The Energy Queensland Group Final Project Assessment Report

27 May 2019

PBH Palm Beach – Replace 33/11kV Transformers

Part of the Energy Queensland Group

DISCLAIMER

While care was taken in the preparation of the information in this document, and it is provided in good faith, Energy Queensland accepts no responsibility or liability (including without limitation, liability to any person by reason of negligence or negligent mis-statement) for any loss or damage that may be incurred by any person acting in reliance on this information or assumptions drawn from it, except to the extent that liability under any applicable Queensland or Commonwealth of Australia statute cannot be excluded.

Ergon Energy Corporation Limited ABN 50 087 646 062
Energy Queensland Limited ABN 96 612 535 583
Energex Limited ABN 40 078 849 055

Executive summary

Description of the network risks

Palm Beach Zone Substation (SSPBH) is equipped with 3 x 10/12.5MVA 33/11kV transformers and provides electricity supply to approximately 9,700 predominantly domestic customers in the Bilinga, Currumbin, Currumbin Waters, Elanora And Palm Beach areas.
It is supplied from Burleigh Heads Bulk Supply Substation (SSBHD) via 33kV feeders 396 and 3756.

Based on a Condition Based Risk Management (CBRM) analysis of the effect of current condition and ageing on the expected life of the assets at SSPBH, the following have been deemed to each their retirement ages as follows:

- 33/11kV transformers TR1, TR2 and TR3 in 2022;
- 33kV VT39 in 2022; and
- 33kV isolators AB3T19, AB3T29 and AB3T39 in 2024.

Recommendation

It is recommended that Energex replace the existing 3 x 33/11kV transformers with 2 x 15/25MVA 33/11kV transformers, replace 8 x 33kV isolators and reconfigure the 33kV bus at SSPBH, for a total estimated cost of $7,061,571, at 2018/19 prices. The target completion date for the recommended development is July 2022.

TABLE OF CONTENTS

1.0 EXISTING NETWORK

1.1 Introduction

Palm Beach Zone Substation (SSPBH) is equipped with 3 x 10/12.5MVA 33/11kV transformers and provides electricity supply to approximately 9,700 predominantly domestic customers in the Bilinga, Currumbin, Currumbin Waters, Elanora And Palm Beach areas.

It is supplied from Burleigh Heads Bulk Supply Substation (SSBHD) via 33kV feeders 396 and 3756.

A geographic view of the 33kV network of the study area and a schematic view of SSPBH are provided in Figure 1 and Figure 2.

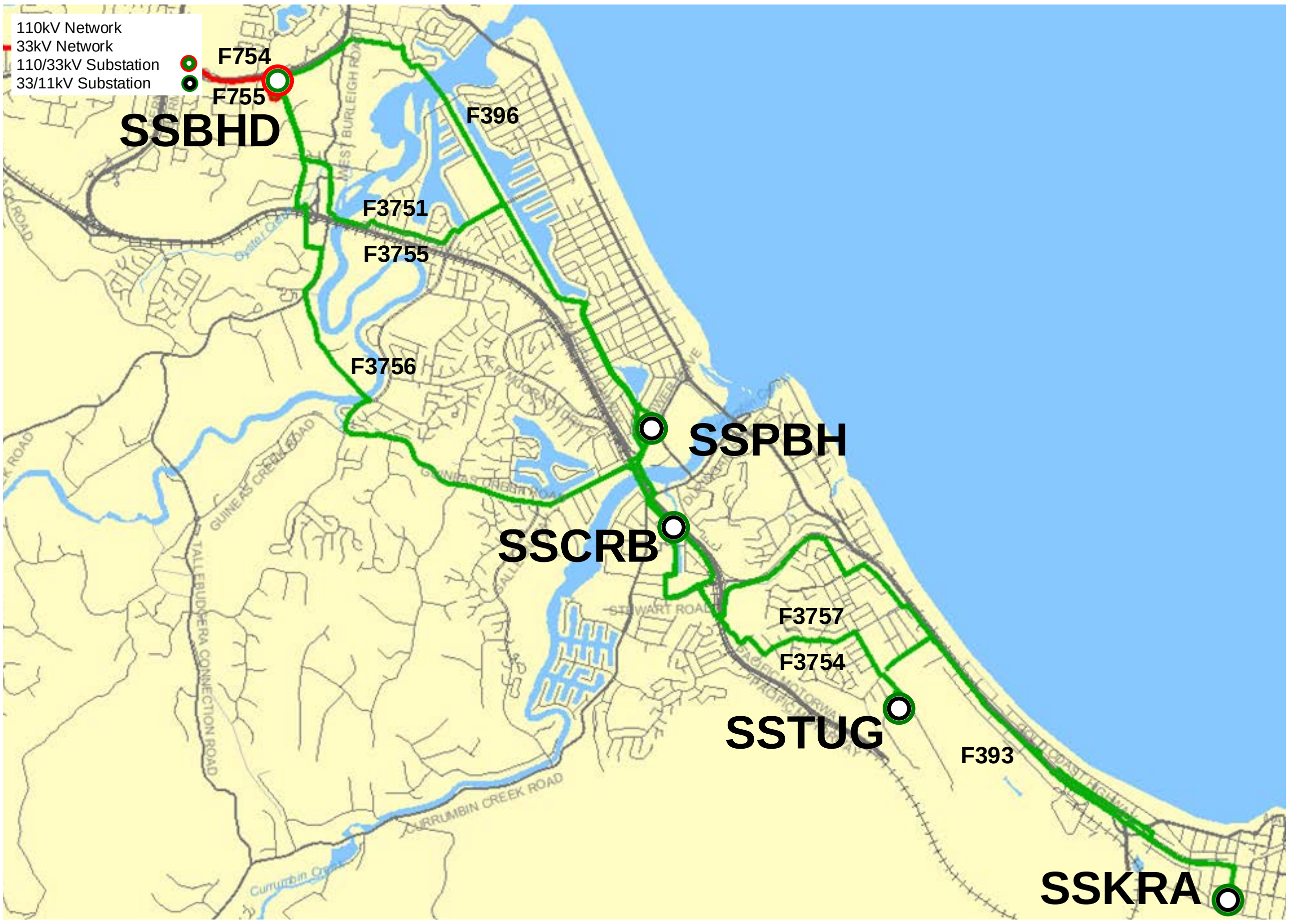


Figure 1: Existing 33kV network arrangement (geographic view)

