



Regulatory Investment Test for Distribution (RIT-D)

West End Zone Substation Limitation

Notice of No Non-Network Options

27 April 2022

West End Network Limitation Notice of No Non-Network Options

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

West End Zone Substation (SSWED) is fed via two 110kV feeders 905 (from Rocklea SSH16) and 830 (From Charlottes Street SSCST). SSWED is equipped with two 60MVA 110/11kV single winding transformers and provides electricity supply to approximately 9,200 predominately residential customers in the surrounding areas.

The ongoing operation of the ageing circuit breakers and protection relays beyond 2024 presents a significant risk to safety and customer reliability. The Protection department has also identified the need to upgrade current protection schemes configured on the assets.

As per STNW3039, SSWED has been classified as a critical site. Based on this classification, the current security system is deemed inadequate and must be upgraded to monitor the critical site. Civil Condition Assessments have identified various works such as building a new boundary retaining wall as well as various conduit and transformer bunding.

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 West End 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.

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1. BACKGROUND

1.1. Geographic Region

West End Zone Substation (SSWED) supplies the suburbs of South Brisbane, West End and Highgate Hill. SSWED provides electricity supply to approximately 9,200 predominately residential customers in the surrounding areas. The geographical location of Energex's sub-transmission network and substations in the area is shown in Figure 1.



Figure 1: Existing network arrangement (geographic view).

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1.2. Existing Supply System

SSWED is fed via two 110kV feeders 905 from Rocklea Bulk Supply Point (SSH16) and 830 from Charlotte Street Zone Substation (SSCST). SSWED is equipped with two 60MVA 110/11kV single winding transformers and provides electricity supply to approximately 9,200 predominately residential customers in the surrounding areas.

SSWED has four 11kV buses with TR3 supplying BB13, BB16 and TR4 supplying BB14, BB15. There are ACO schemes for bus section CBs between BB13, BB14 and BB15, BB16. In addition, there is a bus tie between BB14 and BB15. BB14 supplies three remote direct-connect customer substations. SSWED has been identified as one of the critical substations supplying the Olympic 2032 games infrastructure.

A schematic view of the existing sub-transmission network arrangement is shown in Figure 2.

