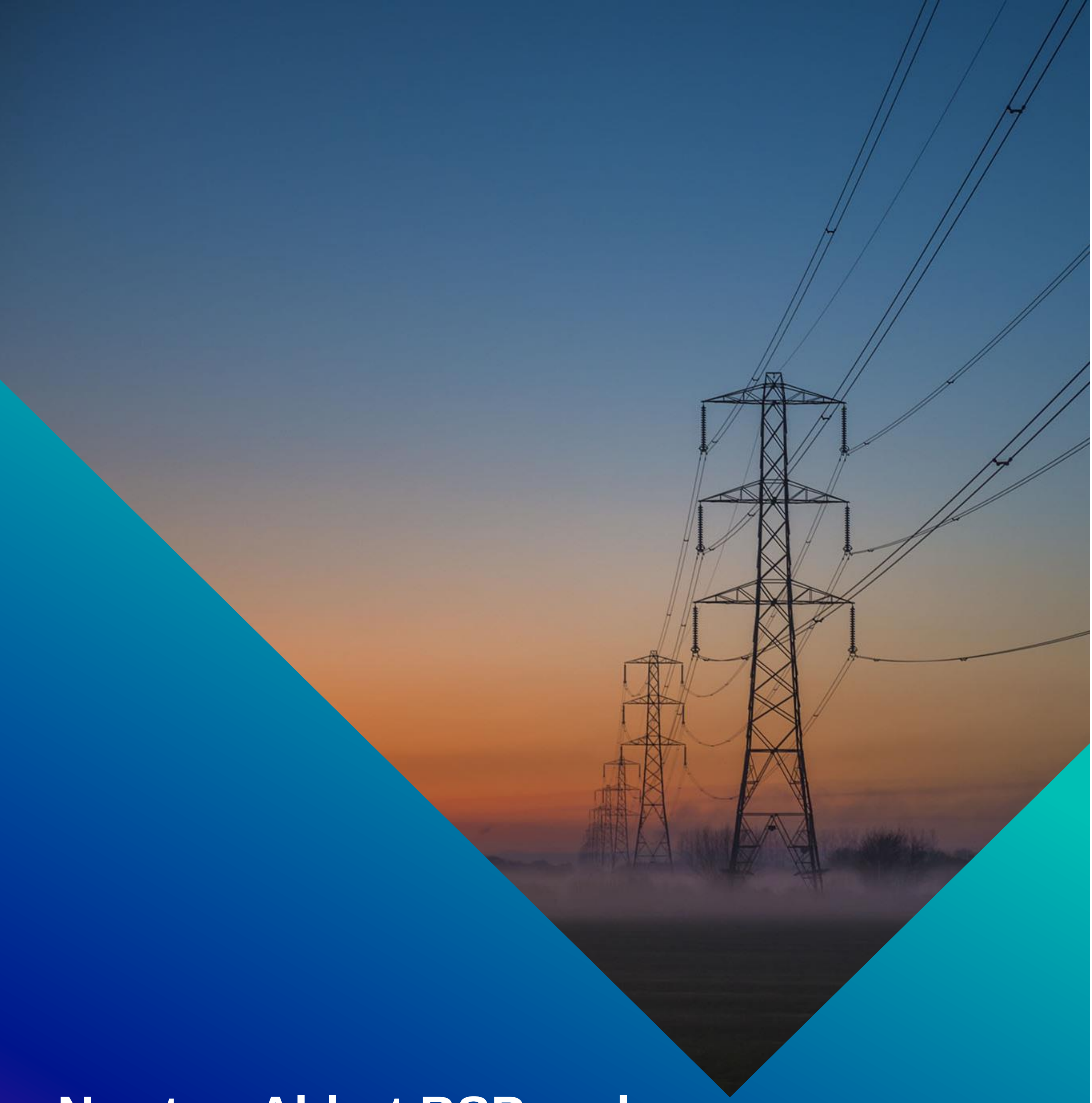

Newton Abbot BSP and Associated 33 kV Network

Network Development Report – South West

May 2024

Electricity Distribution

nationalgrid

Contents

Newton Abbot BSP and Associated 33 kV Network

1. Network Overview

Newton Abbot Bulk Supply Point (BSP) supplies an area of 33 kV network, in South Devon including Newton Abbot, Dawlish & Teignmouth. It is supplied from two 132/33 kV Gird Transformers (GTs), which feed approximately 52,800 customers.

