Regulatory Investment Test for Distribution (RIT-D)

Addressing Reliability Requirements in the LDM Network Area

Notice of No Non-Network Options

14 November 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

Lindum Zone Substation (SSLDM) is a 33kV switching station linking 110/33kV bulk supply substations SSLBS (Lytton Bulk Supply), and SSDBS (Doboy Bulk Supply). SSLBS is radially fed by 2 x (110kV) feeders, on the same towers, from Powerlink's' H21 Murrarie substation. SSLBS 33kV system feeds a total 22,700 customers (21,229 residential and 1,471 business), with a residential consumption of 115.03 GWh and business consumption of 435.21 GWh. Several 33kV/11kV Zone Substations are fed by SSLBS, which include: SSGIS (Gibson Island), SSLYT (Lytton), SSFIS (Fishermans Island), SSFBS (Fishermans Bulk Supply), SSWYN (Wynnum), SSLBS (Lytton Bulk Supply), SSLTA (LTA). There are large industrial customers supplied from the 33kV network of SSLBS including, one with a maximum demand of 24.8MVA and energy consumption of 147GWh per annum, another with a maximum demand of 19.2MVA and energy consumption of 128GWh per annum and a third with a maximum demand of 11.2MVA and energy consumption of 48.1GWh per annum. SSLDM provides an alternate supply for SSLBS.

Based on a Condition Based Risk Management (CBRM) analysis, the following have been deemed to reach their retirement age at SSLDM:

- 8 x 33kV Circuit Breakers: CB3X12, CB3X22, CB5992, CB6002, CB6812, CB6822, CB6872 and CB6882 by 2023
- 36 concrete busbar supports
- 13 electronic protection relays

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 LBS supply area in a reliable, safe, and cost-effective manner. Accordingly, this investment is subject to a RIT-D. An internal assessment has been conducted and it has been determined that there is no 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

Lindum substation (SSLDM) is a 33kV switching station providing alternate 33kV supply to SSLBS (Lytton Bulk Supply Substation). SSLBS supply area is predominately industrial supply with several large industrial customers. SSLBS supplies 7 x 33/11/kV zone substations (GIS Gibson Island, LYT Lytton, FIS Fishermans Island, FBS Fishermans Island Bulk, WNM Wynnum, LTA Lota, LBS Lytton Bulk Supply) providing electricity supply to approximately 22,700 customers, of which 94% are residential and 6% are commercial, and industrial. Total energy supplied by SSLBS is 550.24 GWh of which 79% is used by in commercial and industrial processes and 21% by residential customers

SSLBS is radially fed by 2 x 110kV power lines, on the same tower, from Powerlink's' H21 Substation, Murrarie. SSLDM provides an alternate supply for SSLBS.

The geographical location of Energex's 110kV network and substations in the area is shown in Figure 1 and Figure 2 provides a schematic view. SSLDM 33kV feeder geographic view is shown in Figure 3

Figure 1: Existing 110kV network arrangement (geographic view)

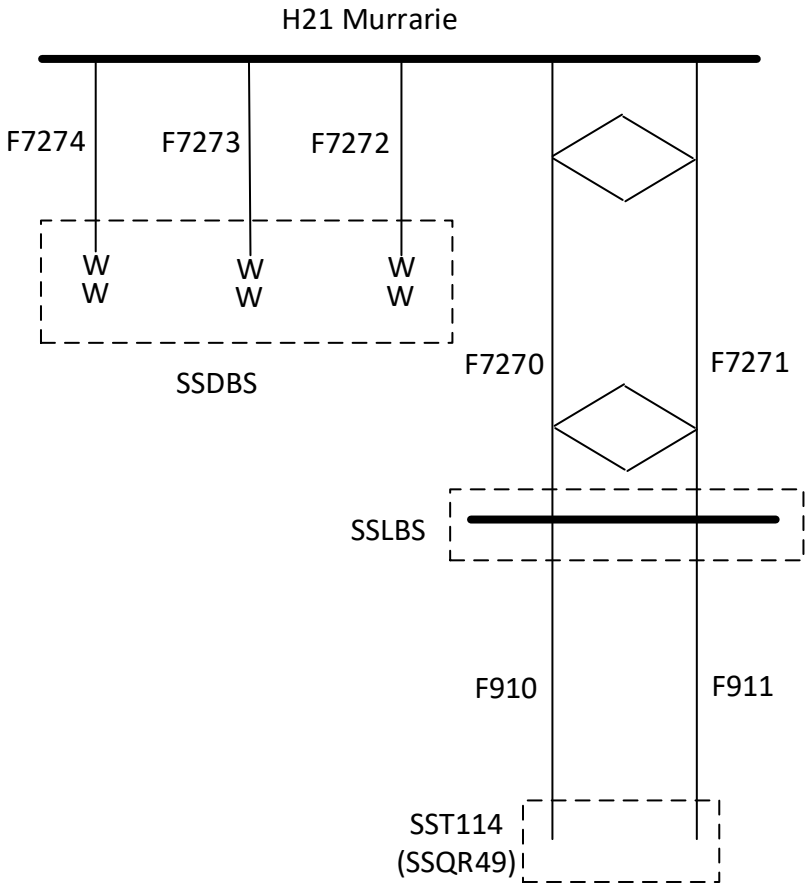

Figure 2: Existing 110kV network arrangement (Schematic)