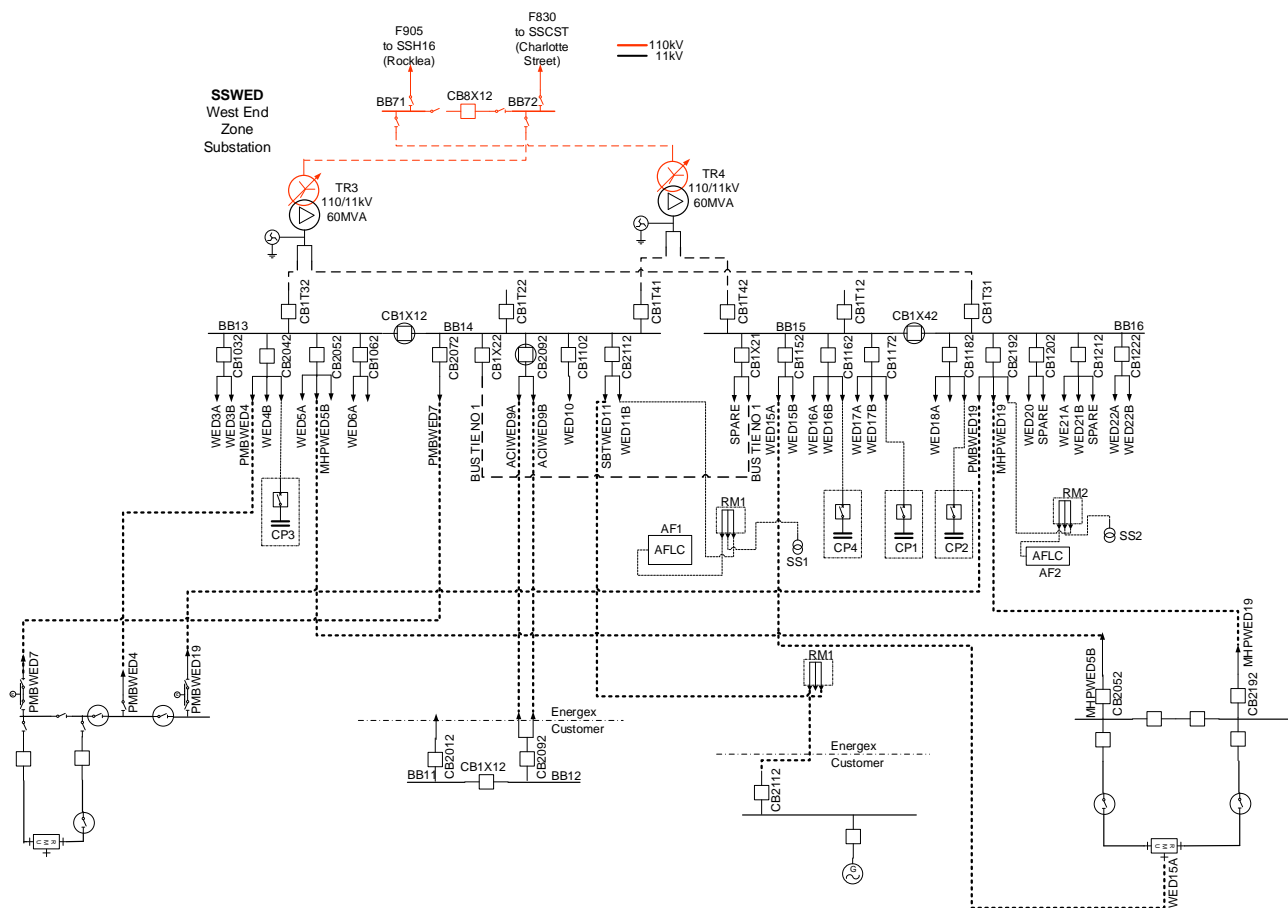


Figure 2: Existing network arrangement (schematic view)

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1.3. Load Profiles / Forecasts

The load at SSWED comprises of largely residential customers. The load is summer peaking, and the annual peak loads are predominantly driven by residential power consumption.

1.3.1. Full Annual Load Profile

The full annual load profile for West End Substation over the 2020/21 financial year is shown in Figure 3. It can be noted that the peak load occurs during summer.

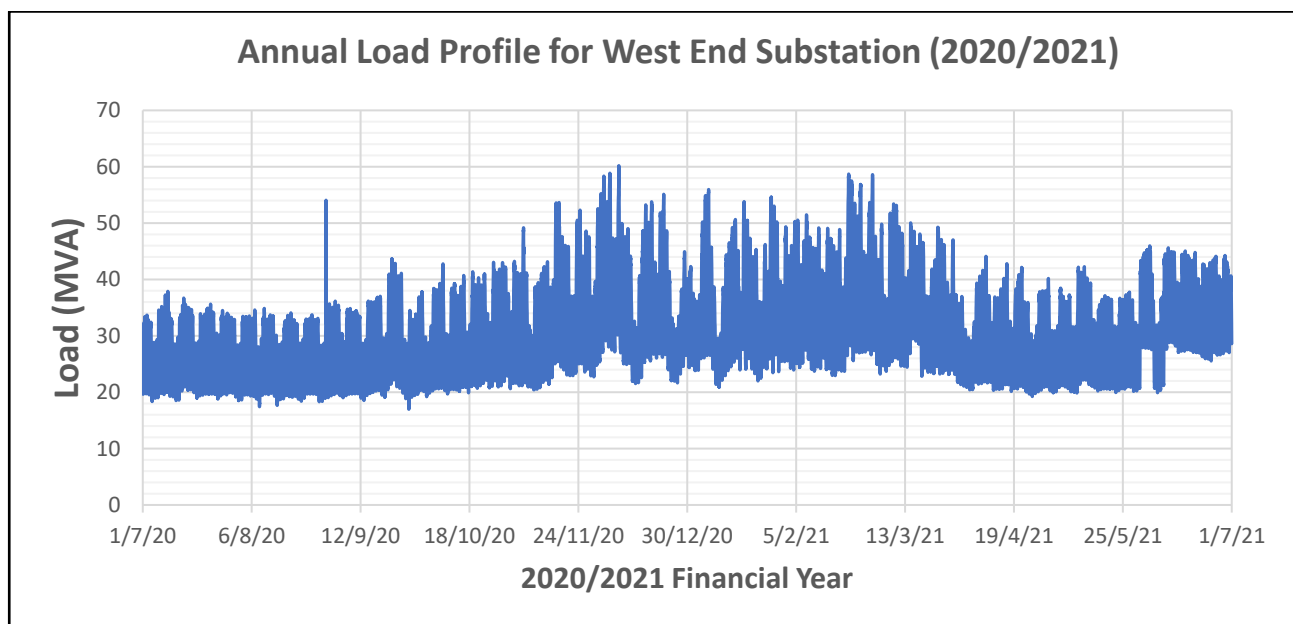


Figure 3: Substation actual annual load profile

1.3.2. Load Duration Curve

The load duration curve for West End Substation over the 2020/21 financial year is shown in Figure 4.

