# Regulatory Investment Test for Distribution (RIT-D)

# Jimboomba and Beaudesert Network Limitation

## Non-Network Options Report

4 July 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

North Maclean (SSNMC), Jimboomba (SSJBB) and Logan Village (SSLGV) zone substations are currently supplied from Jimboomba Bulk supply substation (SSJBB BS). F7354 and F820 supplies SSJBB BS from Loganlea Bulk Supply Substation (SSH22). SSJBB BS provides electricity supply to approximately 22,925 customers, of which 77% are residential and 23% are commercial, agricultural and industrial.

Beaudesert bulk supply substation (SSBDS) supplies Bromelton (SSBTN), Beaudesert (SSBDT), Mount Tamborine (SSMTB), Innisplain (SSIPL) and Tamborine Village (SSTBV) zone substations. Only one 110kV feeder F7351 supplies SSBDS from SSJBB BS and one 33kV feeder F314 connects SSJBB and SSBDS. SSBDS provides electricity supply to approximately 11,098 customers of which 37% are residential and 63% are commercial, agricultural, and industrial.

The identified need for this Non-Network Options Report is that Energex will experience three upcoming network limitations due to the load growth in the area:

- The 10% POE load at SSJBB BS is forecast to exceed Substation system normal cyclic capacity (NCC) in summer 2025/26. The system normal condition is assessed against the 10%PoE load forecast.
- Under a credible contingency event (such as for an outage of the 110/33kV transformer at SSJBB BS) benchmarked against 50% POE load, Energex will not be able to meet Safety Net restoration times to supply the Jimboomba area.
- Under a credible contingency event (such as for an outage of 110kV feeder F7351 (SSJBB BS-SSBDS) benchmarked against 50% POE load, Energex will not meet the Safety Net restoration times to supply the Beaudesert area, after the current network support agreement expires in 2025/26.

The requirements of a non-network option to solve the identified need are summarised in **Error! Reference source not found.**, Table 2 and Table 3.



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| Year | Forecast 10 PoE Load (MVA) | Security Standard Load At Risk (MVA) | Days/Yr Above Limit | % Time Above Limit | Hrs Over Limit |
|---|---|---|---|---|---|
| 2023/24 | 83.8 | 0.0 | - | - | - |
| 2024/25 | 85.1 | 0.0 | - | - | - |
| 2025/26 | 89.0 | 1.0 | 1 | 0.01% | 0.5 |
| 2026/27 | 94.0 | 6.0 | 4 | 0.06% | 5.5 |
| 2027/28 | 100.1 | 12.1 | 7 | 0.16% | 14 |
| 2028/29 | 104.6 | 16.6 | 9 | 0.23% | 20.5 |
| 2029/30 | 108.9 | 20.9 | 14 | 0.37% | 32.5 |
| 2030/31 | 113.2 | 25.2 | 20 | 0.55% | 48 |

**Table 1: Non-network Option Requirements for SSJBB BS under System Normal**

| Year | Forecast 50 PoE Load (MVA) | Security Standard Load At Risk (MVA) | Days/Yr Above Limit | % Time Above Limit | Hrs Over Limit |
|---|---|---|---|---|---|
| 2023/24 | 69.6 | 0.0 | - | - | - |
| 2024/25 | 70.7 | 0.0 | - | - | - |
| 2025/26 | 74.2 | 0.0 | - | - | - |
| 2026/27 | 78.8 | 1.3 | 1 | 0.01% | 1 |
| 2027/28 | 84.4 | 6.4 | 4 | 0.07% | 6 |
| 2028/29 | 88.3 | 9.1 | 6 | 0.10% | 9 |
| 2029/30 | 91.9 | 11.9 | 7 | 0.17% | 14.5 |
| 2030/31 | 95.4 | 14.8 | 9 | 0.22% | 19 |

**Table 2: Non-network Option Requirements for SSJBB BS under System Contingency**



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| Year | Forecast 50 PoE Load (MVA) | Security Standard Load At Risk (MVA) | Days/Yr Above Limit | % Time Above Limit | Hrs Over Limit |
|---|---|---|---|---|---|
| 2023/24 | 50.0 | 0.0 | - | - | - |
| 2024/25 | 51.1 | 0.0 | - | - | - |
| 2025/26 | 51.6 | 11.40 | 13 | 0.38% | 33.5 |
| 2026/27 | 52.2 | 11.9 | 16 | 0.47% | 41.5 |
| 2027/28 | 53.2 | 12.8 | 20 | 0.61% | 53 |
| 2028/29 | 54.1 | 13.7 | 26 | 0.77% | 67.5 |
| 2029/30 | 55.1 | 14.6 | 33 | 1.01% | 88.5 |
| 2030/31 | 56.0 | 15.4 | 40 | 1.26% | 110 |

**Table 3: Non-network Option Requirements for F314 under System Contingency**

## 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 Jimboomba and Beaudesert supply area in a reliable, safe and cost-effective manner. Accordingly, this investment is subject to a RIT-D. This Non-Network Options Report has been prepared by Energex in accordance with the requirements of clause 5.17.4(e) of the NER and seeks information from interested parties about possible alternate solutions to address the need for investment.

Submissions in writing are due on the **15 May 2020** by 4pm and must be lodged to demandmanagement@energex.com.au

For further information and inquiries please contact:

E: demandmanagement@energex.com.au
P: 13 74 66



Energex Corporation Limited ABN 50 087 646 062

# CONTENTS





Energex Corporation Limited ABN 50 087 646 062

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# 1. INTRODUCTION

This Non-Network Options Report has been prepared by Energex in accordance with the requirements of clause 5.17.4(e) of the NER.

This report represents the first stage of the consultation process in relation to the application of the RIT-D on potential credible options to address the identified need for the Jimboomba and Beaudesert network area.

In preparing this RIT-D, Energex is required to consider reasonable future scenarios. With respect to major customer loads and generation, Energex has, in good faith, included as much detail as possible while maintaining necessary customer confidentiality. Potential large future connections that Energex is aware of are in different stages of progress and are subject to change (including outcomes where none or all proceed). These and other customer activity can occur over the consultation period and may change the timing and/or scope of any proposed solutions.

## 1.1. Structure of the Report

This report:

- Provides background information on the network capability limitations of the distribution network supplying the Jimboomba and Beaudesert area.
- Identifies the need which Energex is seeking to address, together with the assumptions used in identifying and quantifying that need.
- Describes the credible options that Energex currently considers may address the identified need, including for each:
  - Its technical definitions;
  - The estimated commissioning date; and
  - The total indicative cost (including capital and operating costs).
- Sets out the technical characteristics that a non-network option would be required to deliver in order to address the identified need.
- Is an invitation to registered participants and interested parties to make submissions on credible options to address the identified need.



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## 1.2. General Terms and Conditions

1. By issuing this Non-Network Options Report (NNOR), Energex is under no obligation whatsoever to review, discuss, select or enter into any agreement with any proponent who may submit a proposal.
2. Proponents will be responsible for all costs associated with the preparation and assessment of providing a proposal in response to this NNOR including but not limited to any site visits and responding to further information requests made by Energex in order to assist Energex in its assessment of the proposal.
3. When evaluating a proposal, Energex will follow the NER and RIT-D Guidelines (available on the AER website). Further, Energex will follow the process as described in Energex's Demand Side Engagement Strategy (DSES) a copy of which can be found at the following link.
4. Energex may combine all or parts of separate proposals for the purposes of evaluation where this may lead to a more efficient outcome than the separate proposal or option. Proponents should indicate in their proposal whether they wish to have their proposals or options considered in isolation or in combination with other proponents proposals.
5. Energex will publicly announce the outcome of the evaluation process. This announcement will be published on Energex's website and will include a summary of all submissions. Energex view the information provided as part of submissions to the NNOR as Commercial-in-Confidence and as such will not publish the capital and operating costs associated with a proponents proposal.

## 1.3. Contact Details

Submissions in writing are due by 4pm on **15 May 2020** and should be lodged to demandmanagement@energex.com.au.

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P: 13 74 66



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# 2. BACKGROUND

## 2.1. Geographic Region

SSJBB BS supplies North Maclean, Lyons, Cedar Grove, Munruben and Undullah areas and the surrounding area. SSJBB BS provides electricity supply to approximately 22,925 customers, of which 77% are residential and 23% are commercial, agricultural and industrial.

SSBDS supplies Maroon, Kooralbyn, Tamrookum, Laravale, Bromelton, Kerry, Beaudesert, Tabragalba, Witheren, Eagle Heights, Mount Tamborine, Flying fox, O'Reilly areas and the surrounding area. Beaudesert Bulk Substation provides electricity supply to approximately 11,098 customers of which 37% are residential and 63% are commercial, agricultural and industrial.

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

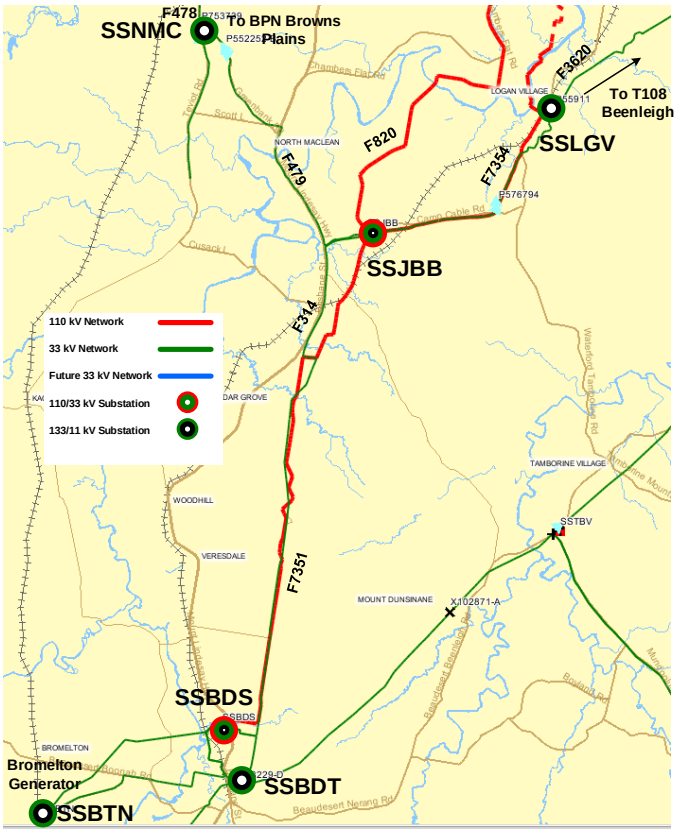


**Figure 1: Existing network arrangement (geographic view)**



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## 2.2. Existing Supply System

SSNMC, SSJBB and SSLGV are currently supplied from SSJBB BS. Only one 110/33kV 80MVA transformer supports these substations at SSJBB BS. SSJBB BS is presently supplied via two incoming 110kV feeders from SSH22, and there is one outgoing 110kV feeder from SSJBB BS which provides supply to SSBDS.

SSJBB BS and SSJBB are located at the same site. SSJBB BS has an outdoor 110kV Gas Insulated Switchgear (GIS) and one 110/33kV 80MVA transformer. It also consists of a 110kV control room (Control Building 3). SSJBB has two indoor 33kV and 11kV switchgear and control room (Control Building 1 and 2) and two 33/11kV transformers, 1 x 25 MVA transformer (TR 2) and 1x15 MVA transformer (TR 1).

SSBDS supplies Bromelton (SSBTN), Beaudesert (SSBDT), Mount Tamborine (SSMTB), Innisplain (SSIPL) and Tamborine Village (SSTBV) zone substations. Only one 110kV feeder F7351 supplies SSBDS from SSJBB BS and one 33kV feeder F314 connects SSJBB and SSBDS.

SSBDS has an outdoor 110kV switchyard with steel structures, one 110/33 kV 60 MVA transformer and one 110/33 kV 80 MVA transformer. SSBDS also has two indoor 33kV switchgear and control room.

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



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**Figure 3**.



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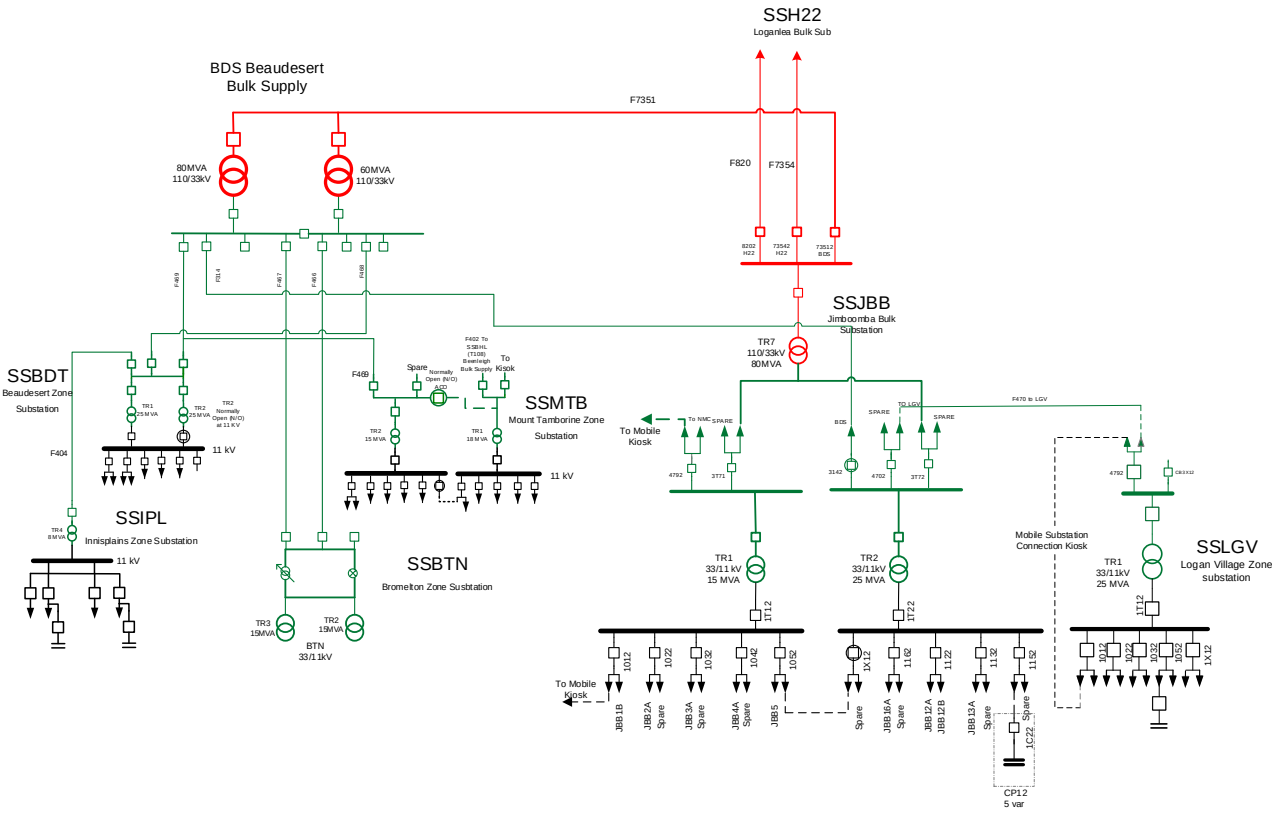


**Figure 2: Existing network arrangement (schematic view)**


**Figure 3:SSJBB BS (geographic view)**



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## 2.3. Load Profiles / Forecasts

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

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

### 2.3.1. Full Annual Load Profile

The full annual load profile for Jimboomba Substation over the 2020/21 financial year is shown in Figure 4. It can be noted that the peak load occurs during summer.

