Regulatory Investment Test for Distribution (RIT-D)

Connection of Major Customer in the Bundaberg Region

Notice of No Non-Network Options

6 September 2023

ERGON ENERGY NETWORK

Part of Energy Queensland

EXECUTIVE SUMMARY

About Ergon Energy

Ergon Energy Corporation Limited (Ergon Energy) is part of Energy Queensland and manages an electricity distribution network which supplies electricity to more than 765,000 customers. Our vast operating area covers over one million square kilometres (around 97% of the state of Queensland) from the expanding coastal and rural population centres to the remote communities of outback Queensland and the Torres Strait.

Our electricity network consists of approximately 160,000 kilometres of powerlines and one million power poles, along with associated infrastructure such as major substations and power transformers.

We also own and operate 33 stand-alone power stations that provide supply to isolated communities across Queensland which are not connected to the main electricity grid.

Identified Need

Ergon Energy has received a connection application for a major customer to connect to the network in the Bundaberg region with a requirement for a large supply. The connection arrangement, which has been agreed on through consultation with the customer, is for a dedicated connection which is comprised of both Alternate Control Services (ACS) and Standard Control Services (SCS) as defined in Chapter 10 of the National Electricity Rules (NER).

Works classified as ACS requires that the customer fund the cost directly. SCS works are those that are central to the supply of electricity and provided by Ergon Energy, including design, construction and operation of the shared network. Cost for these services is recovered through network charges for all relevant customers.

The RIT-D only considers the SCS component, as this is network expenditure under the identified need; however, any solution must be capable of supplying the major customer up to 10MW and provide an N-1 supply. The proposed connection arrangement requires that a new 2 x 20/25MVA 66/11kV Thabeban substation (THAB) is established at Thabeban, a new 66kV feeder from Bundaberg (T20) 132/66kV substation (BUND) to THAB and new 66kV feeder from South Bundaberg 66/11kV substation (SOBU) to THAB. The completion date for the works is October 2026, which is driven by the customer timeframes for connection.

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). Ergon Energy has determined that network investment is essential in this case for it to continue to provide electricity to the consumers in the Bundaberg supply area in a reliable, safe and cost-effective manner and to connect the major customer. 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 Ergon Energy in accordance with the requirements of clause 5.17.4(d) of the NER.

CONTENTS

1. BACKGROUND

1.1. Geographic Region

The Bundaberg region is supplied via five 66/11kV zone substations, West Bundaberg (WEBU), Bundaberg Central (BUCE), East Bundaberg (EABU), South Bundaberg (SOBU) and Bargara (BARG). The 66kV network is supplied from Bundaberg (T20) 132/66kV Bulk Supply Substation, where the 66kV network forms a ring, connecting WEBU, BUCE, EABU and SOBU, with Bargara supplied radially from South Bundaberg. A major customer has requested electrical connection within the Thabeban suburb of the Bundaberg region. During the consultation with the customer a planning report was developed to identify the credible options for connection, with the preferred option being an N-1 11kV connection from a new 66/11kV substation located near Thabeban.

The geographical location of Ergon Energy's sub-transmission network and substations in the area is shown in Figure 1 and Figure 2.

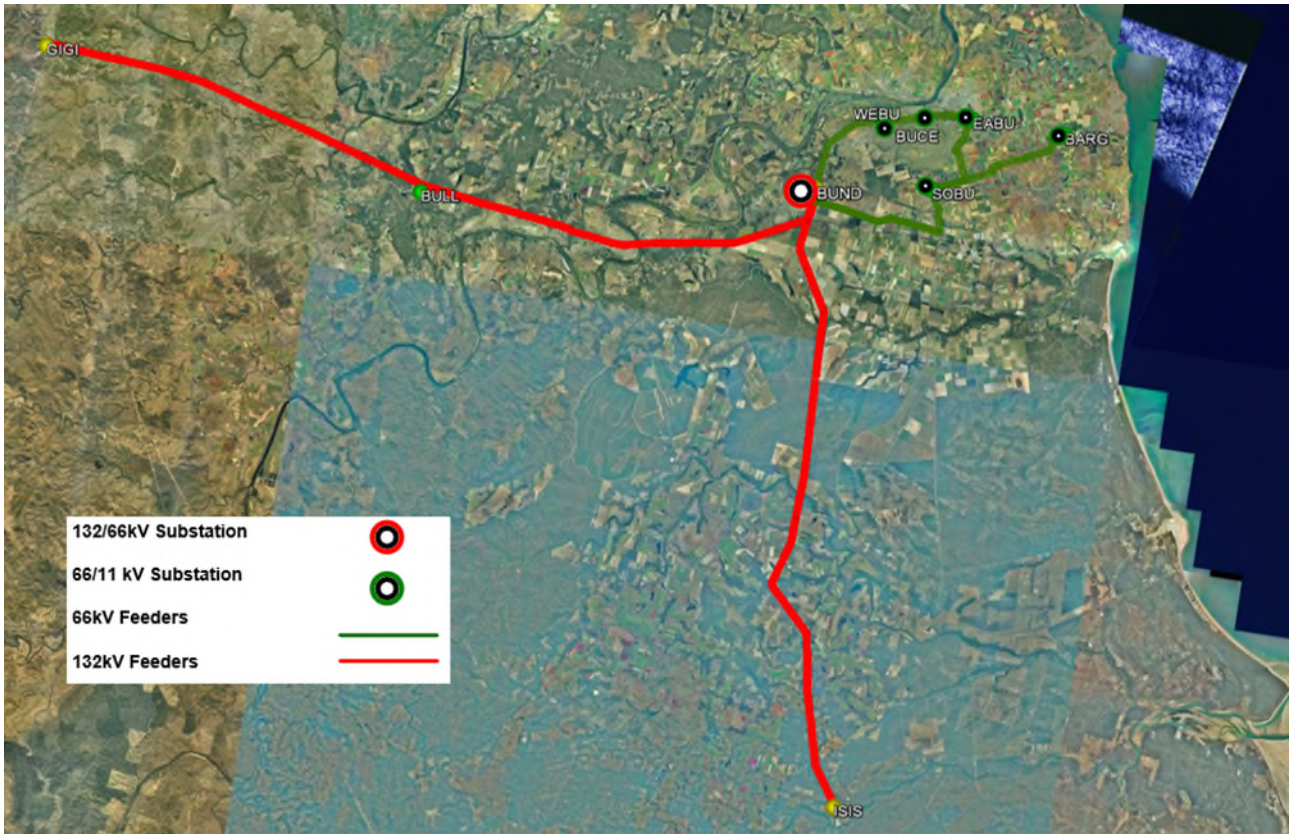


Figure 1: Existing network arrangement (geographic view)

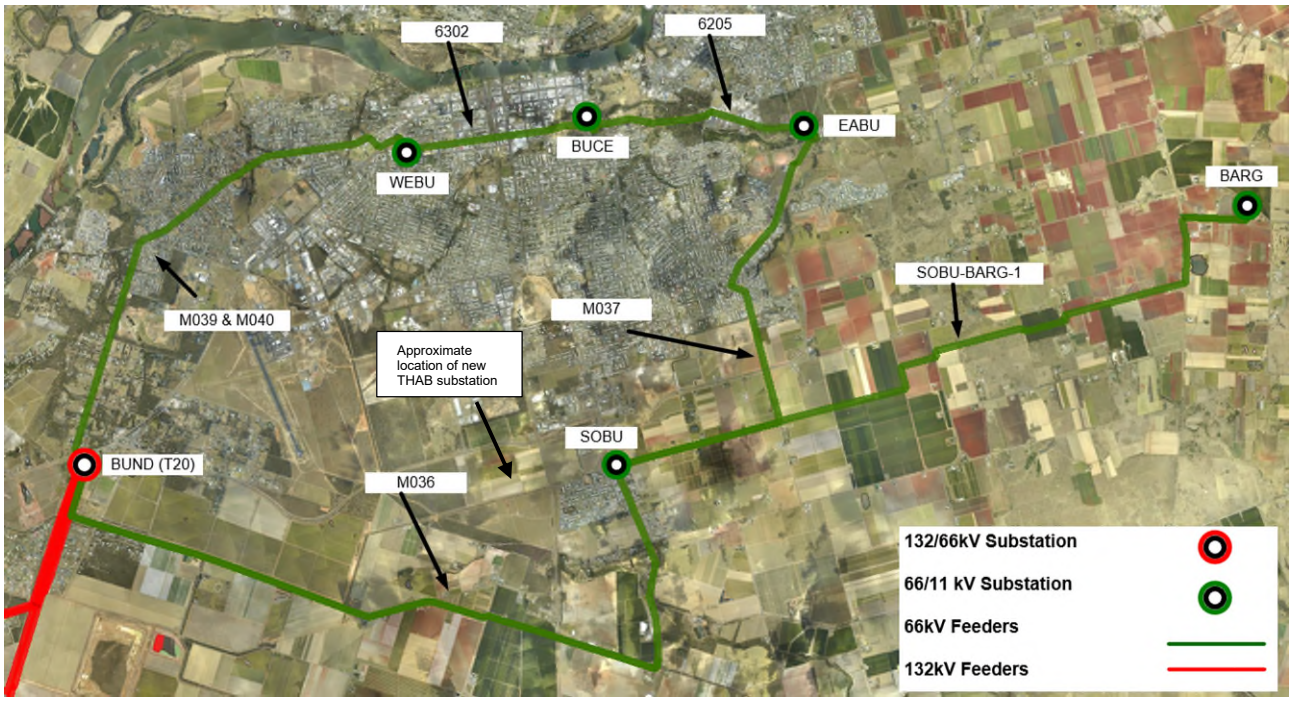


Figure 2: Existing Geographic view of the network arrangement (Zoomed)

1.2. Existing Supply System

The existing 66kV network is supplied from Bundaberg (T20) 132/66kV Bulk Supply substation, which is located approximately 2.5km West of the Bundaberg Airport. The 66kV network supplies the Bundaberg ring, connecting WEBU, BUCE, EABU and SOBU; BARG is also supplied radially from SOBU at 66kV. Each of these zone substations subsequently supplies local customers at 11kV.

A schematic view of the existing sub-transmission network arrangement is shown in Figure 3.

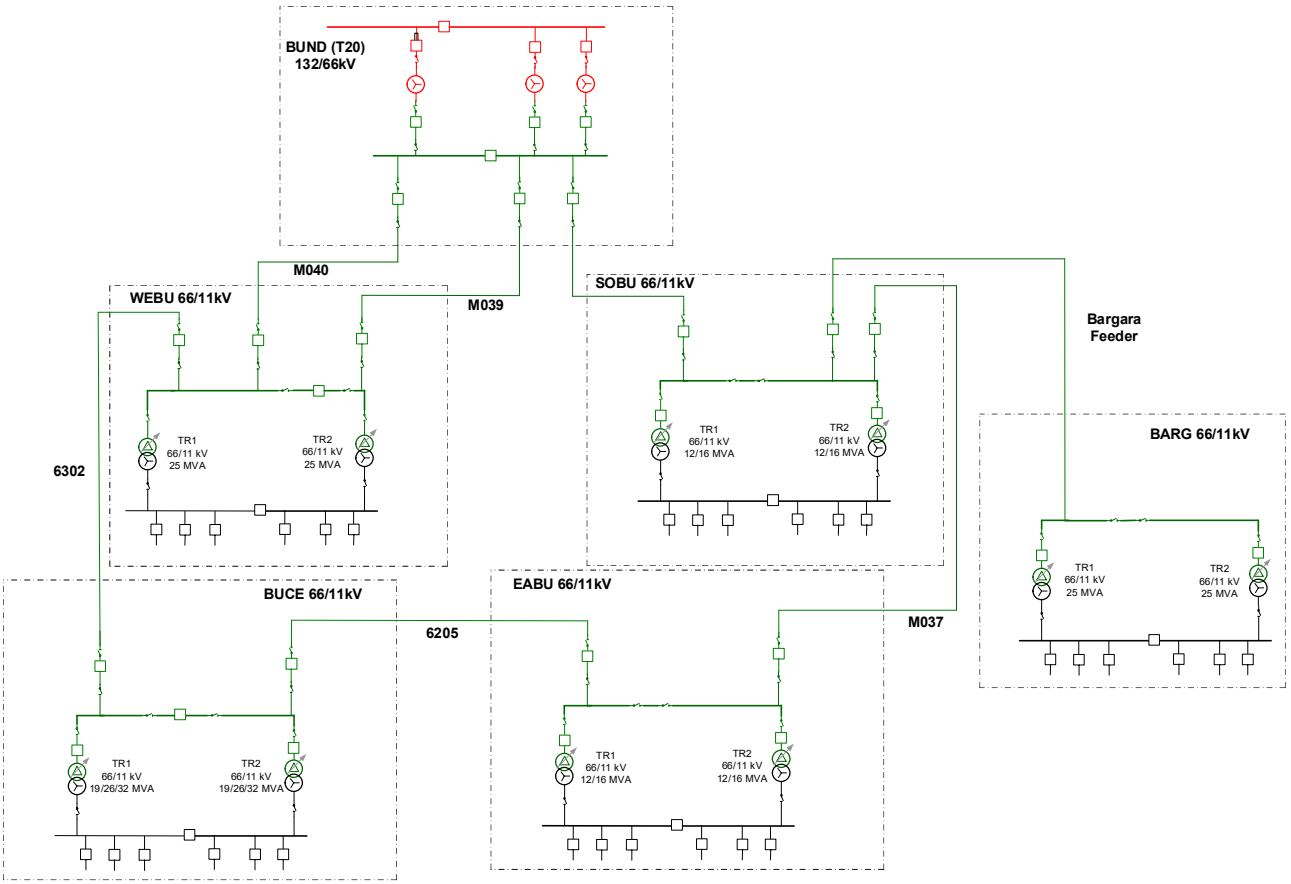


Figure 3: Existing network arrangement (schematic view)

1.3. Zone Substation Load Profiles / Forecasts

The load profiles pertinent to this project include WEBU, BUCE, EABU and SOBU. Each of these are provided in the following sections. The loads of the four zone substations are predominantly summer peaking.

