Barnstaple BSP

Network Development Report – South West

May 2024

Electricity Distribution

nationalgrid

Contents

Barnstaple BSP

1. Network Overview

Barnstaple Bulk Supply Point (BSP) supplies a mostly urban area of 33 kV network, with the bulk of the demand centred in Barnstaple, South Molton, Great Torrington and Lynton towns. It is supplied from two 132/33 kV Grid Transformers (GTs) at Barnstaple BSP, fed via 132 kV circuits from Alverdiscott Grid Supply Point (GSP). Barnstaple BSP supplies approximately 31,000 customers.

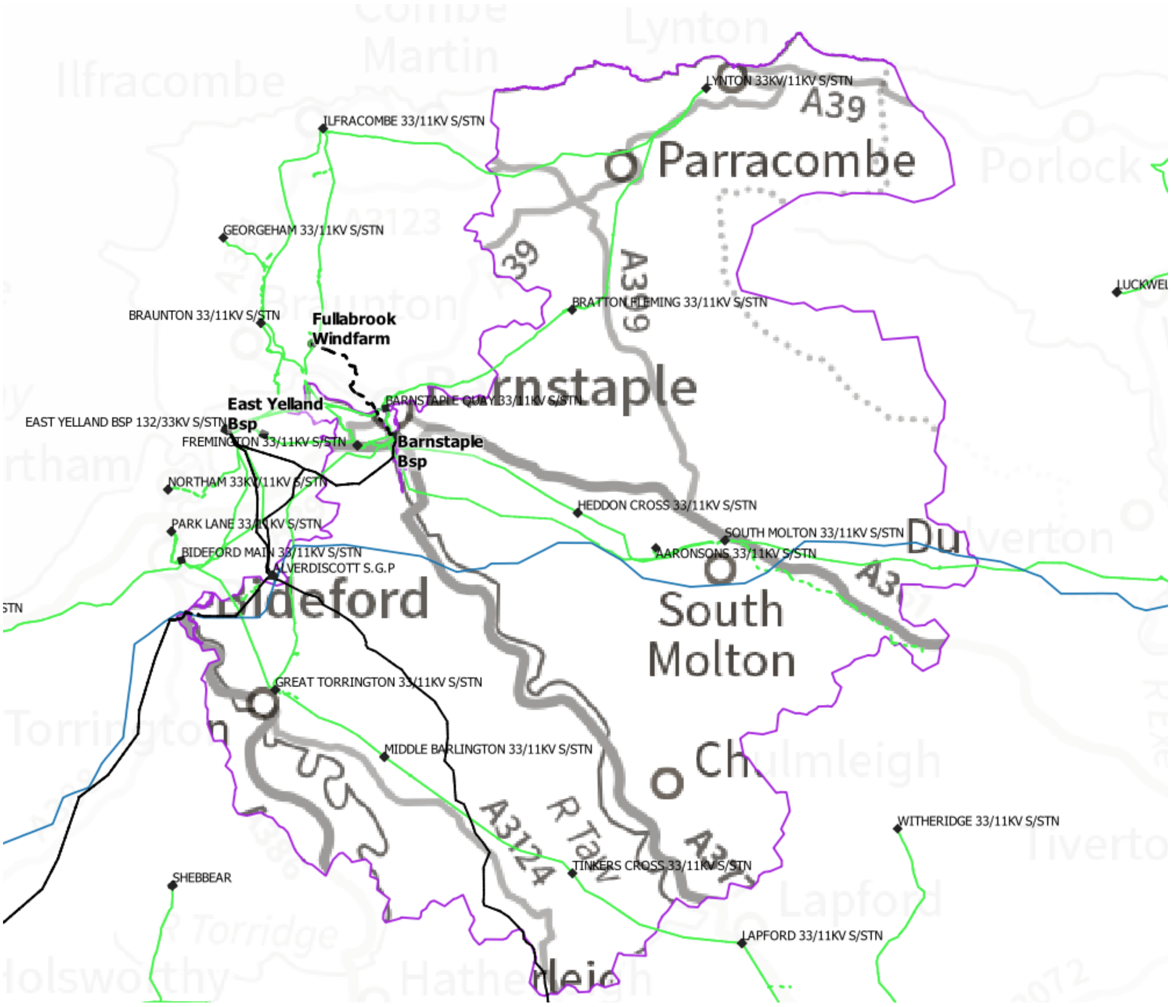

Figure 1.1 Barnstaple BSP geographic network coverage

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 and are supplied by Barnstaple 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 Barnstaple BSP network is arranged as follows:

- Rock Park and Roundswell Primaries are each supplied via two transformer feeders.
- A 33 kV ring supplying South Molton & Heddon Cross, along with connections to two 33 kV connected generators and a 33 kV demand customer with 33 kV interconnection to Taunton BSP via a normal open points at South Molton.

- Lynton and Bratton Flemming are fed via a single 33 kV circuit with interconnection to the East Yelland network via normal open points at Lynton and Barnstaple Quay
- A 33 kV circuit supplying Great Torrington, Middle Barlington & Tinkers Cross along with three 33 kV generator connections. Interconnection with East Yelland BSP exists via a normal open point at Great Torrington and Exeter City BSP at Lapford.

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.

- Curtailment of 33 kV connected generators within the group are modelled are a variety of arranged outages, as outlined in customer connection agreements
- For an arranged outage on Lynton 33 kV main busbar 2, the substation demand is transferred to the East Yelland network
- For an arranged outage on Great Torrington 33 kV main busbar 2, the substation demand is transferred to the East Yelland network

2. Summary of Network Constraints

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

- Barnstaple Grid Transformer capacity
- Middle Barlington regulator capacity
- South Molton and Heddon Cross ring capacity
- Roundswell and Rock Park primary transformer and circuit capacity
- Tinkers Cross to Barnstaple circuit capacity and transformers capacity

3. Network Constraint Details and Solution Options

