

Replacement / Unforeseen Project Summaries

There were no failures or other unforeseen replacement needs on the Energex network, with a value greater than 2 million dollars, during 2022/23.

A complete listing of all committed projects is contained within Appendix D. A summary list of replacement driven projects that have recently been approved with a capital cost of \$2M or greater is shown below.

Table 1 – Projects (>\$2M Replacement) Approved in the Past Twelve Months

Project Name	Estimated Commissioning
CRB-KRA – Replace 33kV OH F393	Jan-25
MGL Moggill – Improve 11kV Backup Protection Reach	Mar-26
BHD Burleigh Heads – SRTS SE GC SSBHD Building Remediation Works	Aug-24
T78 Lockrose – Install new 15kVA 33/11kV transformer & Replace 33kV CBs	July-26
ESK-TGW – Replace 33kV OH F3840	Dec-26
CMY Coominya – Replace TR1 with 33/11kV 5/8MVA Transformer	Jun-27
TGW Toogoolawah – Replace 33kV Outdoor Isolators	Dec-24
LDM Lindum – Replace 8x33kV Circuit Breakers	Mar-27
PTE Petrie – Establish 33/11kV Zone Substation	Dec-26
TRP Tarampa – Rebuild Substation to Replace Ageing Assets	Apr-27

Details of replacement driven projects that have been recently approved are shown on the following pages.

Identified need

33kV feeder F393 from Currumbin Zone Substation (SSCRB) to Kirra Zone Substation (SSKRA) is a mix of OH and UG assets (approximately 8.78km long). F393 has a normally open tee-off connection to F3756 (SSCRB Currumbin – SSBHD Burleigh Heads - SSPBH Palm Beach), which consists of an ABS on a single span located outside SSCRB.

SSKRA is equipped with 2 x 10MVA 33/11kV transformers and a 30MVA 66/11kV transformer (on hot standby) and supplies approximately 5,461 predominantly residential customers. SSKRA is normally supplied from SSCRB via 33kV feeder F393. Under contingency, SSKRA can be supplied from the Essential Energy 66kV network via feeder F9508 and Energex 66/11kV Transformer TR4 at SSKRA.

Energex overhead conductors have traditionally been replaced on failure; however, the Asset Lifecycle Management Asset Management Plan for Overhead Conductors has transitioned to a condition-based assessment prior to a replacement recommendation being made, subsequent to the conductor being identified as having an age greater than 70 years (55 years for SC/GZ conductor in coastal environments). Sections of F393 from SSCRB to SSKRA have been identified as consisting of approximately 4.08km of aged 19/.101 HDDB conductor and approximately 3.29km of aged 7/.080 HDDB OHEW conductor. In addition, these sections are in a very poor condition. They are visibly aged, with conductor stranding, and many of the spans having multiple sleeves in it (approximately 70 in total). Furthermore, the feeder runs adjacent to private properties with sections through a very high potential bushfire area.

Furthermore, it has been identified that the communications network servicing the Energex network at SSCRB and SSKRA will require the establishment of diverse telecommunications paths in order to support the proposed protection configuration at SSKRA.

Credible options considered (options considered but rejected are available on request)

- 1) Reconductor aged and poor condition F393.

Other than the above option that has been assessed as meeting the applied service standards, no other practically feasible and economically equivalent network option has been identified in this analysis

Economic comparison

As there has only been a single credible option identified, no economic comparison has been undertaken.

Approved Project Cost and Timing

The estimated total project cost is \$2.44M at 2022/23 prices. Construction will occur during the period leading up to the estimated completion date of January 2025.

Impact on Network Charges

This project has been estimated as having an impact on average network charges of 0.00385 ¢/kWh.

Identified need

Moggill Zone Substation (SSMGL) provides electricity supply to over 5,000 predominantly residential customers in the Anstead, Bellbowrie, Kenmore, Moggill, Pinjarra Hills, Pullenvale, Upper Brookfield and Westlake areas.

It has been determined that all 11kV feeders from SSMGL do not have sufficient back-up protection reach to isolate phase to phase faults on the 11kV network for a failure of the primary protection.

It has also been identified by Asset Maintenance (AM) that the following protection assets at SSMGL need to be replaced:

- Reyrolle Argus 1 relays with a manufacture year of 2005 or earlier, installed on 11kV circuit breaker CB1012 and CB1022 are known to be problematic and prone to failure;
- Alstom KBCH120 relays installed on 33/11kV Transformer TR2 and 33/11kV Transformer TR3 are known to be problematic and prone to failure;
- Alstom KCGG142 relay installed on 33kV BB31 has reached end of life; and
- Nulec CAPM5 relays installed on 33kV reclosers RE4456, RE3X22, and RE3572 have reached end of life.

