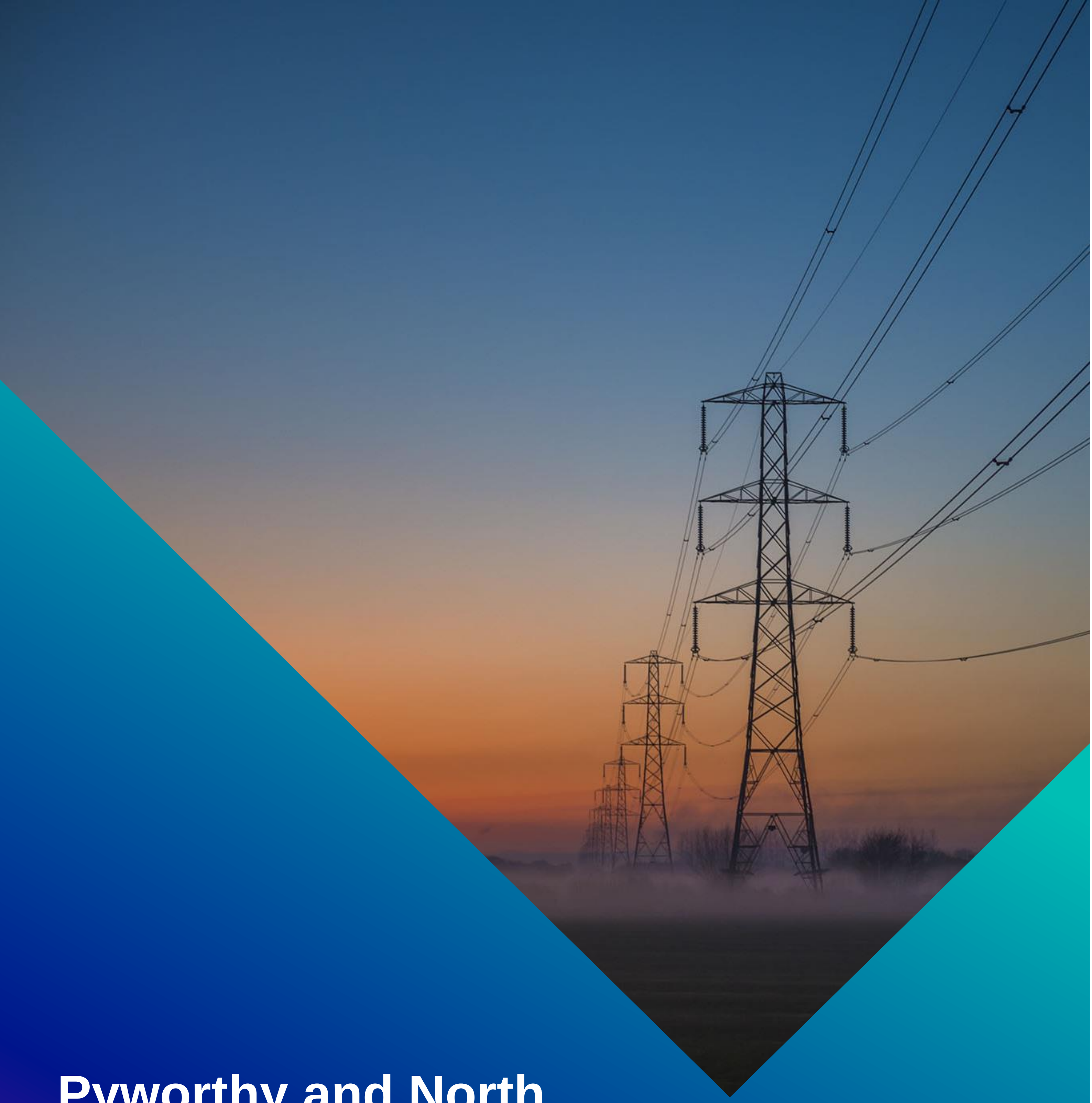

Pyworthy and North Tawton BSP group

Network Development Report – South West

May 2024

Electricity Distribution

nationalgrid

Contents

Pyworthy and North Tawton BSP groups

1. Network Overview

Pyworthy and North Tawton Bulk Supply Point (BSP) supplies a mostly rural area of 33 kV network, with the bulk of the demand centred in Stratton, Hollsworthy, North Tawton and Launceston towns, as well as Okehampton town on the East side of Pyworthy. It is supplied from three 132/33 kV (Grid Transformers) GTs at Pyworthy BSP and one at North Tawton BSP, fed via 132 kV circuits from Alverdiscott (Grid Supply Point) GSP. Pyworhty BSP together with North Tawton BSP supplies approximately 44,000 customers.

