Taunton BSP and Associated 132 kV Network

Network Development Report – South West

May 2024

Electricity Distribution

nationalgrid

Contents

Taunton BSP and Associated 132 kV Network

1. Network Overview

Taunton Bulk Supply Point (BSP) supplies the Somerset county town of Taunton and its surrounding areas including the town of Wellington as well as several other small towns and villages. It is supplied from three 132/33 kV Grid Transformers (GTs) at Taunton BSP, fed via 132 kV from Taunton Grid Supply Point (GSP). Taunton BSP supplies approximately 53,000 customers.

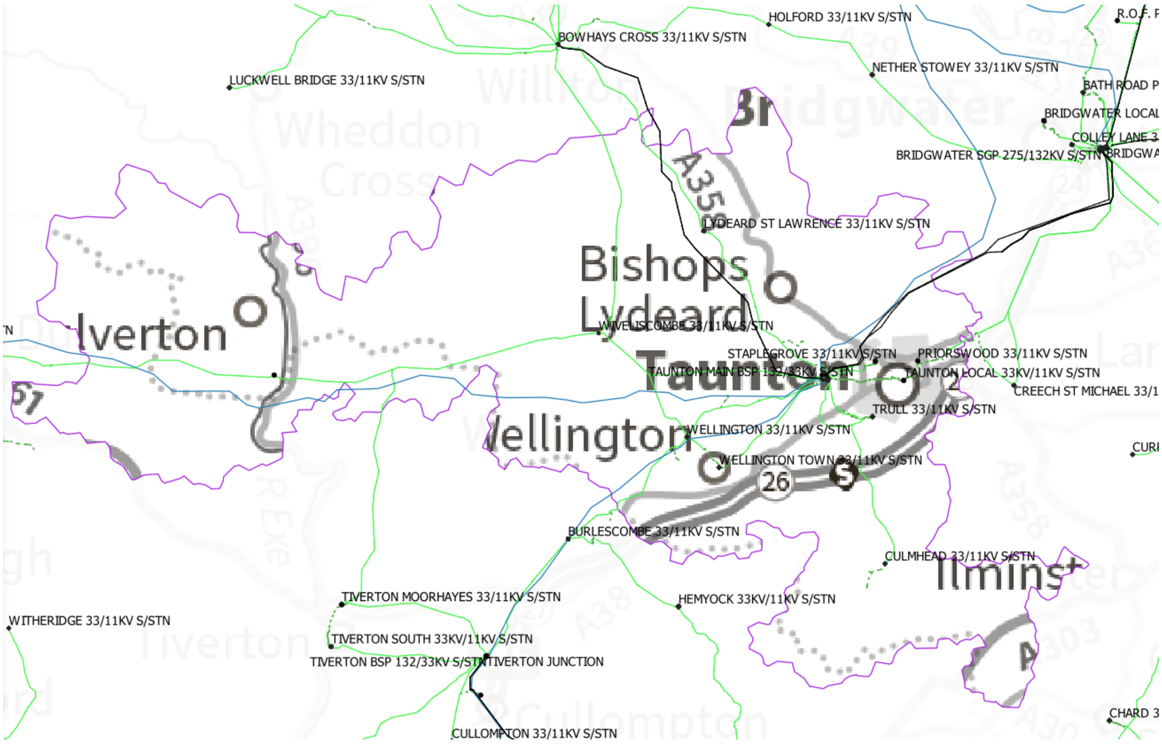

Figure 1.1 Taunton BSP geographic network coverage

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, 132/33 kV transformers and 132 kV circuits which supply and are supplied by Taunton 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. The two most onerous half-hours have been studied for each of the five representative days considered: Winter Peak Demand, Intermediate Warm Peak Demand, Intermediate Cool Peak Demand, Summer Peak Demand and Summer Peak Generation.

1.1 Network Topology

The Taunton BSP network is arranged as follows:

- Taunton GT1, GT2 and GT3 currently run in parallel supplying a three-section indoor 33kV switchboard. The 132 kV sides of these GTs are supplied by 132 kV from Bridgwater GSP.
- There are two 132 kV overhead line circuits between Bridgwater GSP and Taunton GSP, which are normally closed to parallel the two GSPs.
- Taunton local has two primary transformers and is supplied via three 33 kV circuits from Taunton BSP.