Credible options considered (options considered but rejected are available on request)

- 1) Improve the 11kV feeder back-up protection reach on 7 x feeders supplied by SSMGL, replace 2 x obsolete / problematic Reyrolle Argus1 relays, replace 2 x obsolete / problematic Alstom KBCH120 relays, replace the end of life Alstom KCGG142 relay and replace 3 x end of life CAPM5 relays at SSMGL.

Other than the above option that has been assessed as meeting the applied service standards, no other practically feasible and economically equivalent network option has been identified in this analysis

Economic comparison

As there has only been a single credible option identified, no economic comparison has been undertaken.

Approved Project Cost and Timing

The estimated total project cost is \$2.82M at 2023/24 prices. Construction will occur during the period leading up to the estimated completion date of March 2026.

Impact on Network Charges

This project has been estimated as having an impact on average network charges of 0.00445 ¢/kWh.

Approved Project:

BHD Burleigh Heads - SRTS SE GC SSBHD Building
Remediation Works

Identified need

Burleigh Heads Substation (SSBHD) is a combined zone and bulk supply substation. The bulk supply substation provides electricity to over 35,659 predominantly residential customers in the surrounding suburbs.

A Substation property maintenance audit was carried out by the Civil Engineering team in October 2016 identifying the existing 110/33kV control building at SSBHD to be severely deteriorated, in particular the substation basement and suspended concrete floor. Temporary props were installed to manage the risk.

A recent assessment of the building identified further deterioration. No further civil remediation work is possible to improve the condition of the building and extend its useful life.

Credible options considered (options considered but rejected are available on request)

- 1) Install new protection panels for TR1 & TR3 110/33kV transformer with dual-TR DIFF schemes in the 110/11kV building, recover all other assets and demolish the end of life 110/33kV control building at SSBHD.

Other than the above option that has been assessed as meeting the applied service standards, no other practically feasible and economically equivalent network option has been identified in this analysis.

Economic comparison

As there has only been a single credible option identified, no economic comparison has been undertaken.

Approved Project Cost and Timing

The estimated total project cost is \$2,85M at 2022/23 prices. Construction will occur during the period leading up to the estimated completion date of August 2024.

Impact on Network Charges

This project has been estimated as having an impact on average network charges of 0.00457 ¢/kWh.

Approved Project:**T78 Lockrose - Install new 15kVA 33/11kV transformer & Replace 33kV CBs****Identified need**

Lockrose Bulk Substation (SST78) is a combined zone and bulk supply substation. The zone substation provides electricity supply to over 2,800 predominantly residential customers in the surrounding suburbs.

As a result of a condition based assessment, the following assets listed below have been deemed to reach their retirement ages, and therefore recommended for replacement within 5 years:

- 33kV voltage transformers VT39 & VTSPARE1.
- 33kV circuit breakers CBSPARE12 & CB3X22.
- 5 sets of 33kV porcelain surge arrestors.
- Duobias transformer protection relay on TR4.
- 2 x protection relays on 110kV feeder F7289.
- 24VDC Exide type battery charger

In the event of a failure of TR4, the Safety Net obligations within the Energex Distribution Authority cannot be met.

Credible options considered (options considered but rejected are available on request)

- 1) Install a second 15MVA 33/11kV transformer, replace 33kV voltage transformer, 2 x bulk-oil 33kV circuit breakers, 5 x 33kV porcelain surge arrestors, 24VDC battery charger, upgrade substation security and 110kV feeder protection relays at SST78 & remote end at SSGBS.

Other than the above option that has been assessed as meeting the applied service standards, no other practically feasible and economically equivalent network option has been identified in this analysis.

Economic comparison

As there has only been a single credible option identified, no economic comparison has been undertaken.

Approved Project Cost and Timing

The estimated total project cost is \$4,76M at 2023/24 prices. Construction will occur during the period leading up to the estimated completion date of July 2026.

Impact on Network Charges

This project has been estimated as having an impact on average network charges of 0.00751 ¢/kWh.

Identified need

Esk (SSESK), Toogoolawah (SSTGW), Somerset Dam (SSSDM) and Murrumba (SSMRB) zone substations are supplied by a 33kV feeder ring emanating from Paddys Gully Substation (SSPGY). This ring comprises F3828 (SSPGY-SSESK), F3840 (SSESK-SSTGW), F380 (3-ended SSTGW-SSSDM-SSMRB) and F3829 (SSMRB-SSPGY).