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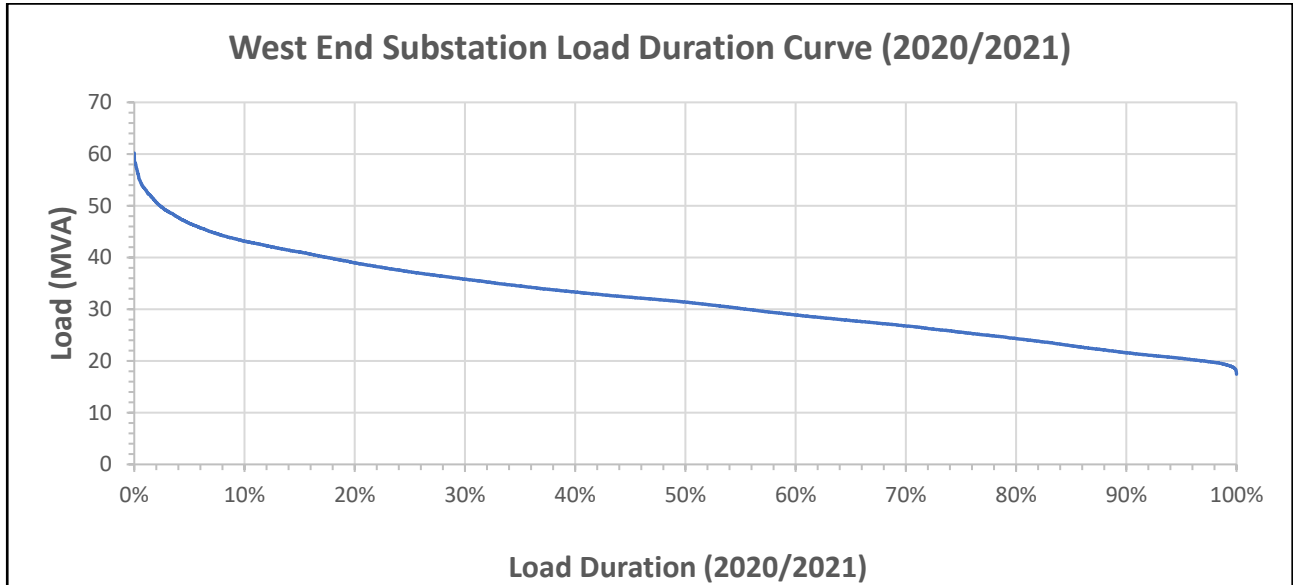
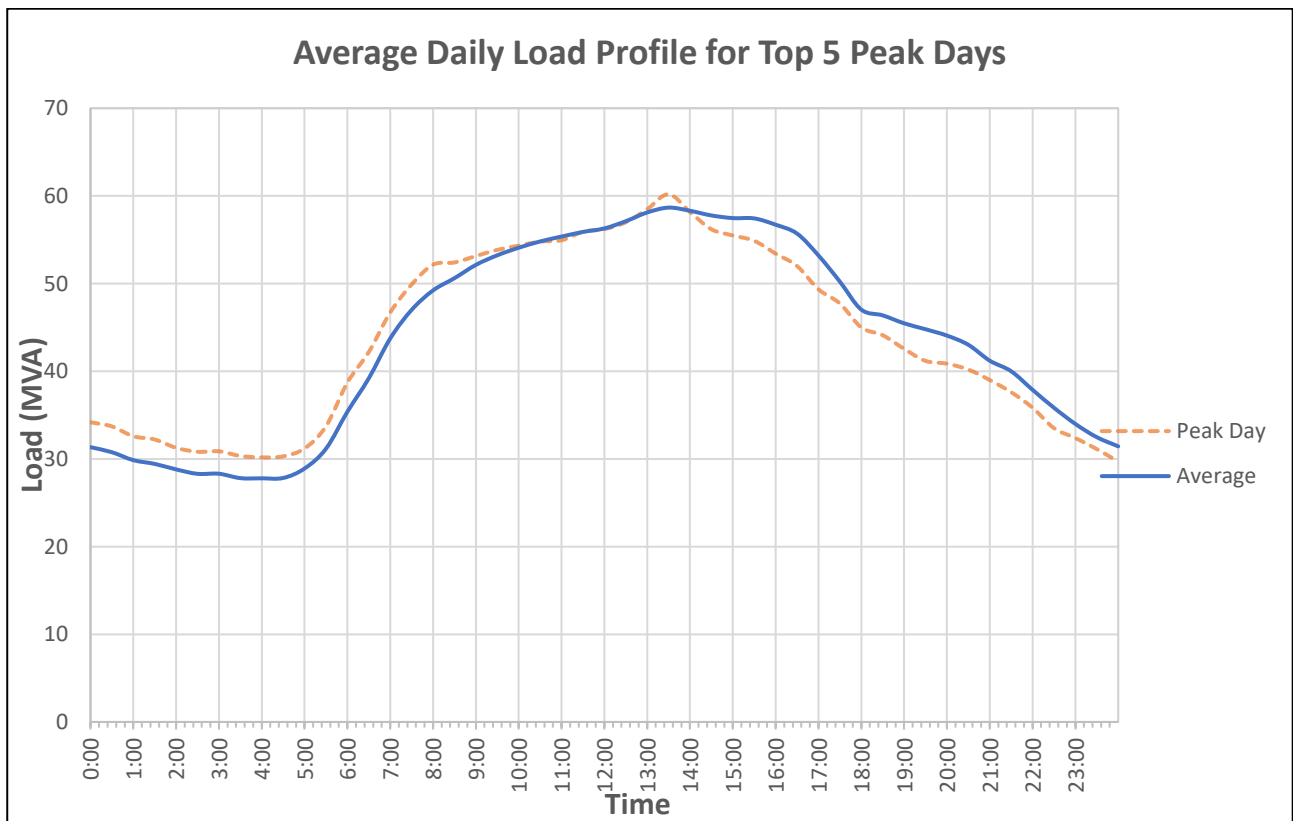


