Regulatory Investment Test for Distribution (RIT-D)

Addressing Reliability Requirements in the Pimpama East and Stapylton Network Area

Notice of No Non-Network Options

21 February 2023

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

Pimpama East Zone Substation (SSPPE) is supplied from Coomera Bulk Supply Substation (SSCMA) via 33kV feeders F3641 and F3642. SSPPE provides electricity supply to approximately 11,652 predominately domestic customers in the surrounding suburbs

Stapylton Zone Substation (SSSTT) is supplied from Beenleigh Bulk Supply Substation (SST108) via 33kV feeders F426 and F3601. SSSTT provides electricity supply to approximately 248 mixed industrial and residential customers in the surrounding suburbs.

The 33kV feeders F3641 and F3642 supplying Pimpama East Zone Substation from Coomera Bulk Supply Substation are constructed as a double circuit line sharing the same poles, with parts of these feeders traversing along road corridors, which exposes the network to an increased likelihood of losing both feeders with a single pole failure. Similarly, the 33kV feeders F426 and F3601 supplying Stapylton Zone Substation are also constructed as a double circuit line sharing the same poles along road corridors, which again exposes the network to an increased likelihood of losing both feeders with a single pole failure.

The assessment identified that Energex will experience three upcoming network limitations due to the load growth in the area, of which only one limitation is being addressed by this report:

- Both the 33kV feeder networks supplying SSPPE (F3641 & F3642) and SSSTT (F426 & F3601) are double circuit, single pole arrangements. The route of these feeders traverses along road corridors, which increases the likelihood of pole damage and failure. As such, the risk of a double circuit outage with a single pole failure is considered credible.

  Should such an event occur, the only option to restore supply to customers is to utilise manual transfers to adjacent substations.

  Under this credible contingency event, Energex will not be able to restore all supply to Stapylton or Pimpama East zone substation until the defect is repaired. The energy required to resolve the outage at SSPPE and SSSTT is summarised in Table 1 and Table 2.

Year	Forecast peak unsupplied energy (kWh)
2023	136359
2024	140568
2025	159337
2026	164956
2027	171117
2028	179151
2029	187500
2030	196950
2031	206645
2032	218086
2033	230478

Table 1: Energy required to resolve the outage at SSPPE after the loss of F3641 & F3642

Year	Forecast peak unsupplied energy (kWh)
2023	33882
2024	35028
2025	34703
2026	34590
2027	34396
2028	34631
2029	34860
2030	35304
2031	35750
2032	36739
2033	37556

Table 2: Energy required to resolve the outage at SSSTT after the loss of F426 & F3601

The following network limitations are being addressed in a separate project:

- The 10% POE load at SSPPE ZS is forecast to exceed Substation system normal cyclic capacity (NCC) in summer 2030/31. The system normal condition is assessed against the 10%PoE load forecast.

- Under a credible contingency event (such as for an outage of the 33/11kV transformer at SSPPE ZS) benchmarked against 50% POE load, Energex will not be able to meet Safety Net restoration times to supply the Pimpama East area from 2024/25 onwards. This limitation exists even after installing POPs at SSPPE.

There is a proposed project to establish a new substation at Pimpama to resolve the above NCC and N-1 limitations at SSPPE. The proposed substation will be supplied by the same double circuit feeders currently supplying SSPPE, therefore the load at risk resulting from a double circuit outage will remain the same. The project to establish a new substation at Pimpama has already had an open consultation which is now closed.

The purpose of this project is to restore supply to the SSPPE and SSSTT loads following a double contingency event occurring (loss of F3641 & F3642 or loss of F426 & F3601).

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 Pimpama East and Stapylton 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

Energex Limited ABN 40 078 849 055

1 BACKGROUND

Geographic Region

SSPPE provides electricity supply to 11,652 customers, of which 68.5% are residential and 31.5% are commercial, agricultural and industrial, in the Pimpama, Coomera and Jacobs Well areas.

SSSTT provides electricity supply to 248 customers, of which 97.4% residential and 2.6% are commercial, agricultural and industrial, in the Stapylton, Ormeau and surrounding areas.

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

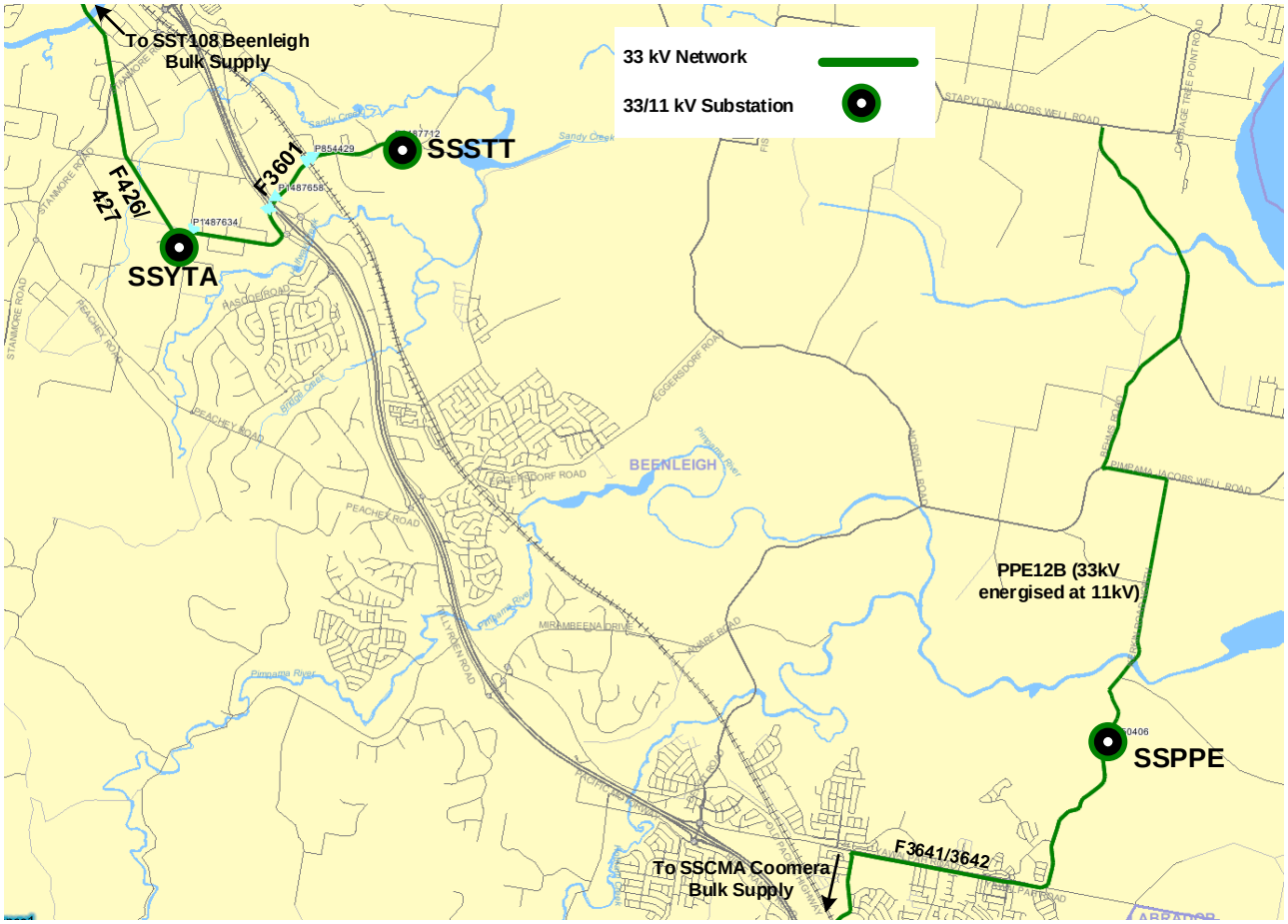

Figure 1: Existing 33kV network arrangement (geographic view)

Existing Supply System

SSPPE is supplied from SSCMA (Coomera Bulk Supply) via 33kV feeders F3641 and F3642. The substation has two indoor 33kV and 11kV switchgear and control room buildings, and two 25MVA 33/11kV transformers. The 2 x 11kV bus has twelve (12) active feeders which supplies a total of approximately 11,652 residential, industrial, commercial, and rural customers, with a peak of 36.82MVA in 2021/22.

SSSTT is supplied from SST108 (Beenleigh Bulk Supply) via 33kV feeders F426 and F3601 (Yatala to Stapylton). The substation has two indoor 33kV and 11kV switchgear and control room buildings, and two 15/25MVA 33/11kV transformers. The 2 x 11kV bus has five (5) active feeders which supplies a total of approximately 248 residential, industrial, commercial, and rural customers, with a peak of 10.82MVA in 2021/22.

A schematic view of the existing sub-transmission network arrangement is shown in Figure 2 and the general arrangement of Pimpama East Substation is illustrated in Figure 3 and the general arrangement of Stapylton Substation is illustrated in Figure 4.

