Torquay BSP and Associated 33 kV Network

Network Development Report – South West

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Electricity Distribution

nationalgrid

Contents

Torquay BSP and Associated 33 kV Network

1. Network Overview

Torquay Bulk Supply Point (BSP) supplies a predominantly urban 33 kV network, in South Devon. It is supplied from two 132/33 kV GTs and feeds approximately 37,700 customers.

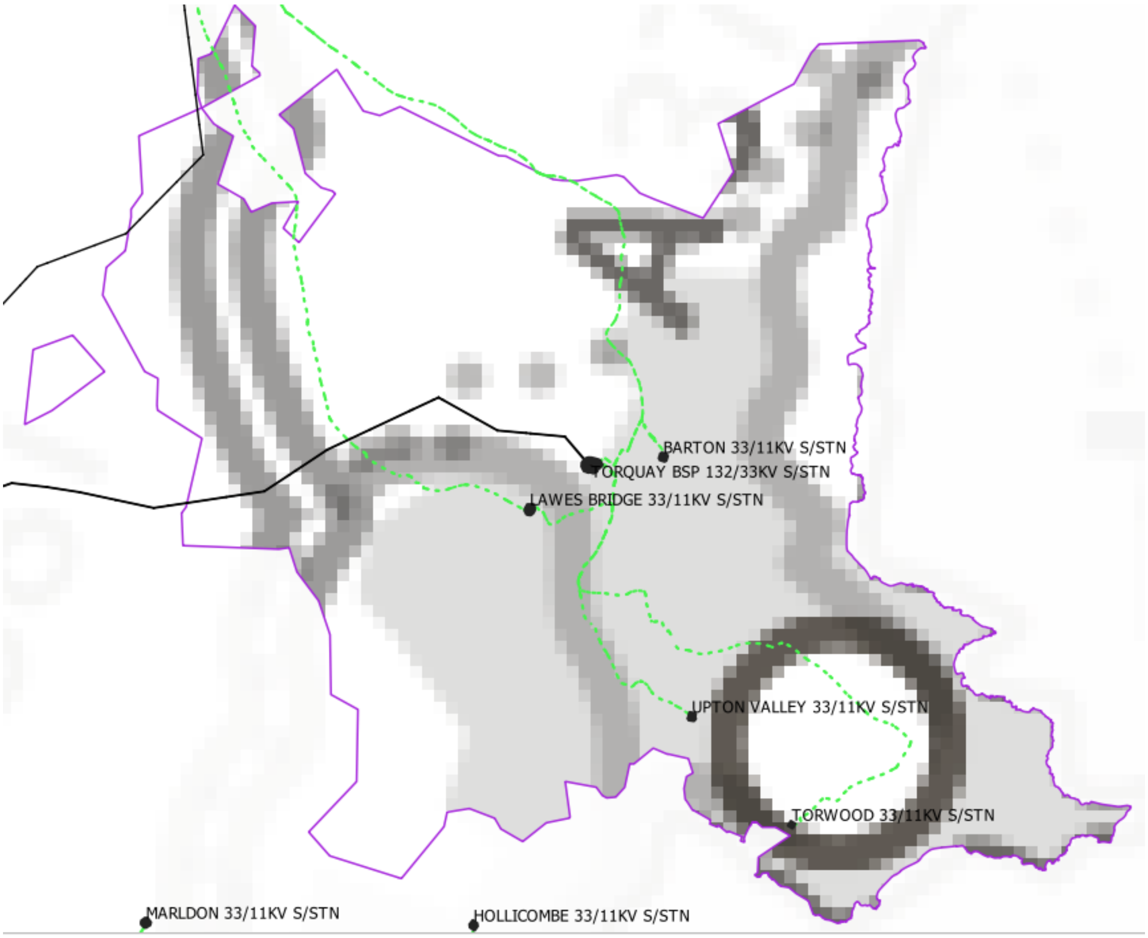

Figure 1.1 Torquay BSP geographic network coverage

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 Torquay 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 Torquay BSP network is arranged as follows:

- Torwood Primary substation is supplied via two separate 33 kV circuits as transformer feeders with a 33 kV generator connection connected to each of the feeders as a ‘double banked’ connection
- Upton Valley Primary substation is supplied via two separate 33 kV circuits as transformer feeders, with one feeder double banked to supply a feeder to Barton Primary.

- Lawes Bridge Primary substation is supplied via two separate 33 kV circuits as transformer feeders each teed off one of the Torquay BSP to Newton Abbot BSP circuits with normal open points at Newton Abbot.
- Barton Primary substation is supplied as transformer feeders with one feeder being teed off a Torquay BSP to Newton Abbot BSP circuit with a normal open point at Newton Abbot. The other feeder is ‘double banked’ with one of the Upton Valley feeders.

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 on a section of 33 kV Busbar where possible feeders are re-allocated to in in service busbar.
- For an arranged outage on feeder 28L5 the connected 33 kV generator output is constrained to zero.