3.1 Barnstaple Grid Transformer capacity

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 3.1.1 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
Barnstaple Grid Transformer capacity	Loss of one transformer	None	Baseline (2030 with cyclic ratings)	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 definitely 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	Reinforce existing transformers	✓	×	✓	Viable
2	New BSP	✓	✓	✓	Viable
3	Enhance transformer ratings by applying cyclic ratings	✓	×	✓	Viable
Operational Mitigation					
4	Transfer demand to other BSPs	×	×	✓	Discounted
Load Management Schemes					
5	Post-fault transfers	×	×	×	Discounted
Flexibility services					
6	Procure flexibility	✓	✓	✓	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. This would lead to an inability to meet the Security of Supply requirements of Engineering Recommendation P2 for Barnstaple BSP.

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

Option 1 – Reinforce existing transformers

Capacity Released for constraint(s) considered: 36 MVA — **Viable**

Detailed description: This option suggests replacing the existing GTs with larger 60/90 MVA units and removing any ancillary limitations. The consideration that is needed if this option is chosen is the number of circuits into the Barnstaple/East Yelland group which will be discussed in further detail in the 132 kV Alverdiscott report.

New limiting factor for constraint(s) considered: New transformer capacity.

Option 2 – New BSP

Capacity released for constraint(s) considered: 80 MVA — **Viable**

Detailed description: There is a possibility of creating a 15/30 MVA 132/11 kV around Barnstaple (Rock Park) and a single transformer BSP (132/33V) at or around a generator to the north of Barnstaple relieving the north part of the network of Barnstaple and East Yelland. This would need a tower circuit between Alverdiscott and the J route tee.

However, it is the most expensive option including more than 5 km of 132 kV circuit. More detail in the Indian Queens and Alverdiscott GSP groups' report.

New limiting factor for constraint(s) considered: New BSP capacity.

Option 3 – Enhance transformer ratings by applying cyclic ratings

Capacity Released for constraint(s) considered: 18 MVA — **Viable**

Detailed description: Uprate the existing transformers 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, 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.

