Business Case
33kV Feeder Doboy to Queensport Substations

energex

Executive Summary

The Doboy Substation (SSDBS) provides electricity supply via two 33kV feeders to the Queensport Substation (SSQPT), which in turn provides electricity supply via two 33kV feeders to the Bulimba Substation (SSBLB).

Due to anticipated increases in load in coming years, it has been identified the Doboy – Queensport feeders (F581 and F677) will not meet the Safety Net Distribution Authority criteria. For an outage of either feeder, there is more than 4MVA of load that would remain unsupplied for greater than 3 hours and more than 4MVA that would remain unsupplied for greater than 8 hours (refer Appendix F).

A counterfactual, 'do nothing' option was considered but rejected, as during a contingency event it would lead to a breach of the Safety Net criteria. Network options to supply the forecast load growth from other 11kV and 33kV feeders and substations were also considered but were rejected as they did not provide any network or technical benefit relative to other proposed options. One option was evaluated as part of this business case:

Option 1 - Establish a new 33kV feeder from SSDBS to SSQPT

Energex aims to minimise expenditure in order to keep pressure off customer prices, however understands that this must be balanced against critical network performance objectives. These include network risk mitigation (e.g. safety, bushfire), regulatory obligations (e.g. safety), customer reliability and security and preparing the network for the ongoing adoption of new technology by customers (e.g. solar PV). In this business case regulatory obligations are a strong driver, as the forecast load growth will result in breach of the Safety Net criteria if no augmentation works are carried out.

To this end, Option 1 is the preferred option, as it is the only feasible and cost-effective option which can address the forecast increase in load while meeting the Safety Net criteria. The Net Present Value (NPV) of this option is -$4.9M.

The direct cost of the program for each submission made to the AER is summarised in the table below. Note that all figures are expressed in 2018/19 dollars and apply only to costs incurred within the 2020-25 regulatory period for the preferred option.

Regulatory Proposal	Draft Determination Allowance	Revised Regulatory Proposal
$5.1M	$3.5M	$5.1M

As the project costs are estimated at greater than $5 million, a Regulatory Investment Test for Distribution (RIT-D) is required, as required by the Australian Energy Regulator (AER). The RIT-D will compare potential for a non-network or hybrid solution against the projected costs of the new feeder to determine the lowest cost solution.

Contents

1 Introduction

The Doboy Bulk Supply Substation (SSDBS) provides electricity supply via two 33kV feeders to the Queensport Zone Substation (SSQPT), which in turn provides electricity supply via two 33 kV feeders to the Bulimba Zone Substation (SSBLB). Due to anticipated increases in load in coming years, the Doboy – Queensport feeders (F581 and F677) have been identified as not meeting the Safety Net Distribution Authority criteria. For an outage of either feeder, there is more than 4MVA of load that would remain unsupplied for greater than 3 hours and more than 4MVA that would remain unsupplied for greater than 8 hours (refer Appendix F). This business case outlines the need for a regulatory investment test for distribution (RIT-D) investigating a new 33kV underground feeder from SSDBS to SSQPT to strengthen the network.

1.1 Purpose of document

This document recommends the optimal capital investment necessary for maintaining Energex's Service Safety Net Targets requirements in the event of the loss of one of the 33 kV feeders from SSDBS to SSQPT.

This is a preliminary business case document and has been developed for the purposes of seeking funding for the required investment in coordination with the Energex Revised Regulatory Proposal to the Australian Energy Regulator (AER) for the 2020-25 regulatory control period. Prior to investment, further detail will be assessed in accordance with the established Energy Queensland (EQL) investment governance processes. The costs presented are in $2018/19 direct dollars.

1.2 Scope of document

This document is the business case to establish a new 33kV underground feeder from SSDBS to SSQPT. The document will outline the need for this investment, any associated risks and benefits, options analysed, and the financial modelling completed.

1.3 Identified Need

Energex aims to minimise expenditure in order to keep pressure off customer prices, however understands that this must be balanced against critical network performance objectives. These include network risk mitigation (e.g. safety, bushfire), regulatory obligations (e.g. safety), customer reliability and security and preparing the network for the ongoing adoption of new technology by customers (e.g. solar PV). In this business case regulatory obligations are a strong driver, as the forecast load growth will result in breach of the Safety Net criteria.

Bulimba 33/11kV substation (SSBLB) is fed via 2 x 33kV feeders from Queensport Substation (SSQPT) which in turn is fed via 2 x 33kV feeders from Doboy Bulk Supply Substation (SSDBS). The loads and customers that form part of the network include:

- Bulimba zone substation (SSBLB) provides electricity supply to approximately 581 commercial/industrial customers and 8,890 domestic customers in the Bulimba, Balmoral, Hawthorne, Morningside and surrounding areas.
- Queensport zone substation (SSQPT) provides electricity supply to approximately 590 commercial/industrial customers and 4,823 domestic customers in the Cannon Hill, Colmslie, Morningside, Norman Park, Queensport and surrounding areas.

Load is anticipated to increase and exceed emergency cyclic capacity (ECC) on the F581/F677 feeders between the Doboy and Queensport substations from 2021. Geographic constraints in supplying SSQPT and SSBLB means a new 33kV feeder has been identified as necessary for maintaining secure supply to the area. This proposal aligns with the CAPEX objectives and criteria from the National Electricity Rules as detailed in Appendix C.