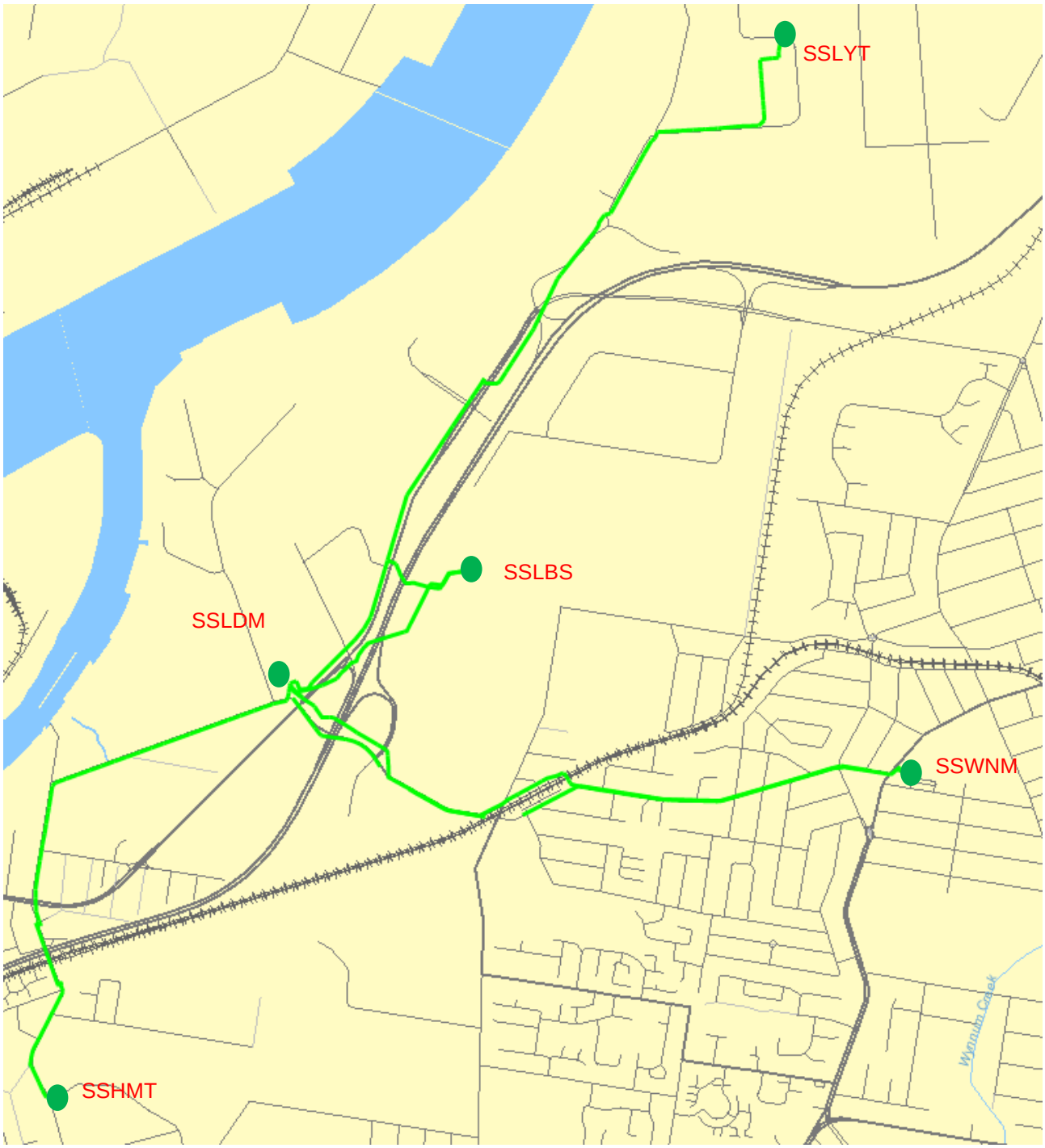

Figure 3: Existing 33kV network arrangement LDM (geographic view)

1.2. Existing Supply System

Lindum 33kV Switching Substation (SSLDM) is located approximately 2.7 km NE from H21 Murrarie and approximately 800m SW of LBS Lytton Bulk Supply beside the Port of Brisbane Motorway. The substation is part of the LBS / DBS 33kV sub-transmission network and aides in providing supply to Lytton Bulk Supply 110/33kV Bulk Supply Substation (LBS) for total loss of 110kV supply to SSLBS. Lindum Substation is presently supplied via two incoming 33kV feeders from LBS Lytton Bulk Substation, and there are two outgoing 33kV feeders from Lindum Substation which provide supply to Wynnum 33/11kV Substation (WNM), there is a 33kV feeder CB which is normally open at HMT (Hemmant Zone Substation) plus a tee 33kv feeder normally open at LYT (Lytton Zone Substation).

Lindum Substation was established in 1972 according to applicable design and construction standards during that time. It has an outdoor 33kV switchyard with concrete structures, and a small protection and control building.

The 33kV bus contains two bus tie circuit breakers and 6 x 33kV feeder circuit breakers. There are eight sets of manually operated 33kV bus isolators. There is a 33kV VT providing 110V supply for protection relay functions. Existing 415V supply to the substation is provided by the local distribution network. For loss of distribution supply there is no alternate backup arrangements.

A schematic view of the existing sub-transmission network arrangement is shown in Figure 4 and the geographic view of Lindum Substation is illustrated in Figure 5.