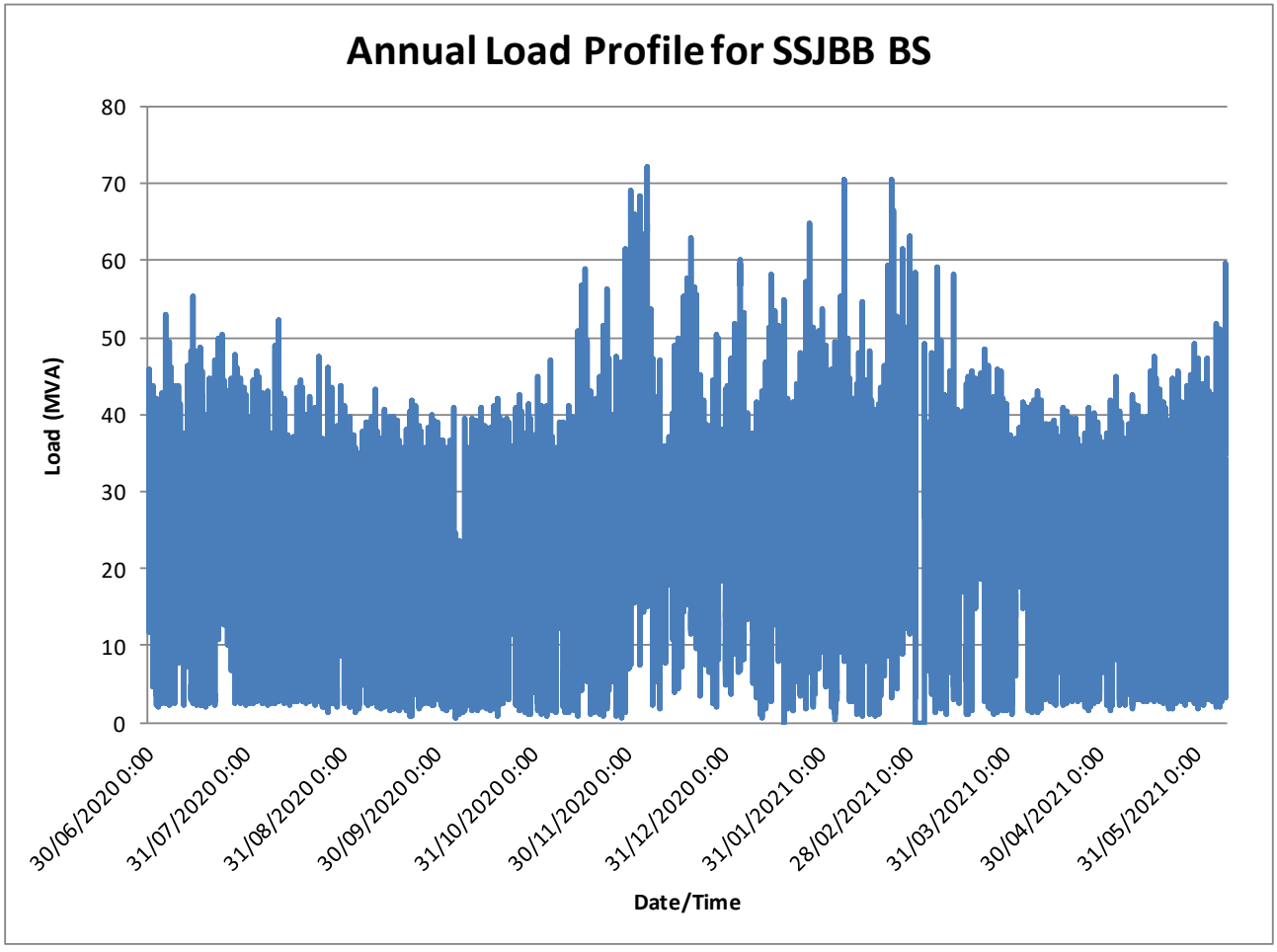


**Figure 4: SSJBB BS actual annual load profile**

The full annual load profile for Beaudesert Substation over the 2020/21 financial year is shown in Figure 5.



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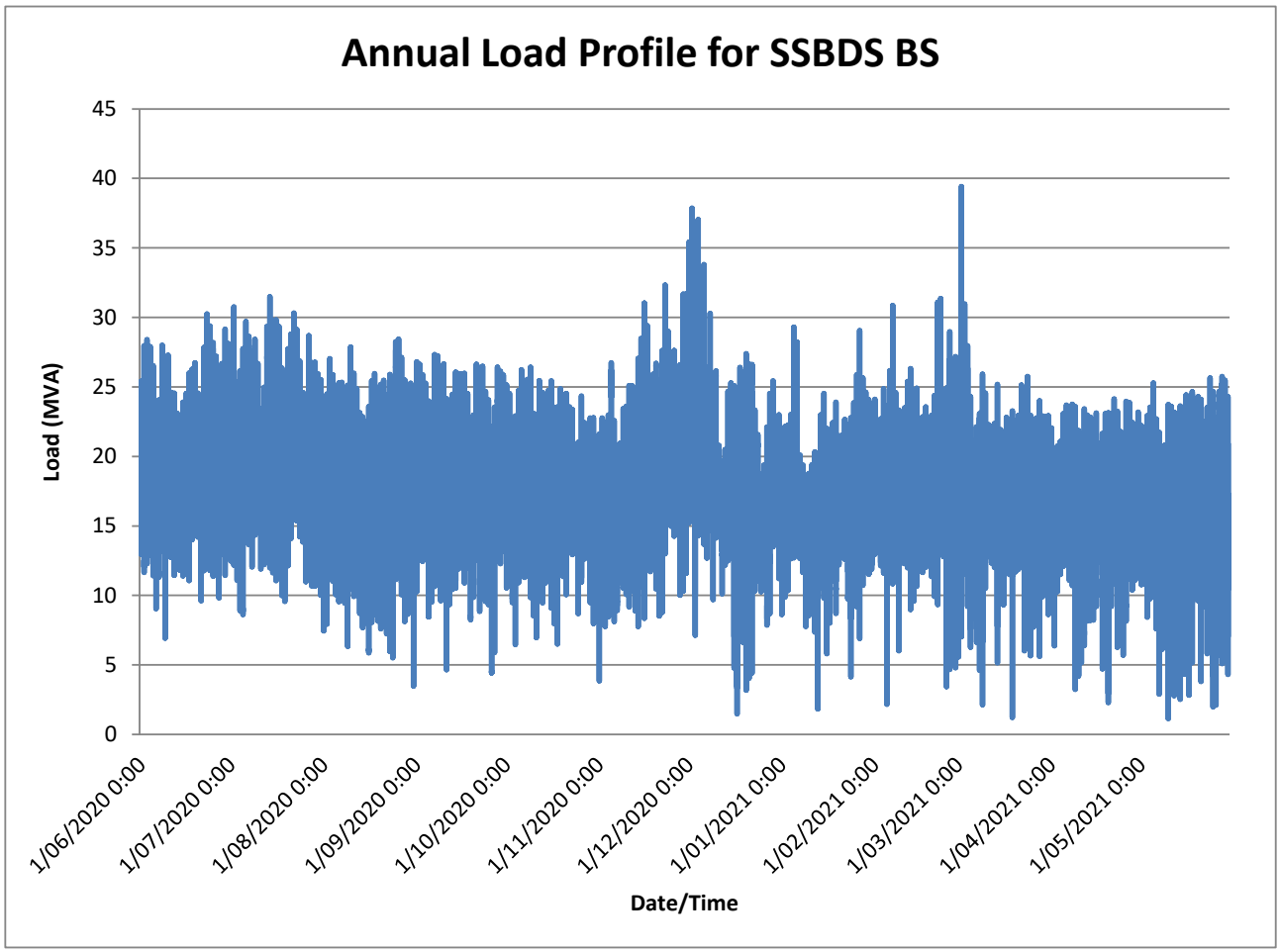
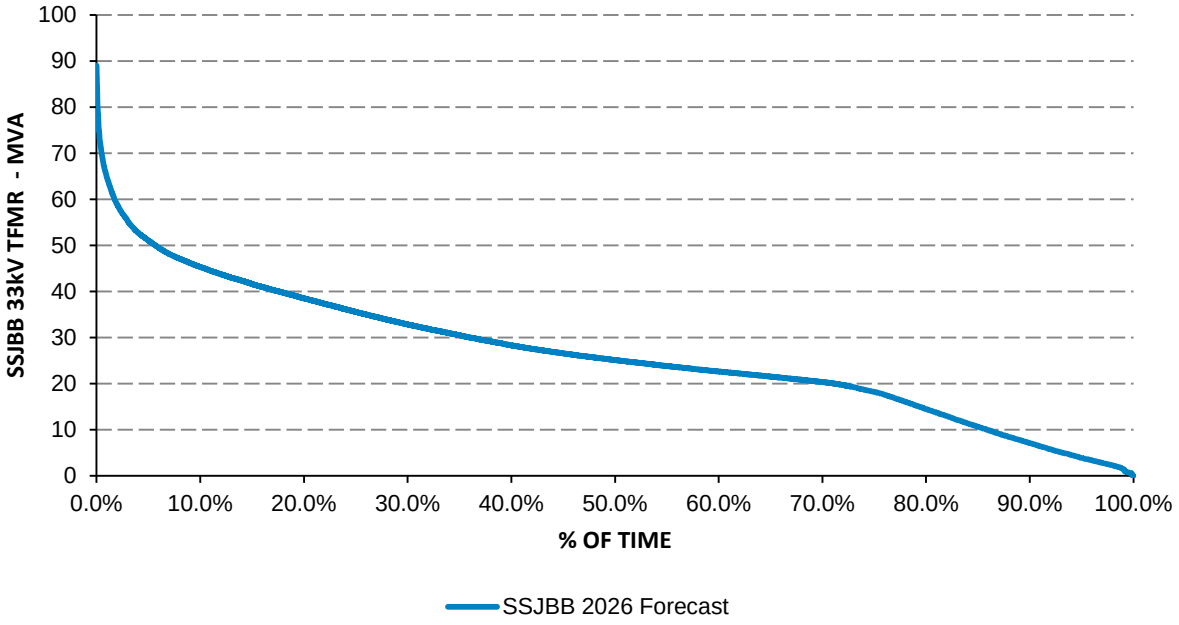



**Figure 5: SSBDS actual annual load profile**

### 2.3.2. Load Duration Curve

The load duration curve for SSJBB BS and SSBDS under System Normal and contingency is shown in *The values for SSJBB BS have been scaled to the 2026 peak forecast load of 89MVA (10% POE). 2026 is the year the identified need first appears at SSJBB BS.

**Figure 6** and Figure 7. These are based on the previous 3 years of data and are scaled to their respective maximum 10% Probability of Exceedance (10PoE) and 50% Probability of Exceedance (50PoE) forecasts.




*The values for SSJBB BS have been scaled to the 2026 peak forecast load of 89MVA (10% POE). 2026 is the year the identified need first appears at SSJBB BS.

**Figure 6: Substation load duration curve for SSJBB BS**



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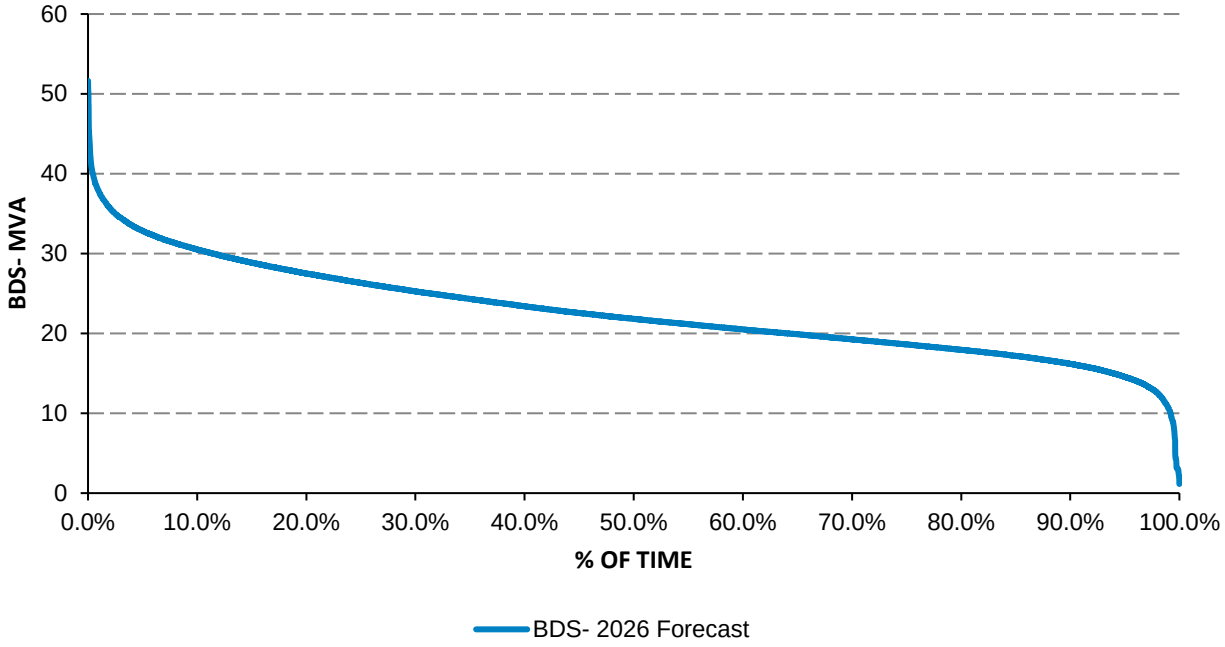


*The values for SSBDS BS have been scaled to the 2026 peak forecast load of 51.6 MVA (50% POE). 2026 is the year the identified need first appears at SSBDS BS.

**Figure 7: Substation load duration curve for SSBDS**



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### 2.3.3. Average Peak Weekday Load Profile (Summer)

The daily load profile for an average peak weekday during summer is illustrated below in Figure 8. It can be noted that the summer peak loads at SSJBB BS are historically experienced in the late afternoon and evening.

