Portishead BSP

Network Development Report – South West

May 2024

Electricity Distribution

nationalgrid

Contents

Portishead BSP

1. Network Overview

Portishead Bulk Supply Point (BSP) supplies a mixture of urban and rural areas via its 33 kV network. It is supplied by two 132 kV circuits from Seabank Grid Supply Point (GSP) with two 30/60 MVA 132/33 kV grid transformers (GTs) supplying the group. Portishead BSP supplies approximately 28,000 customers.

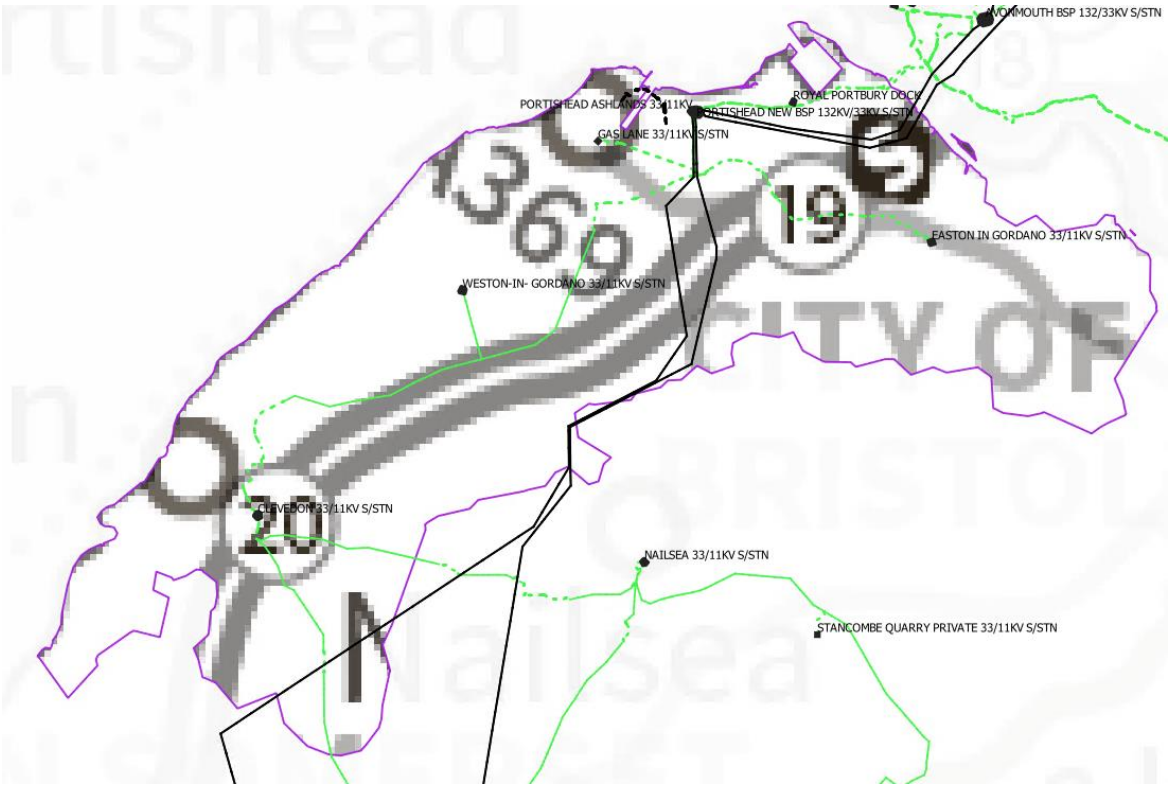

Figure 1.1 Portishead BSP geographic network coverage

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

- GT1 and GT2 currently run in parallel supplying Portishead BSP.
- Ashlands Primary is a two transformer primary supplied by two 33 kV circuits.
- West Dock Primary substation is supplied via two separate transformers.
- Gas Lane Primary substation is a two transformer Primary supplied by two 33 kV circuits.
- Weston in Gordano and Clevedon are supplied by a single 33 kV circuit from Portishead BSP with a normal open point at Clevedon Primary connecting to Churchill BSP.
- There is a 33 kV circuit with no connections on between Portishead and Avonmouth BSPs with a normally normal open point at Portishead 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.