Figure 4: Substation load duration curve

1.3.3. Average Peak Weekday Load Profile (Summer)

The daily load profile for an average peak weekday during summer is illustrated below in Figure 6. It can be noted that the summer peak loads at West End Substation are historically experienced at midday and in the evenings.



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Figure 5: 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 6. 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 have fluctuated slightly over the past five years. It can also be noted that the peak load is forecast to remain relatively steady over the next 10 years until experiencing a rapid increase in demand due to the upcoming Olympics under the base case scenario.

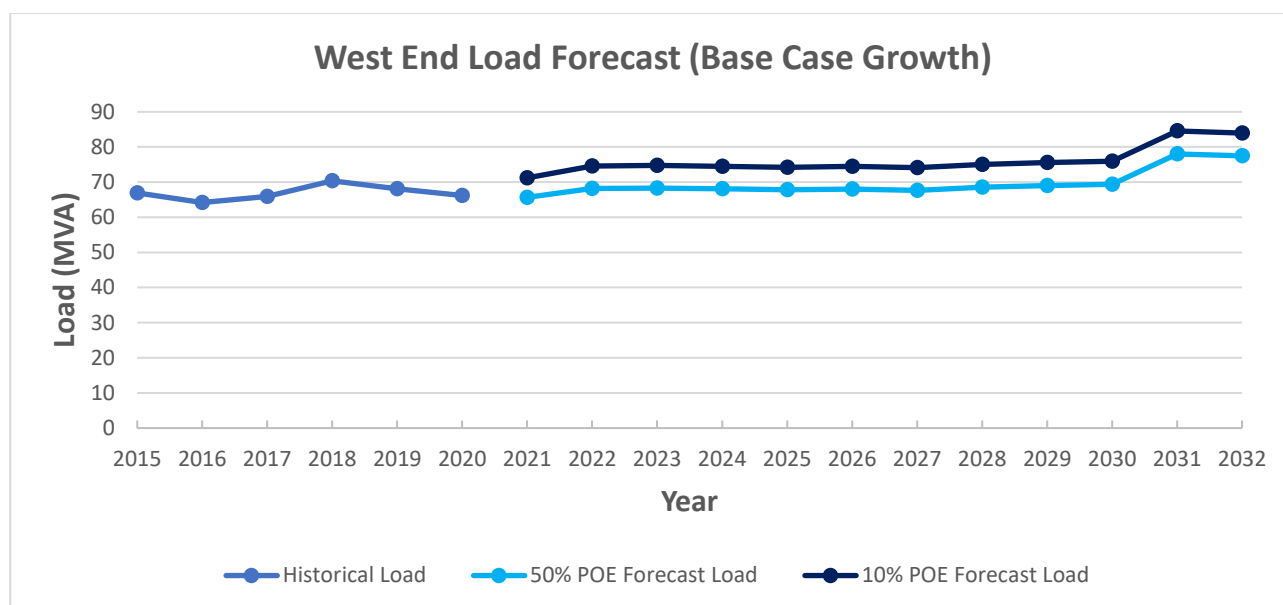


Figure 6: Substation base case load forecast

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 7. With the high growth scenario, the peak load is forecast to remain relatively steady over the next 10 years until experiencing a rapid increase in demand due to the upcoming Olympics.