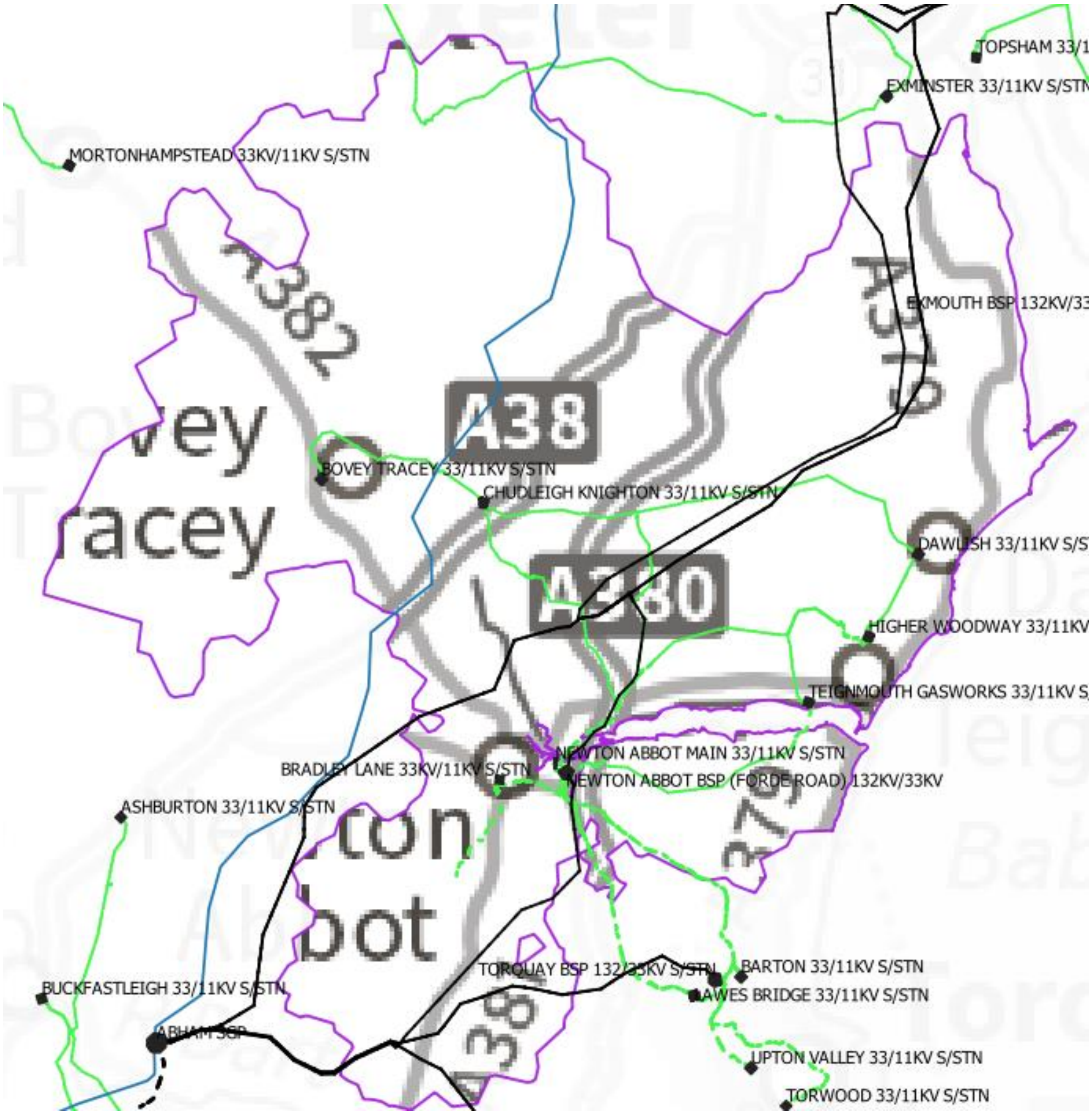

Figure 1.1 Newton Abbot BSP geographic network coverage

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 Newton Abbot 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 Newton Abbot BSP network is arranged as follows:

- Bradley Lane is a two transformer Primary connected to the 33 kV busbar at Newton Abbot BSP as radial feeders with a tee to Rydon Farm Solar Park on one of the feeders.
- Newton Abbot Main is a three transformer Primary connected to the 33 kV Busbar via three radial feeders. T1 & T3 being connected to Main 1 section and T2 to Main 2 section.
- A 33 kV four leg ring feeding Primaries at Chudleigh Knighton, Dawlish, Higher Woodway and Teignmouth Gasworks. Generation is connected at 33 kV at Ashcombe Solar Park and Heathfield Landfill.

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.

- Open Low Voltage (LV) circuit breakers on transformers for arranged outages on the High Voltage (HV) side to avoid back energisation
- For arranged 33 kV busbar outages at Newton Abbot reselection of circuits to energised busbars

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:

- Newton Abbot BSP 132/33 kV GT overload
- Dawlish 1L3 to Higher Woodway 2L5 33 kV circuit overload
- Newton Abbot 3L5 to Higher Woodway 1L5 33 kV circuit overload
- Newton Abbot Main 33/11 kV transformer overload
- Bradley Lane 33/11 kV transformer overload
- Newton Abbot 10L4 33 kV isolator overload

3. Network Constraint Details and Solution Options

3.1 Newton Abbot BSP 132/33 kV GT 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 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
Newton Abbot GT1 overload	Newton Abbot GT2 fault	None	2029	2032	-	-
Newton Abbot GT 2 overload	Newton Abbot GT1 fault	None	2029	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	Application of an increased rating following checks on ancillary ratings	✓	×	✓	Viable
Operational Mitigation					
2	Transfer demand to other BSPs	✓	×	×	Discounted