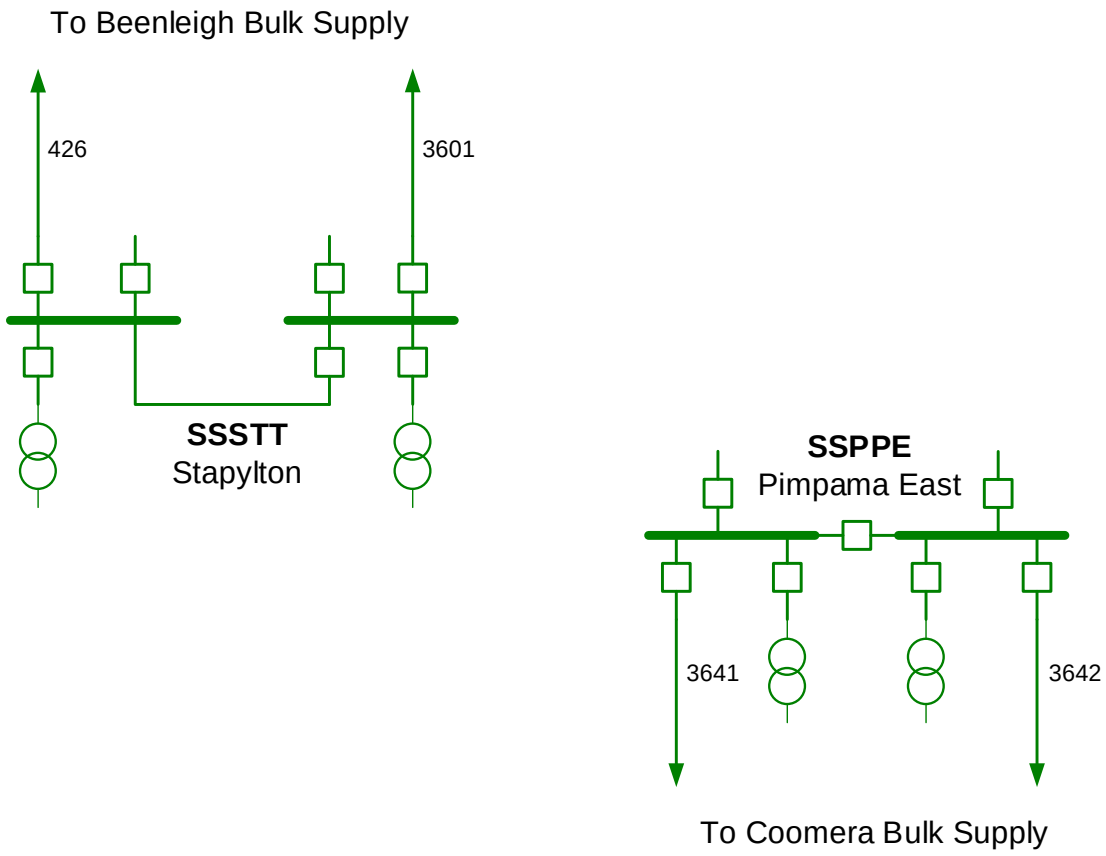

Figure 2: Existing network arrangement (schematic view)

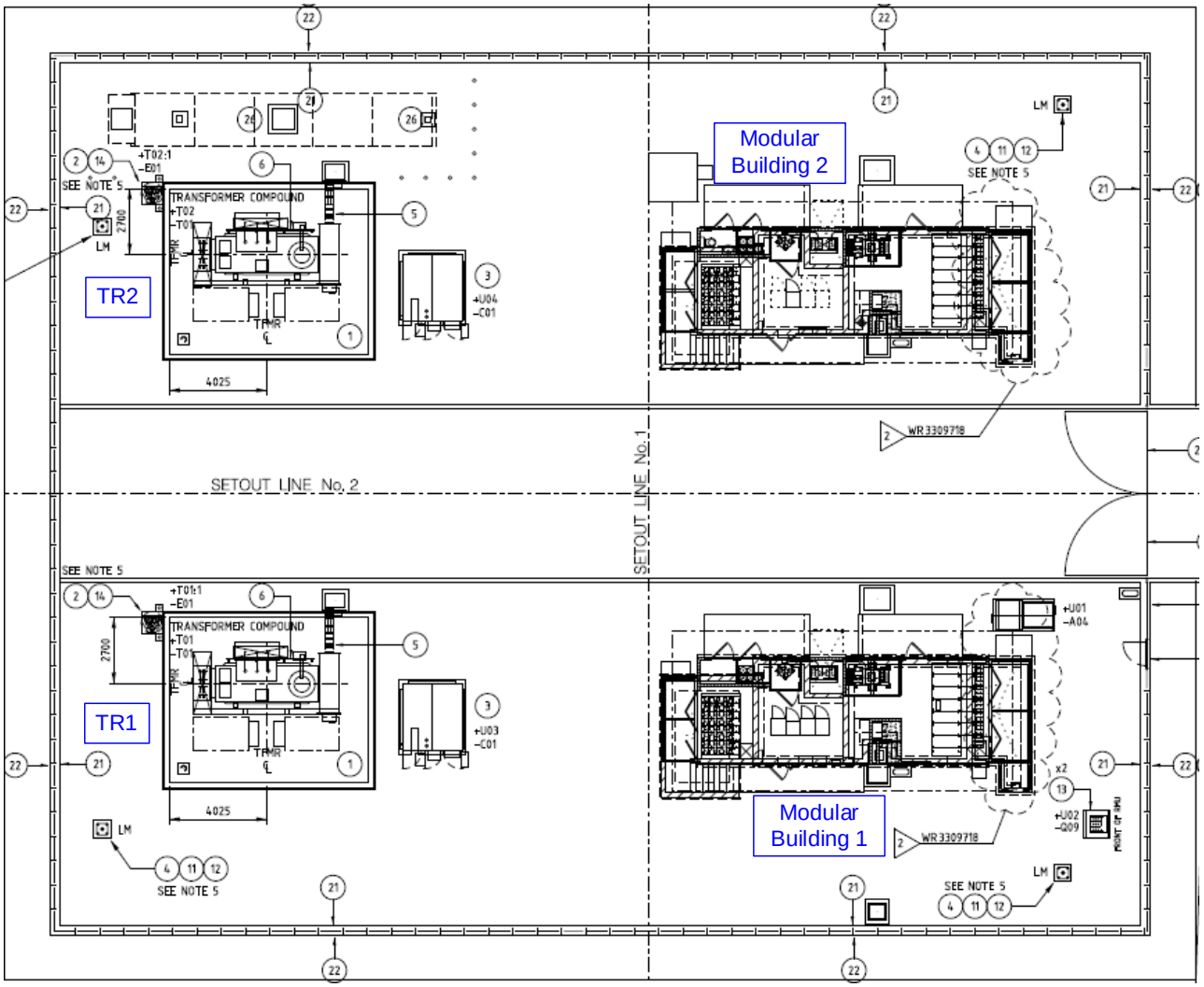

Figure 3: Pimpama East Substation (general arrangement)

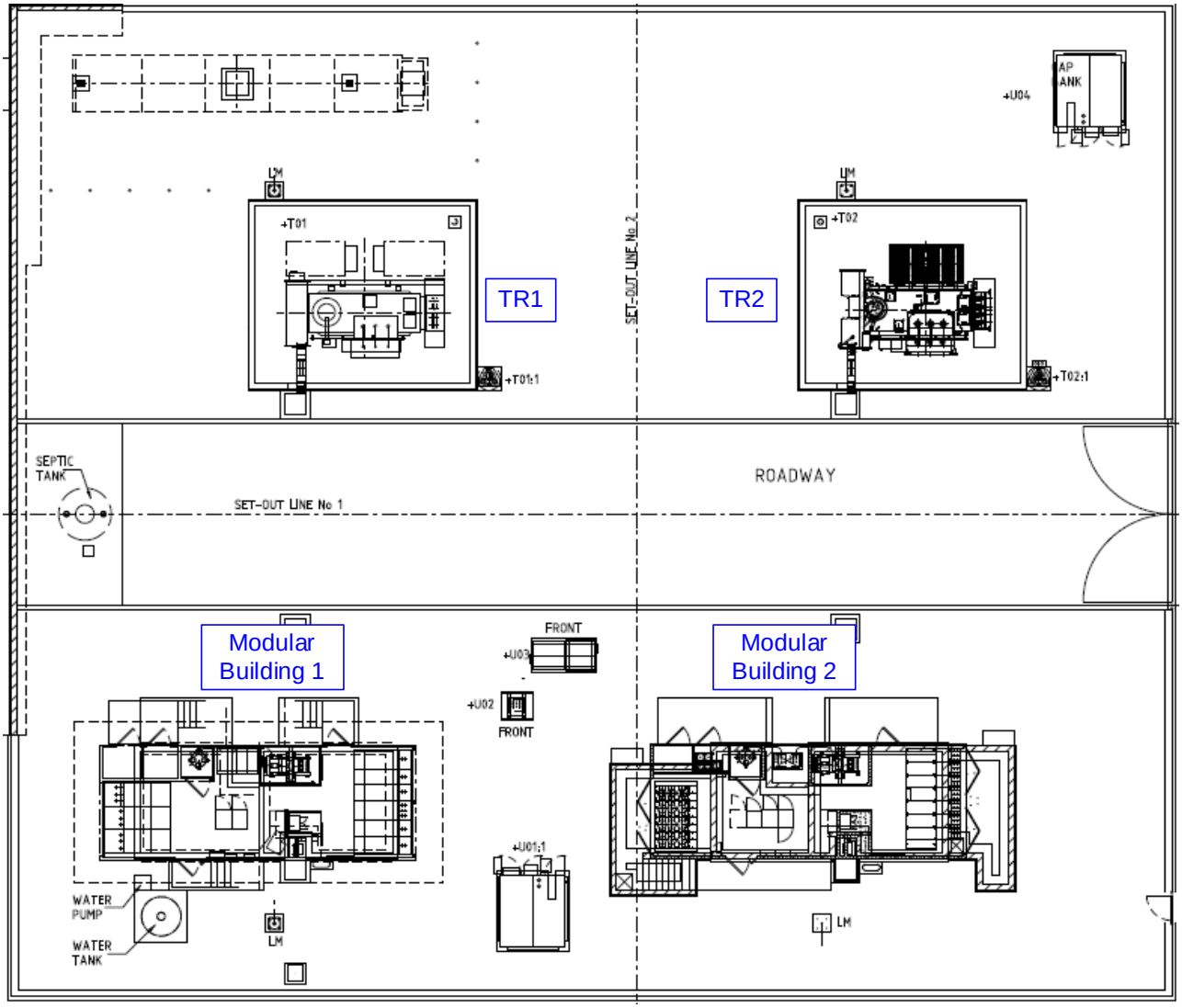

Figure 4: Stapylton Substation (general arrangement)

Load Profiles / Forecasts

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

The load at Stapylton comprises of predominantly industrial/commercial customers with a small proportion of residential customers and is summer peaking.