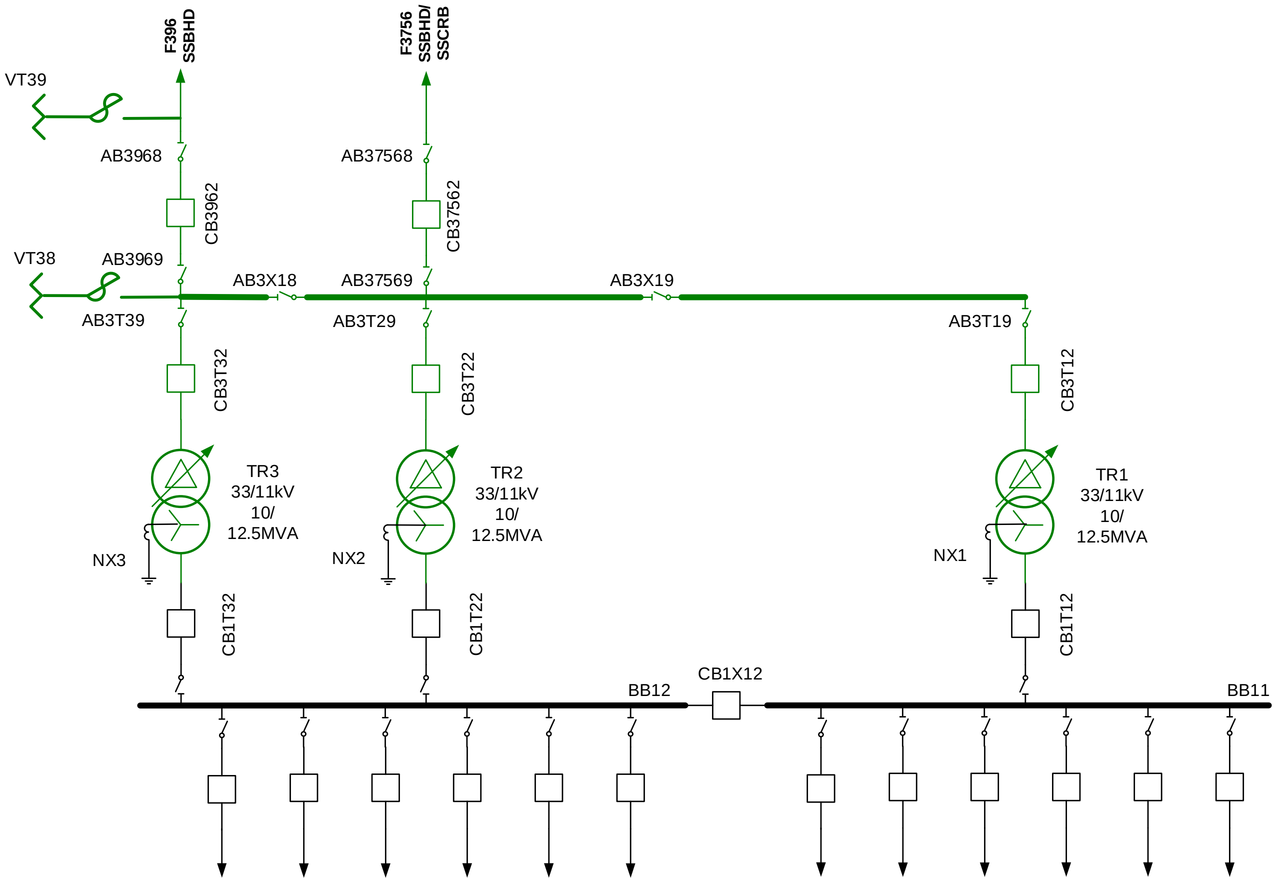


Figure 2: Existing network arrangement (schematic view)

1.2 Applied Service Standards

The Service Standards that are applicable to a consideration of supply constraints affecting this area of study are summarised below:

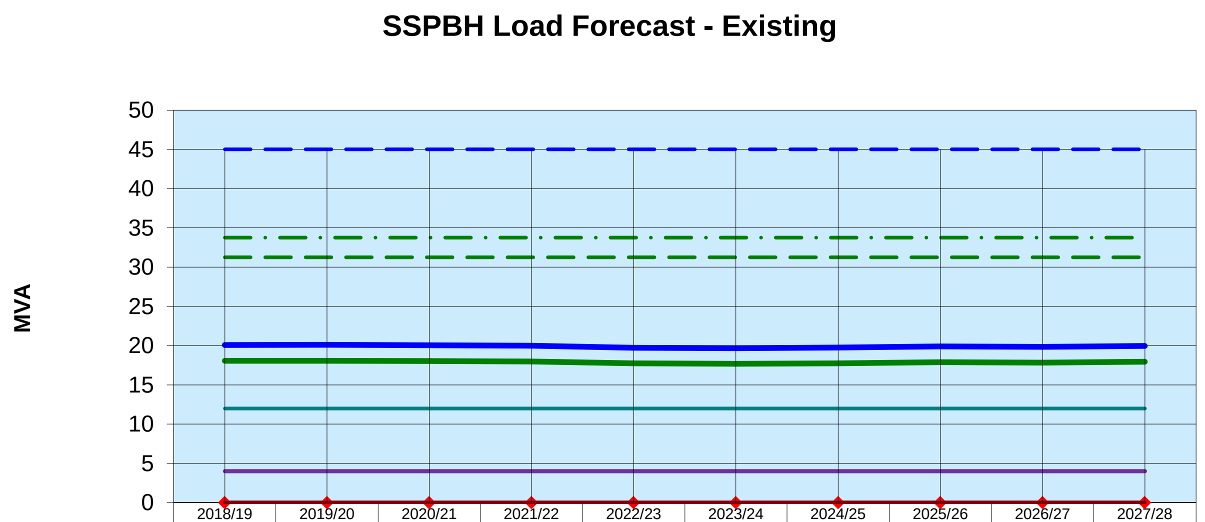
- As per *Joint Workings Protocol for Refurbishment and Replacement*, all electrical network assets that are in greatest need are identified and scheduled for refurbishment or replacement in sufficient time to prevent failure and to minimise the associated risks.
- As per *Energex Network Risk Framework*, for risks in the tolerable range, the aim is to reduce all network risks to As Low As Reasonably Practicable (The ALARP principle, as represented by the ALARP range in tolerability scales).

