Hayle BSP

Network Development Report – South West

May 2024

Electricity Distribution

nationalgrid

Contents

Hayle BSP

1. Network Overview

Hayle Bulk Supply Point (BSP) supplies a sparse area of 33 kV network, in the most South Western part of Cornwall and the Isles of Scilly. It is supplied from two 132/33 kV Grid Transformers (GTs) at Hayle with two busbar sections at Hayle and another two at Penzance (which is a suitable location for a future BSP), where most of the circuits are fed from. Hayle BSP together supply approximately 43,000 customers.

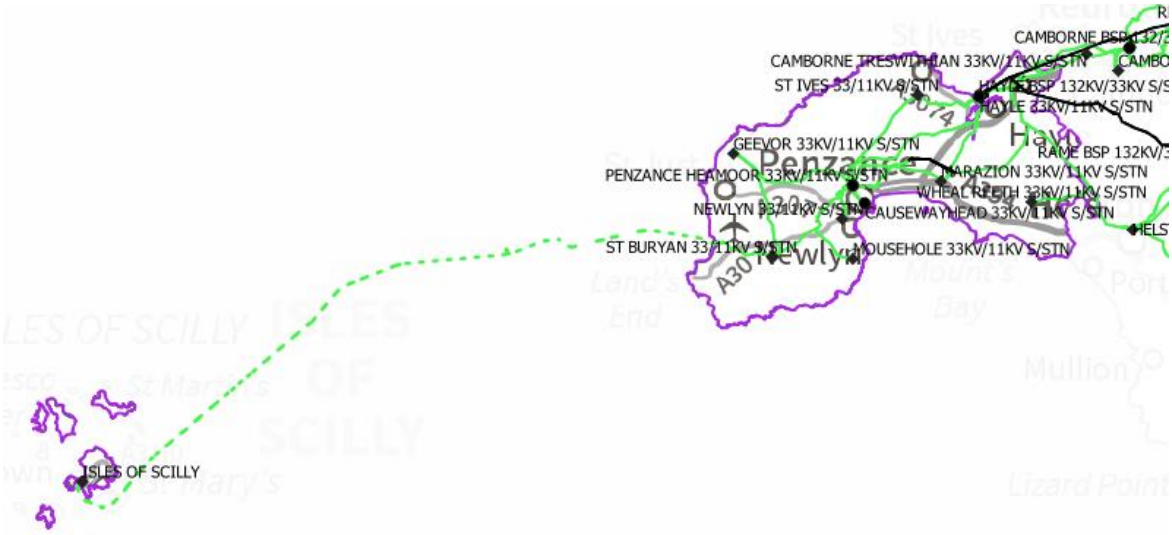

Figure 1.1 Hayle BSP geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon associated with the 132/33 kV transformers, 33/11 kV transformers and 33 kV circuits which supply and are supplied by Hayle 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 Hayle BSP network is arranged as follows:

- Hayle Local Primary is connected through Hayle switching station to Hayle BSP on different sections of busbar. Hayle switching station has two interconnectors with Camborne that are normally open.
- St Ives is a three transformer primary connected from GT1 at Hayle BSP to Main 1 at Penzance.
- Marazion Primary is connected to GT2 at Hayle BSP and to Main 2 and Main 1 at Penzance (due to the strong bond between Hayle BSP and Penzance). On the Hayle leg it has a tee off interconnector to Rame BSP.
- Penzance Heamoor Primary is connected two both sections of busbars at Penzance.
- Penzance Causeway is a single transformer primary connected to Main 1 at Penzance.
- Newlyn is a single transformer primary fed from Main 2 at Penzance and a tee off from the ring of Penzance.
- The ring off Penzance feeds four primaries:
- Mousehole being a single transformer primary.

- Isles of Scilly being a single transformer primary connected through a subsea cable.
- St Buryan and Geevor two transformer primaries ringed in.

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.

- Freewheel schemes for some of the primaries in the group.
- Splitting of rings for arranged outages to avoid network integrity issues for the next fault
- Transfer of Hayle Local and Marazion to Camborne and Rame BSPs respectively for a combination of arranged outages

2. Summary of Network Constraints

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

- Hayle GT capacity
- St Ives Transformers and Circuits Capacity
- Hayle Local Transformers capacity
- Hayle Penzance 33 kV circuit capacity
- Penzance 33 kV low volts
- Isles of Scilly Power Station end of life

3. Network Constraint Details and Solution Options

3.1 Hayle 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	-	2027	2027	2028	2032

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 2030.

