The Energy Queensland Group Notice of no non-network options

26 September 2019

NGE Nudgee Zone Substation – Maintain supply to customers and address 11kV switchgear reaching end-of-life

Part of the Energy Queensland Group

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1.0 SUMMARY

This notice is being issued by Energex Limited (Energex) to declare that there are no credible non-network options to the proposed works to meet the identified need of maintaining a safe, sufficient and reliable supply to over 3,400 predominantly commercial and industrial customers at Nudgee Zone Substation (SSNGE) when the 11kV switchgear reaches retirement age in 2021. This determination is made under clause 5.17.4(c) of the National Electricity Rules (NER) and is published according to clause 5.17.4(d). In this regard, Energex will not be publishing a non-network options report for the proposed works at SSNGE.

The reasons for this conclusion are as follows:

- Continuous operation of the 11kV switchgear that has been deemed to reach retirement age impacts the safety to personnel and the reliability of supply to customers.

- Should the 11kV switchgear be recovered, the existing load being supplied cannot be permanently transferred to adjacent zone substations and/or managed via non-network alternative solutions while satisfying the Customer Outcome Standards (COS) or Service Safety Net Targets as specified in the Distribution Authority issued to Energex.

- Only an everday and 24/7 total reduction in demand at SSNGE would address the identified need.

Energex will publish the final project assessment report as the estimated capital cost of the preferred solution is below $10 million.

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2.0 EXISTING NETWORK

2.1 Introduction

Nudgee Zone Substation (SSNGE) provides electricity supply to over 3,400 predominantly industrial customers in the Banyo, Northgate, Nudgee and Nudgee Beach areas. Approximately 80% of the total number of customers supplied from SSNGE are residential customers amounting to 12% of the energy supplied. Also, approximately 20% of the number of customers supplied from SSNGE are Commercial & Industrial customers, amounting to about 88% of the energy supplied.

Geographic and schematic views of the network area under study are provided in Figure 1 and Figure 2.

