Camborne BSP

Network Development Report – South West

May 2024

Electricity Distribution

nationalgrid

Contents

Camborne BSP

1. Network Overview

Camborne Bulk Supply Point (BSP) supplies a mixture of rural and urban sections of 33 kV network, in West Cornwall. It is supplied from the A-route 132 kV circuit which is fed from Indian Queens Grid Supply Point (GSP), with one 60/90 MVA and one 45/90 MVA 132/33 kV grid transformers supplying the group. Camborne BSP supplies approximately 28,000 customers.

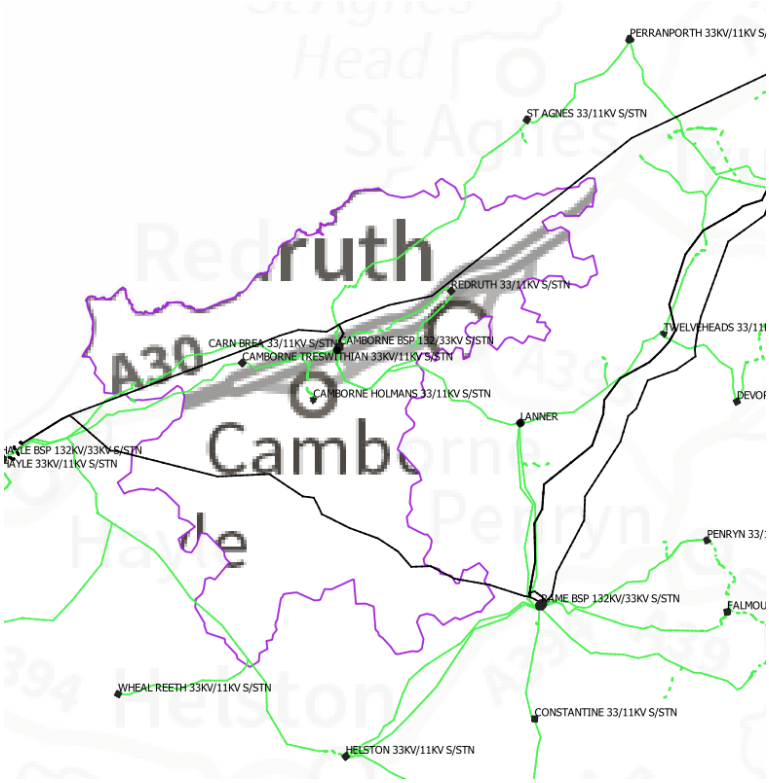

Figure 1.1 Camborne BSP geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon associated with the 33/11 kV transformers and 33 kV circuits which supply and are supplied by Camborne 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. The two most onerous half-hours have been studied for each of the five representative days considered: Winter Peak Demand, Intermediate Warm Peak Demand, Intermediate Cool Peak Demand, Summer Peak Demand and Summer Peak Generation.

1.1 Network Topology

The Camborne BSP network is arranged as follows:

- Carn Brea Primary is supplied via two transformer feeders.
- A 33 kV ring supplying Camborne Holmans, Camborne Treswithian, along with connections to two 33 kV connected generators and with 33 kV interconnection to Hayle BSP with normal open points on 11L5 & 12L5 at Hayle Switching Station.
- Redruth Primary is fed on its own via a 33kV ring
- A 33 kV circuit providing interconnection with Truro BSP with a tee-off to a 33 kV connected generator with the circuit being normally run open on circuit breaker 1S0 at St Agnes.

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.

- The 33 kV busbar running arrangement at Camborne is altered for a variety of circuit and busbar outages to maintain network integrity.
- Curtailment of 33 kV connected generators within the group are modelled are a variety of arranged outages, as outlined in customer connection agreements.

2. Summary of Network Constraints

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

- Camborne GT Capacity
- Camborne Treswithian Capacity
- Camborne Treswithian/Holman circuit capacity
- Redruth Primary and circuits Capacity

3. Network Constraint Details and Solution Options

3.1 Camborne GT 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 during outage period.

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

Constraint	N-1 Condition	Subsequent N-2 Condition	First year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Transformer capacity	Loss of one transformer	-	2031	2032	2034	2040

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2030 and under falling short it is 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 3.1.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	New GT and 33 kV board	✓	×	✓	Discounted
Operational Mitigation					
2	Transfer load away from the BSP	✓	✓	✓	Viable
3	New BSP	✓	✓	×	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 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 GTs going out of firm.

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

Option 1 – New GT and 33 kV board

Capacity Released for constraint(s) considered: 30 MVA **Discounted**

Detailed description: Adding a new GT will add some capacity on the Camborne area. However, it may be a bit too much as there will be extra GT capacity in neighbouring BSPs.