SSPGY is supplied from Lockrose Bulk Supply Substation (SST78) via 2 x 33kV feeders. SSTGW is equipped with 1 x 5/8MVA and 3 x 1.5MVA 33/11kV transformers and is proposed to be equipped with 2 x 5/8MVA 33/11kV transformers by 2027. It supplies approximately 2,000 predominantly residential customers.

Energex overhead conductors have traditionally been replaced on failure; however, the Asset Strategy *Asset Management Plan for Overhead Conductors* has transitioned to a condition-based assessment prior to a replacement recommendation being made, subsequent to the conductor being identified as having an age greater than 70 years (55 years for SC/GZ conductor in coastal environments). F3840 consists of aged 7/.104 HDCu conductors. There are also a multitude of aged poles and cross arms. Furthermore, sections of the feeder run across private properties with several sections through medium potential bushfire areas.

Credible options considered (options considered but rejected are available on request)

1) Reconductor aged and poor condition F3840.

Other than the above option that has been assessed as meeting the applied service standards, no other practically feasible and economically equivalent network option has been identified in this analysis.

Economic comparison

As there has only been a single credible option identified, no economic comparison has been undertaken.

Approved Project Cost and Timing

The estimated total project cost is \$4.86M at 2022/23 prices. Construction will occur during the period leading up to the estimated completion date of December 2026.

Impact on Network Charges

This project has been estimated as having an impact on average network charges of 0.00766 ¢/kWh.

Approved Project:**CMY Coominya - Replace TR1 with 33/11kV 5/8MVA Transformer****Identified need**

Coominya Zone Substation (SSCMY) is equipped with 1 x 5MVA (TR1) and 1 x 5/6.5MVA (TR2) 33/11kV transformers and provides electricity supply to approximately 285 predominantly residential in the surrounding suburbs, while also supplying major customers. The substation primarily supplies two industrial customers and have two 11kV feeders supplying residential customers in the surrounding areas.

Based on the Substation Condition Assessment Report, the following assets have been deemed to reach their retirement ages:

- Power transformer TR1 by 2025;
- 33kV bulk-oil circuit breaker CB3T12 by 2020; and
- 3 x controllers for reclosers by 2023.

It has been determined that two of the 11kV feeders from SSCMY do not have sufficient back-up protection reach to isolate phase to phase faults on the 11kV network for a failure of the primary protection.

Credible options considered (options considered but rejected are available on request)

1) Replace existing 33/11kV TR1, CB3T12 and recloser controllers.

Other than the above option that has been assessed as meeting the applied service standards, no other practically feasible and economically equivalent network option has been identified in this analysis.

Economic comparison

As there has only been a single credible option identified, no economic comparison has been undertaken.

Approved Project Cost and Timing

The estimated total project cost is \$4.9M at 2022/23 prices. Construction will occur during the period leading up to the estimated completion date of June 2027.

Impact on Network Charges

This project has been estimated as having an impact on average network charges of 0.0077 ¢/kWh.

Approved Project:

TGW Toogoolawah - Replace 33kV Outdoor Isolators

Identified need

Toogoolawah Zone Substation (SSTGW) is equipped with 1 x 5/8MVA and 3 x 1.5MVA (on hot-standby) 33/11kV transformers and provides electricity supply to approximately 2,000 predominantly residential customers in the surrounding suburbs. Approximately 74% of the total number of customers supplied from SSTGW are residential customers amounting to 47% (7.65GWh) of the total energy supplied (16.12GWh), while 26% of the total number of customers supplied are business customers, amounting to 53% (8.47GWh) of the total energy supplied.

A condition based assessment has identified a number of primary and secondary plant and equipment that are reaching or have reached their retirement age. The deterioration of these primary and secondary system assets poses safety risks to staff working within the switchyard, and reliability risks to the customers supplied from SSTGW.

Credible options considered (options considered but rejected are available on request)

1) Rebuild substation to replace ageing assets at SSTGW.

Other than the above option that has been assessed as meeting the applied service standards, no other practically feasible and economically equivalent network option has been identified in this analysis.

Economic comparison

As there has only been a single credible option identified, no economic comparison has been undertaken.

Approved Project Cost and Timing

The estimated total project cost is \$9.4M at 2022/23 prices. Construction will occur during the period leading up to the estimated completion date of December 2024.

Impact on Network Charges

This project has been estimated as having an impact on average network charges of 0.01486 ¢/kWh.

