Ebbw Vale BSP and Associated 33 kV Network

Network Development Report – South Wales

May 2024

Electricity Distribution

nationalgrid

Contents

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1. Network Overview

Ebbw Vale Bulk Supply Point (BSP) supplies much of the built up area in the region at the heads of the valleys, east of Merthyr Tydfil. It is supplied by two 132 kV circuits from Rassau GSP.

Ebbw Vale BSP together with its primary substations supplies approximately 15,000 customers.

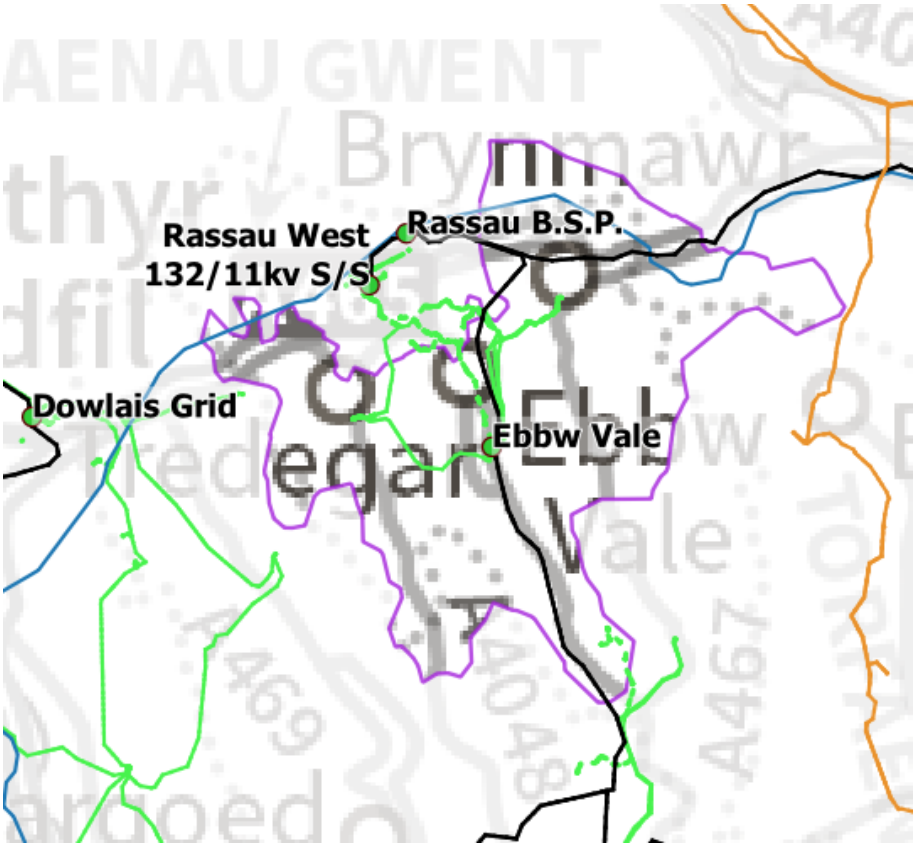

Figure 1.1 – Ebbw Vale BSP geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon associated with the 33 kV circuits and 33/11 kV transformers which supply the Ebbw Vale BSP area. 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 Ebbw Vale BSP network is arranged as follows:

- Two grid transformers running in parallel, one connected to each of the incoming 132 kV circuits.
- A two section 33 kV bar at the BSP.
- Brynmawr primary substation fed by two 33 kV circuits, with Beaufort STOR and Brecon STOR distributed generators present as tee offs.
- Tredegar primary substation fed by two 33 kV circuits, with Rassau Industrial Estate STOR distributed generator present as a tee off.
- Additionally, an additional 33 kV generator Waun Y Pound STOR is connected directly to the 33 kV bar.