1.1.1 Full Annual Load Profile

The full annual load profile for Pimpama East 33/11kV zone substation for 2021/22 financial year is shown in Figure 5. The peak occurs through the summer period.

The full annual load profile for Stapylton 33/11kV zone substation for 2021/22 financial year is shown in Figure 6. The peak occurs through the summer period.

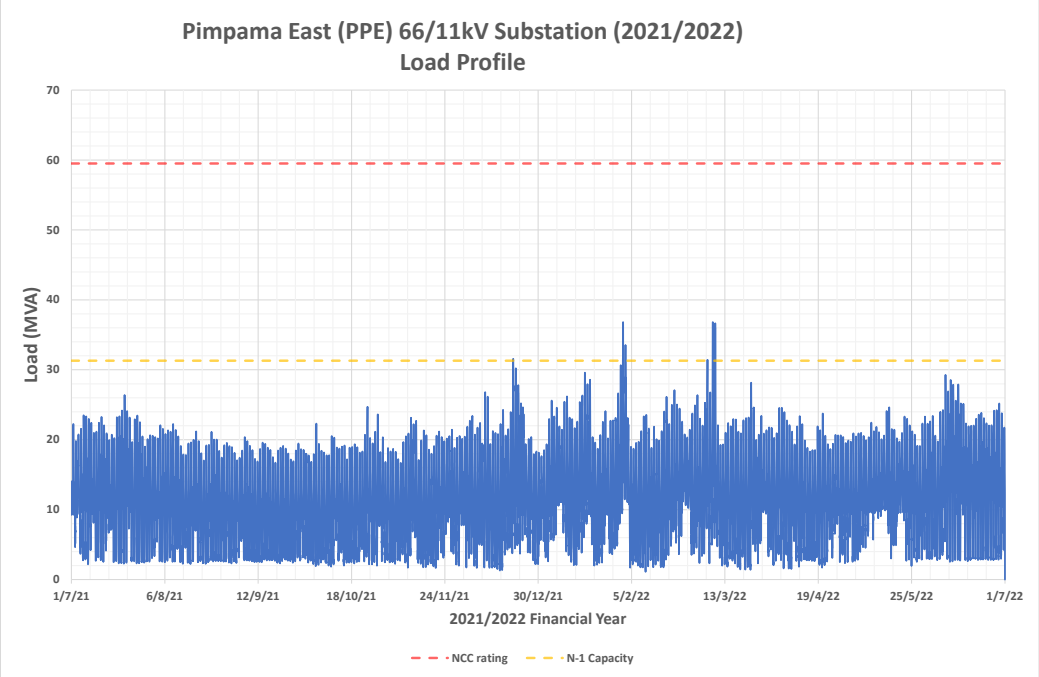

Figure 5: Pimpama East Zone Substation actual annual load profile

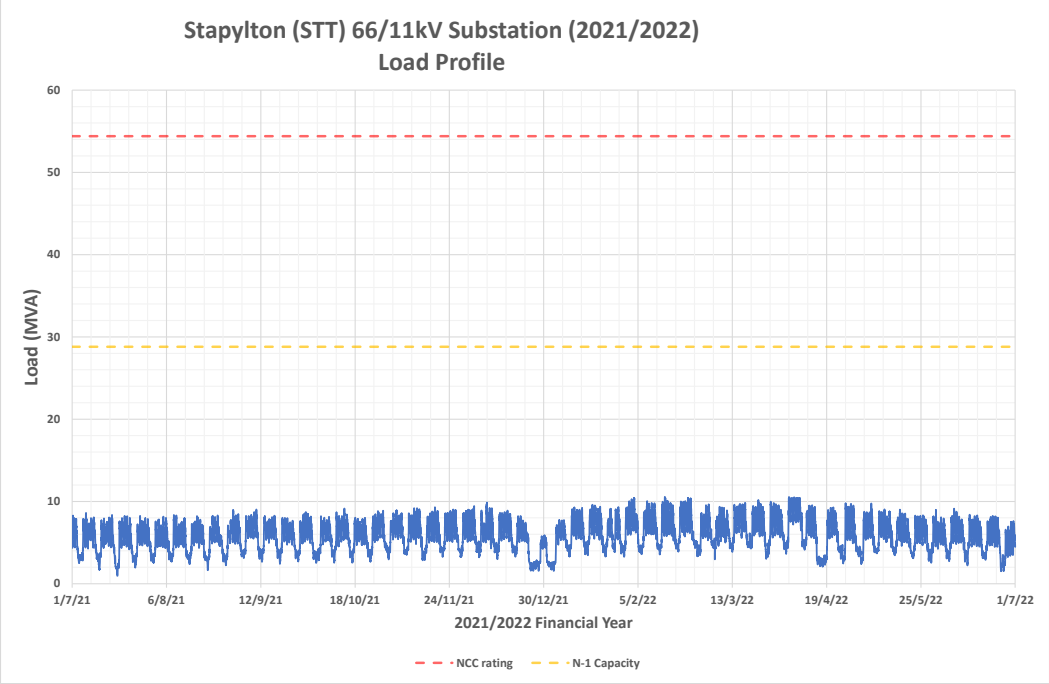

Figure 6: Stapylton Zone Substation actual annual load profile

1.1.2 Load Duration Curve

The load duration curve for Pimpama East Zone Substation for 2021/22 is shown in Figure 7. The load does not exceed the NCC capacity of 59.5MVA.

The load duration curve for Stapylton Zone Substation for 2021/22 is shown in Figure 8. The load does not exceed the NCC capacity of 54.4MVA.