1.3 Limitations of the existing network

1.3.1 Subtransmission network limitations

Substation capacity

SSPBH is equipped with 3 x 10/12.5MVA 33/11kV transformers. The substation capacity is limited by transformers, providing a Normal Cyclic Capacity of 45MVA. The 10-year 10 PoE and 50 PoE load forecasts, and the existing Normal Cyclic Capacity (NCC), Emergency Cyclic Capacity (ECC), Two Hour Emergency Capacity (2HEC), Residual Load at Risk (RLAR), available transfers and available mobile equipment, are shown in Figure 3.



	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
10 PoE Load	20.08	20.10	20.05	19.98	19.73	19.66	19.74	19.89	19.84	19.96
Summer NCC	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00
Load > NCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50 PoE Load	18.06	18.08	18.03	17.97	17.74	17.68	17.76	17.89	17.84	17.95
Summer ECC	31.25	31.25	31.25	31.25	31.25	31.25	31.25	31.25	31.25	31.25
Summer 2HEC	33.75	33.75	33.75	33.75	33.75	33.75	33.75	33.75	33.75	33.75
LAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RLAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Available Transfers	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Avail Mobile Eqpt	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Figure 3: Substation load forecast (existing network)

As outlined above:

- There are no capacity limitations at SSPBH within the planning horizon.

Note: Several residential apartment complexes have been proposed in the suburbs served by SSPBH. These have not been taken into account in the load forecast given above.

A Plant Overload Protection Software (POPS) scheme is installed at SSPBH to automatically reduce load to below 2HEC in the event of a contingency condition.

Substation Load

The load duration and load curves for SSPBH are shown in Figure 4 and Figure 5.

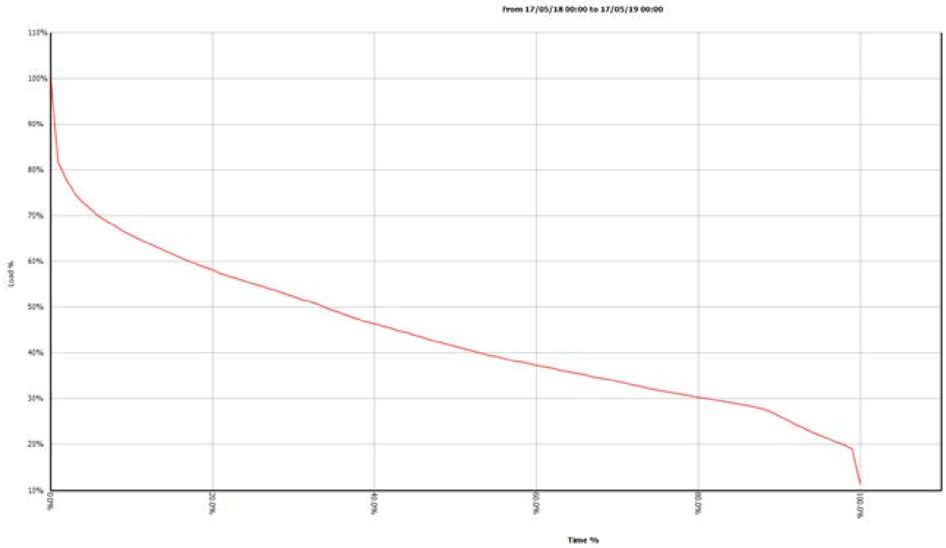


Figure 4: Substation load duration curve

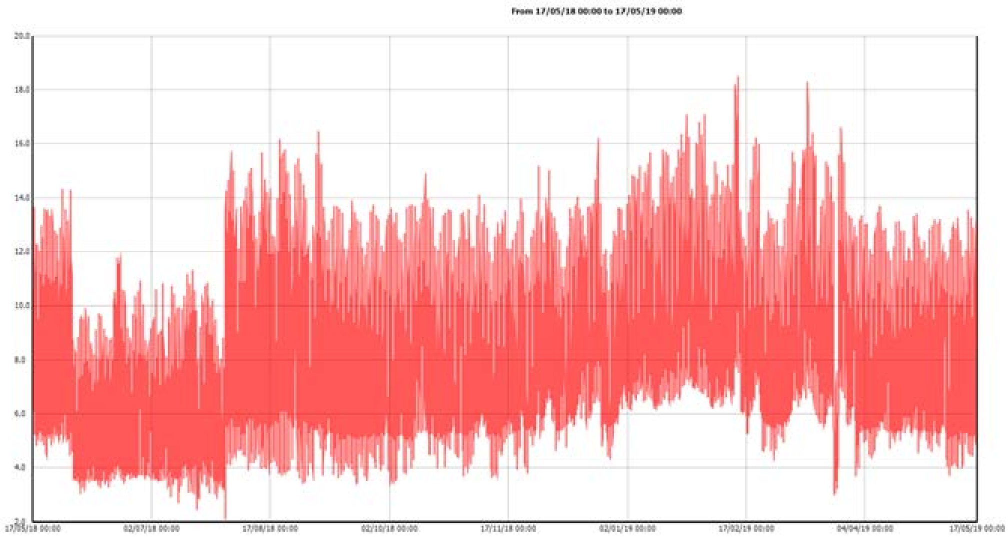


Figure 5: Substation load curve

Substation condition

Based on a Condition Based Risk Management (CBRM) analysis of the effect of current condition and ageing on the expected life of the assets at SSPBH, the following have been deemed to each their retirement ages as follows:

- 33/11kV transformers TR1, TR2 and TR3 in 2022;
- 33kV VT39 in 2022; and
- 33kV isolators AB3T19, AB3T29 and AB3T39 in 2024.

33/11kV transformers

TR1

TR1 has been manufactured by English Electric and is fitted with a Fuller tap changer. This unit is 42 years old.

Significant oil leakages are visible from multiple locations of the unit. Out of the three transformers, TR1 appears to have the worst oil leakage and also the worst leakage from the bund to ground. Local substation maintenance staff have advised that TR1 requires approximately one drum of replacement oil every 3 months.

Field services reveal that Fuller tap-chargers are known to be associated with operational and maintenance issues. TR1 tap-changer tends to lock up on some occasions and requires manual lowering and raising of tap changer to reset the lower/raise mechanism back to working condition.