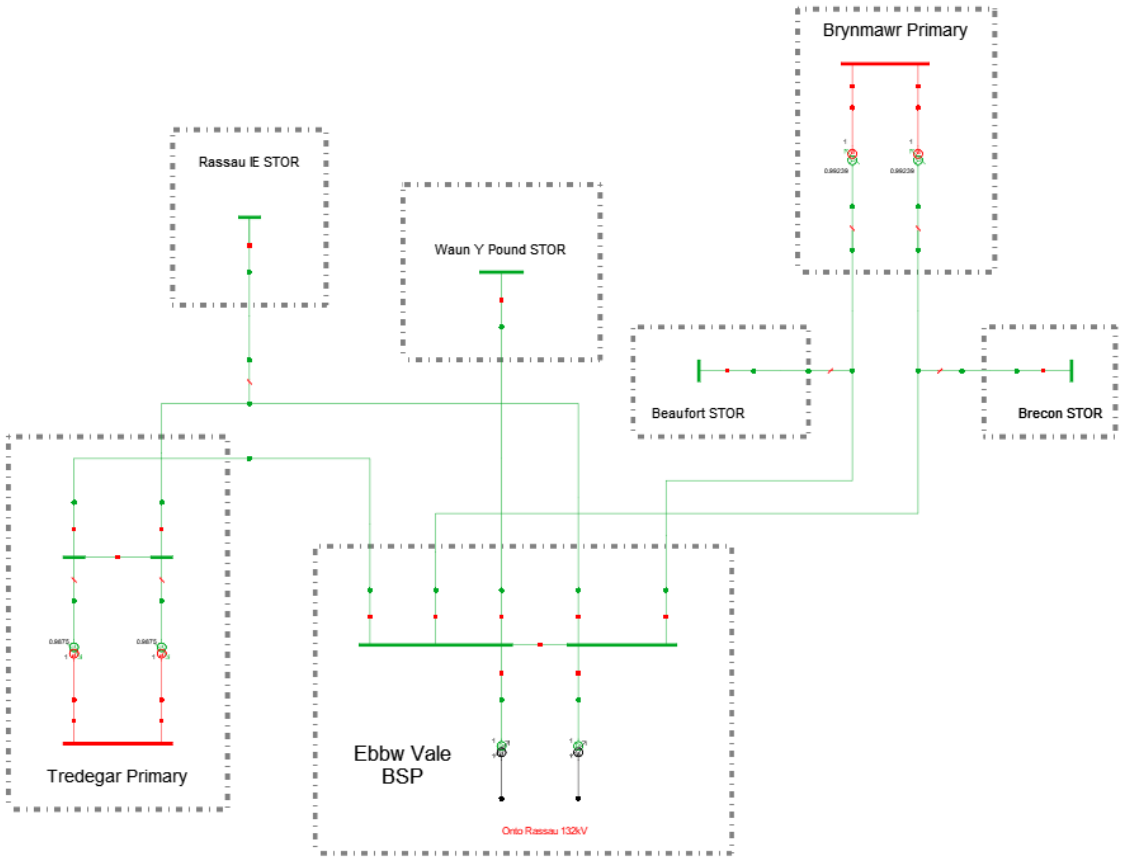

Figure 1.2 - Single Line Diagram for Ebbw Vale BSP

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.

- Intertrip schemes have been created for the relevant 33 kV distributed generation sites present in the area, generally to ensure generators are taken off safely if the direct path to the BSP is lost.
- Primary transformer freewheeling schemes have been created to overcome energised transformers remaining in service with no EHV infeed during arranged outages.

2. Summary of Network Constraints

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

- Brynmawr primary substation 33 kV circuit capacity
- Tredegar primary substation 33 kV circuit capacity

3. Network Constraint Details and Solution Options

3.1 Brynmawr primary substation 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 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
33 kV circuit overload between Ebbw Vale 1L5 and Beaufort STOR	Fault or outage of Brynmawr T2	None	n/a	n/a	n/a	2027
33 kV circuit overload between Ebbw Vale 4L5 and Brecon STOR	Fault or outage of Brynmawr T1	None	n/a	n/a	n/a	2027

Uncertainty under other Distribution Future Energy Scenarios: Under the Leading the Way scenario the constraint is forecast by 2026, under Consumer Transformation by 2026, under System Transformation by 2029 and under Falling Short by 2031.

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	Overlay the existing cables	✓	×	✓	Viable
2	Rebuild the 33 kV circuits up to the generation tee offs	✓	✓	✓	Discounted
Operational Mitigation					
3	Transfer demand to other Primaries	×	×	×	Discounted
Flexibility services					
4	Procure flexibility at Brynmawr	×	×	×	Discounted

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. 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 – Overlay the existing cables

Capacity Released for constraint(s) considered: 3.3 MVA

Viable

Detailed description: The circuit sections adjacent to Ebbw Vale BSP are quite old and constructed of relatively small cross sectional area cable. This was adequate for the historic topology with only a primary substation downstream but new generation growth within the primary added to the recent 33 kV generation connections is too much. Approximately 330 m of cable overlay would resolve the constraints within the period under assessment. Growth forecasts should be reviewed at the time that this Option is considered under a DNOA as the OHL sections of the circuit are not far behind the cable sections and if an adequate amount of headroom for future needs is not created than an alternative solution may be required as over 5.0 km of additional conductor is at risk for the next increment of capacity release.