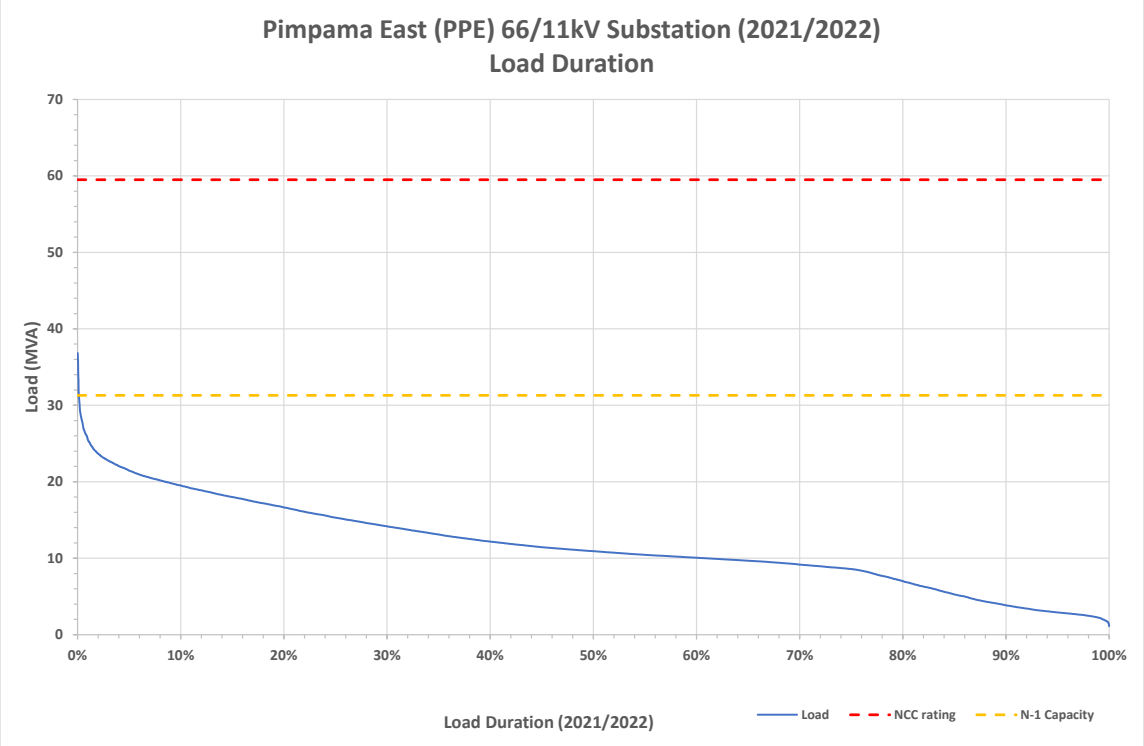

Figure 7: Substation load duration curve for SSPPE

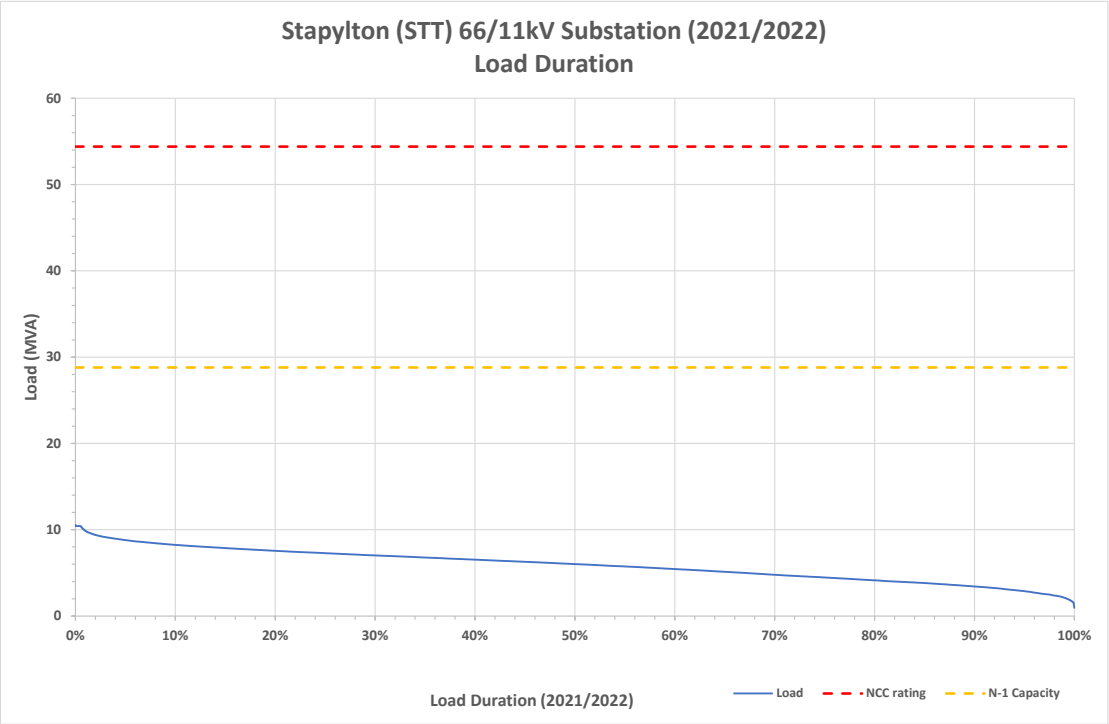

Figure 8: Substation load duration curve for SSSTT

1.1.3 Average Peak Weekday Load Profile (Summer)

The daily load profile for the average and peak weekday during summer is illustrated below in Figure 9. The summer peak loads for Pimpama East Zone Substation are historically experienced in the late afternoon and evening.

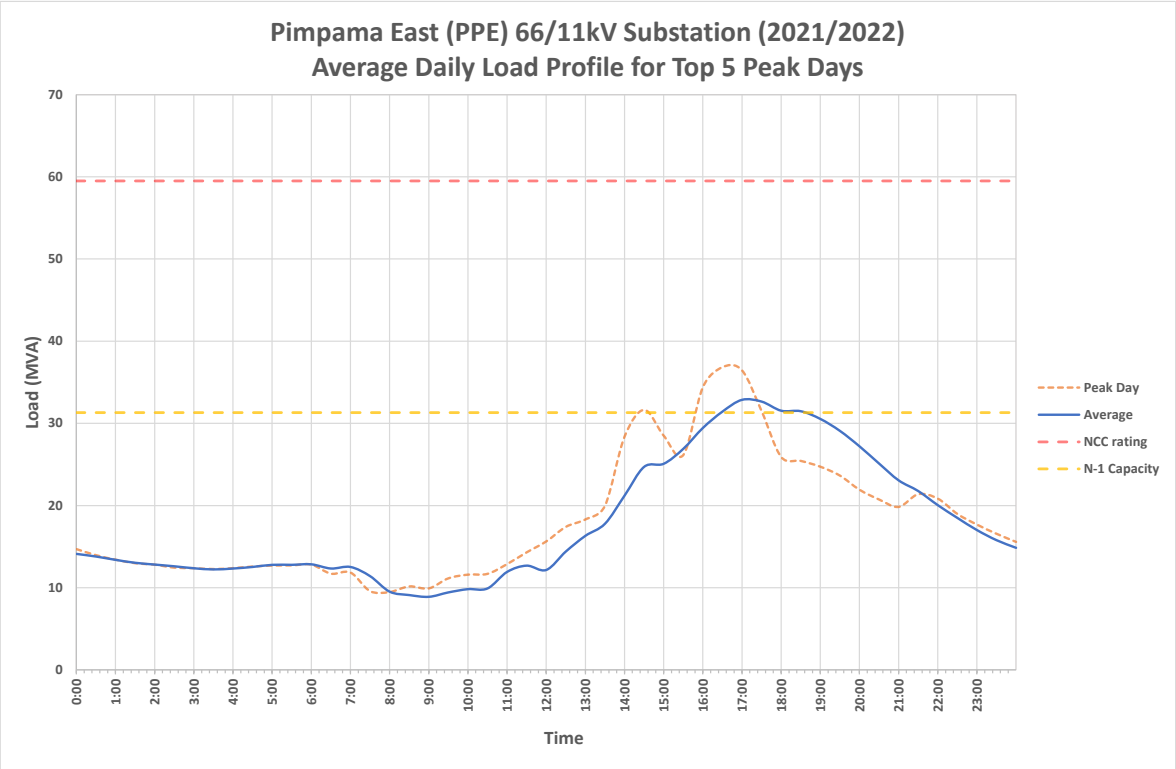

Figure 9: Average Daily and Maximum Load Profiles (Summer)

The daily load profile for the average and peak weekday during summer is illustrated below in Figure 10. The summer peak loads for Stapylton Zone Substation are historically experienced in the early morning.

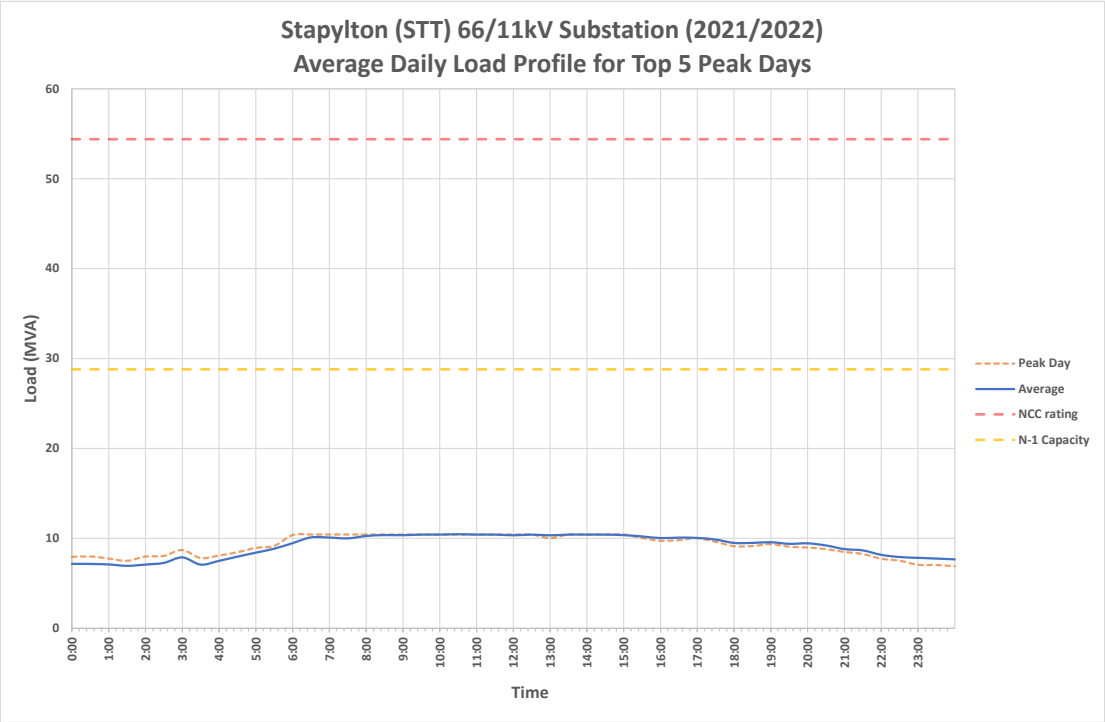

Figure 10: Average Daily and Maximum Load Profiles (Summer)

1.1.4 Base Case Load Forecast

The 10 PoE and 50 PoE load forecasts for the base case load growth scenario for Pimpama East Zone Substation are illustrated Figure 11. The historical peak load for the past six years has also been included in the graph.

It can be noted that the historical annual peak loads for Pimpama East Zone Substation have increased over the past six years. It can also be noted that the peak load is forecast to increase over the next 10 years under the base case scenario.