DGA analysis shows a wet transformer, high saturation of water-in-oil and moderate to high moisture-by-weight. A high level of acetylene has been noted. Based on the latest DGA, the current furan level is lower than the the highest furan observed. This is due to the dilution of old oil with new replacement oil. Hence, it is likely that the current corrected furan level is higher than indicated, suggesting that the transformer is in an advanced state of insulation degradation.

It has been recommended to replace TR1 by 2022.

Figure 6: Transformer TR1

Figure 7: Transformer TR1 showing leaks and water with oil in the bund

TR2

TR2 has been manufactured by Tyree and is fitted with a problematic Fuller tap changer. This unit is 48 years old.

This transformer has a moderate level of oil leakage. Based on external visual inspection of the fins only, there appears to be a moderate level of rust at some spots on radiator fins.

DGA analysis shows a consistently wet transformer, moderate saturation of water-in-oil and moisture-by-weight, consistently high acidity and average resistivity of oil which most likely due to high moisture levels. A high level of acetylene has been noted. Based on the latest DGA, the current furan level is lower than the the highest furan observed. This is due to the dilution of old oil with new replacement oil. Hence, it is likely that the current corrected furan level is higher than indicated, suggesting that the transformer is in an advanced state of insulation degradation.

Although the CBRM model recommends the estimated replacement year as 2018, with required additional maintenance measures put in place to address network risk, it has been recommended to defer TR2 replacement to 2022 to align with TR1 and TR3 replacement.

Figure 8: Transformer TR2

Figure 9: Transformer TR2 showing leaks and water with oil in the bund

TR3

TR3 has been manufactured by Tyree and is fitted with a Fuller tap changer. This unit is 48 years old.

TR3 has the lowest level of oil leakage. DGA analysis shows a wet transformer, high acidity, average resistivity, high saturation of water-in-oil, moderate to high moisture by dry weight, fluctuating break down voltage, moderate levels of furan, average level of oil resistivity and total combustible gases. A high level of acetylene has been noted. Based on the latest DGA, the current furan level is lower than the the highest furan observed. This is due to the dilution of old oil with new replacement oil. Hence, it is likely that the current corrected furan level is higher than indicated, suggesting that the transformer is in an advanced state of insulation degradation.

This bund appears not as leaky as TR1 bund but allows some oil/water to seep to the ground. This may be due to the lower volume of oil/water in the bund.

Consistent with the CBRM model, it has been recommended to replace TR3 in 2022.

Figure 10: Transformer TR3

Figure 11: Transformer TR3 showing leaks and water with oil in the bund

33kV Voltage Transformer VT39

It is assumed that this unit has been manufactured by J S Hansom in 1970.

Visual inspection of this VT has revealed oil leaks on all bushings, from the main tank lid gasket and the conservator tank oil level sight glass.

Whilst the leakage is being monitored by local operations staff, it is predicted that this aged VT is likely to require refurbishment with new gaskets and a dry out in the next 5 years assuming the paper insulation is in acceptable condition to justify refurbishment.

Furthermore, this unit is in close proximity to the property boundary and does not meet the boundary clearance requirements. Catastrophic failure of this unit will have a safety impact on the adjacent residential property.

This has been recommended to be replaced.


Figure 12: Views of VT39

33kV Braid Type Isolators

Braid type isolators AB3T19, AB3T29 and AB3T39 are assumed to have been installed around 1970 when the substation was originally built.

This braided type, vertical break isolator model is known to be a problematic one, potentially resulting in cracked insulators supporting the female contacts when closed. There is a small tolerance between the maximum and minimum force required to close the isolator. The closing action assisted by the force generated by the momentum of 3 moving centre insulators can result in insulator damage if the force is excessive. Insulator top galvanised end caps show significant rust due to erosion and the normally elevated temperature of silver plated copper contacts and terminal palms.

It has been recommended that these isolators be replaced by 2024.

Figure 13: Views of 33kV braid type isolators

Other Identified Issues

Other identified issues at SSPBH include ageing 33kV bus support insulators, non-availability of surge arresters on the 33kV feeder cable terminations, non-availability of a feeder VT on feeder 3756 bay and ageing 33kV horizontal double-break type isolators.

Figure 14: Ageing 33kV bus support insulators

Figure 15: 33kV feeder cable terminations (396 on left and 3756 on right)

Figure 16: Views of 33kV horizontal double-break type isolators

1.4 Impact of doing nothing

The “do nothing” option is not acceptable as the following do not comply with the applied service standards detailed in section 1.2:

- Continuous operation of the existing 33/11kV transformers poses an ongoing low level risk to the safety of Energex personnel due to the potential for in-service failure of the asset.

- Continuous operation of the existing 33/11kV transformers poses an ongoing low level risk to the environment due to the potential for in-service failure of the asset causing an oil spill.

- The level of risk will increase over time, particularly as these assets continue to age and deteriorate.

2.0 OPTIONS ANALYSIS

In the process of determining the most cost-effective solution to address the identified network limitations, Energex has sought to identify a practicable range of technically feasible, alternative options that could satisfy the network requirements in a timely and efficient manner. As a result of this process, Energex has identified a range of options that represent practical alternatives to address the network limitations in the required timeframe.

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

Alternative option	Reasons for being rejected
Repair of oil leaks on power transformers to extend their life	– Only a short term reactive solution. – Does not address the major age related issues such as advanced state of insulation degradation.
Decommission SSPBH, transfer load from SSPBH to SSBHD and convert the 33kV feeder F393 to 11kV to supply the remaining load	– Not feasible due to the significant voltage drop across the 11kV energised feeder. – SSPBH is optimally configured (under the previous project) to accommodate the transformer replacement and associated works.
Replace the existing transformers with 1 x 25MVA transformer and invest in demand management to reduce the load on SSPBH	– Only 3 large demand charged businesses are in the supply footprint of SSPBH and main demand reduction initiatives that could be undertaken by these have already been undertaken previously under Demand Reduction Initiative. – The demand reduction opportunities available to the majority of the other businesses supplied by this substation would be relatively small as they are only consumption charged sites and would be limited in demand reduction terms with very small returns in demand reduction per site. – Hence, Incentives Delivery Dept. has confirmed the likelihood of non-network opportunities being able to deliver a demand reduction needed is very low. – In addition, this option leads to a significant reduction in the network reliability at SSPBH that is located in an urban are with high load density.
Non-network asset solution	– Available funding that can be used for a non-network solution to address the load-at-risk is around $82/kVA. Energex typically use a threshold cost of $185/kVA for screening demand response procurement. Hence, it is anticipated that there would be no non-network alternatives available.