New limiting factor for constraint(s) considered: Cyclic ratings capacity.

Option 4 – Transfer demand to other BSPs

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

Detailed description: Due to the constraints in the neighbouring areas for example East Yelland GTs and 132 kV circuit constraints it may be difficult to transfer demand away from the group. This is just a two BSP group with a small amount of interconnection to other BSPs.

New limiting factor for constraint(s) considered: 33 kV circuit capacity and neighbouring BSP GT capacity.

Option 5 – Post-fault transfers

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

Detailed description: Post fault transfers cannot be utilised as the overload is beyond post-fault ratings meaning there is no window to reduce the load on the 33 kV circuits through load management.

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

Option 6 – Procure flexibility

Estimated Flexibility Required (MVA): 1 MVA+ **Viable**

Detailed description: Flexibility services could be procured to alleviate projected overloads. This could defer reinforcement but due to the large quantity of flexibility required this may not be a viable solution.

Solution Recommendation

It may be possible to procure flexibility at Barnstaple BSP substation to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

To facilitate longer term growth it is likely that new larger 60/90 MVA units will be required and possibly 132 kV works will be required alongside it. The alternative is building a new BSP around Alverdiscott potentially at or around Great Torrington.

Both options will be needed in the next ten years.

3.2 Middle Barlington regulator capacity

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 3.2.1 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
Middle Barlington voltage regulator capacity	Outage of T2 at Lapford primary substation	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. There is a risk that demand reduces, however this is not forecast under any scenario so mitigation against this constraint is definitely 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 Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Reinforce existing regulator	✓	×	✓	Viable
2	Install Witheridge circuit into Lapford which would deload the regulator	✓	✓	✓	Viable
3	Circuit from North Tawton BSP to Tinkers Cross	✓	✓	✓	Viable
Operational Mitigation					
4	Transfer demand to other Primaries	×	×	×	Discounted
Load Management Schemes					
5	Post-fault transfers	×	×	×	Discounted
Flexibility services					
6	Procure flexibility	✓	✓	✓	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 Lapford, and Tinkers Cross primary substations.

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

Option 1 – Reinforce existing regulator

Capacity Released for constraint(s) considered: 7 MVA — Viable

Detailed description: Replacing the existing voltage regulator with a larger 18 MVA unit will improve the thermal overload on the current unit. The issue here is that larger regulators have decreased voltage regulation, this issue will need input from the policy team. However, if the Witheridge to Lapford circuit goes ahead and enough flexibility is procured it might not be needed.

New limiting factor for constraint(s) considered: New regulator size

Option 2 – Install Witheridge circuit into Lapford which would deload the regulator

Capacity released for constraint(s) considered: 0 MVA — Viable

Detailed description: More details will be in the Exeter City report where it solves the Witheridge Single Transformer Primary constraint. In essence it is a circuit between Lapford and Witheridge primary substations which will then enable the second transformer at Witheridge and allow Lapford to not be fed from Barnstaple for abnormal running.

New limiting factor for constraint(s) considered: Existing regulator and circuits.

Option 3 – Circuit from North Tawton BSP to Tinkers Cross

Capacity released for constraint(s) considered: 18 MVA — Viable

Detailed description: Build a 10 km circuit of at least 150 mm^2 All Aluminium Alloy Conductor (AAAC) or equivalent from North Tawton to Tinkers Cross to take that circuit off Barnstaple and improve voltage in that network. This will deload Barnstaple and will link with the second GT at North Tawton.

New limiting factor for constraint(s) considered: Existing regulator and circuits.

Option 4 – Transfer demand to other Primaries

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

Detailed description: Transferring demand away from the area is very challenging due to the distances involved.

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

Option 5 – Post-fault transfers

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

Detailed description: Post fault transfers cannot be utilised as the overload is beyond post-fault ratings meaning there is no window to reduce the load on the 33 kV circuits through load management.