- Priorswood Primary substation is supplied by a single circuit teed off one of the 33 kV circuits to Taunton local. Priorswood is normally fed from Taunton BSP but is supplied from Bridgwater BSP in the event of a fault/outage.
- Staplegrove has two primary transformers supplied by two 33 kV circuits from Taunton BSP.
- There is a normal open point at Lydeard St Lawrence which is normally supplied from Taunton BSP but is supplied from Bowhays Cross BSP in the event of a fault/outage.
- Trull primary substation has two primary transformers and is supplied by two 33 kV circuits from Taunton BSP. There is a 33 kV normal open point at Trull separating the two circuits.
- Culmhead is a single transformer primary substation teed off one of the 33 kV circuits to Trull near to Trull primary substation, with the 33 kV circuit running south to Culmhead primary.
- There is a single 33 kV circuit between Taunton BSP and Wellington T2, which is normally separated from Wellington T1 on the 33kV and 11 kV.
- There is a single 33 kV circuit from Taunton BSP to Wellington Town T2.
- There is a single 33 kV circuit between Taunton BSP, Wellington T1, Exebridge and Wiveliscombe primary substations.
- A single 33 kV circuit connects between Wellington T1 and Wellington Town T1.
- Exebridge is supplied normally from Taunton BSP but is supplied from Barnstaple BSP during a fault/outage.
- Wiveliscombe Primary is normally fed from Bowhays Cross BSP but is supplied from Taunton BSP in the event of a fault/outage.
- Wellington T1 busbar is supplied from Taunton 20L5 via Wellington T2 by closing the 11 kV bus section in the event of a fault/outage.

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.

- Priorswood Primary 2T0 breaker closed to supply Priorswood via Bridgwater BSP 8L5 circuit for a fault/outage affecting T1 or the supplying 33 kV circuit from Taunton BSP.
- Lydeard St Lawrence 2T0 breaker closed to supply Lydeard St Lawrence via Bowhays Cross BSP 5L5 circuit for a fault/outage affecting T1 or the supplying 33 kV circuit from Taunton BSP.
- South Molton 3L5 circuit breaker closed to supply Exebridge for a fault/outage affecting the 33 kV supply from Taunton BSP.
- Wiveliscombe 2T0 breaker closed to supply Wiveliscombe via Taunton BSP 2L5 circuit for a fault/outage affecting T1 or the supplying 33 kV circuit from Bowhays Cross BSP.
- Wellington Primary section breaker closed to supply Priorswood via Bridgwater BSP 8L5 circuit for a fault/outage affecting T1 or the supplying 33 kV circuit from Taunton BSP.
- Wellington T1 busbar is supplied from Taunton 20L5 via Wellington T2 by closing the 11 kV bus section at Wellington in the event of a fault/outage.
- For a Taunton Main 3 busbar arranged outage, the 11kV breaker associated with Trull T1 is opened to prevent reverse power flow through T1. Culmhead primary substation is picked up via 11 kV circuits as it is a single transformer primary.
- Various winter arranged outages not permitted due to SCO overloads.
- Various SCO overloads solved by network reconfiguration for arranged outages.

2. Summary of Network Constraints

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

- Taunton Grid Transformer overload
- Culmhead Single transformer primary transformer overload
- Taunton 34L5 to Culmhead tee 33 kV circuit overload
- Wellington Town Town T1 and T2 overload
- Taunton to Wellington Town 33 kV circuit overload (36L5 circuit)
- Taunton to Wellington 33 kV circuit overload (20L5 circuit)
- Wellington 5L3 to Wellington Town 1L3 33 kV circuit overload
- Trull T2 transformer overload
- Taunton to Taunton Local 33 kV circuit overload (3L5 circuit)

3. Network Constraint Details and Solution Options

3.1 Taunton Grid 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 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
Taunton GT overload	Arranged GT outage/ associated 132 kV outage	GT fault/ associated 132 kV fault	Baseline	Baseline	Baseline	2026

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 demand 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 3.1.2 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	Install additional transformer and 132 kV circuit	✓	✓	✓	Viable
Operational Mitigation					
2	Limit arranged outage window to summer	✓	✓	✓	Viable
3	Change running arrangement during arranged outage	✓	✓	✓	Viable
Load Management Schemes					
4	Uprate the existing GT at Taunton via use of cyclic ratings	✓	✓	✓	Viable
Flexibility services					
5	Procure flexibility at Taunton BSP	×	×	×	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 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. Therefore, not intervening would cause problems with system integrity (overloads) and would risk damaging the transformers.