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
3	Procure flexibility under Newton Abbot BSP at 33 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 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.

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

Option 1 –Application of an increased transformer rating

Capacity released for constraint(s) considered: TBC

Viable

Detailed description: Uprate the existing GTs at Newton Abbot 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. This may allow reinforcement to be further deferred beyond 2034. In addition, it is likely that sections of 33 kV busbar (1620 Amps or 92.6 MVA rating) will need to be replaced for the full transformer capacity to be utilised.

New limiting factor for constraint(s) considered: TBC following confirmation of 33 kV busbar rating.

Option 2 – Transfer demand to other BSPs

Capacity Released for constraint(s) considered: 4.6 MVA

Discounted

Detailed description: Bradley Lane 33 kV demand could be transferred to Torquay BSP, however network resilience would be reduced placing supplies at risk of a single fault outage.

New limiting factor for constraint(s) considered: 90 MVA transformer rating

Option 3 – Procure flexibility under Newton Abbot BSP at 33 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 a Grid Transformer at Newton Abbot. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to undertake an assessment using NGED Standard Technique SD8C to achieve the full rating of both grid transformers along with checking the 33 kV busbar rating (Option 1).

3.2 Dawlish to Higher Woodway 33 kV circuit 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 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
Dawlish to Higher Woodway 33 kV	Newton Abbot 33 kV main 2 busbar fault	None	Baseline	Baseline	Baseline	-

Uncertainty under other Distribution Future Energy Scenarios: As this constraints occurs under baseline there is no uncertainty about future forecasts.