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	Replace with larger 60/90 MVA units	✓	×	×	Viable
2	New BSP and associated new P line 132 kV circuits	✓	✓	×	Viable

Operational Mitigation					
3	Transfer primaries away from the BSP	×	×	×	**Discounted**
Load Management Schemes					
4	Post-fault transfers	×	×	×	**Discounted**
Flexibility services					
5	Procure flexibility at Hayle 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 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. The capacity of the site was calculated to be 60 MVA if only nameplate ratings used or if cyclic ratings used it could potentially go up to 78 MVA.

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

Option 1 – Replace with larger 60/90 MVA units

Capacity Released for constraint(s) considered: 40 MVA **Viable**

Detailed description: Replace the transformers with larger 60/90 MVA units. This would still leave the unresolved issue of the load centre being very far from the BSP which leads to very low volts on the Western side of Hayle network.

New limiting factor for constraint(s) considered: Voltage issues on the Western side of Hayle.

Option 2 – New BSP and associated new P line 132 kV circuits

Capacity Released for constraint(s) considered: 114 MVA **Viable**

Detailed description: New 132 kV circuits from Rame to Penzance passing through the double circuits towers (P-line) which currently carry some of the 33 kV cables. This is the preferred option as it would improve voltage levels around the Western most side of Hayle network and it would solve 33 kV interconnection overloads with the advantage of fixing the constraint identified here too.

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

Option 3 – Transfer primaries away from the BSP

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

Detailed description: Only Hayle and a bit of Marazion primaries could be transferred onto other BSPs. However, we would be shifting load into areas with their own problems exacerbating their problems. With 33 kV reinforcement and reactive compensation it would be possible, but not recommended.

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

Capacity Released for constraint(s) considered: 0 MVA

Viable

Detailed description: The need for flexibility will be around 2 MW in 2027 if nameplate rating used or 1 MW in 2031.

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

Solution Recommendation

It is recommended to carry out SD8C checks to uprate transformers to fully use cyclic ratings. Building the new 132 kV circuits and BSP at Penzance will be the option to go for as it solves the current constraint and others. It is the most expensive option which has more risks of delivery. However, due to Penzance being the furthest away from any GSP in our licence areas it does suffer from low voltage which can be solved by 132 kV closer to the load source. Connecting it to the Rame Camborne new cable could potentially add resilience to the network as the size of the cable will be enough to handle the extra load from Penzance.

3.2 St Ives Transformers 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 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
Transformer and circuit overload	Loss of the middle busbar	None	Baseline	Baseline	Baseline	Baseline
Penzance to St Ives 33 kV interconnector capacity	Loss of Main 2 Penzance busbar	Fault of Hayle 5L5 to Penzance 7L5	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	Rationalise network to two transformers	✓	✓	×	Viable
2	Replace two outer transformers with larger units	✓	✓	×	Discounted
3	Reinforce 11 kV circuits to transfer demand to other Primaries	✓	×	×	Discounted
Operational Mitigation					
4	Split St Ives on the 11 kV	✓	×	✓	Discounted
Load Management Schemes					
5	Post-fault transfers	×	×	×	Discounted
Flexibility services					
6	Procure flexibility	✓	×	✓	Discounted

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.

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

Option 1 – Rationalise network to two transformers

Capacity Released for constraint(s) considered: 12 MVA

Viable

Detailed description: This option suggests replacing the three transformers with two 12/24 MVA transformers. This should include removing one of the 33 kV circuit breakers so if one of the circuit disconnects the site is not left as an interconnector through the 11 kV between Penzance and Hayle..

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

Option 2 – Replace two outer transformers with larger units

Capacity Released for constraint(s) considered: 23 MVA

Discounted

Detailed description: This option was discounted due to the interconnection still remaining through the 11 kV and not having enough capacity in the other circuits to maintain it. As there are only two busbars we would need a third section on both sites which would add extreme complexity and potentially affect safety.