1.3.1. Full Annual Load Profile

The full annual load profile for West Bundaberg, Bundaberg Central, East Bundaberg and South Bundaberg Substation over the 2022/23 financial year are shown in Figure 4, Figure 5, Figure 6, and Figure 7.

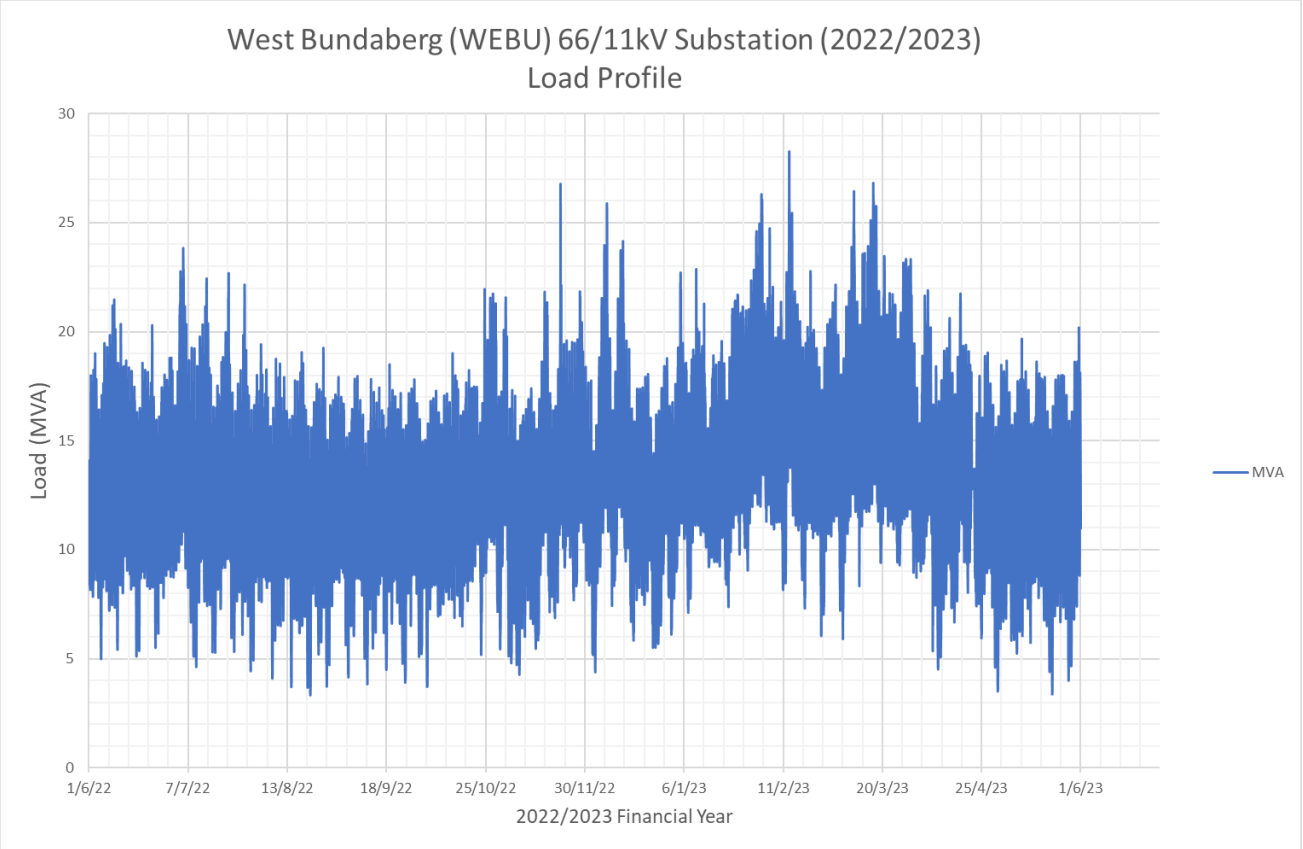


Figure 4: West Bundaberg Substation actual annual load profile

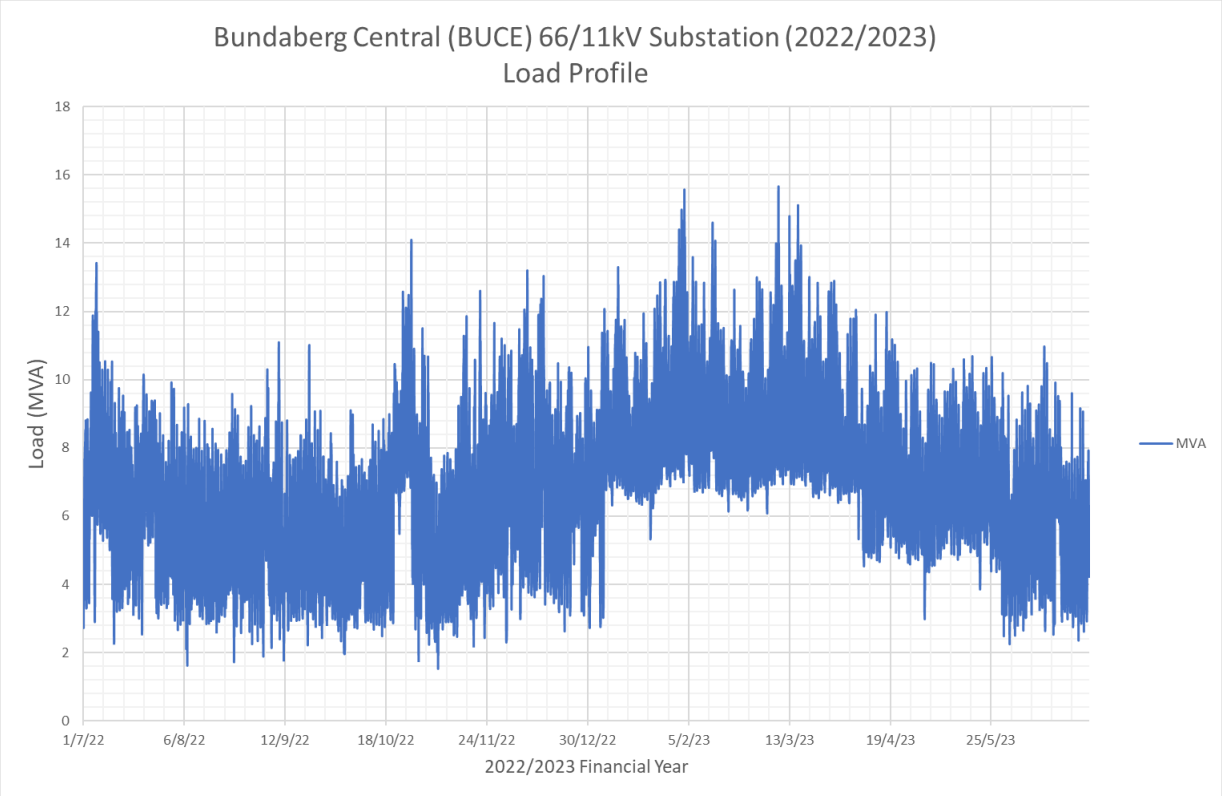


Figure 5: Bundaberg Central Substation actual annual load profile

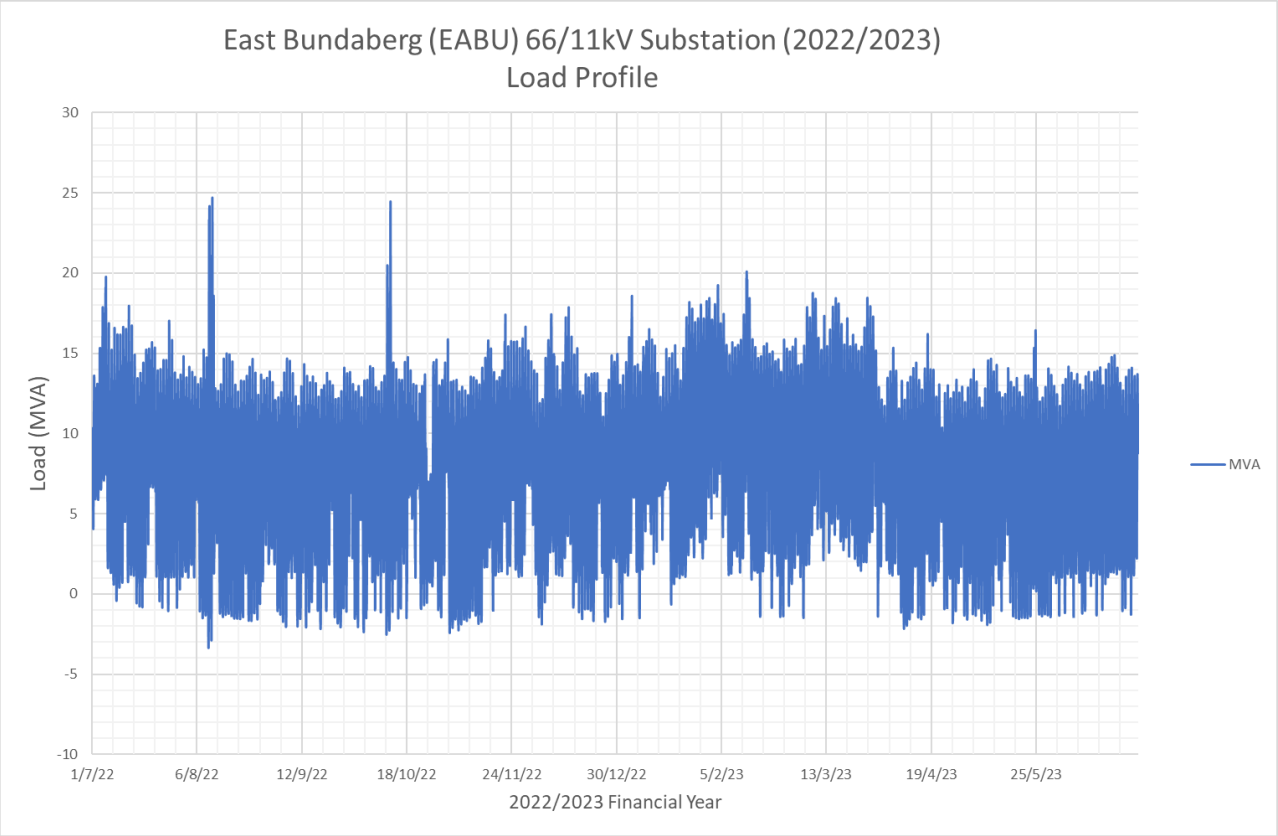


Figure 6: East Bundaberg Substation actual annual load profile

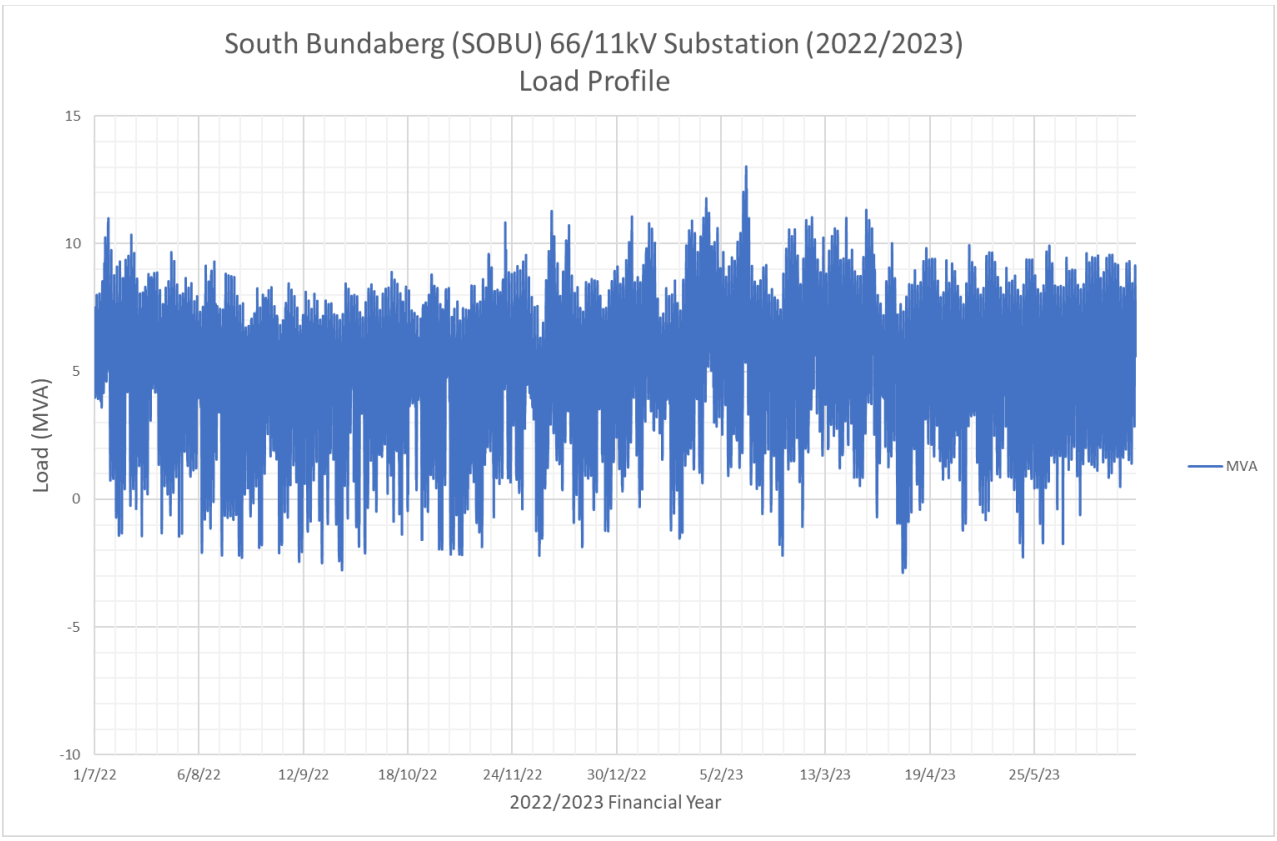


Figure 7: South Bundaberg Substation actual annual load profile

1.3.2. Load Duration Curve

The load duration curve for West Bundaberg, Bundaberg Central, East Bundaberg and South Bundaberg Substation over the 2022/23 financial year is shown in Figure 8, Figure 9, Figure 10, and Figure 11.