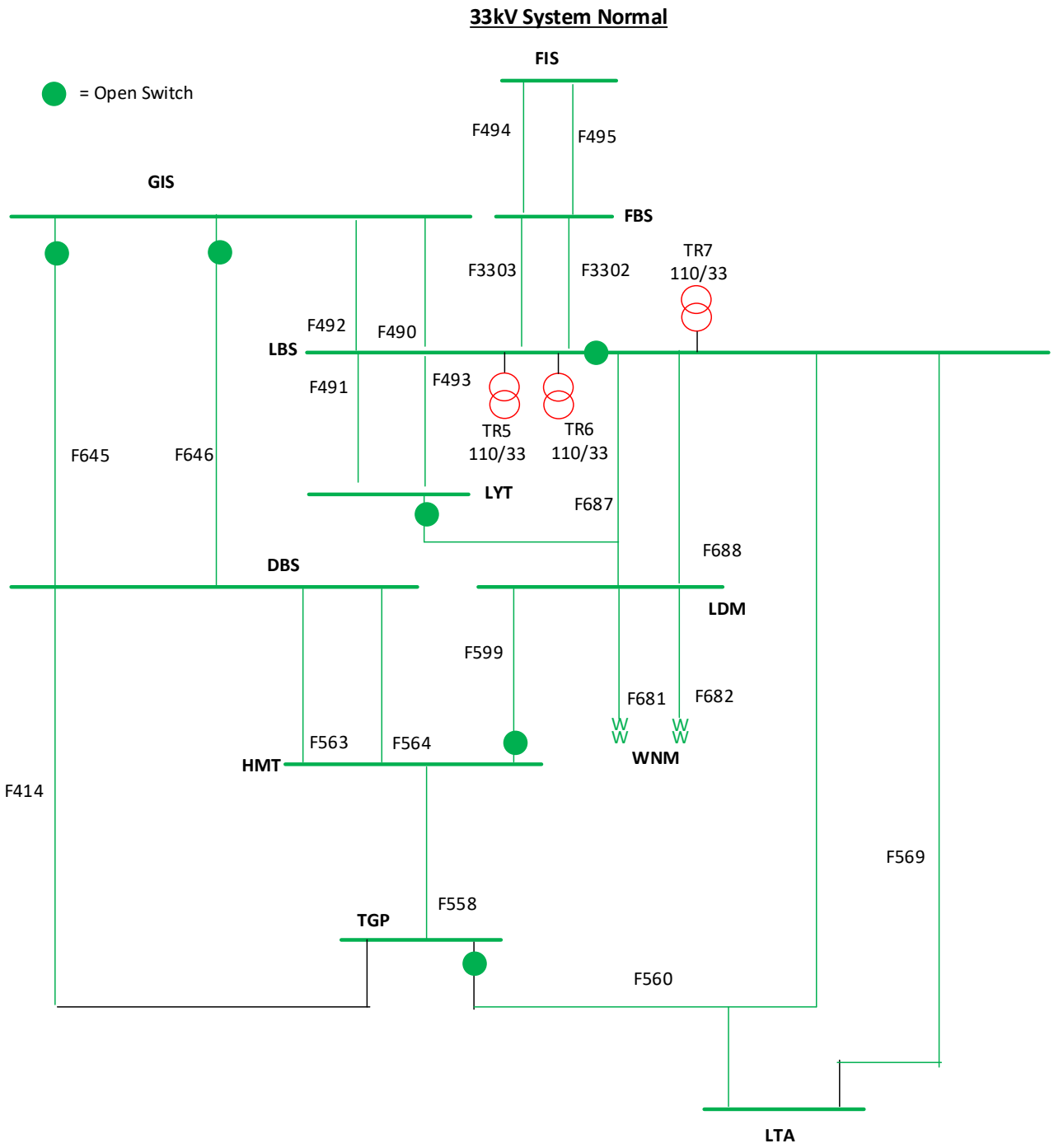

Figure 4: Existing network arrangement (schematic view)

Figure 5: Lindum Substation (geographic view)

1.3. Load Profiles / Forecasts

The load at Lytton Bulk Supply Substation (110/33kV) comprises a mix of residential and commercial/industrial customers. The load is summer peaking, and the annual peak loads are predominantly driven by industrial processes.

1.3.1. Full Annual Load Profile

The full annual load profile for LBS Substation over the 2021/22 financial year is shown in Figure 6. It can be noted that the peak load occurs during summer.

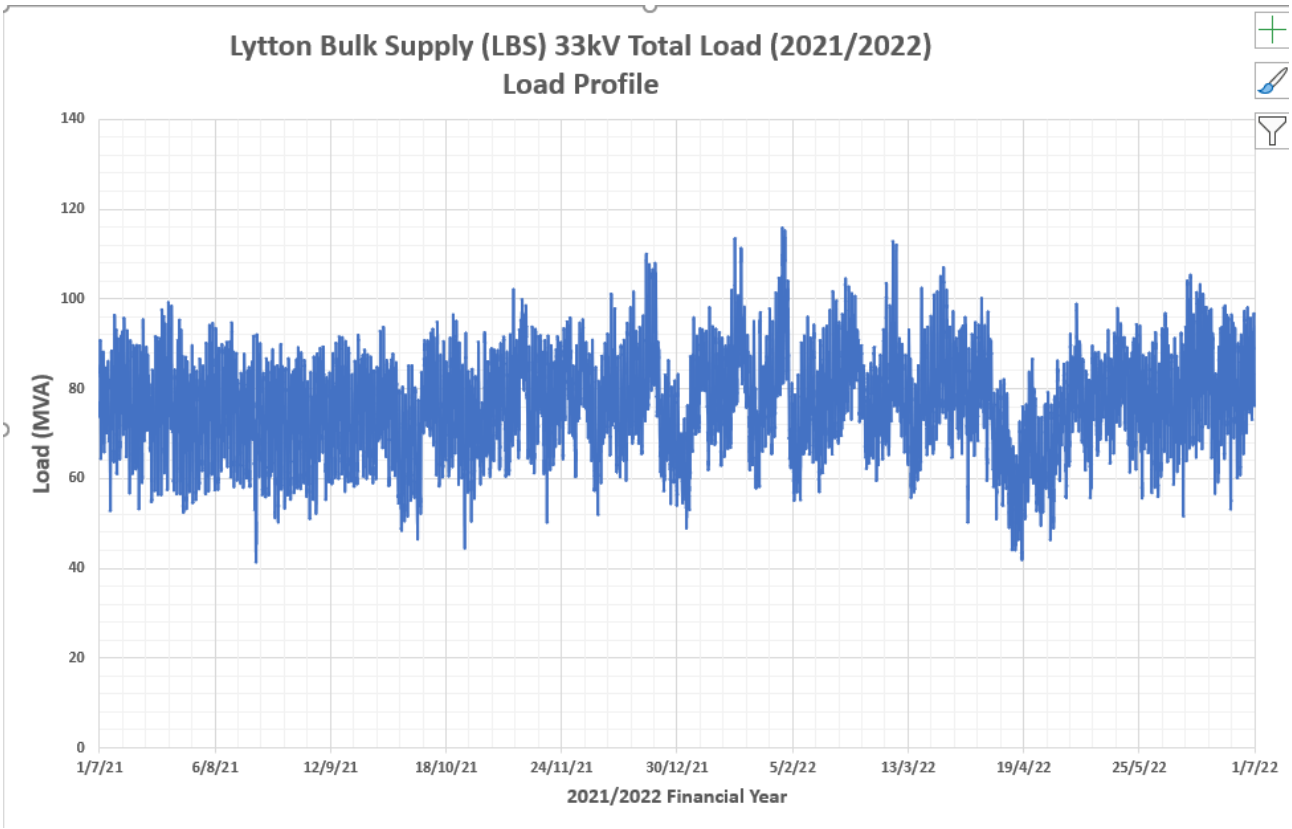

Figure 6: Substation actual annual load profile

1.3.2. Load Duration Curve

The load duration curve for LBS Substation over the 2021/22 financial year is shown in Figure 7.