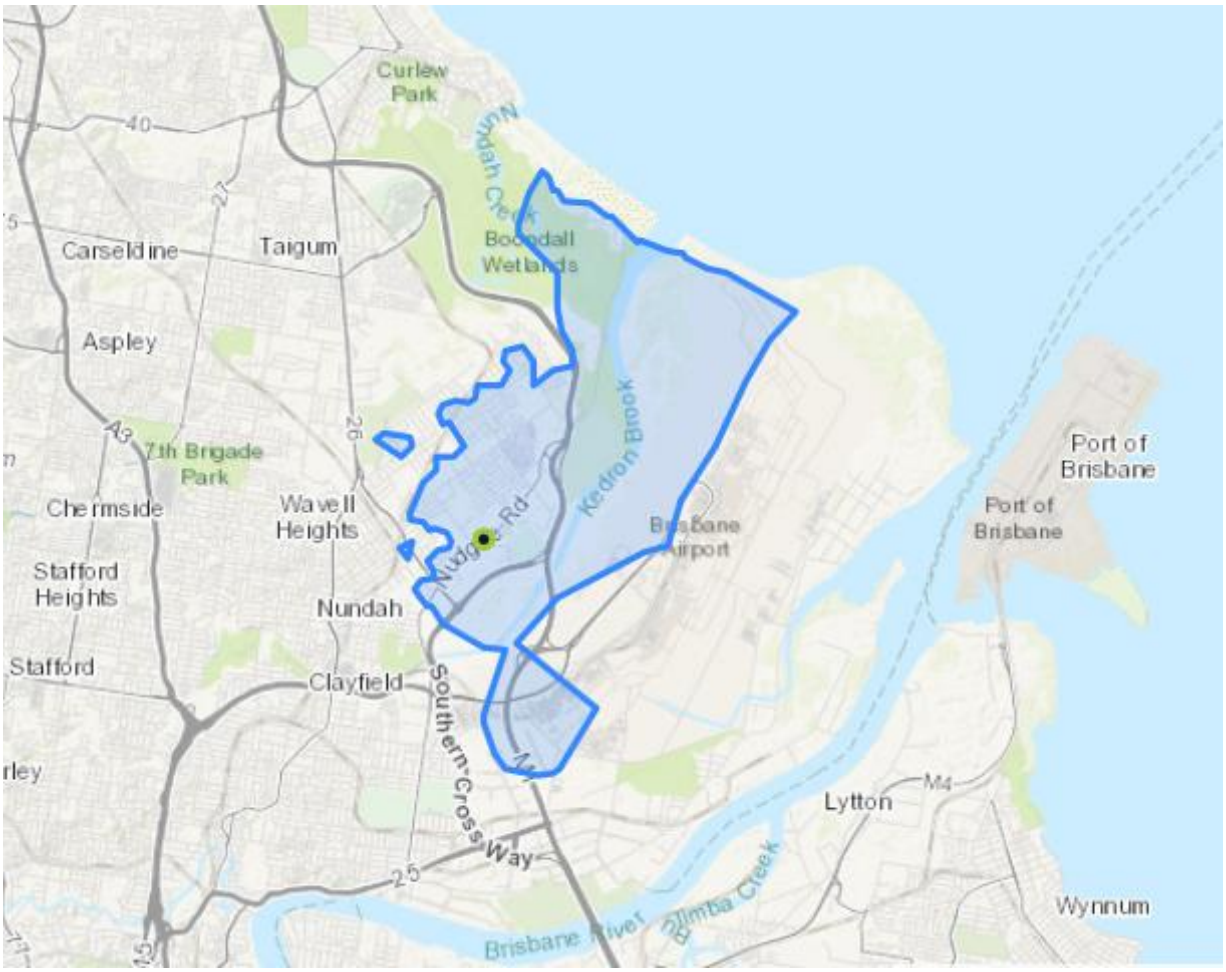

Figure 1: Existing network arrangement (geographic view)

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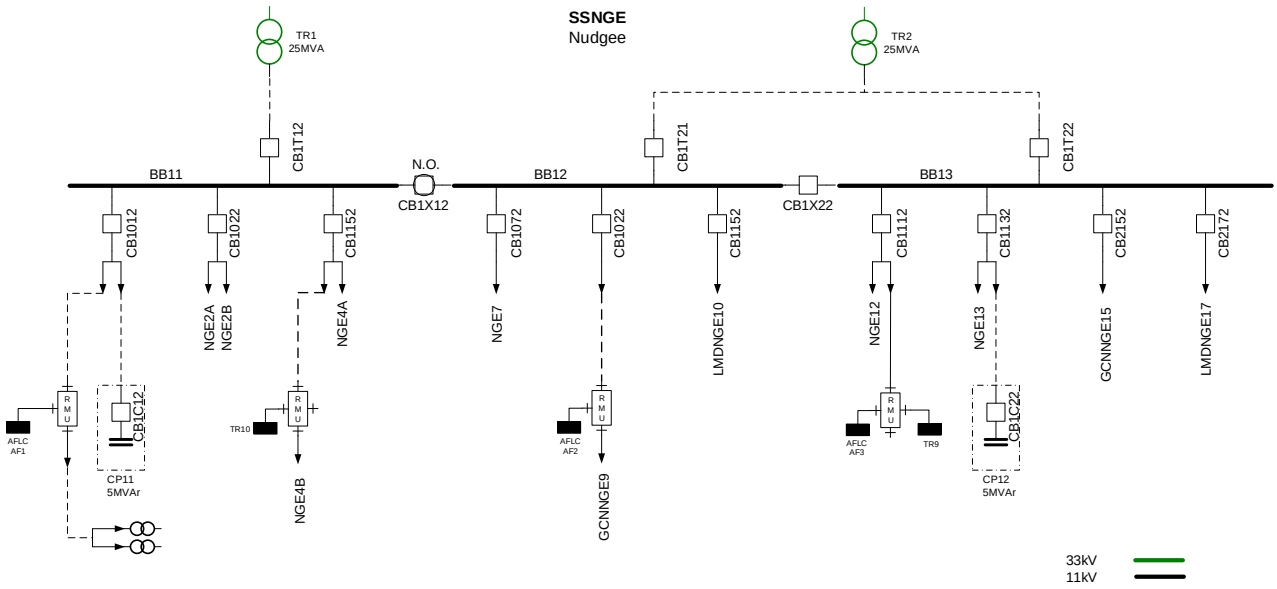


Figure 2: Existing network arrangement (schematic view)

2.2 Identified need

To maintain a safe, sufficient and reliable electricity supply to over 3,400 predominantly commercial and industrial customers, with an approximate total load of 21MVA, provided by SSNGE when the 11kV switchgear reaches retirement age in 2021.