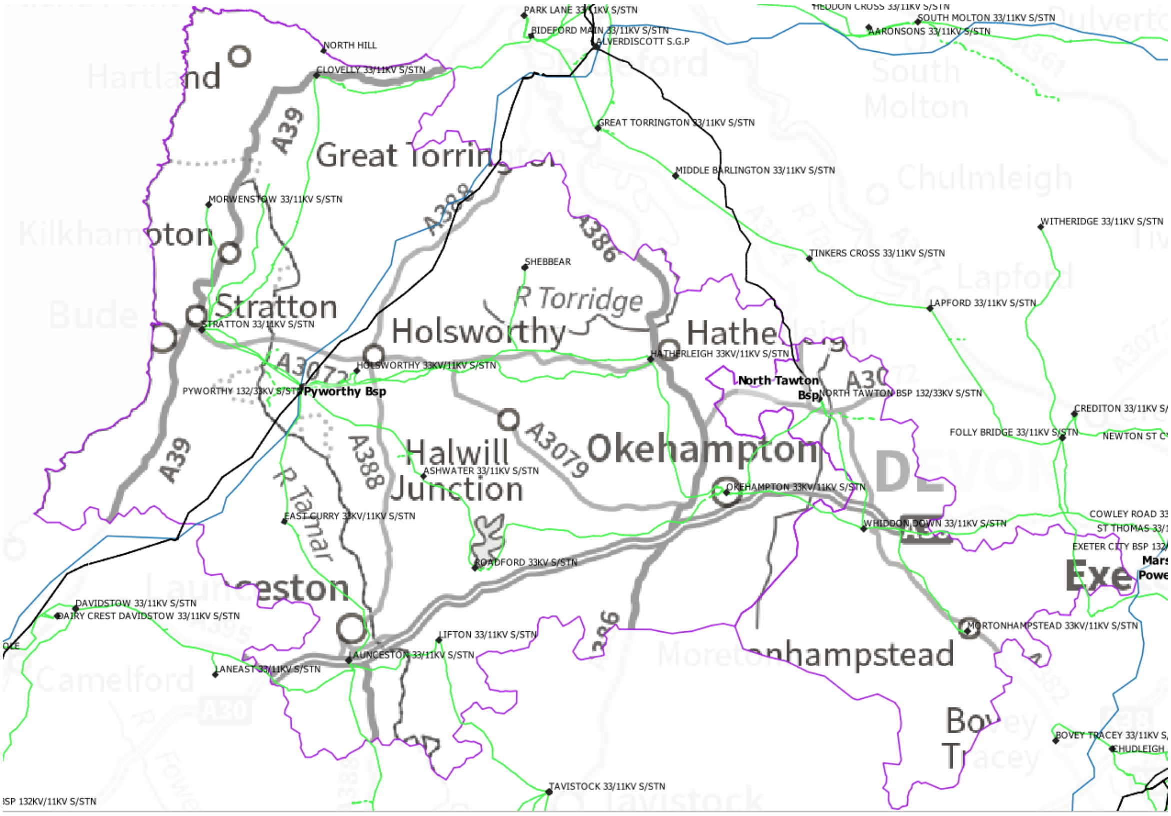

Figure 1.1 Pyworthy and North Tawton BSPs geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon associated with the 33/11 kV transformers, 33 kV circuits and 132/33 kV transformers which supply and are supplied by Pywoehty and North Tawton BSP. This uses the methodology outlined in the Network Development Plan Methodology Report with Network Operability Modelling applied as outlined below.

For the purposes of this analysis the NGED Best View Distribution Future Energy Scenario (DFES) has been used to study the years 2022 (baseline), 2028 and 2034, with consideration given to how proposals could change under the other scenarios. Five representative days have been studied across the four seasons: Winter Peak Demand, Intermediate Warm Peak Demand, Intermediate Cool Peak Demand, Summer Peak Demand and Summer Peak Generation.

1.1 Network Topology

The Pyworhty BSP network is arranged as follows:

- GT2, GT3 and GT4 currently run in parallel supplying Pyworthy BSP's three busbars, GT1 at North Tawton runs in parallel with Pyworthy BSP.
- Stratton is on transformer feeds from Pyworthy's Main 2 and Main 3. From the busbars at Stratton there is a generator connected to one side and a circuit off to another which

connects to Morwenstow and then follows to Clovelly on an autochangeover to East Yelland with two generators on the way.

- East Curry is a Single Transformer Primary connecting to Main 4 at Pyworthy it then follows to Launceston through a generator. Launceston is a two transformer primary with interconnection to Landulph and St Tudy BSP.
- There are two generators directly connected at Main 4 and two other generators connecting at Main 3.
- There are three circuit towards North Tawton.
    - The first goes through Ashwater Single Transformer Primary towards Okehampton and has four generators on that branch.
    - Second circuit feeds one of the sides of Holsworthy towards Hatherleigh with two generators on the way. Hatherleigh primary then has a circuit connecting to Okehampton primary.
    - Third circuit goes towards Shebbear Single Transformer Primary through. Then it follows to Hatherleigh primary passing by a generator.

North Tawton BSP network is arranged as follows:

- North Tawton Primary connects to North Tawton on transformer feeders with a generator coming off one of the busbars.
- There are two circuits connecting towards Okehampton primary one of them passing by Whiddon Down primary in a ring configuration.
- Mortenhampstead Single Transformer Primary connects to one of the busbars at Whiddon Down Primary. This then has interconnection to Exeter City BSP.

1.2 Network Operability Modelling

The following network automation and manual switching schemes have been modelled in the analysis of this area, aligning to how the network is currently operated, as well as proposed actions, to manage some constraints identified operationally.