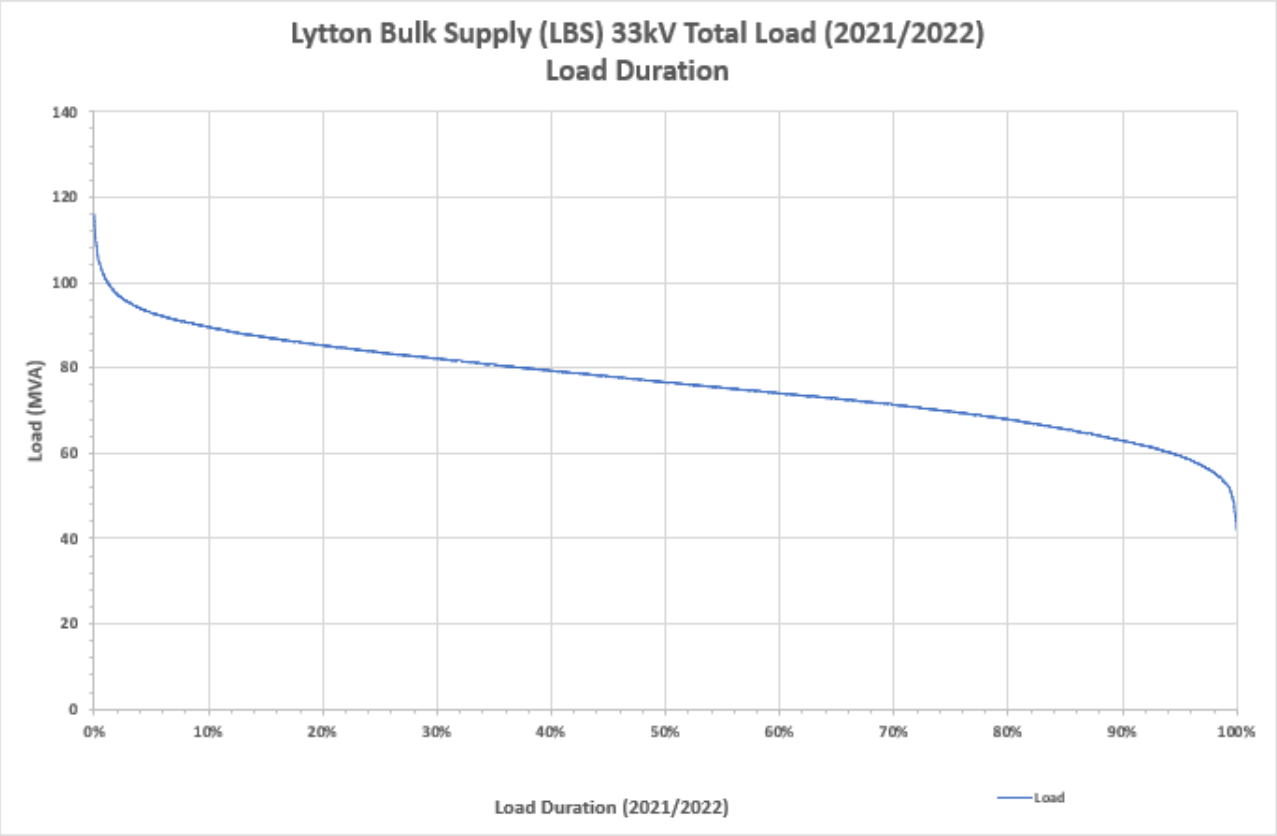

Figure 7: Substation load duration curve

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 8. It can be noted that the summer peak loads at LBS Substation are historically experienced in the late afternoon and evening.