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

Option 1 – Install additional transformer and 132 kV circuit

Capacity Released for constraint(s) considered: 90 MVA

Viable

Detailed description: Installing a fourth grid transformer at Taunton BSP would alleviate the constraints by ensuring two transformer remain online for any N-2 (second circuit outage) event. There is no space in the existing compound for a fourth grid transformer meaning a compound extension would be required. In addition, fault level would increase meaning an assessment of fault level would be required to determine if switchgear is rated sufficiently.

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

Option 2 – Limit arranged outage window to summer

Capacity Released for constraint(s) considered: 0 MVA

Viable

Detailed description: Limiting the arranged outage window to summer where maximum demand is lower means that the overload is not observed until 2026 under best view for N-2. This would defer reinforcement meaning it is likely to be a cost-effective option.

New limiting factor for constraint(s) considered: Summer rating of 1 gird transformer

Option 3 – Change running arrangement during arranged outage

Capacity Released for constraint(s) considered: 0 MVA

Viable

Detailed description: Splitting the network via 33 kV busbars at Taunton BSP and 11 kV transformer breakers to provide radial feeds during an arranged outage would prevent overloads for N-2 by disconnecting the substations associated with the transformer in the event of a fault within the allowance of engineering recommendation P2. Given the very low probability of an N-2 event this offers a potentially cost-effective method to prevent an overload and defer reinforcement. Longer term, additional capacity would be required to secure supplies and allow load growth.

New limiting factor for constraint(s) considered: Ability of single transformer to pick up radial demand during network split.

Option 4 – Uprate the existing GT at Taunton via use of cyclic ratings

Capacity Released for constraint(s) considered: 9 MVA during summer outage

Viable

Detailed description: Uprate the existing GTs at Taunton 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 Transformer (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 as summer demand is forecast to exceed the 99 MVA summer cyclic rating in 2029.

New limiting factor for constraint(s) considered: Summer cyclic rating of GTs

Option 5 – Procure flexibility at Taunton BSP

Estimated Flexibility Required (MVA): 12 MVA

Discounted

Detailed description: Very large amounts of flexibility would need to be procured to mitigate against this constraint. Therefore, this would not be economical.

Solution Recommendation

It is recommend to limit the outage window to summer to prevent baseline overloads and mitigate the constraint until 2026 under best view. In addition, cyclic ratings can be investigated, which in combination with limiting the outage window to summer would mitigate the constraint until 2029 under best view.

Following this, it is possible to split the network during an arranged outage to provide radial feeds and disconnect substations within the allowance of engineering recommendation P2 to further defer reinforcement.

Finally, installing a fourth grid transformer at Taunton BSP could be considered to allow further demand growth and prevent overloads. This would require a compound extension and an investigation of the fault level impact.

3.2 Culmhead Single transformer primary transformer 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 3.2.1 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
Culmhead Single transformer primary transformer overload	Chard 11 kV circuit fault (which transfers demand to Chard)	None	Baseline	Baseline	Baseline	Baseline

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	Replace transformer	✓	✓	✓	Viable
2	Install additional transformer and 33 kV circuit	✓	×	×	Discounted
Operational Mitigation					
-	*None Identified*	-	-	-	-
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
3	Procure flexibility at Culmhead Primary	×	×	×	Discounted

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

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 – Replace transformer

Capacity Released for constraint(s) considered: 11 MVA **Viable**

Detailed description: Replacing the existing 3 MVA transformer with a 7.5/15 MVA unit would remove this overload and release capacity for future growth. In addition, the existing transformer was installed in 1957 meaning it is over 65 years old. Therefore, replacing the transformer is likely to be the most cost-effective option.