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

Option 6 – Procure flexibility

Estimated Flexibility Required (MVA): 1 MVA+ **Viable**

Detailed description: Flexibility services could be procured at Lapford and Tinkers Cross to alleviate projected overloads.

Solution Recommendation

It may be possible to procure flexibility at Lapford and Tinkers Cross Primary substation to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

However, longer term a new circuit from North Tawton to Tinkers Cross is recommended to improve voltage stability and deload Barnstaple. This is dependent on GT2 at North Tawton being built. Otherwise uprating the regulator by specifying a larger voltage range may need to be looked at by Engineering Policy.

3.3 South Molton and Heddon Cross ring 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 3.3.1 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
Barnstaple 7L5 to Heddon Cross Single Transformer Circuit capacity	Barnstaple Main 1 Fault	None	2031	2032	2033	Baseline (generation)
Heddon Cross to South Molton circuit capacity	Barnstaple Main 1 Fault	None	2033	2034	2034	Baseline (generation)
South Molton to Barnstaple 8L5 circuit capacity	Barnstaple Main 2 Fault	None	2031	2032	2033	2027 (generation)

Heddon Cross single transformer primary capacity generation	Intact	None	-	-	-	2034
South Molton Transformer Capacity	Loss of one transformer	None	2033	2034	-	-
High and Low volts	Loss of a busbar at Barnstaple	None	2026	2026	2026	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 definitely 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 Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Reinforce existing circuit and transformers	×	✓	×	Viable
2	New circuit between South Molton and Barnstaple for generators and single customer	✓	✓	✓	Viable
Operational Mitigation					
3	Transfer demand to other BSPs	×	×	✓	Discounted
Load Management Schemes					
4	ANM	×	×	×	Discounted
Flexibility services					
5	Procure flexibility	✓	✓	✓	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 South Molton and Heddon Cross primary substations.

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

Option 1 – Reinforce existing circuit and transformers

Capacity Released for constraint(s) considered: 20 MVA — Viable

Detailed description: This option is still viable on a combination with Option 2 as alone it will not solve all the issues. The circuits that will need replacing will be including the CTs:

- Barnstaple 7L5 to Heddon Cross circuit 6km of 0.1in^2 HDC
- Heddon Cross to South Molton 1L3 circuit 5km of 0.1in^2 HDC
- Barnstaple 8L5 to South Molton 4L5 circuit 100m of 0.1in^2 HDC

These section should be replaced with 200mm^2 AAAC or equivalent to provide enough capacity for both primaries on the ring.

Heddon Cross Primary transformer should be uprated to 7.5/15 MVA.

South Molton primary transformers would need replacing with 12/24 MVA units.

New limiting factor for constraint(s) considered: New transformer capacity.

Option 2 – New circuit between South Molton and Barnstaple for generators and single customer

Capacity released for constraint(s) considered: 23 MVA — Viable

Detailed description: This option describes a need for a third circuit into the route. It would only need about 7 km of conductor as part of the circuit is already there in the form of a not connected overhead line on a tower line circuit.

This new circuit would take off the two generators and the single customer off the ring. The regulator will no longer be needed and generation constraint would be deferred.

This means that the two primaries South Molton and Heddon Cross would be on a ring on their own which would improve voltage performance and thermal overload by shifting some demand away from the ring.

New limiting factor for constraint(s) considered: Capacity of new circuit

Option 3 – Transfer demand to other BSPs

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

Detailed description: Due to geographical restrictions this option was discounted.

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

Option 4 – ANM

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

Detailed description: As customers are already connected it will be challenging to implement ANM on this ring.

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

Option 6 – Procure flexibility

Estimated Flexibility Required (MVA): 1 MVA+ — Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads on the demand side. However, the generation issues would need to be solved with reinforcement.

Solution Recommendation

It may be possible to procure flexibility at South Molton and Heddon Cross primary substations. However, generation issues may need to be reinforced for.

