Business Case
Establish Bell's Creek Central Zone Substation

Executive Summary

Caloundra 132/11kV zone substation (SSCLD) is located in Caloundra, in the Sunshine Coast area of South East Queensland. SSCLD provides electricity supply to approximately 22,000 predominantly domestic customers in the Aroona, Caloundra, Currimundi, Meridan Plains, Pelican Waters and Shelly Beach areas and currently supplies a forecast peak load of 54.5MVA (10POE). The Sunshine Coast area continues to see strong population growth and economic development, with a very proactive council developing and promoting the area.

There is a significant master-planned community (Aura) to the south-west of SSCLD that when completed is forecast to add at least 47MVA load to the network. Further, an additional 15MVA of load to be added to the network from the Sunshine Coast Industrial Park, located to the west of SSCLD. These developments, as well as native demand growth, will at least double the ultimate electrical demand in the SSCLD supply area. Left unaddressed there will be an ongoing high level of customer impact risk associated with not being able to supply new customers in the Aura or industrial park developments in a timely manner. This risk will continue to increase as more customers move into the area.

The counterfactual of “Do Nothing” has been rejected as it results in unacceptable risks of supply availability to the increasing demand in the area of study. The option to supply the new load from the next two closest zone substations, the Beerwah zone substation (SSBWH) and the Landsborough zone substation (SSLBH), was also not considered a feasible option due to the length of the feeders making corridor acquisition and voltage drop difficult issues to overcome. The following options were evaluated in this business case:

Option 1 – Continue to supply the developing load with 11kV feeders from SSCLD

Option 2 – Establish a new two-transformer 132/11kV zone substation at Bells Creek Central, located within the development at Aura

Option 3 – Construct the 132kV Overhead line to the Bells Creek Central area and utilise at 11kV

Option 4 – Establish a new 132/11kV zone substation at Bells Creek North, which is located in the Sunshine Coast Industrial Park

Option 5 – Establish a new 132/33kV bulk supply substation at Meridan Plains and establish a new 33/11kV zone substation at Bells Creek Central

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 customer reliability is a key driver, due to the need to deliver supply for the significant master-planned community (AURA) to the south-west of SSCLD.

To this end, Option 2 is the preferred option as it is the most cost-effective means of providing an efficient and secure supply to the Caloundra area that will accommodate future customer growth and community development. The Net Present Value (NPV) of this option is -$60.2M.

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
$28.6M	$1.5M	$28.6M

Contents

1 Introduction

This document provides details of various options to augment electricity supply capacity in the area to the South of Caloundra. Significant demand growth is expected in the area in future years due to a combination of a major industrial estate development plus a master-planned residential community, Aura.

1.1 Purpose of document

This document recommends the optimal capital investment necessary for augmentation of electricity supply to the area South of Caloundra. It proposes the establishment of a new 132/11kV substation at Bell's Creek central.

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

The scope of this document is limited to the major electricity supply infrastructure in the study area. It does not include additional routine incremental infrastructure such as new 11kV feeders within existing areas to cater for demand increases or for projects with other drivers such as protection coverage. Several such additional projects are currently in progress and these are shown in Appendix I, Additional Known Projects.

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 customer reliability is a key driver, due to the need to deliver supply for the significant master-planned community (AURA) to the south-west of SSCLD.

The Aura development is forecast to add at least 47MVA load to the network. Further, an additional 15MVA load will be added to the network from the Sunshine Coast Industrial Park, located to the west of the Caloundra substation (SSCLD). These developments, as well as native demand growth, will at least double the ultimate electrical demand in the SSCLD supply area.

Left unaddressed there will be an ongoing high level of customer impact risk associated with not being able to supply new customers in the Aura or industrial park developments in a timely manner. This risk will continue to increase as more customers move into the area. This proposal aligns with the CAPEX objectives and criteria from the National Electricity Rules as detailed in Appendix C.

1.4 Energy Queensland Strategic Alignment

Table 1 details how this reinforcement to the Caloundra area contributes to Energy Queensland's corporate and asset management objectives. The linkages between these Asset Management Objectives and EQL's Corporate Objectives are shown in Appendix D.

Table 1: Asset Function and Strategic Alignment

Objectives	Relationship of Initiative to Objectives
Ensure network safety for staff contractors and the community	Suitable electricity infrastructure development is critical to the safe operation of the electricity network.
Meet customer and stakeholder expectations	The provision of suitable electricity infrastructure is critical to enable suitable developments to occur in support of economic development and customer housing growth in the area south of Caloundra. This infrastructure contributes to important electricity security and reliability outcomes expected by the community.
Manage risk, performance standards and asset investments to deliver balanced commercial outcomes	Without suitable electricity infrastructure developments, significant risks of inability to supply new demand is likely to arise in coming years. Hence the most suitable economic development provides a balanced result in terms of investment to meet required supply obligations.
Develop Asset Management capability & align practices to the global standard (ISO55000)	Timely development of infrastructure using suitable asset standards aligns with the practices in ISO55000.
Modernise the network and facilitate access to innovative energy technologies	The proposed developments are in line with modern standards that support future technologies. This development will be progressed through the Regulatory Investment Test for Distribution (RIT-D) process to ensure that demand-side and other innovative technologies are tested as alternatives to the network proposal.

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

Corporate Policies relating to establishing the desired level of service are detailed in Appendix D.

Under the Distribution Authorities, EQL is expected to operate with an 'economic' customer value-based approach to reliability, with "Safety Net measures" for extreme circumstances. Safety Net measures are intended to mitigate against the risk of low probability 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. A table of safety net obligations can be found in Appendix F.

EQL is expected to employ all reasonable measures to ensure it does not exceed minimum service standards (MSS) for reliability, assessed by feeder types as

- 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 monthly.

1.6 Compliance obligations

Table 2 shows the relevant compliance obligations for this proposal.

Table 2: Compliance Obligations

Legislation, Regulation, Code or Licence Condition	Obligations	Relevance to this investment
Distribution Authority for 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 uses good industry practice in the development of planning proposals for network development. This proposal considers the optimal investments to meet Energex's obligations to meet safety net targets.

1.7 Limitation of existing assets

The limitations identified in this report are due to load growth in the Caloundra area and the need to supply new customers in the Aura subdivision and the Sunshine Coast Industrial Park. The following sections outline the likely growth and the resulting constraints in the existing network in the area.

Existing Network Overview

SSCLD is supplied from the Powerlink Palmwoods injection point via a 132kV ring network, which also supplies Mooloolaba zone substation (SSMLB), Currimundi zone substation (SSCMD), Birtinya zone substation (SSBTY), Kawana zone substation (SSKWA), Alexandra Headlands zone substation (SSAHD) and West Maroochydore zone substation (SSWMD). There is also a 33kV network that is supplied by Beerwah bulk supply substation (SSBWH) that provides supply to Woodford zone substation (SSWFD) and Landsborough zone substation (SSLBH).

SSCLD provides electricity supply to approximately 22,000 predominantly domestic customers in the Aroona, Caloundra, Currimundi, Meridan Plains, Pelican Waters and Shelly Beach areas. Geographic and schematic views of the network area under study are provided in Appendix J Existing Electricity Supply Network.

Development Overview and Demand Forecast

The Aura development (previously known as Caloundra South) is south-west of SSCLD and is a master-planned community that will have over 20,000 new homes in a 24km^2 site within the next 30 years. The development also contains a significant commercial and light industrial area, forecast to be roughly half the load of the development. Further to this, there is an existing Sunshine Coast Industrial Park directly west of SSCLD which is currently planned for a large expansion. When fully developed, this industrial park will represent a load of around 15MVA to 20MVA.

Priority Development Areas (PDA) are parcels of land within Queensland identified for development to deliver significant benefits to the community. When a PDA is declared, Economic Development Queensland (EDQ) becomes the planning agency responsible for all approvals within the development, which streamlines the approvals process and ensures a single point of accountability for the development. More information on PDA's generally can be found at https://www.dsdmip.qld.gov.au/economic-development-qld/priority-development-areas.html.

The Caloundra South Priority Development Area (PDA) was declared on 28 October 2010 and covers 2310 hectares of land. Given the Development Scheme has been released and the size and use of the land has already been effectively approved, and that Stockland is a single developer over the entire site, there is certainty over the development proceeding. Furthermore, the development has already begun with over 2,000 customers in the Aura development connected to the Energex network within the last 3 years. The development period is expected to be over a 30-year period.

Working with the developer and EDQ, Energex have identified that the overall development will be approximately 20,000 dwellings, 1.8 hectares of light industrial land and 16 hectares of commercial land across the overall development. As a conservative estimate, Energex have assumed the following development staging across the next ten-year period.