New limiting factor for constraint(s) considered: Circuit capacity.

Option 2 – Transfer load away from the BSP

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

Detailed description: Transferring load away from Camborne BSP can be achieved. Looking at the wider works there will be load shifted from Hayle BSP to future Penzance BSP this will mean extra capacity and probably Camborne Treswithian and Holman could be transferred away from Camborne BSP.

New limiting factor for constraint(s) considered: Hayle BSP capacity

Option 3 – New BSP

Capacity released for constraint(s) considered: 114 MVA **Discounted**

Detailed description: A new BSP in the area would help especially as part of the Hayle GT constraint. This would then alleviate Camborne GTs as explained in Option 2. A new BSP around Camborne is currently not needed in the area with the predicted level of growth.

New limiting factor for constraint(s) considered: New BSP capacity.

Option 4 – Post-fault transfers

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

Detailed description: This option would not be suitable due to it being a capacity issue.

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

Option 5 – Procure flexibility

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

Detailed description: Flexibility should be procured to delay the reinforcement and if continued may even stop the need for transferring demand away from Camborne BSP.

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

Solution Recommendation

It is recommended to carry out SD8C checks so transformers are able to fully use cyclic ratings. Reverse power flow ratings need to be checked and reassessed. Flexibility should then procured and if it is not enough to meet capacity load can be moved to neighbouring BSPs.

3.2 Camborne Treswithian 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 during outage period.

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

Constraint	N-1 Condition	Subsequent N-2 Condition	First year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
5 MVA Primary Transformer capacity	None (Intact)	-	Baseline	Baseline	Baseline	Baseline

Uncertainty under other Distribution Future Energy Scenarios: As this is a Baseline issue the uncertainty does not exist.

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 Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	**Discounted**
Reinforcement					
1	New 33kV 7.5/15MVA transformer	✓	✓	✓	**Viable**
2	Upgrading current transformer to 7.5/15MVA transformer	✓	✓	✓	**Viable**
Operational Mitigation					
3	Transfer 11kV demand to neighbouring primaries	×	×	✓	**Viable**
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 Camborne Treswithian continue to overload.

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

Option 1 – New 33kV 7.5/15MVA transformer

Viable

Capacity Released for constraint(s) considered: 14 MVA

Detailed description: The new 33kV transformer would be able to put on the existing bay with no major works needed. It would add instantly the capacity needed.

New limiting factor for constraint(s) considered: Backfeed capacity when current transformer retires

Option 2 – Upgrading current transformer to 7.5/15MVA transformer

Capacity Released for constraint(s) considered: 2.5 MVA

Viable

Detailed description: This option is similar to option 1 as even if it was replaced we would probably build it in position for T1 and then put T2 offline. This may be the preferred option until 2033 where the backfeed capacity is exceeded. The current transformer is from 1960 which means it may need to be replaced soon depending on condition, but it may be that two transformers in full may only be needed in 2033.

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

Option 3 – Transfer 11kV demand to neighbouring primaries

Capacity released for constraint(s) considered: 0 MVA

Viable

Detailed description: This option could work temporarily work but it would require further study from the Secondary Planning Team. Camborne Holmans has extra capacity until 2035 that could be used.

New limiting factor for constraint(s) considered: Capacity of existing primaries.

Option 4 – Post-fault transfers

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Post fault transfers is not the issue here.

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

Option 5 – Procure flexibility

Capacity Released for constraint(s) considered: 0MVA

Viable

Detailed description: Camborne Treswithian is a constraint area with flexibility being procured.

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

Solution Recommendation

It is recommended that Camborne Treswithian continue as Flexibility with reinforcement. With the reinforcement being a new 7.5/15 MVA transformer. The second transformer is only needed from 2033, which means the current transformer could stay in place depending on asset condition until then.

3.3 Camborne Treswithian/Holman circuit 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 during outage period.

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

Constraint	N-1 Condition	Subsequent N-2 Condition	First year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Camborne 2L5 to Hayle and Camborne 1L5 to Camborne Holman Primary	Loss of one circuit	None	2027	2027	2027	2027

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2024 and under falling short it is predicted to arise in 2032.

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 Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	**Discounted**
Reinforcement					
1	Uprate circuit sections to 185 mm^2 Copper (Underground) and 200 mm^2 AAAC (Overhead)	✓	✓	×	**Viable**
2	New 33 kV circuits to take Camborne Holman out of the ring	✓	✓	✓	**Viable**
Operational Mitigation					
3	Transfer Camborne Treswithian and Churchtown to Hayle	✓	×	✓	**Discounted (if Penzance BSP is built it will become viable)**
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 the circuits from Camborne BSP to Hayle being out of firm.