2.3 Approved Capex works

Approved works not yet commissioned within the study area include:

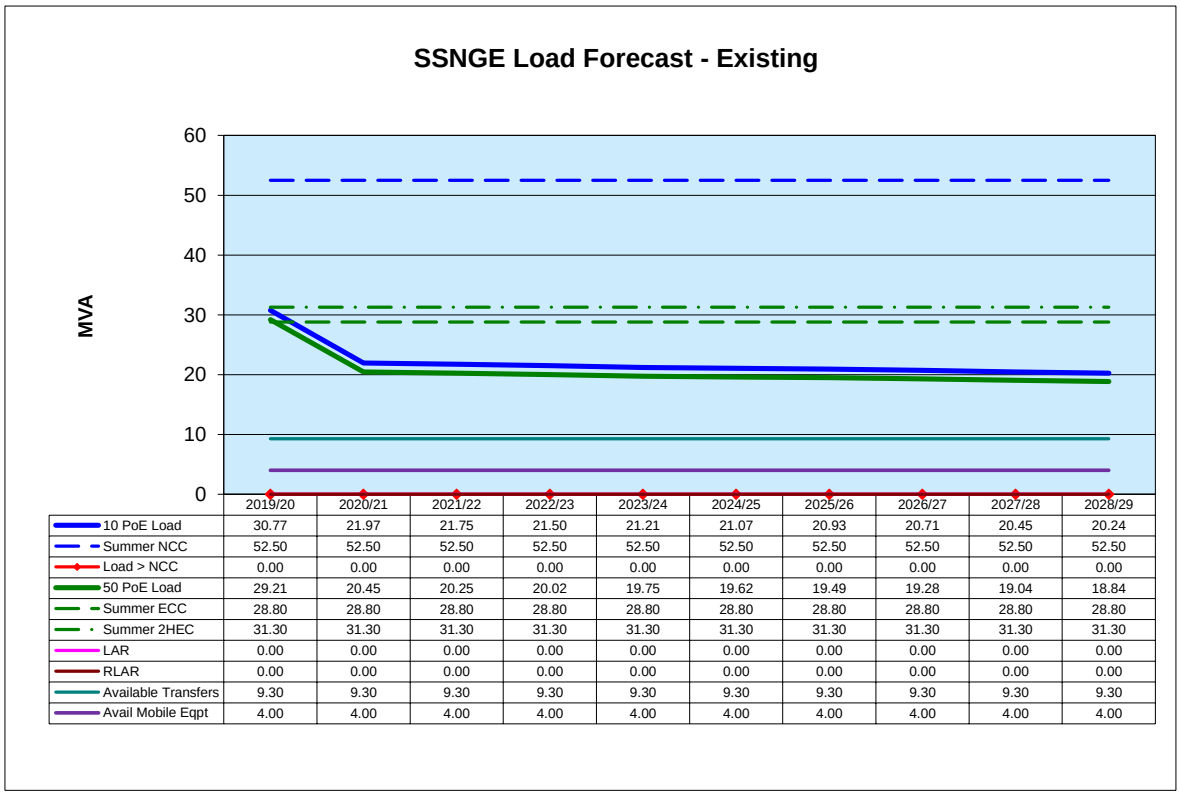
- LMD Lomandra Drive – Establish 33/11kV zone substation by November 2020.

This project establishes 2 x 25MVA 33/11kV transformers at Lomandra Drive Zone Substation (SSLMD). The recommended works will involve transferring the supply of an existing large customer from SSNGE to the proposed 33/11kV substation SSLMD. Hence, the forecast load at SSNGE is reducing in 2021-22. This project was not subject to a Regulatory Investment Test for Distribution (RIT-D).