New limiting factor for constraint(s) considered: 11kV circuit capacity

Option 2 – Install additional transformer and 33kV circuit

Capacity Released for constraint(s) considered: 3 MVA **Discounted**

Detailed description: This solution would involve installing an additional 7 km+ 33 kV circuit and second transformer at Culmhead primary. This would not significantly increase the firm capacity of Culmhead primary without also replacing the 3 MVA transformer unit. Therefore, this option would incur significant cost without releasing significant capacity for load growth. Therefore, this is not an economically viable option.

New limiting factor for constraint(s) considered: Existing 3 MVA transformer

Option 3 – Procure flexibility at Taunton BSP

Estimated Flexibility Required (MVA): Approximately 2 MVA **Discounted**

Detailed description: Flexibility would be required across most of the demand of Culmhead primary substation in order to mitigate this constraint. It is highly unlikely that sufficient flexibility could be procured to mitigate the overload. In addition, due to the age of the transformer there is significant benefit in replacing it with a larger unit.

Solution Recommendation

It is recommended to replace the transformer at Culmhead with a larger unit to remove the overload and provide capacity for future growth. There is already an asset replacement programme planned to replace the transformer which will mitigate this constraint.

3.3 Taunton 34L5 to Culmhead tee 33 kV circuit 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 3.3.1 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
Taunton 34L5 to Culmhead tee 33 kV circuit overload	Taunton 27L5 circuit fault / Taunton 33 kV main 2 busbar fault	None	2032	2032	2034	2035

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2029 and under Falling Short it is predicted to arise in 2038.

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	Reinforce existing 33 kV circuits	✓	×	✓	Viable
2	Install additional 33 kV circuits	✓	✓	✓	Viable
Operational Mitigation					
3	Transfer demand to other Primaries	✓	✓	✓	Viable
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
4	Procure flexibility at Trull and/or Culmhead Primaries 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. 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 – Reinforce existing 33 kV circuits

Capacity Released for constraint(s) considered: 3.7 MVA — Viable

Detailed description: Upgrading the 34L5 33 kV circuit to remove the limiting factors requires the following upgrades to be made:

- Remove CT limitations
- Remove protection limitation
- Remove Isolator limitations
- Re-profile or re-conductor 3718 m overhead line (type K – HDC 0.15 in² 50° C)

In addition, there is approximately 250 m of cable with a higher rating but this may be considered for upgrade at the same time as this will still limit the rating of the circuit.

New limiting factor for constraint(s) considered: Existing 33 kV cable sections on 34L5 which do not require upgrading.

Option 2 – Install additional 33 kV circuits

Capacity released for constraint(s) considered: 22.7 MVA — Viable

Detailed description: Installing a third circuit into Trull would prevent overloads seen. It would also mitigate against future overload on the other side of the ring (27L5 circuit). This would involve installing a 33 kV cable between Taunton and Trull as well as associated switchgear and carrying out required civil works.

This option releases the most capacity but is significantly more costly than upgrading the overload section of circuit. Therefore, it is necessary to assess the long term cost benefit of both options, as well as considering the use of flexibility to defer reinforcement.

New limiting factor for constraint(s) considered: Existing 33 kV circuits

Option 3 – Transfer demand to other Primaries

Capacity Released for constraint(s) considered: — Viable

1-3 MVA depending on 11 kV circuit capacity for transfer

Detailed description: Transferring demand from Trull to Taunton Local may offer a way to mitigate the overload without significant reinforcement works. This will require an assessment of how much demand can be transferred on the 11 kV network between Trull and Taunton Local.

New limiting factor for constraint(s) considered: 33 kV circuit capacity after transfers

Option 4 – Procure flexibility at Trull and/or Culmhead Primaries at 11 kV or below

Estimated Flexibility Required (MVA): 0.5 MVA+ — Viable

Detailed description: Flexibility services could be procured at Culmhead or Trull to alleviate projected overloads. The amount required will continue to grow as demand grows meaning this would likely only defer the reinforcement.

Solution Recommendation

It is recommended to assess the capability of the existing 11 kV circuits between Trull and Taunton local determine if any demand can be transferred away from Trull in order to prevent overloads and defer reinforcement. If sufficient demand cannot be transferred, it may be possible to procure flexibility at Culmhead or Trull primary substations to defer the reinforcement requirements, subject to a CBA confirmation through the DNOA process.