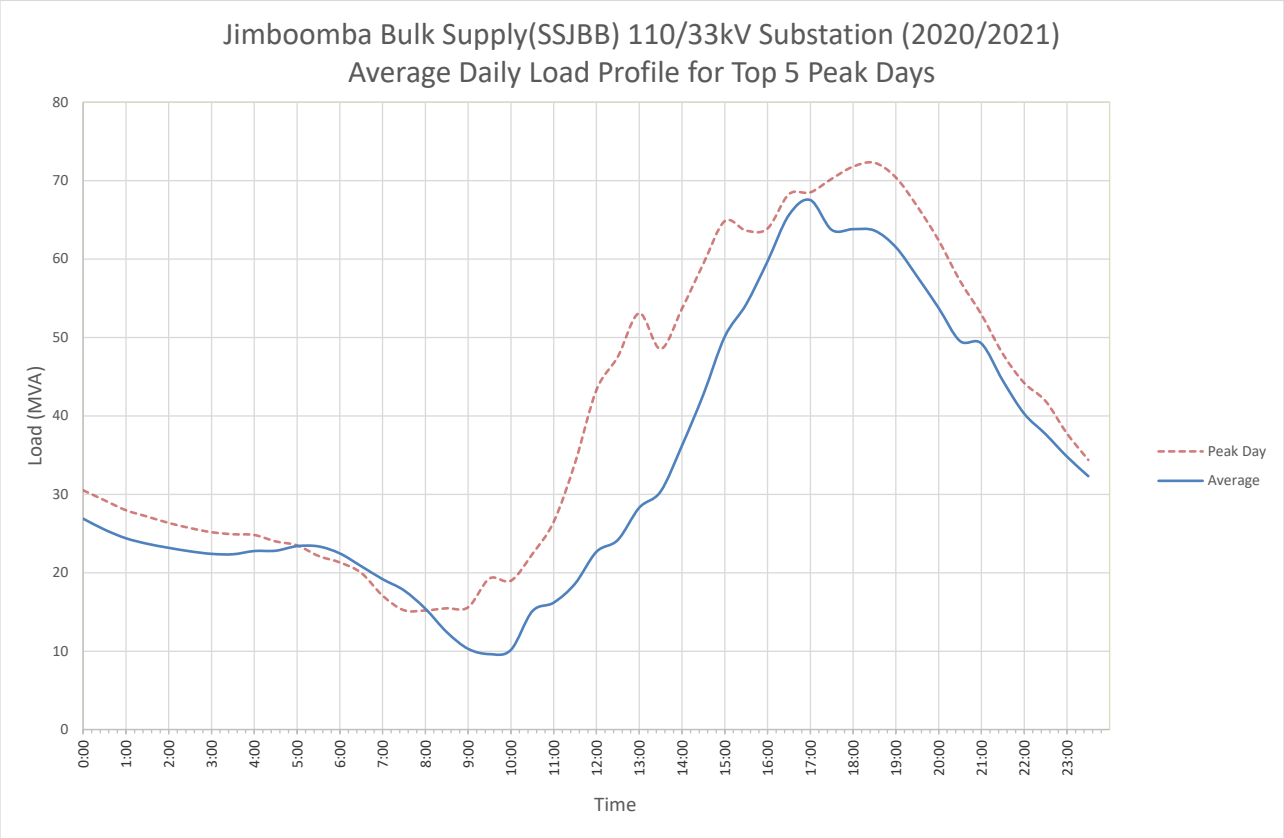


**Figure 8: Substation average peak weekday load profile (summer)**

The daily load profile for an average peak weekday during summer is illustrated below in Figure 9. It can be noted that the summer peak loads at SSBDS are historically experienced in the late afternoon and evening.



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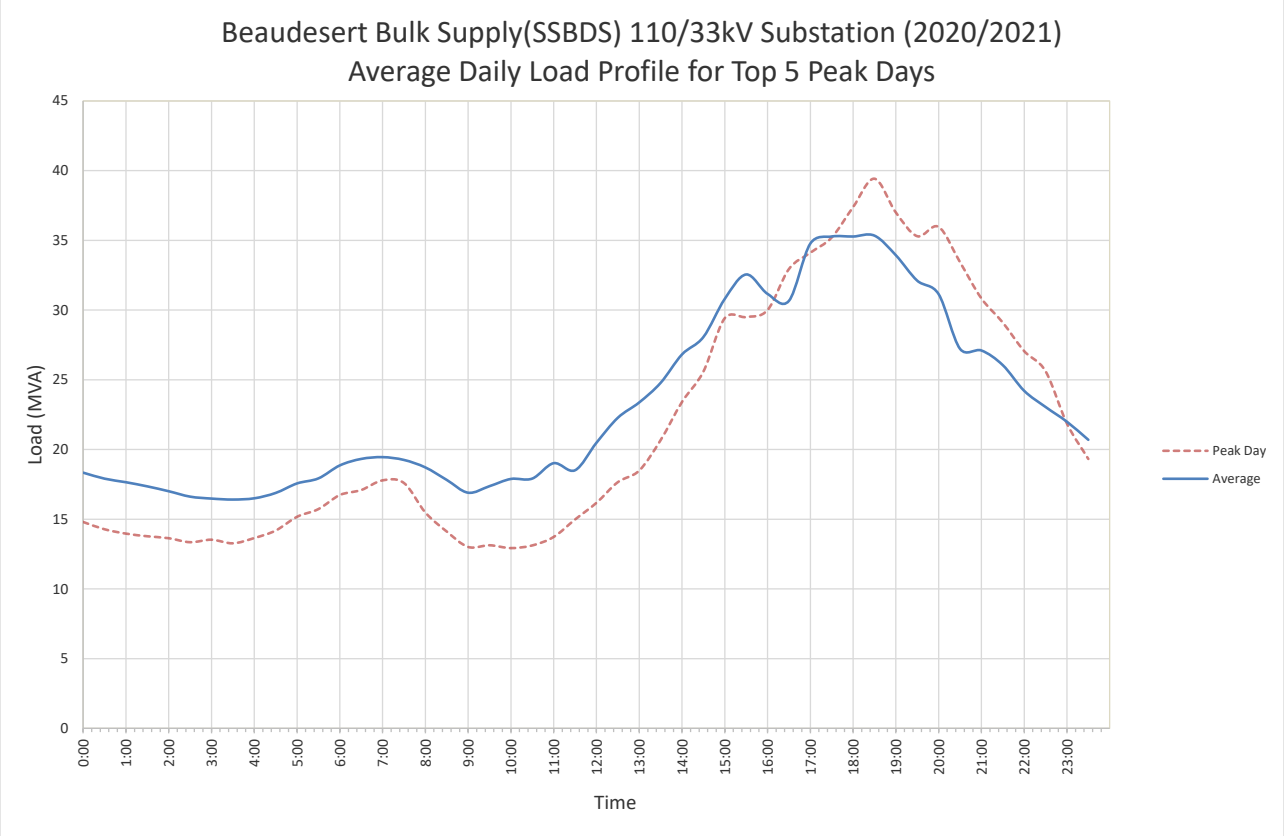


**Figure 9: Substation average peak weekday load profile (summer) Peak**



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### 2.3.4. Base Case Load Forecast

The 10 PoE and 50 PoE load forecasts for the base case load growth scenario for Jimboomba Bulk Supply are illustrated in Figure 10. 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 SSJBB BS 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. The drop in 2024 is due to the reduce in load because of permanent transfer of SSLGV to SST108.

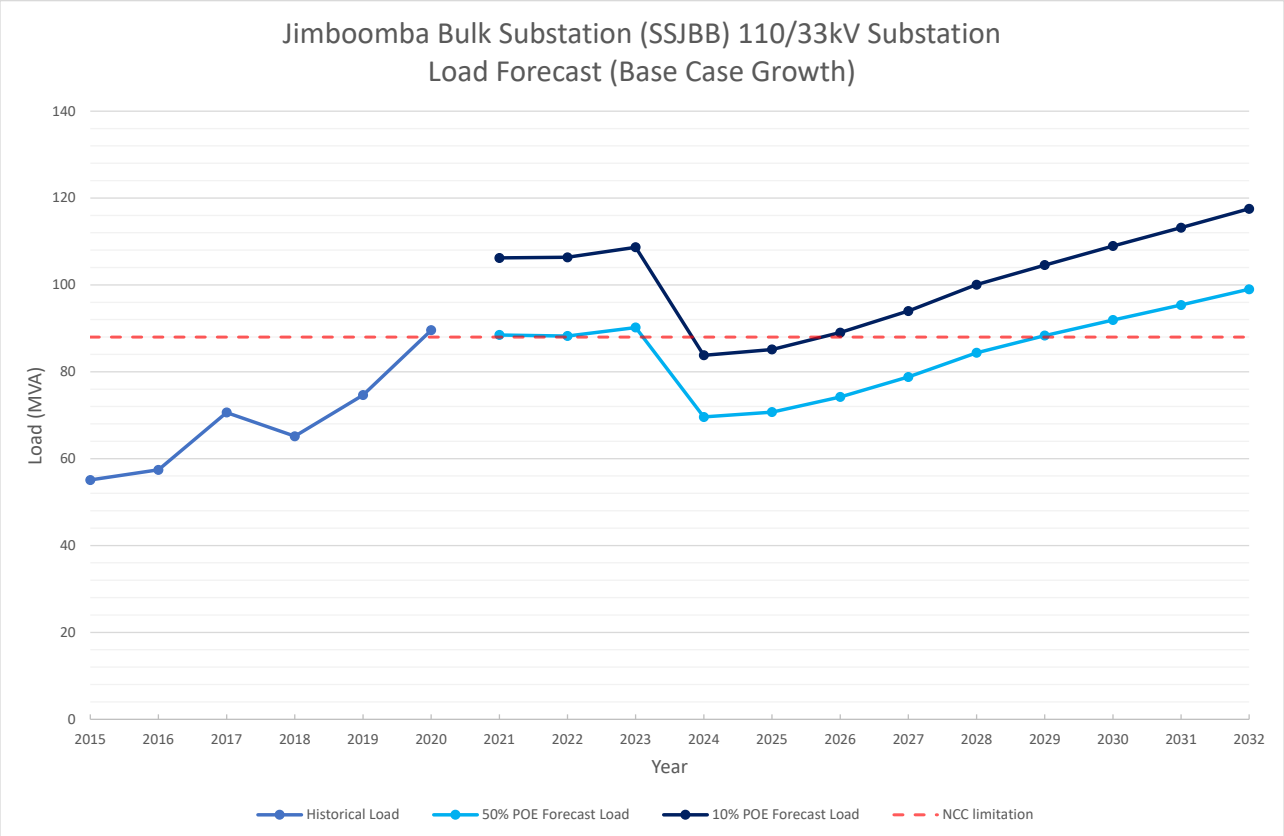


**Figure 10: SSJBB BS base case load forecast**

The 10 PoE and 50 PoE load forecasts for the base case load growth scenario for Beaudesert Bulk Supply are illustrated in 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 Beaudesert Bulk 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.



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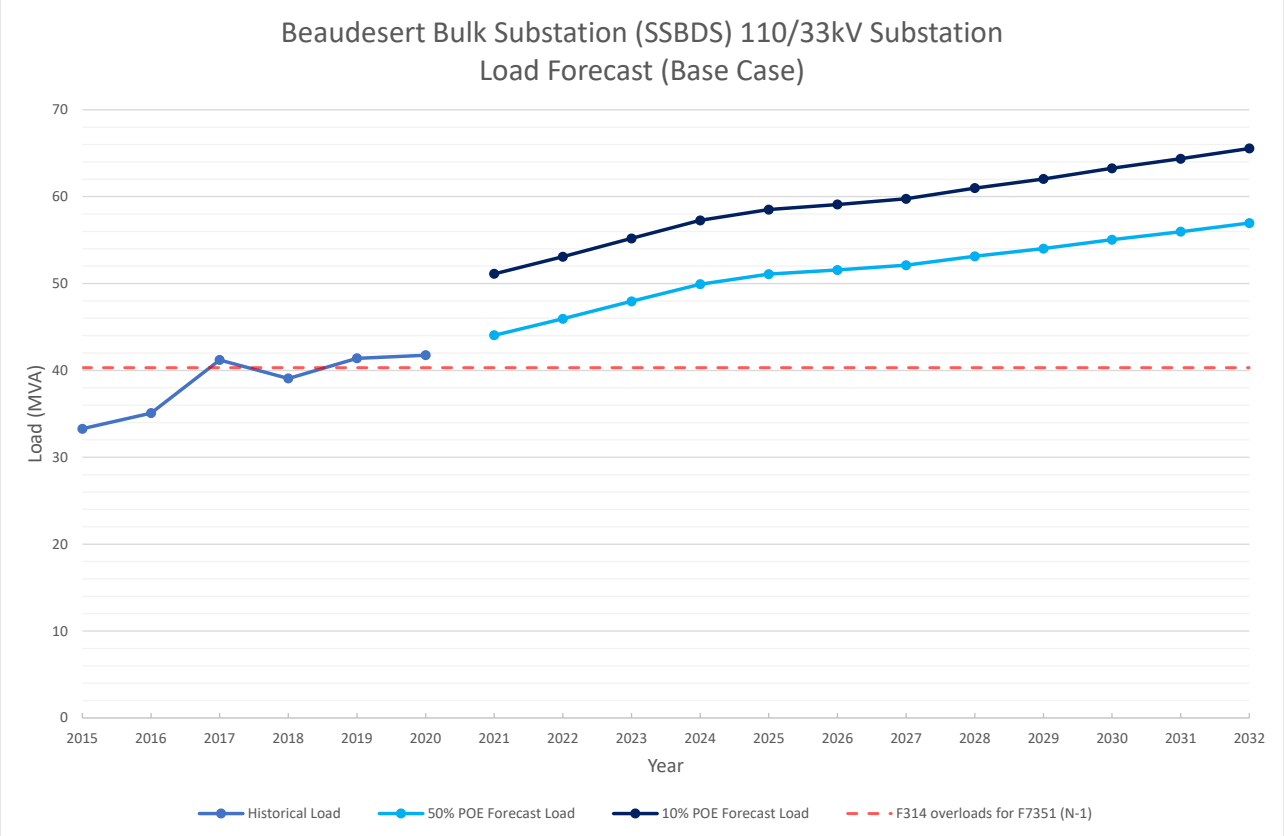


**Figure 11: SSBDS base case load forecast**

### 2.3.5. High Growth Load Forecast

The 10 PoE and 50 PoE load forecasts for the high load growth scenario for Jimboomba and Beaudesert Bulk Supply are illustrated in Figure 12 and Figure 13. With the high growth scenario, the peak load is forecast to increase over the next 10 years.