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	Reconductor circuit with larger conductor (150 sq.mm Cu or 200 sq.mm AAAC)	✓	✓	×	Viable
Operational Mitigation					
2	Reconfigure 33 kV Busbar running arrangement at Newton Abbot to prevent the loss of 3 circuits for a single Busbar outage	✓	×	✓	Viable
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
3	Procure flexibility under Dawlish/Higher Woodway 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 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.

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

Option 1 – Re-conductor the circuit with larger conductor

Capacity released for constraint(s) considered: 9.8 MVA

Viable

Detailed description: Re-conductor the circuit with 150 sq.mm Cu or 200 sq.mm All Aluminium Alloy Conductor (AAAC) along with overlaying any necessary sections of 33 kV cable.

New limiting factor for constraint(s) considered: 32.6 MVA.

Option 2 – Reconfigure 33 kV Busbar running arrangement at Newton Abbot

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

Viable

Detailed description: Selecting 9L5 to the reserve 2 Newton Abbot 33 kV busbar to prevent the loss of 3 out of 4 circuits for a fault on the 33 kV Main 2 busbar. This appears to be effective until beyond 2034 Best view scenario.

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

Option 3 – Procure flexibility under Dawlish/Higher Woodway 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 the Dawlish to Higher Woodway 33 kV circuit. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to select circuit breaker 9L5 to the reserve 2 busbar at Newton Abbot BSP to prevent the loss of 3 out of 4 circuits for a busbar fault (Option 2).

3.3 Newton Abbot to Higher Woodway 33 kV circuit 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 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
Newton Abbot BSP to Higher Woodway 33 kV	Newton Abbot 33 kV main 2 busbar	None	Baseline	Baseline	Baseline	Baseline

Uncertainty under other Distribution Future Energy Scenarios: As this constraint occurs under baseline there is no uncertainty about future forecasts.

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	Reconductor circuit with larger conductor (150 sq.mm Cu or 200 sq.mm AAAC)	✓	✓	×	Viable
Operational Mitigation					
2	Reconfigure 33 kV Busbar running arrangement at Newton Abbot to prevent the loss of 3 circuits for a single Busbar outage	✓	×	✓	Viable
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
3	Procure flexibility under Dawlish/Higher Woodway 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 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. .

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

Option 1 – Reconductor circuit with larger conductor (150 sq.mm Cu or 200 sq.mm AAAC)

Capacity released for constraint(s) considered: 13.3 MVA Viable

Detailed description: Re-conductor the circuit (6.067 km) with 150 sq.mm Cu or 200 sq.mm AAAC along with overlaying any necessary sections of 33 kV cable and replace 400 A line/Busbar isolators.

New limiting factor for constraint(s) considered: 36 MVA

Option 2– Reconfigure 33 kV Busbar running arrangement at Newton Abbot to prevent the loss of 3 circuits for a single Busbar outage

Capacity Released for constraint(s) considered: N/A Viable

Detailed description: Selecting 9L5 to the reserve 2 Newton Abbot 33 kV busbar to prevent the loss of 3 out of 4 circuits for a fault on the 33 kV Main 2 busbar. This defers the need to re-conductor this circuit until 2030 (Best view scenario).

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

Option 3 – Procure flexibility under Dawlish/Higher Woodway 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 the Newton Abbot to Higher Woodway 33 kV circuit. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to select circuit breaker 9L5 to the reserve 2 busbar at Newton Abbot BSP to prevent the loss of 3 out of 4 circuits for a busbar fault (Option 2) which is sufficient to defer the ned to re-conductor this circuit until 2030 (Option 3).