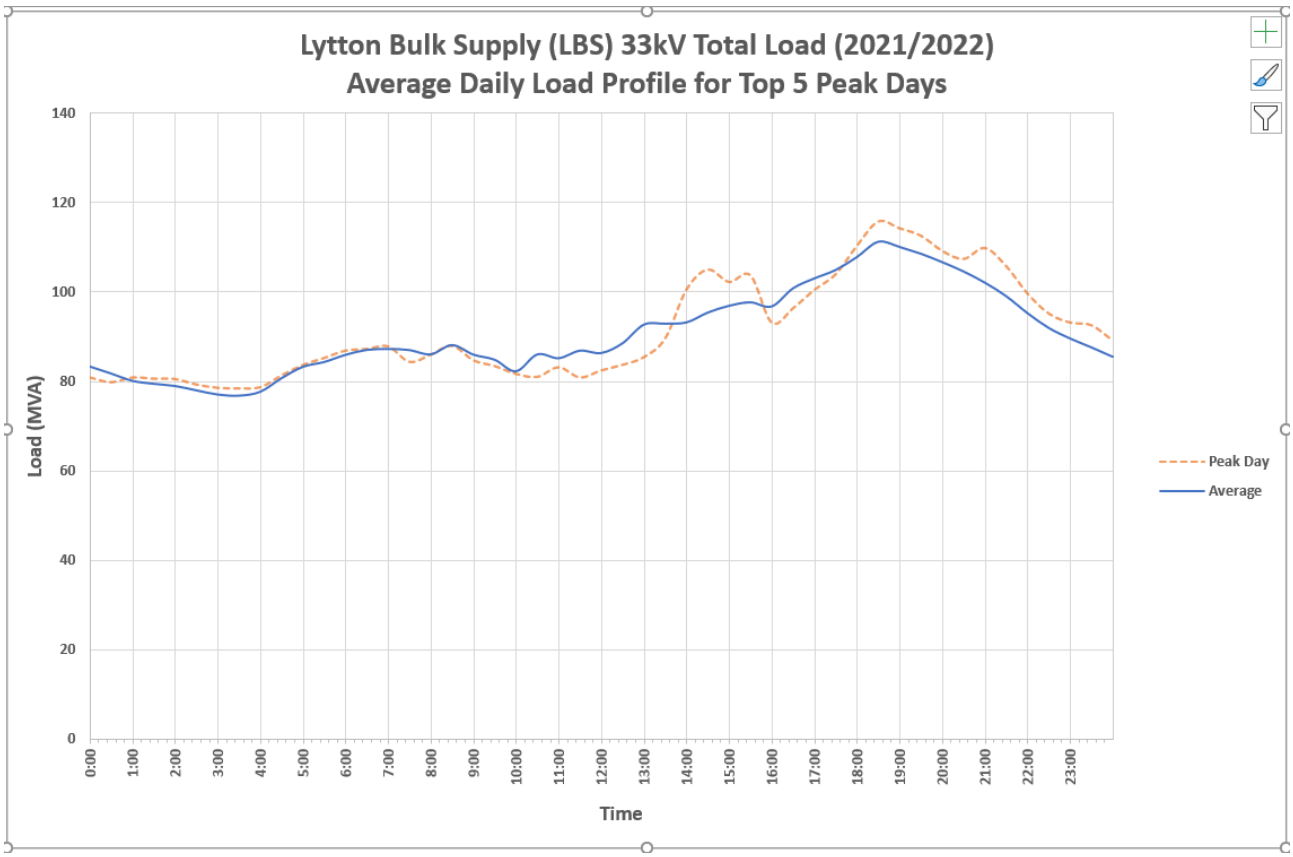

Figure 8: Substation average peak weekday load profile (summer)

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 . The historical peak load for the past six years has also been included in the graph.

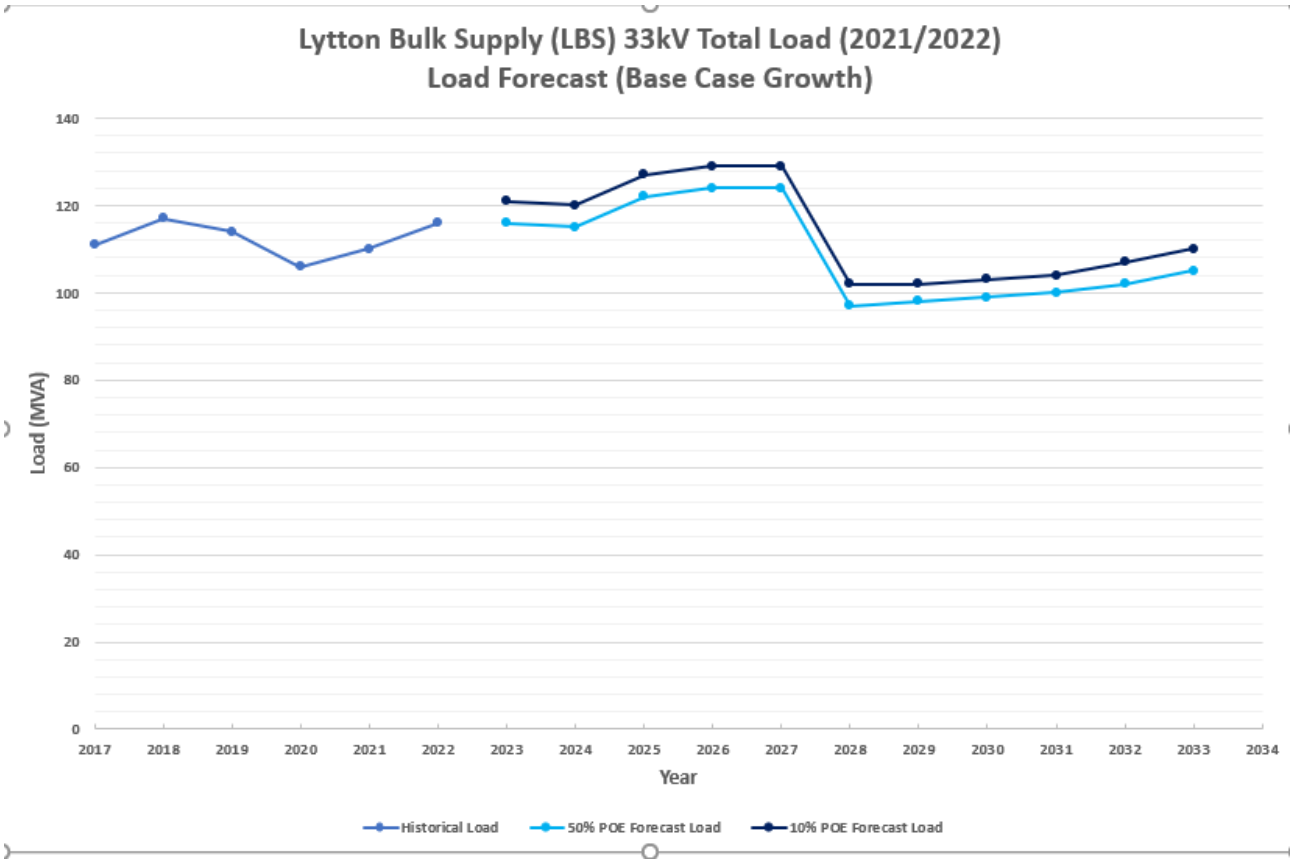

Figure 9: Substation base case load forecast

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 .