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

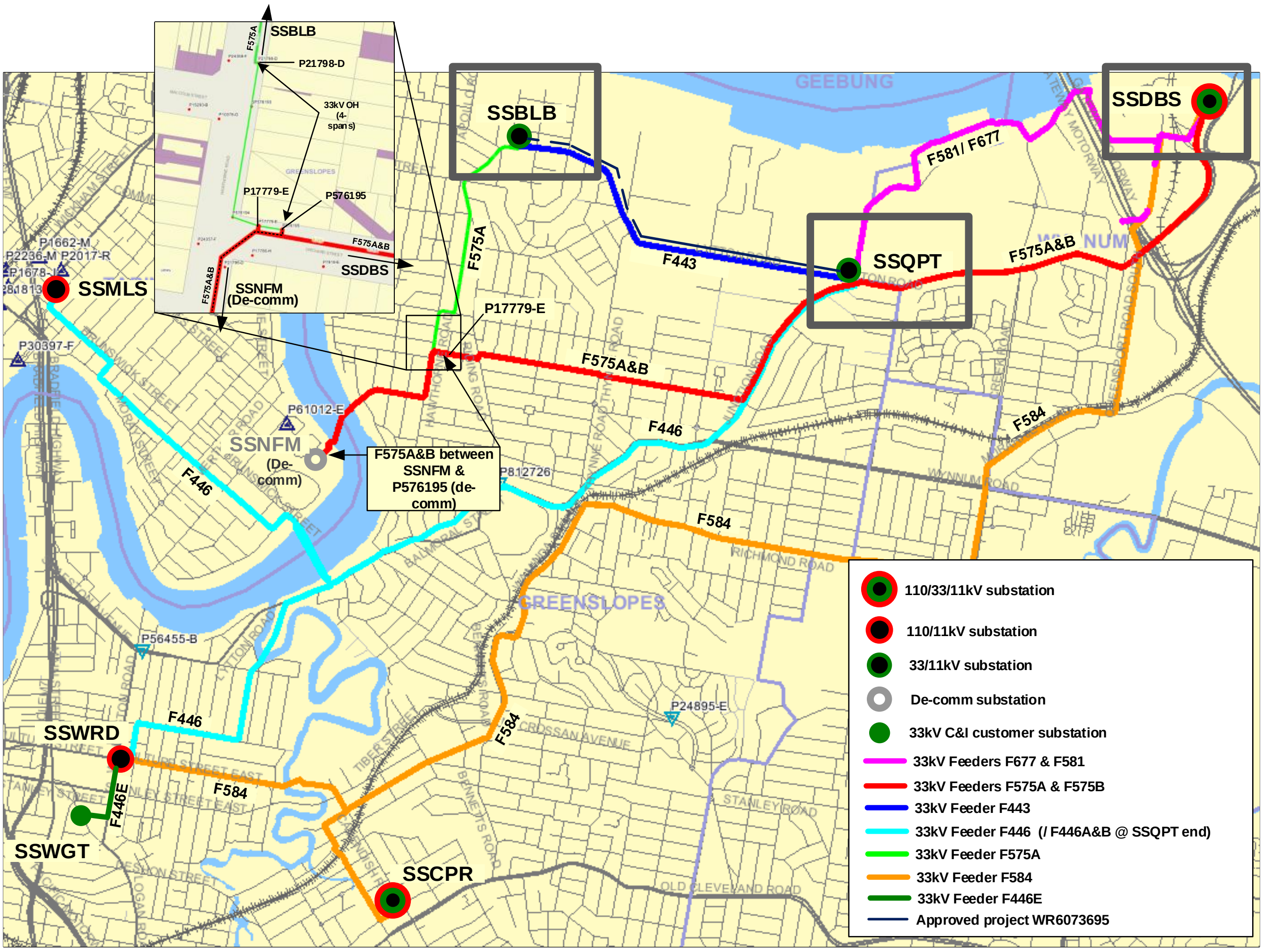

Figure 1: Existing Network Arrangement (Geographic View)

1.4 Energy Queensland Strategic Alignment

Table 1 details how "New Feeder Doboy to Queensport (DBS-QPT)" contributes to Energy Queensland's corporate and asset management objectives.

Table 1: Asset Function and Strategic Alignment

Objectives	Relationship of Initiative to Objectives
Ensure network safety for staff contractors and the community	This initiative contributes to meeting the Energex Safety Net, which aims to prevent an outage exceeding 8 hours for more than 1,600 customers to 'avoid unexpected customer hardship and/or significant community or economic disruption.' Increases in outage duration presents unacceptable safety risk to staff, contractors, and the community.
Meet customer and stakeholder expectations	The initiative aims to minimise risk of increased outage duration for the customers and stakeholders supplied by the Queensport and Bulimba Substations.

Objectives	Relationship of Initiative to Objectives
Manage risk, performance standards and asset investments to deliver balanced commercial outcomes	The initiative outlines the need for a RIT-D to be conducted, which would allow a business case to be developed in detail that to manage risk, performance standards, and asset investments.
Develop Asset Management capability & align practices to the global standard (ISO55000)	This business case is consistent with ISO55000 objectives and drives asset management capability by promoting a continuous improvement environment.
Modernise the network and facilitate access to innovative energy technologies	This initiative assesses underground cables which modernises and upgrades the existing Doboy – Queensport network.

The following projects are dependencies for this planning study.

Table 2: Project dependencies

Project	Project Description	Required by Date
WR7112763	QPT – BLB Install 33kV Single Circuit (SCCT) to replace FF575A & B	June 2019
	This approved project decommissions F575A and F575B between SSDBS and SSBLB and replaces these feeders with a new 33kV feeder F3426 between SSQPT and SSBLB. The area study conducted as part of this project identified a future stage of establishing a new 33kV feeder between SSDBS and SSQPT, nominally in December 2023, however this would be dependent on load growth in the area. This planning proposal is a continuation of this area plan.	

1.5 Applicable service levels

Corporate performance outcomes for this asset are rolled up into Asset Safety & Performance group objectives, principally the following Key Result Areas (KRA):

- Customer Index, relating to Customer satisfaction with respect to delivery of expected services
- Optimise investments to deliver affordable & sustainable asset solutions for our customers and communities

Under its Distribution Authority, Energex is expected to operate with an 'economic' customer value-based approach to reliability, with "Service Safety Net Targets" for extreme circumstances. These are intended to mitigate against the risk of low probability vs high consequence network outages. Safety Net targets are described in terms of the number of times a benchmark volume of energy is undelivered for more than a specific time period. Energex's Service Safety Net Targets are as set out in Appendix F.

Further, Energex is expected to employ all reasonable measures to ensure it does not exceed minimum service standards (MSS) for reliability, assessed by feeder types for the following measure:

- System Average Interruption Duration Index (SAIDI), and;
- System Average Interruption Frequency Index (SAIFI).

Both Safety Net and MSS performance information are publicly reported annually in the Distribution Annual Planning Reports (DAPR). MSS performance is monitored and reported within EQL daily.

In the event of an outage of either 33kV feeder F677 or F581, the resultant load on the remaining feeder F581 or F677 will exceed the feeder thermal capacity. Hence, for an outage of either feeder, there is more than 4MVA of load that would remain unsupplied for greater than 3 hours and more than 4MVA that would remain unsupplied for greater than 8 hours (refer Appendix F).