To facilitate baseline growth it is likely that a new circuit between Barnstaple and South Molton that takes off the two generators and the single customer will be needed. Additionally, uprating the transformers and the circuits on the ring will be enough to get through the next 10 years of generation and demand growth.

3.4 Roundswell and Rock Park primary transformer and circuit capacity

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 3.4.1 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
Roundswell primary transformer capacity	Loss of a transformer	None	2031	2031	2027	2030
Rock Park primary transformer capacity	Loss of a transformer	None	2035	-	2035	2040
Roundswell to Barnstaple circuits capacity	Loss of a circuit	None	2027	2027	2027	2028

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2026 and under falling short is it predicted to arise in 2028.

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	Reinforce existing circuits and transformers with 15/30 MVA units	✓	✓	✓	Viable
2	New circuit towards Fremington and add second transformer and uprate existing at Fremington	✓	✓	✓	Viable
3	Build new primary on the East side of Barnstaple	×	✓	✓	Viable
Operational Mitigation					
4	Transfer demand to other primaries	×	×	×	Discounted
Load Management Schemes					
	None identified				
Flexibility services					
5	Procure flexibility	✓	✓	✓	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 Roundswell and Rock Park primary substations.

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

Option 1 – Reinforce existing circuits and transformers with 15/30 MVA units

Capacity Released for constraint(s) considered: 5 MVA + 15 MVA Viable

Detailed description: This option suggests the reinforcement of the circuits between Barnstaple and Roundswell protection on both circuits and between Barnstaple 9L5 and Roundswell 2L3 and the 600m section of 100 mm^2 Aluminium Conductor Steel Reinforced (ACSR) with 150 mm^2 AAAC or equivalent.

As Rock Park is very close to the 132 kV two 132/11 kV 15/30 MVA units should be considered as it would increase the amount of 11 kV capacity in the area and deload the GTs. If this option is chosen it may trigger the extra J route circuit to split Barnstaple from East Yelland and a 132kV busbar at or around Barnstaple.

New limiting factor for constraint(s) considered: New transformer capacity and circuit capacity.

Option 2 – New circuit towards Fremington and add second transformer and uprate existing at Fremington

Capacity released for constraint(s) considered: 18 MVA Viable

Detailed description: Adding a second circuit to Fremington from East Yelland, uprating the existing transformer and add a new 12/24 MVA transformer. This would help with the new developments on the West side of the river.

New limiting factor for constraint(s) considered: Capacity of new primary and circuit.

Option 3 – Build new primary on the East side of Barnstaple

Capacity Released for constraint(s) considered: 23 MVA Viable

Detailed description: Building a new 12/24 MVA primary on the East side of Barnstaple will help the development on that side of town and would help the 11kV running through town. A cost benefit analysis would need to be carried out between this option and uprating the Rock Park transformers to 20/40 MVA units.

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

Option 4 – Transfer demand to other primaries

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

Detailed description: This option would not solve the problem as the demand growth in the area is very high across all the primaries around Barnstaple.

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

Option 6 – Procure flexibility

Estimated Flexibility Required (MVA): 1 MVA+ Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads on the demand side.

Solution Recommendation

It may be possible to procure flexibility at Roundswell and Rock Park primary substations to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

However, longer term circuits between Barnstaple and Roundswell should be reinforced and all protection limits be raised. Depending on the speed of developments on the East or West side of the river Fremington primary should have a new circuit to it from East Yelland and replace the existing transformer to 12/24 MVA and add a second unit to 12/24 MVA. This would allow the growth to happen in East Yelland BSP spreading the load between both BSPs. Once load grows on the East side a new primary or uprating Rock Park to 20/40 MVA units will be needed.

3.5 Tinkers Cross to Barnstaple circuit capacity and transformers capacity

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
Great Torrington primary transformer capacity	Loss of a transformer	None	2035	-	-	2034 (generation)
Great Torrington to Middle Barlington circuit capacity	Outage of Lapford Main 2	None	2035	-	2035	2040
Low volts at Tinkers Cross, Great Torrington and Tinkers Cross Primary substations	Arranged outage of 5L5 breaker at Barnstaple	Fault of Barnstaple GT2 and East Yelland GT1	2028	2028	2028	2028
Barnstaple 5L5 to Great Torrington circuit capacity	Intact	None	2034	2034	-	2034 (generation)

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2026 and under falling short is it predicted to arise in 2028.