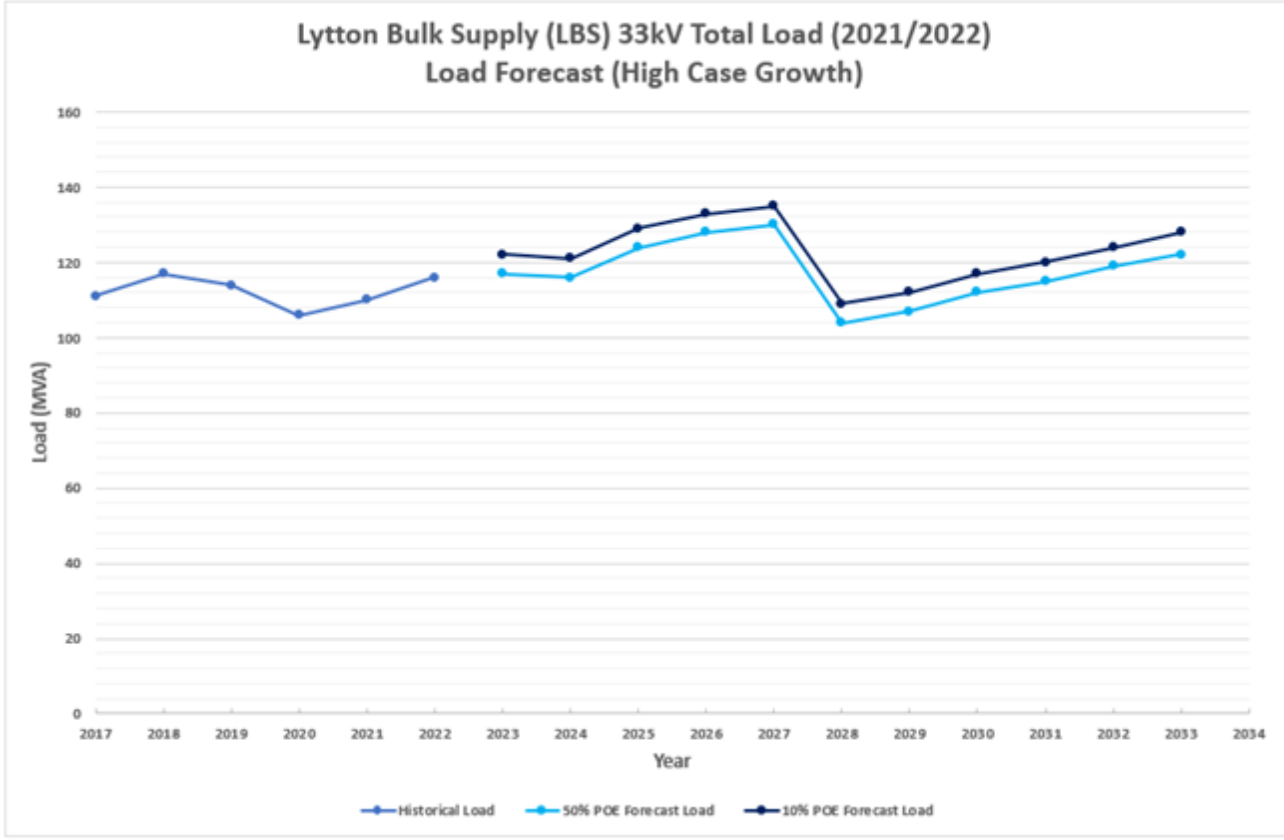

Figure 10: Substation high growth load forecast

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 .