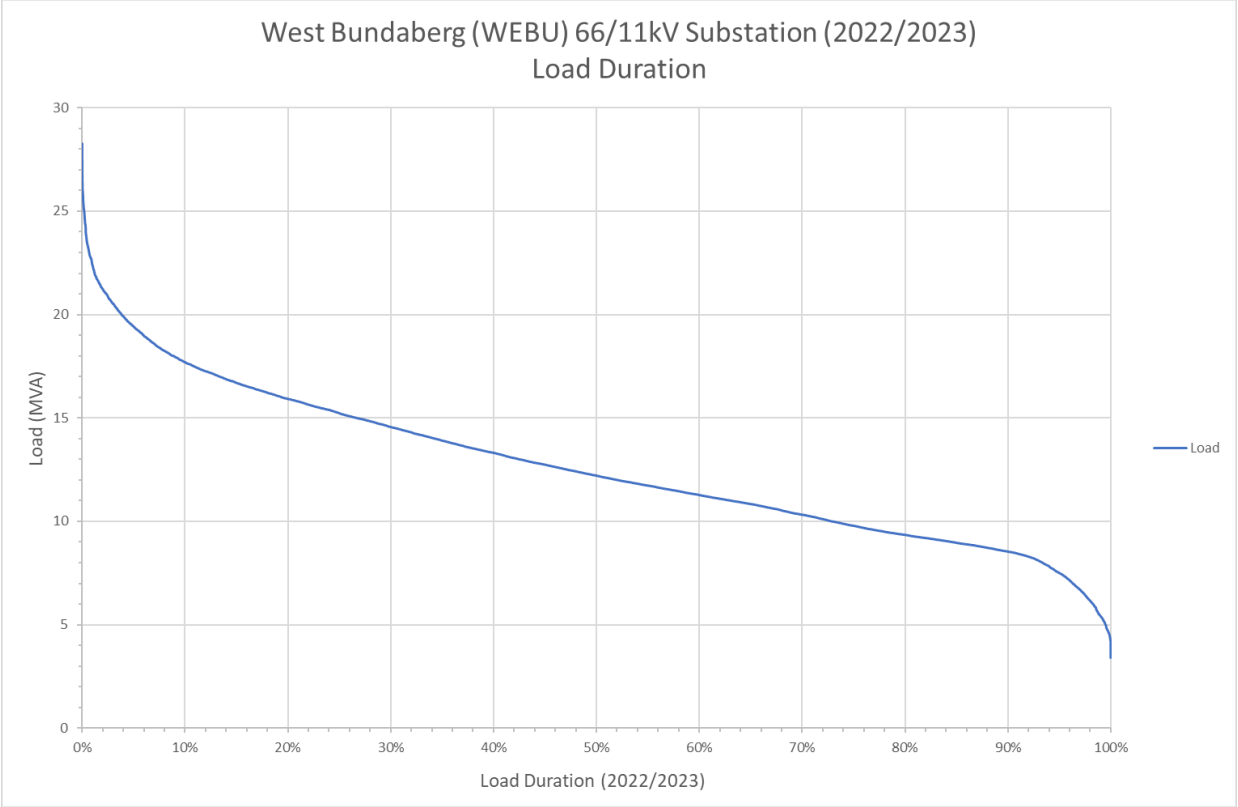


Figure 8: West Bundaberg Substation load duration curve

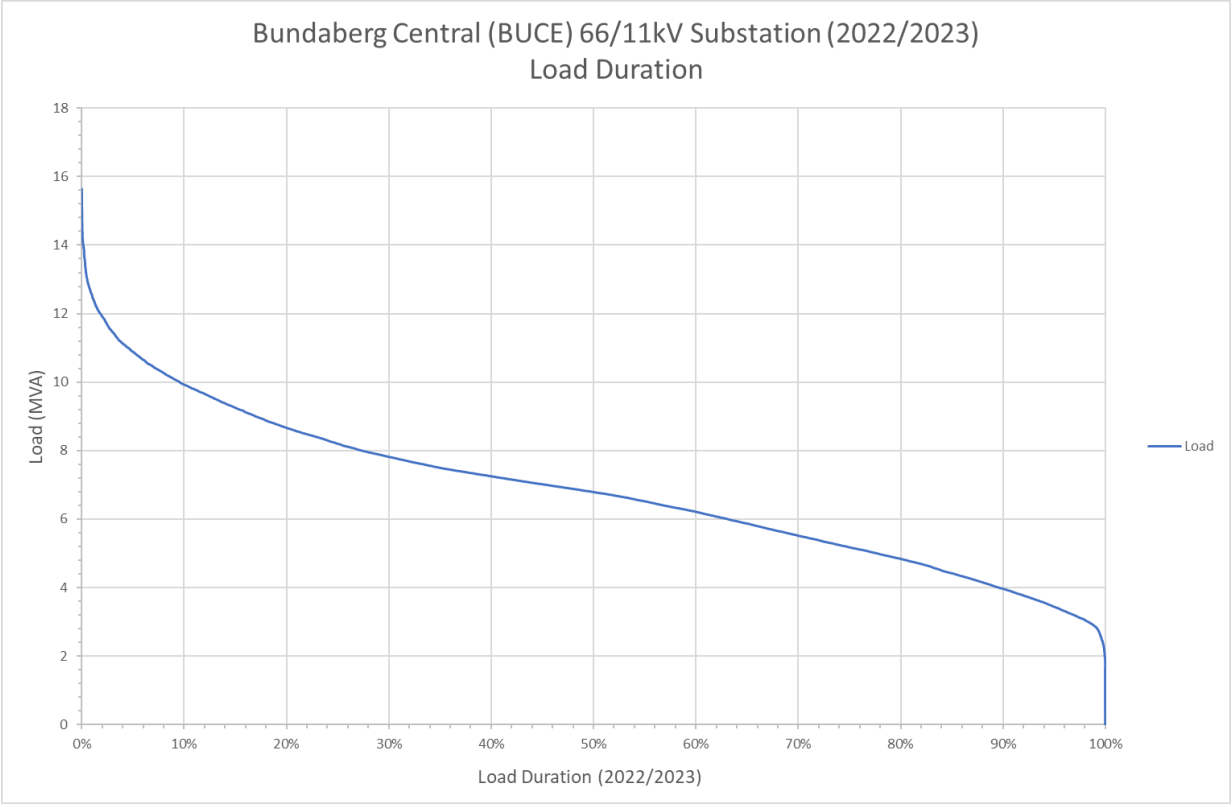


Figure 9: Bundaberg Central Substation load duration curve

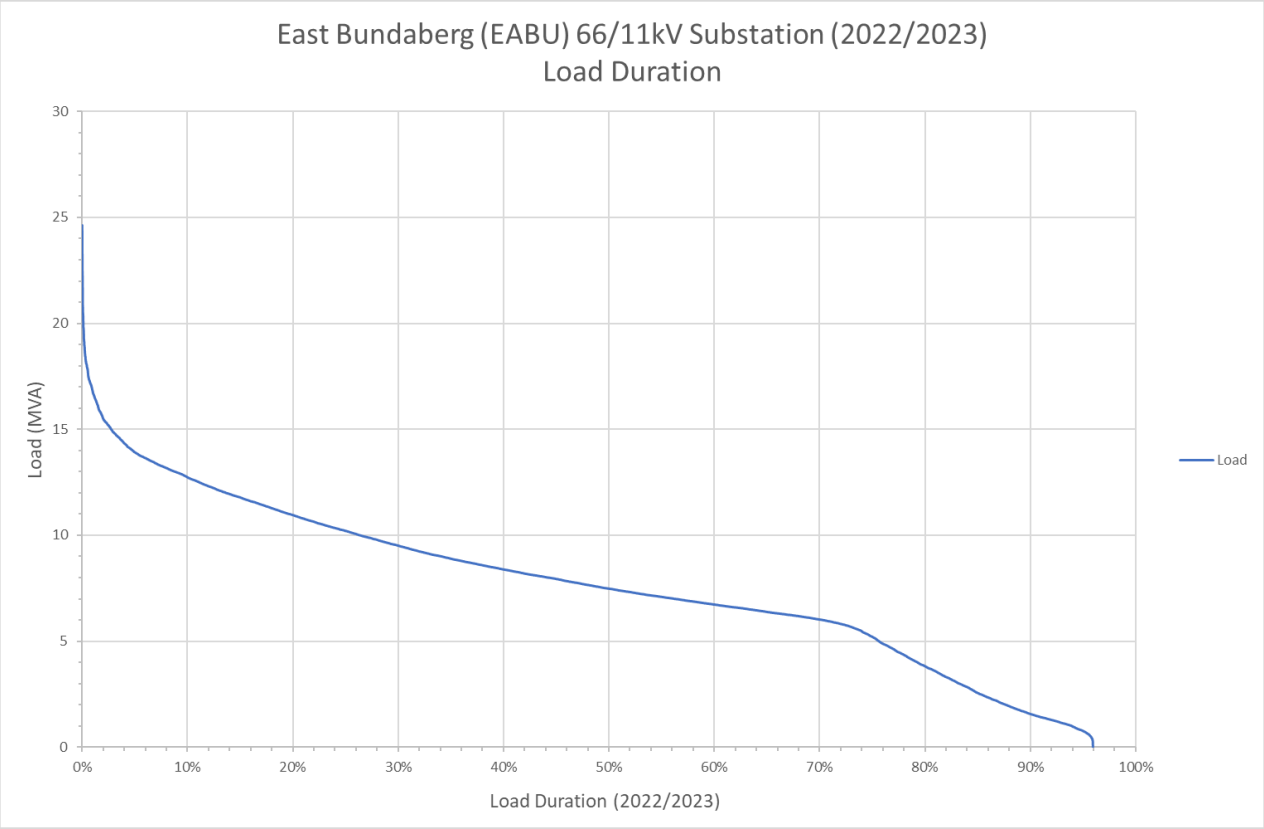


Figure 10: East Bundaberg Substation load duration curve

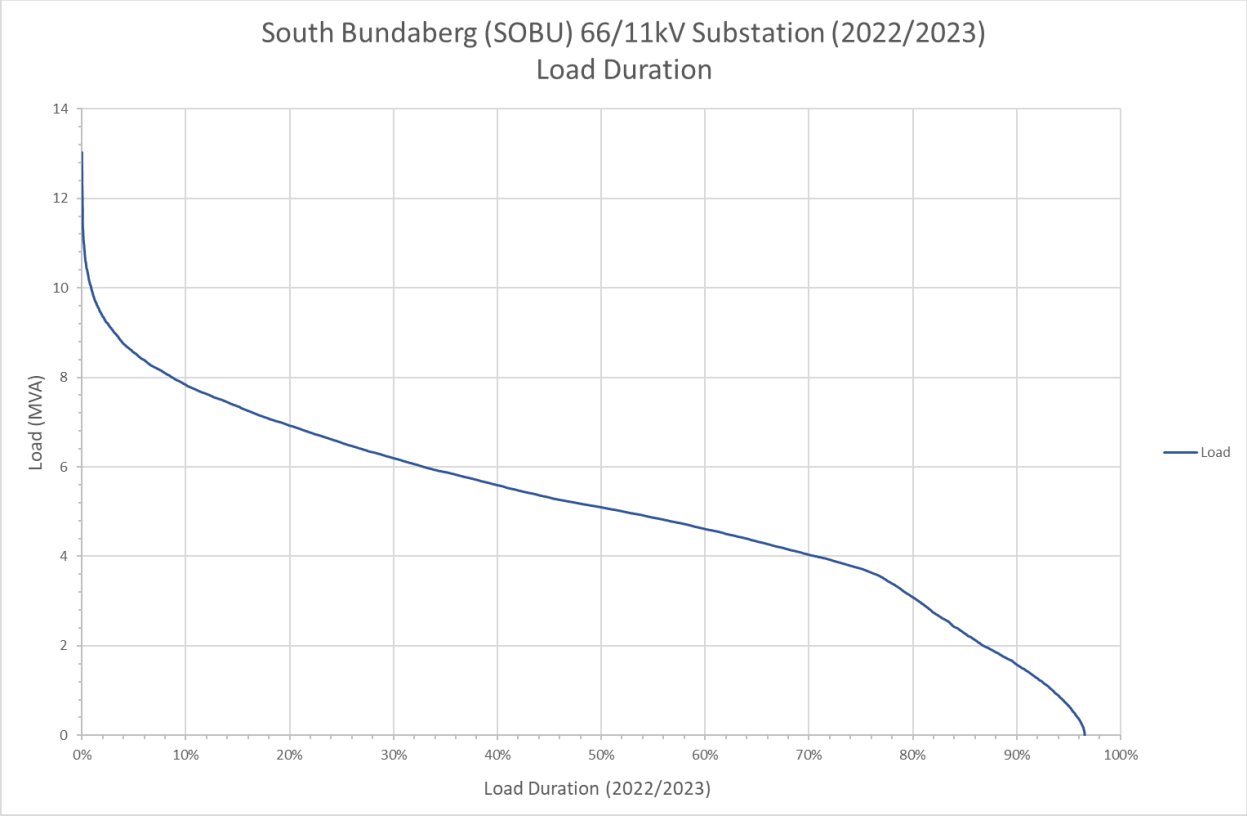


Figure 11: South Bundaberg Substation load duration curve

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 12, Figure 13, Figure 14, and Figure 15 for each of the zone substations. It can be noted that there is a daytime minimum demand with an evening peak for most of the zone substations in the Bundaberg region.