2.4 Assessment of the existing network

2.4.1 Substation capacity

SSNGE is equipped with 2 x 25MVA 33/11kV transformers. The substation capacity is limited by the transformers, providing a Normal Cyclic Capacity (NCC) of 52.5MVA. The 10 year 10 PoE and 50 PoE load forecasts, and the existing NCC, Emergency Cyclic Capacity (ECC), Two Hour Emergency Capacity (2HEC), Residual Load at Risk (RLAR), available transfers and available mobile equipment, are shown in Figure 3. The 11kV bus is operated as normally open with an auto-changeover scheme to close the bus tie during the contingency of a transformer failure.



	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
10 PoE Load	30.77	21.97	21.75	21.50	21.21	21.07	20.93	20.71	20.45	20.24
Summer NCC	52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50
Load > NCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50 PoE Load	29.21	20.45	20.25	20.02	19.75	19.62	19.49	19.28	19.04	18.84
Summer ECC	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80
Summer 2HEC	31.30	31.30	31.30	31.30	31.30	31.30	31.30	31.30	31.30	31.30
LAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RLAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Available Transfers	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30
Avail Mobile Eqpt	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Figure 3: Substation load forecast (existing network)

As outlined above, there are no capacity limitations at SSNGE within the planning horizon. The load drops in 2020-21 due to the transfer of a large customer from the 11kV network at SSNGE to the 33kV network under the project at SSLMD as described in section 2.2.

2.4.2 Substation Load

The load duration, actual annual load and peak day load profile curves for SSNGE are shown in Figure 4, Figure 5 and Figure 6.

The load duration curve shown in Figure 4 indicates that the load at SSNGE is above 85% of the peak for approximately 1% of the time, or approximately 88 hours in a year.

The annual load curve and peak day load profile shown in Figure 5 and Figure 6 indicate that the customers supplied by SSNGE are predominantly commercial and industrial. A drop in load from late December to early January is noticeable as businesses shut during the holiday period. The load is highest during the middle of the day and starts to drop from 3:00pm onwards.

The actual peak load at SSNGE for 2018-19, which occurred on 13 February 2019, was 29.9MVA.