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 circuits and transformers	×	✓	✓	Viable
2	New BSP	✓	✓	×	Discounted
3	New circuit	✓	✓	×	Viable
4	Install Witheridge circuit into Lapford which would deload the regulator	✓	✓	×	Viable
5	Circuit from North Tawton BSP to Tinkers Cross	✓	✓	×	Viable
Operational Mitigation					
6	Transfer demand to other primaries	×	×	×	Discounted
Load Management Schemes					
	None identified				
Flexibility services					

7	Procure flexibility	✓	✓	✓	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 Tinkers Cross, Middle Barlington and Great Torrington primary substations.

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

Option 1 – Reinforce existing circuits and transformers

Capacity Released for constraint(s) considered: 9MVA — **Viable**

Detailed description: This option suggests the reinforcement of the circuit between Barnstaple 5L5 and Great Torrington. Reprofiling the sections of 0.15in² 50°C HDC to be able to operate at 75°C which is over 2 km of circuit. There is also a need to reassess the protection, ABI and CT limits. There may need to add a capacitor due to low volts for arranged outage of the circuit

Great Torrington will need new 12/24 MVA transformers to replace the existing ones.

New limiting factor for constraint(s) considered: New transformer capacity and circuit capacity.

Option 2 – New BSP

Capacity released for constraint(s) considered: 114 MVA — **Discounted**

Detailed description: This option would help support the volts in the area and would add capacity. However, due to load growth not being high enough and cost of 132 kV circuits this may not be the most cost effective solution for this particular problem.

New limiting factor for constraint(s) considered: Capacity of new BSP.

Option 3 – New circuit

Capacity Released for constraint(s) considered: 23 MVA — **Viable**

Detailed description: Building a new circuit from Barnstaple or East Yelland avoiding Bideford Main would help with the voltage issues and thermal overloads on the East Yelland side for the n-1 position. This could be about 13 km 33 kV circuit from Barnstaple or about 8 km from the Park Lane to East Yelland circuit. The conductor size should be at least 200 mm² AAAC or equivalent.

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

Option 4 – Install Witheridge circuit into Lapford which would deload the regulator

Capacity released for constraint(s) considered: 0 MVA — **Viable**

Detailed description: More details will be in the Exeter City report where it solves the Witheridge Single Transformer Primary constraint. In essence it is a circuit between Lapford and Witheridge primary substations which will then enable the second transformer at Witheridge and allow Lapford to not be fed from Barnstaple for abnormal running.

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

Option 5 – Circuit from North Tawton BSP to Tinkers Cross

Capacity released for constraint(s) considered: 18 MVA — **Viable**

Detailed description: Build a 10 km circuit of at least 150 mm² All Aluminium Alloy Conductor (AAAC) or equivalent from North Tawton to Tinkers Cross to take that circuit off Barnstaple and improve voltage in that network. This will deload Barnstaple and will link with the second GT at North Tawton.

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

Option 6 – Transfer demand to other primaries

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: This option would not solve the problem as primary substations are geographically distant from other primaries.

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

Option 7 – Procure flexibility

Viable

Estimated Flexibility Required (MVA): 1 MVA+

Detailed description: Flexibility services could be procured to alleviate projected overloads on the demand side.

Solution Recommendation

It may be possible to procure flexibility at Great Torrington, Tinkers Cross and Middle Barlington primary substations to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

However, longer term circuits between Barnstaple and Great Torrington will need reprofiling of the smaller sections. And if a new GT at North Tawton goes ahead a new circuit between North Tawton and Tinkers Cross to deload the radial feed from Barnstaple would help voltage and thermal overloads.

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