Table 3: Staging for Development Area

Year	Commercial (Ha)	Industrial Light (Ha)	Residential (dwellings)
Existing	0	0	2,000
2019	0	0	500
2020	0	0	500
2021	0	0	500
2022	0	0	500
2023	0.6	0.07	500
2024	0.6	0.07	500
2025	0.6	0.07	1000
2026	0.6	0.07	1000
2027	0.6	0.07	1000
2028	0.6	0.07	1000
Total	3.6	0.42	9,000

Note: Assumptions on load development:

- 1.6kVA/dwelling for residential
- 6,000kVA/ha for industrial
- 1,200kVA/ha for commercial

The above figures show that Energex has assumed that around 20% of the commercial and industrial development and 45% of the residential component will be completed up to 2028. Given the proposed development period of 30 years, this is a conservative estimate of the progress for Aura, particularly in relation to the commercial and industrial elements of the development.

Energex's projections above closely align with the Queensland Government Statistician's Office "Queensland Regional Profile for Caloundra – West Statistical Area Level 2", which is the area that incorporates the Aura development. The forecast population projections for this area are shown below:

Table 4: Population Forecasts for Development Area

Area	2016	2021	2026	2031	2036	2041
Caloundra West	20,842	30,271	41,891	56,938	69,872	81,280

It can be seen from above that there it is expected that the population for the area will have grown by around 30,000 people out to 2028. Some of this growth will be in the broader Caloundra West area; however the majority of this growth will be in the Aura development. As such, an expectation of an addition 7,000 dwellings in this period is a conservative view of the possible growth in the area.

Figure 1 below shows the development area, with Table 5 showing the ultimate load of the area.

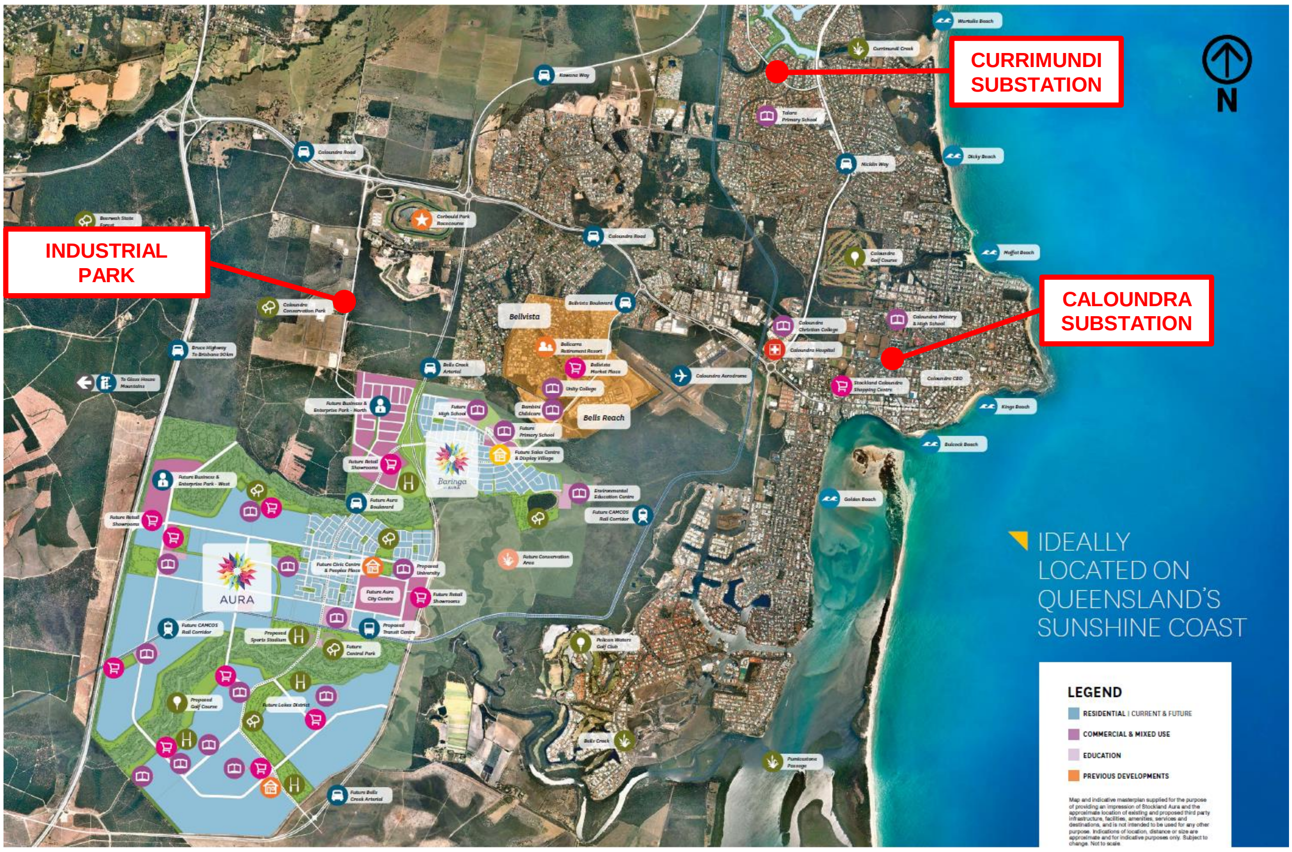

Figure 1: Proposed Aura Development Area

Table 5: Ultimate Load for Development Area

Load Type	Low Load Scenario (MVA)	Medium Load Scenario (MVA)
Commercial	14.9	18.6
Industrial Light	8.5	10.6
Residential High	0.5	0.6
Residential High B5	1.8	2.4
Residential Medium	6.0	8.0

Load Type	Low Load Scenario (MVA)	Medium Load Scenario (MVA)
Residential Undeveloped	15.3	20.4
Total for Aura Development	**47.0**	**60.4**
Sunshine Coast Industrial Park	15.0	20.0
Area Total – South Caloundra	**62.0**	**80.4**

As can be seen from Table 5, even under a low load scenario, the ultimate load in the Aura development alone totals at least 47MVA. When this is combined with the projected low load scenario of the Sunshine Coast Industrial Park directly north of Aura the total load in the area is forecast to be at least 62MVA. For the Energex network, a typical 132/11kV zone substation has a capacity of between 40-70MVA, with the capacity of a two transformer 33/11kV zone substation around 30-40MVA. Given the projected ultimate load, it is clear that Energex will require at least one additional zone substation in the area to be able to supply the Aura community and the Sunshine Coast Industrial Park to the north.

It should also be noted that there is a second future large development further west of the Aura development in Beerwah East. While this development is not in the immediate ten-year period, the network augmentation undertaken for supply to Aura will need to consider a large future load further to the west.

Load forecasts including Caloundra and the new developments for the period to 2028 are provided in Appendix K and an overall summary is provided in Table 6 on the following page. It should be noted that the load forecasts for Aura and Sunshine Coast Industrial Park have been developed based on known information about projected housing numbers and commercial / industrial development. The demand estimates are largely based around an After Diversity Maximum Demand (ADMD) of 1.3kVA/dwelling to 1.6kVA/dwelling.

The two feeders currently supplying the Aura development are CLD18A and CLD11. During 2018 these feeders had ADMDs of 1.8kVA/customer and 2.9kVA/customer respectively. The evidence to date and the future plans for the Aura development includes relatively affordable housing, and hence further reductions of demand due to higher levels of battery/solar support appears unlikely. Hence, the forecasts developed are conservatively low, given recent experience.

It should be noted that under this forecast, including the Aura development, the timing of the safety net breaches at Caloundra have come forward compared to previous forecasts.

Substation Limitations

Caloundra:

SSCLD is equipped with 2 x 60MVA 132/11kV transformers. The substation capacity is limited by the transformers and provides the following ratings:

- Normal Cyclic Capacity (NCC) – 115.1MVA
- Emergency Cyclic Capacity (ECC) – 64.5MVA
- 2 Hour Emergency Capacity (2HEC) – 81.0MVA

In summary for the next 10 years:

- There is no NCC load at risk for Caloundra substation
- From 2028 onwards the 50% Probability of Exceedance (POE) load exceeds the substation ECC for the contingency of a transformer out of service. From about 2028 or 2029, depending on the Sunshine Coast Industrial Park (not included above), this will exceed the safety net standard after allowing for with 6.3MVA of manual load transfers and 4MVA of emergency mobile generation. This excess demand escalates rapidly after 2028 and is a

trigger for augmentation to remove some of the load off Caloundra substation, which should be logically be completed by 2030 at the latest.