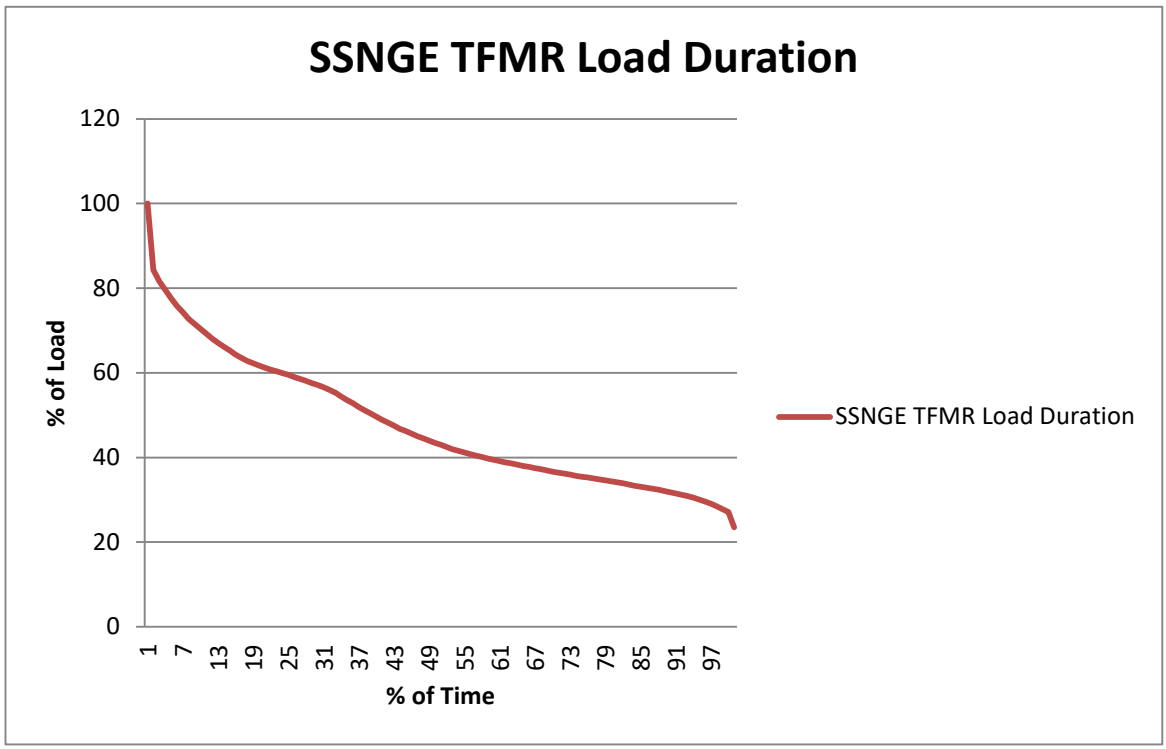


Figure 4: Substation load duration curve

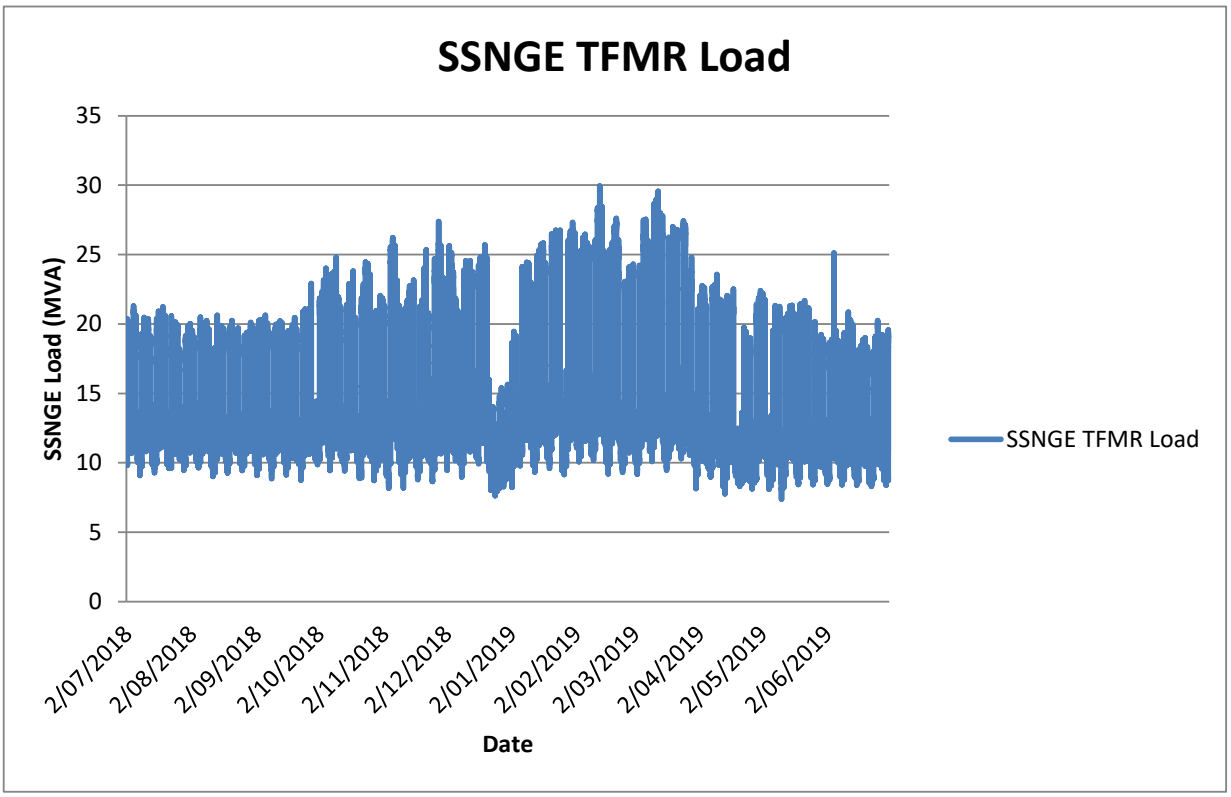


Figure 5: Substation actual load curve – SSNGE

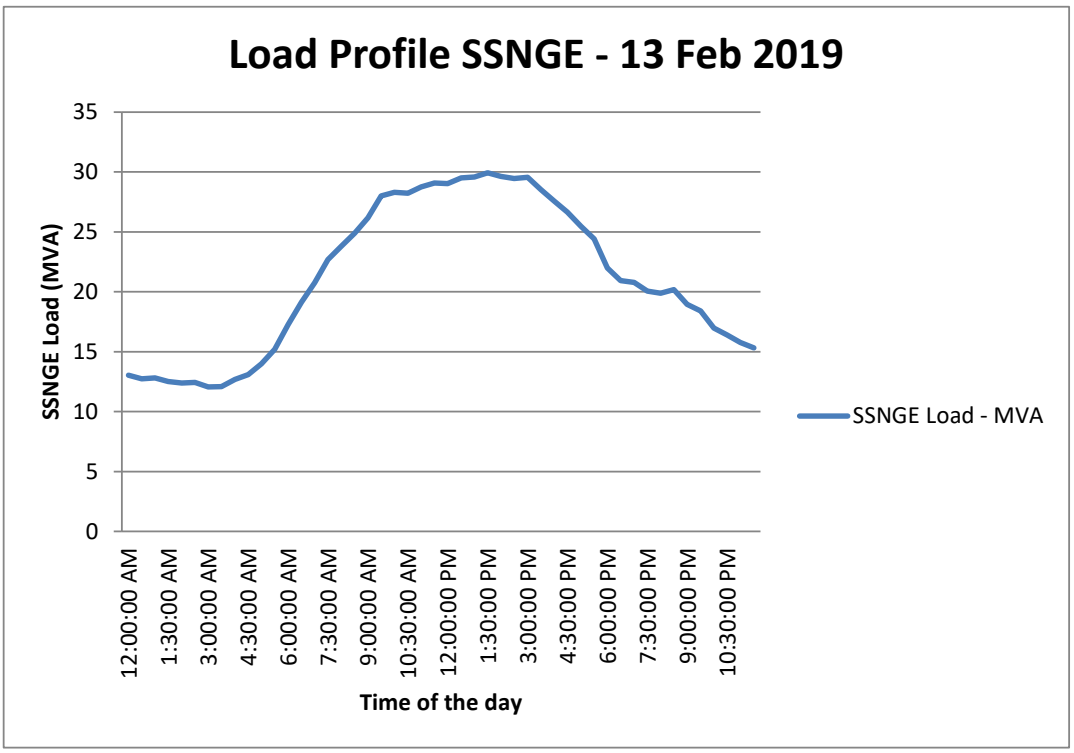


Figure 6: Substation peak day load profile (13 February 2019) – SSNGE

2.4.3 Substation condition

Based on a Condition Based Risk Management (CBRM) analysis of the effect of the current condition and ageing on the expected life of the asset, the 11kV Email Westinghouse J18 switchgear has been deemed to reach retirement age due to condition.

11kV switchgear

The 11kV bus at SSNGE is composed of three bus sections – BB11, BB12 and BB13. Bus sections BB12 and BB13 are Email Westinghouse J18 11kV switchgear, which was manufactured in 1966. Bus section BB11 is GECHED HWX switchgear, which was manufactured in 1995. As per the CBRM analysis, the Email Westinghouse J18 11kV switchgear has been deemed to reach retirement age in 2021.

Furthermore, recent investigations confirmed that the Email Westinghouse J18 11kV switchgear have been found to contain asbestos in the umbilical leads and arc chutes within the instrument chamber.

Protection relays

Energex has over 20,000 protection relays installed in the network in its 357 substations. The need to effectively manage the protection relay assets is recognised by Energex. As such, a risk based replacement program has been developed with the intention of having a balanced outcome for safety risks, legislative compliance and reliability requirements while maintaining cost effectiveness.

Protection relays are vital in keeping the Energex network safe, secure and reliable. It has been established that age is a factor in the failure of protection relays. Considering the number of protection relays in the network, replacing relays simply on age is not practical. Priority will be given to replace relay types with high failure rates, those nearing or exceeded end-of-life and those with the potential for significant interruption of supply.