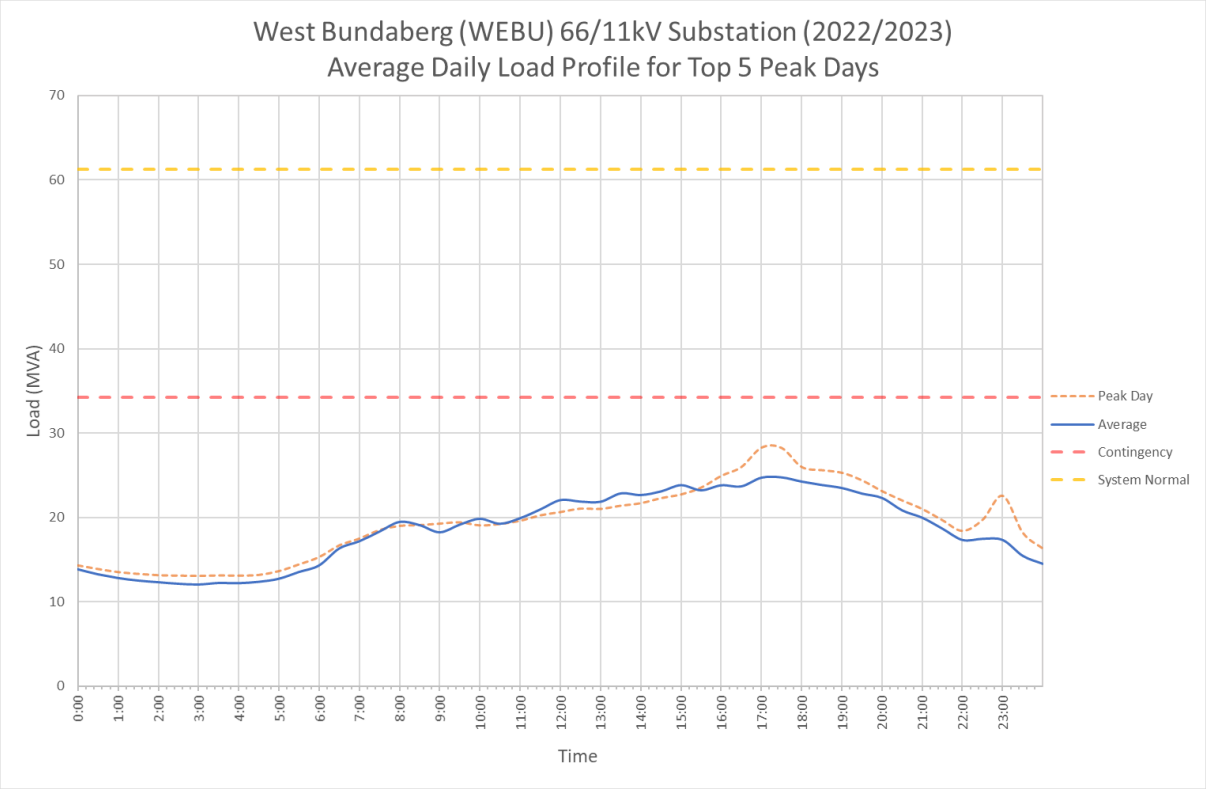


Figure 12: West Bundaberg Substation average peak weekday load profile (summer)

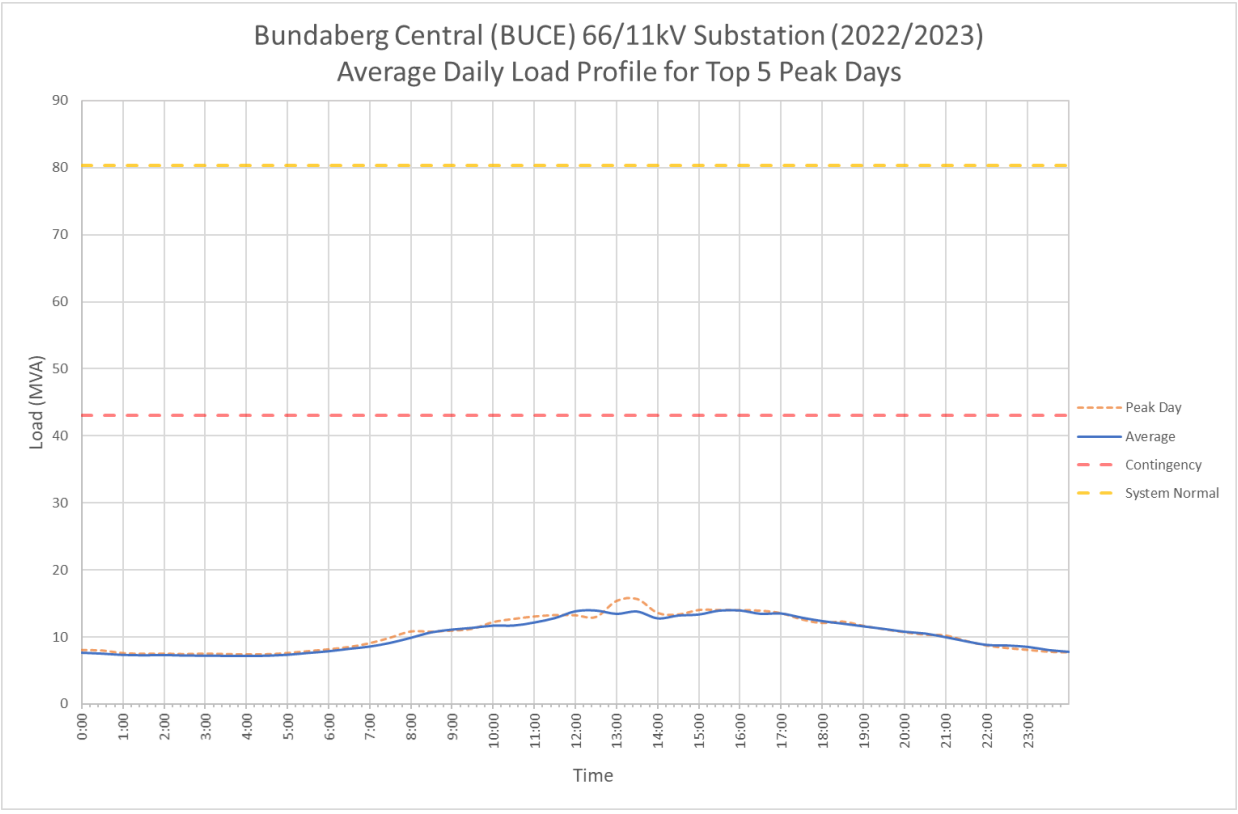


Figure 13: Bundaberg Central Substation average peak weekday load profile (summer)

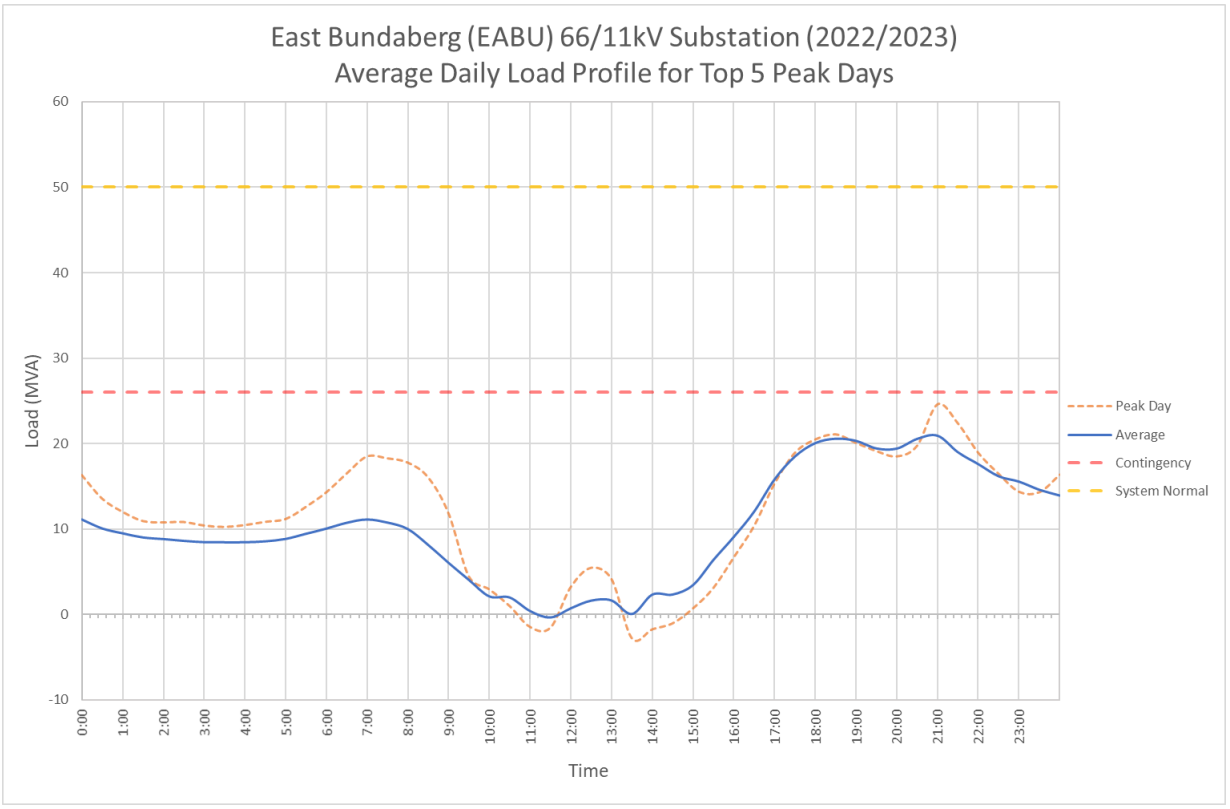


Figure 14: East Bundaberg Substation average peak weekday load profile (summer)

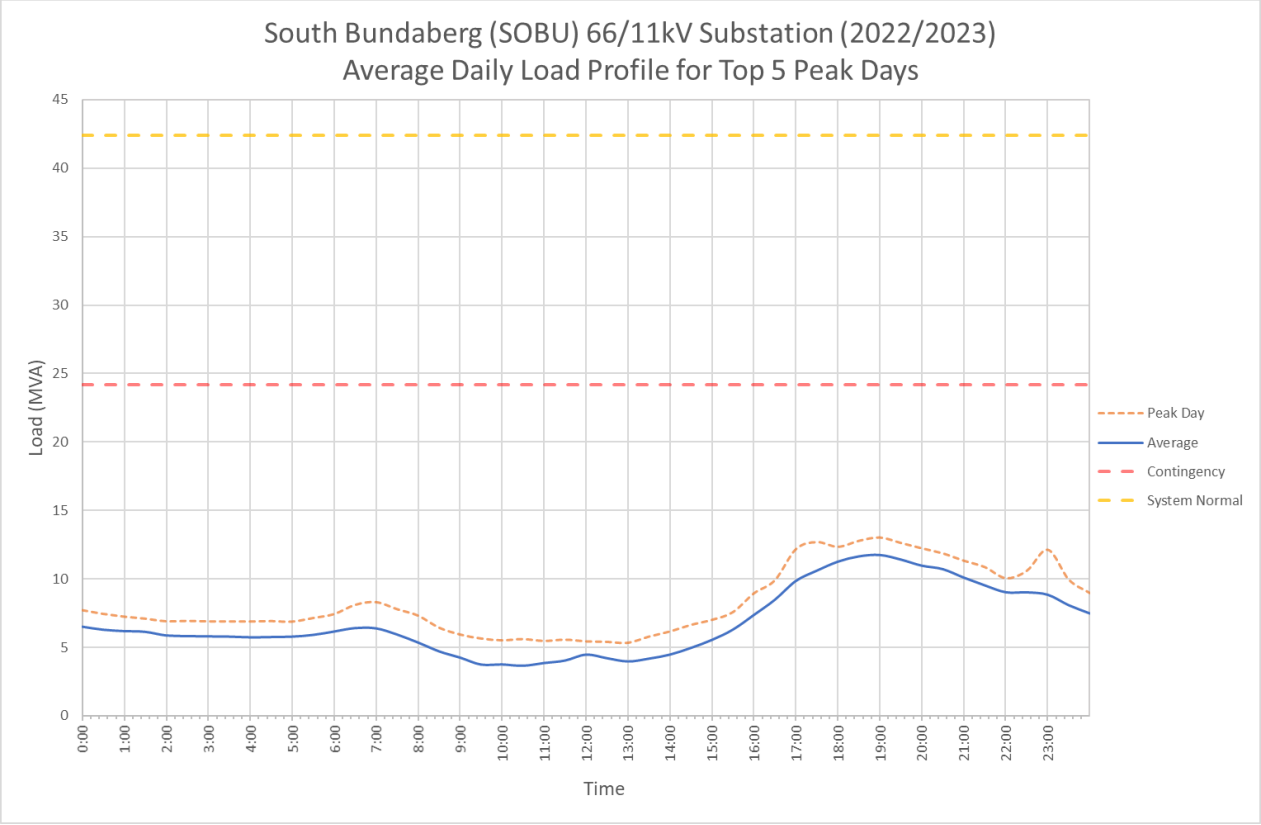


Figure 15: South Bundaberg Substation average peak weekday load profile (summer)

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 16, Figure 17, Figure 18 and Figure 19. The historical peak load for the past six years has also been included in the graph. Each graph also contains an indicative forecast loading if the major customer was to be supplied from each zone substation respectively. This indicative loading has only been included for the base load forecast to demonstrate the constraints at the existing zone substation 11kV supply. As can be seen, with the major customer connected upgrade works would be required at all substations except Bundaberg Central.