Table 6: SSCLD Load Forecast and Ratings (Not Including Sunshine Coast Industrial Park)

Year	10% POE Load (MVA)	NCC (MVA)	Caloundra 50% POE Load (MVA)	Total 50 POE including Aura (MVA)	ECC (MVA)	Safety Net Load At Risk (LAR)[1]
2019	54.49	115.1	49.92	49.92	64.5	0.00
2020	55.40	115.1	50.82	50.82	64.5	0.00
2021	56.66	115.1	51.83	52.61	64.5	0.00
2022	57.70	115.1	52.83	54.40	64.5	0.00
2023	58.28	115.1	53.34	56.85	64.5	0.00
2024	59.17	115.1	54.01	59.47	64.5	0.00
2025	60.59	115.1	55.29	63.48	64.5	0.00
2026	62.15	115.1	56.65	67.57	64.5	0.00
2027	62.97	115.1	57.41	71.06	64.5	0.00
2028	64.17	115.1	58.53	74.91	64.5	0.11
2029	65.36	115.1	59.49	78.76	64.5	3.96

Surrounding Zone Substations

Other than Caloundra zone substation, the closest zone substations to the Caloundra South area are Beerwah zone substation (SSBWH) and Landsborough zone substation (SSLBH). SSBWH is around 20km from the development and SSLBH is around 15km. Although each of these substations has some capacity to cater for more load, supplying the development from either of these substations is not a feasible option due to the length of the feeders making corridor acquisition and voltage drop difficult issues to overcome. As such, the capacity of these substations has not been considered in this study.

Sub-Transmission Network Limitation

As shown in Appendix J Existing Electricity Supply Network, following completion of the Palmwoods to West Maroochydore feeder, the 132kV feeder network supplying the Sunshine Coast area is a highly meshed network with sufficient capacity to cater for the load in the area. No network limitations have been identified on the sub-transmission feeder network.

Corridor Access

The location of the future Bells Creek Central zone substation will be within the Aura development area. It is proposed that it would be located to the south of where the development has currently progressed to and as such Energex anticipates that completion of any 132kV and 33kV lines would have a strong prospect of being overhead construction while the development is still in its early stages. However, as the development continues to progress and the community in the area grows; it is more likely that the construction of this line would be required to be underground given that the proposed line route would be amongst existing housing stock.

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[1] Assumes 6.3MVA of manual load transfers plus 4MVA of emergency generation

The plans for the development for the period up to 2025 involves the establishment of the first stages of the Town Centre, the first residential community Baringa, some of the further residential villages close to the Town Centre and the first schools and parklands. The period from 2025 onwards will see the development of the balance of the future residential villages, further parklands, the business and enterprise park. Because of the higher balance of residential development beyond 2025, Energex considers that the window of opportunity to use overhead construction will be until 2025, with any sub-transmission lines through the Aura development after this period likely to be underground construction.

11kV Feeder Limitations

There are limited distribution assets in the area of the new Aura development at present, with 11kV feeders CLD18A and CLD11 currently supplying the development. Energex has recently constructed a new feeder into the area, with a further feeder to be established in about 2022 or 2023. With the current projected load growth, Energex anticipates establishing a new 11kV feeder into the area every two to three years, depending on the load growth scenario, to service the load.

SSCLD currently only has six spare 11kV circuit breakers, with two already committed for the new 11kV feeders above. While Energex is generally able to utilise a single circuit breaker for two feeders, there are reliability impacts from doing this in a widespread manner, particularly for long feeders with high customer numbers such as those that will be established from SSCLD to the Aura development. As such, Energex views the limit of new 11kV feeders from SSCLD is around four new feeders without having a material impact on the reliability of new and existing customers.

It should also be noted that the Aura development will continue to move towards the south and new feeders from SSCLD will continue to be longer and more costly. In addition, there are limited 11kV corridors to be able to construct new feeders from SSCLD. This means that further 11kV feeder establishment will incur significant costs for conduit establishment to provide for further 11kV feeder routes.

Standard building block feeders in the Energex network are constructed for a 6MVA capacity. With an ADMD of 1.6kVA/dwelling, this results in around 2000 customers/feeder prior to augmentation. This is more customers than the current Energex average customer count/feeder of around 1500. Where feeders are beyond 7-8km, their capacity is more likely to be constrained by voltage drop, with a recent customer connection example showing that 4MVA is the most that could be achieved from an 11kV feeder of 10km if the load is lumped at the end of the feeder.

2 Counterfactual Analysis

2.1 Purpose of asset

Continued growth in the study area means that some augmentation work will be required to supply the demand in the area.

2.2 Business-as-usual service costs

There is no acceptable “do nothing” state in this study. The risks arising from no augmentation, are unacceptable as detailed below.

2.3 Key assumptions

The key assumption in the counterfactual case is that no augmentation work is carried out to supply the increasing load.

2.4 Risk assessment

The following risks have been identified as a result of not addressing the identified limitations. These risks are unacceptable and result in compliance failures, hence some augmentation is required.

Table 7: Counterfactual risk assessment

Risk Scenario	Risk Type	Consequence (C)	Likelihood (L)	Risk Score	Risk Year
10POE load on the existing 11kV network exceeds the NCC rating, resulting in underground (UG) cable damage and a prolonged outage of over 12 hours for customers in the area.	Customer	3 *(Interruption>12 hours)*	5 *(very likely to occur)*	**15 *(Moderate Risk)***	2021
50POE load on the existing 11kV network exceeds the 80% Target Maximum Utilisation resulting in a breach of Energex internal standards.	Business	1 *(Compliance Breach with Internal Guideline or standards)*	5 *(very likely to occur)*	**5 *(Very Low Risk)***	2021
50 POE Load on the existing 11kV network exceeds to 80% target maximum utilisation which leaves insufficient capacity to supply >1000 customers following an 11kV feeder outage.	Customer	4 *(Interruption up to 15000 customers)*	2 *(Very unlikely to occur)*	**8 *(Low Risk)***	2021
Without network augmentation, Energex will be unable to supply customers in the Caloundra area, resulting in adverse national media attention and a loss of public trust.	Customer	4 *(Adverse National Media attention and loss of public trust)*	5 *(very likely to occur)*	**20 *(High Risk)***	2025
Without network augmentation, Energex will be unable to supply customers in the Caloundra area, resulting in a breach of legislated requirements.	Legislated	4 *(Improvement Notice issues by regulator)*	4 *(Likely to occur)*	**16 *(Moderate Risk)***	2025

2.5 Retirement or de-rating decision

Given that this proposal is driven by demand increases, there is no logical retirement or de-rating of assets. There is a risk that support of the new developments through further 11kV feeder construction will result in excess 11kV feeder infrastructure connecting the existing Caloundra substation to the new development area – these assets may become underutilised in future once a new 132/11kV substation is established in the vicinity of the new developments.

3 Options Analysis

3.1 Options considered but rejected

The counterfactual of “Do Nothing” has been rejected as it results in unacceptable risks of supply availability to the increasing demand in the area of study.

Connecting new load to other substations

Other than Caloundra zone substation, the closest zone substations to the Caloundra South area are Beerwah zone substation (SSBWH) and Landsborough zone substation (SSLBH). SSBWH is around 20km from the development and SSLBH is around 15km. Although both of these substations have some capacity to cater for more load, supplying the proposed Aura development from either of these substations is not a feasible option due to the length of the feeders making corridor acquisition and voltage drop difficult issues to overcome.

3.2 Identified options

3.2.1 Network options

Note that the options below are based on a medium load growth scenario. Significant demand changes are tested in the Net Present Value (NPV) scenario modelling.

Option 1 – Supply New Demand with 11kV Feeders from SSCLD

In its feedback in the draft determination, AER noted that 11kV feeder costs should achieve efficiency after the first 11kV feeder – detailed costing work has now been carried out and this is reflected in the revised business case.

This option involves continuing to supply the Aura subdivision and surrounding area with 11kV feeders from SSCLD until an additional 132/11kV substation is triggered by the safety net limitation at Caloundra substation. This option includes (timings based on the medium demand growth scenario):

- New 11kV feeders from SSCLD. These are to supply during the period up to 2029, at which time the additional 132/11kV substation is required to relieve the demand on the existing Caloundra substation. The costs for 11kV feeders have been determined individually considering conduit requirements, civil and other works in each case. Standard costs include $860/m direct cost for conduit installation (6 conduits, $1000/m total cost), plus $165/m direct cost for cable installation ($250/m total cost). Further details of the cost estimates are available in the attachment in Appendix G.
  - **2025** - $3,030,000
  - **2027** - $1,587,000
  - **2029** - $2,080,000
- Establish 132kV feeder to Bells Creek Central, establish Bell’s Creek Central 132/11kV zone substation in **2030** to supply the continued load growth in the area and address the safety net limitation at Caloundra. In this case it is assumed the 132kV feeders are constructed overhead for the first 10km and underground for the remaining 2km based on the timing of the works;
- Establish 11kV feeders as required to supply the Aura area;

- Establish the 2nd 132/11kV transformer in **2033** at Bells Creek Central;
- Establish Bells Creek North 132/11kV zone substation with a single transformer in **2045** plus a second transformer in **2048** based on continued demand growth.

