33kV outdoor circuit breakers, isolators and protection relays

This option involves the following works:

Geebung Zone Substation (SSGBG):

- Replace & scrap obsolete 33kV feeder circuit breakers CB6642 & CB6042 with current contract CB.
- Decommission corresponding obsolete panel and relays reaching end of life. Replace with current contract feeder protection relays and panel. Install new multicore run for current protection.
- Replace & scrap obsolete 33kV bus section circuit breakers CB3X12 & CB3X22 with current contract CB.
- Decommission corresponding obsolete panel and relays reaching end of life. Replace with current contract bus zone protection relays and panel. Install new multicore run for current protection.
- Replace & scrap obsolete 33kV transformer circuit breaker CB3T12 with current contract CB.
- Decommission corresponding obsolete panel and relays reaching end of life. Replace with current contract transformer diff protection relays and panel. Install new multicore run for current protection.
- Recover & scrap obsolete 33kV feeder circuit breaker CBSPARE22 and decommission corresponding obsolete panel and relays reaching end of life.
- Replace 33kV Isolators on BB31; AB3X14, AB3X15, AB3X16, AB3X18 and AB3X19 on a new foundation and support structure.
- Replace & scrap obsolete 33kV feeder circuit breaker CB6052 with current contract CB.
- Decommission corresponding obsolete panel and relays reaching end of life. Replace with current contract feeder protection relays and panel. Install new multicore run for current protection.

- Replace & scrap obsolete 33kV transformer circuit breaker CB3T22 with current contract CB.
- Decommission corresponding obsolete panel and relays reaching end of life. Replace with current contract transformer diff protection relays and panel. Install new multicore run for current protection.
- Recover & scrap obsolete 33kV feeder circuit breaker CBSPARE12 and decommission corresponding obsolete panel and relays reaching end of life.
- Replace 33kV obsolete Isolators on BB32; AB3X26, and AB3X27 on a new foundation and support structure.
- Replace & scrap obsolete 33kV feeder circuit breaker CB6832 with current contract CB.
- Decommission corresponding obsolete panel and relays reaching end of life. Replace with current contract feeder protection relays and panel. Install new multicore run for current protection.
- Upgrade existing TR3 protection scheme to current standard dual diff protection.
- Replace 33kV obsolete Isolators on BB32; AB3X39 on a new foundation and support structure. (Replace foundation and support structures for AB3X38 & AB3X36)
- Replace 12 x aged 11kV feeder relays with new current relay contract.

Nudgee Zone Substation (SSNGE):

- Replace end of life relay in existing panel with current contract relay and establish fibre comms to SSGBG for 33kV feeders F604, F605 and F683.