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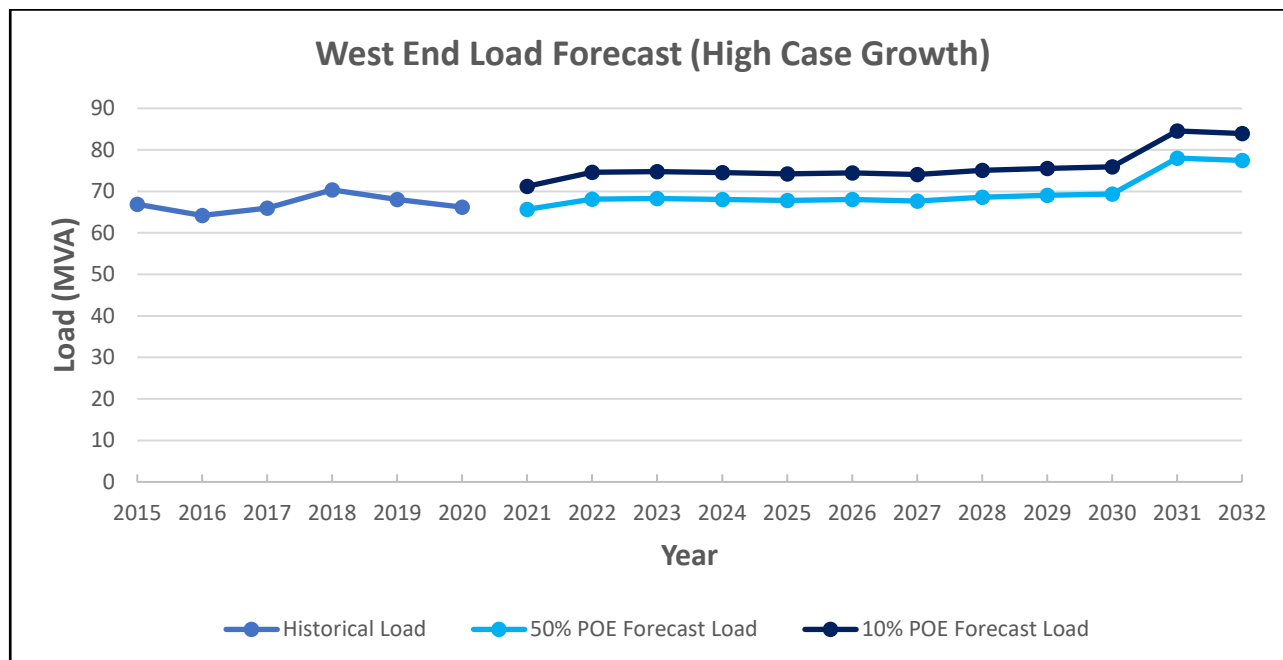


Figure 7: Substation high growth load forecast

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 8. With the low growth scenario, the peak load is forecast to remain relatively steady over the next 10 years until experiencing a rapid increase in demand due to the upcoming Olympics.