Option 2 – Supply New Demand with Bell's Creek Central Establishment (proposed)

This option involves supplying the Aura subdivision and surrounding area with 11kV feeders from a new substation at Bell's Creek central. This option includes (timings based on the medium demand growth scenario):

- Establish Bell's Creek Central 132/11kV zone substation in **2025**, including 12km of 132kV overhead double circuit line, plus a single 132/11kV transformer and associated switchgear. In this case it is assumed the 132kV feeders are constructed as overhead based on the timing of the works;
- Establish 11kV feeders as required to supply the Aura area;
- The establishment of the second 132/11kV transformer in **2028** at Bells Creek Central;
- The establishment of Bell's Creek North in **2040** and plus a second 132/11kV transformer at Bells Creek North in **2043** based on continued demand growth. The earlier timing of this work compared to option 1 reflects the additional capacity utilised at Caloundra for option 1.

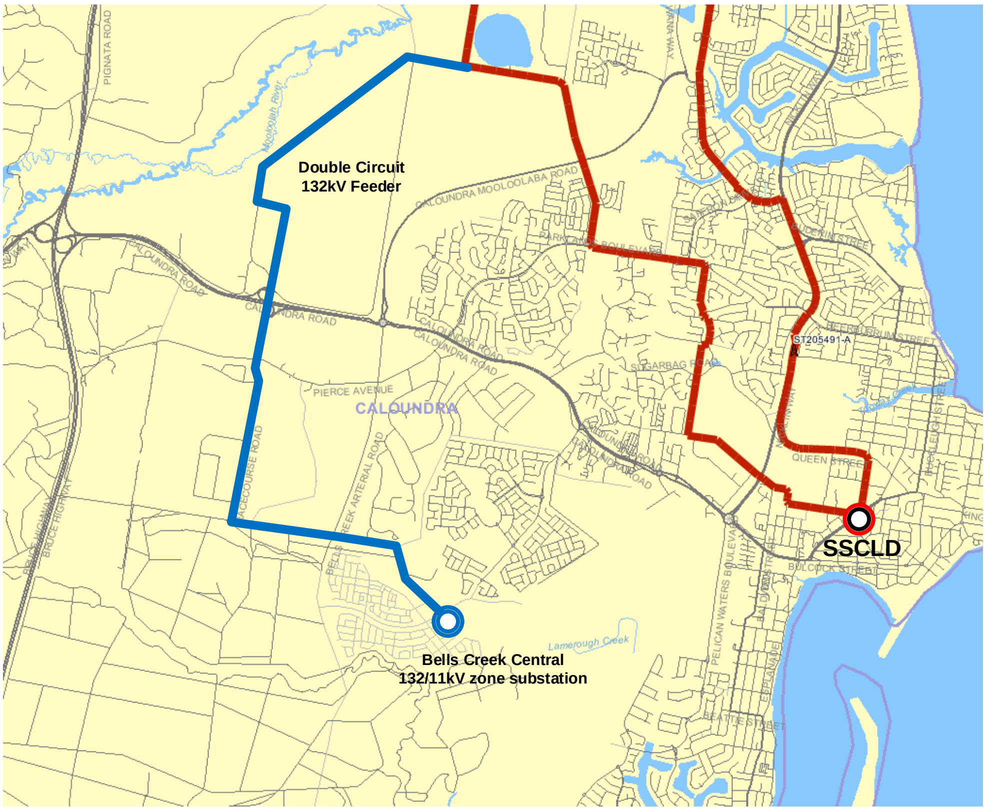

Figure 2: Bells Creek Central Option

Option 3 – Establish 132kV Line to Bell's Creek Central and Utilise at 11kV

This option involves establishing the 132kV double circuit line to Bells Creek central and utilising it initially at 11kV to supply the Aura subdivision and surrounding area. This option de-risks the later construction of overhead 132kV by constructing it in 2025 and utilising it only when required at 132kV (2030). This option includes (timings based on the medium demand growth scenario):

- Establish 12km of 132kV overhead double circuit line plus one 11kV feeder to connect to Caloundra 11kV in **2025**, with 132kV circuits utilised at 11kV;

- Establish Bell's Creek Central 132/11kV zone substation in **2030** with a single 132/11kV transformer and associated switchgear;
- Establish 11kV feeders as required to supply the Aura area;
- The establishment of the second 132/11kV transformer in **2033** at Bells Creek Central;
- The establishment of Bell's Creek North in **2045** and a second 132/11kV transformer at Bells Creek North in **2048;**

Option 4 - Supply New Load with Bell's Creek North Establishment

This option involves establishing a new substation at Bell's Creek North to supply the Aura subdivision and surrounding area. This option includes (timings based on the medium demand growth scenario):

- Establish Bell's Creek North 132/11kV zone substation in **2025**, including 10km of 132kV overhead double circuit line, plus a single 132/11kV transformer and associated switchgear;
- Establish 11kV feeders as required to supply the Aura area;
- The establishment of the second 132/11kV transformer in **2028** at Bells Creek North
- The establishment of Bell's Creek Central in **2040** plus a second 132/11kV transformer at Bells Creek Central in **2043**

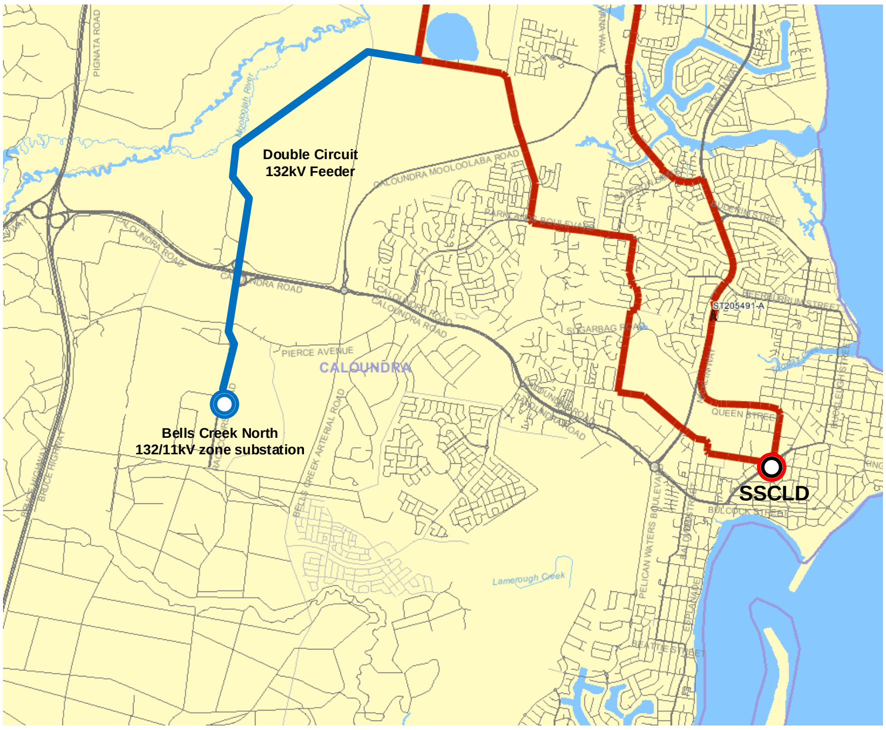

Figure 3: Bells Creek North Option

Option 5 - Supply New Load with proposed Meridan Plains 132/33kV plus 33/11kV Bell's Creek Central Establishment

This option involves establishing a new bulk supply 132/33kV substation at Meridan Plains and then supplying the Aura subdivision and surrounding area utilising 33kV feeders to a 33/11kV substation at Bell's Creek central. This option includes (timings based on the medium demand growth scenario):

- Establish Meridan Plains 132/33 kV substation, plus 12km of 33kV overhead double circuit line to Bells Creek Central, plus a single 33/11kV transformer and associated switchgear at Bells Creek central in **2025**;
- Establish 11kV feeders as required to supply the Aura area;
- The establishment of a second 132/33kV transformer at Meridan Plains plus a second 33/11kV transformer at Bells Creek Central in **2028;**
- The establishment of Bell's Creek North with a single 33/11kV transformer in **2038** and a second 33/11kV transformer at Bells Creek North in **2040**