Energex considers that the recommended investment in the new 33kV SSQPT-SSDBS feeder represents a reasonable expenditure to meet its Safety Net obligations for the Queensport and Bulimba supply areas.

1.6 Compliance obligations

Table 3 shows the relevant compliance obligations for this proposal.

Table 3: Compliance obligations related to this proposal

Legislation, Regulation, Code or Licence Condition	Obligations	Relevance to this investment
Distribution Authority for Ergon Energy or Energex issued under section 195 of *Electricity Act 1994* (Queensland)	Under its Distribution Authority: • The distribution entity must plan and develop its supply network in accordance with good electricity industry practice, having regard to the value that end users of electricity place on the quality and reliability of electricity services. • The distribution entity will ensure, to the extent reasonably practicable, that it achieves its safety net targets as specified. • The distribution entity must use all reasonable endeavours to ensure that it does not exceed in a financial year the Minimum Service Standards (MSS)	This proposal reduces the risk of Energex not meeting its Safety Net targets

1.7 Limitation of existing assets

Sub-Transmission Network Limitation

Table 4 outlines the 50POE (50% Probability of Exceedance) (standard) load forecast and summer emergency cyclic capacity (ECC) which shows there is a breach of the safety net, beginning in 2021.

Table 4: Feeder N-1 load at risk for F581/F677

Plant Out of Service (OOS)	Year	50% POE Load (MVA)	Summer ECC (MVA)	Manual Transfers Available (MVA)	Mobile Generation (MVA)	Security Standard Load At Risk (MVA)
Either F581 / F677 OOS (50% POE Load)	2019	44.8	44.9	3.4	4.0	0.0
	2020	51.1	44.9	3.4	4.0	0.0
	2021	57.3	44.9	3.4	4.0	**5.0***
	2022	57.3	44.9	3.4	4.0	**5.0***
	2023	50.5	44.9	3.4	4.0	0.0
	2024	57.3	44.9	3.4	4.0	**5.0**
	2025	60.1	44.9	3.4	4.0	**7.9**
	2026	60.3	44.9	3.4	4.0	**8.1**
	2027	60.3	44.9	3.4	4.0	**8.1**
	2028	60.3	44.9	3.4	4.0	**8.1**

*Note that there is a temporary load on this network that is in the load forecast that will be removed from the network in 2023. There is a subsequent block load that is forecast to connect to the network in 2024.

The core driver of the increased load is the construction and redevelopment of the Bulimba Barracks (20 hectares) and associated nearby developments, whose purchase from the Department of Defence is expected to be settled in early 2020. This will be coupled with the redevelopment of the Faulkner Chains and Forgacs Cairncross Dockyards (15 hectares) sites which are immediately adjacent to the Bulimba Barracks. This is anticipated to increase load overall by 8MVA, with the first 4MVA expected in 2024 followed by a further 4MVA in 2025.

The 50POE load forecast is used to assess for contingency conditions and against the safety net highlights a breach from 2021 that is due to a temporary load, with a permanent block load connecting to the network in 2024, with the risk growing from 2025 onwards. The emergency cyclic capacity (ECC) line rating is exceeded in 2021 by 12.4 MVA.

As can be seen from Figure 1, SSBLB is located in a pocket surrounded by the Brisbane River, so Backup supply from alternate substations is limited. The only 11kV transfers available under a contingency are from SSQPT. Load transfers from SSQPT to other adjacent substations, are limited to around 3.4MVA, with a switching time of 2-3 hours. This leaves 9MVA unsupplied after manual transfers.

A further 4MVA is available through mobile generation, however this takes at least 8 hours to be operational. This means 5MVA remains unsupplied for more than 8 hours from 2021, creating a breach of the Energex Safety Net, refer Appendix F. The operational strategies following a contingency event are listed below:

- 12.4MVA is immediately shed from the network
- 0-3 hours, 3.4MVA of manual transfers are carried out
    - This leaves 9MVA unsupplied.
    - Under the Safety Net, after 3 hours the allowable load to be unsupplied is 4MVA.
    - This means there is a resultant Safety Net breach of 5MVA (9MVA-4MVA)
- After some 8 hours, mobile generation will be deployed to restore further supply, however the total 9MVA is not feasible leaving more than 5MVA offline for more than 8 hours until repairs are completed, a further safety net breach.

2 Counterfactual Analysis

2.1 Purpose of asset

The Bulimba zone substation (SSBLB) supplied from Doboy substation (SSDBS) via the Queensport substation (SSQPT). Supplies some 581 commercial and industrial customers and 8,890 domestic customers have electricity supplied by SSBLS, while SSQPS supplies some 590 commercial and industrial customers and 4,823 domestic customers. SSDBS supplies SSQPT (and SSBLB by extension) via two 33kV feeders; F581 and F677. Under a single credible contingency event of loss of one feeder, forecast load on the remaining 33kV feeder is expected to exceed the ECC rating of the remaining feeder. After accounting for available load transfer capacity and the use of mobile generation, a residual load in excess of 4MVA would remain unsupplied for greater than 3 hours and more than 4MVA that would remain unsupplied for greater than 8 hours (refer Appendix F). This is not compliant with the Safety Net Targets as prescribed under Energex's Distribution Authority.

2.2 Business-as-usual service costs

The business as usual (BAU) service costs for these assets are the maintenance costs associated with ongoing operations. In addition to these costs, significant emergency response costs would be incurred for the counterfactual BAU case if failures occur.

2.3 Key assumptions

- The counterfactual is assumed as the BAU case where no new feeder is constructed.
- Demand is anticipated to increase in the Bulimba and surrounding areas due to growing local populations.
- A block load increase is expected because of the 'Bulimba Barracks', Forgacs Cairncross Dockyards and Faulkner Chains developments. The Department of Defence recently entered into a contract to sell the land formerly used as the barracks, with the sale expected to be finalised in early 2020. These developments are anticipated to include both housing and commercial developments and are assumed to have a substantial impact on demand in the region.

2.4 Risk assessment

The following risks have been identified because of not addressing the identified limitations. These risks represent a Moderate and Low risk under the Energy Queensland Network Risk Framework, however Energex does not consider these risks to be as low as reasonably practicable (ALARP).