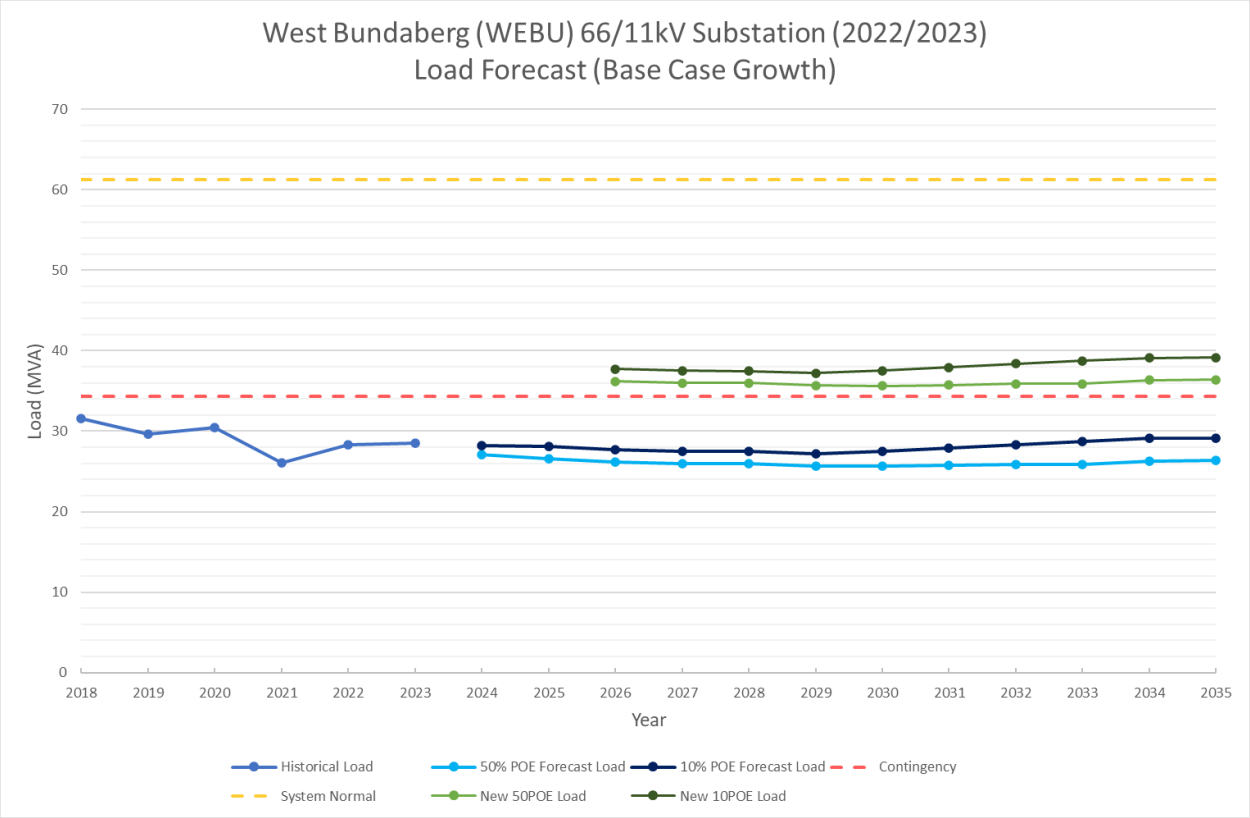


Figure 16: West Bundaberg Substation base case load forecast

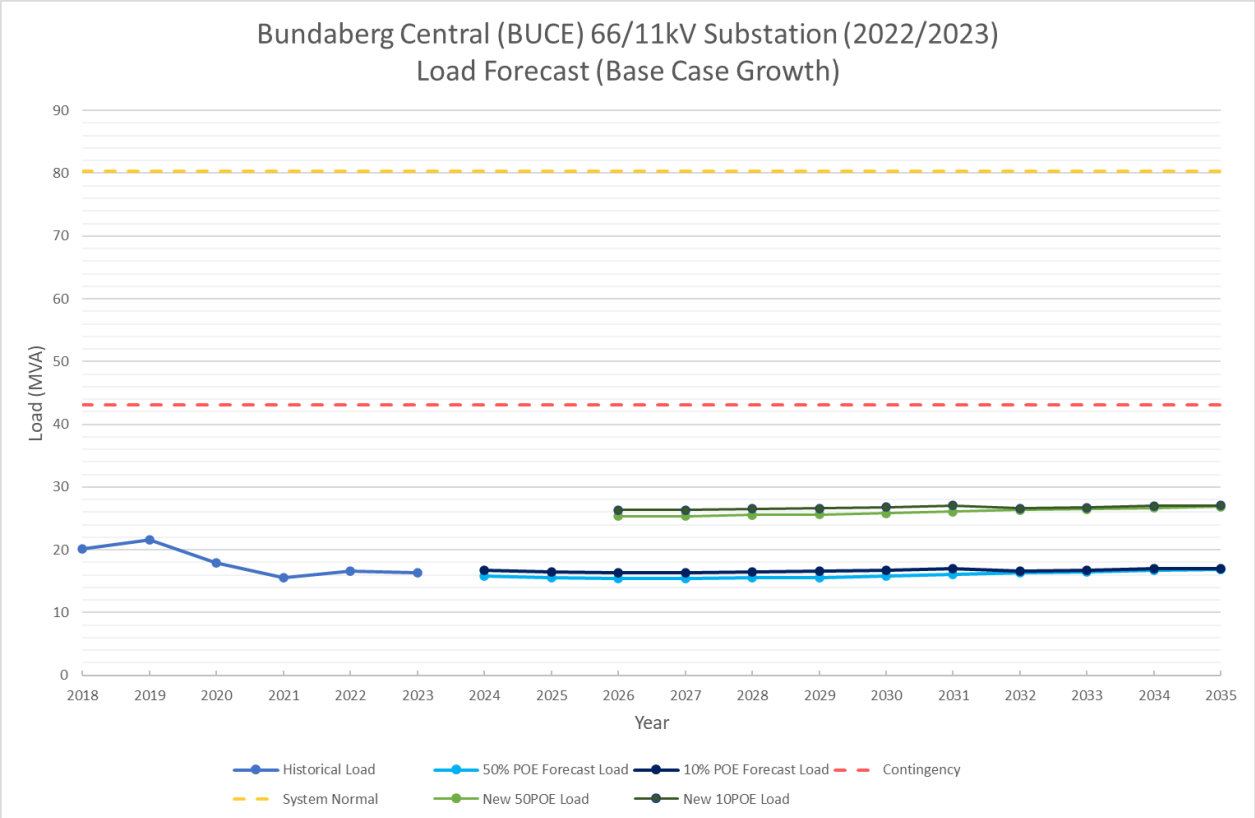


Figure 17: Bundaberg Central Substation base case load forecast

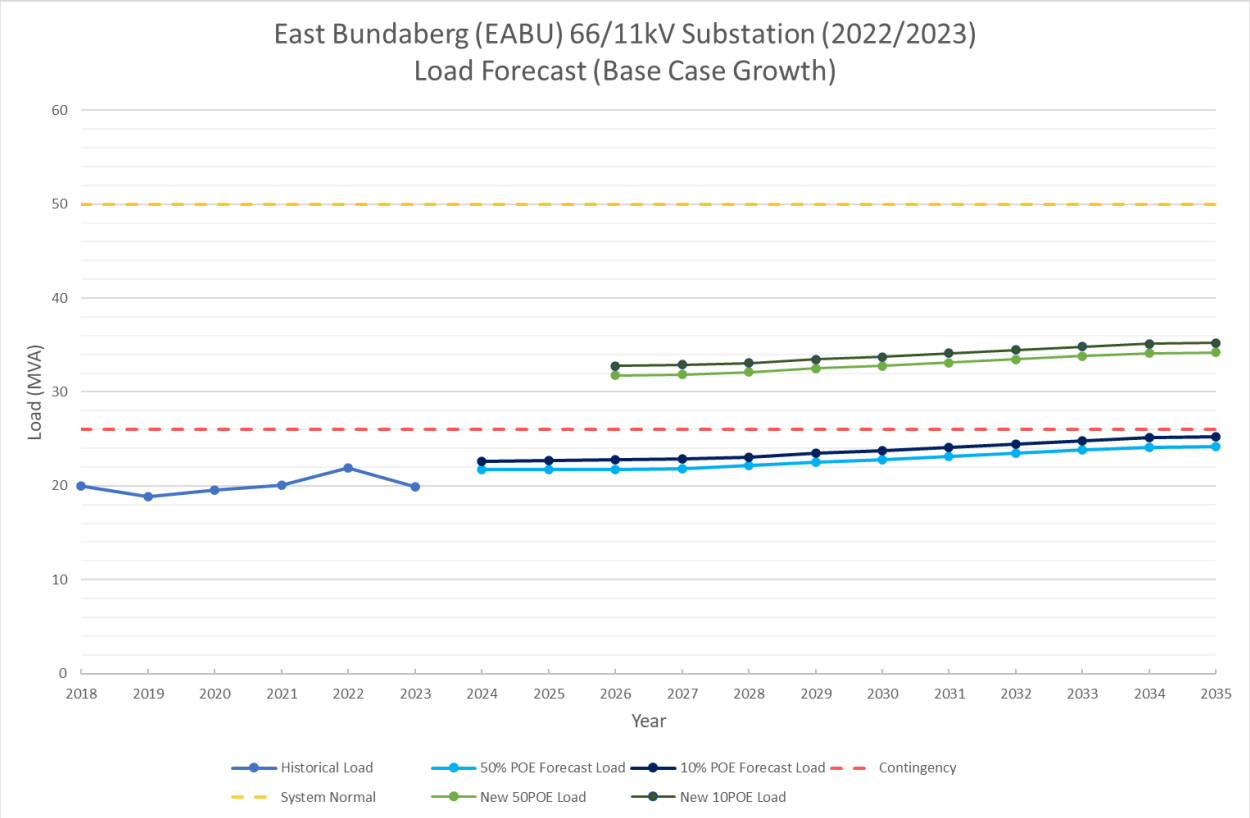


Figure 18: East Bundaberg Substation base case load forecast

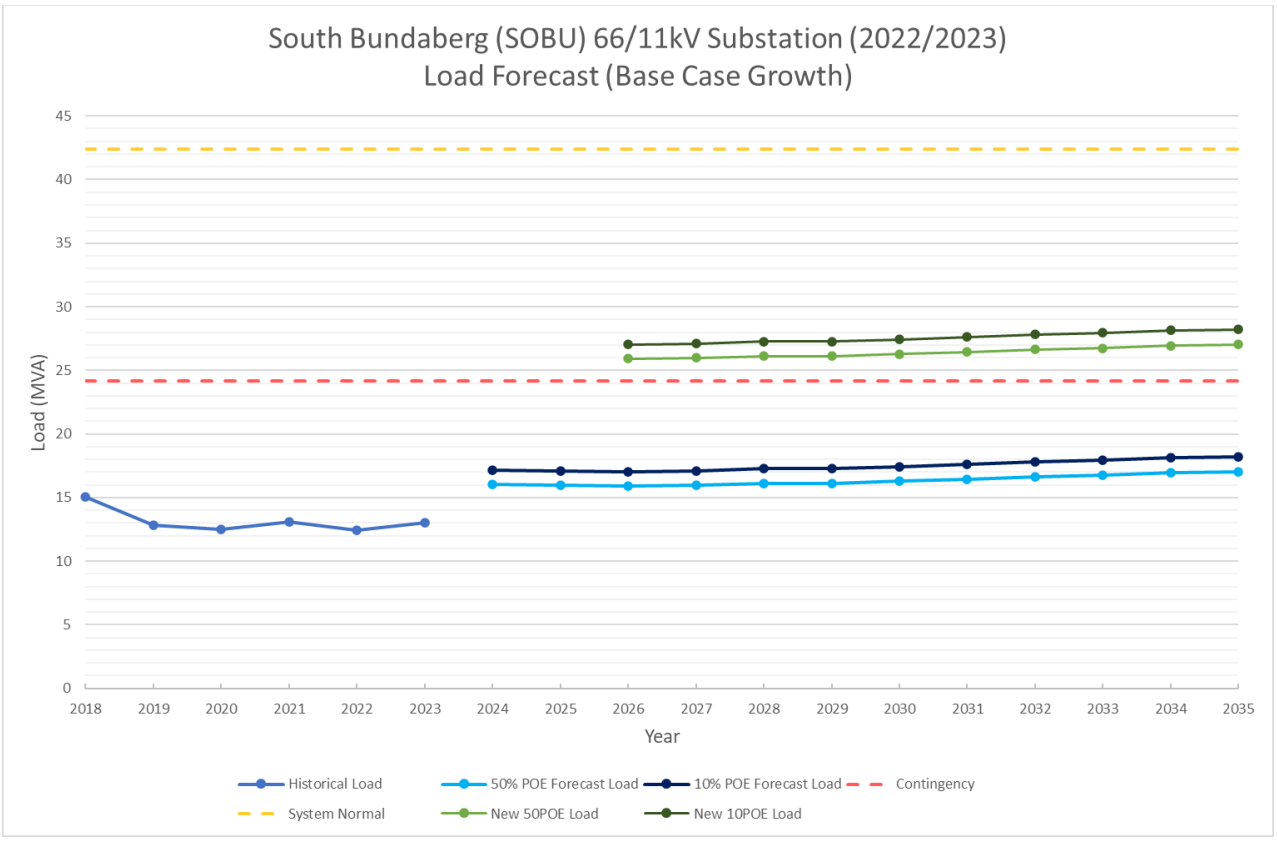


Figure 19: South Bundaberg Substation base case load forecast

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 20, Figure 21, Figure 22, and Figure 23. With the high growth scenario, the peak load is forecast to increase over the next 10 years.