- Clovelly Autochangeover has been modelled when infeed lost Clovelly gets put onto East Yelland.
- Launceston autochangeover which moves Launceston onto Landulph BSP.
- Various winter arranged outages not permitted due to SCO overloads.
- Various SCO overloads solved by network reconfiguration for arranged outages.
- For the loss of an infeed to a transformer at any of the Primary substations fed from North Tawton BSP under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.

2. Summary of Network Constraints

The following constraints were identified for the Best View Scenario, for which mitigation options will be discussed:

- Hatherleigh Primary Transformer capacity
- Shebbear Single Transformer Primary capacity
- Hatherleigh, Holsworthy and Pyworthy 33 kV ring capacity
- North Tawton Grid Transformer capacity
- North Tawton to Okehampton circuit capacity
- Stratton Primary Transformer and circuits capacity
- Launceston Primary Transformer and circuits capacity

3. Network Constraint Details and Solution Options

3.1 Hatherleigh Primary Transformer capacity

Constraint Overview

Generation | **Demand**

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at winter peak demand.

Table 3.1.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First studied year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Hatherleigh primary transformer capacity	Loss of one transformer	None	Baseline	Baseline	Baseline	Baseline

Uncertainty under other Distribution Future Energy Scenarios: As this constraint occurs under baseline, there is no uncertainty about future forecasts. There is a risk that demand reduces, however this is not forecast under any scenario so mitigation against this constraint is definitely required.

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.1.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Replace existing units with 7.5/15 MVA units	✓	✓	✓	Viable
Operational Mitigation					
2	Transfer demand to other Primary substations	✓	×	✓	Discounted
Load Management Schemes					
3	Post-fault transfers	×	×	×	Discounted
Flexibility services					
4	Procure flexibility	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full cost benefit analysis (CBA). This CBA will be subsequently carried out by the Distribution Network Operator (DNO) to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the Distribution System Operator (DSO) as part of the Distribution Network Options Assessment (DNOA) process.

Option 0 – No Intervention

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above. This would lead to an inability to meet the Security of Supply requirements of Engineering Recommendation P2 for Hatherleigh Primary.

New limiting factor for constraint(s) considered: N/A

Option 1 – Replace existing units with 7.5/15 MVA units

Capacity Released for constraint(s) considered: 7 MVA — Viable

Detailed description: Reinforce existing transformers with large 7.5/15 MVA transformers. As it is a remote area and predicted growth is low there is a reduced need for larger transformers. This will also have an asset replacement driver as transformers are 62 and 59 years old.

New limiting factor for constraint(s) considered: New primary transformers.

Option 2 – Transfer demand to other Primary substations

Capacity released for constraint(s) considered: 0 MVA — Discounted

Detailed description: Another option to deload Hatherleigh could be transferring demand through the 11 kV to other primary substations. The limitations here would be the distance of the circuits which may mean lower voltages at the end of the 11 kV circuits. If this option is chosen 11 kV reinforcement may also be required.

New limiting factor for constraint(s) considered: Capacity of two existing circuits for FCO.

Option 3 – Post-fault transfers

Capacity Released for constraint(s) considered: 0 MVA — Discounted

Detailed description: Post fault transfers cannot be utilised as the overload is beyond post-fault ratings meaning there is no window to reduce the load on the 33 kV circuits through load management.

New limiting factor for constraint(s) considered: N/A

Option 4 – Procure flexibility

Estimated Flexibility Required (MVA): 1 MVA+ — Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads. This could defer reinforcement.

Solution Recommendation

It is recommended to procure flexibility at Hatherleigh Primary to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

To facilitate longer term growth it is likely that new 7.5/15 MVA transformers will be needed this goes alongside the asset replacement strategy due to transformer ages being of 59 and 62 years old.

3.2 Shebbear Single Transformer Primary capacity

Generation | Demand

Constraint Overview

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at winter peak demand.

Table 3.2.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First studied year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Holsworthy primary transformer capacity	Loss of one transformer	None	2031	2032	2034	2032

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2027 and under falling short is it predicted to arise in 2031.

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.2.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Replace existing units with 7.5/15 MVA units	✓	✓	✓	Viable
2	New circuit and 7.5/15 MVA transformer	✓	✓	×	Discounted
3	Reinforce 11 kV backfeed	✓	×	✓	Viable
Operational Mitigation					
4	Transfer demand to other Primary substations	✓	×	✓	Discounted
Load Management Schemes					
5	ANM	×	×	×	Viable
Flexibility services					
6	Procure flexibility	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No Intervention

Capacity Released for constraint(s) considered: 0 MVA — Discounted

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above. This would lead to an inability to meet the Security of Supply requirements of Engineering Recommendation P2 for Shebbear Single Transformer Primary.

New limiting factor for constraint(s) considered: N/A

Option 1 – Replace existing units with 7.5/15 MVA units

Capacity Released for constraint(s) considered: 8 MVA — Viable

Detailed description: Reinforce existing transformer with larger 7.5/15 MVA transformer. Shebbear would also need option 3 to be carried out as only increasing capacity and backfeed capacity at the same time it would increase capacity by 8 MVA. According to the Best View this will only be required in 2040.