- For an arranged outage of Portishead 8L5 circuit, Clevedon and Weston in Gordano are assumed to be transferred to Churchill BSP.
- For the loss of an infeed to a transformer at any of the primaries fed from Portishead BSP under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.
- For the loss of an infeed to a grid transformer at Portishead 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:

- Clevedon Transformers Overload
- Weston in Gordano Transformer Overload
- Portishead to Weston in Gordano 33 KV Circuit Overload (WESG3A to WESG3T section)

3. Network Constraint Details and Solution Options

3.1 Clevedon Transformers Overload

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
Clevedon T1 overload	Clevedon T2 fault/outage	None	Baseline	Baseline	Baseline	2026
Clevedon T2 overload	Clevedon T1 fault/outage	None	Baseline	Baseline	Baseline	2026

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 transformers	✓	✓	✓	Viable
2	Install additional transformer	✓	×	×	Discounted
Operational Mitigation					
3	Transfer demand to other Primaries	×	×	×	Discounted
Load Management Schemes					
4	Uprate the existing transformers via use of cyclic ratings	×	×	×	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 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. Therefore, not intervening would cause problems with system integrity (overloads) and would not be a technically viable solution.

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

Option 1 – Replace existing transformers

Capacity Released for constraint(s) considered: 13 MVA

Viable

Detailed description: This would involve replacing the existing transformers with 12/24 MVA units. Given the age of the transformers (installed 1963/4) this would have a dual benefit in terms of releasing capacity and replacing aging assets.

New limiting factor for constraint(s) considered: 23 MVA transformer ratings

Option 2 – Install additional transformer

Capacity Released for constraint(s) considered: 10 MVA

Discounted

Detailed description: Installing a third transformer alongside switchgear and civil works would allow two transformers to remain in service for a fault of either of the existing circuits, preventing an overload. However, due to the age of the existing transformers and compatibility with the existing site layout it would be much more cost-effective to replace the existing transformers.

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

Option 3 – Transfer demand to other Primaries

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: The nearest primary substation with transfer capacity is Gas Lane Primary. However, there is only one 11 kV circuit between Clevedon and Gas Lane, meaning there would not be sufficient 11 kV capacity to de-load Clevedon. Therefore, this option has been discounted.

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

Option 4 – Uprate the existing transformers via use of cyclic ratings

Capacity Released for constraint(s) considered: 3 MVA

Discounted

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, Current Transformers (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.

As the transformers are 10 MVA units, this would only increase the capacity to 13 MVA which is already exceeded under baseline maximum demand.

Option 5 – Procure flexibility

Estimated Flexibility Required (MVA): 3.5 MVA+

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads. The amount required will continue to grow as demand grows meaning this would likely only defer the reinforcement.

Solution Recommendation

Whilst flexibility may potentially be used to solve the constraints; as the existing transformers were installed in 1963/4 it is recommended to replace them with 12/24 MVA units to facilitate future growth and replace aging assets. This should be done before 2028 when any additional rating achieved through previously retrofitted fans or pumps (up to 14 MVA rating if confirmed) will also be exceeded.

3.2 Weston in Gordano Transformer Overload

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 3.2.1 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
Weston in Gordano Transformer overload	None (intact)	None	2028	2028	2028	2034

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, the demand constraint is predicted to arise in 2026 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 3.2.2 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 transformer	✓	✓	✓	**Viable**
2	Install additional transformer and 33 kV circuit	×	×	×	**Discounted**
Operational Mitigation					
3	Transfer demand to other Primaries	×	×	×	**Discounted**
Load Management Schemes					
4	Uprate the existing transformers via use of cyclic ratings	×	×	×	**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. Therefore, not intervening would cause problems with system integrity (overloads) and would not be a technically viable solution.

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

Option 1 – Replace existing transformer

Capacity Released for constraint(s) considered: 9 MVA

Viable

Detailed description: This would involve replacing the existing transformer with a 7.5/15 MVA unit. Given the age of the transformer (installed 1955) this would have a dual benefit in terms of releasing capacity and replacing aging assets.

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

Option 2 – Install additional transformer and 33 kV circuit

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Installing an additional transformer would mitigate the intact overloads but this would then become an N-1 (first circuit outage) constraint which would still need to be mitigated. Therefore, this option is not technically viable but may be considered in the long term to improve security of supply at Weston in Gordano.