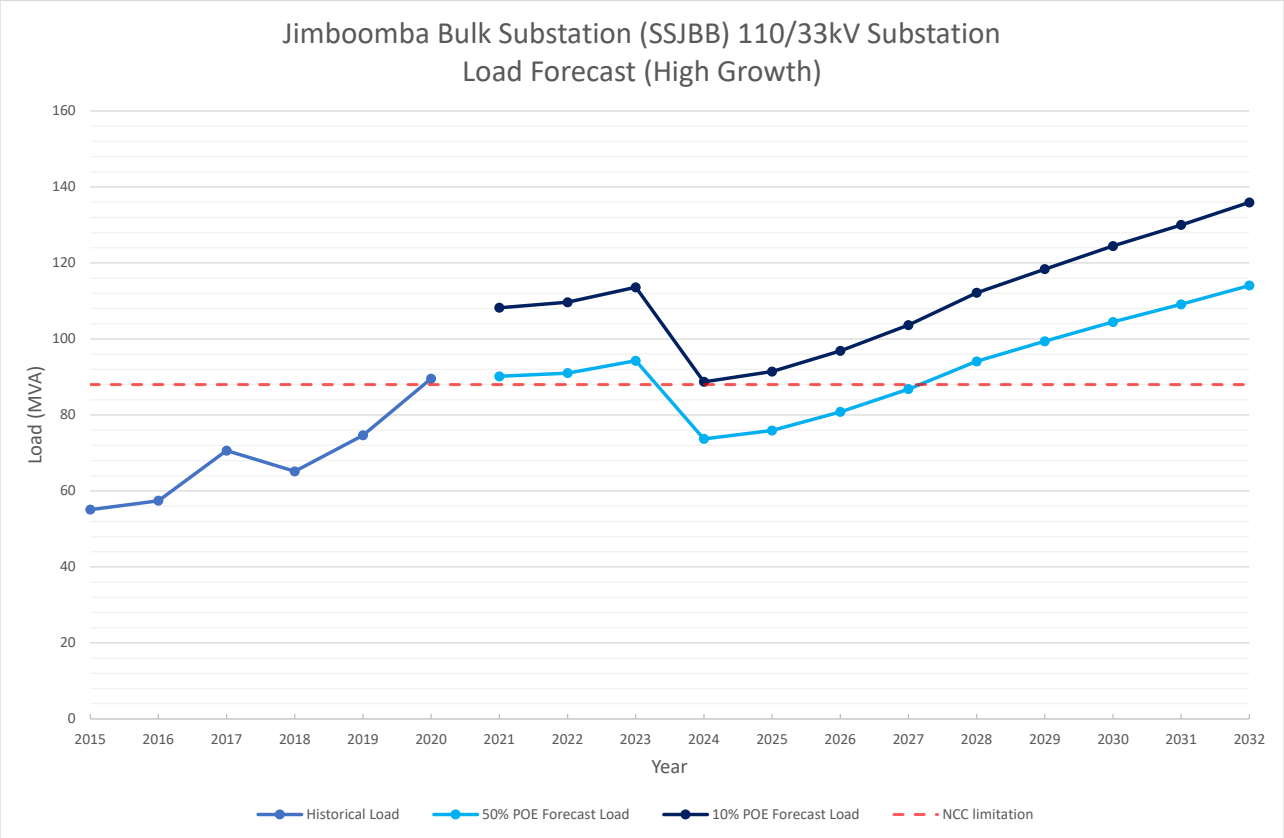


**Figure 12: SSJBB BS high growth load forecast**

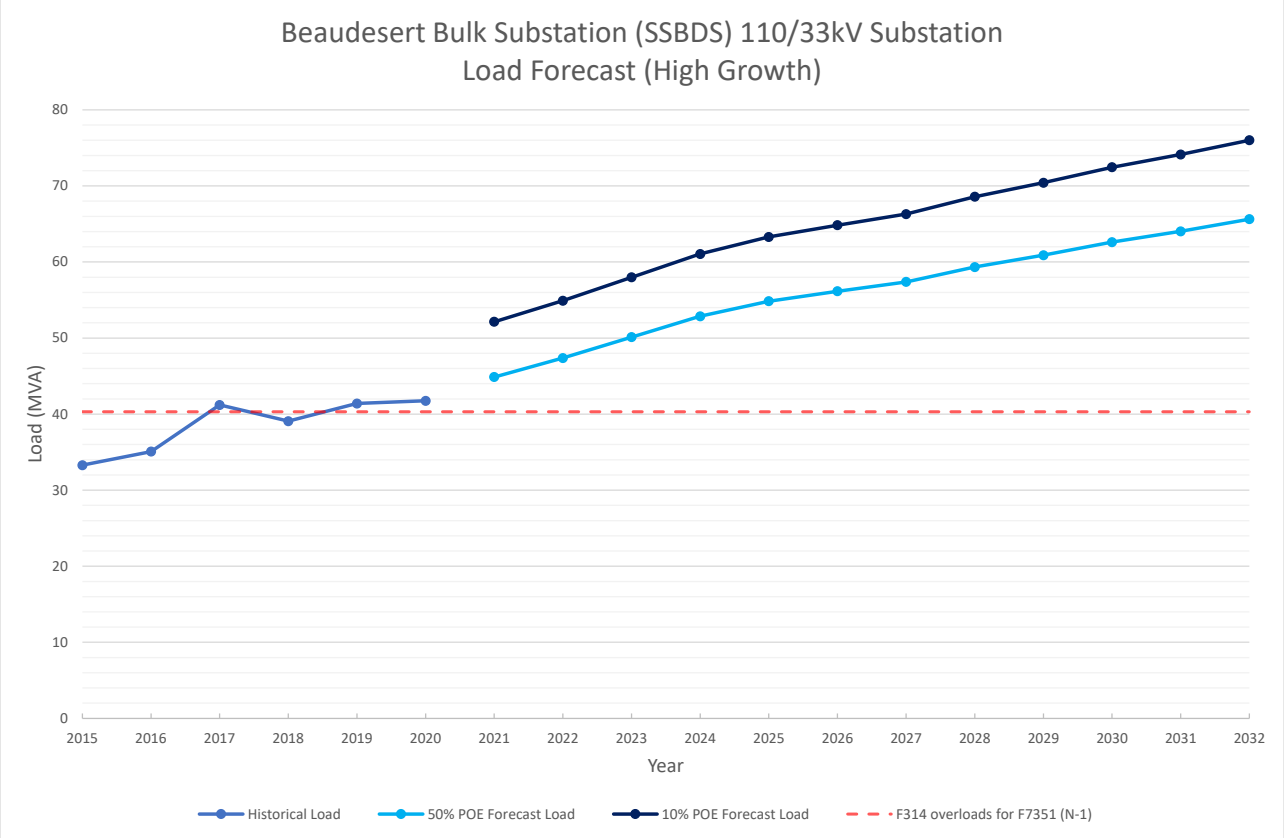


**Figure 13: SSBDS high growth load forecast**

### 2.3.6. Low Growth Load Forecast

The 10 PoE and 50 PoE load forecasts for the low load growth scenario for Jimboomba and Beaudesert Bulk Supply are illustrated in Figure 14 and Figure 15. With the low growth scenario, the peak load is forecast to remain relatively steady over the next 10 years.

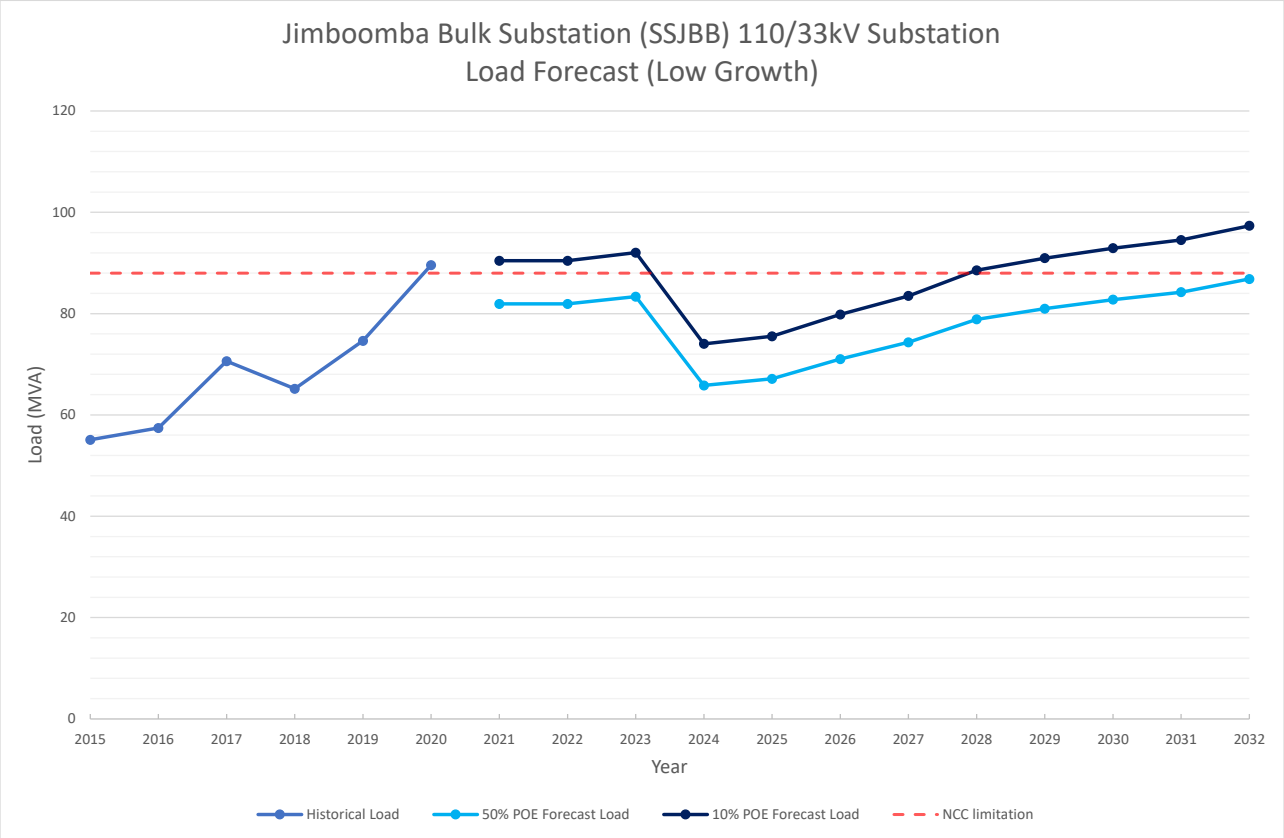


**Figure 14: SSJBB BS low growth load forecast**

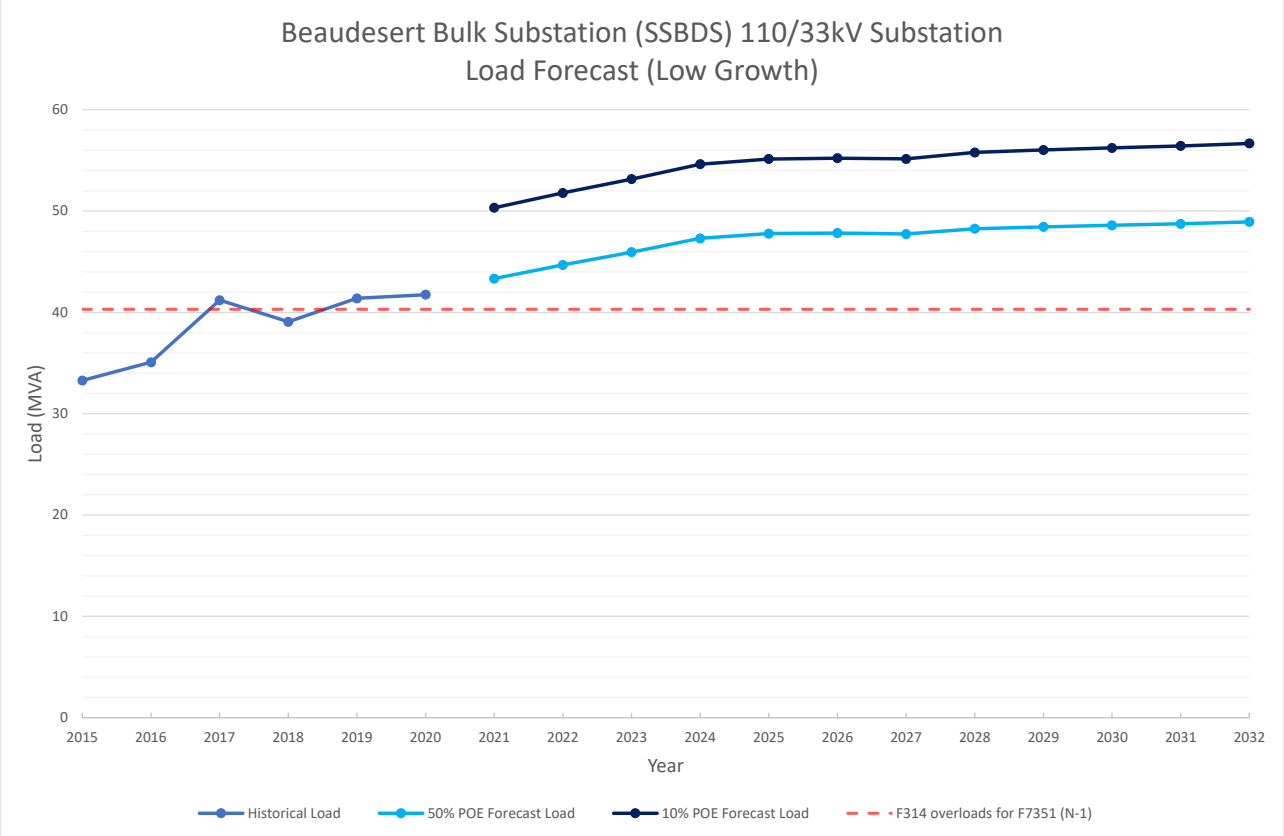


**Figure 15: SSBDS low growth load forecast**

# 3. IDENTIFIED NEED

## 3.1. Description of the Identified Need

### 3.1.1. Safety Net Non-Compliance

The existing supply to the Jimboomba area does not meet the Safety Net under System Normal. Under a credible contingency event for an outage of the 110/33kV transformer at SSJBB BS benchmarked against 50% POE load, Energex will not be able to meet Safety Net restoration times as 33kV feeder F478 (Browns Plains bulk supply substation to SSNMC) does not have sufficient capacity to supply the total load of SSJBB TR1 and SSNMC for an outage of the 110/33kV transformer at SSJBB BS .

Also, under a credible contingency event (such as for an outage of 110kV feeder F7351) benchmarked against 50% POE load, Energex will not be able to meet Safety Net restoration times, as 33kV feeder F314 (SSJBB-SSBDS) does not have sufficient capacity to supply the SSMTB TR1, SSBTN and SSBDT after the contract for the network support agreement expires in 2025.

## 3.2. Quantification of the Identified Need

### 3.2.1. Safety Net Non-Compliance

**SSJBB BS System Limitations**

SSJBB BS is equipped with one 80MVA 110/33kV transformer. The Normal Cyclic Capacity is 88MVA. The substation capacity is limited by the transformers and provides a Normal Cyclic Capacity (NCC), Emergency Cyclic Capacity (ECC), Two Hour Emergency Capacity (2HEC) as below:

- Normal Cyclic Capacity (NCC) – 88MVA
- Emergency Cyclic Capacity (ECC) – 0MVA
- 2 Hour Emergency Capacity (2HEC) – 0MVA

In the event of an outage of the 80MVA 110/33kV transformer at Jimboomba Bulk Supply, the following transfers are implemented:

- SSLGV 33kV Auto Changeover (ACO) will operate to restore supply to SSLGV via F3620 to SST108.

  Note: From 2023/24 SSLGV will be permanently transferred to SST108.

- Check SSJBB 33kV ACO has operated to restore supply to TR2 at SSJBB via F314 to SSBDS Bulk.