3.4 Newton Abbot Main 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 intermediate cool peak demand.

Table 3.4.1 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
Newton Abbot Main 33/11 kV Transformer (T2) & 33 kV circuit from BSP & 33 kV circuit breaker (2H0) CTs	Newton Abbot 33 kV Main 1 Busbar fault	None	Baseline	Baseline	2025	-

Uncertainty under other Distribution Future Energy Scenarios: As this constraint occurs under baseline there is no uncertainty about future forecasts.

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.4.2 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	Install an additional 33/11 kV transformer at Newton Abbot BSP to run in parallel with the existing T3 and transfer demand at 11 kV from Newton Abbot Main to create two separate Primaries each with 2 transformers	✓	✓	×	Viable
Operational Mitigation					
2	Reconfigure 33 kV busbar running arrangement to prevent loss of 2 trsnaformers (33/11 kV) for a single (busbar) fault	✓	×	✓	- Viable
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
3	Procure flexibility under Newton Abbot Main 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 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. .

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

Option 1 – Install an addition 33/11 kV transformer at Newton Abbot BSP

Capacity released for constraint(s) considered: 6.8 MVA **Viable**

Detailed description: Install an additional 33/11KV transformer (T4) and replace T3 at Newton Abbot BSP along with a new 11 kV switchboard to create a new 2 transformer 33/11 kV substation with T3 & T4 running in parallel. Demand on the existing Newton Abbot Main substation may then be split across either T1 & T2 or T3 & T4 to be balanced across the 33 kV Busbar to avoid overloads for a single fault.

New limiting factor for constraint(s) considered: 38.4 MVA (combined)

Option 2 – Reconfigure the 33 kV busbar running arrangement at Newton Abbot BSP

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

Detailed description: Reconfigure the 33 kV busbar running arrangement at Newton Abbot BSP by selecting circuit breaker 1H0 to the reserve 1 section of busbar. This prevents the loss of two 33/11 kV transformers in the event of a single busbar fault.

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

Option 3 – Procure flexibility under Newton Abbot Main at 11 kV

Flexibility service type: Generation turn up/demand turn down **Viable**

Detailed description: Flexibility services could be procured to alleviate projected overloads seen on Newton Abbot Main transformer T2 and associated circuit. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to reconfigure the 33 kV busbar running arrangement at Newton Abbot BSP by selecting circuit breaker 1H0 to the reserve 1 section of busbar (Option 2).

3.5 Bradley Lane 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 winter peak demand.

Table 3.5.1 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
Bradley Lane 33/11 kV Transformer	Bradley Lane 33/11 kV transformer	None	2032	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 3.5.2 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 Bradley Lane 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 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 – 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: TBC

Viable

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

New limiting factor for constraint(s) considered: TBC

Option 3 – Procure flexibility under 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 a transformer a Bradley Lane. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to undertake a review of the transformer ratings as detailed in option 1.

3.6 Newton Abbot 10L4 isolator 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 3.6.1 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
Newton Abbot 33 kV isolator 10L4 (10L6) overload	Newton Abbot 33 kV Main 1 busbar fault	None	2032	2032	-	-

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.6.2 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 both 33 kV isolators with larger units	✓	×	✓	Viable
Operational Mitigation					
-	*None Identified*	-	-	-	
Load Management Schemes					
-	*None Identified*	-	-	-	
Flexibility services					
2	Procure flexibility under Newton Abbot BSP at 33 kV or below	✓	×	✓	Viable

Uncertainty under other Distribution Future Energy Scenarios: As this constraint occurs under baseline there is no uncertainty about future forecasts.

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.

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

Option 1 – Replace both 33 kV isolators with larger units

Capacity released for constraint(s) considered: TBC

Viable

Detailed description: Replacement of 33 kV isolator (10L4 & 10L6) with 2000 Amp units.

New limiting factor for constraint(s) considered: TBC

Option 2– Procure flexibility under Newton Abbot BSP at 33 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 isolator 10L4 at Newton Abbot BSP. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended that isolators 10L4 & 10L6 are replaced at Newton Abbot BSP (Option 2).

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