WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

Network Development Plan

Network Development Reports

March 2022 Draft for Consultation

Introduction

This report outlines the expected constraints that could materialise across the WPD extra high voltage (EHV) networks throughout a 0-10 year period. For information on the methodology used to undertake these studies please refer to the Network Development Plan Methodology Report.

Stakeholder Consultation

This report forms part of the Network Development Plan 2022 draft for consultation. This is required as part of the Standard Licence Condition SLC 25B.8 states as part of the Network Development Plan, the licensee must:

a) consult interested parties on the proposed Network Development Plan for a period of at least 28 days before publishing as required by 25B.1; and
b) publish the non-confidential consultation responses

This report contains a draft of the planned Network Development Reports for a chosen area of network. Feedback is welcomed on the methodology and format of these reports and will be taken into account for the final Network Development Plan publication in May 2022, with technical summary papers for all WPD licence areas.

Initial drafts of the Network Development Plan reports is available on the WPD website in conjunction with consultation questions, to gather feedback on the methodology used and format of information presented. In addition, WPD are hosting a consultation webinar on 31st March 2022 to seek further feedback from stakeholders.

South West Licence Area

westernpower.co.uk

St Tudy

Network Overview

St Tudy Bulk Supply Point (BSP) supplies a sparse area of 33kV network, mostly in Cornwall. It is supplied from the K-route 132 kV circuit between Indian Queens and Alverdiscott Grid Supply Points (GSP), with two 30/60 MVA 132/33 kV grid transformers supplying the group. The 33 kV network supplies the following Primary substations:

- St Tudy Primary supplied via two transformer feeders.
- A 33 kV ring supplying Polzeath and Wadebridge Primaries, along with connections to three 33 kV connected generators and normally open 33 kV interconnection with Fraddon BSP via Padstow.
- A 33 kV ring supplying Callywith and Bodmin Primaries, along with connections to three 33 kV connected generators and normally open 33 kV interconnection with Fraddon BSP via Treningle switching station.
- A 33 kV ring supplying Davidstow, Delabole and Laneast Primaries, along with connections to a 33 kV connected generators and large demand customer, with normally open 33 kV interconnection with Pyworthy/North Tawton BSP group via Launceston.

In addition the 33 kV connected generation, there is currently a large amount of LV and 11 kV connected generation present in this group, with over 5.5 MW of domestic rooftop solar generation connected in the baseline year of study.

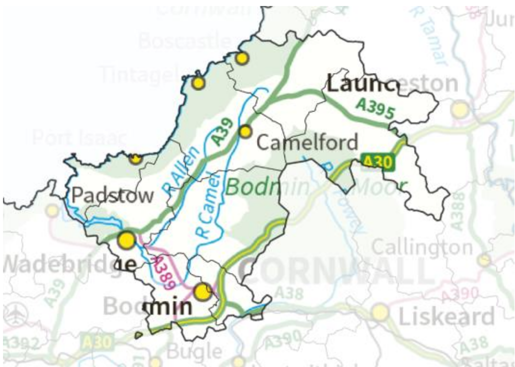
Network Operability Modelling

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.

- For an arranged outage of either grid transformer at St Tudy, the normal open point at Treningle switching station is moved from isolator 4L3 to circuit breaker 2L5, which is available for operation with tele control. This allows for quicker restoration of customers in the event of a fault where the network needs to be reconfigured.
- Directional overcurrent (DOC) schemes are modelled on 33/11 kV transformer T2 at Wadebridge substation and on both 132/33 kV grid transformers at St Tudy BSP.
- The 33 kV busbar running arrangement at St Tudy is altered for a variety of circuit and busbar outages to maintain network integrity.
- Arranged outages of the 33 kV busbar at Davidstow result in the transfer of Laneast and a 33 kV wind farm onto the neighbouring Pyworthy/North Tawton BSP group.
- For arranged outages of the 1S0 circuit breakers at Callywith and Delabole primary substations, one of the primary transformers is run with the 11 kV circuit breaker open (i.e. on 'hot standby'). This is to reduce the risk of through-flow for credible next faults on the network, where the 11 kV network at the primary becomes a link to the wider 33 kV network and could overload transformers.
- Curtailment of 33 kV connected generators within the group are modelled are a variety of arranged outages, as outlined in customer connection agreements.

Any modelling of schemes on the upstream 132 kV networks are reported as part of the Alverdiscott/Indian Queens Network Development Report.

Figure 1 St Tudy BSP geographic network coverage



Future network constraints

Using the methodology outlined in the Network Development Plan Methodology Report, the St Tudy group has been assessed for the 0-10 year horizon for potential network constraints. These are summarised in more detail below.

Polzeath/Wadebridge ring 33 kV circuit capacity

Constraint Summary

Generation Demand

The table below outlines the nature of the network constraints identified in the network analysis.