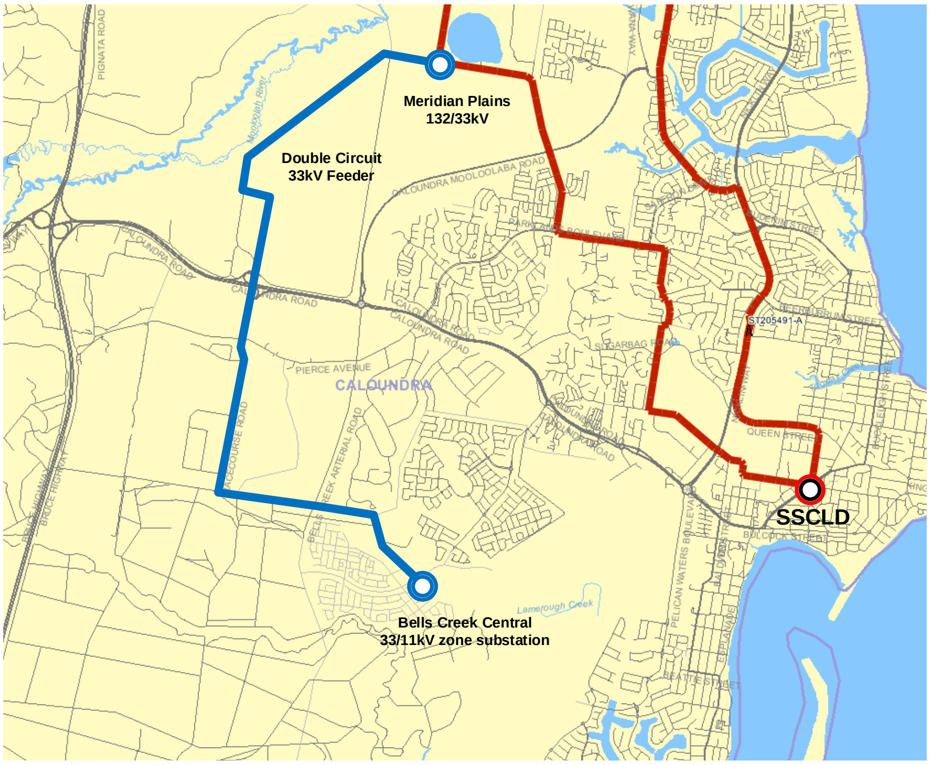

Figure 4: Meridan Plains Option

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 which 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 the 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 $6M this investment will be subject to RIT-D as a mechanism for customer and market engagement on solutions to explore further opportunities. Energex is proposing to apply to two-step RIT-D process to enable the most transparent and cost-effective option to be applied for the identified limitations:

- **2019** – Energex will make Caloundra and the Bell’s Creek area a target area under its Demand Management Plan to begin working with partners to reduce growth in the area well in advance of the need for a new zone substation
- **2023** – Formal RIT-D process to enable non-network proponents to identify options to address the limitations at the point where more information should be available.

The customer base in the study area is predominantly new residential customers 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.

3.3 Economic analysis of identified options

3.3.1 Cost versus benefit assessment of each option

The Net Present Value (NPV) of each option has been determined by considering costs and benefits over the program lifetime from FY2019/20 to FY2068/69, using EQL’s standard NPV analysis tool. The tool incorporates any residual value for assets at the end of the program lifetime into the NPV analysis. The cost benefit summary for the weighted average result of the various demand scenarios is shown below, along with the Present Value (PV) of CAPEX and OPEX over the study lifetime. Option 2 provides the lowest NPV cost and is the preferred option.

Table 8: Net Present Value of Options (Weighted Average)

Option Name	Rank	NPV	CAPEX PV	OPEX PV
1. 11kV Feeders Followed by Bells Creek Central	5	**-71,260**	-60,749	-10,511
2. Bells Creek Central 132/11kV	1	**-60,254**	-50,099	-10,155
3. 132kV at 11kV followed by Bells Creek Central	4	**-67,955**	-56,794	-11,161
4. Bell’s Creek North 132/11kV	3	**-65,555**	-55,641	-9,914
5. Median Plains 132/33kV plus Bells Creek Central 33/11 kV followed by Bell's Creek North	2	**-61,786**	-49,697	-12,089

3.4 Scenario Analysis

3.4.1 Sensitivities

The key sensitivity in this proposal is the demand growth associated with the Aura development and the Sunshine Coast Industrial Park. The assumptions associated with each growth scenario are detailed below and the NPV results are shown for each scenario:

Base Case – Moderate Growth (60% Chance)

- Sunshine Coast Industrial park not included in demand forecast;
- New 11kV feeders required every 2 years on average;
- New Substation required by 2025, or 2030 in cases using 11kV feeders to defer development;
- Second transformer for new substations required 3 years after first, based on safety net N-1;
- Second additional substation in the area required by 2040, or 2045 in options 1 and 3 where additional capacity from Caloundra is utilised.

- For Option 5 (33/11kV development) a second substation is required by 2038 due to the smaller capacity substations.

Table 9: Net Present Value of Options (Moderate Demand)

Option Name	Rank	NPV	CAPEX PV	OPEX PV
1. 11kV Feeders Followed by Bells Creek Central	5	**-68,836**	-58,741	-10,094
2. Bells Creek Central 132/11kV	1	**-59,421**	-49,468	-9,953
3. 132kV at 11kV followed by Bells Creek Central	4	**-66,624**	-55,786	-10,838
4. Bell's Creek North 132/11kV	3	**-64,864**	-55,081	-9,784
5. Median Plains 132/33kV plus Bells Creek Central 33/11 kV followed by Bell's Creek North	2	**-61,019**	-49,184	-11,835

Alt Scenario 1 – High Growth (30% Chance)

- Sunshine Coast Industrial park included in demand forecast;
- New 11kV feeders required every 1.5 years on average;
- New substation required by 2023, or 2028 in cases using 11kV feeders to defer;
- Second transformer for new substations required 3 years after first, based on safety net N-1;
- Second additional substation in the area required by 2035, or 2038 in options 1 and 3 using 11kV feeders to utilise additional capacity at Caloundra
- For Option 5 (33/11kV development) a second substation is required by 2033 due to the smaller capacity substations.

Table 10: Net Present Value of Options (High Demand)

Option Name	Rank	NPV	CAPEX PV	OPEX PV
1. 11kV Feeders Followed by Bells Creek Central	5	**-78,607**	-66,742	-11,865
2. Bells Creek Central 132/11kV	1	**-63,894**	-52,850	-11,045
3. 132kV at 11kV followed by Bells Creek Central	4	**-71,728**	-59,603	-12,125
4. Bell's Creek North 132/11kV	3	**-70,299**	-59,406	-10,892
5. Median Plains 132/33kV plus Bells Creek Central 33/11 kV followed by Bell's Creek North	2	**-65,220**	-52,116	-13,104

Alt Scenario 2 – Low Growth (10% Chance)

- Sunshine Coast Industrial park not included in demand forecast;
- New 11kV feeders required every 3 years on average;
- New substation required by 2028, or 2032 in cases using 11kV feeders to defer;
- Second transformer for new substations required 3 years after first based on safety net N-1;
- Second additional substation in the area required by 2042, or 2050 in options 1 and 3 using 11kV feeders to utilise additional capacity at Caloundra

- For Option 5 (33/11kV development) a second substation is required by 2040 due to the smaller capacity substations.

Table 11: Net Present Value of Options (Low Demand)

Option Name	Rank	NPV	CAPEX PV	OPEX PV
1. 11kV Feeders Followed by Bells Creek Central	4	**-63,766**	-54,816	-8,950
2. Bells Creek Central 132/11kV	1	**-54,336**	-45,639	-8,697
3. 132kV at 11kV followed by Bells Creek Central	5	**-64,623**	-54,417	-10,207
4. Bell's Creek North 132/11kV	2	**-55,469**	-47,708	-7,761
5. Median Plains 132/33kV plus Bells Creek Central 33/11 kV followed by Bell's Creek North	3	**-56,080**	-45,513	-10,567

The results of this scenario analysis are that under all scenarios option 2 is ranked first with the lowest NPV cost.

3.4.2 Value of regret analysis

In terms of selecting a decision pathway of 'least regret', the key uncertainty is the demand growth rate. The recommended option has been selected by using a risked NPV which applies a deterministic proportional weighting to the low, moderate and high growth rate to compare and evaluate the options. The option also allows for an economically efficient balanced approach to investment by targeting works that reduce the identified risks to the greatest extent without bringing forward unnecessary expenditure.

A quantitative value of regret analysis has been conducted to test whether the investment decision is robust in the outcome of each of the uncertain growth scenarios. The following table provides a summary of the analysis to determine which option minimises the maximum NPV regret across the weighted three growth demand scenarios (moderate, high and low). The methodology used in the value of regret analysis is an "expected regret" calculation which is also known as "minimisation of opportunity loss".

Table 12: Value of regret analysis summary for options being used across the base, high and low growth scenarios.

	Value of Regret Analysis															
	Options															
	Option 1			Option 2			Option 3			Option 4			Option 5			
Growth scenarios	NPV	Weighted NPV	Regret	NPV	Weighted NPV	Regret	NPV	Weighted NPV	Regret	NPV	Weighted NPV	Regret	NPV	Weighted NPV	Regret	NPV max for scenario
Mid (60%)	-68,836	-41,301	5,649	-59,421	-35,652	0	-66,624	-39,974	4,322	-64,864	-38,919	3,266	-61,019	-36,612	959	-35,652
High (30%)	-78,607	-23,582	4,414	-63,894	-19,168	0	-71,728	-21,518	2,350	-70,299	-21,090	1,921	-65,220	-19,566	398	-19,168
Low (10%)	-63,766	-6,377	943	-54,336	-5,434	0	-64,623	-6,462	1,029	-55,469	-5,547	113	-56,080	-5,608	174	-5,434
Expected regret ($ NPV)			11006			0			7701			5301			1531	

Table 13: Value of regret analysis summary

Value of Regret Analysis Summary	
Options	**Expected Regret (NPV $)**
1. 11kV Feeders Followed by Bells Ck Central	11,006
2. Bells Ck Central 132/11kV	0
3. 132kV at 11kV followed by Bells Ck Central	7,701
4. Bells' Ck North 132/11kV	5,301
5. Median Plains 132/33kV plus Bells Ck Central 33/11 kV followed by Bell's Ck North	1,531

This analysis supports that Option 2 has the "least amount of regret" or "opportunity loss" across all three growth demand scenarios.