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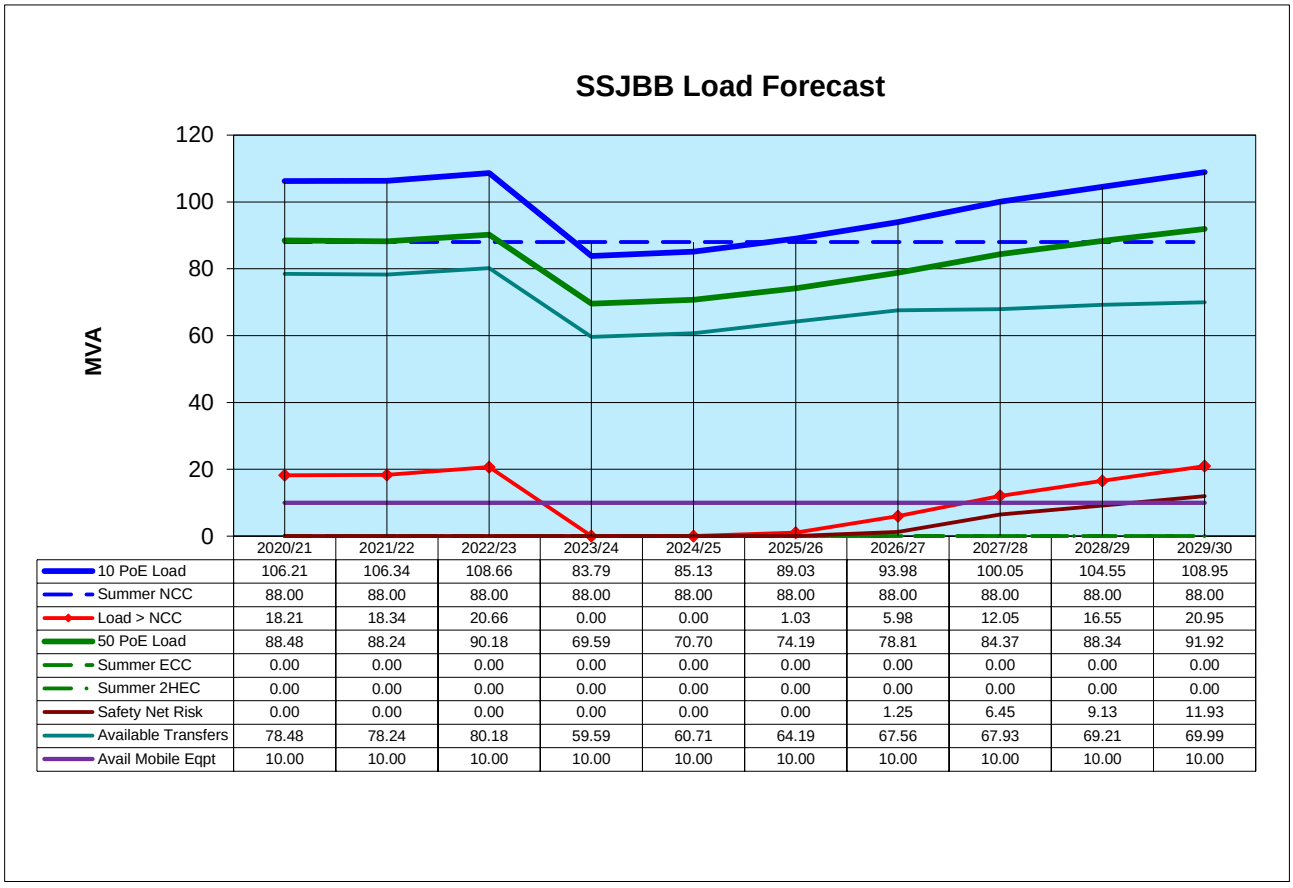
- 33kV ACO will be installed in 2024 to restore supply to SSJBB TR1 via F479 (SSNMC-SSJBB) and F478 (SSBPN-SSNMC) to SSBPN Bulk. Feeder POPs (Plant overload protection scheme) will be installed in 2024 to cater for the overload of F478 for the loss of a transformer at JBB BS. F478 will overload (supplying JBB TR1 and NMC for the loss of a transformer at SSJBB BS) in 2026/27 even after the installation of feeder POPS.
- SSNMC 33kV ACO would operate to restore supply to SSNMC via F478 and F479 to BPN Bulk Supply.

Figure 16 illustrates that there is a system normal load at risk (LAR) limitation with the existing transformer at SSJBB BS from 2025/26. There is also Safety Net limitation for an outage of a transformer at SSJBB BS from 2026/27. It should be noted that the reduction in load forecast that occurs in 2023/24 is a result of SSLGV being transferred to adjacent bulk supply substations.




| | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 PoE Load | 106.21 | 106.34 | 108.66 | 83.79 | 85.13 | 89.03 | 93.98 | 100.05 | 104.55 | 108.95 |
| Summer NCC | 88.00 | 88.00 | 88.00 | 88.00 | 88.00 | 88.00 | 88.00 | 88.00 | 88.00 | 88.00 |
| Load > NCC | 18.21 | 18.34 | 20.66 | 0.00 | 0.00 | 1.03 | 5.98 | 12.05 | 16.55 | 20.95 |
| 50 PoE Load | 88.48 | 88.24 | 90.18 | 69.59 | 70.70 | 74.19 | 78.81 | 84.37 | 88.34 | 91.92 |
| Summer ECC | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Summer 2HEC | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Safety Net Risk | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.25 | 6.45 | 9.13 | 11.93 |
| Available Transfers | 78.48 | 78.24 | 80.18 | 59.59 | 60.71 | 64.19 | 67.56 | 67.93 | 69.21 | 69.99 |
| Avail Mobile Eqpt | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |

**Figure 16: Safety Net Analysis for SSJBB BS**

Figure 16 illustrates that there is an NCC load at risk (LAR) limitation with the existing transformers at SSJBB BS from 2025/26. There is also Safety Net limitation for an outage of a transformer at SSJBB BS from 2026/27.



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SSJBB BS can supply up to 88MVA with its transformer in service under system normal. Under system N-1 where one transformer has an outage in 2025/26, the load at SSJBB BS can be supplied by 64.19 MVA of available automatic transfers and 10MVA of mobile generation, to meet Energex's Safety Net obligations.

Figure 17 shows that approximately 0.01% of the time in 2025/26 the 10PoE load is forecast to be above the 88MVA limit.

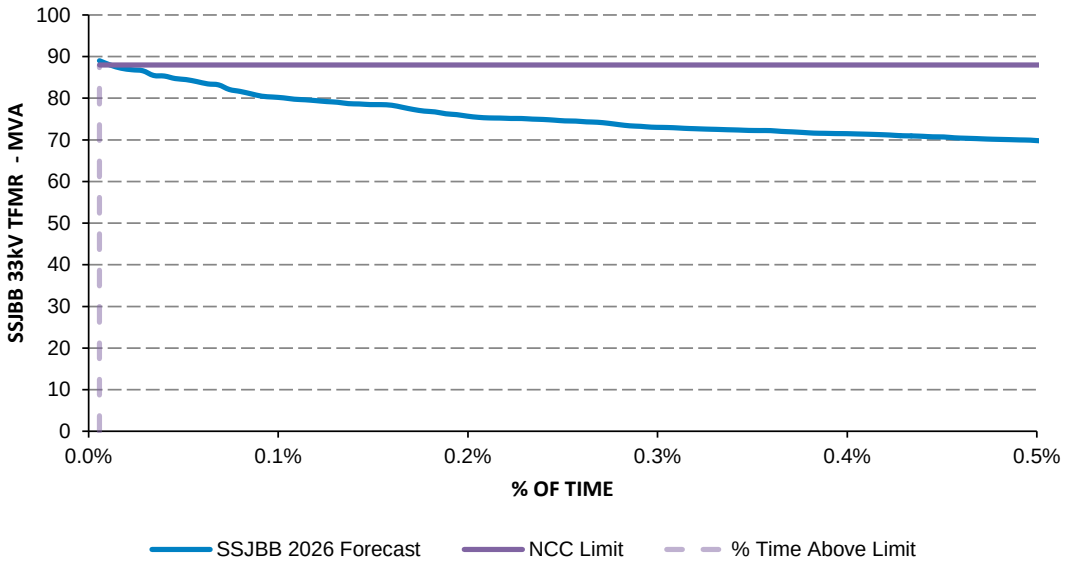


**Figure 17: Load Duration Curve SSJBB BS in 2026 with NCC Limit**



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Figure 18 shows that approximately 0.01% of the time in 2026/27 the 50PoE load is forecast to be above the 77.6 MVA limit.

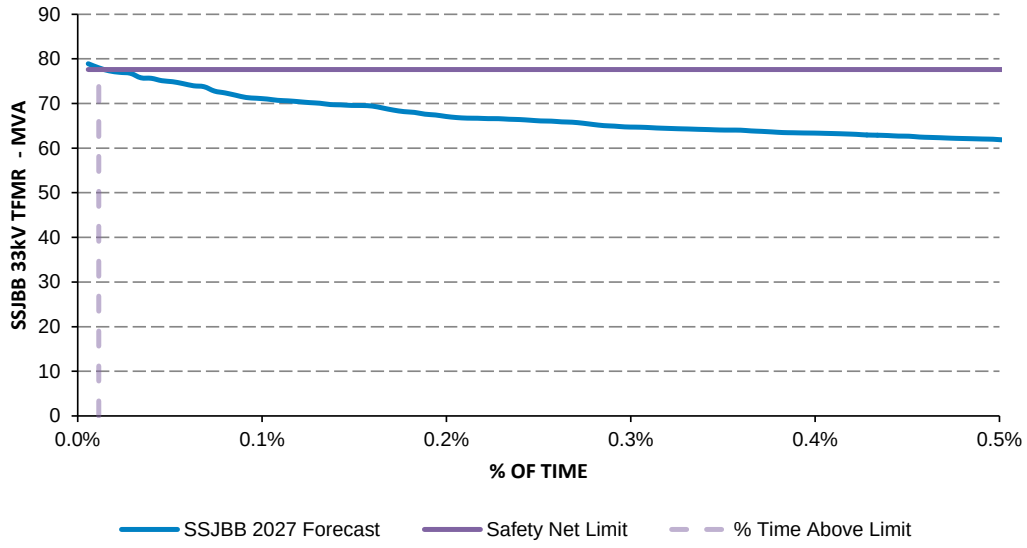



**Figure 18: Load Duration Curve SSJBB BS in 2027 with Safety Net Limit**

Figure 19 shows that as the load increases each year at JBB BS, the limit is surpassed for a longer duration per year for 10% POE against system normal capacity.

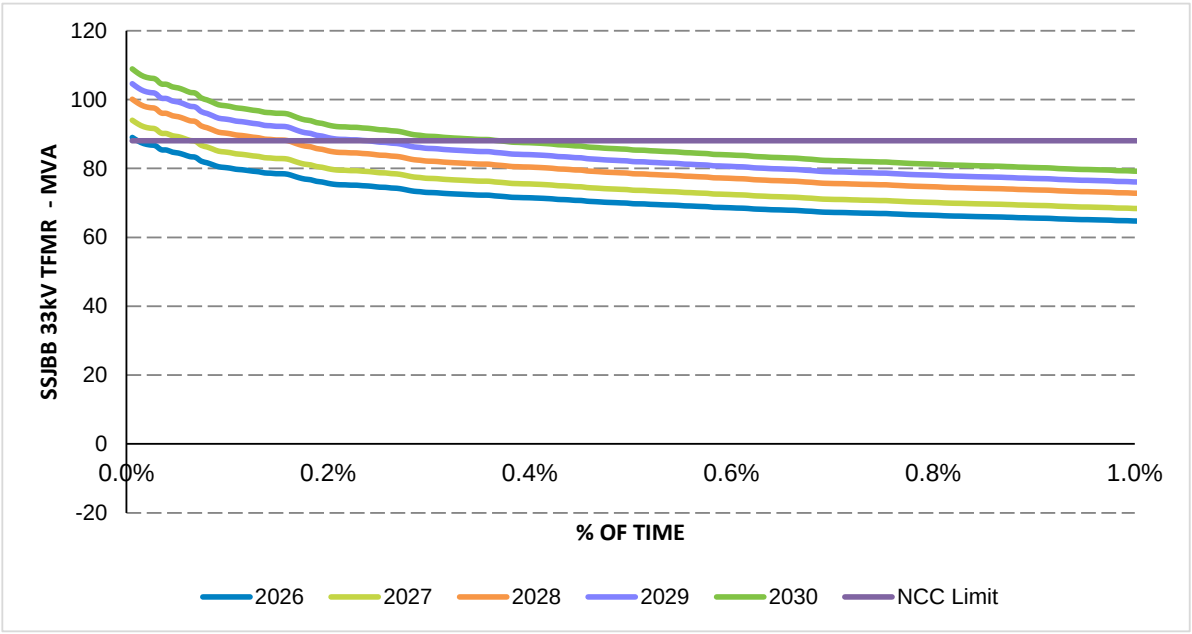



**Figure 19: Load Duration Curve for JBB BS from 2026 – 2030 (10% POE load)**

Table 4 illustrates that the amount of time support would be required is forecast to start with 1 day in 2025/26 and increases to 48 days by 2030/31 under system normal.

| Year | Forecast 10 PoE Load (MVA) | Security Standard Load At Risk (MVA) | Days/Yr Above Limit | % Time Above Limit | Hrs Over Limit |
|---|---|---|---|---|---|
| 2023/24 | 83.8 | 0.0 | - | - | - |
| 2024/25 | 85.1 | 0.0 | - | - | - |
| 2025/26 | 89.0 | 1.0 | 1 | 0.01% | 0.5 |
| 2026/27 | 94.0 | 6.0 | 4 | 0.06% | 5.5 |
| 2027/28 | 100.1 | 12.1 | 7 | 0.16% | 14 |
| 2028/29 | 104.6 | 16.6 | 9 | 0.23% | 20.5 |
| 2029/30 | 108.9 | 20.9 | 14 | 0.37% | 32.5 |
| 2030/31 | 113.2 | 25.2 | 20 | 0.55% | 48 |

**Table 4: Forecast duration load will be at risk under System Normal for SSJBB BS**

Table 5 illustrates that the amount of time support would be required is forecast to start with 1 day in 2026/27 and increases to 19 days by 2030/31 under system contingency at SSJBB BS.

| Year | Forecast 50 PoE Load (MVA) | Security Standard Load At Risk (MVA) | Days/Yr Above Limit | % Time Above Limit | Hrs Over Limit |
|---|---|---|---|---|---|
| 2023/24 | 69.6 | 0.0 | - | - | - |
| 2024/25 | 70.7 | 0.0 | - | - | - |
| 2025/26 | 74.2 | 0.0 | - | - | - |
| 2026/27 | 78.8 | 1.3 | 1 | 0.01% | 1 |
| 2027/28 | 84.4 | 6.4 | 4 | 0.07% | 6 |
| 2028/29 | 88.3 | 9.1 | 6 | 0.10% | 9 |
| 2029/30 | 91.9 | 11.9 | 7 | 0.17% | 14.5 |
| 2030/31 | 95.4 | 14.8 | 9 | 0.22% | 19 |

**Table 5: Forecast duration load will be at risk under System Contingency for JBB BS (loss of 110/33kV transformer at JBB BS)**