Table 5: Counterfactual risk assessment

Risk Scenario	Risk Type	Consequence (C)	Likelihood (L)	Risk Score	Risk Year
Outage of 33kV feeder F677, resultant load on F581 exceeds feeder thermal capacity, **shedding customers (>1,600) for >8hrs**.	Customer	*3* *(5,000 customers for > 12 hours)*	*3* *(Unlikely to occur)*	***9*** ***(Low risk)***	2019
Without augmenting the network, the Safety Net requirement as prescribed in the Distribution Authority is not met, resulting in the regulator being notified and a subsequent **improvement notice being issued**.	Legislative	*4* *(Energex/ Ergon identified issue requiring regulator to be notified. Improvement notice issued.)*	*3* *(Unlikely to occur)*	***12*** ***(Moderate risk)***	2019

Further Details of the risk ratings and descriptions can be found in Energy Queensland's Network Risk Framework.

2.5 Retirement or de-rating decision

SSBLB and SSQPT supply the suburbs of Bulimba, Balmoral, Hawthorne, Morningside Cannon Hill, Colmslie, Morningside, Norman Park and Queensport. There are approximately 1171 commercial and industrial customers reliant on the electricity supplied by both the SSBLB and SSQPT. Retirement or de-rating of either of these assets would result in the loss of supply to these customers, as no other substations feed into these locations. Retirement or de-rating is therefore an unacceptable option.

3 Options Analysis

3.1 Options considered but rejected

Base Case (Counterfactual)

If the identified limitations are not addressed, the risks outlined in section 2 will not be resolved. Specifically, during a single contingency event, interruption of supply for an outage of F677 or F581 will breach the Safety Net outlined in Energex's Distribution Authority.

As such, Energex considers that the counterfactual case is an unacceptable solution for the identified limitations.

11kV Solutions

The limitations identified in this planning report were on the 33kV sub-transmission network, meaning any load shifts between SSBLB and SSQPT would only have the impact of marginally reducing losses and would not materially decrease the load on the network. Furthermore, there were no load transfers available of enough volume to any adjacent substation to enable a consideration of load transfers and upgrading accordingly.

A further feasible 11kV feeder solution would be to supply 11kV feeders into the area from Newstead across the river into the Bulimba area, a separate 110kV source. The costs for this option would significantly exceed the proposed 33kV feeder solution due to the costs of an 11kV river crossing. Hence this option has not been considered.

Alternative 33kV Feeder Solution

The location of both SSQPT and SSBLB mean that the only commercially feasible 33kV feeder solution is to supply SSQPT from SSDBS. There are other zone substations at SSWRD (Wellington Road) and SSCPR (Coorparoo) that could provide 33kV reinforcement, however these are simply longer routes without any network benefit or technical advantage that would warrant consideration. As such, no other 33kV feeder solutions have been considered.

3.2 Identified options

3.2.1 Network options

Option 1: Establish a new 33kV 40MVA U/G Feeder from SSDBS to SSQPT

This option involves installation of a new 33kV 40MVA feeder, including:

- Establishing approximately 3.5km of new 33kV underground feeder following the route of F581 and F677 due to the difficulty of traversing the Gateway Motorway.
- Installation of a new 33kV circuit breaker at SSQPT.
- Establishing sufficient protection, automation and plant protection schemes at SSQPT and SSBLB.

The new 33 kV feeder will mitigate the Safety Net Load at Risk for the loss of F677 and F581. It has an estimated direct cost of $5.1M.

Geographic diagrams in Figure 2 show the network following completion of this project and WR6073695 – QPT to BLB Install 33kV SCCT to replace F575A and F575B.

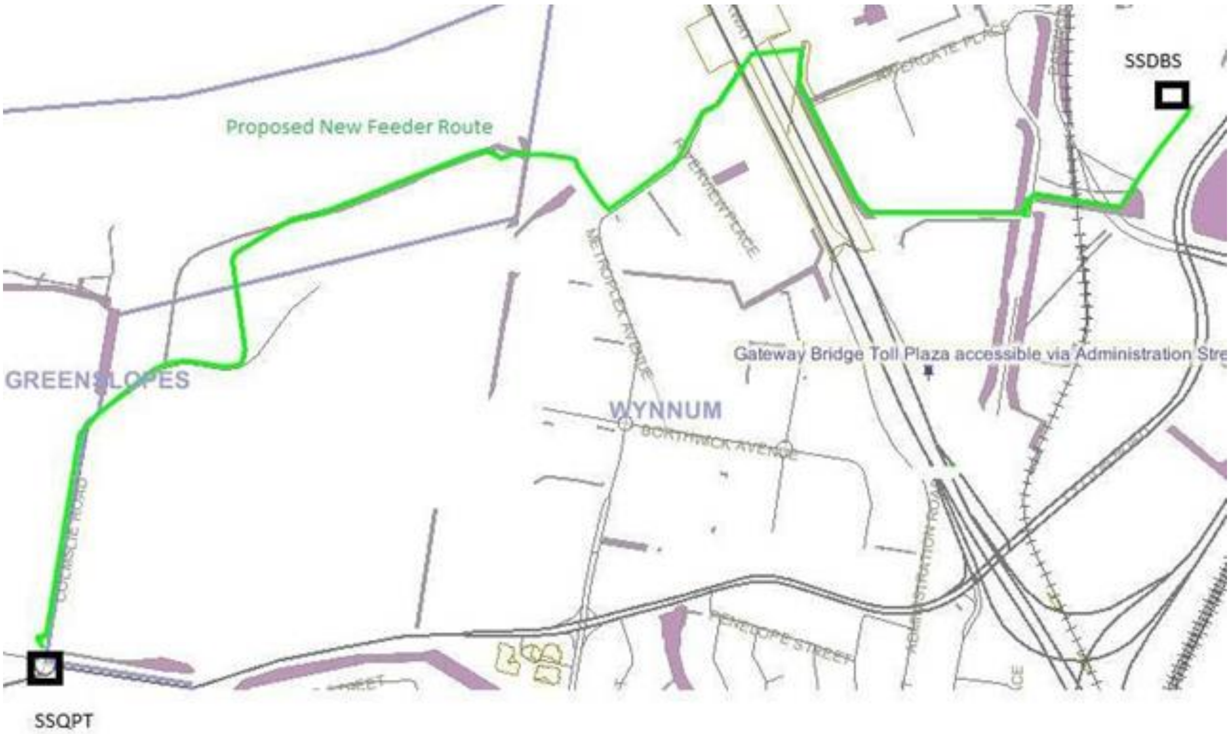

Figure 2: Proposed Network Arrangement (Geographic View)

Construction of this feeder is expected to begin in 2021 and continue until the anticipated completion in October 2022, so that the feeder is ready for commissioning in 2023.