The following protection relays have been identified as nearing retirement age at SSNGE:

- GEC CAG14 relays on the 11kV bus
- GEC CDG31 relay on 11kV feeder GCNNGE15
- ABB SPAJ140C relays on 11kV feeders and capacitor banks
- Reyrolle Argus 1 relay on 11kV feeder NGE2B
- ABB SPAJ140C relay on 33kV feeder 449
- SEL 351-1 relay on 33kV feeder 450.

These limitations have been identified and discussed in the Energex Protection Relay Replacement Program business case as submitted to the Australian Energy Regulator (AER) as part of the submission for the 2015-16 – 2019-20 regulatory control period.

2.4.4 Legislated requirements

Back-up protection

Section S5.1.9(c) of the NER specifies that a Network Service Provider must provide sufficient primary and back-up protection systems (including circuit breaker fail protection) to ensure that a fault of any type anywhere on the transmission and distribution system is automatically disconnected.

Energex typically employs overcurrent protection on a radial distribution network (11kV level), with the backup protection provided by a slower graded upstream protection scheme which is typically a substation transformer LV overcurrent relay. The concept of operating (reach) factor is used to assess the adequacy of primary and backup protection on a distribution network.

Remedial actions are recommended where a feeder has been reviewed and found to have a reach factor below the minimum threshold.

The existing backup protection at SSNGE does not meet the minimum target reach factor for three of the 11kV radial feeders (NGE4B, NGE7 and NGE12).

2.5 Impact of doing nothing

The “do nothing” option is not acceptable as the following do not comply with the applied service standards:

- Continuous operation of existing Email Westinghouse J18 11kV switchgear that have been deemed to reach retirement age at SSNGE poses an ongoing low level risk to Energex personnel safety due to the potential for in-service failure of the assets.

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- Continuous operation of existing Email Westinghouse J18 11kV switchgear that have been deemed to reach retirement age at SSNGE poses an ongoing low level risk to customers due to the reduced capacity and reliability of supply for an extended period in the event of an in-service failure of the assets.

- Continuous operation of the existing 11kV feeders that have been identified as not having sufficient back-up protection reach at SSNGE poses an ongoing low level risk to Energex personnel or public safety due to the potential for in-service failure of primary protection subsequent to a fault on the 11kV network.

- Continuous operation of the existing 11kV feeders that have been identified as not having sufficient back-up protection reach at SSNGE poses an ongoing low level risk to Energex due to the potential for in-service failure of primary protection subsequent to a fault on the 11kV network and thereby breaching the requirements of NER Section S5.1.9(c).

3.0 ASSESSMENT OF OPTIONS

3.1 Alternative network options rejected

For clarity, the following alternative options were considered but rejected as they were not practicable alternatives for the reasons indicated in Table 1.

Alternative option	Reasons for being rejected
Do nothing	– The option of doing nothing is not acceptable since the risk of the switchgear failing in service impacts on the safety of staff and the reliability of supply to the customers at SSNGE.
Transfer SSNGE load to adjacent substations	– Limited available 11kV feeder transfer capability. – Limited number of spare 11kV feeder circuit breakers at adjacent substations for new 11kV feeders. – Limited available 11kV feeder routes in a congested network.
Replace the Email Westinghouse J18 11kV switchgear in-situ	– Increased network risk due to longer outages required thereby prolonging project duration for staging over an estimated three year period. – Increased safety risk to staff due to the need to clean asbestos dust from the J18 switchgear for preliminary works and temporary works required for staging. – Inability to supply load during replacement of the switchgear.

Table 1: Alternative options rejected

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3.2 Network options assessment

In addition to the following option that has been assessed as meeting the identified need, no other practically feasible and economically equivalent option has been identified in this analysis.

3.2.1 Preferred option: Replace 11kV switchgear at SSNGE

This option involves establishing a new building for the new current-contract 11kV switchgear consisting of two transformer circuit breakers, 12 x feeder/capacitor circuit breakers and one bus coupler. It also involves recovery and disposal of the Email Westinghouse J18 11kV switchgear, and recovery of the GEC-Alsthom HWX 11kV switchgear to be re-used as needed. This option also involves upgrading the protection system at SSNGE and at adjoining customer substations, re-conductoring a total of 10 spans of 7/.080 hard-drawn copper (HDC) conductor and recovering four spans of 7/.080 HDC conductor on the 11kV network.

The estimated capital cost of the preferred option is $9.4m.