New limiting factor for constraint(s) considered: New primary transformer.

Option 2 – New circuit and 7.5/15 MVA transformer

Capacity released for constraint(s) considered: 8 MVA — Discounted

Detailed description: This option involves having another circuit to Shebbear from the Pyworthy to Hatherleigh circuit. For the amount of circuit needed and uncertainties about load growth, Option 3 may be best for now. A new circuit could be an option considered in the longer term.

New limiting factor for constraint(s) considered: New primary and circuit capacity.

Option 3 – Reinforce 11 kV backfeed

Capacity Released for constraint(s) considered: 2 MVA Viable

Detailed description: By reinforcing the 11 kV Shebbear will have enough capacity to reach the 2040s on the demand side. The solar potential in the area is very high which may mean large solar farms wanting to connect these could happen at 33 kV and if done at 11 kV they could have option 5 which is ANM.

New limiting factor for constraint(s) considered: N/A

Option 4 – Transfer demand to other Primary substations

Capacity Released for constraint(s) considered: 0 MVA Discounted

Detailed description: The reason for discounting transferring demand to other primaries is because it can only be done with 11kV reinforcement towards Hatherleigh or Holsworthy, even pontentially Great Torrington primary susbtations.

New limiting factor for constraint(s) considered: N/A

Option 5 – ANM

Capacity Released for constraint(s) considered: 0 MVA Viable

Detailed description: As the generation issue is larger than demand issues it is sensible to put the larger solar generators connecting to the 33 kV or have an ANM arrangement with them.

New limiting factor for constraint(s) considered: N/A

Option 6 – Procure flexibility

Estimated Flexibility Required (MVA): 1 MVA+ Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads. This could defer reinforcement.

Solution Recommendation

It is recommended to procure flexibility at Shebbear Primary to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

To facilitate longer term growth it is likely that 11 kV reinforcement will be needed to increase backfeed capacity and a new 7.5/15 MVA transformer will be needed in the 2040s. The new circuit may only be needed in the 2050s or even further along.

3.3 Hatherleigh, Holsworthy and Pyworthy 33 kV ring capacity

Constraint Overview

Generation | Demand

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at winter peak demand.

Table 3.3.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First studied year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Pyworthy 23L5 to Holsworthy circuit	Fault of the teed circuit between Shebbear and Hoslworthy	None	2030	2030	2031	Baseline
Holsworthy to Hatherleigh circuit	Arranged outage of North Tawton infeed	None	2032	2032	2033	2034
Pyworthy 46L5 to Holsworthy circuit mainly to Chasty Tee	Fault of the Pyworthy 23L5 to Holsworthy circuit	None	2030	2031	2031	Baseline

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2027 and under falling short is it predicted to arise in 2029.

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.3.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Reinforce existing 33 kV circuits	✓	✓	✓	Viable
2	Install additional 33 kV circuits	✓	✓	×	Viable
3	Reinforce 11 kV circuits to transfer demand to other Primaries	×	×	×	Discounted
Operational Mitigation					
4	Transfer demand to other Primary substations	×	×	×	Discounted
Load Management Schemes					
5	ANM	✓	×	✓	Viable
Flexibility services					
6	Procure flexibility at Shebbear, Holsworthy and Hatherleigh Primary substations	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No Intervention

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above. This would lead to an inability to meet the Security of Supply requirements of Engineering Recommendation P2 for Hatherleigh and Holsworthy primary substations.

New limiting factor for constraint(s) considered: N/A

Option 1 – Reinforce existing 33 kV circuits

Capacity Released for constraint(s) considered: 15 MVA

Viable

Detailed description: All of the sections (about 6 km) that can have the three primaries fed from it will need to be reinforced to 200 mm² All Aluminium Alloy Conductor (AAAC) capable of operating at 75° C or similar by 2030. This is mostly the circuits above.

The 23 km circuit between Holsworthy and Hatherleigh may only need to be reprofiled to be capable to operating to 75° C. Reinforcement may be needed in the late 2030s.

New limiting factor for constraint(s) considered: Reinforced circuits new capacity

Option 2 – Install additional 33 kV circuits

Capacity released for constraint(s) considered: 23 MVA **Viable**

Detailed description: Installing additional 33 kV circuits to take Holsworthy Primary substation off the ring would buy the most capacity. This is only going to be needed in the 2040s and could avoid the reprofiling of the circuit between Hatherleigh and Holsworthy proposed in Option 1.

New limiting factor for constraint(s) considered: New circuit capacity

Option 3 – Reinforce 11 kV circuits to transfer demand to other Primaries

Capacity Released for constraint(s) considered: 0 MVA **Discounted**

Detailed description: The ring is geographically isolated and load growth is relatively high to transfer out of the group.

New limiting factor for constraint(s) considered: N/A

Option 4 – Transfer demand to other Primaries

Capacity Released for constraint(s) considered: 0 MVA **Discounted**

Detailed description: As there are no primary substations nearby to Shebbear, Hateherleigh and Holsworthy supplied by different 33 kV circuits there are no options to reduce load on the circuits supplying the ring.