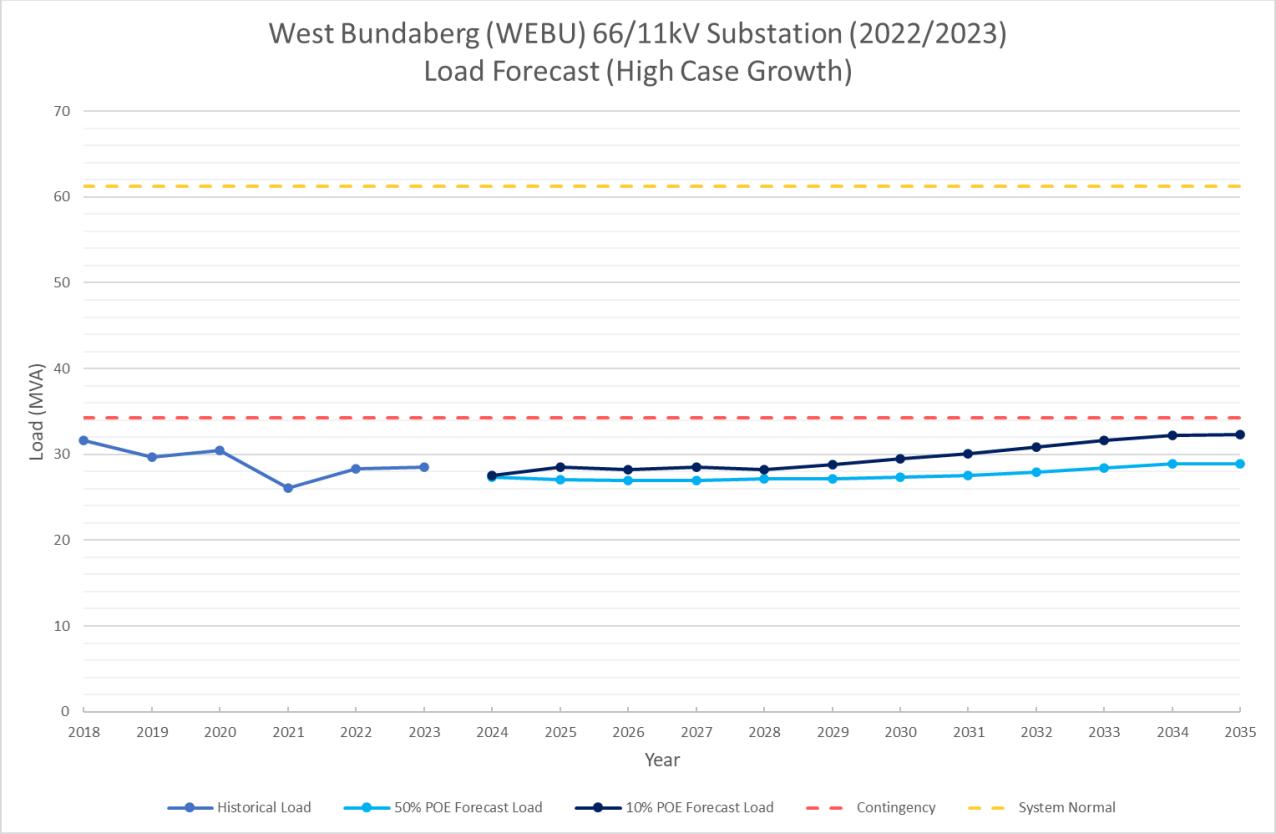


Figure 20: West Bundaberg Substation high growth load forecast

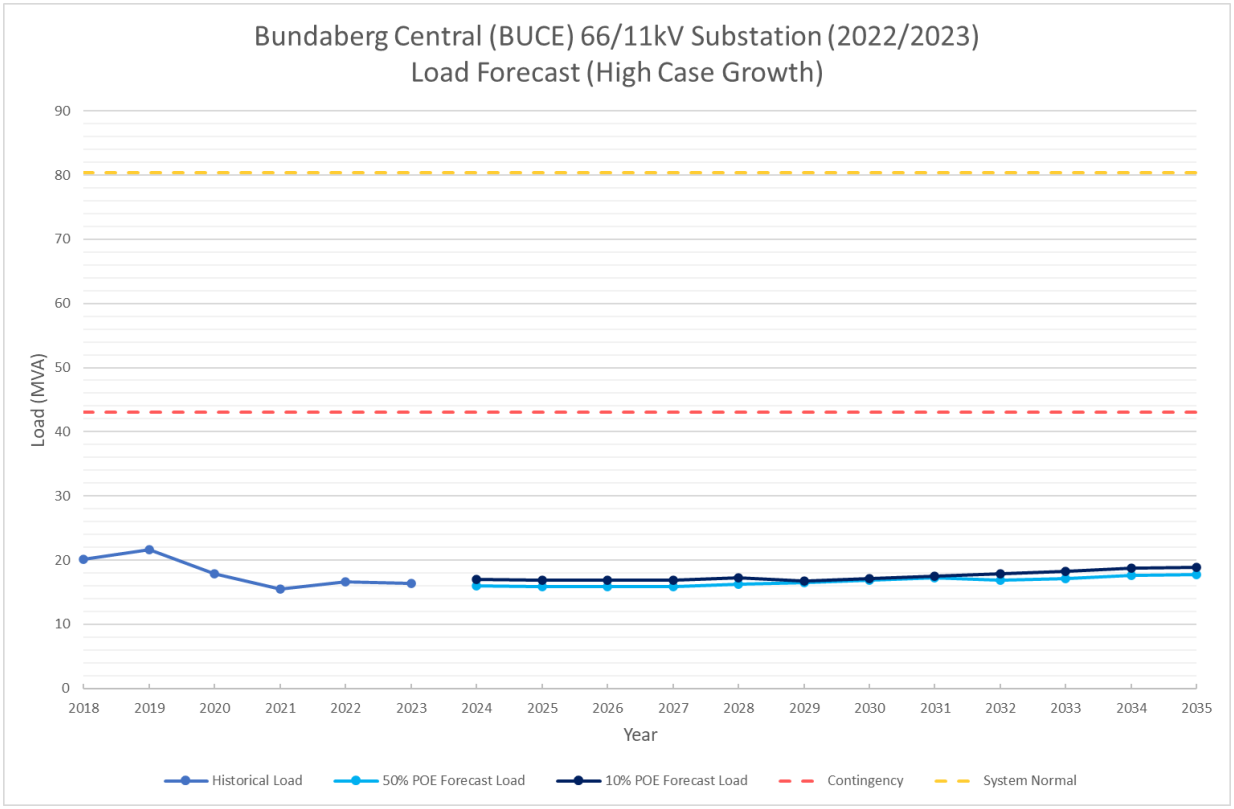


Figure 21: Bundaberg Central Substation high growth load forecast

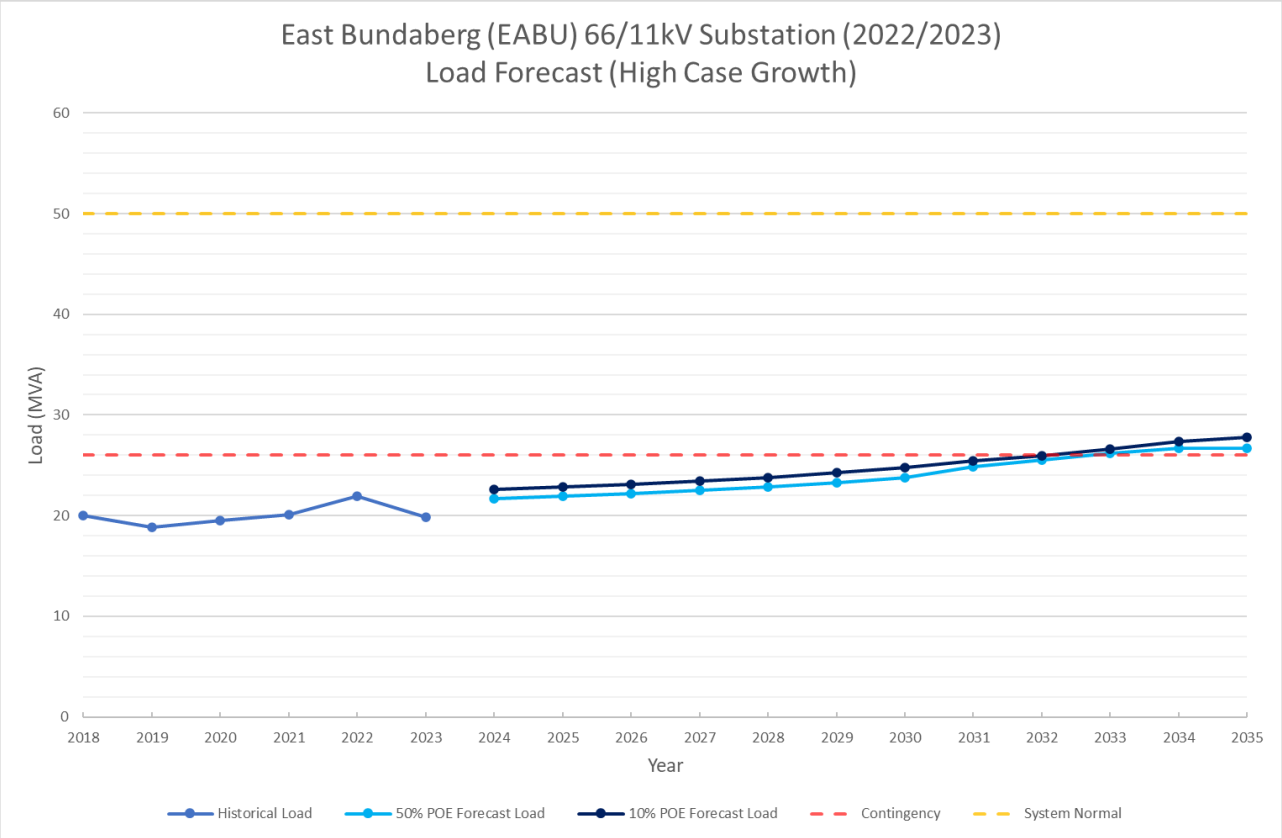


Figure 22: East Bundaberg Substation high growth load forecast

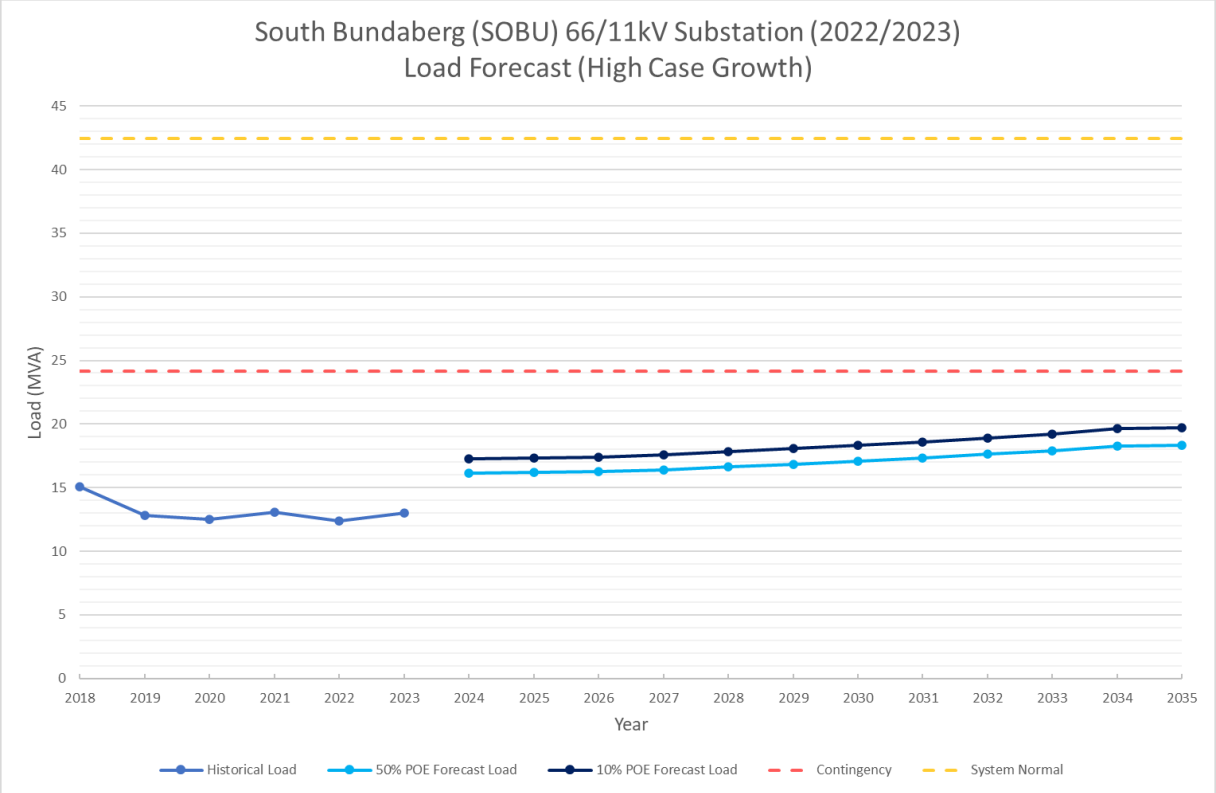


Figure 23: South Bundaberg Substation high growth load forecast

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 24, Figure 25, Figure 26, and Figure 27. With the low growth scenario, the peak load is forecast to remain relatively steady over the next 10 years.