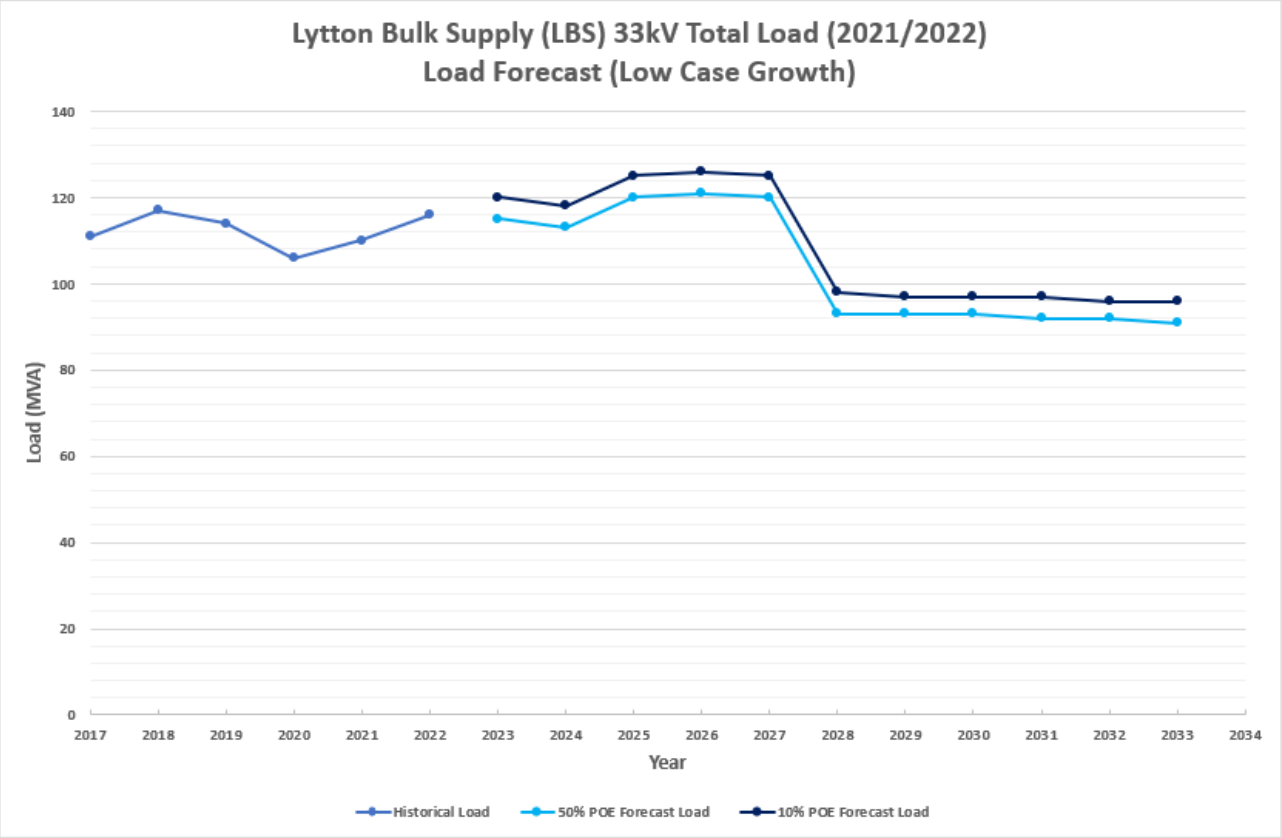

Figure 11: Substation low growth load forecast

2. IDENTIFIED NEED

2.1. Description of the Identified Need

2.1.1. Aged and Poor Condition Assets

A condition assessment of plant at SSLDM 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.

Condition assessment indicates that the 8 x 33kV outdoor oil filled circuit breakers are reaching end of life. Additionally, a civil assessment of the structures on site also identified that the substation concrete 33kV busbar support structures are deteriorating, requiring acrow props to be utilised for temporary support. There are also 13 protection relays whose electronic components are nearing retirement age.

The deterioration of these primary and secondary system assets poses safety risks to staff working within the switchyard. It also poses a safety risk the general public, though the increased likelihood of protection relay mal-operation and catastrophic failure of the oil circuit breaker or busbar support structure. There is also a considerable risk of environmental harm due to loss of oil from the oil circuit breakers, which would require clean up and rectification. Additionally, the poor condition of these assets significantly increases the likelihood of outages, resulting in a reduction in the level of reliability experienced by the customers supplied from Lindum Substation.

Where Energex identifies an imminent asset safety risk, immediate temporary measures are put in place to ensure safety of staff and public until permanent remediation can be performed.

2.1.2. Reliability

There are presently HV circuit breakers and disconnectors on the 33kV buses at Lindum Substation. Under the existing sub-transmission network configuration any singular CB failure within Lindum Substation will not result in loss of supply to supplied from Wynnum Substation. However, backup supply to Lytton Bulk Supply substation (110/33kV supply) would be restricted particularly for a double 110kV outage to F7270 & F7271 which are on the same tower feeding LBS; since LDM substation is used to provide 33kV backup supply to major customers, fed from LBS 33kV bus. SSLDM will also supply a large generator with no alternate supply available.

2.1.3. Safety Net Non-Compliance

Under a credible contingency event (such as for an outage of 110kV tower failure between Powerlink's H21 Murrarie Substation and Energex 110/33kV Bulk Supply Substation) Energex will not be able to meet Safety Net restoration times based on a 50POE forecast, as there are no alternate 110kV supply arrangements available for LBS Substation. The alternate supply for SSLYT is a 33kV supply from Doboy Bulk supply Substation via SSLDM. This is required to continue supply to the number of large customers connected to SSLYT.

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 Lindum area to address the identified need.

3.2. Network Options Identified

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

3.2.1. Option A: Replace End of life Assets

This option involves replacing 8 x outdoor 33kV oil circuit breakers with vacuum breakers, replacing all concrete 33kV ring bus structures, upgrading the substation physical security, and addressing secondary systems limitations, to address the identified need.