Identified need

Lindum Substation (SSLDM) is a 33kV switching station with an outdoor ring bus topology, directly supplying Wynnum Zone Substation (SSWNM), providing an alternate supply to Lytton Zone Substation (SSLYT), and linking Lytton Bulk Supply Substation (SSLBS) and Dobby Bulk Supply Substation (SSDBS) via 33kV Feeder F599 from Hemmant Zone Substation (SSHMT).

SSLBS is supplied from Murrarie Powerlink Substation (SSH21) via 2 x 110kV feeders on the same towers (double-circuit construction). SSLBS 33kV network feeds a total 22,700 customers (21,229 residential and 1,471 business), with a residential consumption of 115.03 GWh and business consumption of 435.21 GWh and provides electricity supply to SSLBS 11kV network, Fisherman's Island Zone Substation (SSFIS), Fisherman's Island Bulk Supply Substation (SSFBS), Gibson Island Zone Substation (SSGIS), Lindum Substation (SSLDM), Lota Zone Substation (SSLTA), SSLYT and SSWNM. SSLBS directly supplies approximately 766 predominantly residential customers in the Fisherman's Island, Gibson Island, Hemmant, Lytton, Wynnum, and Wynnum West areas.

SSWNM provides electricity supply to approximately 11,000 predominantly residential customers in the Hemmant, Lytton, Manly, Port of Brisbane, Wynnum and Wynnum West areas.

Based on a Condition Based Risk Management (CBRM) analysis of the effect of current condition and ageing on the expected life of the asset, the following have been deemed to reach retirement age as follows:

- 8 x 33kV oil circuit breakers at SSLDM
- 8 x 33kV bus disconnectors at SSLDM
- 33kV concrete support structures at SSLDM
- 33kV protection relays at SSLDM
- Control Building at SSLDM
- Local Substation Supply at SSLDM
- LV Supply and Main / Distribution Board at SSLDM
- 11kV TR1 & TR2 protection relays at SSWNM
- 11/0.433kV station services transformer at SSWNM
- LV Supply and Main / Distribution Board at SSWNM

A condition based assessment has identified some primary and secondary plant and equipment that are reaching or have reached retirement age. It was also identified that the concrete structures of the 33kV outdoor air-insulated switchgear are structurally unsound. The deterioration of these structures and primary and secondary system assets poses safety risks to staff working within the switchyard, and reliability risk to the customers supplied from SSLDM. Additionally, it was identified that a total of 11 x protection relays have been deemed as reaching end of life at SSLDM and SSWNM.

Additionally, it has been identified that the station services transformer at SSWNM has reached end of life, and as such need to be replaced, following poor oil test results. Furthermore, it has been ascertained that the AC Main / Distribution Panel associated with the existing station services transformer at SSWNM is required to be replaced in order to comply with AS/NZS3000.

In addition to this, the only means of supplying the SSLBS 33kV network for a low probability – high consequence event of the complete loss of 110kV supply is via the 33kV tie feeders from SSDBS. The loss of 110kV supply to SSLBS results in a total loss of 55.2 MVA for three high security major customers.

Credible options considered (options considered but rejected are available on request)

- 1) Replace 8 x 33kV circuit breakers with 7 x 33kV circuit breakers, 8 x disconnectors with 12 x disconnectors, 33kV bus bars, end of life / obsolete protection relays, control building and LV local

supply at SSLDM, and replace end of life / obsolete protection relays, and LV local supply at SSWNM.

Other than the above option that has been assessed as meeting the applied service standards, no other practically feasible and economically equivalent network option has been identified in this analysis.

Economic comparison

As there has only been a single credible option identified, no economic comparison has been undertaken.

Approved Project Cost and Timing

The estimated total project cost is \$13.51M at 2022/23 prices. Construction will occur during the period leading up to the estimated completion date of March 2027.

Impact on Network Charges

This project has been estimated as having an impact on average network charges of 0.02132 ¢/kWh.

Identified need

Griffin Bulk Supply Substation (SSGFN) is equipped with 2 x 80MVA 110/33kV transformers and supplies Kallangur (SSKLG), Mango Hill (SSMHL) and Queensland Rail Petrie (SSQRPE) substations. It also supplied the recently de-energised Australian Paper Mill Zone Substation (SSAPM).

SSKLG is equipped with 2 x 12MVA and 1 x 25MVA 33/11kV transformers and provides electricity supply to approximately 14,000 predominately residential customers in the surrounding areas of Kallangur, Kurwongbah, Petrie, Murrumba Downs and Griffin.