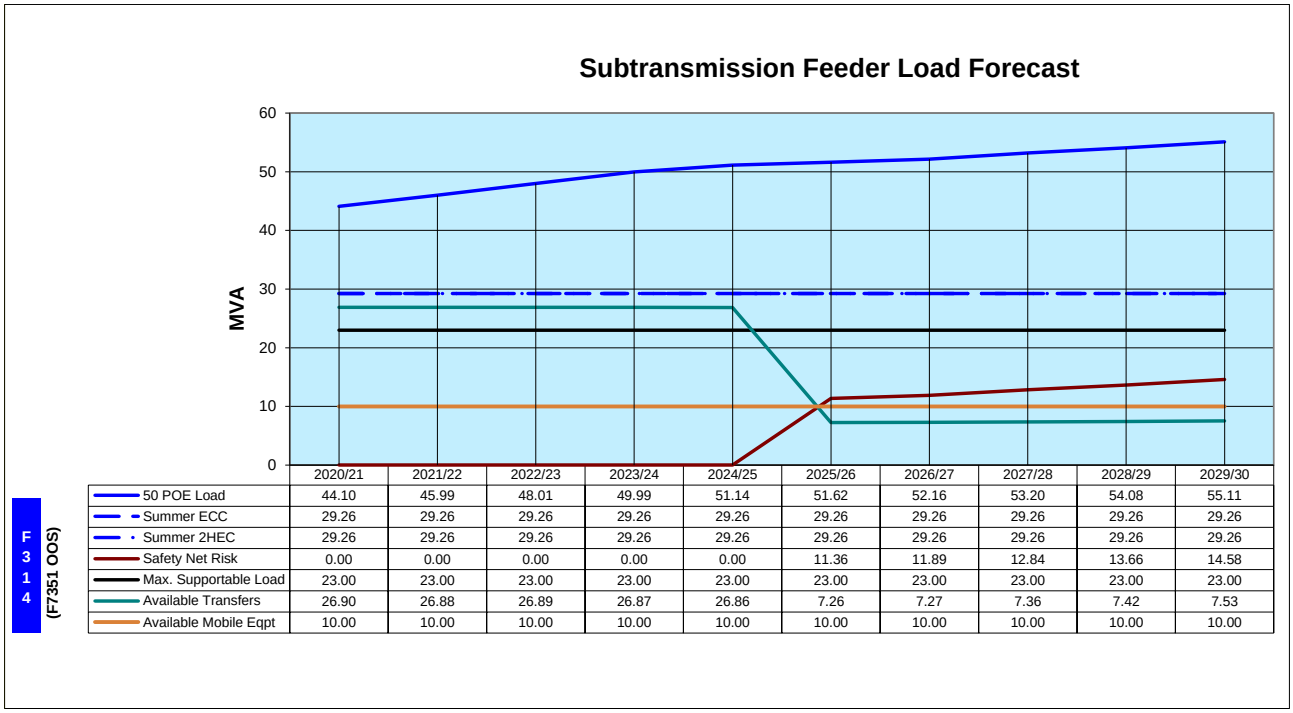
Energex Corporation Limited ABN 50 087 646 062

### SSBDS System Limitations

For an outage of feeder F7351, there will be a loss of supply of SSBDS; and in turn a loss of supply to SSBDT, SSBTN, SSIPL and SSMTB Bus 2. To restore supply, the following strategy is undertaken:

- An Auto Changeover (ACO) scheme is used to transfer Bus 2 of SSMTB to SST108, restoring approximately 7MVA.
- During peak load conditions, SSLGV is transferred to SST108 and SSNMC is transferred to SSBPN through remote transfers to provide optimal support to the SSBDS network.
- F314 is used to remotely transfer the entire load of SSBTN and a portion of SSBDT from the 110kV network to the 33kV network. Note: F314 is rated to Summer NCC of 512A (29.26 MVA). However, due to the length of the feeder and the resultant voltage drop issues, only 23 MVA can be supplied by F314.

Energex currently has a network support agreement for the back-up supply to SSBDS for the loss of F7351. The agreement is due to expire in 2025. Figure 20 shows the limitations on F314 when transferring load from F7351 under a contingency. The reduction in available transfers from 2025/26 onwards is due to the expiry of this support agreement.




F314 (F7351 OOS)

| | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 POE Load | 44.10 | 45.99 | 48.01 | 49.99 | 51.14 | 51.62 | 52.16 | 53.20 | 54.08 | 55.11 |
| Summer ECC | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 |
| Summer 2HEC | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 | 29.26 |
| Safety Net Risk | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 11.36 | 11.89 | 12.84 | 13.66 | 14.58 |
| Max. Supportable Load | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 |
| Available Transfers | 26.90 | 26.88 | 26.89 | 26.87 | 26.86 | 7.26 | 7.27 | 7.36 | 7.42 | 7.53 |
| Available Mobile Eqpt | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |

**Figure 20: Safety Net Analysis for F314 (Loss of a 110kV feeder F7351)**

Figure 23 shows that approximately 0.038% of the time in 2025/26 the 50PoE load for F314 is forecast to be above the 40.3 MVA limit.

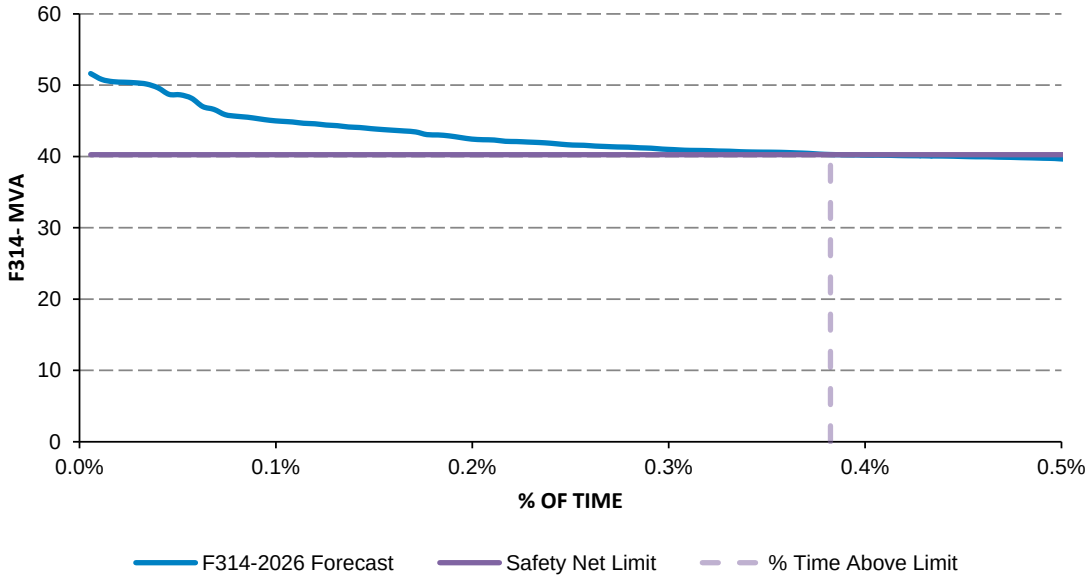



**Figure 21: Load Duration Curve for F314 in 2026 with Safety Net Limit**

Figure 22 show that as the load increases each year, the limit is surpassed for a longer duration per year for 50% POE load forecast for F314 against N-1 contingency capacity respectively.

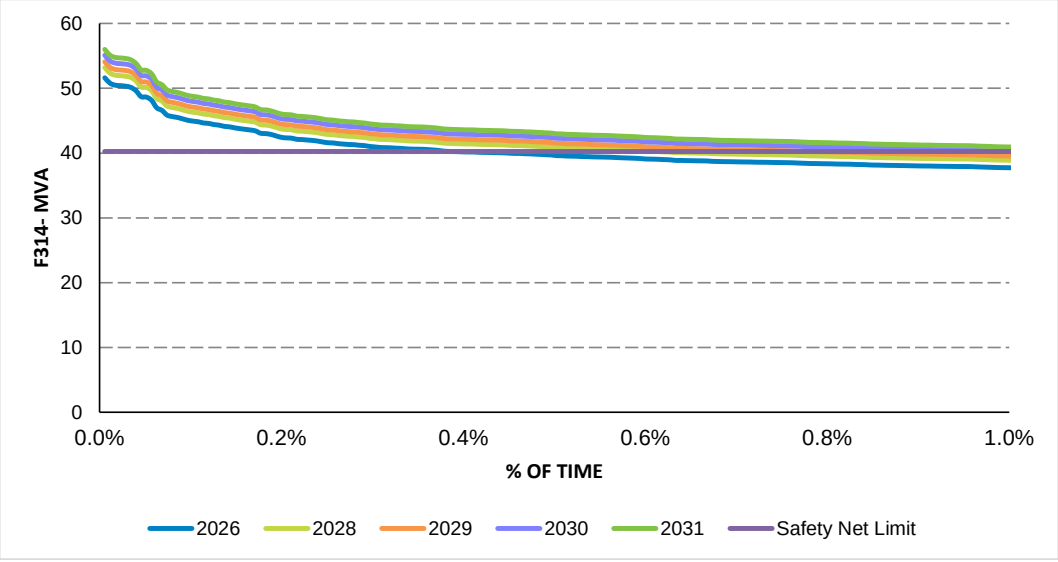


**Figure 22: Load Duration Curve for F314 from 2026 – 2030 (50% POE load)**

Table 6 illustrates that the amount of time support would be required is forecast to start with 33.5 day in 2025/26 and increases to 110 days by 2030/31 under system contingency (N-1) for F314.

| Year | Forecast 50 PoE Load (MVA) | Security Standard Load At Risk (MVA) | Days/Yr Above Limit | % Time Above Limit | Hrs Over Limit |
|---|---|---|---|---|---|
| 2023/24 | 50.0 | 0.0 | - | - | - |
| 2024/25 | 51.1 | 0.0 | - | - | - |
| 2025/26 | 51.6 | 11.40 | 13 | 0.38% | 33.5 |
| 2026/27 | 52.2 | 11.9 | 16 | 0.47% | 41.5 |
| 2027/28 | 53.2 | 12.8 | 20 | 0.61% | 53 |
| 2028/29 | 54.1 | 13.7 | 26 | 0.77% | 67.5 |
| 2029/30 | 55.1 | 14.6 | 33 | 1.01% | 88.5 |
| 2030/31 | 56.0 | 15.4 | 40 | 1.26% | 110 |

**Table 6: Forecast duration load will be at risk under System Contingency (N-1) for F314 (loss of F7351)**

## 3.3. 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.

### 3.3.1. Forecast Maximum Demand

It has been assumed that forecast peak demand at Jimboomba and Beaudesert Substation will be consistent with the base case forecast outlined in Section 2.3.4.

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.

### 3.3.2. Load Profile

Characteristic peak day load profiles shown in Section 2.3.3 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.



Energex Corporation Limited ABN 50 087 646 062

# 4. ASSESSMENT METHODOLOGY AND ASSUMPTIONS

## 4.1. Planning Criteria

Energex's Distribution Authority includes legislated Safety Net targets. The Safety Net targets provide a 'base-case' or minimum security criteria for the network to be planned to, and provide protection against low probability, high impact events. The Distribution Authority requires Energex to ensure "to the extent reasonably practical" compliance with the Safety Net criteria.

The purpose of the Safety Net planning criteria is to avoid unexpected customer hardship and/or significant community or economic disruption by mitigating the effects of credible contingencies largely on the sub-transmission network, which have a low probability of occurring and result in high consequence network outages. Additional investment beyond the Safety Net requirements would be driven based on an economic, reliability based Value of Customer Reliability (VCR) methodology. This approach is consistent with the recommendations from the National Reliability Framework.

There are three sets of Safety Net targets applicable to Energex: "CBD", "Urban" and "Short Rural", each having different timelines as shown below in Table 7. SSJBB Bulk Supply Substation is classed as 'Short Rural'.

| Area | Targets<br>(for restoration of supply following an N-1 Event) |
|---|---|
| CBD | Any interruption in customer supply resulting from an N-1 event at the sub-transmission level is restored within 1 minute. |
| Urban | Following an N-1 event, load not supplied must be:<br>○ No greater than 40MVA (16,000 customers) is without supply for more than 30 minutes;<br>○ No greater than 12MVA (5,000 customers) is without supply for more than 3 hours; and<br>○ No greater than 4MVA (1,600 customers) is without supply for more than 8 hours. |
| Short Rural | Following an N-1 event, load not supplied must be:<br>○ No greater than 40MVA (16,000 customers) is without supply for more than 30 minutes;<br>○ No greater than 15MVA (6,000 customers) is without supply for more than 4 hours; and<br>○ No greater than 10MVA (4,000 customers) is without supply for more than 12 hours. |
| **Note:** All modelling and analysis will be benchmarked against 50% POE loads and based on credible contingencies. | |

**Table 7: Energex service Safety Net targets**

## 4.2. 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.



Energex Corporation Limited ABN 50 087 646 062

## 4.3. 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 period. The identified need described in this Non-Network Options Report occurs in the 2020-2025 AER period, where the WACC is 2.62%.

## 4.4. Cost Estimates

Project costs are calculated using standard estimate components which are developed & evaluated by estimation teams in Energex. The costs are split into 2 components: direct cost, which is the costs which are 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.

## 4.5. Evaluation Test Period

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



Energex Corporation Limited ABN 50 087 646 062

# 5. INTERNAL OPTIONS CONSIDERED

## 5.1. 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 Jimboomba and Beaudesert areas to address the identified need.

## 5.2. Network Options and Hybrid Network and Non-Network Options Identified

Energex has identified 4 credible network options that will address the identified need.

### 5.2.1. Option 1: Install 2nd 80MVA 110/33kV transformer at SSJBB BS and establish a network support agreement

This is a hybrid option that includes:

- Establishing a 2nd 80MVA 110/33 kV transformer at Jimboomba Bulk Supply
- Installation of 110kV CBs:
  - 1 x transformer CB
  - 2 x 110kV feeder CBs
  - Note: one of the existing 110kV feeder breakers will be converted to a Bus breaker to connect to second bus section.
- Installation of a new 33kV indoor switch room consisting of:
  - 8 x 33kV feeder CBs
  - 2 x transformer CBs
  - 1 x 33kV bus section CB
- The 33kV switchgear at SSJBB is required to connect to the future Jimboomba West Zone Substation.
- Establish a network support agreement for the back-up supply to SSBDS for the loss of F7351
- Estimated capital cost: $13 million ± 40%
- Estimated operating cost per annum: $5,647. This excludes the cost of a network support agreement.

A schematic diagram of the proposed network arrangement for Option 1 is shown in Figure 23.