Table 1: Alternative options rejected

2.1 Network options

The options below have been assessed as meeting the applied service standards.

2.1.1 Option 1: Replace existing transformers with 2 x 15/25MVA transformers

This option involves replacing the existing 3 x 10/12.5MVA 33/11kV transformers with 2 x 15/25MVA 33/11kV transformers, replacing the identified 33kV isolators and voltage transformer VT39 and reconfiguring the 33kV bus at SSPBH.

Instead of procuring two new 33/11kV transformers, this option proposes to use the third 25MVA transformer unit this is redundant at Meeandah Zone Substation (SSMDH) and an existing 25MVA strategic spare transformer currently in stock at Larapinta.

Figure 17 provides a schematic diagram for Option 1 and is replicated in the Recommended development section.

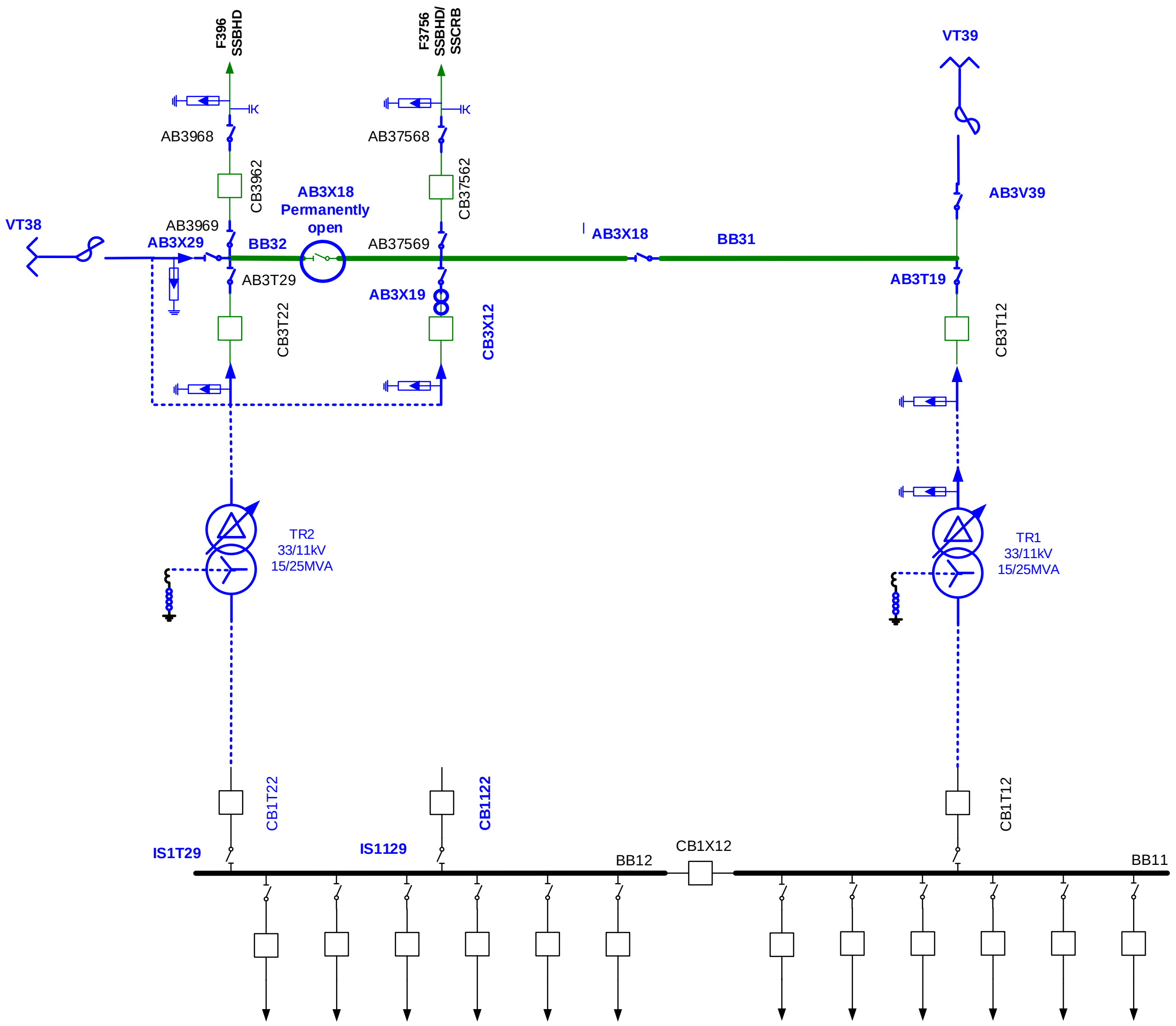


Figure 17: Proposed network arrangement (schematic view)

2.1.1 Option 2: Replace existing transformers with 2 x 15/25MVA transformers

This option involves replacing the existing 3 x 33/11kV transformers with a single 15/25MVA transformer and converting 33kV feeder F396 to 11kV to provide back-up supply for an outage of the transformer at SSPBH.

In the event of an outage of the single 33kV feeder F3756 supplying SSPBH, 11kV transfers to SSCRB and SSBHD will be utilised to ensure compliance with the Safety Net.

Figure 18 provides a schematic diagram for Option 2.