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

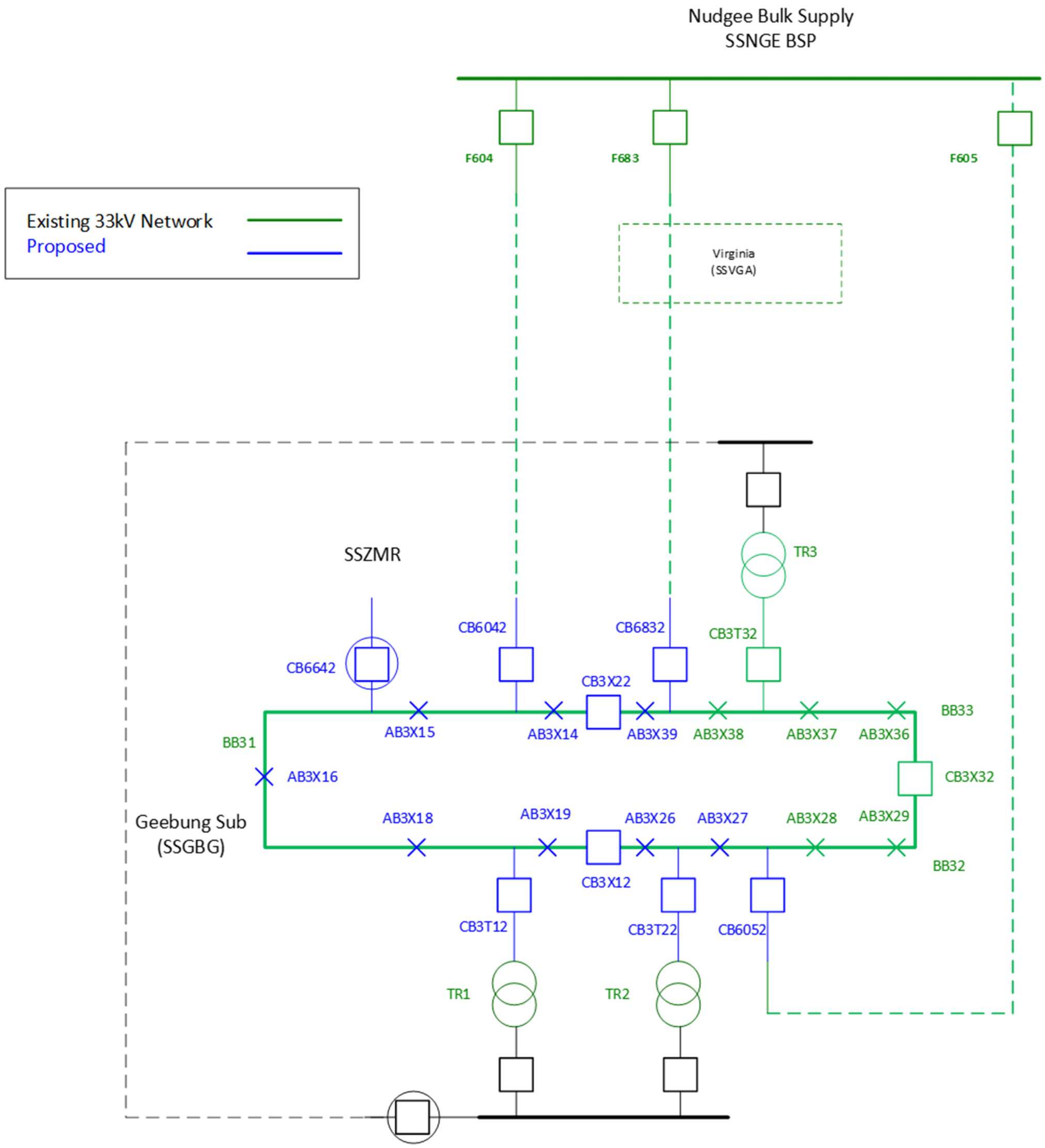


Figure 10: Option 1 proposed network arrangement (schematic view)

3.3. Preferred Network Option

Energex's preferred internal network option is Option 1, to replace 33kV outdoor circuit breakers, isolators and protection relays at Geebung Zone Substation.

Upon completion of these works, the asset safety and reliability risks at Geebung 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 direct cost of this option is $6.2 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 September 2024 and construction completed by July 2027.

4. ASSSESSMENT OF SAPS AND NON-NETWORK SOLUTIONS

Energex has considered SAPS and demand management solutions to determine their feasibility to meet the identified need. Each of these are considered below.

4.1. Consideration of SAPS Options

Energex 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 Geebung region could not be supported by a network that is not part of the interconnected national electricity system.

4.2. Demand Management (Demand Reduction)

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.

The DEM team has completed a review of the Geebung 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 Geebung. It has been determined that most demand management options will not be viable propositions and have been explored in the following sections.

4.2.1. Network Load Control

The residential customers and commercial load appear to drive the daily peak demand which generally occurs between 2:00pm and 5:00pm.

There are 2134 customers on tariff T31 and T33 hot water load control (LC). An estimated demand reduction value of 790kVA[1] is available.

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.

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

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 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.

4.3.4. Customer Solar Power Systems

A total of 1833 customers have solar photo voltaic (PV) systems for a connected inverter capacity of 13170kVA.

The daily peak demand is driven by residential and commercial customer demand and the peak generally occurs between 2:00pm and 5:00pm. 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 a fewer customers and therefore are cheaper and easier to engage and contract.