3.2.2 Non-network options

Energex is committed to the implementation of Non-Network Solutions to reduce the scope or need for traditional network investments. Our approach to Demand Management is listed in Chapter 7 of our Distribution Annual Planning Report but involves early market engagement around emerging constraints as well as effective use of existing mechanisms such as the Demand Side Engagement Strategy and Regulatory Investment Test for Distribution (RIT-D). We see that the increasing penetration and improving functionality of customer energy technology, such as embedded generation, Battery Storage Systems and Energy Management Systems, have the potential to present a range of new non-network options into the future.

The primary investment driver for this project is Augex, supporting customer growth and network security. A successful Non-Network Solution may be able to assist in reducing the scope or timing for this project. As the cost of options considered as part of this report is greater than $5M this investment will be subject to RIT-D as a mechanism for customer and market engagement on solutions to explore further opportunities.

The customer base in the study area is predominantly established residential and commercial and has a medium opportunity to reduce demand or provide economic non-network solutions. Expenditure for the proposed project has been modelled as CAPEX and included in the forecast for the current regulatory control period. Funding of any successfully identified Non-Network solutions will be treated as an efficient OPEX/CAPEX trade-off, consistent with existing regulatory arrangements. This will be determined as a result of the RIT-D process.

3.3 Economic analysis of identified options

3.3.1 Cost versus benefit assessment of each option

The Net Present Value (NPV) of the proposed option has been determined by considering costs and benefits, using EQL's standard NPV analysis tool.

Costs

The capital cost of the project is estimated at $5.1M.

Results

The NPV for the project has been determined using the above cost assumptions and is summarised in Table 6. The Regulated Real Pre-Tax Weighted Average Cost of Capital (WACC) rate of 2.62% has been applied as the discount rate for this analysis (as per EQL's Standard NPV Tool).

Table 6: NPV estimate of DBS-QPT feeder ($ 000s)

Option Name	NPV
Option 1 – New Feeder DBS-QPT	-$4,907

3.4 Scenario Analysis

3.4.1 Sensitivities

Delaying expenditure improves the Net Present Value (NPV) of the project however if load increases occur in 2024 as anticipated, the result is a failure in meeting the Safety Net during any contingencies. This would be viewed as an unacceptable risk and therefore not a viable option.

The necessity of the new feeder is predicated on an increase in load in the areas reliant on supply from the Doboy, Queensport and Bulimba substations. Load increases are anticipated to commence from 2021 onwards. A temporary load for the Cross-River Rail project is the main driver for this additional demand in 2021. This demand will be managed in conjunction with the relevant Authority in the 2021 and 2022 period when a safety net breach is likely to occur to ensure that the total demand can be managed for contingency events.

The core driver of the increased load is the construction and redevelopment of the Bulimba Barracks, whose purchase from the Department of Defence is expected to be settled in early 2020. This is anticipated to increase load overall by 8MVA, with the first 4MVA expected in 2024 followed by a further 4MVA in 2025. Should this development not go ahead, it is uncertain whether the new feeder would still be required. The RIT-D analysis should incorporate the probabilities of constant load in the future in its analysis.

3.4.2 Value of regret analysis

There is little value of regret as Energex considers that the counterfactual case is an unacceptable solution due to the inability to meet Safety Net compliance. Energex is required under its Distribution Authority to plan suitable augmentation to ensure that Safety Net compliance occurs for the 50POE demand forecast. If the load increases as anticipated and the new feeder is not constructed, Safety Net targets will be breached in a contingency event. If the development does not proceed or is delayed, or load remains constant through these areas despite the Bulimba Barracks development, the new feeder will be advancing works that would otherwise need to occur at some future time.

The risk of not being able to meet Safety Net targets outweighs the relatively low probability that the demand forecast does not increase as predicted.

3.5 Qualitative comparison of identified options

3.5.1 Advantages and disadvantages of each option

Table 7 details the advantages and disadvantages of each option considered.

Table 7: Assessment of options

Option	Advantages	Disadvantages
Option 1: New Feeder DBS-QPT	Reduces the risk of not adhering to the Energex Safety Net for supply load of QPT and BLB substations Can follow a predetermined route of existing 33kV feeders	High capital expenditure

3.5.2 Alignment with network development plan

The proposed works would ensure that Energex meets its Service Safety Net Targets obligations. It looks to proactively provide contingency capacity just in time for load growth, maximising utilisation of assets while also considering the long-term growth of the local network and customer base. The proposal aligns with the Asset Management Objectives in the Distribution Annual Planning Report. In particular it manages risks, performance standards and asset investment to deliver balanced commercial outcomes while modernising the network to facilitate access to innovative technologies.

3.5.3 Alignment with future technology strategy

This program of work does not contribute directly to Energy Queensland's transition to an Intelligent Grid, in line with the Future Grid Roadmap and Intelligent Grid Technology Plan. However, it does support Energy Queensland in maintaining affordability of the distribution network while also maintaining safety, security and reliability of the energy system, a key goal of the Roadmap, and represents prudent asset management and investment decision-making to support optimal customer outcomes and value across short, medium and long-term horizons.

3.5.4 Risk Assessment Following Implementation of Proposed Option

Table 8: Risk assessment showing risks mitigated following Implementation

Risk Scenario	Risk Type	Consequence (C)	Likelihood (L)	Risk Score	Risk Year
Outage of 33kV feeder F677, resultant load on F581 exceeds feeder thermal capacity, **shed customers (2500) for >3hrs**.	Customer	(Original) 3 *(5,000 customers for > 12 hours)*	3 *(Unlikely to occur)*	**9** ***(Low risk)***	2019
		(Mitigated) 3 (5,000 customers for > 12 hours)	1 (Almost no likelihood to occur)	**3** **(Very low risk)**	2023
Without augmenting the network, the Safety Net legislated requirement as part of the Distribution	Legislative	(Original) 4 *(Energex/ Ergon identified issue requiring regulator to be notified.*	3 *(Unlikely to occur)*	**12** ***(Moderate risk)***	2019

Risk Scenario	Risk Type	Consequence (C)	Likelihood (L)	Risk Score	Risk Year
Authority is not met, resulting in the regulator being notified and a subsequent **improvement notice being issued**.		*Improvement notice issued)* (Mitigated) 4 (Energex/ Ergon identified issue requiring regulator to be notified. Improvement notice issued.)	1 (Almost no likelihood to occur)	**4** **(Very low risk)**	2023

Risk Assessment Outcome:

The network (business) risk the organisation would be exposed to if the project was not undertaken is not deemed to be as low as reasonably practicable (ALARP). Addressing the risks as detailed above through implementation of the preferred option will reduce Energex's risk exposure.