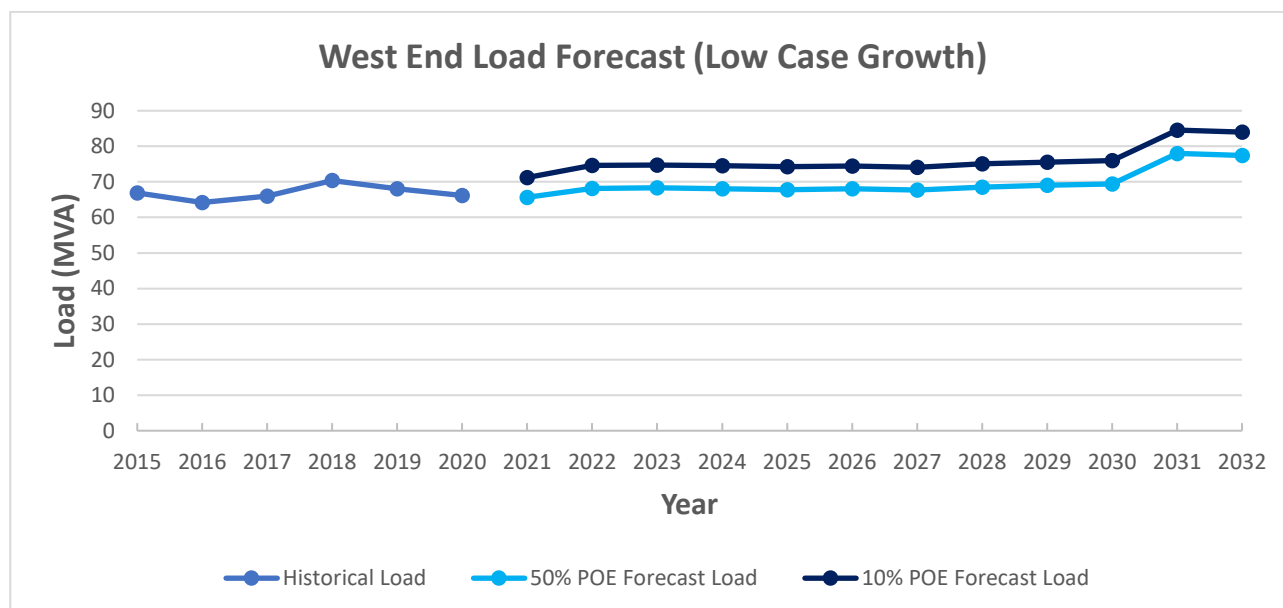


Figure 8: Substation low growth load forecast

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2. IDENTIFIED NEED

2.1. Description of the Identified Need

2.1.1. Aged and Poor Condition Assets

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

- Six (6) 11kV Circuit Breakers
- Protection Relays on BB13 and 110kV bus

The deterioration of these primary and secondary system assets poses safety risks to staff working within the switchyard. It also poses a safety risk to the general public, through the increased likelihood of protection relay mal-operation. Without remediation, Energex views that the safety risk to the public and its staff to not be reduced to So Far As Is Reasonably Practicable.

The failure of both circuit breakers and protection relays significantly increases the likelihood of outages in addition to potential damage to existing infrastructure, resulting in a reduction in the level of reliability experienced by the customers supplied from West End Substation.

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

2.1.2. Reliability

Currently the aged assets present a risk to the reliability of supply at West End. Figure 11 shows that the value of customer reliability (VCR) by replacing the assets is over \$800,000 after the first five years. The scenarios that have been considered are:

- 11kV feeder CB failure
- 11kV transformer CB failure
- Bus Section CB failure
- Protection Relay failure

For 11kV feeder and/or transformer CB failure it was assumed that up to half the load on the 11kV switchboard could potentially be lost; however, it was assumed that this load could be supplied by transfers within 3hrs. This provides a conservative estimate for the VCR. A bus fault would result in an outage to a quarter of 11kV customers, which affects over 2,300 customers and results in a load at risk of approximately 17.5MVA.

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3. INTERNAL OPTIONS CONSIDERED

3.1. Non-Network Options Identified

Energex has not identified any viable non-network solutions internally that will provide a complete or a hybrid (combined network and non-network) solution to provide the magnitude of network support required in the West End area to address the identified need.

3.2. Network Options Identified

Energex has identified 1 credible network options that will address the identified need.

3.2.1. Option 1: Establish new 11kV Switchboard

This option involves the following works:

- Replace existing BB14 with new switchgear (6 x feeder CBs, 1 x transformer CB)
- Upgrade TR3 and TR4 protection to dual DIFF protection
- Upgrade 110kV BZ protection
- Replace identified EOL relays on BB13
- Improve backup protection reach on identified 11kV feeders on BB13
- Upgrade site security as per network asset classification
- Decommission the existing CO2 fire suppression system
- Replace 110kV surge arresters on TR3 and TR4
- Upgrade remote end protection (SSACI, SSSBT, SSPMB) to match SSWED end
- Provide FO communications (SSWED-SSACI, SSACI-SSPMB)
- Demolish existing boundary retaining wall and build new wall 3m high

A schematic diagram of the proposed network arrangement for Option 1 is shown in Figure 9.