New limiting factor for constraint(s) considered: N/A

Option 5 – ANM

Capacity Released for constraint(s) considered: 0 MVA **Viable**

Detailed description: Continue using ANM for connected generators and consider using it for future connections to manage over commitment on the network.

New limiting factor for constraint(s) considered: N/A

Option 6 – Procure flexibility at Shebbear, Holsworthy and Hatherleigh Primary substations

Estimated Flexibility Required (MVA): 3 MVA+ **Viable**

Detailed description: Flexibility services could be procured at Shebbear, Holsworthy and Hatherleigh to alleviate projected overloads.

Solution Recommendation

It may be possible to procure flexibility at Shebbear, Holsworthy and Hatherleigh Primary substations to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

However, longer term there is a need to reinforcing the 33 kV circuits that for some outages will need to fully support the three primaries in full, meaning subject to a cost benefit analysis this is likely to be the most cost-effective option. In a very long term additional 33 kV circuits will be needed to take out Holsworthy from the ring.

3.4 North Tawton Grid Transformer capacity

Constraint Overview

Generation | Demand

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at winter peak demand.

Table 3.4.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First studied year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
North Tawton GT capacity	Arranged of Pyworhty BSP Main 3	None	2034	-	-	2028

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2028 and under falling short is it predicted to arise in 2028.

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.4.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Second transformer and circuit	✓	✓	×	Discounted
2	Enable cyclic ratings	✓	✓	✓	Viable
3	Reinforce 33 kV circuits to transfer demand to other BSPs	×	×	×	Discounted
Operational Mitigation					
4	Transfer demand to other BSPs	×	×	×	Discounted
Load Management Schemes					
5	ANM	×	×	×	Viable
Flexibility services					
6	Procure flexibility at North Tawton BSP	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full cost benefit analysis (CBA). This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the Distribution Network Options Assessment (DNOA) process.

Option 0 – No Intervention

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above. This would lead to an inability to meet the Security of Supply requirements of Engineering Recommendation P2 for North Tawton BSP.

New limiting factor for constraint(s) considered: N/A

Option 1 – Second transformer and circuit

Capacity Released for constraint(s) considered: 60 MVA — Discounted

Detailed description: Second transformer will eventually be needed potentially late 2030s, for now option 2 will be enough to enable cyclic ratings. This option would involve building a 30 km 132 kV circuit between Alverdiscott and North Tawton and a new 40/60 MVA 132/33 kV transformer.

New limiting factor for constraint(s) considered: New circuit and transformer capacity

Option 2 – Enable cyclic ratings

Capacity released for constraint(s) considered: 18 MVA — Viable

Detailed description: Uprate the existing transformers via use of cyclic ratings in accordance with British Standard 171/IEC60076 and NGED Standard Technique SD8C. This requires a capability assessment of all ancillaries, such as busbars, isolators, CTs, cables (including cabling within the substation), switchgear, tap changer, transformer bushings, conservator and earthing transformer. In addition, an assessment of the cyclic profile of the load is required to determine if transformer temperature and ageing is within acceptable limits.

New limiting factor for constraint(s) considered: Cyclic rating capacity

Option 3 – Reinforce 33 kV circuits to transfer demand to other BSPs

Capacity Released for constraint(s) considered: 0 MVA — Discounted

Detailed description: Reinforcing or building new circuits between Okehampton and Hatherleigh could alleviate the constraints if Okehampton could be moved to Pyworthy for the above arranged outages. Due to the capacity issues at Pyworthy and lengthy circuits/voltage issues this option was discounted.

New limiting factor for constraint(s) considered: N/A

Option 4 – Transfer demand to other BSPs

Capacity Released for constraint(s) considered: 0 MVA — Discounted

Detailed description: Not possible without extensive reinforcement outlined in Option3.

New limiting factor for constraint(s) considered: N/A

Option 5 – ANM

Capacity Released for constraint(s) considered: 0 MVA — Viable

Detailed description: Continue using ANM for connected generators and consider using it for future connections to manage over commitment on the network. Generation issues start from 2028.

New limiting factor for constraint(s) considered: N/A

Option 6 – Procure flexibility at North Tawton BSP

Estimated Flexibility Required (MVA): 1 MVA+ — Viable

Detailed description: Flexibility services could be procured at North Tawton BSP to alleviate projected overloads.

Solution Recommendation

It may be possible to procure flexibility at North Tawton BSP to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process. By using ANM, generation constraints can be reduced to a manageable level.

However, longer term there is a need to enable cyclic ratings which will happen in the mid-2030s and in the 2040s the new circuit and 132/33 kV transformer will be needed.

3.5 North Tawton to Okehampton circuit capacity

Generation | **Demand**

Constraint Overview

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at winter peak demand.

Table 3.5.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First studied year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Okehampton to Whiddon Down circuit capacity	Pyworhty Main 3 outage	Fault of Okehampton Main 2	2030	2029	2031	2032
Whiddon Down to North Tawton circuit capacity	Pyworhty Main 3 outage	Fault of Okehampton Main 2	-	2034	-	-

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2029 and under falling short is it predicted to arise in 2031.