Energex Corporation Limited ABN 50 087 646 062

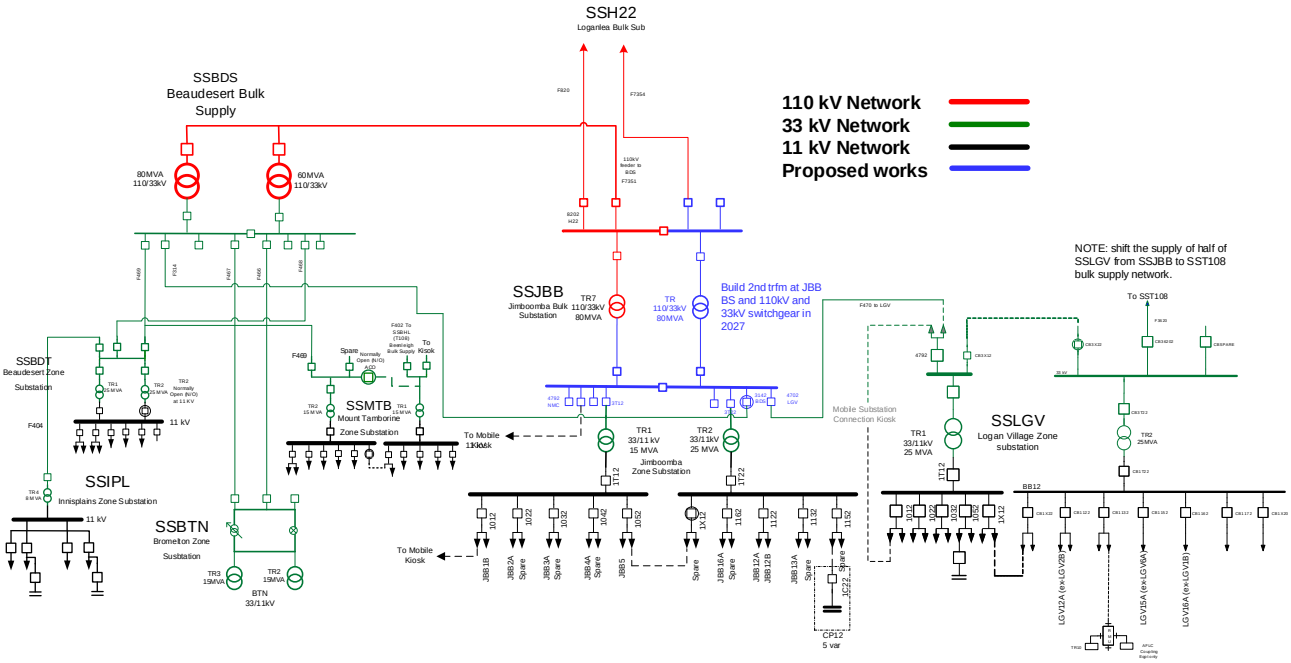



**Figure 23: Proposed network arrangement for option 1 (schematic view)**

### 5.2.2. Option 2: Build 2nd feeder 33kV feeder from SSBDS-SSJBB and build a 33kV Switch room (1 x Bus) at SSJBB

This option involves:

- Establishing approximately 20.2 kms of 2nd 33kV overhead SCCT construction from SSJBB to SSBDS and 1.3 kms of underground SCCT feeder in order to address the identified need.
- Installation of 33kV Switch room consisting of:
    - 4 x 33kV feeder CBs
    - 1 x transformer CB
    - 1 x bus-section CB
- The 33kV switchgear at SSJBB is required to connect to the new feeder and future JBW zone substation.
- Estimated capital cost: $17.9 million ± 40%
- Estimated operating cost per annum: $48,764

The preferred route for the new feeder from SSJBB to SSBDS is shown in yellow below in Figure 24. The majority of the easement for this route has already been acquired.

A schematic diagram with the proposed network arrangement for Option 2 is shown in Figure 25.



Energex Corporation Limited ABN 50 087 646 062

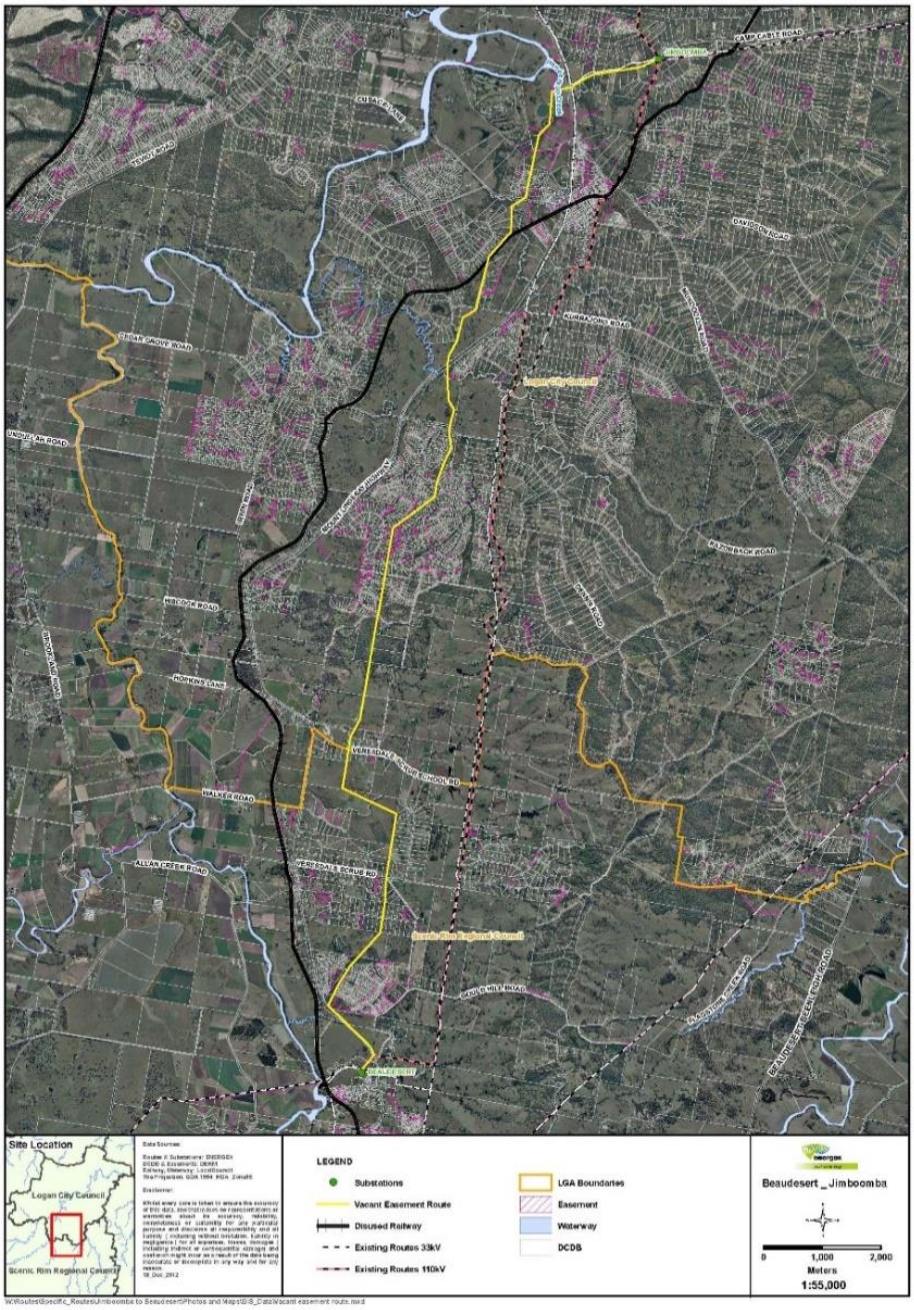



**Figure 24: Proposed network arrangement for option 2 (geographic view)**

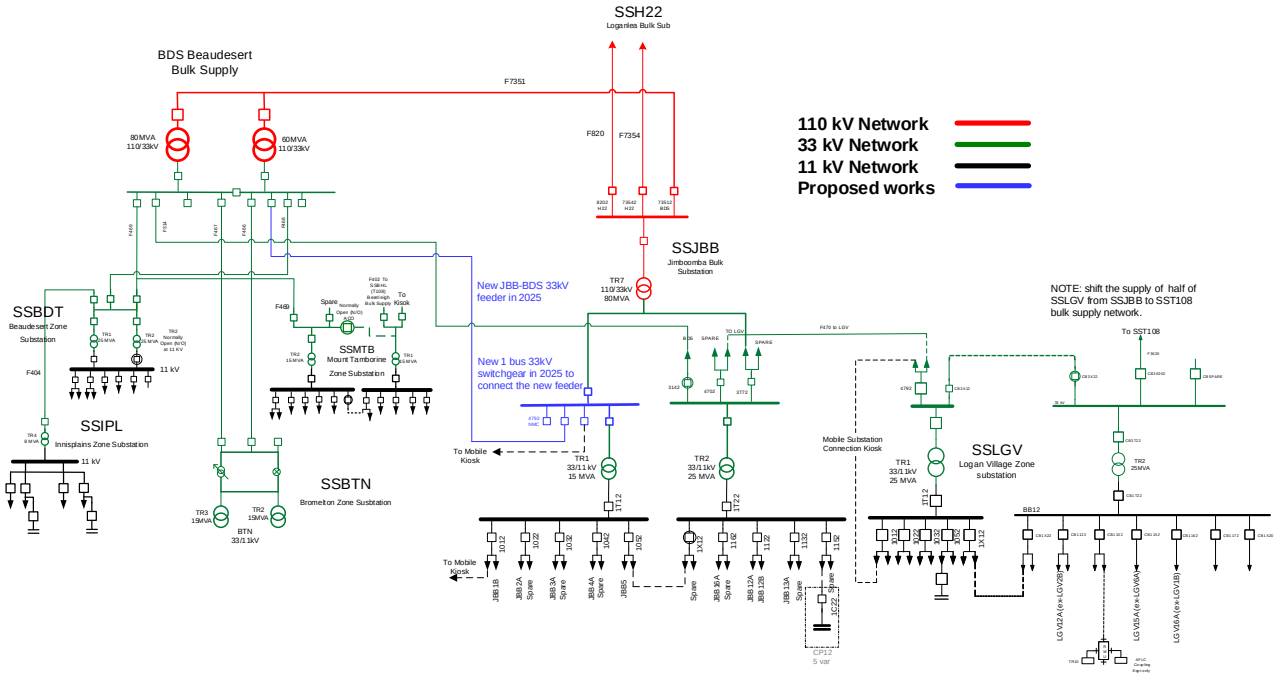



**Figure 25: Proposed network arrangement for option 2 (schematic view)**

### 5.2.3. Option 3: Install 2nd 80MVA 110/33kV transformer at SSJBB BS and establish a network support agreement

This is a hybrid network and non-network option that involves:

- Establishing a 2nd 80MVA 110/33kV transformer at SSJBB BS
- Installation of 110kV CBs:
    - 1 x transformer CB (GIS)
    - 2 x 110kV feeder CBs (GIS)
    - Note: one of the 110kV feeder breakers will be converted to a Bus breaker to connect to second bus section.
- Energex is able to defer building the 33kV switchgear by connecting the 2nd 80MVA 110/33kV transformer to CB3T72 and utilise spare leg of CB4702 to connect to the future Jimboomba West zone substation.
- Establish network support agreement for the back-up supply to SSBDS for the loss of F7351.
- Estimated capital cost: $9 million ± 40%
- Estimated operating cost per annum: $3,312. This excludes any payment associated with a network support agreement.

Figure 26 provide schematic diagrams for Option 3.

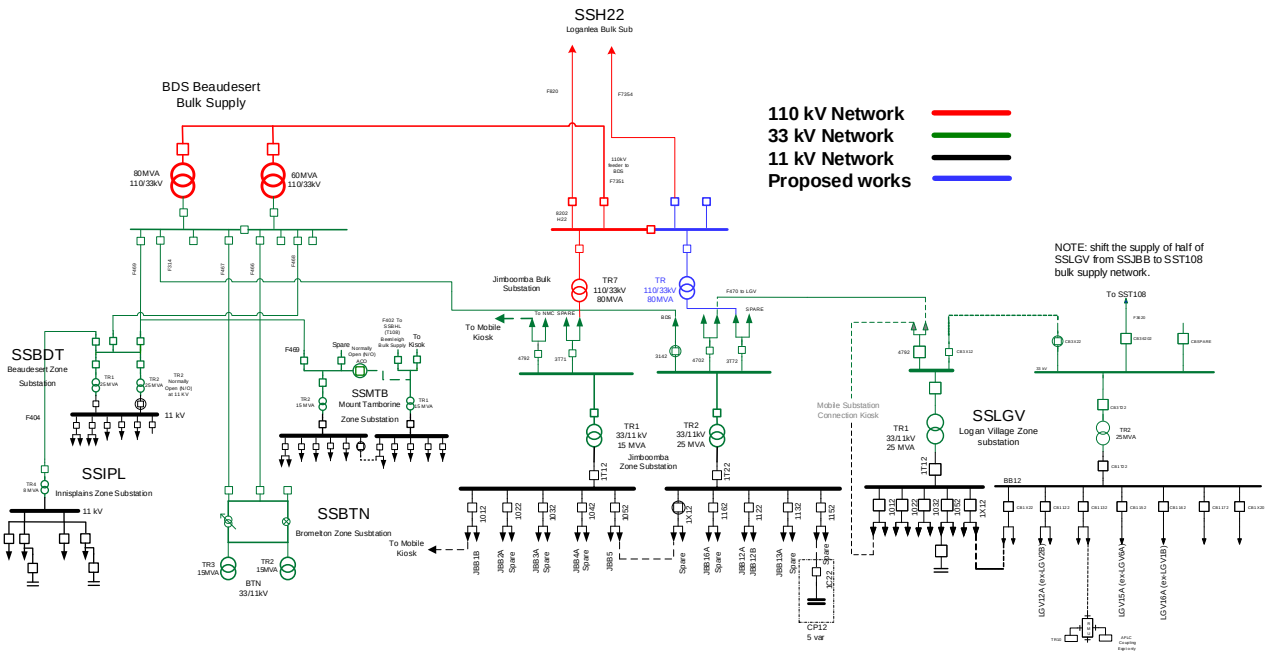



**Figure 26: Proposed network arrangement for option 3 (schematic view)**

### 5.2.4. Option 4: Build a 2nd 33kV feeder from SBDS-SSJBB in parallel to F314 and connect to the same 33kV CB, utilise spare leg CB4702 for the feeder to SSJBW

This option involves:

- Establishing approximately 20.2 kms of new 33kV overhead SCCT and 1.3kms of underground construction from SSJBB to SSBDS in parallel to F314 and connecting to the same 33kV CB (CB3142) and thus deferring building the 33kV switchgear at JBB. Also, the spare leg of CB4702 can be utilised to connect to the future JBW zone substation.
- Estimated capital cost: $14.9 million ± 40%
- Estimated operating cost per annum: $47,703

Figure 27 provide schematic diagram for Option 4.

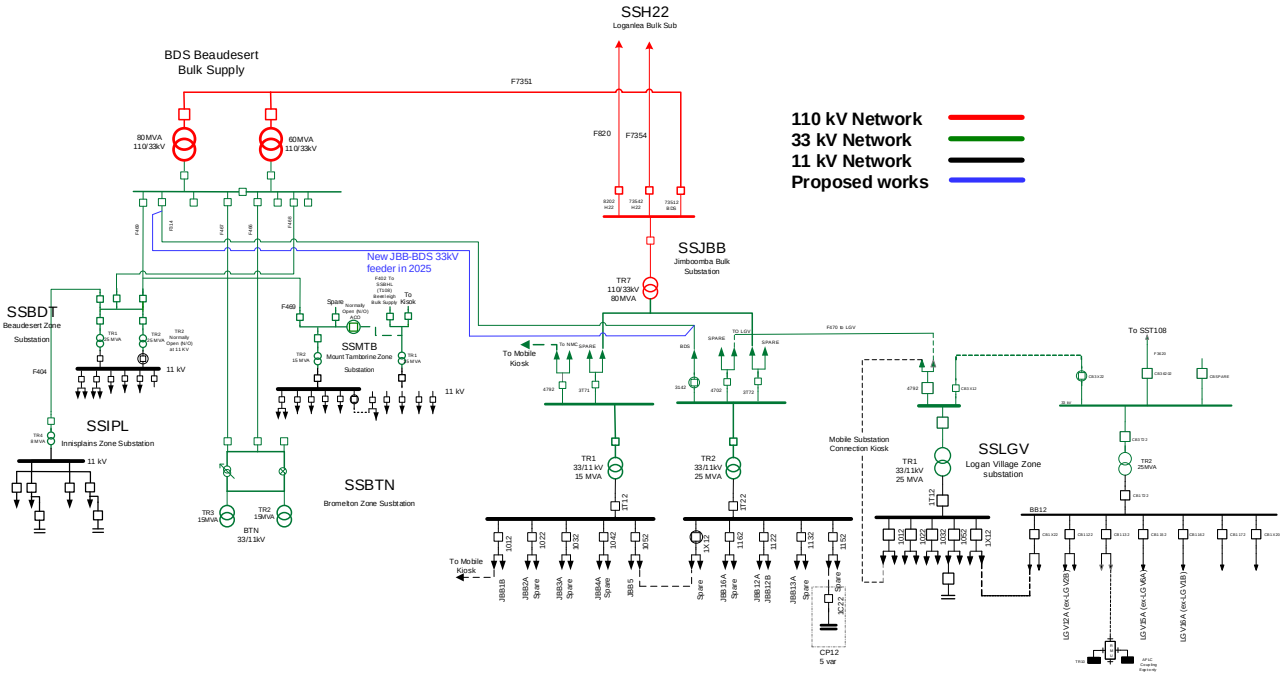



**Figure 27: Proposed network arrangement for option 4 (schematic view)**

## 5.3. Preferred Option

Energex's preferred internal network option is Option 4, to approximately 20.2 kms of 2nd 33kV overhead SCCT and 1.3 kms of underground construction from SSJBB to SSBDS in order to address the identified need.