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

Option 1 – Uprate circuit sections to 185mm2 Copper (Underground) and 200mm2 AAAC (Overhead)

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

Detailed description: This option would alleviate the constraints in this ring and would allow the ring to not being out of firm until 2034. Protection and CTs would also need to be checked as they are limiting circuit capacity. The circuit section would consist of:

Between Camborne and Camborne Holmans:

- 700 m of 0.2 in² 50°C
- 350 m of 0.3 CU cable

Between Camborne and Hayle:

- 11 km of 0.2 in² 50°C

Between Hayle and Camborne Holmans:

- 400 m of 0.3 CU cable
- 10 km of 0.2 in² 50°C

All of the above may be needed at different stages depending how fast Penzance BSP is built. If circuits get close to firm the sections to Camborne BSP will need to be reinforced first. If Penzance gets delivered before the circuits are projected to overload only the sections to Hayle will need reconductoring.

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

Option 2 – New 33 kV circuits to take Camborne Holman out of the ring

Capacity Released for constraint(s) considered: 24 MVA

Viable

Detailed description: By adding two circuits from Camborne BSP into Camborne Holman it would alleviate the rest of the ring. This option will be too much for now but after 2034 may be needed.

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

Option 3 – Transfer Camborne Treswithian and Churchtown to Hayle

Capacity released for constraint(s) considered: 0 MVA

Discounted (if Penzance BSP is built it will become viable)

Detailed description: This option only becomes viable if Penzance BSP is built because it can use the released capacity at Hayle BSP.

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

Option 4 – Post-fault transfers

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Not applicable as problem is a first circuit outage.

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

Option 5 – Procure flexibility

Capacity Released for constraint(s) considered: 1+ MVA

Viable

Detailed description: Could alleviate the problem and it is already a flexibility zone.

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

Solution Recommendation

It is recommended that Camborne Holman/Trewithian primaries continue to be flexibility zones. The circuits will be out of firm in 2027 and will need to have protection and CTs changed with some sections of circuits overhead and underground needing replacement with 200 mm² AAAC and 185mm² HDC respectively.

3.4 Redruth Primary and circuits 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 during outage period.

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

Constraint	N-1 Condition	Subsequent N-2 Condition	First year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer

Redruth primary Transformers capacity	Loss of one transformer	-	2032	2033	2034	2035
Redruth Circuits' capacity	Loss of one circuit	-	2026	2026	2026	2026

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2026 and under falling short it is predicted to arise in 2026.

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 Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	New primary substation	✓	✓	✓	Viable
2	Replace existing primary transformers with 20/40 MVA units and respective circuits	✓	×	✓	Viable
3		✓	×	✓	Viable
Operational Mitigation					
4	Transfer demand away and reinforce the 11 kV	✓	×	✓	Viable
Load Management Schemes					
5	Post-fault transfers	×	×	×	Discounted
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 circuits being out of firm for a variety of conditions described above

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

Option 1 – New primary substation

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

Detailed description: The proposal is to use the circuit to a generator from Twelveheads 1L3 or use the non-committed circuit to Redruth and continue it to meet St Day Landfill to make a ring. There would be a need for a 12/24 MVA primary as there is high growth predicted in the area.

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

Option 2 – Replace existing primary transformers with 20/40 MVA units and respective circuits

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

Detailed description: Replacing with larger units and circuits will only add 15 MVA which will not be 2050 proof. If larger investment is needed it may be better to do it off a longer circuit and ring in to the generator from Twelvehaeds 1L3 and give a more reliable network which matches Option 1.

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

Option 3 – Transfer demand away and reinforce the 11 kV

Capacity released for constraint(s) considered: 0 MVA

Viable

Detailed description: With 11 kV reinforcement some demand could be transferred away to neighbouring rings. This would allow to defer the reinforcement need at 33 kV a couple of years, but due to growth in other areas it will be triggered.

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

Option 4 – Post-fault transfers

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: This is a first circuit outage problem, which means post-fault transfers are not an appropriate solution.

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

Option 5 – Procure flexibility

Capacity Released for constraint(s) considered: 1+ MVA

Viable

Detailed description: If flexibility could be procured in the area it could delay the need for reinforcement.

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

Solution Recommendation

It is recommended to build a new primary substation at or around the generator off Twelveheads 1L3 or closer to Redruth on the other side from the 33 kV customer to loop in the circuit into Camborne. Flexibility should be procured to defer the constraint if possible based on a CBA.

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