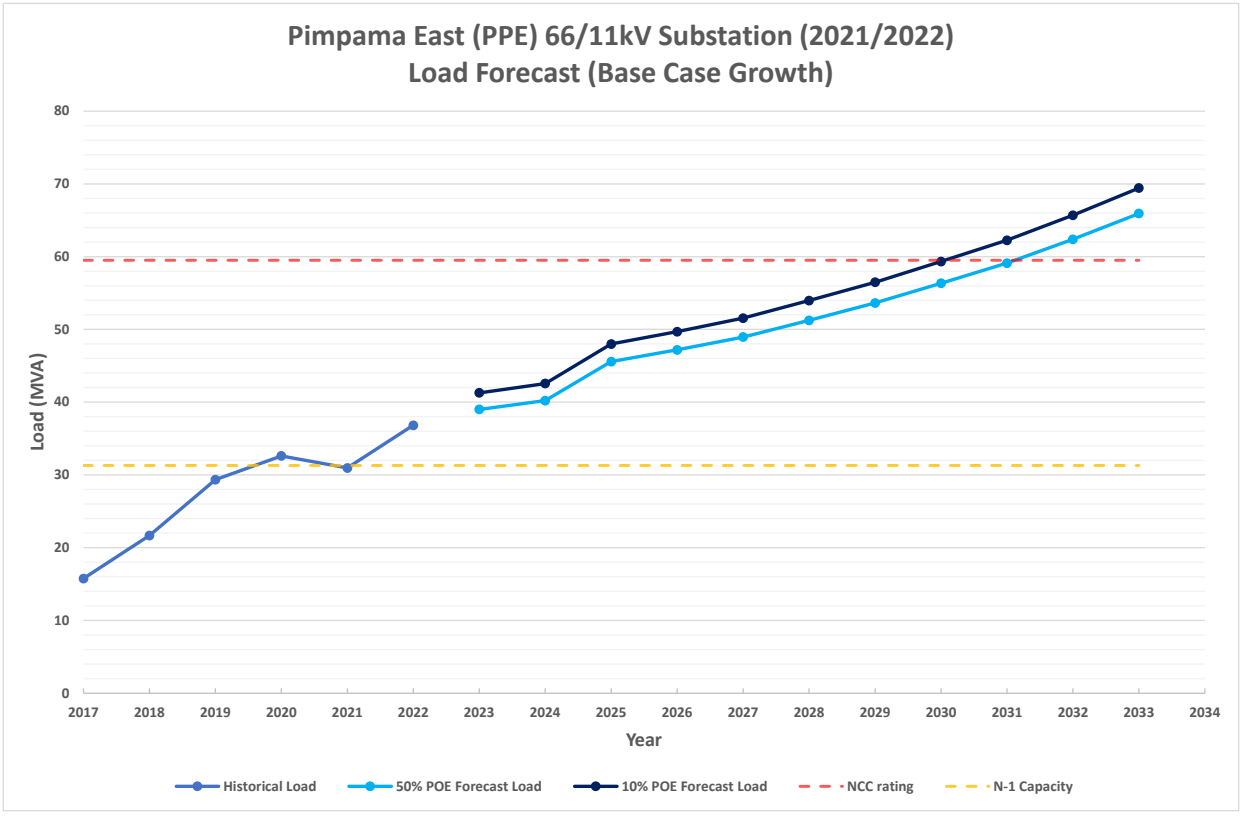

Figure 11: Pimpama East Zone Substation Base case load forecast

The 10 PoE and 50 PoE load forecasts for the base case load growth scenario for Stapylton Zone Substation are illustrated Figure 12. The historical peak load for the past six years has also been included in the graph.

It can be noted that the historical annual peak loads for Stapylton Zone Substation have been flatline over the past six years. It can also be noted that the peak load is forecast to flatline over the next 10 years under the base case scenario.

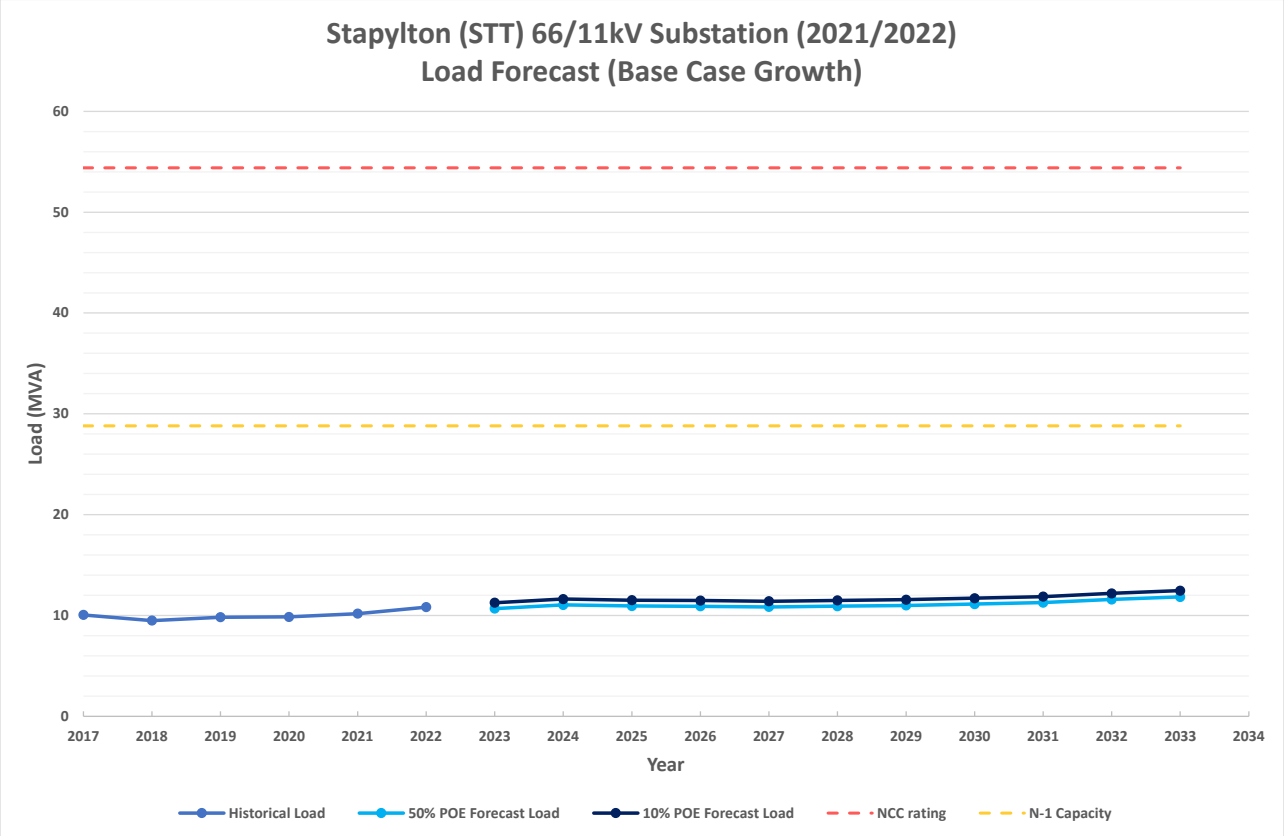

Figure 12: Stapylton Zone Substation Base case load forecast

1.1.5 High Growth Load Forecast

The 10 PoE and 50 PoE load forecasts for the high load growth scenario for Pimpama East Zone Substation and Stapylton Zone Substation are illustrated in Figure 13 and Figure 14. With the high growth scenario, the peak load for Pimpama East Zone and Stapylton Zone Substation is forecast to increase over the next 10 years.