Figure 7 provides schematic diagram for Option 1.

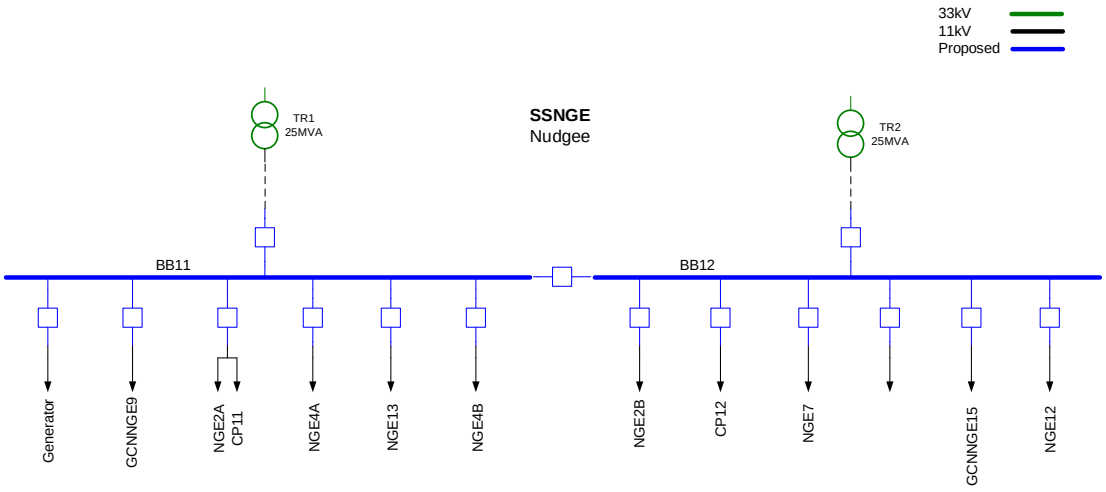

Figure 7: Proposed network arrangement (schematic view)

3.3 Non-Network options assessment

Once the 11kV switchgear at SSNGE reaches retirement age and can no longer be safely operated, the existing load must be transferred to adjoining substations and/or managed via non-network alternative solutions while satisfying the COS or Service Safety Net Targets as specified in the Distribution Authority issued to Energex.

Demand & Energy Management (DEM), a team within Energex, has been engaged to conduct a screen test to investigate potential non-network alternative solutions to defer or eliminate the requirement to install a new 11kV switchgear at SSNGE, while addressing the identified need.

3.3.1 Potential non-network solutions considered

Permanent demand reduction

a) Energy efficiency

b) Power factor correction

c) Load control tariff

d) Customer solar

On-call demand reduction

e) Customer embedded generation

f) Customer demand response (commercial)

g) Customer demand response (residential)

h) Load control tariff (change switching during peak load)

Reactive power support

i) Permanent reactive power support

j) On-call reactive power support

3.3.2 Result of non-network options assessment

The load at risk will be the total load of SSNGE, which will be unsupplied when the 11kV switchgear reaches retirement age. Based on the load at risk and the estimated capital cost of the preferred network option, the annuitized incentive available for a non-network solutions provider has been calculated to be $24/kVA per year.

As confirmed by DEM, it is considered that no available demand management products or strategies can provide sufficient demand reduction at SSNGE to address the identified need. Given the significantly lower incentive of $24/kVA,, it is evident that an economically feasible non-network option would not be available to defer or eliminate the requirement to replace the 11kV switchgear and continue to provide a safe, sufficient and reliable supply to customers at SSNGE.

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4.0 CONCLUSION

Considering the nature of the project, being refurbishment-driven, and as per clause 5.17.4(c) of the NER Energex has determined that there are no credible non-network options to address the identified need at SSNGE. Thus, with reference to clauses 5.17.4(c) and 5.17.4(d) of the NER, Energex will not publish a non-network options report for the proposed project to install a new building for a new 11kV switchgear at SSNGE.

Since the estimated project cost is below $10 million, Energex is exempt from publishing a draft project assessment report, as per clause 5.17.4(n) of the NER, and will therefore publish the final project assessment report as soon as practicable in accordance to clause 5.17.4(p) of the NER.

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