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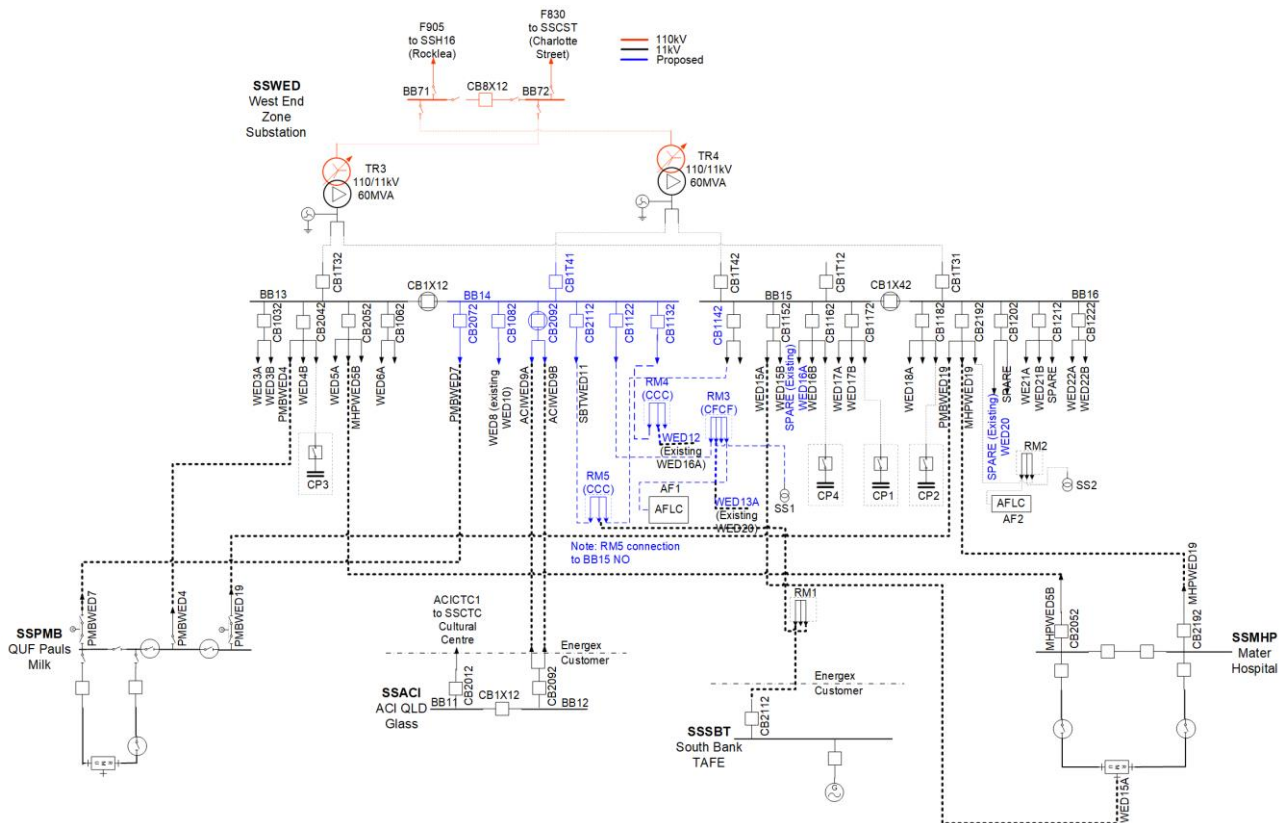


Figure 9: Option 1 proposed network arrangement (schematic view)

3.3. Preferred Network Option

Energex's preferred internal network option is Option 1, to Establish a new 11kV switchboard.

Upon completion of these works, the asset safety and reliability risks at West End Substation will be addressed. The preferred option will provide the greatest reliability benefit for customers, whilst also reducing expenditure on obsolete, non-compliant and high maintenance assets, while ensuring more efficient use of design and construction resources.

The estimated capital cost of this option inclusive of interest, risk, contingencies and overheads is \$5.19 million. The change in annual operating and maintenance costs are anticipated to be immaterial. The estimated project delivery timeframe has design commencing towards the end of 2022 and construction completed by March 2024.

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4. 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.

Once the aged assets at SSWED reach their retirement age and can no longer be safely operated, the existing load would need to be supplied via non-network alternative solutions while satisfying the Service Safety Net Targets as specified in the Distribution Authority issued to Energex.

It is considered that no available demand management products or strategies can provide sufficient demand support at SSWED to address the identified need. It is evident that an economically feasible non-network option would not be available to defer or eliminate the requirement to remove and replace the 11kV Switchboard and continue to provide a safe, sufficient and reliable supply to customers in the West End Area.

