Cumlin BSP and Associated 33 kV Network

Network Development Report – South Wales

May 2024

Electricity Distribution

nationalgrid

Contents

Crumlin BSP and Associated 33 kV Network

1. Network Overview

Crumlin Bulk Supply Point (BSP) supplies a semi-rural area of 33 kV network to the north west of Newport City, with most demand build up following the routes of the valleys. It is supplied from two 132 kV circuits from Rassau GSP. Crumlin BSP together with its primary substations supplies approximately 20,100 customers.

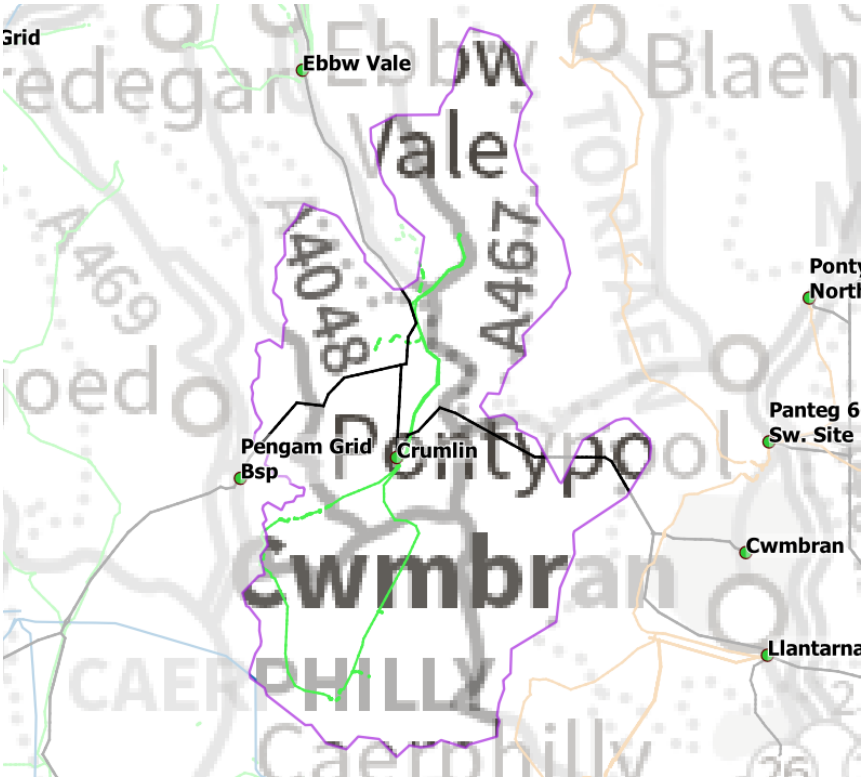

Figure 1.1 - Crumlin BSP geographic network coverage

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 Crumlin 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 Crumlin 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.
- Abertillery Primary Substation fed by two 33 kV circuits, with Manmoel PV and Haford Y Dafal distributed generators present as tee offs.
- Cwmfellinfach Primary Substation and Pontllanfraith Primary Substation, fed as a 33 kV ring, with Hill farm and Cwm Cae Singrug distributed generators present as tee offs.
- Additionally, an additional 33 kV generator Crumlin STOR is connected directly to the 33 kV bar.