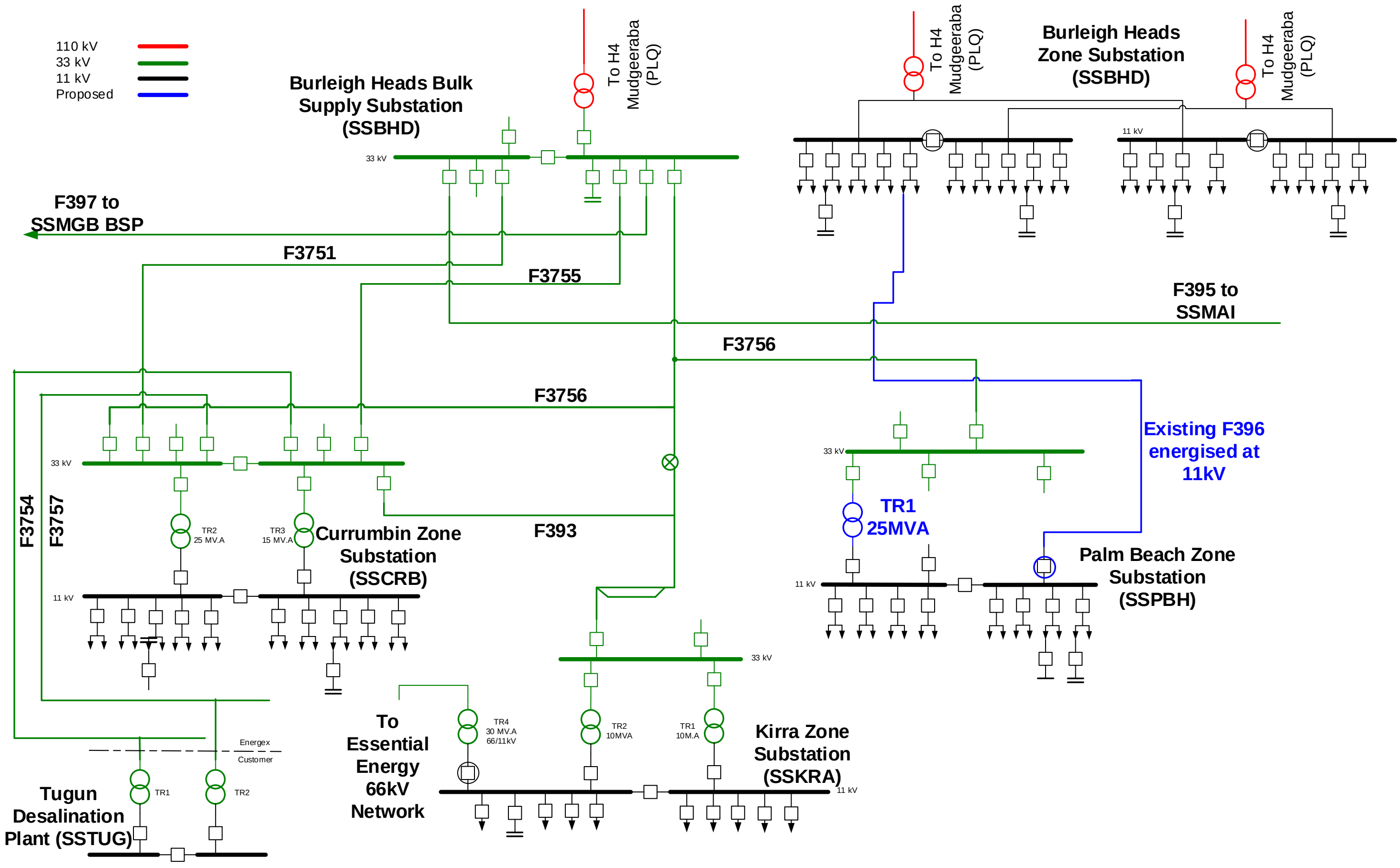


Figure 18: Proposed network arrangement (schematic view)

2.2 Non-Network options assessment

In order for a non-network solution to address the identified limitations, it should be able to maintain supply to the customers supplied by SSPBH as the existing network assets reach their retirement age.

There are no other substations in the area that can supply the existing/forecast load at SSPBH when the existing substation assets reach retirement age. Embedded generation to supply the load continuously and provide reliable and secure supply is not practicable. The likelihood of non-network opportunities being able to deliver a demand reduction needed is very low. Available funding that can be used for a non-network solution to address the load-at-risk is well below the typical threshold value used by Energex for screening demand response procurement. Hence, it is anticipated that there would be no non-network alternatives available.

2.3 Comparison of options

2.3.1 Technical comparison

A summarised comparison of the advantages and disadvantages of the alternative development options is given in Table 2.

Option	Advantages	Disadvantages
Option 1 Replace existing transformers with 2 x 15/25MVA transformers	+ More capacity available to cater for possible load growth. + Highest operational flexibility. + Optimally utilises existing the 33kV feeder network in the area of interest and other network assets at SSPBH. + Optimally utilises the existing 25MVA transformer stock while increasing overall asst utilisation. + Retains N-1 capability/reliability of supply to SSPBH.	– No obvious disadvantages.

Option 2 Replace the existing transformers with 1 x 25MVA transformer and convert the existing 33kV feeder F396 to 11kV to provide a backup supply	+ 33kV feeder (energised at 11kV) can be utilised to supply a second transformer at SSPBH when needed in the future. .	– Lower reliability than Option 1, with unserved energy for a loss of either the single remaining 33kV feeder and single 33/11kV transformer supplying SSPBH. – Exposes SSPBH to outages at SSCRB as F3756 supplies both substations and SSPBH would require shedding for certain contingencies. – Significant works associated with connecting 33kV feeder to 11kV switchgear at both ends. – Sub-optimal utilisation of the 11kV feeder (only during contingencies). – Does not optimally utilise the existing new network assets at SSPBH – Risk of public perception of over investment. – Lower reliability/ operational flexibility compared to option 1 due to requirements for 11kV load transfers and/or deployment of mobile generators. – Limits the ability to cater for load growth.

Table 2: Technical comparison of alternative development options

2.3.3 Economic Comparison

The r*egulatory investment test for distribution* requires Energex to identify the credible option that maximises the present value of net economic benefit to all who produce, consume and transport electricity in the National Electricity Market.

Accordingly a base case net present value comparison of the alternative development options has been undertaken. The financial analysis contains anticipated costs of providing, operating and maintaining the options as well as expected costs of compliance and administration associated with each option.

NPV ranking table

Table 3 provides an overview of the initial capital cost and present value of direct costs covering the period of study for each of the development options.

The present value comparison summary includes all costs directly associated with constructing and providing the option. This includes the cost of land and easements currently owned or to be acquired for network augmentation.

Interest on borrowings is not included as a cost in the comparison of options as it represents a cost of project financing, and as such is accounted for in present value calculations through the discounting of the project cash flows at the regulated WACC. The interest on borrowings is included in the total project cost for which approval is being sought as it represents a legitimate cost of network augmentation.