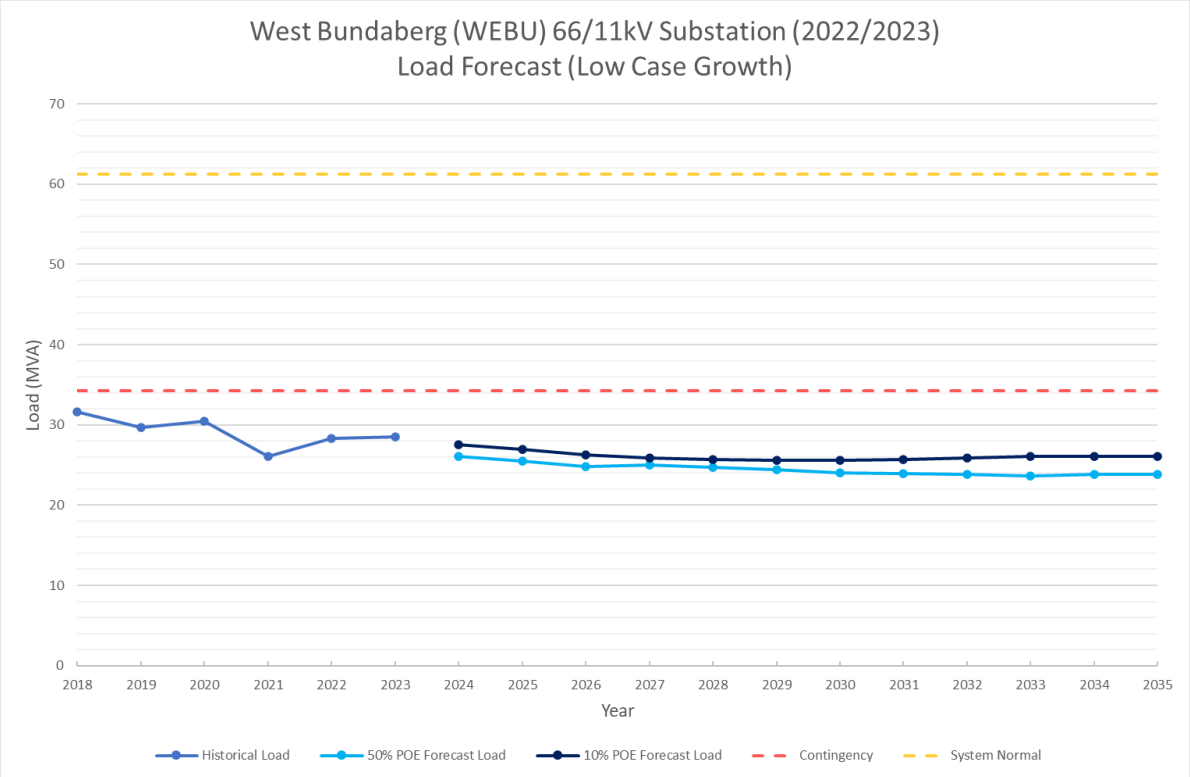


Figure 24: West Bundaberg Substation low growth load forecast

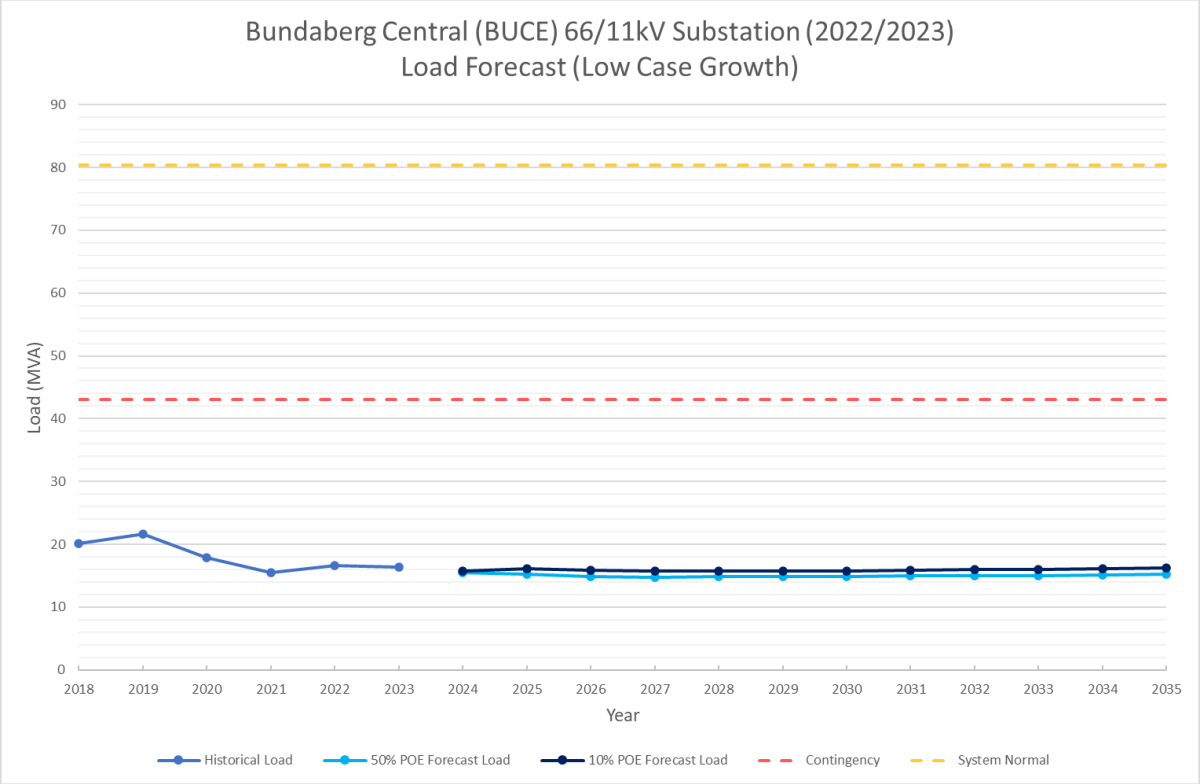


Figure 25: Bundaberg Central Substation low growth load forecast

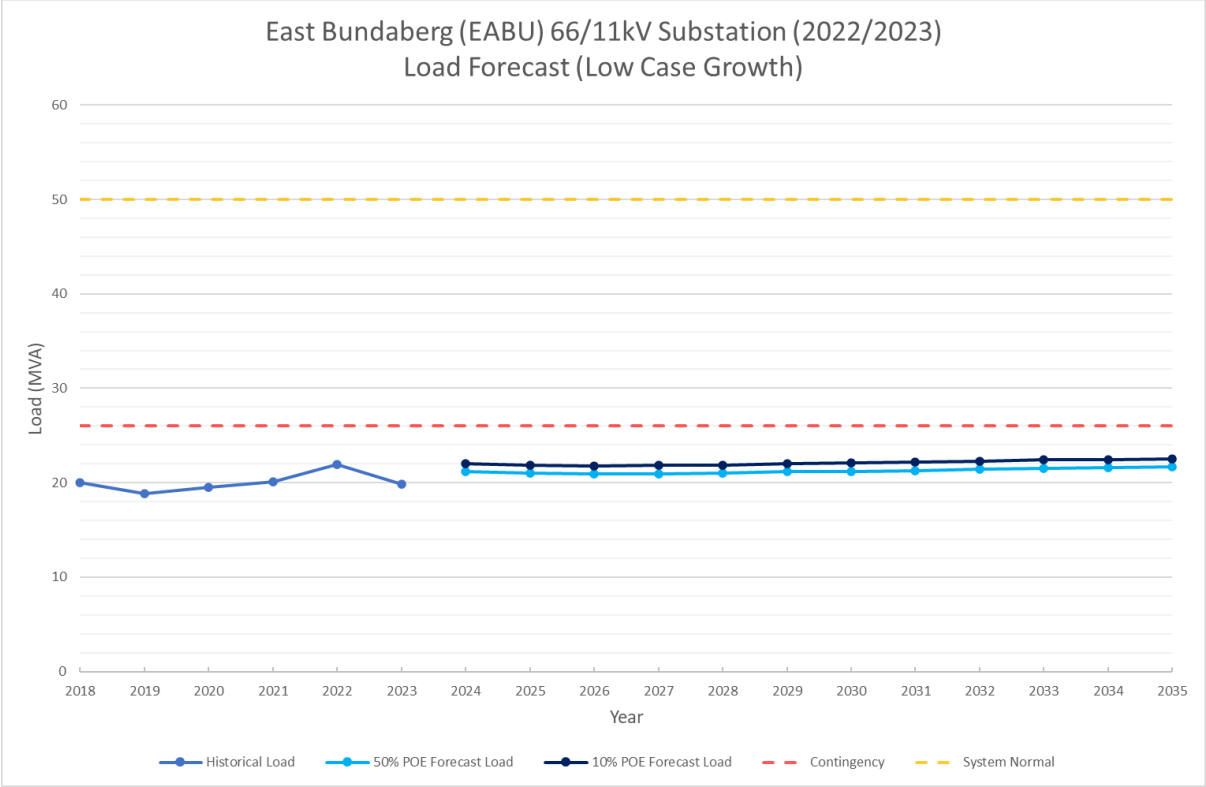


Figure 26: East Bundaberg Substation low growth load forecast

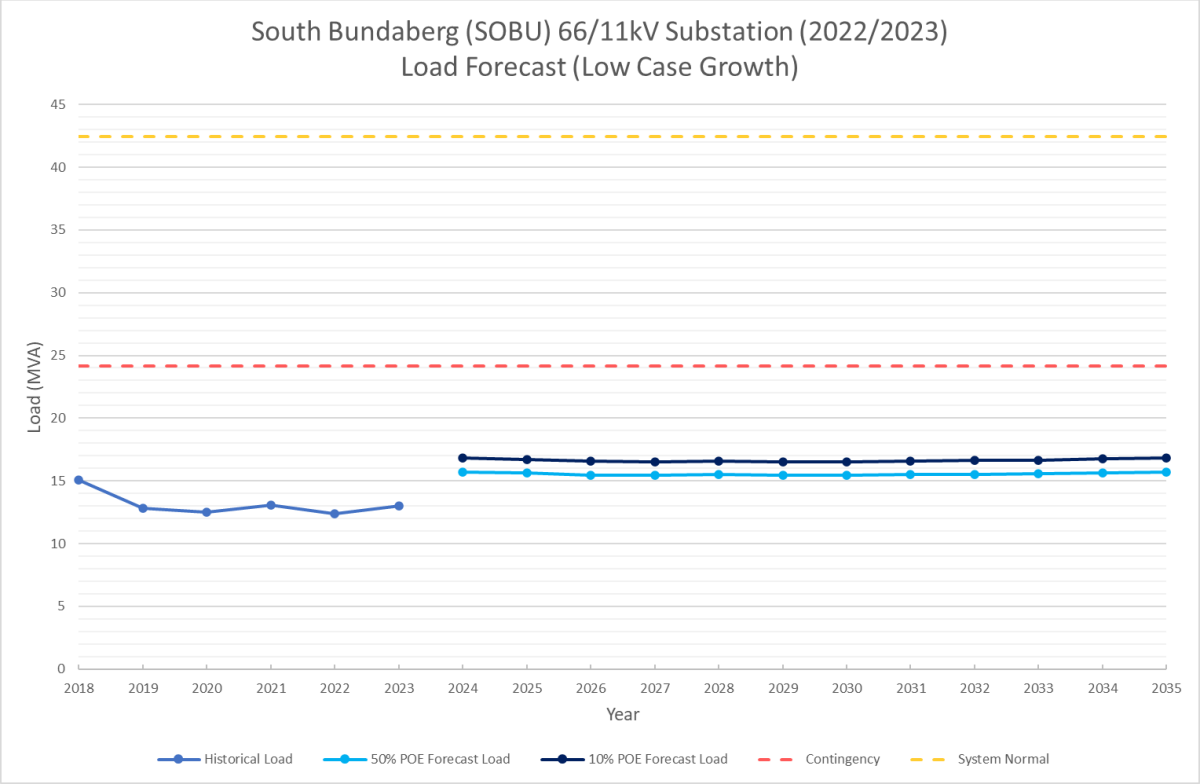


Figure 27: South Bundaberg Substation low growth load forecast

1.4. 66kV Sub-transmission Network

The 66kV network in the Bundaberg region emanates from Bundaberg (T20) Bulk Supply Substation and forms a ring between WEBU, BUCE, EABU and SOBU. M039 and M040 supply WEBU, which subsequently supplies Meadowvale (MEAD) and Gooburrum (GOOM) via M041, along with partial supply to BUCE via 6302 under system normal. This is an anticipated combined forecast load in 2034 of 67MVA. M036 supplies SOBU, which subsequently supplies EABU and partial supply to BUCE under system normal, along with BARG. The anticipated combined forecast load in 2034 is 65MVA.

It can be seen when comparing against values in Table 1 that the anticipated load in 2034 on M036 will exceed the rating of feeder, without the major customer connected. With connection of the major Customer at 11kV at any of the substation, SOBU, EABU or BUCE M036 would be overloaded and require augmentation as SCS costs. As shown in Section 1.3 only BUCE would have sufficient capacity to connect the customer without Zone substation augmentation.

It should be noted that the load flows through the Bundaberg Ring is complex and depends on network configuration. The above loading is indicative of the expected flows on the sub-transmission network under system normal, without the load of the major customer connected.

Table 1: 66kV Sub-transmission Network Ratings

Feeder Name	M040	M039	6302	6205	M037	M036
Voltage (kV)	66	66	66	66	66	66
Conductor Type	Taurus 19/4.75 AAC 1350	Taurus 19/4.75 AAC 1350	Wasp 7/.173" (7/4.39) AAC 1350 (British)	Wasp 7/.173" (7/4.39) AAC 1350 (British)	Wasp 7/.173" (7/4.39) AAC 1350 (British)	Iodine 7/4.75 AAAC 1120
Design Temp	75	75	75	75	50	75
Ergon Energy Climate Zone	Eastern & Coastal - Special	Eastern & Coastal - Special	Eastern & Coastal - Special	Eastern & Coastal - Special	Eastern & Coastal - Special	Eastern & Coastal - Special
Summer Day A (MVA)	809 (92.5)	809 (92.5)	397 (45.4)	397 (45.4)	225 (25.7)	440 (50.3)
Summer Evening A (MVA)	906 (103.6)	906 (103.6)	436 (49.8)	436 (49.8)	311 (35.6)	480 (54.9)
Summer Night Morning A (MVA)	748 (85.5)	748 (85.5)	356 (40.7)	356 (40.7)	258 (29.5)	390 (44.6)
Winter Day A (MVA)	849 (97.1)	849 (97.1)	419 (47.9)	419 (47.9)	285 (32.6)	456 (52.1)
Winter Evening A (MVA)	799 (91.3)	799 (91.3)	381 (43.6)	381 (43.6)	295 (33.7)	417 (47.7)
Winter Night Morning A (MVA)	804 (91.9)	804 (91.9)	383 (43.8)	383 (43.8)	297 (34)	419 (47.9)

2. IDENTIFIED NEED

2.1. Description of the Identified Need

2.1.1. Connection of Major Customer

The primary driver for this project is the connection of a major customer in the Bundaberg Region by 2026. Due to commercial in confidence all details of the enquiry cannot be disclosed, however the information pertinent to this RIT-D is the connection of a load up to 10MW and requirement for an N-1 supply. The overall project includes both ACS and SCS costs components, although this RIT-D only focuses on the SCS component.