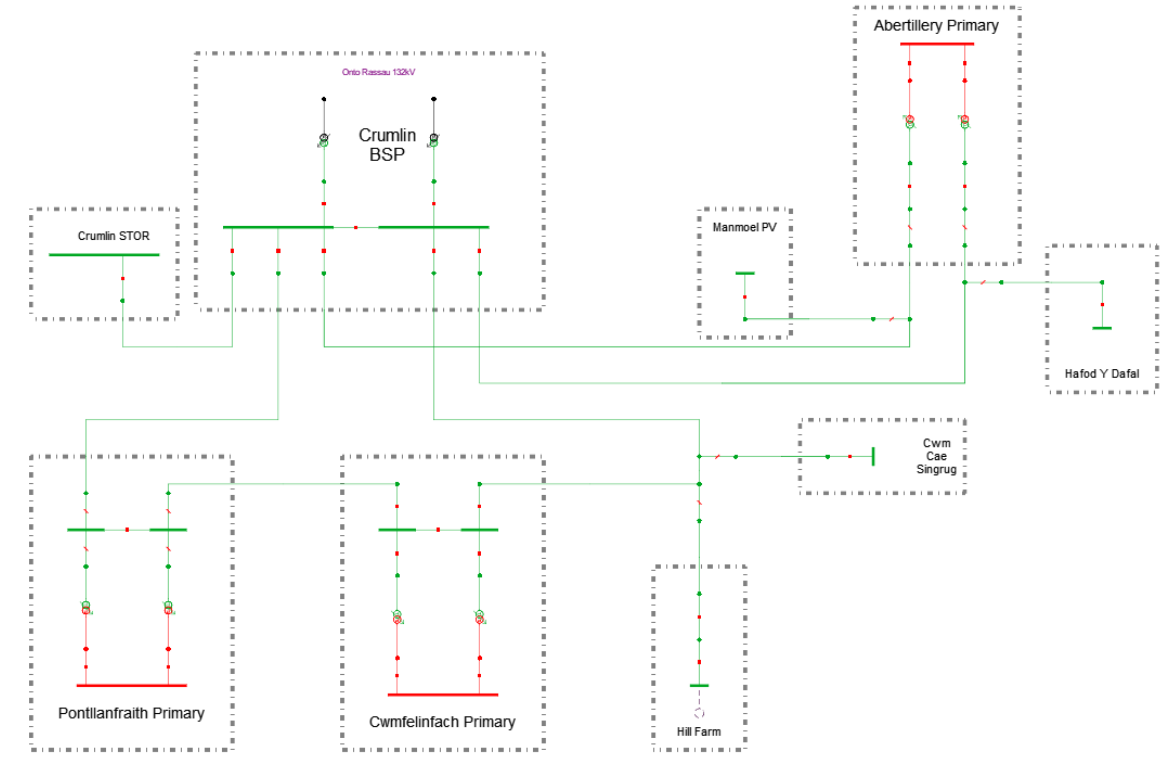

Figure 2 - Crumlin BSP Single Line Diagram

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.

2. Summary of Network Constraints

The following constraint has been identified for the Best View Scenario, for which mitigation options will be discussed:

- Cwmfellinfach-Pontllanfraith 33 kV Group capacity

3. Network Constraint Details and Solution Options

3.1 Cwmfellinfach-Pontllanfraith 33 kV Group 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
Pontllanfraith primary transformer overload	Fault or outage of opposite transformer	None	2029	2030	2030	2032
Crumlin BSP to Pontllanfraith circuit overload	Fault or outage of Crumlin to Cwmfelinfach circuit	None	2034	n/a	n/a	n/a
Crumlin BSP to Cwmfelinfach circuit overload	Fault or outage of Crumlin to Pontllanfraith circuit	None	2030	2032	2032	2033

Uncertainty under other Distribution Future Energy Scenarios: Under the Leading the Way scenario the constraint is forecast by 2028, under Consumer Transformation by 2030, under System Transformation by 2032 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 3.1.2 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 the existing assets	✓	×	✓	Viable
2	Build a new Primary Substation and transfer 11 kV demand	✓	✓	✓	Viable
Operational Mitigation					
3	Transfer demand to other Primaries	×	×	×	Discounted
Flexibility services					
4	Procure flexibility at both primary substations	✓	×	✓	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 one or other of the primaries.

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

Option 1 – Replace the existing assets

Capacity Released for constraint(s) considered: 7 MVA

Viable

Detailed description: To achieve a fully compliant solution the overall works will eventually include:

- Replacement of the Pontllanfraith primary transformers with 11.5/23 MVA units
- The reinforcement of approximately 2.2 km of OHL on the Crumlin BSP to Pontllanfraith 33 kV circuit
- The reinforcement of approximately 7.8 km of predominantly OHL on the Crumlin BSP to Cwmfelinfach 33 kV circuit

New limiting factor for constraint(s) considered: The combined rating of the new set of transformers at approximately 37 MVA

Option 2 – Build a new Primary Substation and transfer 11 kV demand

Capacity Released for constraint(s) considered: Depends on available transfers

Viable

Detailed description: Option 1 includes the replacement of most of the major items of plant required for an entirely new primary substation. An extension of this scheme could be to find a new site and build a new primary substation instead. This option has good synergies with the Pengam BSP overloads discussed in Rassau GSP report Section 3.3 as load could also be transferred from that site to defer the works on that side.

New limiting factor for constraint(s) considered: New primary transformers rated at 11.5/23 MVA winter cyclic

Option 3 – Transfer demand to other Primaries

Capacity Released for constraint(s) considered: dependent on 11 kV

Discounted

Detailed description: In this location, 11 kV transfers are not available to sites which are not also constrained. However temporary transfers may be useful to make scheduling the resolution of the group of constraints on this network easier.

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

Option 4 – Procure flexibility at both primary substations

Estimated Flexibility Required (MVA): 7 MVA by 2034

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads and could defer reinforcement. Given the complexity due to constraints in the wider area and the desire for a single solution, some degree of Flexibility could be practical.

Solution Recommendation

It is recommended to eventually pursue a new substation somewhere in this area (Refer to Rassau GSP report Section 3.3), a simple 132/11 proposal at Pengam would be the simplest scheme but a new 33/11 kV site would provide wider benefit into Crumlin BSP. Flexibility and managing the overall distribution of 11 kV load between the group of substations in the area covered by this constraint would be of useful for deferring the work.

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