3.5 Qualitative comparison of identified options

3.5.1 Advantages and disadvantages of each option

Table 14: Qualitative Comparison of Options

Option	Advantages	Disadvantages
Option 1	• Incremental approach to network infrastructure - more easily scaled to lower load growth • Higher utilisation on SSCLD	• Lowest reliability with long 11kV feeders from SSCLD • Makes use of spare CBs at SSCLD which limit their future use for any load growth for other areas • Potential for underutilised 11kV feeder assets in ultimate development • Deferral of 132kV construction may result in higher cost underground being required.
Option 2	• Higher reliability outcome than Option 1 and 3 due to substation being located at the load centre. • Enables more responsiveness to higher load growth, with a zone substation located close to the load. • Earlier construction of 132kV ensures best chance of lower cost overhead construction.	• Lower asset utilisation with an increase in transformer capacity of 60MVA • Less responsive to lower load growth with a new zone substation having been constructed earlier.
Option 3	• Incremental approach to network infrastructure - more easily scaled to lower load growth • Higher utilisation on SSCLD	• Lowest reliability with long 11kV feeders from SSCLD • Makes use of spare CBs at SSCLD which limit their future use for any load growth for other areas • Potential for asset stranding of 11kV feeder assets in ultimate development • Advances 132kV construction to mitigate risk of higher cost underground being required.
Option 4	• Higher reliability outcome of Option 1 • Can better cater to load growth in the industrial park, having a zone substation located within the park itself.	• Lower reliability than Option 2 and 5 with longer 11kV feeder lengths

Option	Advantages	Disadvantages
Option 5	• Higher 11kV reliability • BSP allows for more flexibility, with 33kV network easier to establish to Bells Creek North and Palmview should load increase in these areas.	• Lower asset utilisation with an increase in transformer capacity of over 100MVA

The proposed option provides the most economically efficient solution with the lowest NPV cost to address the network limitations. The key regrets in this case are firstly the potential inability to supply demand associated with the new developments and secondly the escalation of the cost of the 132kV transmission if underground construction is required. Under the proposed option, with a new substation development proposed for 2025, both risks are mitigated. Firstly, the risk of high demand growth is mitigated through provision of the 132/11kV substation in the Aura development, providing flexibility should rapid demand growth occur. Secondly, the risk of cost escalation of the 132kV line is mitigated by early construction in 2025.

It acknowledges the risk of continuing to operate assets with known irreparable manufacturing defects, phasing these out to avoid in-service failure. The key potential regret in this case is loss of some critical communications infrastructure in the event of a major weather event resulting in major loss of supply or safety risks through protection failures. The proposed option manages this key risk through a planned risk-based program of replacements and provides the lowest value of regret.

3.5.2 Alignment with network development plan

The proposed works outlined in this business case will enable Energex to proactively respond to changing network requirements. This will ensure that customer supply, network reliability and safety requirements continue to be met going forward.

The Sunshine Coast area continues to see strong population growth and economic development, with a very proactive council developing and promoting the area. Hence the proposed works are necessary to meet new customer demand and will form the basis for ongoing network development in the area.

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, the proposal has considered the implications of higher penetration of Distributed Energy Resources in the demand forecast.

3.6 Risk Assessment Following Implementation of Proposed Option

This risk assessment is in accordance with the EQL Network Risk Framework and the Risk Tolerability table from the framework is shown in Appendix E.

Table 15: Risk assessment showing risks mitigated following Implementation

Risk Scenario	Risk Type	Consequence (C)	Likelihood (L)	Risk Score	Risk Year
10POE load on the existing 11kV network exceeds the NCC rating, resulting in UG cable damage and a prolonged outage of over 12 hours for customers in the area.	Customer	(Original) 3 *(Interruption > 12 hours)* (Mitigated) 3 *(Interruption > 12 hours)*	5 *(very likely to occur)* 1 *(Almost no likelihood)*	**15** ***(Moderate Risk)*** **5** ***(Very Low Risk)***	2021
50POE load on the existing 11kV network exceeds the 80% Target Maximum Utilisation resulting in a breach of Energex internal standards.	Business	(Original) 1 *(Compliance breach with internal standards)* (Mitigated) 1 *(Compliance breach with internal standards)*	5 *(very likely to occur)* 1 *(Almost no likelihood)*	**5** ***(Very Low Risk)*** **1** ***(Very Low Risk)***	2021
50 POE Load on the existing 11kV network exceeds to 80% target maximum utilisation which leaves insufficient capacity to supply >1000 customers following an 11kV feeder outage.	Customer	(Original) 4 *(Interruption >15000 customers)* (Mitigated) 4 *(Interruption >15000 customers)*	2 *(Very unlikely to occur)* 1 *(Almost no likelihood)*	**8** ***(Low Risk)*** **4** ***(Very Low Risk)***	2021
Without network augmentation, Energex will be unable to supply customers in the Caloundra area, resulting in adverse media attention and a loss of public trust.	Customer	(Original) 4 *(Adverse media attention and a loss of public trust)* (Mitigated) 4 *(Adverse media attention and a loss of public trust)*	5 *(very likely to occur)* 1 *(Almost no likelihood)*	**20** ***(High)*** **4** ***(Very Low Risk)***	2025
Without network augmentation, Energex will be unable to supply customers in the Caloundra area, resulting in a breach of the Distribution Authority.	Legislated	(Original) 4 *(Notice issued by regulator)* (Mitigated) 4 *(Notice issued by regulator)*	4 *(Likely to occur)* 1 *(Almost no likelihood)*	**16** ***(Moderate)*** **4** ***(Very Low Risk)***	2025

4 Recommendation

4.1 Preferred option

To address the emerging 11kV feeder and zone substation limits at SSCLD, it is recommended that Energex undertake a process of initially targeting demand reductions in the area, followed by a RIT-D process to establish the lowest cost non-network or hybrid solution for comparison with the establishment of the 132/11kV zone substation at Bells Creek Central.

4.2 Scope of preferred option

The proposed approach (Option 2) involves supplying the Aura subdivision and surrounding area with 11kV feeders from a new substation at Bell's Creek central. This option includes:

- Establish Bell's Creek Central 132/11kV zone substation in **2025**, including 12km of 132kV overhead double circuit line, plus a single 132/11kV transformer and associated switchgear;
- Establish 11kV feeders as required to supply the Aura area;
- The establishment of the second 132/11kV transformer in **2028** at Bells Creek Central;
- The establishment of Bell's Creek North in **2040** and plus a second 132/11kV transformer at Bells Creek North in **2043** based on continued demand growth. The earlier timing of this work compared to option 1 reflects the additional capacity utilised at Caloundra for option 1.

The total estimated cost of option 2 is approximately $28.6M for the 2020-25 regulatory control period.

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).*

AEMO, *Value of Customer Reliability Review, Final Report,* (September 2014).

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	2 Hour Emergency Capacity
ADMD	After Diversity Maximum Demand
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AMP	Asset Management Plan
Augex	Augmentation Capital Expenditure
BAU	Business as Usual
CAPEX	Capital expenditure
Current regulatory control period or current period	Regulatory control period 1 July 2015 to 30 June 2020
DAPR	Distribution Annual Planning Report
DC	Direct Current
DNSP	Distribution Network Service Provider
ECC	Emergency Cyclic Capacity
EQL	Energy Queensland Ltd
IT	Information Technology
KRA	Key Result Areas
kV	Kilovolt
LAR	Load At Risk
MSS	Minimum Service Standard
MVA	Megavolt Ampere
NCC	Normal Cyclic Capacity
NEL	National Electricity Law
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules (or Rules)

Abbreviation or acronym	Definition
Next regulatory control period or forecast period	The regulatory control period commencing 1 July 2020 and ending 30 Jun 2025
NPV	Net Present Value
OPEX	Operational Expenditure
PCBU	Person in Control of a Business or Undertaking
POE	Probability of Exceedance
Previous regulatory control period or previous period	Regulatory control period 1 July 2010 to 30 June 2015
PV	Present Value
Repex	Replacement Capital Expenditure
RIN	Regulatory Information Notice
RIT-D	Regulatory Investment Test – Distribution
RTS	Return to Service
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SAMP	Strategic Asset Management Plan
SCADA	Supervisory Control and Data Acquisition
SSAHD	Alexandra Headlands Zone Substation
SSBTY	Birtinya Zone Substation
SSBWH	Beerwah Bulk Supply Substation
SSCLD	Caloundra Substation
SSCMD	Currimundi Zone Substation
SSKWA	Kawana Zone Substation
SSLBH	Landsborough Zone Substation
SSMLB	Mooloolaba Zone Substation
SSWFD	Woodford Zone Substation
SSWMD	West Maroochydore Zone Substation
UG	Underground
WACC	Weighted average cost of capital
ZS	Zone Substation

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

The table below details the alignment of this proposal with the NER capital expenditure requirements as set out in Clause 6.5.7 of the NER.