Energex's ageing substation SSAPM, which supplied the former paper mill, is equipped with 3 x 5MVA 33/11kV transformers. It has been de-energised recently and its 33kV outdoor bus recovered prematurely under the current project, due to safety risks.

The new development site *The Mill at Moreton Bay*, located within the suburbs of Petrie, Kallangur and Lawnton encompasses the new University of Sunshine Coast Campus and is proposed to consist of several new developments including the Moreton Bay Indoor Sports Centre (to host competition events for 2032 Brisbane Olympics), a hospital and mixed domestic and commercial precincts. This area is being currently supplied by two 11kV feeders from SSKLG and Lawnton (SSLTN) zone substations.

With new developments in the surrounding areas, loads are forecast to increase significantly causing network limitations in the area. Based on the current load forecast 10 PoE peak demand on SSKLG will exceed the substation Normal Cyclic Capacity (NCC) in the summer of 2026/27. In addition, Energex will not meet its Safety Net obligation as outlined in its Distribution Authority at SSKLG in the summer of 2026/27.

Furthermore, The Mill at Moreton Bay development area encompasses land currently occupied by SSAPM. In exchange for relinquishing this to facilitate the development, Energex has been gifted a parcel of land in an alternative location in the proximity of SSAPM to establish a new zone substation.

Credible options considered (options considered but rejected are available on request)

- 1) Establish a new 33/11kV zone substation at Petrie and replace ageing transformers at SSKLG.
- 2) Replace ageing transformers at SSKLG, establish new 11kV feeders to supply the new development areas and establish a new 33/11kV zone substation at Petrie.

Other than the above options that have been assessed as meeting the applied service standards, no other practically feasible and economically equivalent network option has been identified in this analysis.

Economic comparison

Energex's planning and NPV analysis have identified that option 1 is the lowest cost option in 65% of the scenarios considered.

Rank	Option	Initial Capital Cost*	Net Economic Benefit (NPV relative to Option 1)
1	Establish a new 33/11kV zone substation at Petrie and replace ageing transformers at SSKLG.	\$21.1M	
2	Replace ageing transformers at SSKLG, establish new 11kV feeders to supply the new development areas and establish a new 33/11kV zone	\$29.5M	- \$1.2M

substation at Petrie.		
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Approved Project Cost and Timing

The estimated total project cost is \$22.74M at 2022/23 prices. Construction will occur during the period leading up to the estimated completion date of July 2026.

Impact on Network Charges

This project has been estimated as having an impact on average network charges of 0.03588 ¢/kWh.

Identified need

Tarampa Zone Substation (SSTRP) is equipped with 1 x 5MVA 33/11kV transformer and 1 x 5/6MVA 33/11kV transformer and provides electricity supply to approximately 2,500 predominantly residential customers in the surrounding suburbs. Approximately 88% of the total number of customers supplied from SSTRP are residential customers amounting to 57% (14.3GWh) of the total energy supplied (24.95GWh), while 12% of the total number of customers supplied are business customers, amounting to 43% (10.65GWh) of the total energy supplied.

A condition based assessment has identified a number of primary and secondary plant and equipment that are reaching or have reached their retirement age. The deterioration of these primary and secondary system assets poses safety risks to staff working within the switchyard, and reliability risks to the customers supplied from SSTRP.

The following assets have been deemed to reach their retirement ages:

- Power Transformer TR1 by 2026
- 33kV VT replace by 2026
- 33kV CB3T02 replace by 2023
- 2 x problematic 33kV Duo Roll 33kV air break switches by 2026
- 7 x problematic 11kV braided air break switches by 2026
- 4 x sets of EDO fuse by 2026
- 11kV feeder cast iron cable termination by 2026
- 11kV local transformer by 2026
- 30VDC battery charger by 2023

In addition, a number of additional issues have been identified such as cracking and movement of switchyard slabs, inadequate boundary clearances from the 11kV bus, low inter-bay clearances and non-availability of 33kV or 11kV bus protection.

Credible options considered (options considered but rejected are available on request)

1) Rebuild substation to replace ageing assets at SSTRP.

Other than the above option that has been assessed as meeting the applied service standards, no other practically feasible and economically equivalent network option has been identified in this analysis.

Economic comparison

As there has only been a single credible option identified, no economic comparison has been undertaken.

Approved Project Cost and Timing

The estimated total project cost is \$11.27M at 2022/23 prices. Construction will occur during the period leading up to the estimated completion date of April 2027.

Impact on Network Charges

This project has been estimated as having an impact on average network charges of 0.01778 ¢/kWh.