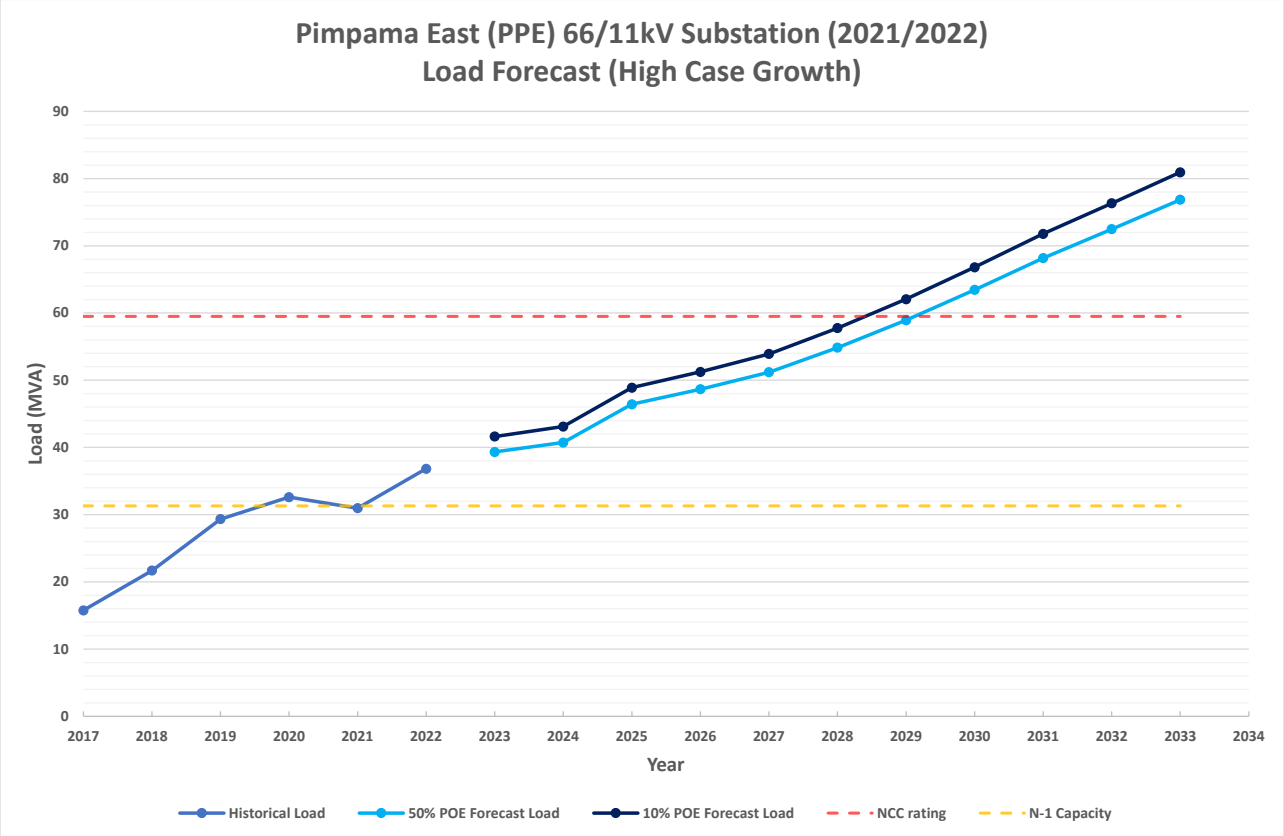

Figure 13: Pimpama East Zone Substation Network High Growth Load Forecast

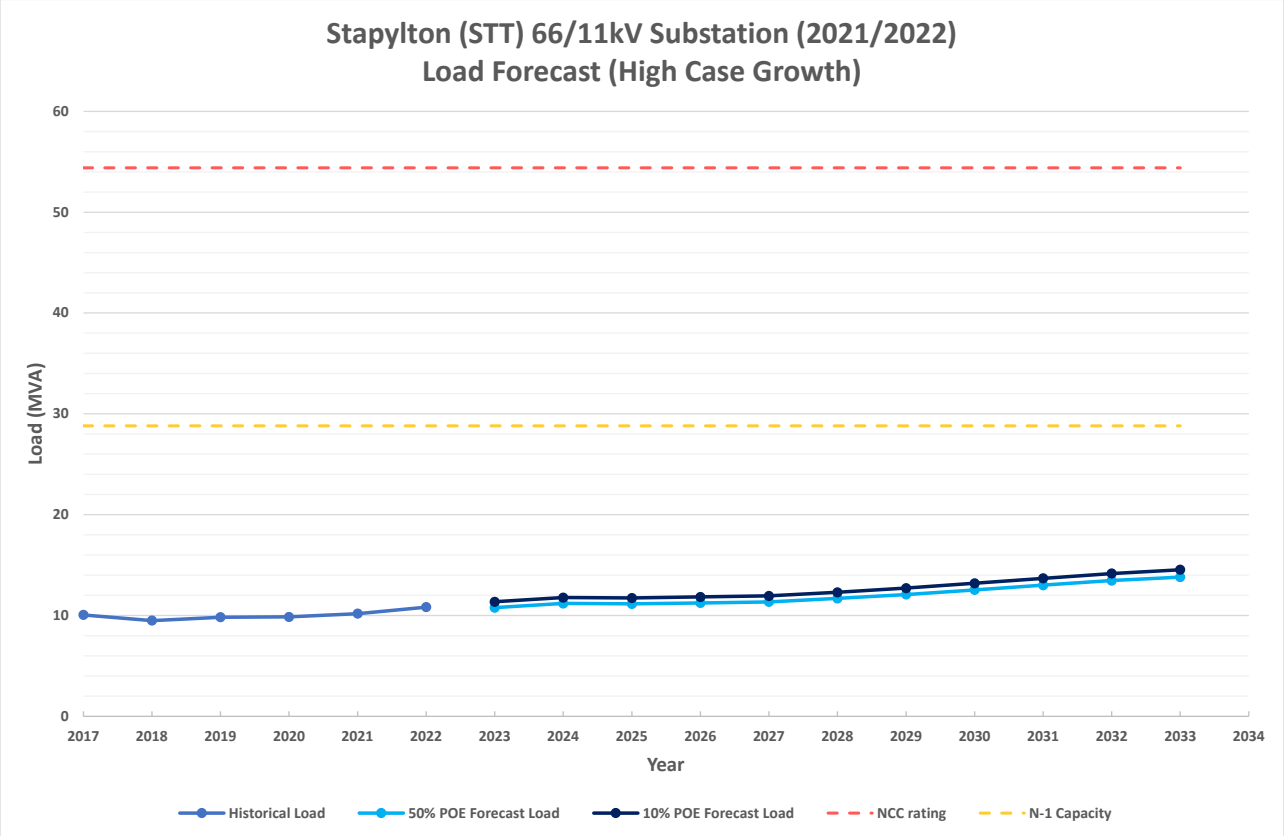

Figure 14: Stapylton Substation Zone High Growth Load Forecast

1.1.6 Low Growth Load Forecast

The 10 PoE and 50 PoE load forecasts for the low load growth scenario for Pimpama East Zone and Stapylton Substation are illustrated in Figure 15 and Figure 16. With the low growth scenario, the peak load is forecast to flatline over the next 10 years for Stapylton Substation.

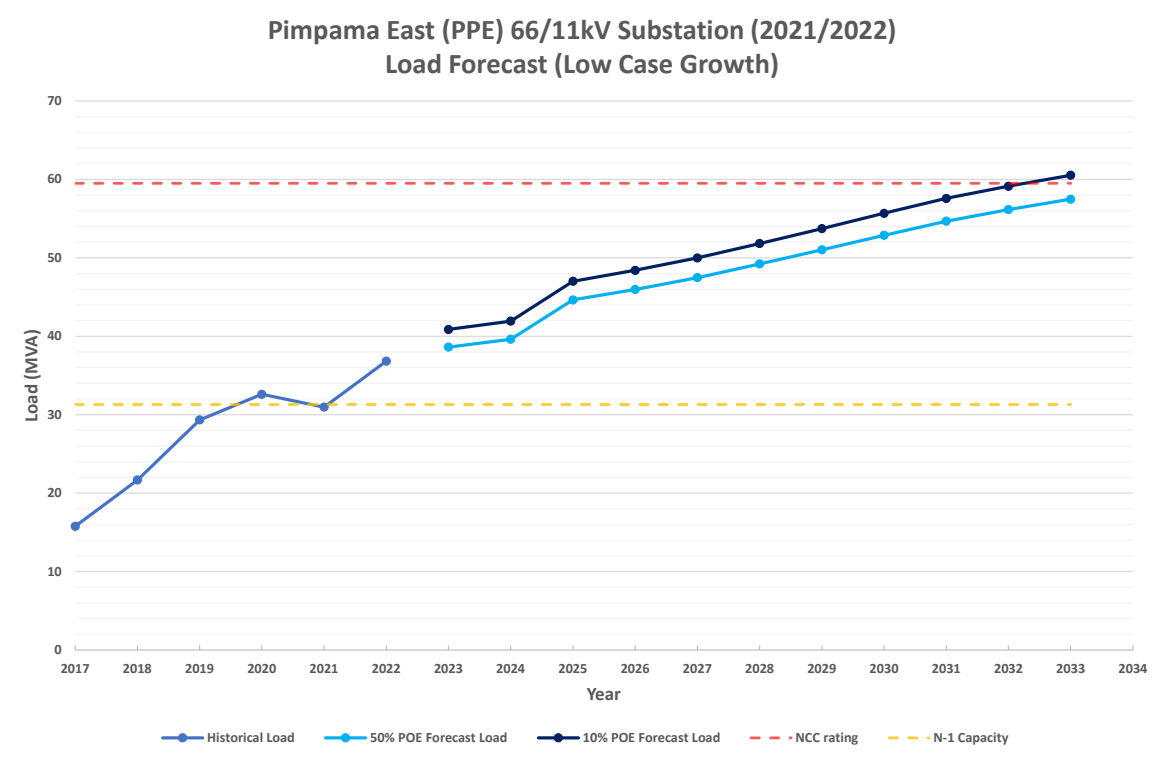

Figure 15: Pimpama East Zone Low Growth Load Forecast

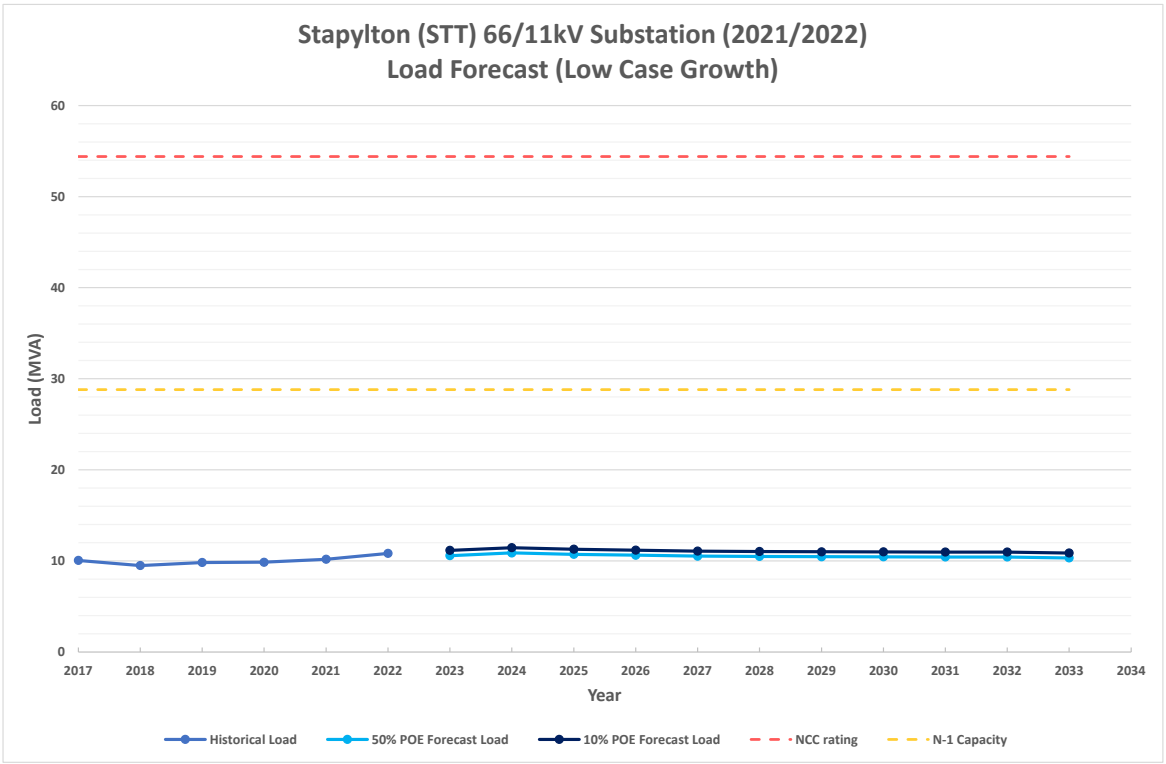

Figure 16: Stapylton Substation Zone Low Growth Load Forecast

2 IDENTIFIED NEED

Description of the Identified Need

2.1.1 Safety Net Non-Compliance

Energex has the obligations to meet and report on Safety Net measures that are listed in the Distribution Authority. The purpose of the service safety net is to effectively mitigate the risk of low probability - high consequence network outages to avoid unexpected customer hardship and/or significant community or economic disruption.