Upon completion of these works, the asset safety and reliability risks at SSJBB BS and SSBDS will be addressed. The estimated capital cost of this option inclusive of interest, risk, contingencies and overheads is $14.9 million. This provides the most economically efficient network option, with the lowest NPV cost to address the network limitations.

It should be noted that although this option has a higher initial capital cost than Options 1 and 3, the future stages associated with Option 1 and 3 are not the most economically efficient solution in NPV terms. The estimated project delivery timeframe has design commencing in mid-2021 and construction completed by October 2025.



Energex Corporation Limited ABN 50 087 646 062

# 6. TECHNICAL CHARACTERISTICS OF NON-NETWORK OPTIONS

This section describes the technical characteristics of the identified need that a non-network option would be required to comply with.

## 6.1. Size

To meet Energex's ongoing operational needs, it is expected that any alternate solution must provide stand-alone supply to the distribution network that supports a load up to the values listed in the tables below.

| Year | Demand Reduction Required |
|---|---|
| 2025 | 0 MVA |
| 2026 | 0 MVA |
| 2027 | 1.3 MVA |
| 2028 | 6.4 MVA |
| 2029 | 9.1 MVA |
| 2030 | 11.9 MVA |

**Table 8: Demand reduction required in the Jimboomba area (50% POE load – SSJBB BS for the loss of 110/33kV transformer)**

| Year | Demand Reduction Required |
|---|---|
| 2025 | 0 MVA |
| 2026 | 1.0 MVA |
| 2027 | 6.0 MVA |
| 2028 | 12.1 MVA |
| 2029 | 16.6 MVA |
| 2030 | 20.9 MVA |

**Table 9: Demand reduction required in the Jimboomba area (10% POE load – SSJBB BS)**



Energex Corporation Limited ABN 50 087 646 062

| Year | Demand Reduction Required |
|---|---|
| 2025 | 0 MVA |
| 2026 | 11.4 MVA |
| 2027 | 11.9 MVA |
| 2028 | 12.8 MVA |
| 2029 | 13.7 MVA |
| 2030 | 14.6 MVA |

**Table 10: Demand reduction required in the Beaudesert Area (50% POE Load – F314 for the loss of F7351)**

## 6.2. Location

The location where network support and load restoration capability will be measured / referenced is SSJBB BS and SSBDS supply areas. For clarity, to resolve the network limitations in this report, non-network support alternatives will need to be provided at both the SSJBB BS and SSBDS ends of the network. Resolving a limitation at SSJBB BS will not resolve the limitation at SSBDS and vice-versa.

## 6.3. Timing

### 6.3.1. Implementation Timeframe

In order to ensure compliance with Energex's planning criteria and the National Electricity Rules, a non-network solution will need to be implemented by October 2025.

### 6.3.2. Duration

Load restoration capability (for Service Safety Net Targets) may be required at any time of the year. Network support may be required for 24 hours per day for a duration of up to six months, although the required magnitude will be significantly lower during seasons with low to moderate daily peak loads (e.g. late autumn, winter and early spring).

## 6.4. Compliance with Regulations and Standards

As a distribution network service provider (DNSP), Energex must comply with regulations and standards, including the Queensland Electricity Act and Regulation, Distribution Authority, National Electricity Rules and applicable Australian Standards.

These obligations must be taken in consideration when choosing a suitable solution to address the identified need at SSJBB BS and SSBDS as discussed in this RIT-D report.



Energex Corporation Limited ABN 50 087 646 062

## 6.5. Potential Deferred Augmentation Charge

The annual deferred augmentation charge associated with the identified need is approximately $438,083 per year.

Energex have estimated the capital cost of the network options to within ± 40% of estimation accuracy. Using these costs as a guide, a deferral of the preferred network option by a year represents a deferral saving of approximately $438,083 per annum, assuming the same reliability outcomes are maintained as with the preferred network option. While this should not be considered as the precise deferral cost available to a non-network proponent, it serves as a guide for interested parties to determine the viability of their proposal. Energex will work with non-network proponents based on the specifics of what the proponents offer and any necessary further works that Energex may have to undertake to ensure the reliability, security and safety of the network are maintained.



Energex Corporation Limited ABN 50 087 646 062

# 7. NON-NETWORK OPTIONS

## 7.1. Assessment of Non-Network Solutions

To reduce, defer or avoid network expenditure, a non-network proponent would need to provide a non-network option that would eliminate the Load at Risk outlined in **Error! Reference source not found.** and **Error! Reference source not found.**.

## 7.2. Feasible vs Non-Feasible Options

### 7.2.1. Potentially Feasible Options

The identified need presented in this RIT-D is driven by Energex not meeting its Substation NC Limitation and Safety Net obligations. Specifically, under system normal with all transformers in service, there is a load at risk of 1.03MVA that the substation load at SSJBB BS will exceed its NC limitation in 2025/26. In addition, an outage of an existing transformer at SSJBB BS leads to a security standard load at risk of 1.25MVA in 2026/27 which increases in future years. Also, an outage of 110kV feeder F7351 overloads F314 which leads to a security standard load at risk of 11.36MVA from 2025/26 onwards which increases in future years.

In respect of the requirements under 5.17.4(e)(4), any non-network option will contribute to power system security and reliability to the extent that the solution solves the Substation NC limitation and Safety Net limitation. The contribution to power system fault levels is not an issue for this limitation.

Any solutions that prudently and efficiently address these constraints will be considered. A non-exhaustive list of potentially feasible options includes:

- Embedded dispatchable network generation
- Embedded energy storage systems
- Embedded energy storage systems combined with Generation (possibly dispatchable or non-dispatchable)
- Load curtailment agreements with customers to disconnect from the network following a contingency

If a proponent is unable to support the total load required, Energex still encourages the submission of any solutions to reduce the constraints as it may be possible to aggregate multiple proposals to address the limitation or to have a hybrid solution with a potential network solution.

### 7.2.2. Timing of Feasible Options

In order to ensure compliance with Energex's planning criteria and the National Electricity Rules, a non-network solution will need to be implemented by October 2025.



Energex Corporation Limited ABN 50 087 646 062

# 8. SUBMISSION AND NEXT STEPS

## 8.1. Submissions from Solution Providers

Energex invites written submissions to address the identified need in this report from registered participants and interested parties. With reference to Section 6, all submissions should include sufficient technical and financial information to enable Energex to undertake comparative analysis of the proposed solution against other options.

The proposals shall include, but are not limited to, at least the following:

- Full costs of completed works.
- Whole of life costs including losses.
- Project execution strategy including design, testing and commissioning plans.
- Engineering network system studies and study reports.
- Verified and approved engineering designs.
- Manufacture and supply of all plant, equipment and materials.
- Delivery to site, receiving and off-loading of all plant, equipment and materials.
- Assembly and installation on site.

Energex will not be legally bound in any way or otherwise obligated to any person who may receive this RIT-D report or to any person who may submit a proposal. At no time will Energex be liable for any costs incurred by a proponent in the assessment of this RIT-D report, any site visits, obtainment of further information from Energex or the preparation by a proponent of a proposal to address the identified need specified in this RIT-D report.

The RIT-D process is aimed at identifying a technically feasible non-network alternative to the internal option that has greater net economic benefits. However, the selection of the solution provider to implement the preferred option will be done in accordance with Energex's standards for procurement.

Submissions in writing are due by 4pm on the **15 May 2020** and should be lodged to demandmanagement@energex.com.au

## 8.2. Next Steps

Energex intends to carry out the following process to assess what action should be taken to address the identified need in the SSJBB BS and SSBDS supply areas:

| | | |
|---|---|---|
| Step 1 | Publish Non-Network Options Report (this report) inviting non-network options from interested participants | Date Released:<br>**14 February 2020** |
| Step 2 | Consultation period | **Minimum of 3 months (12 weeks)** |
| Step 3 | Deadline for Submission of proposals for non-network alternatives | **15 May 2020** |
| Step 4 | Release of Draft Project Assessment Report (DPAR) | Anticipated to be released by:<br>**12 June 2020** |
| Step 5 | Consultations in response to the DPAR | **Minimum of 6 weeks** |
| Step 6 | Publish the Final Project Assessment Report (FPAR) | Anticipated to be released by:<br>**14 August 2020** |
| Energex reserves the right to revise this timetable at any time. The revised timetable will be made available on the Energex RIT-D website. | | |

Energex will take all reasonable efforts to maintain the consultation schedule listed above. Due to various circumstances the schedule may change, however, up-to-date information will be available on the Energex website.

During the consultation period, Energex will review, compare and analyse all internal and external solutions. Detailed economic options analysis and comparisons of expected market benefits will be undertaken during this time. At the end of the consultation and review process Energex will publish a final report which will detail the most feasible option and proceed to implement that option.



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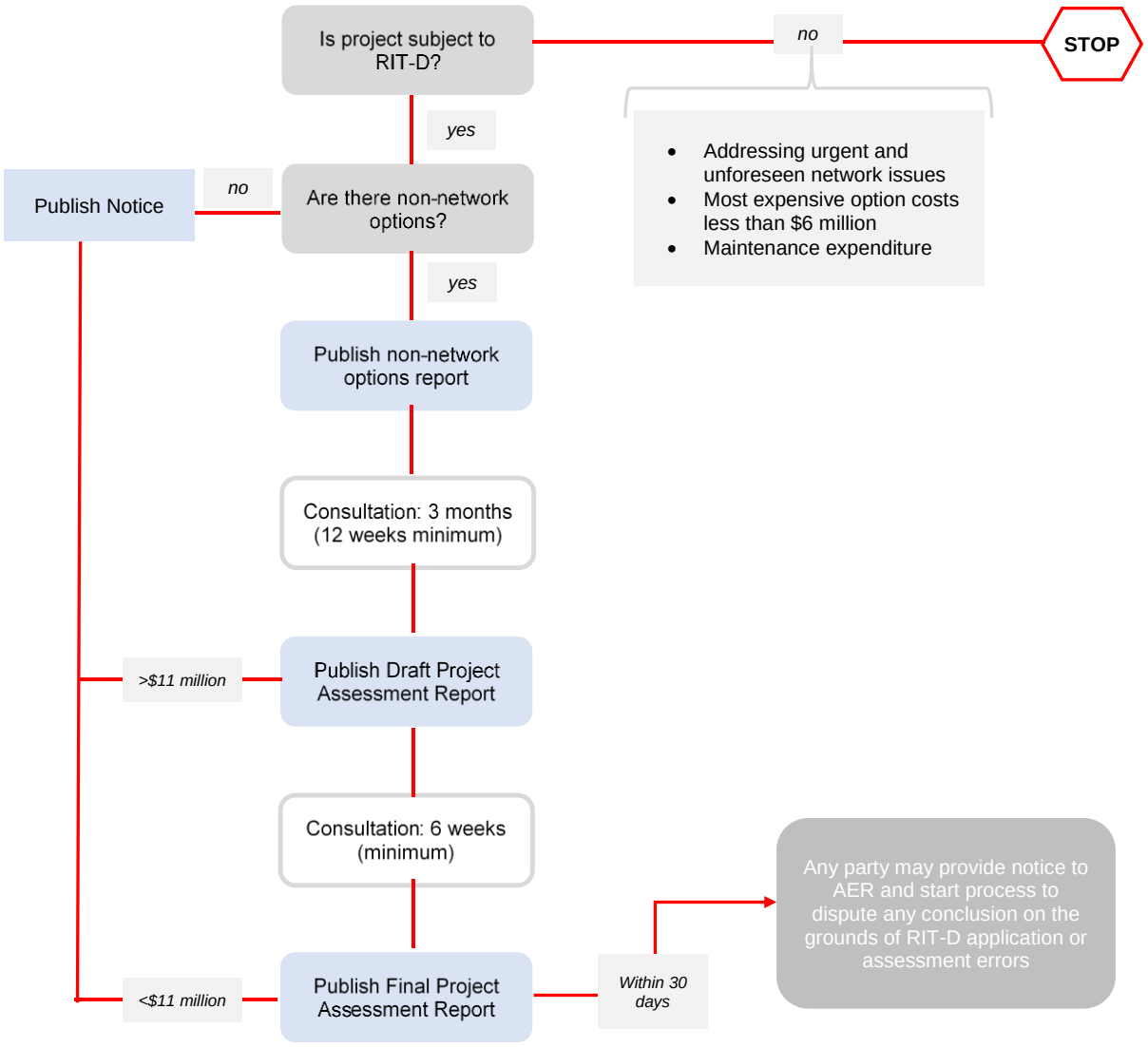
# 9. COMPLIANCE STATEMENT

This Non-Network Options Report complies with the requirements of NER section 5.17.4(e) as demonstrated below:

| Requirement | Report Section |
|---|---|
| (1) a description of the identified need; | 3 |
| (2) the assumptions used in identifying the identified need (including, in the case of proposed reliability corrective action, why the RIT-D proponent considers reliability corrective action is necessary; | 3.3 |
| (3) if available, the relevant annual deferred *augmentation* charge associated with the identified need; | 6.6 |
| (4) the technical characteristics of the identified need that a non-network option would be required to deliver, such as:<br>(i) the size of *load* reduction or additional *supply*;<br>(ii) location;<br>(iii) contribution to *power system security* or *reliability*;<br>(iv) contribution to *power system* fault levels as determined under clause 4.6.1; and<br>(v) the operating profile; | 2.3 & 6 |
| (5) a summary of potential credible options to address the identified need, as identified by the RIT-D proponent, including network options and non-network options; | 5 & 7 |
| (6) for each potential credible option, the RIT-D proponent must provide information, to the extent practicable, on:<br>(i) a technical definition or characteristics of the option;<br>(ii) the estimated construction timetable and commissioning date (where relevant); and<br>(iii) the total indicative cost (including capital and operating costs); and | 5 & 6 |
| (7) information to assist non-network providers wishing to present alternative potential credible options including details of how to submit a non-network proposal for consideration by the RIT-D proponent. | 8 |

# APPENDIX A – THE RIT-D PROCESS




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