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.5.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Reinforce existing 33 kV circuits	✓	✓	✓	Viable
2	Install additional 33 kV circuits	✓	✓	×	Discounted
3	Reinforce 11 kV circuits to transfer demand to other Primaries	×	×	×	Discounted
Operational Mitigation					
4	Transfer demand to other Primary substations	×	×	×	Discounted
Load Management Schemes					
5	Post-fault transfers	×	×	×	Discounted
Flexibility services					
6	Procure flexibility at North Tawton BSP and Ashwater STP	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No Intervention

Capacity Released for constraint(s) considered: 0 MVA **Discounted**

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above. This would lead to an inability to meet the Security of Supply requirements of Engineering Recommendation P2 for Okehampton and Ashwater primary substations.

New limiting factor for constraint(s) considered: N/A

Option 1 – Reinforce existing 33 kV circuits

Capacity Released for constraint(s) considered: 14 MVA **Viable**

Detailed description: Replace 300 metres of cable with 240 mm^2 Cu. The overhead line section which is over 9 km long will need to be replaced with 150 mm^2 AAAC or equivalent capable of operating at 75° C. This links well if the second 132 kV circuit to North Tawton and transformer get built as it will help get more power into or out of the Okehampton ring.

In the mid-2030s Whiddon Down to North Tawton would need to be reprofiled to be operated at 75°C.

New limiting factor for constraint(s) considered: Reinforced circuits new capacity

Option 2 – Install additional 33 kV circuits

Capacity released for constraint(s) considered: 14 MVA **Discounted**

Detailed description: Installing additional 33 kV circuits would probably make sense having another circuit directly between North Tawton and Okehampton or a 33 kV circuit between Whiddon Down and North Tawton which allow more flexibility for the second circuit outage. It was discounted as reconductoring can be done on existing circuits adding substantial capacity.

New limiting factor for constraint(s) considered: New circuit capacity

Option 3 – Reinforce 11 kV circuits to transfer demand to other Primaries

Capacity Released for constraint(s) considered: 0 MVA **Discounted**

Detailed description: The ring is geographically isolated and load growth is relatively high to transfer out of the group.

New limiting factor for constraint(s) considered: N/A

Option 4 – Transfer demand to other Primaries

Capacity Released for constraint(s) considered: 0 MVA **Discounted**

Detailed description: As there are no primary substations near North Tawton there are no options to reduce load on the circuits supplying the ring.

New limiting factor for constraint(s) considered: N/A

Option 5 – Post-fault transfers

Capacity Released for constraint(s) considered: 0 MVA **Discounted**

Detailed description: Post fault transfers would not meet security of supply standards.

New limiting factor for constraint(s) considered: N/A

Option 6 – Procure flexibility at North Tawton BSP and Ashwater STP

Estimated Flexibility Required (MVA): 3 MVA+ **Viable**

Detailed description: Flexibility services could be procured at North Tawton BSP and Ashwater STP to alleviate projected overloads.

Solution Recommendation

It may be possible to procure flexibility at North Tawton BSP and Ashwater STP to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

However, longer term there is a need to reinforcing the 33 kV circuits between Whiddon Down and Okehampton the cable to 240 mm^2 Cu and overhead line to 150 mm^2 AAAC operating at 75° C. In the mid-2030s Whiddon Down to North Tawton circuit will need to be reprofiled to operate at 75° C.

3.6 Stratton Primary Transformer and circuits capacity

Constraint Overview

Generation Demand

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at winter peak demand.

Table 3.6.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First studied year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Stratton Primary transformer capacity	Loss of one transformer	None	2033	2034	-	-
Pyworthy 34L5 to Stratton 2L5 circuit	Loss of the other circuit between Pyworthy and Stratton	None	2031	2032	2033	2033
Pyworthy 27L5 to Stratton 1L5 circuit	Loss of the other circuit between Pyworthy and Stratton	None	2031	2032	2033	2033

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2030 and under falling short is it predicted to arise in 2040.

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.6.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Replace existing units with 20/40 MVA units and build new circuit to the first generator between Clovelly and Stratton from Pyworthy	✓	×	✓	Viable
2	Build new circuit to the first generator between Clovelly and Stratton from Pyworthy and then to Morwenstow, add second 12/24 MVA transformer at Morwenstow	✓	✓	✓	Viable
Operational Mitigation					
3	Transfer demand to other Primary substations	✓	×	✓	Discounted
Load Management Schemes					
4	Post-fault transfers	×	×	×	Discounted
Flexibility services					
5	Procure flexibility	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No Intervention

Capacity Released for constraint(s) considered: 0 MVA Discounted

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above. This would lead to an inability to meet the Security of Supply requirements of Engineering Recommendation P2 for Morwenstow, Clovelly and Stratton Primary substations.

New limiting factor for constraint(s) considered: N/A

Option 1 – Replace existing units with 20/40 MVA units and build new circuit to the first generator between Clovelly and Stratton from Pyworthy

Capacity Released for constraint(s) considered: 15 MVA **Viable**

Detailed description: Reinforce existing transformers with larger 20/40 MVA transformers. A new circuit into the ring will be needed as circuit capacity would be reached. Reprofiling would be needed from 2031 and it would delay the need for the circuit for three years. At or around 2034 a new circuit from Pyworthy to the circuit between Stratton and Clovelly will be needed to support the ring Figure 2 shows a sketch of where the circuit would be. This circuit would need to be 200 mm^2 AAAC or equivalent and it would be about 8 km.