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

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

Capacity released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Reinforcing the 11 kV may have its own issues as primaries are very far a part in Cornwall, which means potential voltage issues or moving capacity issues around.

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

Option 4 – Split St Ives on the 11 kV

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: This option would stop the overload of the Transformers but put customers at single circuit risk with a potential way of transferring on the 11 kV.

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

Option 5 – Post-fault transfers

Capacity Released for constraint(s) considered: 0MVA

Discounted

Detailed description: Not applicable in this area.

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

Option 6 – Procure flexibility

Capacity Released for constraint(s) considered: 5 MVA

Discounted

Detailed description: Flexibility would need to be procured across St Ives and the Western part of Hayle or anything downstream of Penzance.

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

Solution Recommendation

It is recommended that St Ives gets split on the 11 kV to avoid 11 kV through flows. Once that is done and there is a need for larger transformers St Ives transformers can be rationalised to two 12/24 MVA units and take out one of the 33 kV circuit breakers to allow for the interconnecting circuit to not through flow past the 11 kV on a FCO. This should be done with a possible permanent transfer to Hayle BSP in the future. If the current running arrangement is maintained care will need to be taken with the ratings of the switchgear mainly St Ives 2L4, 4S4, 1S0, 2S0 and 1L3.

3.3 Hayle Local Transformers 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
Transformer overload	Loss of one transformer	None	2032	2033	2031	2032

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2029 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 3.3.2 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	New primary with 12/24 MVA transformers South of Hayle BSP	✓	✓	×	**Viable**
2	Replace with larger 20/40 MVA units	✓	✓	×	**Discounted**
3	Reinforce 11 kV circuits to transfer demand to other Primaries	✓	×	×	**Discounted**
Operational Mitigation					
4	Transfer demand to other sites	✓	×	✓	**Discounted**
Load Management Schemes					
5	Post-fault transfers	×	×	×	**Discounted**
Flexibility services					
6	Procure flexibility	✓	×	✓	**Discounted**

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.

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

Option 1 – New primary with 12/24 MVA transformers South East from Hayle BSP

Capacity Released for constraint(s) considered: 23 MVA

Viable

Detailed description: This is probably the most sensible option due to the growth around Hayle being past the Harbour and on the South side. 33 kV circuits would have to potentially need to go around to effectively get a primary in the heart of the load centre. This will go well with the future idea of having a Hayle and Penzance BSPs.

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

Option 2 – Replace with larger 20/40 MVA units

Capacity Released for constraint(s) considered: 23 MVA

Discounted

Detailed description: This option creates a lump of capacity which is not ideal for places where load will be partially localised and spread around the town.

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

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

Capacity released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Not ideal as any primary seems to be very distant from Hayle or across BSPs.

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

Option 4 – Transfer demand to other sites

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Not possible as too far away from other primaries.

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

Option 5 – Post-fault transfers

Capacity Released for constraint(s) considered: 0MVA

Discounted

Detailed description: Not applicable in this area.

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

Option 6 – Procure flexibility

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Flexibility would need to be procured around Hayle primary.

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

Solution Recommendation

It is recommended that Hayle primary is put forward as a flexibility area. When that is exhausted reinforcement will be needed and the suggestion here is to build a new primary with 12/24 MVA transformers and 33 kV circuits from Hayle BSP to the south around the Harbour.

3.4 Hayle Penzance 33 kV 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 3.4.1 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
Circuit Capacity	Fault of Hayle busbar Main 1	-	Baseline	Baseline	Baseline	Baseline
Circuit Capacity	Penzance Heamoor 2L4 which includes the busbar	Any other fault of the 33kV circuits in between Hayle and Penzance	Baseline	Baseline	Baseline	Baseline
1S0, 1L3 and 2L3 current capacity	Penzance Heamoor Main 1 busbar	Fault of Hayle 4L5 to Penzance 2L5	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 3.4.2 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	Extra 33 kV circuit and extra 33 kV busbar section on both Penzance and Hayle	✓	✓	✓	**Viable**
2	New BSP at Penzance and associated new P line 132 kV circuits	✓	✓	✓	**Viable**
Operational Mitigation					
3	Transfer primaries away from the BSP	×	×	×	**Discounted**
4	Connect busbar protection zones	✓	✓	✓	**Viable**
Load Management Schemes					
5	Post-fault transfers	×	×	×	**Discounted**
Flexibility services					
6	Procure flexibility at Hayle BSP	✓	×	✓	**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. Current position has four 33 kV circuits between Hayle and Penzance once a busbar is on arranged outage and a circuit faults this number is reduced to one which means capacity and voltage issues.