Table 16: 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 study area. The proposed option deals with a range of demand increase scenarios and is the most economically efficient option to deal with these increases.
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**	The forecast capital expenditure is required to deal with Safety Net limitations that arise within the 2020-25 period. The Safety Net is a condition within Energex's Distribution Authority.
6.5.7 (a) (3) **The forecast capital expenditure is required in order to:** **(iii) maintain the quality, reliability and security of supply of supply of standard control services** **(iv) maintain the reliability and security of the distribution system through the supply of standard control services**	The forecast capital expenditure ensures that new demand increases can be supplied. This ensures adequate security of supply as defined by the safety net standard.
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 NPV analysis for each option. The lowest NPV cost option is proposed. 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. 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.

The Table below 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 17: 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 5: 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

Appendix G. Caloundra 11kV Feeder Estimates

Caloundra
Feeders.xlsx

Appendix H. Reconciliation Table

Reconciliation Table Conversion from $18/19 to $2020	
Business Case Value	
(M$18/19)	$28.60
Business Case Value	
(M$2020)	$29.83

Appendix I. Additional Known Projects

The following projects are required to provide a reliable and safe supply to the new development in the Caloundra area.

Project	Project Description	Required by Date
WR6920882	CLD – Establish new 11kV feeder to the south-west	December 2018
	This project establishes a new feeder from Caloundra zone substation to supply the new development.	
WR6943432	CLD – Caloundra Improve 11kV backup protection reach	October 2019
	This project aims to replace approximately 3km of 19/.101 conductor due to age and condition.	
WR7057221	CLD – Establish new 11kV feeder to the south-west	October 2019
	This project establishes a new feeder from Caloundra zone substation to supply the new development.	
WR361747	H9 Palmwoods – WMD West Maroochydore – Establish 132kV Double Circuit Feeders and Upgrade 132kV Switchboard at WMD	October 2020
	This approved project establishes a new 132kV double circuit line to provide extra capacity to the Sunshine Coast area.	

Appendix J. Existing Electricity Supply Network

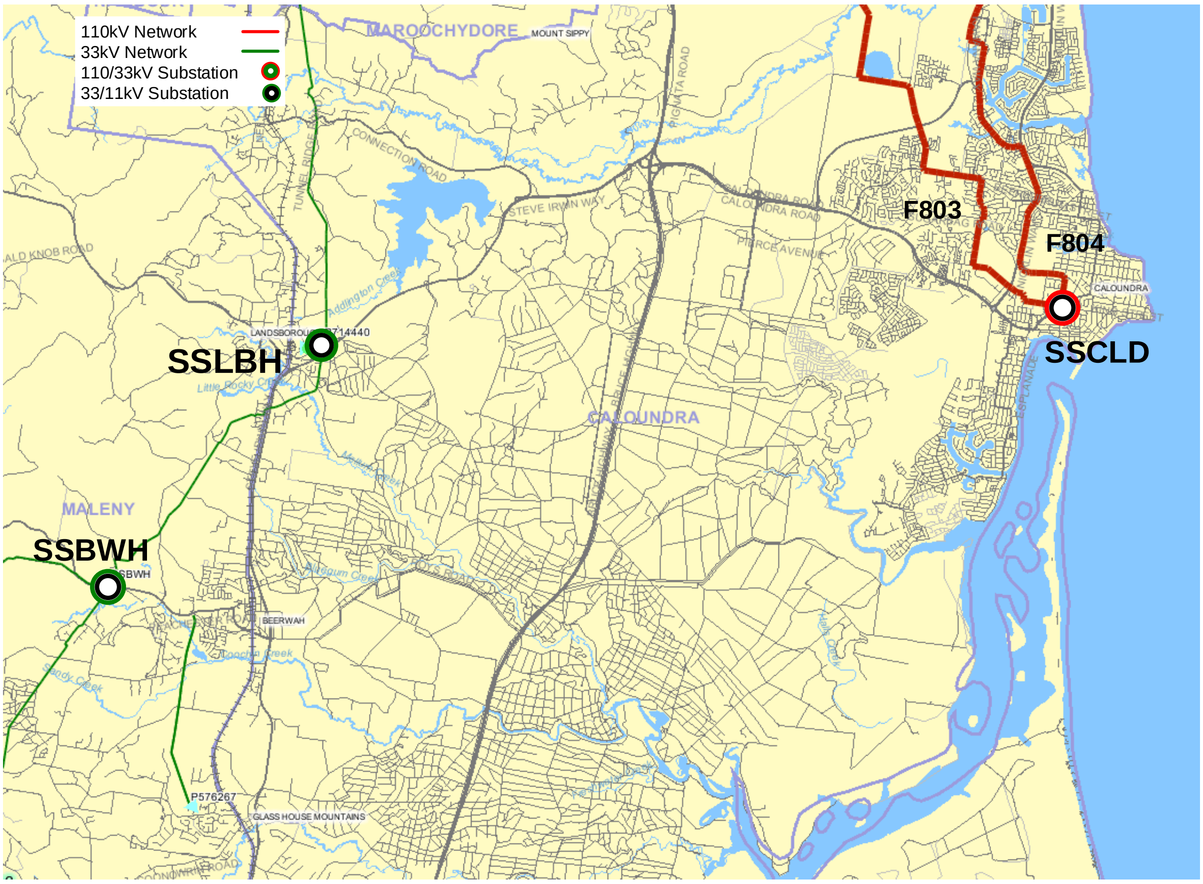

Figure 6: Existing Sub-transmission Network Arrangement (Geographic View)

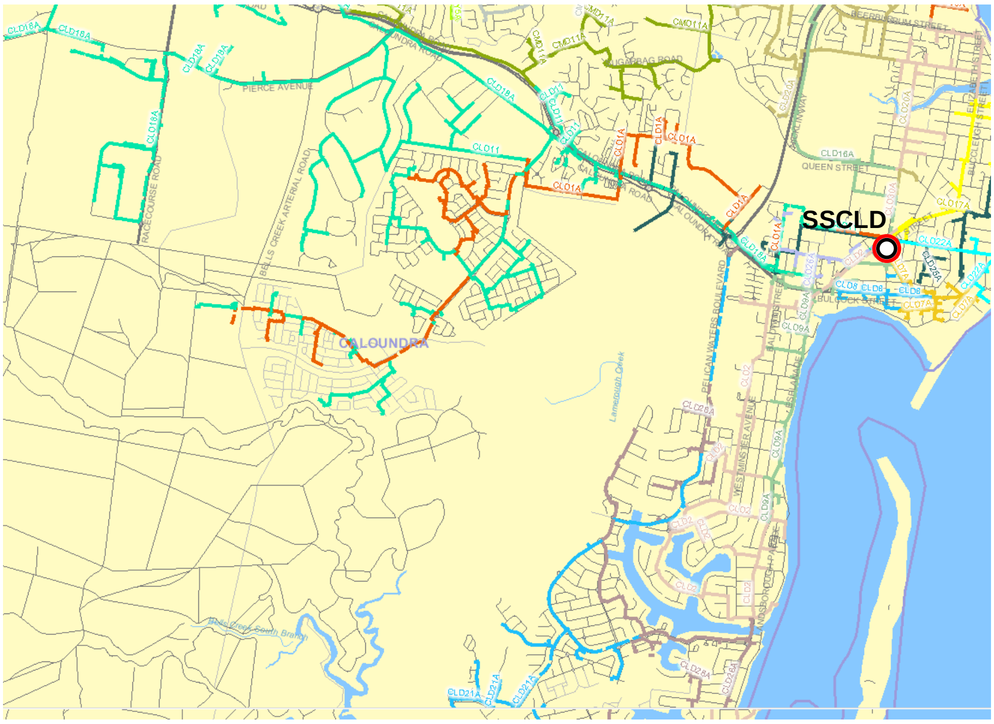

Figure 7: Existing 11kV network arrangement (geographic view)