The 33kV feeders F3641 and F3642 supplying Pimpama East Zone Substation (SSPPE) are approximately 9km long. They are constructed as a double circuit line sharing the same poles, with parts of these feeders traversing along road corridors, which increases the likelihood of a double contingency occurring due to pole failure. Similarly, the 33kV feeders F426 and F3601 supplying Stapylton Zone Substation (SSSTT) are also constructed as a double circuit line sharing the same poles with a length of approximately 3.8km long. As such, the risk of a double circuit outage on these feeders is considered credible.

Under a credible double contingency event for an outage of F3641 & F3642 or F426 & F3601, Energex will not be able to restore supply to Pimpama East Zone Substation or Stapylton Zone Substation . Energex will utilise the manual transfers to adjacent substations via the 11kV feeders and deploy its fleet of mobile generators to partially restore supply to customers, which will result in customer outage times exceeding the Safety Net requirements. Energex has not identified any other suitable alternative supply arrangements to alleviate the outage and maintain supply to these customers should the above event occur.

The energy required to resolve the outage are summarised in Table 3 and Table 4 below.

Year	Forecast peak unsupplied energy (kWh)
2023	136359
2024	140568
2025	159337
2026	164956
2027	171117
2028	179151
2029	187500
2030	196950
2031	206645
2032	218086
2033	230478

Table 3: Energy required to resolve the outage at SSPPE after the loss of F3641 & F3642

Year	Forecast peak unsupplied energy (kWh)
2023	33882
2024	35028
2025	34703
2026	34590
2027	34396
2028	34631
2029	34860
2030	35304
2031	35750
2032	36739
2033	37556

Table 4: Energy required to resolve the outage at SSSTT after the loss of F426 & F3601

Assumptions in Relation to Identified Need

Below is a summary of key assumptions that have been made when the identified need has been analysed and quantified.

It is recognised that the below assumptions may prove to have various levels of correctness, and they merely represent a 'best endeavours' approach to predict the future identified need.

2.1.2 Forecast Maximum Demand

It has been assumed that forecast peak demand at Pimpama East and Stapylton Substation will be consistent with the base case forecast outlined in Section 1.3.4.

Factors that have been taken into account when the load forecast has been developed include the following:

- load history;
- known future developments (new major customers, network augmentation, etc.);
- temperature corrected start values (historical peak demands); and
- forecast growth rates for organic growth.

2.1.3 Load Profile

Characteristic peak day load profiles shown in Section 1.3.3 are unlikely to change significantly from year to year and the shape of the load profile is assumed to remain virtually the same with increasing maximum demand.

3 ASSESSMENT METHODOLOGY AND ASSUMPTIONS

Demand Forecasts

Please refer to Section 5 (Network Forecasting) of the latest Energex DAPR publication for in-depth details regarding the methods and assumptions behind Energex's demand forecasts.

Discount Rate

Calculations for annual deferral values of projects are based on Energex's regulated pre-tax real Weighted Average Cost of Capital (WACC). This value is prescribed by the AER for a specific regulatory control period. The identified need described in this NNOR occurs in the 2020-2025 regulatory control period, where the WACC is 2.62%.

Cost Estimates

Project costs are calculated using standard estimate components which are developed and evaluated by estimation teams in Energex. The costs are split into two components: direct cost, which is those costs directly costed to the project; and indirect costs which cover overheads associated with the business. All costs provided in this report are estimated to fall within ± 40% accuracy of the stated cost.

Evaluation Test Period

Consideration of network options is assessed over an evaluation period of 60 years.

4 INTERNAL OPTIONS CONSIDERED

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 Pimpama East and Stapylton area to address the identified need.

Network Options Identified

Energex has identified two (2) credible network option that will address the identified need.

4.1.1 Option 1: Establish new 33kV Feeder between SSSTT and SSPPE

To address the limitations at SSPPE and SSSTT, it is proposed to establish a new 33kV feeder between SSPPE and SSSTT. Works include:

- Convert existing 11kV feeder PPE12B energised at 33kV to become part of the new 33kV feeder
- Establish approximately 11km of 33kV feeder between SSSTT and PPE12B;
- Underground existing 11kV feeder along Burnside Road to SSSTT to accommodate retrofit of 33kV feeder to existing poles.
- Terminate 33kV feeder to existing 33kV CBs at SSSTT and SSPPE

Figure 17 and Figure 18 provide geographic and schematic diagrams for Option 1.

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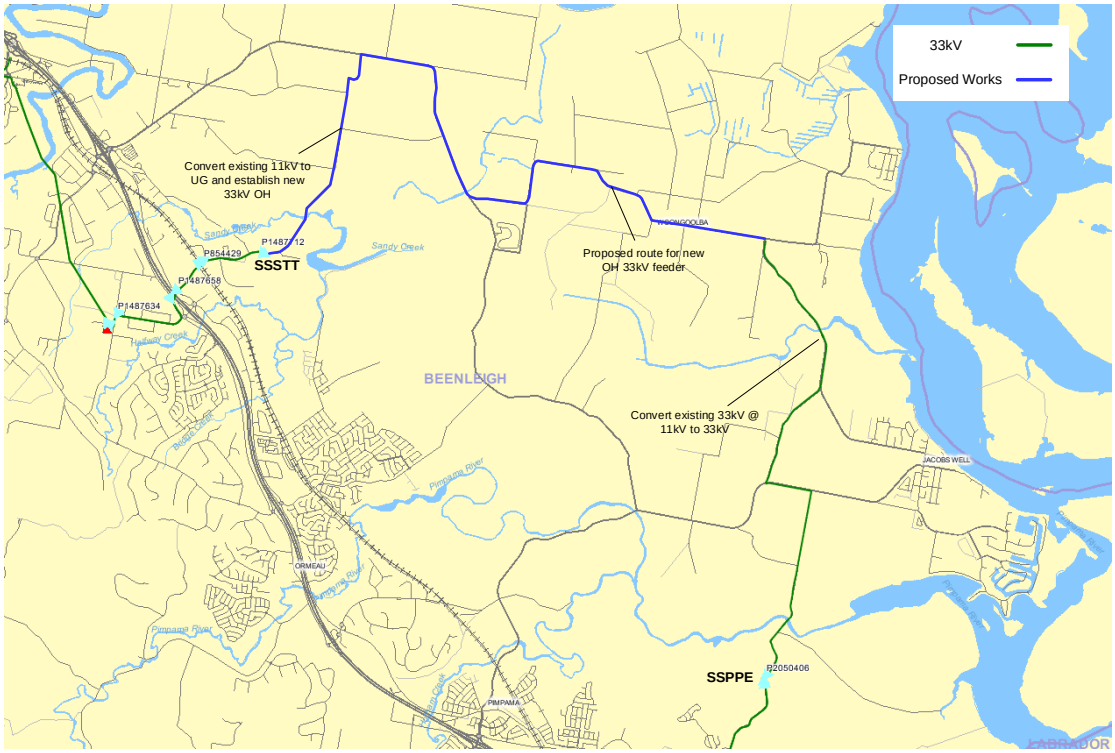

Figure 17: Option 1 proposed network arrangement (geographic view)

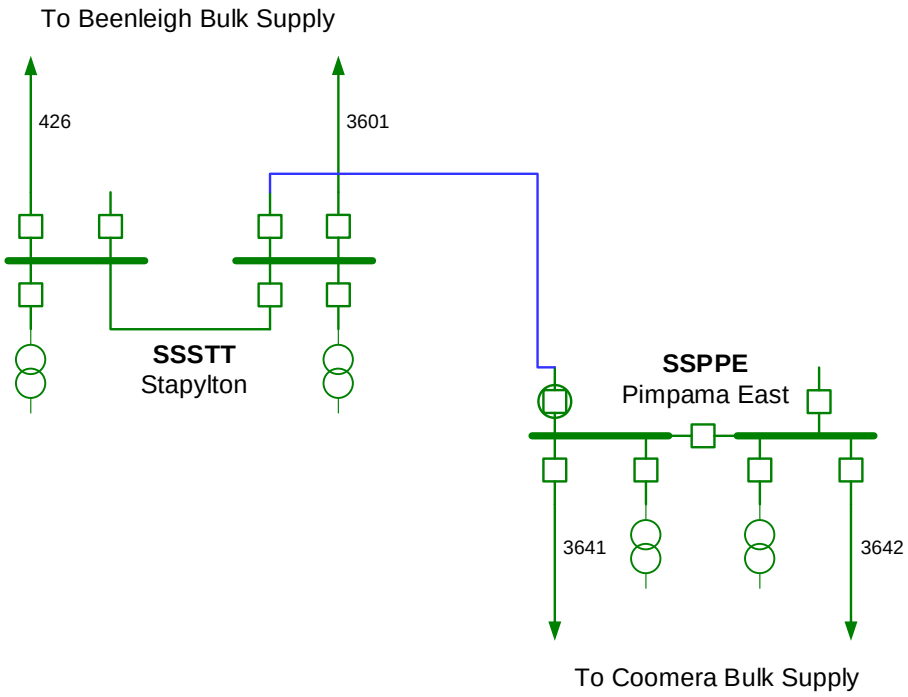

Figure 18: Proposed network arrangement (schematic view)

4.1.2 Option 2: Establish new 33kV feeder between SSCMA and SSPPE and between SSSTT and SSYTA and build a new switchgear building at SSYTA

This option involves the following works:

Establish a new 33kV Feeder between SSCMA and SSPPE (10kms), between SSSTT and SSYTA (4kms) and switchgear building with 1 x 33kV bus switchboard as there is no spare 33kV circuit breaker at SSYTA. A schematic diagram of the proposed network arrangement for Option 2 is shown in Figure 19.