4 Recommendation

4.1 Preferred option

To address the emerging N-1 limits for F581 / F677 for a loss of a feeder, it is recommended that Energex undertake a RIT-D to establish the lowest cost non-network or hybrid solution for comparison with the installation of a new 33kV feeder from SSDBS to SSQPT. Appendix H shows the proposed network on completion of the recommended works should the network option prove to be the lowest cost option.

4.2 Scope of preferred option

The preferred option requires completion of a RIT-D to establish the lowest cost non-network or hybrid solution for comparison with the installation of a new 33kV feeder from SSDBS to SSQPT. Direct costs are estimated at $5.1M.

Appendix A. References

Note: Documents which were included in Energy Queensland's original regulatory submission to the AER in January 2019 have their submission reference number shown in square brackets, e.g. Energy Queensland, *Corporate Strategy [1.001], (31 January 2019).*

Energex, *Distribution Annual Planning Report (2018-19 to 2022-23) [7.050]*, (21 December 2018).

Energy Queensland, *Asset Management Overview, Risk and Optimisation Strategy [7.025]*, (31 January 2019).

Energy Queensland, *Corporate Strategy [1.001],* (31 January 2019).

Energy Queensland, *Future Grid Roadmap [7.054],* (31 January 2019).

Energy Queensland, *Intelligent Grid Technology Plan [7.056],* (31 January 2019).

Energy Queensland, *Network Risk Framework*, (October 2018).

Appendix B. Acronyms and Abbreviations

The following abbreviations and acronyms appear in this business case.

Abbreviation or acronym	Definition
$M	Millions of dollars
$ nominal	These are nominal dollars of the day
$ real 2019-20	These are dollar terms as at 30 June 2020
2020-25 regulatory control period	The regulatory control period commencing 1 July 2020 and ending 30 Jun 2025
2HEC	Hour emergency capacity
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ALARP	As Low as Reasonably Practicable
Augex	Augmentation capital expenditure
BAU	Business as Usual
BLB	Bulimba
CAPEX	Capital expenditure
CBRM	Condition Based Risk Management
Current regulatory control period or current period	Regulatory control period 1 July 2015 to 30 June 2020
DAPR	Distribution Annual Planning Report
DBS	Doboy
DER	Distributed energy resources
DNSP	Distribution Network Service Provider
ECC	Emergency Cyclic Capacity
EQL	Energy Queensland Ltd
IT	Information Technology
KRA	Key Result Areas
kV	Kilovolts
MVA	Megavolt Amperes
MSS	Minimum Service Standard
NCC	Normal cyclic capacity
NEL	National Electricity Law
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules (or Rules)
Next regulatory control	The regulatory control period commencing 1 July 2020 and ending 30 Jun

Abbreviation or acronym	Definition
period or forecast period	2025
NPV	Net Present Value
OOS	Out of Service
OPEX	Operating Expenditure
PCBU	Person in Control of a Business or Undertaking
POE	Probability of Exceedance
Regulatory Proposal	Energex or Ergon Energy's proposal for the next regulatory control period submitted under clause 6.8 of the NER
Repex	Replacement capital expenditure
RIT-D	Regulatory Investment Test - Distribution
SCCT	Single circuit
SSBLB	Bulimba Substation
SSDBS	Doboy Substation
SSLAR	Security standard load at risk
SSQPT	Queensport Substation
QPT	Queensport
VCR	Value of customer reliability
WACC	Weighted average cost of capital

Appendix C. Alignment with the National Electricity Rules (NER)

Table 9 details the alignment of this proposal with the NER capital expenditure requirements as set out in Clause 6.5.7 of the NER.

Table 9: Alignment with NER

Capital Expenditure Requirements	Rationale
6.5.7 (a) (1) **The forecast capital expenditure is required in order to meet or manage the expected demand for standard control services.**	This project is required to meet the forecast demand growth in the Bulimba, Balmoral, Hawthorne, Cannon Hill, Colmslie, Norman Park, Queensport and Morningside areas.
6.5.7 (a) (2) **The forecast capital expenditure is required in order to comply with all applicable regulatory obligations or requirements associated with the provision of standard control services**	Our alignment to regulatory obligations or requirements is demonstrated in this proposal, whereby CAPEX is required in order to maintain compliance and electrical safety through alignment with the QLD Electrical Safety Act 2002 and the QLD Electrical Safety Regulation 2006. In particular, this proposal refers to the Energex Safety Net targets, which are set to meet threshold criteria following an N-1 event on the sub-transmission network. This proposal maintains operations within the Safety Net targets so that Energex remains in compliance and alignment with the NER.
6.5.7 (a) (3) **The forecast capital expenditure is required in order to:** **(iii) maintain the quality, reliability and security of supply of standard control services** **(iv) maintain the reliability and security of the distribution system through the supply of standard control services**	This proposal seeks to ensure we adhere to our Safety Net targets. These targets are set such that any disruption to supply is minimised in terms of the outage time and number of customers affected. This proposal will utilise CAPEX to maintain reliability and security of supply for those customers in the above-mentioned regions.
6.5.7 (c) (1) (i) **The forecast capital expenditure reasonably reflects the efficient costs of achieving the capital expenditure objectives**	The Unit Cost Methodology and Estimation Approach sets out how the estimation system is used to develop project and program estimates based on specific material, labour and contract resources required to deliver a scope of work. The consistent use of the estimation system is essential in producing an efficient CAPEX forecast by enabling: • Option analysis to determine preferred solutions to network constraints • Strategic forecasting of material, labour and contract resources to ensure deliverability • Effective management of project costs throughout the program and project lifecycle, and • Effective performance monitoring to ensure the program of work is being delivered effectively. The unit costs that underpin our forecast have also been independently reviewed to ensure that they are efficient (Attachments 7.004 and 7.005 of our initial Regulatory Proposal).
6.5.7 (c) (1) (ii) **The forecast capital expenditure reasonably reflects the costs that a prudent operator would require to achieve the capital expenditure objectives**	The prudency of this proposal is demonstrated through the options analysis conducted and the quantification of risk and benefits of each option. The prudency of our CAPEX forecast is demonstrated through the application of our common frameworks put in place to effectively manage investment, risk, optimisation and governance of the Network Program of Work. An overview of these frameworks is set out in our Asset Management Overview, Risk and Optimisation Strategy (Attachment 7.026 of our initial Regulatory Proposal).