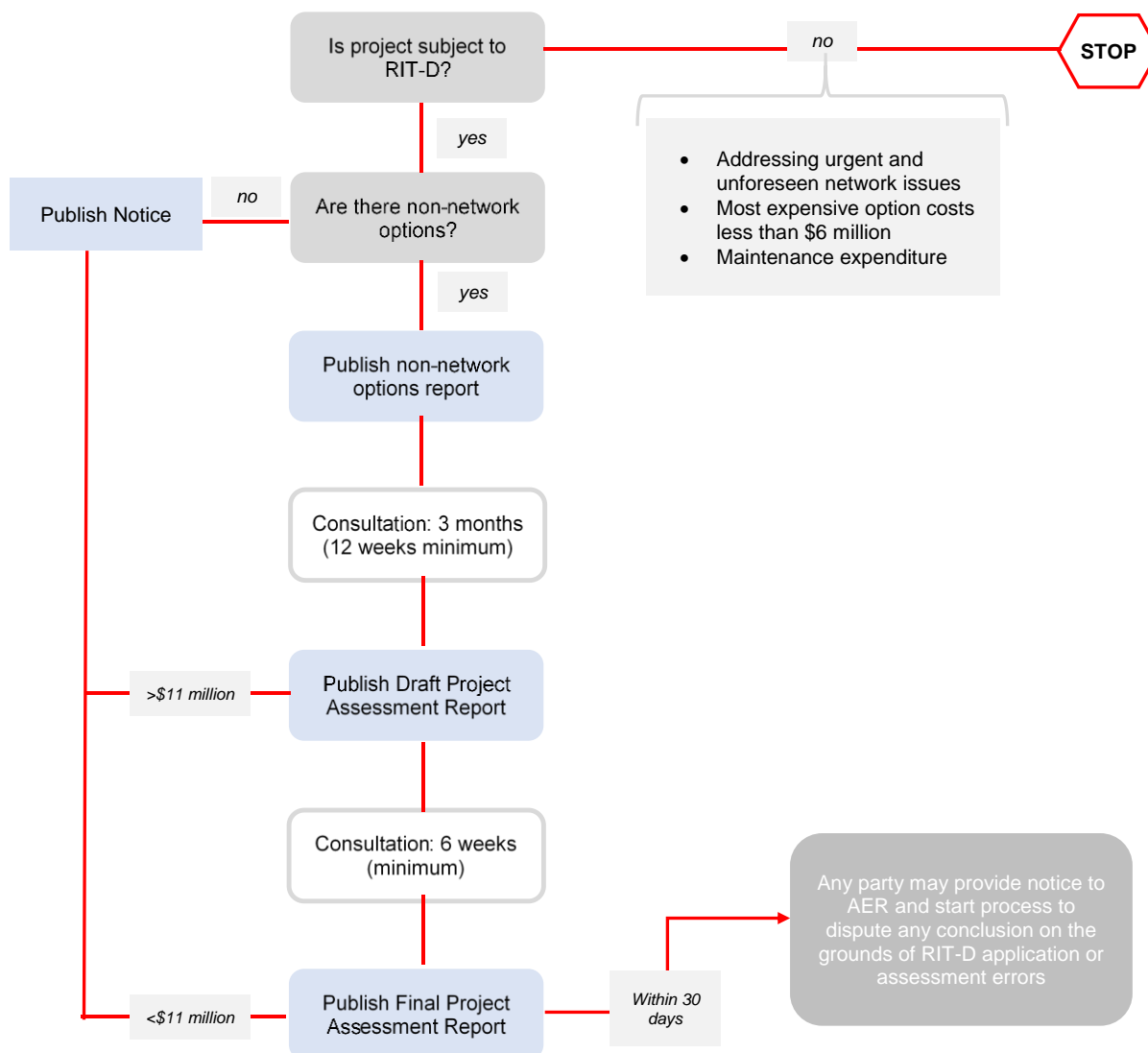
5. CONCLUSION AND NEXT STEPS

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 West End area to address the identified need.

The preferred network option is Option 1 - Establish new 11kV Switchboard. This Notice of No Non-Network Options is therefore published in accordance with rule 5.17.4(d) of the National Electricity Rules. As the next step in the RIT-D process, Energex will now proceed to publish a Final Project Assessment Report.

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APPENDIX A – THE RIT-D PROCESS



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