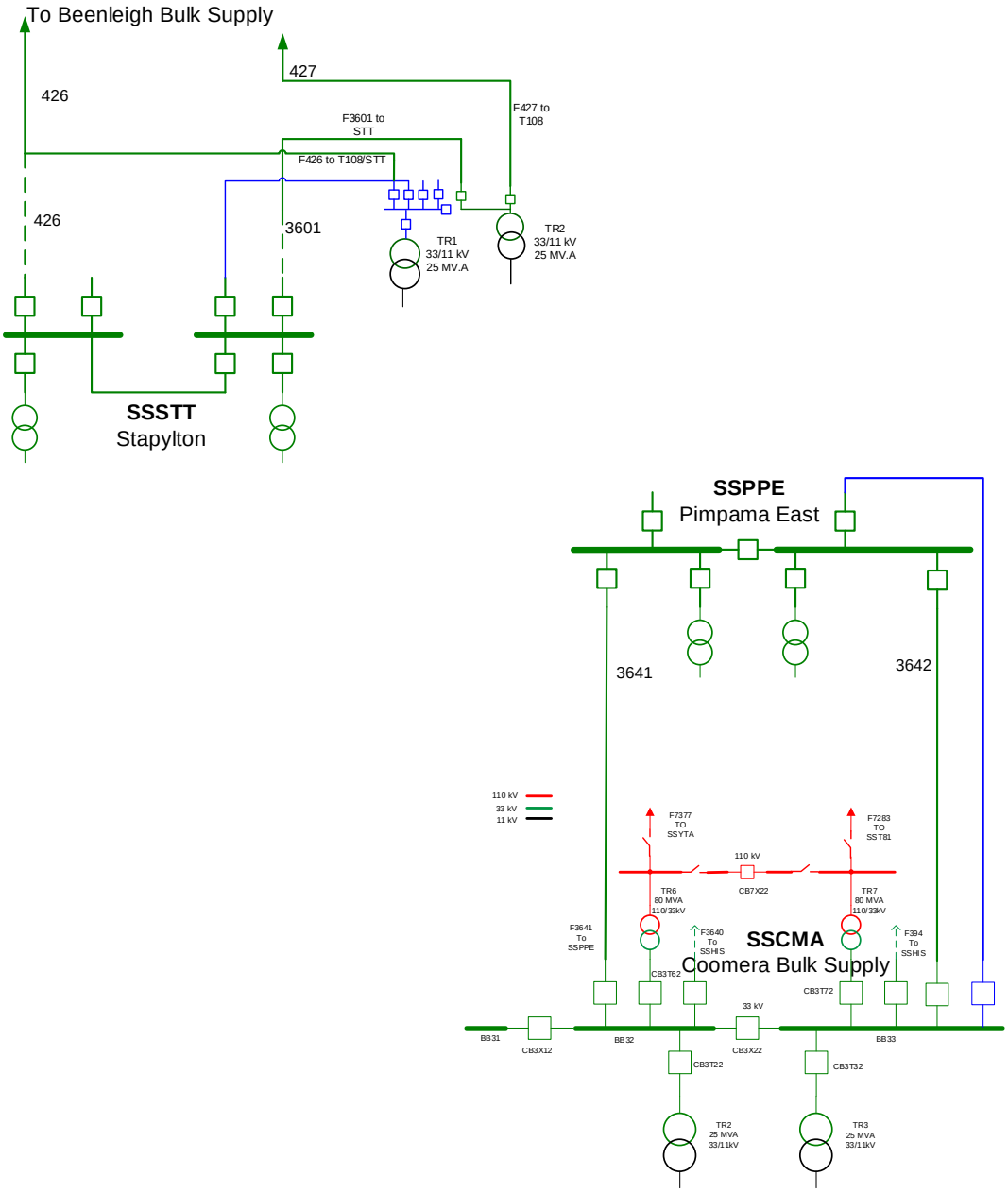

Figure 19: Option 2 proposed network arrangement (schematic view)

Preferred Network Option

Energex's preferred internal network option is Option 1: Establish new 33kV Feeder between SSSTT and SSPPE.

Upon completion of these works, the Safety Net non-compliance and reliability risks at SSPPE and SSSTT will be addressed. The estimated capital cost of this option inclusive of interest, risk, contingencies and overheads is $6.383 million and an annual operating cost of approximately $27,560. This provides the most economically efficient network option, with the lowest NPV cost to address the network limitations. The estimated project delivery timeframe has design commencing in November 2023 and construction completed by October 2025.

5 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.

Demand Management (Demand Reduction)

The DEM team has completed a review of the Pimpama East and Stapylton customer base and considered a number of demand management technologies. Safety Net non-compliance and reliability risks are the key project drivers (i.e. the need) at Pimpama East and Stapylton zone substations. It has been determined that most demand management options will not be viable propositions and have been explored in the following sections.

5.1.1 Network Load Control

The critical contingencies that this project seeks to address relate to total loss of supply to SSPPE or SSSTT, therefore, network load control would not sufficiently address the identified need.

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.

5.1.2 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.

5.1.3 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.

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5.1.4 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.

5.1.5 Customer Solar Power Systems

A total of 4,548 customers have solar photo voltaic (PV) systems for a connected solar capacity of 28,931kW at SSPPE.

The daily peak demand is driven by residential customer demand and the peak generally occurs between 4:00pm and 7:00pm. As such customer solar generation does not coincide with the peak load period.

A total of 55 customers have solar photo voltaic (PV) systems for a connected solar capacity of 2,897kW at SSSTT.

The daily peak demand is driven by industrial/ commercial customer demand and the peak generally occurs between 7:00am and 9:00am. 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.

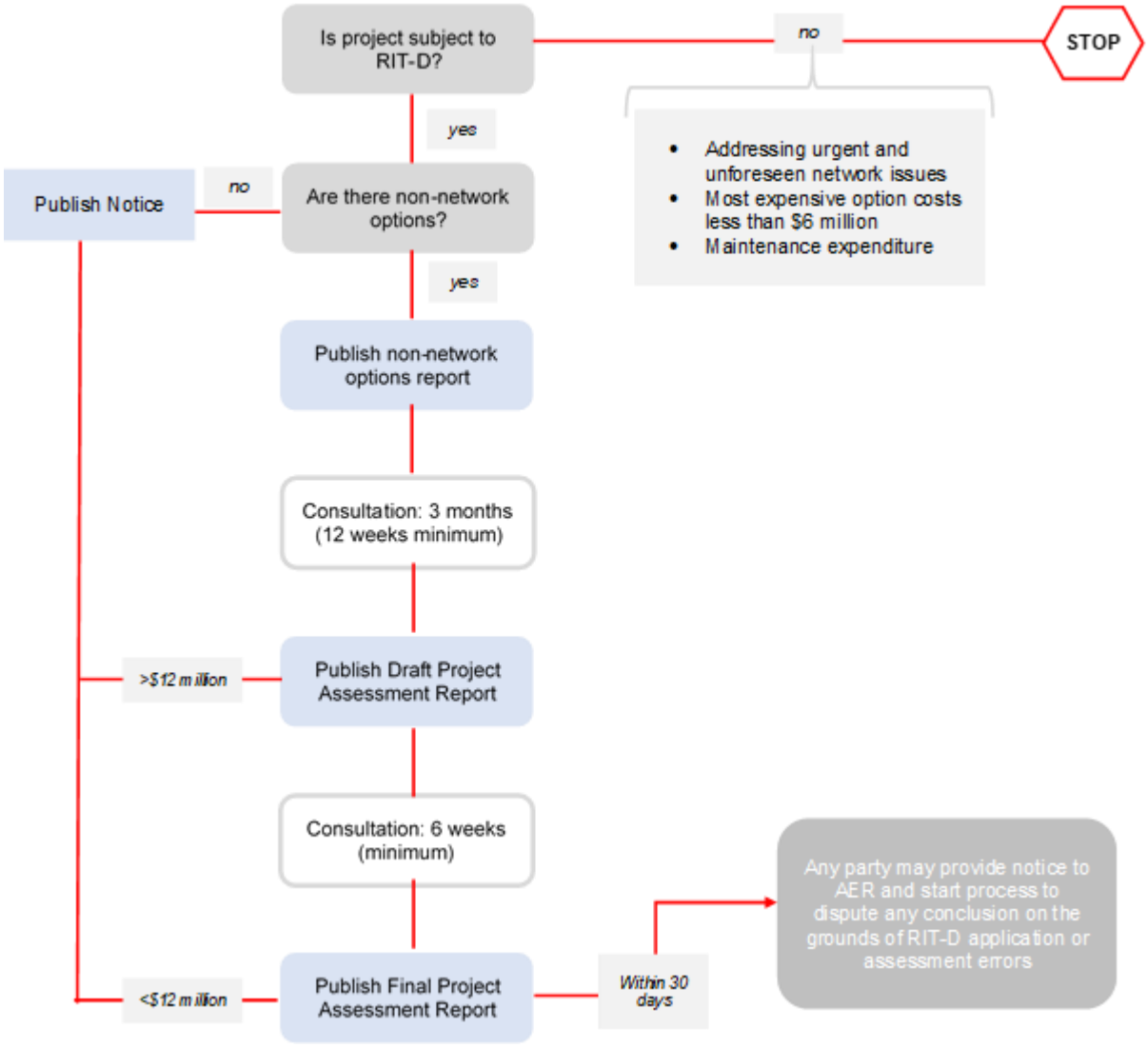
However, only a small percentage of customers in this supply area have solar PV systems and possibly none have a BESS. PV systems with BESS present a future portfolio opportunity for potential demand response but currently this supply area has a very limited solar/BESS. Solar customers without a BESS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

6 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 Pimpama East and Stapylton area to address the identified need.

The preferred network option is Option 1 - Establish new 33kV Feeder between SSSTT and SSPPE. This Notice of No Non-Network Options is 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.