Constrained assets	33 kV circuits between St Tudy - Wadebridge and St Tudy - Polzeath	
Type(s) of constraint	Thermal overload of 33 kV circuits	
Constrained condition(s)	Summer peak generation	
Limiting factor of constrained assets	Circuits limited by existing 33 kV overhead conductor (0.1in² HDC).	
Outage combination which causes the constraint	Intact	Due to coincident output of large amount of small scale embedded generation.
	First Circuit Outage	For the arranged or fault outage of one of the circuits which feeds into this group, the remaining circuit in service could overload.

Scenario identification

The table below highlights how the constraints occurs during the 0-10 year period across the different scenarios studied. The projected overloads are first identified in the baseline year, and is affected by the large amount of small scale embedded generation installed in the area.

	Study year			
Scenario	**Baseline**	**2025**	**2028**	**2032**
Steady Progression		✓	✓	✓
System Transformation		✓	✓	✓
Consumer Transformation	✓	✓	✓	✓
Leading the Way		✓	✓	✓
WPD Best View		✓	✓	✓

Solution options

Any solution options are analysed using the Common Evaluation Methodology (CEM) Cost Benefit Analysis tool to appraise the optimal solution for an identified constraint. The Distribution Network Options Assessment (DNOA) in summer 2022 will publish the chosen decision.

Solution option	**Summary**
Reinforcement	Reconductoring relevant sections of 33 kV overhead line with 175mm² AAAC conductor will alleviate any of the projected overloads in the 0-10 year period for the projected load growth. This will also include removal of ancillary rating limitations on current transformers and existing protection systems.
Operational mitigation	As constraint occurs during intact network running and first circuit fault outage conditions in the baseline year, operational mitigation is not possible.
Load Management Schemes	Any additional generation connections into this group may be included in an Active Network Management (ANM) scheme, which could also be utilised to manage constraints on over-committed networks.
Flexibility services	Generation turn down or demand turn up services could be procured to alleviate projected circuit overloads. Dispatch of services would be required for an extended period of time throughout the summer period.

St Tudy Grid Transformer capacity

Constraint Summary

Generation | Demand

The table below outlines the nature of the network constraints identified in the network analysis.

Constrained assets	132/33 kV Grid Transformers at St Tudy BSP	
Type(s) of constraint	Thermal overload of 33 kV circuits	
Constrained condition(s)	Summer peak generation Winter peak demand	
Limiting factor of constrained assets	30/60 MVA Grid Transformers, demand limited by ancillary rating limitation of 69 MVA. Generation limited by reverse power flow rating of 60 MVA.	
Outage combination which causes the constraint	First Circuit Outage	For the arranged or fault outage of one of the transformers, the remaining transformers in service overloads.

Scenario identification

The table below highlights how the constraints occurs during the 0-10 year period across the different scenarios studied. The projected overloads are first identified in 2025.

Generation Driven Constraints

	Study year			
Scenario	**Baseline**	**2025**	**2028**	**2032**
Steady Progression		✓	✓	✓
System Transformation		✓	✓	✓
Consumer Transformation		✓	✓	✓
Leading the Way		✓	✓	✓
WPD Best View 2021		✓	✓	✓

Demand Driven Constraints

	Study year			
Scenario	**Baseline**	**2025**	**2028**	**2032**
Steady Progression				
System Transformation				
Consumer Transformation			✓	✓
Leading the Way		✓	✓	✓
WPD Best View 2021		✓	✓	✓

Solution options

Any solution options are analysed using the Common Evaluation Methodology (CEM) Cost Benefit Analysis tool to appraise the optimal solution for an identified constraint. The Distribution Network Options Assessment (DNOA) in summer 2022 will publish the chosen decision.

Solution option	**Summary**
Reinforcement	Replacement of the grid transformers with larger 60/90 MVA units (including removal of any ancillary rating limitations) will alleviate the projected overloads in all scenarios out to 2032. Note as group demand does not exceed 100 MW, there is no requirement to secure demand for a second circuit outage of loss of 132 kV infeed into the group.
Operational mitigation	As constraint occurs for a first circuit fault outage, limiting outage windows is not suitable mitigation. Permanent load transfers is not possible due to unavailability of capacity in neighbouring BSPs in future study years.
Load Management Schemes	Any additional connections (demand or generation) into this group could be included in an Active Network Management (ANM) scheme, which can be utilised to manage constraints on over-committed networks.
Flexibility services	Flexibility services could be procured to alleviate projected overloads. Dispatch of services would be required for an extended period of time throughout the summer period for generation constraints, and during winter peak demand periods.

Appendix: Network Schematics

This appendix includes network schematic diagrams for each of the areas included in the Network Development Reports.

South West

St Tudy

Figure 2: Network schematic diagram for St Tudy Bulk Supply Point and 33 kV network, as published in the Long Term Development Statement (November 2021)