Longer term it is recommend to compare the benefits of reinforcing the existing 33kV circuits compared to installing a further 33kV circuit. This should take account of the costs of each and the long term capacity released.

3.4 Wellington Town T1 and T2 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 3.4.1 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
Wellington Town T1/T2 overload	Wellington Town T1/T2 fault	None	2033	2033	2033	2033

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2031 and under Falling Short it is predicted to arise in 2038.

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	Replace existing transformers	✓	✓	✓	Viable
2	Install additional transformer	✓	✓	✓	Viable
Operational Mitigation					
3	Transfer demand to other Primaries	×	✓	×	Discounted
Load Management Schemes					
4	Uprate the existing transformer at Wellington Town via use of cyclic ratings	×	×	✓	Discounted
Flexibility services					
5	Procure flexibility at Wellington Town	✓	✓	✓	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. 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 – Replace existing transformers

Capacity Released for constraint(s) considered: 17 MVA Viable

Detailed description: This would involve replacing the existing transformers with 20/40 MVA units. Given the age of the transformers this would have a dual benefit in terms of releasing capacity and replacing aging assets.

New limiting factor for constraint(s) considered: 40 MVA transformer ratings

Option 2 – Install additional transformer

Capacity Released for constraint(s) considered: 22.9 MVA Viable

Detailed description: Installing a third transformer at Wellington Town alongside switchgear and civil works would allow two transformers to remain in service for a fault of either of the existing circuits, preventing an overload. This would be compatible with an additional 33 kV circuit between Taunton and Wellington town as is one of the solutions proposed in the next section for the Taunton-Wellington Town 33 kV circuit overloads.

New limiting factor for constraint(s) considered: Existing transformers.

Option 3 – Transfer demand to other Primaries

Capacity Released for constraint(s) considered: 0 MVA Discounted

Detailed description: There are no primary substations near to Wellington Town meaning demand transfer is not an option.

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

Option 4 – Uprate the existing transformer at Wellington Town via use of cyclic ratings

Capacity Released for constraint(s) considered: 0MVA Discounted

Detailed description: The transformers at Wellington Town are not capable of cyclic rating as they are already designed to operate at high temperature under N-1. Therefore, any increase to the operating temperature would result in potential damage to the transformers or incorrect operation of protection.

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

Option 5 – Procure flexibility at Wellington Town

Estimated Flexibility Required (MVA): 1 MVA+ Viable

Detailed description: Flexibility services could be procured at Wellington Town substation to alleviate projected overloads. The amount required will continue to grow as demand grows meaning this would likely only defer the reinforcement.

Solution Recommendation

It is recommended to firstly consider flexibility as an option to defer reinforcement, subject to a cost benefit analysis confirmation through the DNOA process. Following this, a technical comparison between replacing the transformers and installing an additional one should be made. Replacing the transformers is likely to prove the most cost-effective long term option and would be compatible with the existing site layout.

3.5 Taunton Wellington Town/Wellington ring 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 3.5.1 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
Taunton to Wellington Town 33 kV circuit overload (36L5 circuit)	Taunton 20L5 33 kV circuit fault/ Taunton 33kV main 2 busbar fault	None	2032	2033	2032	2034
Taunton to Wellington 33 kV circuit overload (20L5 circuit)	Taunton 36L5 33 kV circuit fault/ Taunton 33kV main 3 busbar fault	None	2030	2030	2032	2032
Wellington 5L3 to Wellington Town 1L3 33 kV circuit overload	Taunton 36L5 33 kV circuit fault/ Taunton 33 kV main 3 busbar fault	None	2032	2033	2034	2034

Uncertainty under other Distribution Future Energy Scenarios: These constraints are related and forecasted to occur around the same time. The earliest forecast constraint is the 20L5 circuit. Under Leading the Way Scenario, this constraint is predicted to arise in 2029 and under Falling Short it is predicted to arise in 2035.

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	Reinforce existing 33 kV circuits	✓	×	×	Discounted
2	Install additional 33 kV circuit	✓	✓	✓	Viable
Operational Mitigation					
3	Transfer demand to other Primaries	×	×	×	Discounted
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
4	Procure flexibility at Wellington Town and/or Wellington Primaries 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. This would lead to an inability to meet the Security of Supply requirements of Engineering Recommendation P2 for Wellington and Wellington Town primary substations.