Option Number	Option Name	Rank	Net Economic Benefit ($ real)	PV of CAPEX ($ real)	PV of OPEX ($ real)	PV of Market Benefits ($ real)	Initial CAPEX ($)
1	Replace existing transformers with 2 x 25MVA transformers	1	-$6,087,839	$5,408,581	$679,258	$0	$6,844,247
2	Replace existing transformer with 1x25MVA transformer and convert 33kV feeder to 11kV feeder	2	-$6,424,042	$4,484,624	$339,629	-$1,599,789	$5,675,033

Table 3: Base case NPV ranking table

Sensitivity analysis

A sensitivity analysis was conducted on this base case to establish the option that remained the lowest cost option in the scenarios considered. In this instance, the scenarios that have been considered are:

1. **Medium demand** – under this scenario the existing load remains around the same as it currently is. This is consistent with the base case load forecast provided in SIFT. This scenario has been assigned a likelihood of 80% in the weighted average NPV.

2. **High demand** – under this scenario the only change from the Medium Growth scenario is that for those options that remove a transformer at SSPBH, a new transformer is established there for an N-1 scenario because the load grows beyond the substation's capacity. This scenario has been assigned a likelihood of 20% in the weighted average NPV.

Low demand was not considered because the staging of projects would be identical to that of the Medium demand scenario.

Table 4 provides the results of the sensitivity analysis.

Demand Scenario Probability Weighting Scenarios: Medium Demand,High Demand						
Option Number	Option Name	Weighted Rank	Weighted Net Economic Benefit	Weighted CAPEX PV	Weighted OPEX PV	Weighted Market Benefits PV
1	Replace existing transformers w ith 2x25MVA transformers	1	-$6,087,839	$5,408,581	$679,258	$0
2	Replace existing transformer w ith 1x25MVA transformer and convert 33kV feeder to 11kV feeder	2	-$7,042,874	$4,661,110	$781,975	-$1,599,789

Table 4: Scenario analysis - comparison of options

Value of Customer Reliability (VCR) calculations were undertaken for Option 2 due to the network configuration following the identified project. The resultant network involves a single 33kV feeder supplying SSPBH. For an outage of this feeder, there will be unserved energy that results when the load is above the capacity of the 33kV feeder energised at 11kV.

VCR for the case of supplying Palm Beach via a single 33kV feeder has been modelled using the below assumptions:

- **VCR rate of $31.89 –** on the basis of a load that is 66% domestic and 34% commercial. These have also been modelled in a band between $28.70 (90% of mode) and $35.08 (110%of mode).

- **Forced outage rate of 0.821outages/year –** Energex uses an outage rate of 9.5 outages per 100km, with the feeder supplying SSPBH being 8.6km in length.

- **Load Transfers and Repair Time** – The ECC rating of the 11kV backup feeder is 8MVA which has assumed to be instantaneous. There are also a further 12MVA of load transfers that have been assumed that can be effected in 3 hours, in stages

using remote switching and manual switching.

Further to the scenarios considered, a Monte-Carlo analysis simulation was undertaken on the base case project timings to assess the projects sensitivity to a change in the parameters of the NPV model.

Table 5 outlines the major sensitivities analysed:

Parameter	Mode Value	Lower Bound	Upper Bound
WACC	5.9%	4.1%	9.3%
Project Costs	Standard estimates	-40%	+40%
Project Costs	Preferred option estimates	-30%	+30%
Project Costs	Approval estimates	-25%	+25%
Opex Costs	Calculated percentages	-5%	+5%

Table 5: Economic parameters and sensitivity analysis factors

The Monte-Carlo analysis undertook 1000 simulations of all the variables.

Table 6 shows the percentage of times each option was the most economical across the simulations and also the average NPV cost of all the simulations.

Option Number	Option Name	Rank 1	Rank 2	Average NPV
1	Replace existing transformers with 2 x 25MVA transformers	69%	31%	-$6,216,140
2	Replace existing transformer with 1x25MVA transformer and convert 33kV feeder to 11kV feeder	31%	69%	-$6,598,254

Table 6: Monte Carlo Analysis for Base Case Forecast

Option 1 is the lowest cost option in the weighted average results across the three scenarios and also has the lowest average cost and is the most economical in 69% of cases in the Monte-Carlo simulations.

Option analysis summary

Based on the above technical and economic comparisons of options, Option 1 is considered to provide the optimum solution to address the forecast limitations, and is therefore the recommended development option.

3.0 RECOMMENDED DEVELOPMENT (OPTION 1)

3.1 Scope of proposed works

3.1.1 Description of works

To address the limitations at Palm Beach, it is proposed to replace the existing 3 x 10/12.5MVA 33/11kV transformers with 2 x 15/25MVA 33/11kV transformers. Works include:

At SSPBH

- Installation of 2 x 15/25MVA 33/11kV transformers (ex-MDH TR2 and strategic spare ex-Larapinta) and 33kV and 11kV cables to suit.
- Relocation of NEX recovered from ex-MDH TR2 for new TR2.
- Installation of surge arresters and voltage sensors on 33kV feeders 396 and 3756.
- Replacement of existing 33kV isolators AB3969, AB3968, AB37569, AB37568, AB3T19, AB3T29, AB3T39, AB3X19 with current contact items.
- Installation of new cable termination structures near existing CB3T12, CB3T22, CB3T32, VT38, new TR1 and installation of surge arresters.
- Installation of a new 33KV bus VT (VT39) with in-line fuses and a new 33KV isolator (AB3V39).
- Demolishing existing TR3, TR1, TR2 foundations, storage shed foundation and old control building.
- Removal of oil-contaminated soil.
- Construction of foundations (taking the flood resilience requirements into account) for 2 x 25MVA transformers.
- Construction of masonry walls for noise reduction-on the west and north sides of proposed TR1 and on the north side of proposed TR2 and a firewall between the transformers. Architectural treatment to be provided as required.

  Note: A noise assessment has been carried out for the new transformer locations. Based on this it has been proposed to construct masonry walls.
- Renaming existing CB3T22 to CB3X12 and replacement of 2 x CTs with new CTs to suit high-impedance and low-impedance bus zone protection schemes.
- Removal of existing VT38, rebuild bay for a new 33KV isolator (AB3X29) and re-install VT38 on a new structure.