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

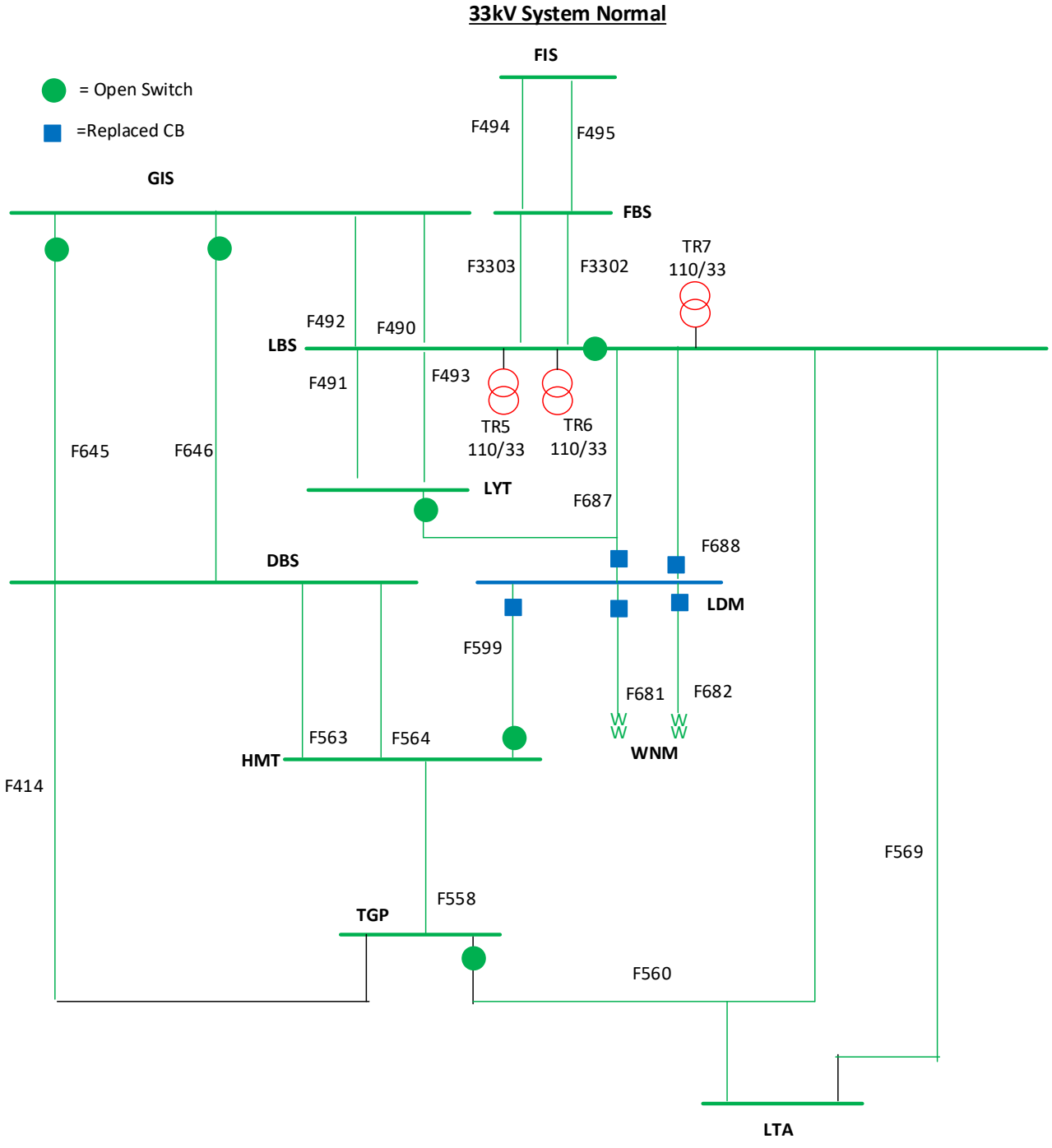

Figure 2: Option A proposed network arrangement (schematic view)

3.3. Preferred Network Option

Energex's preferred internal network option is Option A, replace 8 x 33kV outdoor circuit breakers, replace thirty-six concrete 33kV busbar support structures, replace 8 x 33kX disconnect switches, replace 13 x electronic protection relays approaching end of life, upgrade secondary systems and upgrade substation security at Lindum Substation.

Upon completion of these works, the asset safety and reliability risks at Lindum Substation will be addressed. The preferred option will provide the greatest reliability benefit for load and generation customers.

The estimated capital cost of this option inclusive of interest, risk, contingencies and overheads is $13.4 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 mid-2024 and construction completed by September 2026.

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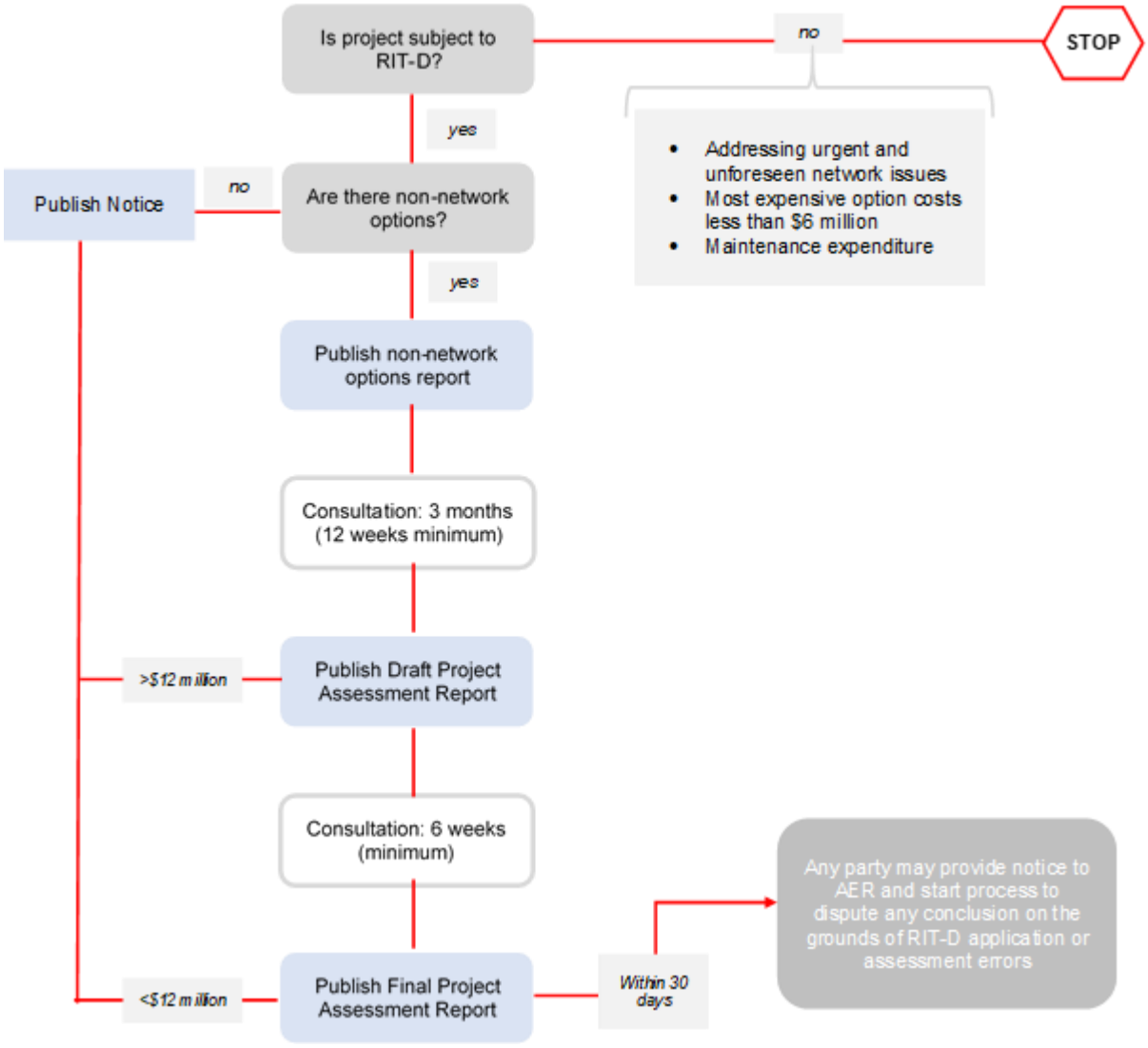
4. CONCLUSION AND NEXT STEPS

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 Lindum area to address the identified need.

The preferred network option is Option A – Replace end of life assets. 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.

APPENDIX A – THE RIT-D PROCESS



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