If such a long circuit is chosen option 2 may also be considered as it would release some capacity from Morwenstow which would alleviate Stratton.

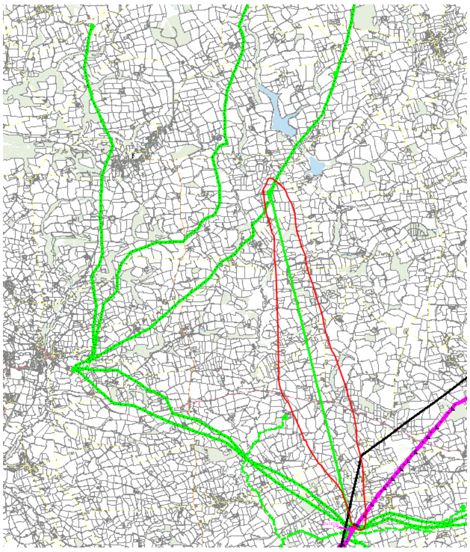

Figure 2 – Circuit between Pyworthy and a point in between Stratton and Clovelly

New limiting factor for constraint(s) considered: New primary transformers and circuits.

Option 2 – Build new circuit to the first generator between Clovelly and Stratton from Pyworthy and then to Morwenstow, add second 12/24 MVA transformer at Morwenstow

Capacity released for constraint(s) considered: 17 MVA

Viable

Detailed description: This option is similar to option 1 but instead of reinforcing Stratton it reinforces Morwenstow by adding another 12/24 MVA unit to the site. This would need an extra 5 km of 150 mm^2 AAAC or equivalent compared with option 1. Figure 3 shows a potential route for the circuit that uses exisiting circuits. The additional capacity created would support the group for a long period of time.

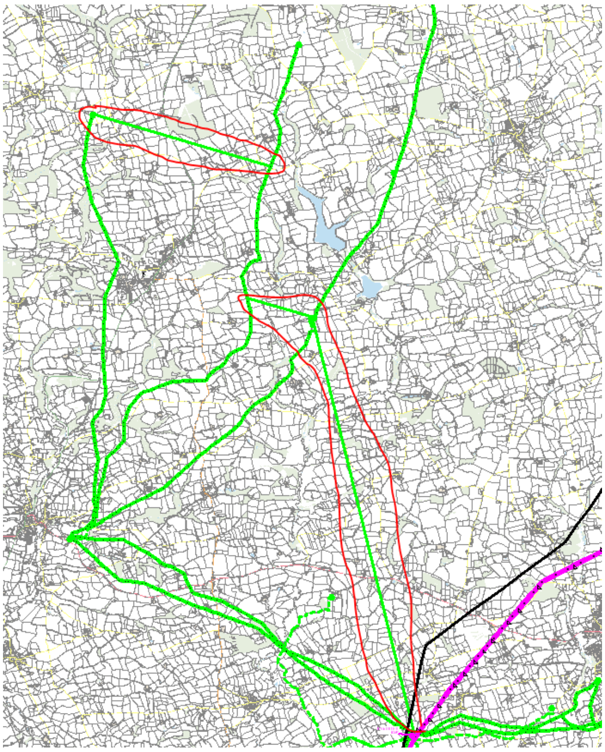

Figure 3 - Circuits from Pyworthy BSP to Morwenstow primary

New limiting factor for constraint(s) considered: Capacity of new circuit and new transformer.

Option 3 – Post-fault transfers

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Post fault transfers cannot be utilised as the overload is beyond post-fault ratings meaning there is no window to reduce the load on the 33 kV circuits through load management.

New limiting factor for constraint(s) considered: N/A

Option 4 – Procure flexibility

Estimated Flexibility Required (MVA): 1 MVA+

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads. This could defer reinforcement.

Solution Recommendation

It is recommended to procure flexibility at Morwenstow, Clovelly and Stratton Primary substations to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

To facilitate longer term growth reprofiling of the circuits between Pyworhty and Stratton Primary substation will be needed to be able to operate at 75° C. It is likely that a new 12/24 MVA transformer at Morwenstow will be needed this goes alongside with 8 km of 200 mm^2 AAAC or equivalent and 5 km of 150 mm^2 AAAC or equivalent of 33 kV circuits.

3.7 Launceston Primary Transformer and circuits capacity

Constraint Overview

Generation | Demand

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at winter peak demand.

Table 3.7.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First studied year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Launceston Primary transformer capacity	Loss of one transformer	None	2034	-	-	-
East Curry 1L3 to Pyworthy Main 4	Loss of the other circuit between Pyworthy and Stratton	None	2031	2032	2033	2033
Lifton to Launceston circuit	Arranged outage of Callington 4L3 to Launceston 4L3	Fault of the single infeed to Launceston from Pyworthy	Baseline	Baseline	Baseline	Baseline
Low volts at Lifton and 3 3kV customer	Fault of Callington Main 2	None	Baseline	Baseline	Baseline	Baseline

Uncertainty under other Distribution Future Energy Scenarios: As this constraint occurs under baseline, there is no uncertainty about future forecasts. There is a risk that demand reduces, however this is not forecast under any scenario so mitigation against this constraint is definitely required.