- Permanently opening isolator AB3X18.
- Establishment 3 x lightning masts.
- Re-configuring of the existing 33kV bus zone protection scheme BB31 (renamed to BB32) to exclude CB37562, CB3T12 and to include CB3X12.
- Installation of a second bus zone protection scheme (comprising of high-impedance and low-impedance scheme similar to the existing in a new bus zone protection panel) to include CB37562, CB3T12 and CB3X12 and name it BB31.
- Re-wiring of the existing TR2 protection panel on site for the new bus-section CB CB3X12 control/protection.
- Recovery and scraping of existing 33kV line VT39.
- Rewiring of SEL351-7 protection relay in existing CB1T22 to provide 3OC EF CBF protection to CB1122.
- Rewiring of CT connections to provide BOC BEF protection on SEL351-7 in CB1T22 (new).
- Installation of a 33kV VT ACO scheme.
- SACS builds required at each stage (3 stages and clean-up) to incorporate standard alarms/controls and new 33kV bus arrangement.
- Relocation and cutover of the fibres (PBH-BHD and PBH-CRB) in the old control building shed to the new communications pits and running fibres to panel in control room.

At SSMDH

- De-commissioning, refurbishment and transportation of ex-MDH TR2 to SSPBH;

Note: Meeandah Zone Substation (SSMDH) is equipped with 3 x 15/25MVA 33/11kV transformers. Based on the current load forecast and the Customer Outcome Standards (COS), only two transformers are required at this substation. Hence, it is proposed to recover TR2 at SSMDH to be installed at SSPBH, in the process improving asset utilisation within Energex.

- Decommission 33kV Hawker Siddeley Horizon circuit breaker CB3T22 and return to stores as a spare (YOM 2010).
- Recovery of panel +1A13 and relays on the panel for transformer TR2 protection (Reyrolle Duobias), CB3T22 protection (SEL351) and NEF protection (Reyrolle TJM11) from the panel.

- Sealing all floor penetrations in the TR2 transformer compound.
- Recovery of 11kV cables (from CB1T22 to TR2) and 33kV cables (from CB3T22 to TR2).
- SACS rebuild to reflect recovery of transformer TR2 and CB3T22.

Figure 19 shows the proposed network on completion of the recommended works.

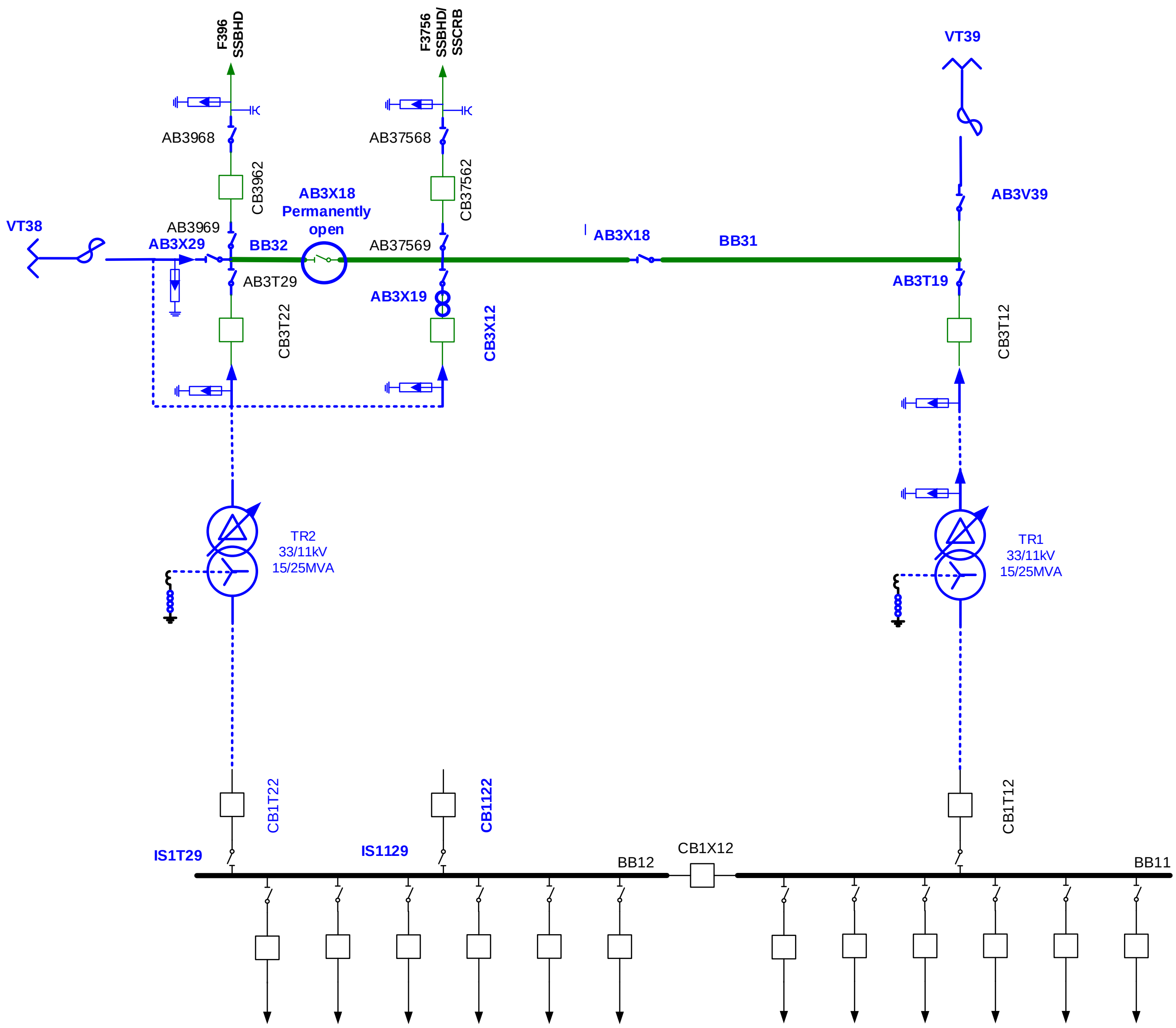


Figure 19: Proposed network arrangement (schematic view)

4.0 RECOMMENDATION

It is recommended that Energex replace existing 3 x 33/11kV transformers with 2 x 15/25MVA 33/11kV transformers, replace 8 x 33kV isolators and reconfigure the 33kV bus at SSPBH, for a total estimated cost of $7,061,571, at 2018/19 prices. The target completion date for the recommended development is July 2022.