Capital Expenditure Requirements	Rationale
6.5.7 (c) (1) (iii) **The forecast capital expenditure reasonably reflects a realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objective**	Our peak demand forecasting methodology employs a bottom-up approach reconciled to a top-down evaluation, to develop the ten-year zone substation peak demand forecasts. Our forecasts use validated historical peak demands and expected load growth based on demographic and appliance information in small area grids. Demand reductions, delivered via load control tariffs, are included in these forecasts. This provides us with accurate forecasts on which to plan.

Appendix D. Mapping of Asset Management Objectives to Corporate Plan

This proposal has been developed in accordance with our Strategic Asset Management Plan. Our Strategic Asset Management Plan (SAMP) sets out how we apply the principles of Asset Management stated in our Asset Management Policy to achieve our Strategic Objectives.

Table 1: "Asset Function and Strategic Alignment" in Section 1.4 details how this proposal contributes to the Asset Management Objectives.

Table 10 provides the linkage of the Asset Management Objectives to the Strategic Objectives as set out in our Corporate Plan (Supporting document 1.001 to our Regulatory Proposal as submitted in January 2019).

Table 10: Alignment of Corporate and Asset Management objectives

Asset Management Objectives	Mapping to Corporate Plan Strategic Objectives
Ensure network safety for staff contractors and the community	EFFICIENCY ***Operate safely as an efficient and effective organisation*** Continue to build a strong safety culture across the business and empower and develop our people while delivering safe, reliable and efficient operations.
Meet customer and stakeholder expectations	COMMUNITY AND CUSTOMERS ***Be Community and customer focused*** Maintain and deepen our communities' trust by delivering on our promises, keeping the lights on and delivering an exceptional customer experience every time
Manage risk, performance standards and asset investments to deliver balanced commercial outcomes	GROWTH ***Strengthen and grow from our core*** Leverage our portfolio business, strive for continuous improvement and work together to shape energy use and improve the utilisation of our assets.
Develop Asset Management capability & align practices to the global standard (ISO55000)	EFFICIENCY ***Operate safely as an efficient and effective organisation*** Continue to build a strong safety culture across the business and empower and develop our people while delivering safe, reliable and efficient operations.
Modernise the network and facilitate access to innovative energy technologies	INNOVATION ***Create value through innovation*** Be bold and creative, willing to try new ways of working and deliver new energy services that fulfil the unique needs of our communities and customers.

Appendix E. Risk Tolerability Table

Network Risks - *Risk Tolerability Criteria and Action Requirements*				
Risk Score	Risk Descriptor	Risk Tolerability Criteria and Action Requirements		
30 – 36	***Intolerable*** *(stop exposure immediately)*			
24 – 29	***Very High Risk***	***ALARP** Risk in this range managed to As Low As Reasonably Practicable	**Executive Approval** (required for continued risk exposure at this level)	May require a full Quantitative Risk Assessment (QRA) Introduce new or changed risk treatments to reduce level of risk Periodic review of the risk and effectiveness of the existing risk treatments
18 – 23	***High Risk***		**Divisional Manager Approval** (required for continued risk exposure at this level)	Introduce new or changed risk treatments to reduce level of risk Periodic review of the risk and effectiveness of the existing risk treatments
11 – 17	***Moderate Risk***		**Group Manager / Process Owner Approval** (required for continued risk exposure at this level)	Introduce new or changed risk controls or risk treatments as justified to further reduce risk Periodic review of the risk and effectiveness of the existing risk treatments
6 – 10	**Low Risk**			
1 to 5	***Very Low Risk***		No direct approval required but evidence of ongoing monitoring and management is required	*Periodic review of the risk and effectiveness of the existing risk treatments*

SFAIRP
Risks in this area to be mitigated So Far as is Reasonably Practicable

Figure 3: A Risk Tolerability Scale for evaluating Semi-Quantitative risk score

Appendix F. Safety Net Obligations

Safety Net Criteria

Network planning criteria is a set of rules that guide how future network risk is to be managed for and under what conditions network augmentation or other related expenditure should be undertaken.

Energex

The Safety Net is effectively a deterministic security standard, requiring Energex to meet a set of threshold criteria following an N-1 event on the sub-transmission network. Energex has a legislated requirement to “design, plan and operate its supply network” to meet the Safety Net “to the extent reasonably practicable”.

The Safety Net Targets are outlined in the Distribution Annual Planning Report, and aim for the following:

Feeder Type	Targets
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	• No greater than 40 MVA (16,000 customers) is without supply for more than 30 minutes; • No greater than 12 MVA (5,000 customers) is without supply for more than 3 hours; and • No greater than 4 MVA (1,600 customers) is without supply for more than 8 hours.
Short rural – following an N-1 Event	• No greater than 40 MVA (16,000 customers) is without supply for more than 30 minutes; • No greater than 15 MVA (6,000 customers) is without supply for more than 4 hours; and • No greater than 10 MVA (4,000 customers) is without supply for more than 12 hours.

Table D1: Safety Net targets – load not supplied and maximum restoration times following a credible contingency

Urban Safety Net Interpretation

Demand Range	Allowed Outage to be within Safety Net
>40MVA	No outage
12-40MVA	30 minutes OK
4-12MVA	3 hours OK
<4MVA	8 hours OK

DBY-QPT Logic

- 12.4MVA over NCC and must be shed immediately
- Manual transfers reduce outage to 9MVA within 3 hours
- 9 MVA for more than 3 hours – a **safety net breach**
- 4MVA of generation within 8 hours, leaving residual 5MVA
- 5MVA for more than 8 hours – a **safety net breach**

Appendix G. Reconciliation Table

Reconciliation Table Conversion from $18/19 to $2020	
Business Case Value	
(M$18/19)	$5.10
Business Case Value	
(M$2020)	$5.32

Appendix H. Additional information

Substation Limitations

Queensport

SSQPT is equipped with 2 x 25MVA 33/11kV transformers. The substation capacity is limited by the transformers and provides an NCC, ECC and 2HEC as below:

Normal Cyclic Capacity (NCC) – 52.4 MVA

Emergency Cyclic Capacity (ECC) – 28.8MVA

Hour Emergency Capacity (2HEC) – 31.3MVA

The forecast peak load at SSQPT over the next ten years is 27MVA. No limitations have been identified at SSQPT.