2. Network Constraints and Solution Options

2.1 Summary of Network Constraints

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

- Lawes Bridge 33/11 kV transformer overloads
- Torwood 33/11 kV transformer overloads
- Torquay BSP to Torwood 33 kV circuits overload

3. Network Constraint Details and Solution Options

3.1 Lawes Bridge 33/11 kV transformer overloads

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 intermediate cool 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
Lawes Bridge T1 overload	Torquay 25L5 circuit or Lawes Bridge T2 outage	None	-	2032	-	-
Lawes BridgeT2 overload	Torquay 24L5 or Lawes Bridge T1 outage	None	-	2032	-	-

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios.

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	Review transformer ratings	✓	×	✓	Viable
2	Replace transformers with larger units	✓	×	×	Viable
Operational Mitigation					
-	*None Identified*	-	-	-	-
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
3	Procure flexibility under Lawes Bridge at 11 kV or below	✓	×	✓	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 1 – Review transformer ratings

Capacity released for constraint(s) considered: Subject to review

Viable

Detailed description: Overloads are only seen in 2032 and beyond for intermediate cool. It is therefore possible that this constraint could be delayed slightly by reviewing NGED's internal policy regarding transformer ratings, which does not currently distinguish between summer and intermediate cool ratings (which may be overly pessimistic). This solution is dependent on an internal review and would not be a long term solution.

New limiting factor for constraint(s) considered: Subject to review

Option 2 – Replace transformers with larger units

Capacity released for constraint(s) considered: Subject to review

Viable

Detailed description: Replace transformers with larger units (20/40 MVA)

New limiting factor for constraint(s) considered: Subject to review

Option 3 – Procure flexibility under Lawes Bridge at 11 kV or below

Flexibility service type: Generation turn up/demand turn down

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads seen on transformers at Lawes Bridge. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended that a review of NGED's internal policy regarding transformer ratings is undertaken (Option 1) and in the longer term if necessary to replace the transformers with larger units (Option 2).

3.2 Torwood 33/11 kV Transformer Overloads

Generation Demand

Constraint Overview

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at summer peak generation.

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
Torwood T1 overload	Torquay 33 kV Main 2 busbar fault	None	-	-	-	Baseline
Torwood T2 overload	Torquay 33 kV Main 2 fault	None	-	-	-	Baseline

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 generation reduces, however this is not forecast under any scenario so mitigation against this constraint is required.

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	Install an additional 33 kV circuit breaker at Torquay to remove existing double banking arrangement	✓	✓	×	Viable
Operational Mitigation					
2	Install an inter-tripping scheme to disconnect the 33 kV generator in the event of a 33 kV Busbar fault	✓	×	✓	Viable
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
-	*None identified*	-	-	-	-

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 1 – Install an additional 33 kV circuit breaker at Torquay BSP

Capacity released for constraint(s) considered: N/A

Viable

Detailed description: When the 33 kV switchgear at Torquay BSP is due for replacement consider installing an additional 33 kV circuit breaker to enable the double banking arrangement to be removed.

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

Option 2 – Install an inter-tripping scheme to disconnect the 33 kV generator

Capacity released for constraint(s) considered: N/A

Viable

Detailed description: Install an inter-tripping scheme to disconnect the 33 kV generator in the event of a 33 kV busbar fault. This would involve sending an intertrip signal to the generator circuit breaker in the event of a busbar fault being detected.

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

Solution Recommendation

It is recommended that an inter-tripping scheme be installed to disconnect generation in the event of a 33 kV busbar fault (Main 2) at Torquay BSP (Option 2). When the 33 kV switchboard at Torquay BSP is to be replaced the double banking arrangement may be removed (Option 1).

3.3 Torquay BSP to Torwood 33 kV circuit Overloads

Generation Demand

Constraint Overview

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at summer peak generation.

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
Torquay BSP 28L5 & 21L5 to Torwood cct overloads	Torquay 33 kV Main 2 busbar	None				Baseline

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 generation reduces, however this is not forecast under any scenario so mitigation against this constraint is required.

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	Install an additional 33 kV circuit breaker at Torquay to remove the existing double banking arrangement	✓	✓	×	Viable
Operational Mitigation					
2	Install an inter-tripping scheme to disconnect the 33 kV generation in the event of a 33 kV busbar fault	✓	×	✓	Viable
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
-	*None Identified*	-	-	-	-

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 1 – Install an additional 33kV circuit breaker

Capacity released for constraint(s) considered: N/A

Viable

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

Detailed description: When the 33 kV switchgear at Torquay BSP is due for replacement consider installing an additional 33 kV circuit breaker to enable the double banking arrangement to be removed.

Option 2 – Install an intertripping scheme to disconnect the 33 kV generator

Capacity released for constraint(s) considered: N/A

Viable

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

Detailed description: Install an inter-tripping scheme to disconnect the 33 kV generator in the event of a 33 kV Busbar fault. This would involve sending an intertrip signal to the generator circuit breaker in the event of a busbar fault being detected.

Solution Recommendation

It is recommended that an inter-tripping scheme be installed to disconnect generation in the event of a 33 kV busbar fault (Main 2) at Torquay BSP (Option 2). When the 33 kV switchboard at Torquay BSP is to be replaced the double banking arrangement may be removed (Option 1).

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