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

Option 1 – Extra 33 kV circuit and extra 33 kV busbar section on both Penzance and Hayle

Capacity Released for constraint(s) considered: 22.7 MVA

Viable

Detailed description: This solution would increase capacity but would not resolve the voltage issues. The complexity of adding a third busbar on both Hayle and Penzance could make it operationally difficult which could impact safety.

New limiting factor for constraint(s) considered: Voltage issues on the Western side of Hayle.

Option 2 – New BSP and associated new P line 132 kV circuits

Capacity Released for constraint(s) considered: 114 MVA

Viable

Detailed description: New 132 kV circuits from Rame to Penzance passing through the double circuits towers (P-line) which currently carry some of the 33 kV cables. This is the preferred option as it would improve voltage levels around the Western most side of Hayle network and it would solve 33 kV interconnection overloads with the advantage of fixing the constraint identified here too.

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

Option 3 – Transfer primaries away from the BSP

Capacity released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Only Hayle local and a bit of Marazion primaries could be transferred onto other BSPs. However, we would be shifting load into areas with their own problems exacerbating them. With 33 kV reinforcement and reactive compensation it would be possible to solve this constraint, but not recommended.

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

Option 4 – Connect busbar protection zones

Capacity Released for constraint(s) considered: 0 MVA

Viable

Detailed description: A bit radical but it would solve some n-1 problems. This would consist in linking busbar zone protection from Main 2 to operate when Main 1 operates effectively clearing the site. This would be an interim solution, which would allow control to restore load and not overload current assets. Engineering and Design would need to carefully assess safety implications.

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

Option 5 – 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 6 – Procure flexibility at Hayle BSP

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: The need for flexibility will be around 2 MW in 2027 if nameplate rating used or 1 MW in 2031.

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

Solution Recommendation

It is recommended to carry on SD8C checks to uprate transformers to fully use cyclic ratings. Building the new 132 kV circuits and BSP at Penzance will be the option to go for as it solves the current constraint and others. It is the most expensive option which has more risks of possibility of delivery. However, due to Penzance being the furthest away from any GSP in our licence areas it does suffer from low voltage which can be solved by 132 kV closer to the load source. If the 33 kV arrangement continues for a long time switchgear at Marazion will need to be uprated.

3.5 Penzance 33 kV low volts

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 3.5.1 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
Low volts	Fault of busbar Main 1	Followed by Hayle 4L5 to Penzance 2L5	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 3.5.2 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	Extra 33 kV circuit and extra 33 kV busbar section on both Penzance and Hayle	✓	×	×	**Viable**
2	New BSP at Penzance and associated new P line 132 kV circuits	✓	✓	×	**Viable**
Operational Mitigation					
3	Transfer primaries away from the BSP	×	×	×	**Discounted**
Load Management Schemes					
4	Post-fault transfers	×	×	×	**Discounted**
Flexibility services					
5	Procure flexibility at Hayle BSP	✓	×	✓	**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. Current position has four 33 kV circuits between Hayle and Penzance once a busbar is on arranged outage and a circuit faults this number is reduced to one which means capacity and voltage issues.

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

Option 1 – Extra 33 kV circuit and extra 33 kV busbar section on both Penzance and Hayle

Capacity Released for constraint(s) considered: 22.7 MVA — **Discounted**

Detailed description: This solution would increase capacity but would not resolve the voltage issues. The complexity of adding a third busbar on both Hayle and Penzance could make it operationally difficult which could impact safety.

New limiting factor for constraint(s) considered: Voltage issues on the Western side of Hayle.

Option 2 – New BSP and associated new P line 132 kV circuits

Capacity Released for constraint(s) considered: 114 MVA — **Viable**

Detailed description: New 132 kV circuits from Rame to Penzance passing through the double circuits towers (P-line) which currently carry some of the 33 kV cables. This is the preferred option as it would improve voltage levels around the Western most side of Hayle network and it would solve 33 kV interconnection overloads with the advantage of fixing the constraint identified here too. To fix the voltage issues in the meantime, 5 MVAr capacitors should be located at Penzance Heamoor (to be operated for certain arranged outages of the interconnection between Hayle and Penzance), St Buryan and the Isles of Scilly.