Bulimba

SSBLB is equipped with 2 x 25MVA 33/11kV transformers. The substation capacity is limited by the transformers and provides an NCC, ECC and 2HEC as below:

Normal Cyclic Capacity (NCC) – 58.3 MVA

Emergency Cyclic Capacity (ECC) – 31.3MVA

Hour Emergency Capacity (2HEC) – 33.8MVA

The forecast peak load at SSBLB over the next ten years grows from 25MVA to 35MVA. This growth in load is as a result of a large block load in the area as a result of the Naval Yards redevelopment and significant gentrification of the area. No limitations have been identified at SSBLB as a result of this load increase.

Schematic outline of solution

Schematic diagrams are provided below, showing the network as it currently stands (Figure 4) and following completion (Figure 5) of this project and WR6073695 – QPT to BLB Install 33kV SCCT to replace F575A and F575B.

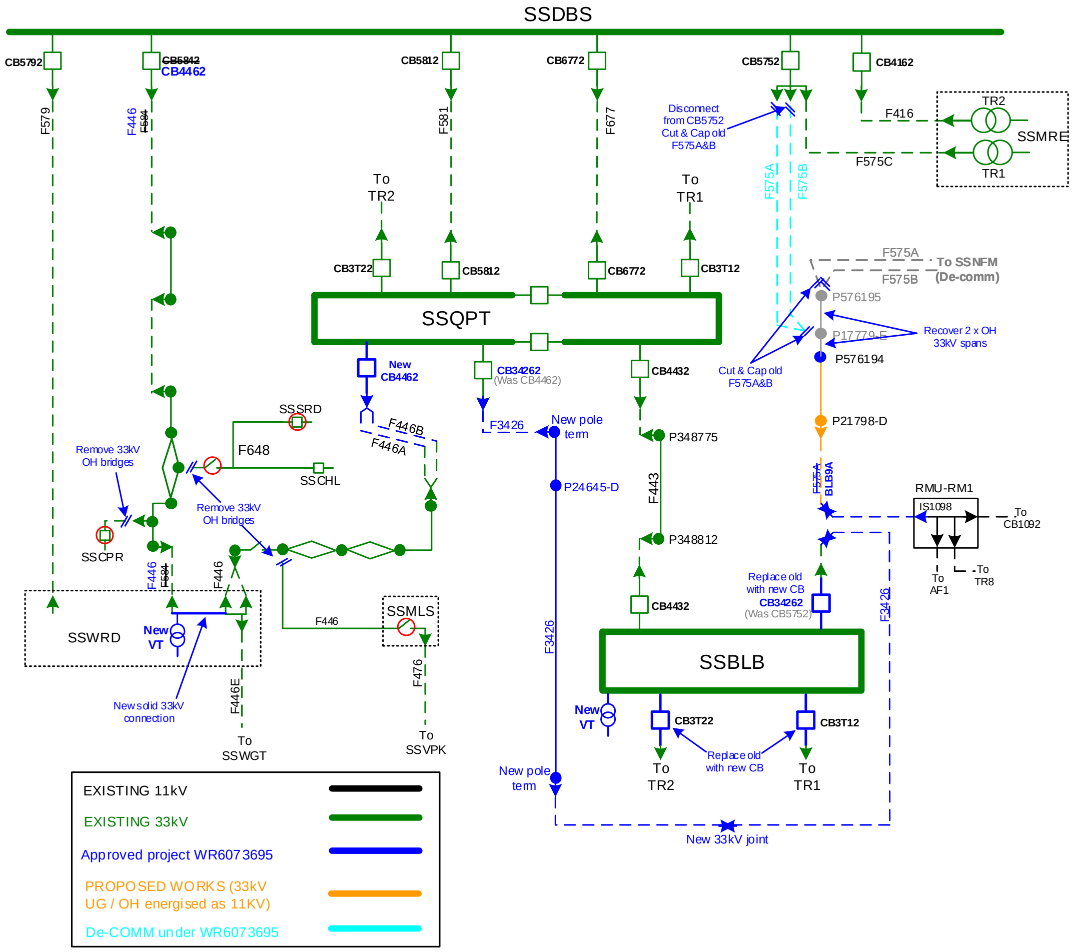

Figure 4: Existing Network Arrangement (Schematic View)

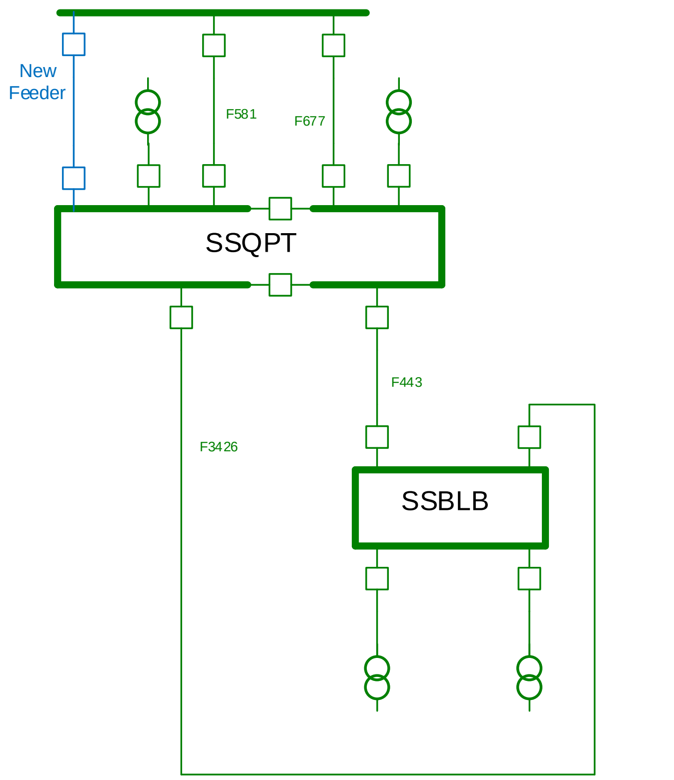

Figure 5: Proposed Network Arrangement (Schematic View)