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

Option 1 – Reinforce existing 33 kV circuits

Capacity Released for constraint(s) considered: 5.6 MVA — Discounted

Detailed description: This options involves reinforcing the existing overhead line and cable sections which limit the rating of the existing circuits. This would involve reinforcing approximately 13 km of overhead line and over 2600 m of cable and would still be limited by sections of cable that are not upgraded. This would be a significant cost, whilst releasing very little capacity meaning it is not a cost-effective option.

New limiting factor for constraint(s) considered: Existing 33 kV cable sections

Option 2 – Install additional 33 kV circuits

Capacity released for constraint(s) considered: 22.7 MVA — Viable

Detailed description: Installing an additional 33 kV circuit from Taunton BSP to Wellington Town, where most of the demand is centred would mitigate this constraint by leaving two circuits in service for the fault of any one circuit. This would need to be connected to a different busbar section to the existing two circuits to prevent this same overload occurring for a busbar fault.

New limiting factor for constraint(s) considered: Existing 33 kV circuits

Option 3 – Transfer demand to other Primaries

Capacity Released for constraint(s) considered: 0MVA — Discounted

Detailed description: There are no primary substations near to Wellington or Wellington Town meaning demand transfer is not an option.

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

Option 4 – Procure flexibility at Wellington Town and/or Wellington Primaries at 11 kV or below

Estimated Flexibility Required (MVA): 3MVA+ — Viable

Detailed description: Flexibility services could be procured at Wellington or Wellington Town substations to alleviate projected overloads. The amount required will continue to grow as demand grows meaning this would likely only defer the reinforcement.

Solution Recommendation

It may be possible to procure flexibility at Wellington or Wellington Town substations to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

However, longer term an additional 33 kV circuit would provide the most capacity to the area, meaning this is likely to be the most cost-effective option.

3.6 Taunton to Taunton Local 33 kV circuit overload (3L5 circuit)

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 solution options to solve constraint(s)

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
Taunton to Taunton Local 33kV circuit overload (3L5 circuit)	Taunton 33kV main 2 busbar fault	None	Baseline	Baseline	Baseline	Baseline
Taunton to Taunton Local 33 kV circuit overload (3L5 circuit)	Taunton Local main 2 busbar fault	None	2030	2030	2031	2031

Uncertainty under other Distribution Future Energy Scenarios: As the first constraint occurs under baseline there is no uncertainty. The overload caused by a Taunton Local main 2 busbar fault is predicted to arise in 2029 under Leading the Way and 2035 under Falling Short.

Solution Recommendation

To prevent the baseline overload the 33 kV section breaker at Taunton Local Primary can be opened to prevent through-flow between Main 1 and Main 3 busbars during a fault of Main 2. It may also be necessary to split the 11 kV bar as part of this to prevent reverse power flow through the primary transformers during certain fault conditions. Alternatively, an inter-trip between Main 2 busbar and a single connection may be implemented to prevent the overload during this fault condition.

To prevent the overload caused by a Taunton Local Main 2 busbar fault, an additional 33 kV section breaker could be installed at Taunton Local to separate all three circuits between Taunton BSP and Taunton local, in order to prevent the loss of two infeeds for a single busbar fault at Taunton local.

3.7 Trull T2 transformer overload due to reverse powerflow (split 11 kV bar)

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 3.7.1 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
Trull T2 transformer overload	Taunton 33 kV main 3 busbar fault	None	2028	2028	2030	2030

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2027 and under Falling Short it is predicted to arise in 2034.

Solution Recommendation

It is recommended to split the 11 kV bar at Trull via the 11 kV section breaker and implement an auto-close scheme to pick up the lost side of the bar automatically during a fault. This could also be achieved by running with 1T0 circuit breaker associated with T1 normally open, with an auto-close for the loss of T2.

Another more costly alternative is to install a 33 kV section breaker to allow Trull to run without a split on the 33 kV network. This would eliminate short interruptions from the above solution when switching over automatically.

One further alternative is to increase the sensitivity of the directional overcurrent protection to prevent reverse power flow.