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

Option 3 – Transfer demand to other Primaries

Capacity Released for constraint(s) considered: 0MVA

Discounted

Detailed description: The nearest primary substation with transfer capacity is Gas Lane Primary. There are some 11 kV circuits between Weston in Gordano, however, some of these will likely need to be picked up by Weston in Gordano during an 11 kV fault/outage which would further increase demand. Therefore, this is not likely to be a technically viable solution and does nothing to help upgrade aging assets.

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

Option 4 – Uprate the existing transformers via use of cyclic ratings

Capacity Released for constraint(s) considered: 0MVA

Discounted

As Weston in Gordano is a single transformer primary the transformer does not run in parallel with a second transformer. Therefore, it is already subject to an increased aging rate as it experiences the full load during normal running (compared to 50% for parallel operation) and cannot be uprated.

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

Option 5 – Procure flexibility

Estimated Flexibility Required (MVA): 0.5MVA+

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads. The amount required will continue to grow as demand grows meaning this would likely only defer the reinforcement.

Solution Recommendation

Whilst flexibility could be considered as an option, due to the age of the existing transformer it is recommended to replace it with a 7.5/15 MVA unit to replace an aging asset and facilitate growth. It may also be considered in the site configuration works to allow for a second transformer in the future as Weston in Gordano is a single transformer primary reliant on 11 kV backfeeds during fault/outage.

3.3 Portishead to Weston in Gordano 33 kV Circuit Overload (WESG3A to WESG3T section)

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
Portishead to Weston in Gordano 33 KV Circuit overload (WESG3A to WESG3T section)	None (intact)	None	2034	-	-	-

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, the demand constraint is predicted to arise in 2028 and under Falling Short it is predicted to arise in 2036.

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 circuit and reinforce 33 kV circuit	✓	✓	✓	**Viable**
Operational Mitigation					
3	Transfer demand to other Primaries	×	×	×	**Discounted**
Load Management Schemes					
-	*None Identified*	-	-	-	-
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 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. Therefore, not intervening would cause problems with system integrity (overloads) and would not be a technically viable solution.

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

Option 1 – Reinforce existing 33 kV circuits

Capacity Released for constraint(s) considered: 5.2 MVA **Viable**

Detailed description: This options involves reinforcing the existing overhead line which limits the rating of the existing circuits. This would involve reinforcing approximately 3000 m of overhead line as well as removing the 400 A isolator limitation. The line would then be limited by a 410 m cable section.

New limiting factor for constraint(s) considered: Existing 33 kV circuit sections.

Option 2 – Install additional 33 kV circuit and reinforce 33 kV circuit

Capacity released for constraint(s) considered: 22.7 MVA **Viable**

Detailed description: This would involve installing an additional circuit between Portishead and Weston in Gordano as well as upgrading the existing overloaded section. This would require significant works and come at significant cost compared to only reinforcing the section which is predicted to overload. However, it would benefit the area by providing more secure supplies to Weston in Gordano and a second circuit which could later be used to add a second transformer at Weston in Gordano as well as extended onto Clevedon to provide a firm supply from Portishead. This would reduce reliance on the 33 kV circuit from Churchill BSP for fault conditions of the single circuit. This circuit is also constrained as noted in the Churchill BSP report, meaning there are several benefits of a further 33 kV circuit in the area.

New limiting factor for constraint(s) considered: Existing 33 kV circuits.

Option 3 – Transfer demand to other Primaries

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

Detailed description: There are no primary substations nearby on a different circuit with transfer capacity

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

Option 4 – Procure flexibility

Estimated Flexibility Required (MVA): 1.5 MVA+ **Viable**

Detailed description: Flexibility services could be procured at Weston in Gordano or Clevedon substations to alleviate projected overloads. The amount required will continue to grow as demand grows meaning this would likely only defer the reinforcement.

Solution Recommendation

It may be possible to procure flexibility at Weston in Gordano or Clevedon in order to prevent an overload and defer reinforcement. Following this it is recommended to reinforce the 3000 m section of overhead line and replace the isolator which limits the circuit rating. Beyond this, installing an additional 33 kV circuit from Portishead to Weston in Gordano and on to Clevedon primary would offer significant improvement to the security of supply of the area which currently relies on constrained backfeeds from Churchill BSP.

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