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.7.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Reinforce 33 kV circuit between East Curry and Pyworthy with 200 mm^2 AAAC or equivalent and reprofile circuit between Pyworthy and Launceston to be able to operate at 75° C	✓	✓	✓	Viable
2	New trident line running at 33 kV between Pyworthy and Launceston	✓	✓	✓	Viable
3	33 kV circuit between Lifton and the existing circuit as a tee-off	✓	✓	✓	Viable
4	Install a Capacitor bank at Lifton	✓	✓	✓	Viable
Operational Mitigation					
5	Transfer demand to other Primary substations	×	×	✓	Discounted
Load Management Schemes					
6	Post-fault transfers	×	×	×	Discounted
Flexibility services					
7	Procure flexibility	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No Intervention

Capacity Released for constraint(s) considered: 0 MVA **Discounted**

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above. This would lead to an inability to meet the Security of Supply requirements of Engineering Recommendation P2 for East Curry, Lifton and Launceston Primary substations.

New limiting factor for constraint(s) considered: N/A

Option 1 – Reinforce 33 kV circuit between East Curry and Pyworthy with 200 mm2 AAAC or equivalent and reprofile circuit between Pyworthy and Launceston to be able to operate at 75° C

Capacity Released for constraint(s) considered: 18 MVA **Viable**

Detailed description: Option 1 consists in reinforcing the East Curry to Pyworthy 10 km section with 200 mm^2 AAAC or equivalent. The remaining sections, about 13 km, between Pyworthy and Launceston will need to be reprofiled to be able to operate at 75° C. This option would be required from the early 2030s.

New limiting factor for constraint(s) considered: Capacity of new circuits.

Option 2 – New trident line running at 33 kV between Pyworthy and Launceston

Capacity released for constraint(s) considered: 18 MVA **Viable**

Detailed description: Option 1 will be required if it takes longer than option 2 to be built. Option 2 requires the build of a trident line running at 33 kV with 200 mm^2 AAAC Poplar. The decision to go for a trident line is due to Launceston being a large demand centre and the high growth in the area. There are limited 33 kV interconnection with very long circuits to Landulph, St Tudy or Pyworhty BSPs.

By building a 33 kV line with trident line it will not stagnate the network if the circuit needs to change voltage. This would enable the creation of a BSP if the load materialises in the later 2030s or even 2040s.

This option would allow to transfer Lifton Primary over to Pyworty deloading the Callington ring and fixing the voltage issue at a 33 kV customer site.

New limiting factor for constraint(s) considered: Capacity of new circuit.

Option 3 – 33 kV circuit between Lifton and the existing circuit as a tee-off

Capacity Released for constraint(s) considered: 0 MVA **Viable**

Detailed description: A 33 kV circuit between the existing circuit East Curry/Launceston and Lifton Main 1 busbar which is about 5 km of distance. This would improve the volts especially if it is built with 150 mm^2 AAAC. However, it would still need a capacitor bank at Lifton for the interim.

New limiting factor for constraint(s) considered: N/A

Option 4 – Install a Capacitor bank at Lifton

Capacity Released for constraint(s) considered: 0 MVA **Viable**

Detailed description: Installing a capacitor bank at Lifton would help reduce the risk of voltage depression. The size of the capacitor bank would have to be about 5 MVAr. It will only be needed during periods of higher demand for example winter.

New limiting factor for constraint(s) considered: N/A

Option 5 – Transfer demand to other Primary substations

Capacity Released for constraint(s) considered: 0 MVA **Discounted**

Detailed description: Not possible due to geographical isolation.

New limiting factor for constraint(s) considered: N/A

Option 6 – Post-fault transfers

Capacity Released for constraint(s) considered: 0 MVA **Discounted**

Detailed description: Post fault transfers cannot be utilised as the overload is beyond post-fault ratings meaning there is no window to reduce the load on the 33 kV circuits through load management.

New limiting factor for constraint(s) considered: N/A

Option 7 – Procure flexibility

Estimated Flexibility Required (MVA): 5 MVA+ **Viable**

Detailed description: Flexibility services could be procured to alleviate projected overloads. This could defer reinforcement.

Solution Recommendation

It is recommended to procure flexibility at Launceston, East Curry and Lifton Primary substations to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

To facilitate longer term growth reprofiling of the circuits between Pyworhty and Launcestn Primary substation will be needed to be able to operate at 75° C, the section between East Curry and Pyworhty will need reinforcing with 200 mm^2 AAAC. To maintain volts and avoid overloads a new 33 kV circuit Trident line running a 200 mm^2 AAAC Poplar conductor will be needed. In addition to the above a capacitor at Lifton will be needed. Into the 2040s a circuit between the existing 33 kV and Lifton will help give a more permanent feed from Pyworthy and help with voltage issues.

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