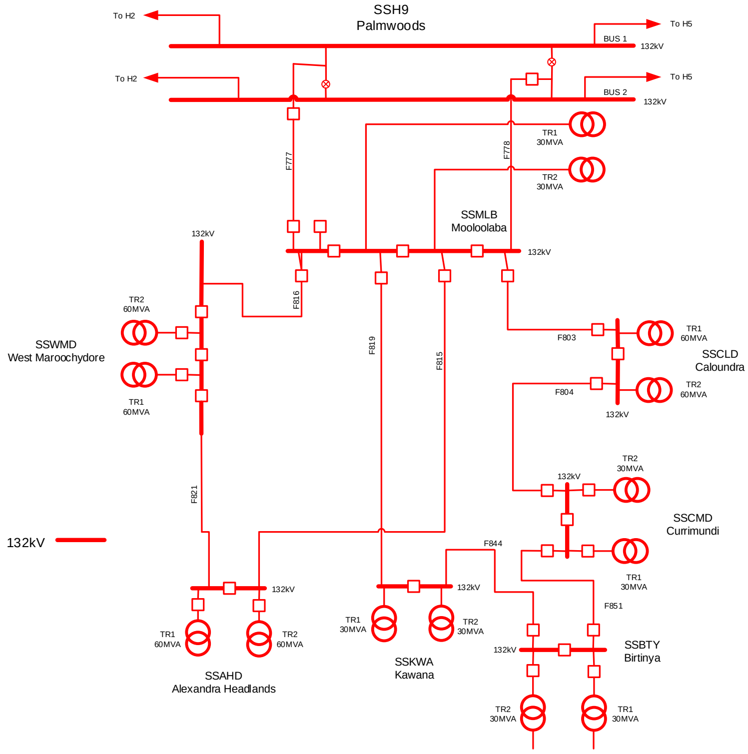

Figure 8: Existing 132kV Network Arrangement (Schematic View)

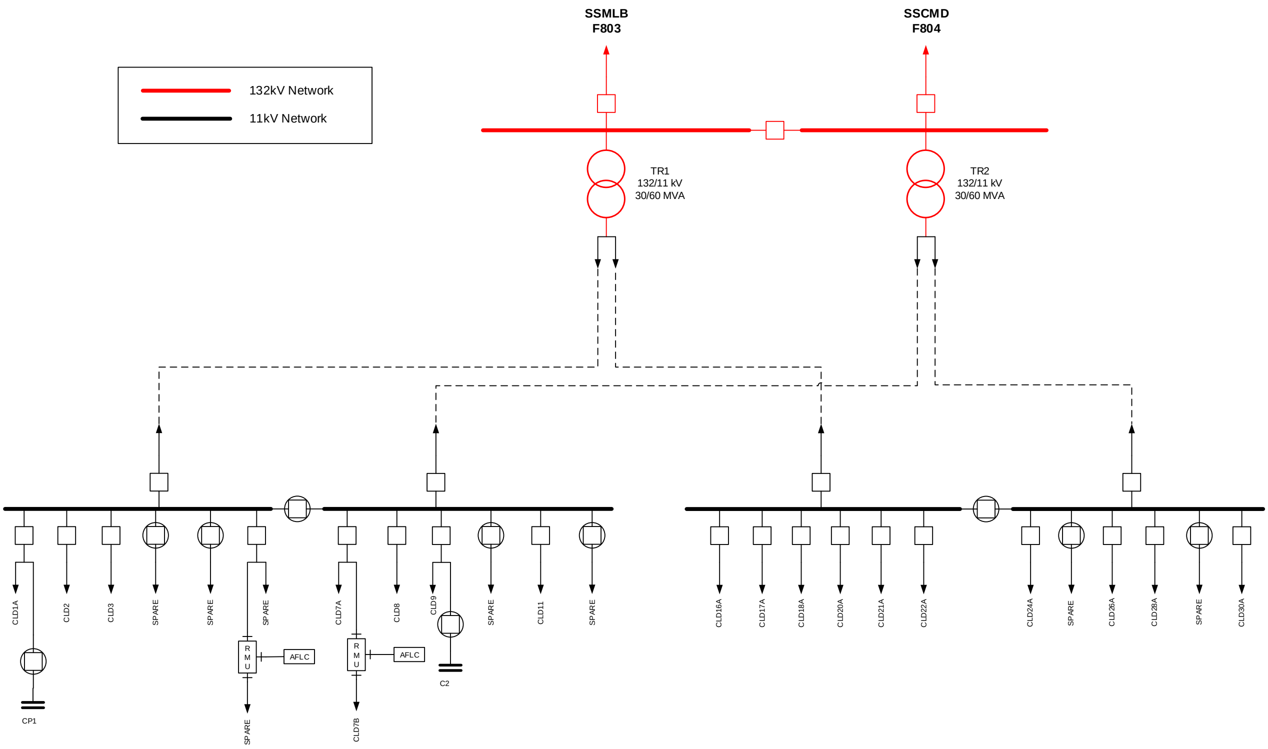

Figure 9: Existing Caloundra Substation Network Arrangement (Schematic View)

50PoE Caloundra Load Forecast

Year	Summer Day MVA	Summer Night MVA	Winter Day MVA	Winter Night MVA
2019	49.92	49.85	35.16	39.89
2020	50.82	50.74	35.83	40.65
2021	51.83	51.74	36.43	41.33
2022	52.83	52.73	37.00	41.98
2023	53.34	53.23	38.16	43.29
2024	54.01	53.90	38.77	43.98
2025	55.29	55.17	39.63	44.95
2026	56.65	56.52	40.71	46.18
2027	57.41	57.27	41.82	47.44
2028	58.53	58.38	42.69	48.43
2029	59.65	59.49	43.57	49.42

10PoE Caloundra Load Forecast

Year	Summer Day MVA	Summer Night MVA	Winter Day MVA	Winter Night MVA
2019	54.49	54.38	37.76	42.84
2020	55.40	55.28	38.55	43.74
2021	56.66	56.53	39.26	44.54
2022	57.70	57.56	39.97	45.34
2023	58.28	58.13	41.29	46.84
2024	59.17	59.02	42.08	47.73
2025	60.59	60.42	43.17	48.97
2026	62.15	61.96	44.44	50.41
2027	62.97	62.79	45.66	51.79
2028	64.17	63.97	46.70	52.68
2029	65.36	65.15	47.75	53.58

50PoE Aura Forecast

Year	Comm	Industrial Light	Res. High	Aura Total Cumulative
2019	0.00	0.00	0.00	0.00
2020	0.00	0.00	0.00	0.00
2021	0.00	0.00	0.79	0.79
2022	0.00	0.00	0.79	1.57
2023	0.74	0.42	0.79	3.52
2024	0.74	0.42	0.79	5.46
2025	0.74	0.42	1.57	8.19
2026	0.74	0.42	1.57	10.92
2027	0.74	0.42	1.57	13.65
2028	0.74	0.42	1.57	16.38
2029	0.74	0.42	1.57	19.11

Appendix K. Demand Forecast Details

50PoE Sunshine Coast Industrial Park

Year	Commercial	Industrial Light	Sun Coast Ind. Park Total
2019	0.00	0.00	0.00
2020	0.00	0.00	0.00
2021	0.00	0.00	0.00
2022	0.00	0.00	0.00
2023	0.30	0.50	0.80
2024	0.30	0.50	1.60
2025	0.30	0.50	2.40
2026	0.30	0.50	3.20
2027	0.30	0.50	4.00
2028	0.30	0.50	4.80
2029	0.30	0.50	5.60

50PoE Total Forecast without Sunshine Coast Industrial Park

Year	Summer Day MVA	ECC	Manual Transfers	Emerg. Gen.	Safety Net
2019	49.92	64.50	6.30	4.00	0.00
2020	50.82	64.50	6.30	4.00	0.00
2021	52.61	64.50	6.30	4.00	0.00
2022	54.40	64.50	6.30	4.00	0.00
2023	56.85	64.50	6.30	4.00	0.00
2024	59.47	64.50	6.30	4.00	0.00
2025	63.48	64.50	6.30	4.00	0.00
2026	67.57	64.50	6.30	4.00	0.00
2027	71.06	64.50	6.30	4.00	0.00
2028	74.91	64.50	6.30	4.00	0.11
2029	78.76	64.50	6.30	4.00	3.96

50PoE Total Forecast with Sunshine Coast Industrial Park

Year	Summer Day MVA	ECC	Manual Transfers	Emerg. Gen.	Safety Net
2019	49.92197	64.50	6.30	4.00	0.00
2020	50.82273	64.50	6.30	4.00	0.00
2021	52.61267	64.50	6.30	4.00	0.00
2022	54.40163	64.50	6.30	4.00	0.00
2023	57.65050	64.50	6.30	4.00	0.00
2024	61.07022	64.50	6.30	4.00	0.00
2025	65.87756	64.50	6.30	4.00	0.00
2026	70.76829	64.50	6.30	4.00	0.00
2027	75.05867	64.50	6.30	4.00	0.26
2028	79.71058	64.50	6.30	4.00	4.91
2029	84.36249	64.50	6.30	4.00	9.56

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