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

Option 3 – Transfer primaries away from the BSP

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

Detailed description: Only Hayle local and a bit of Marazion primaries could be transferred onto other BSPs. However, we would be shifting load into areas with their own problems exacerbating them. With 33 kV reinforcement and reactive compensation it would be possible to solve this constraint, but not recommended.

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

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

Detailed description: The need for flexibility will be around 2 MW in 2027 if nameplate rating used or 1 MW in 2031.

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

Solution Recommendation

It is recommended that reinforcement starts as it is a very lengthy process. In the meantime if operational measures and flexibility are not enough reactive compensation will need to be looked at 11 kV around the Western most ring of Hayle, which would consist of installing 2 x 5 MVAr capacitors at Penzance Heamoor and Isles of Scilly and a statcom at St Buryan. The reinforcement consists of a new BSP and new 132 kV circuits from Rame this is likely to take 10 years or longer to build.

3.6 Isles of Scilly Power Station end of life

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 3.6.1 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
Power Station end of life	Loss of subsea cable	None	2027	2027	2027	2027

Uncertainty under other Distribution Future Energy Scenarios: This is based on predicted asset life of the Isles of Scilly Power Station. Asset replacement function of the business will advise when, how and what to do with the Power Station.

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 Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	2nd subsea cable into the Isles of Scilly	✓	×	×	Viable
2	Replace Power station with new one	✓	✓	✓	Viable
Operational Mitigation					
3	2 subsea cables	✓	✓	×	Discounted
Load Management Schemes					
4	Post-fault transfers	×	×	×	Discounted
Flexibility services					
5	Procure flexibility in the Isles of Scilly	✓	×	✓	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 going head first into a P2 non-compliance after the decommissioning of the Isles of Scilly power station due to the nature of the Isles of not having any network to provide backup if the subsea cable were to fail as it happened a couple of years ago.

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

Option 1 – 2nd subsea cable into the Isles of Scilly

Capacity Released for constraint(s) considered: 0 MVA

Viable

Detailed description: 2nd subsea cable would provide the backup for the single cable. It would not provide extra capacity and if laid on the same route as previous cable it may be affected by any potential ships that happen to drag their anchor through the seabed in that area.

On the other hand it would provide a more reliable connection to the Isles of Scilly and better Security of Supply. A CBA will be needed to prove the feasibility of this project.

New limiting factor for constraint(s) considered: Voltage issues

Option 2 – Replace Power station with new one

Capacity Released for constraint(s) considered: 0 MVA

Viable

Detailed description: Mainly asset replacement. It would continue using fossil fuels, but due to the size it would not be impactful to the business. It could be the cheaper capital cost to replace it. This is essentially two options as NGED will need to tender for a contract and if no one is interested continue the current arrangement.

New limiting factor for constraint(s) considered: None, unless there is significant demand growth during the summer holiday season.

Option 3 – 2 subsea cables

Capacity released for constraint(s) considered: 0 MVA

Discounted

Detailed description: If there is a wish for a super secure network, two additional cables could be laid out this would probably be on separate routes to ensure both are not on the same path. It is probably the largest of the schemes and would require a large investment, certainly would cover all the possible electrification scenarios of the Isles, but it may not be the most efficient.

New limiting factor for constraint(s) considered: Voltage issues

Option 4 – Post-fault transfers

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: The Isles are connected to land by one cable and no other 11 kV backfeeds available.

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

Option 5 – Procure flexibility in the Isles of Scilly

Capacity Released for constraint(s) considered: 0 MVA

Viable

Detailed description: Flexibility will help decrease the amount of load at the time of peak, this usually happens during the summer holiday period.

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

Solution Recommendation

This constraint happens mostly due to the Power Station reaching the end of life which ultimately will be an asset replacement issue. The alternatives to building a new power station are above which should give a good understanding of which solutions to be forward for a cost benefit analysis. The recommended solution would be to keep a Power Station in the Isles as it would help with the voltage issues in the area but it is understood that there might be some environmental concerns and ownership/operation of the site.

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