2.1.2. Zone Substation Limitations

As shown in section 1.3 the zone substations in the area have limited capacity and the connection of up to 10MW would exceed the substations N-1 capacity and induce a safety Net limitation, with the exception being BUCE.

2.1.3. Sub-transmission Network Limitations

As discussed in section 1.4 the sub transmission network between BUND (T20) and SOBU will have a limitation in 2034 based on the current load forecast without the connection of the major customer. This limitation had been on Ergon Energy horizon and tentative project placeholder for Bundaberg 66kV reinforcement had been proposed with completion dates between 2028-2030. This future project would implement a second 66kV feeder from BUND (T20) to SOBU to address the limitation.

3. INTERNAL OPTIONS CONSIDERED

3.1. Non-Network Options Identified

Ergon Energy 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 Bundaberg area to address the identified need.

3.2. Network Options Identified

In consultation with the customer Ergon Energy has identified one credible network option that will address all of the identified needs outlined in section 2, in particular providing an N-1 supply to a major customer. While only one option has been identified to provide a complete solution to the identified needs, given the SCS cost component and that the option will also address network limitations on the 66kV network and allow deferral of future zone substation augmentation the NPVs for options that would address those network limitations will be included in the Draft Project Assessment Report (DPAR) for transparency and to demonstrate that the option not only meets the major customer requirement but also provides the most efficient investment for the network in the Bundaberg Region.

3.2.1. Option A: Development of Thabeban 66/11kV Substation

This option involves the development of a new greenfield 2 x 20/25MVA 66/11kV substation, which will be known as Thabeban (THAB). In order to provide diverse N-1 supply at the 66kV level THAB will be supplied via an approximately 4km 66kV feeder from BUND (T20) and an approximately 4km feeder from SOBU.

A schematic diagram of the proposed network arrangement for Option A is shown in Figure 28.

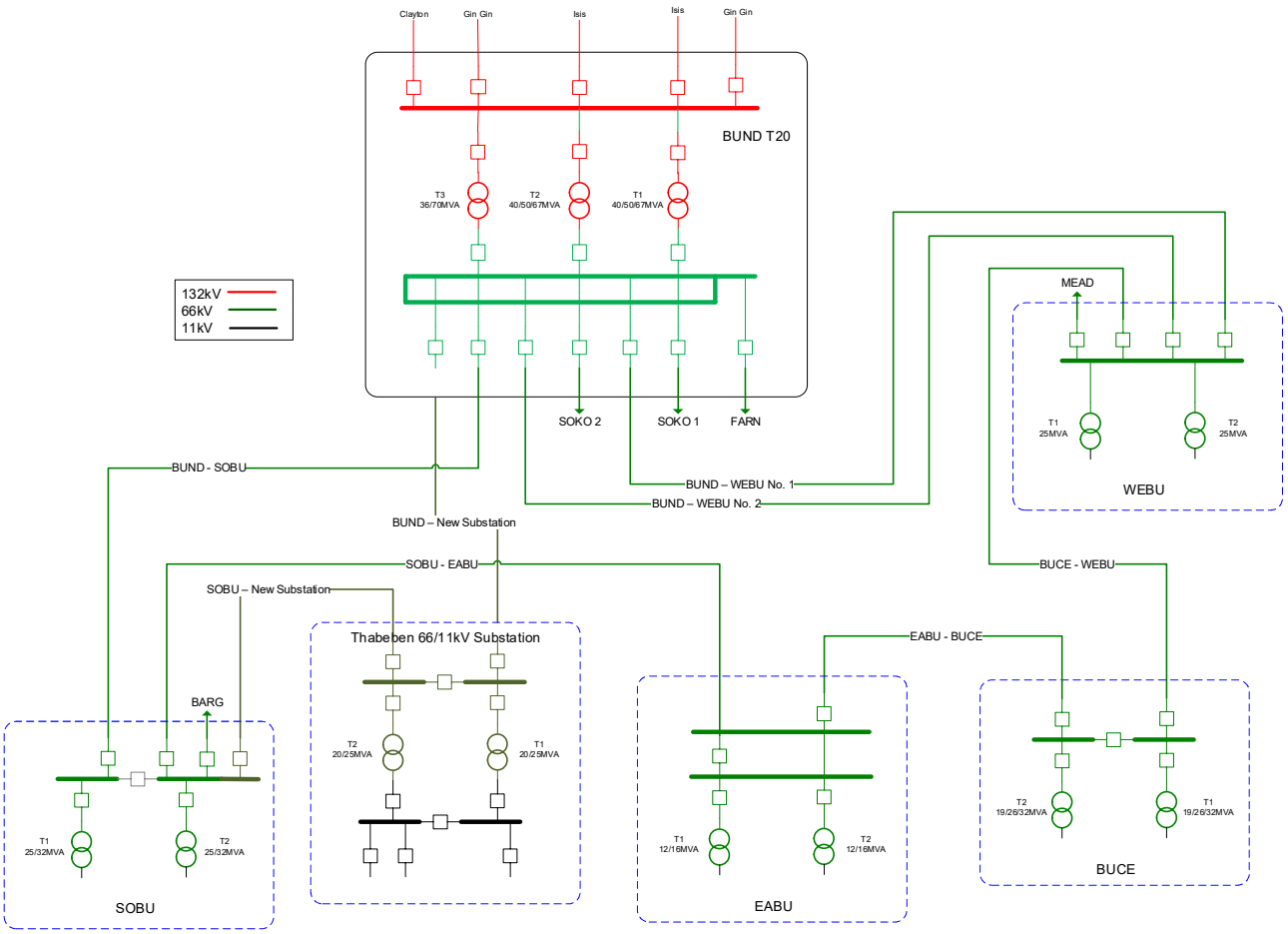


Figure 28: Option A proposed network arrangement (schematic view)

3.3. Preferred Network Option

Ergon Energy's preferred internal network option is Option A, to develop a new greenfield 2 x 20/25MVA 66/11kV substation, Thabeban.

Upon completion of these works, identified needs listed in section 2 for the Bundaberg region will be addressed. The major customer can be connected with all of their requirements met, the 66kV network limitation is addressed and increase 11kV capacity in the region for future growth and connections. The preferred option will provide the greatest reliability benefit for customers, whilst also reducing expenditure and providing future capacity for growth in the region.

The estimated direct SCS capital cost of this option has been estimated $15.41 million. Annual operating and maintenance costs are anticipated to be 1.5% of the capital cost. The estimated project delivery timeframe has design commencing in late 2023 and construction completed by October 2026.

4. ASSSESSMENT OF NON-NETWORK SOLUTIONS

Ergon Energy in assessing the major customer requirements for connection have not identified any full or partial non-network solutions.

Any credible options must be technically and commercially viable and must be able to be implemented in sufficient time (2026) to satisfy the identified need for the network to connect the major customer.

4.1. Demand Management (Demand Reduction)

Given the ultimate load requirement of up to 10MW and the need for high reliability and N-1 supply no demand management reduction methodologies have been identified that would provide a partial or total solution to the identified need.

4.1.1. Network Load Control

Across the four zone substations, WEBU, SOBU, EABU and BUCE the daily peak demand generally occurs between 5:00pm and 9:00pm.

There are 3,919 customers on tariff T31 and 14,193 customers on tariff T33 hot water load control (LC).

The Bundaberg Zone Substations LC signals are controlled from T020 Bundaberg Bulk Supply Substation (BUND). The Tariff 33 and 31 hot water LC channels are dynamic (that is, it responds to exceedance settings not on a timetable). Tariff 33 air-conditioning channels are under manual control of the operational control centre and are used as required. Network load control does not address the identified need, especially once an additional 10MW load is added to the system.

4.2. Demand Response

Four methods utilising demand response technology for deferring network investment are: Call Off Load (COL), Customer Embedded Generation (CEG), Large Scale Customer Generation (LSG) and customer solar power systems.

4.2.1. Customer Call Off Load (COL)

COL is an effective technique for deferring network investment where the need is for a short time period. However, in this instance, the need is required on a long-term permanent basis. There are a small number of large customers in the catchment area but the $/kVA funding available for demand reduction is low therefore customer call off load has been assessed as not a viable proposition as it will not address the identified need, nor benefit the community.

4.2.2. Customer Embedded Generation (CEG)

CEG is an effective technique for deferring network investment where the need is for a short time period. A short-term deferral of network investment by using CEG is not a technically or financially feasible option (due to the number of contracts required to be negotiated and managed).

This option has been assessed as technically not viable as it will not address the identified network requirement.

4.2.3. Large-Scale Customer Generation (LSG)

LSG sites such as renewable energy generation, solar or wind farms of multiple MW's capacity constitute an opportunity to support substation investment by reducing demand on, and potentially providing reactive power support for substation assets. The requirements for the major customer are such that LSG will not provide a technically feasible solution.

4.2.4. Customer Solar Power Systems

The capacity of solar photo voltaic (PV) systems connected at each zone substation is 20,055kVA at WEBU, 20,330kVA at EABU, 6,796kVA at BUCE and 12,301kVA at SOBU.

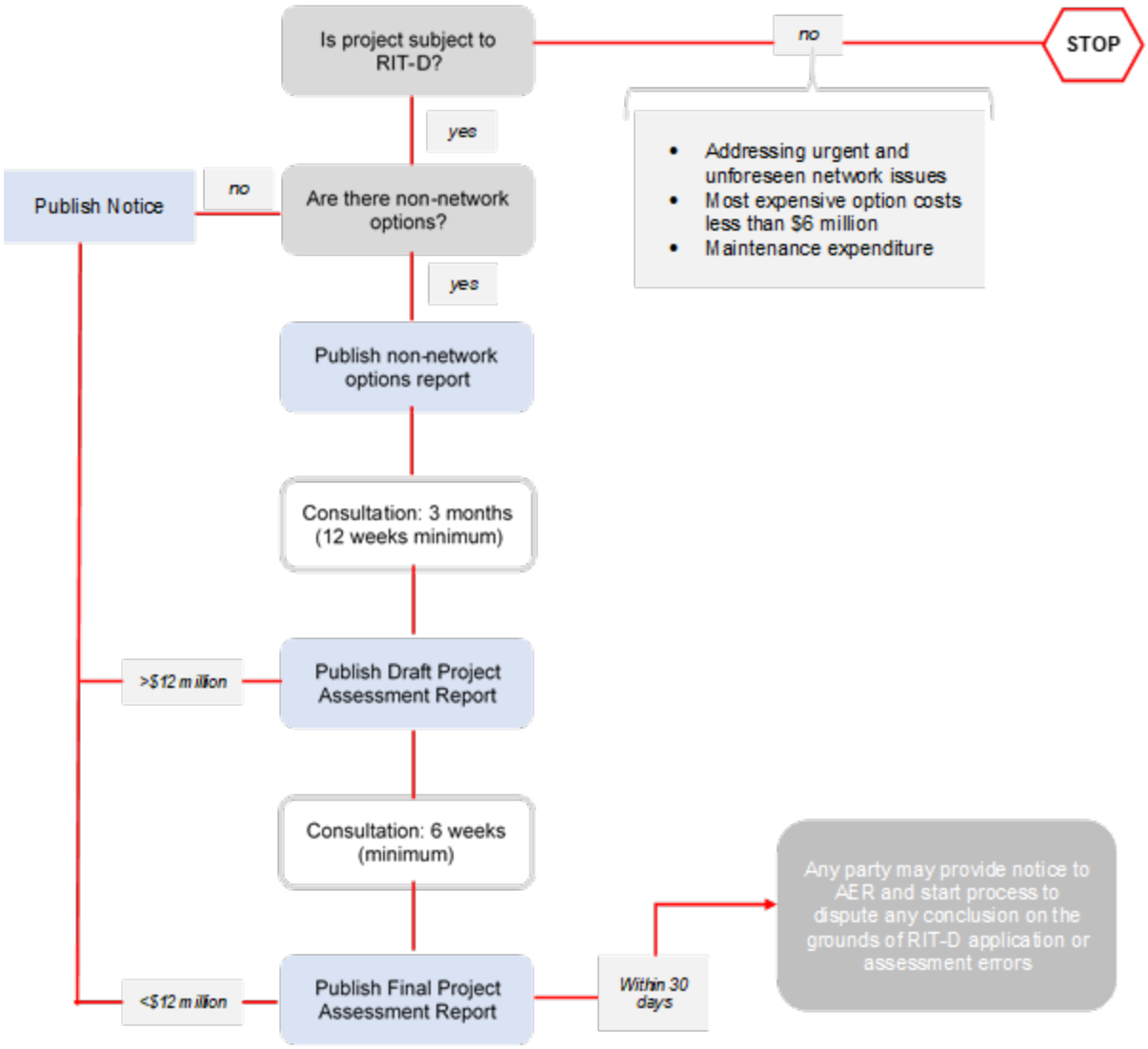
The daytime peak between 9:00am and 3:00pm is reducing year on year in the Bundaberg region due to the integration of residential inverter energy systems. As such customer solar generation does not coincide with the peak load period. Residential Solar PV coupled with BESS may have the potential in the future to reduce peak demand, however when coupled with EV growth and charging profiles the peak may not be reduced substantially. However, it should be noted that reduction of the afternoon peak through BESS integration will not meet the requirements of identified need.

5. CONCLUSION AND NEXT STEPS

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

The preferred network option is Option A – Develop Thabeban 66/11kV Substation. This Notice of No Non-Network Options is therefore published in accordance with rule 5.17.4(d) of the National Electricity Rules. As the next step in the RIT-D process, Ergon Energy will now proceed to publish a Draft 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.