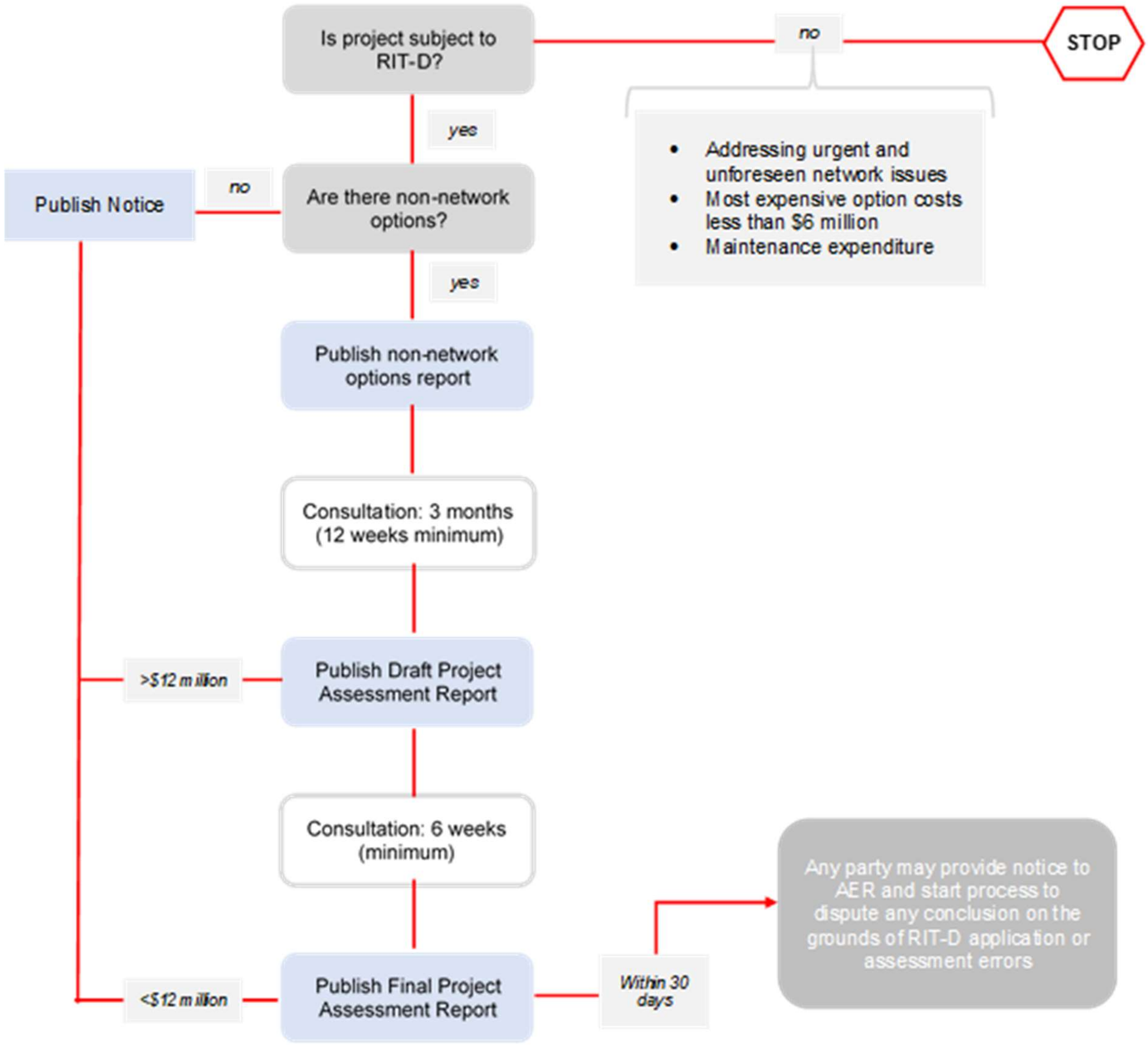
However, only a small percentage of customers in this supply area have solar PV systems and possibly none have a BESS. PV systems with BESS present a future portfolio opportunity for potential demand response but currently this supply area has a very limited solar/BESS. Solar customers without a BESS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

The preferred network option is Option 1 - replace 33kV outdoor circuit breakers, isolators and protection relays at Geebung zone substation. This Notice of Screening for 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.