New limiting factor for constraint(s) considered: The OHL sections are rated to 25.8 MVA for summer conditions.

Option 2 – Rebuild the 33 kV circuits up to the generation tee offs

Capacity Released for constraint(s) considered: Approximately 24 MVA

Discounted

Detailed description: Should Option 1 be inadequate then the whole 33 kV circuits up to the generation tee off will need to be rebuilt. To aid with consenting it could be assumed that cable construction will be used. Two circuits of approximately 2.6 km each will be required. The steeply valleyed terrain of the area will make this Option challenging to achieve, predominantly highways dig and lay could be likely.

New limiting factor for constraint(s) considered: Typical heavy duty cable circuit at 400 mm^2 is rated for 43.7 MVA in summer, a smaller size may be adequate.

Option 3 – Transfer demand to other Primaries

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: As the constraint is due to generation growth from small scale solar and other distributed resources, it will be challenging to transfer an adequate amount of generation without also transferring a greater amount of demand.

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

Option 4 – Procure flexibility at Brynmawr

Estimated Flexibility Required (MVA): N/A

Discounted

Detailed description: We do not currently procure generation turn down flexibility services due to limitations in internal tooling. However we are looking to build out this capability, which should be available before intervention is needed.

Solution Recommendation

It is recommended to proceed with Option 1 and overlay the 33 kV cable sections to glean some additional capacity, these cable sections are still useful if the more severe Option 2 is required thereafter.

3.2 Tredegar primary substation 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 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
33 kV circuit overload between Ebbw Vale 3L5 and Rassau Industrial Estate STOR	Fault or outage of Ebbw Vale 2L5 or Tredegar 33 kV Main 1 section	None	n/a	n/a	n/a	2032

Uncertainty under other Distribution Future Energy Scenarios: Under the Leading the Way scenario the constraint is forecast by 2031, under Consumer Transformation by 2029, under System Transformation by 2034 and under Falling Short it is beyond the period of assessment.

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	Overlay the existing cables	✓	×	✓	Viable
2	Rebuild the 33 kV circuits up to the generation tee off	✓	✓	×	Discounted
Operational Mitigation					
3	Transfer demand to other Primaries	×	×	×	Discounted
Flexibility services					
4	Procure flexibility at Tredegar	×	×	×	Discounted

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. 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 – Overlay the existing cables

Capacity Released for constraint(s) considered: 5.6 MVA with OHL re-profiled

Viable

Detailed description: Similar to the Brynmawr 33 kV circuits above, recent and future changes to the load will cause circuit overloads within the period of this assessment. Approximately 500 m of cable overlay between Ebbw Vale 1L5 and the tee-off to Rassau Industrial Estate would resolve the constraints within the period under assessment. Uprating the running temperature of the OHL sections through re-profiling the line clearances may be possible to reduce the required overlay distance. Growth forecasts should be reviewed at the time that this Option is considered under a DNOA as the OHL sections of the circuit here are also not far behind the cable sections (when uprated) and if an adequate amount of headroom is not created than an alternative solution may be required as over 5.2 km of additional conductor is at risk for the next increment of capacity released.

New limiting factor for constraint(s) considered: The best plausible OHL re-profiling will achieve a rating of 25.8 MVA for summer conditions.

Option 2 – Rebuild the 33 kV circuits up to the generation tee offs

Capacity Released for constraint(s) considered: 27 MVA

Discounted

Detailed description: Should Option 1 be inadequate then the 33 kV circuits up to the generation tee off will need to be rebuilt. Overlay of approximately 5.7 km will be required. This route would be through a built up area so a predominantly cable construction laid in highways might be expected.

New limiting factor for constraint(s) considered: Typical heavy duty cable circuit at 400 mm^2 is rated for 43.7 MVA in summer, a smaller size may be adequate.

Option 3 – Transfer demand to other Primaries

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: As the constraint is due to generation growth from small scale solar and other distributed resources, it will be challenging to transfer adequate generation without also transferring a greater amount of demand.

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

Option 4 – Procure flexibility at Tredegar

Estimated Flexibility Required (MVA): N/A

Discounted

Detailed description: We do not currently procure generation turn down flexibility services due to limitations in internal tooling. However we are looking to build out this capability, which should be available before intervention is needed.

Solution Recommendation

It is recommended to proceed with Option 1 and overlay the 33 kV cable sections and glean some additional capacity, these cable sections are still useful if the larger Option 2 is required eventually.

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