East Yelland BSP

Network Development Report – South West

May 2024

Electricity Distribution

nationalgrid

Contents

East Yelland BSP

1. Network Overview

East Yelland Bulk Supply Point (BSP) supplies a mixture of rural and urban sections of 33 kV network, in North Devon. It is supplied from two 132 kV circuits which are fed from Alverdiscott Grid Supply Point (GSP), with two 30/60 MVA 132/33 kV grid transformers supplying the group. East Yelland BSP supply approximately 45,000 customers.

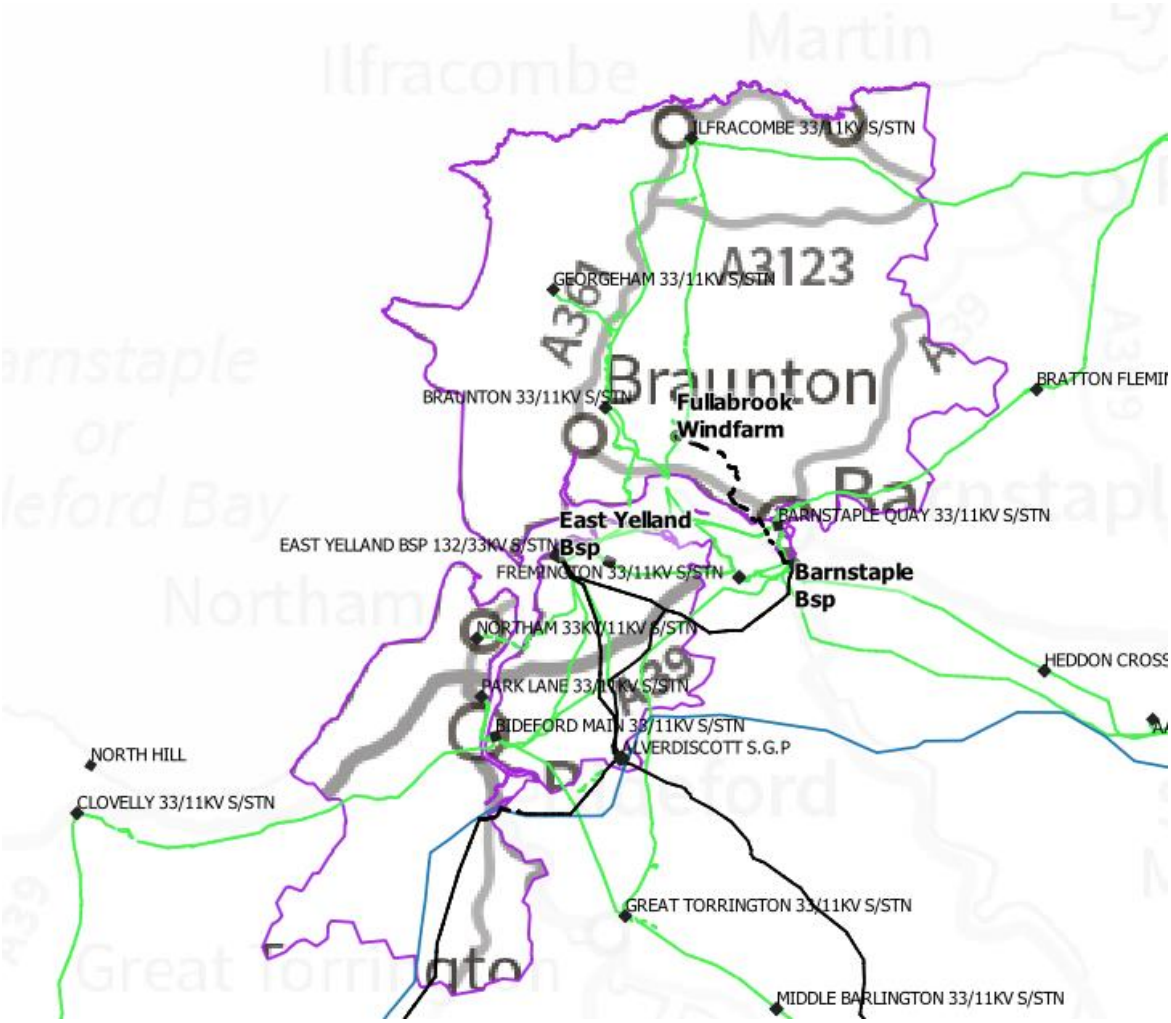

Figure 1.1 East Yelland BSP geographic network coverage

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 which supply East Yelland 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 East Yelland BSP network is arranged as follows:

- Northam Primary is supplied via a single transformer feeders.
- A 33 kV ring supplying Park Lane, Bideford Main, along with connections to three 33 kV connected generators and with 33 kV interconnection to Pyworthy BSP with normal open point at Clovelly and with Barnstaple BSP with a normal open point at Great Torrington

- 33 kV circuits feeding Fremington, Barnstaple Quay, Braunton, Ilfracombe and Georgeham with interconnection to Barnstaple BSP via Lynton

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.

- Arranged outages of the 33 kV transformer at Northam result in the transfer of the demand at Northam to Park Lane.
- For arranged outages of isolator 1L3 at Braunton, 1S0 at Braunton is closed.
- 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:

- Braunton/Ilfracombe and Fremington/Barnstaple Town Quay Primary 33 kV rings capacity
- Park Lane and Bideford Main 33 kV ring capacity
- East Yelland Grid Transformer capacity

3. Network Constraint Details and Solution Options

3.1 Braunton/Ilfracombe and Fremington/Barnstaple Town Quay Primary 33 kV rings 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 3.1.1 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
East Yelland 8L5 to Penhill Tee circuit capacity	East Yelland Main 1 Fault	None	Baseline	Baseline	Baseline	2026
East Yelland 4L5 to Ilfracombe 2L5 circuit	East Yelland Main 1 Fault	None	Baseline	Baseline	Baseline	2026
East Yelland 6L5 to Branton 4L3 circuit	East Yelland Main 2 Fault	None	Baseline	Baseline	Baseline	2026
Fremington to Barnstaple Town Quay circuit capacity	East Yelland Main 2 Fault	None	2031	2032	2033	2034
East Yelland 1L5 to Fremington circuit capacity	East Yelland Main 2 Fault	None	2028	2029	2030	2031
Ilfracombe Transformer capacity	Loss of one transformer	None	2034	-	-	2031 (generation)
Fremington Single Transformer Primary capacity	Loss of one transformer	None	2032	2033	2034	-

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 33 kV circuits	✓	×	✓	Viable
2	Install additional 33 kV circuits and transformer	✓	✓	×	Viable
Operational Mitigation					
3	Transfer demand to other Primaries	×	×	×	Discounted
Load Management Schemes					
4	Post-fault transfers	×	×	×	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 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 Ilfracombe, Georgeham and Braunton Primary.

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

Option 1 – Reinforce existing 33 kV circuits

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

Detailed description: Several sections of the existing 8L5 and 4L5 circuits off East Yelland would have to be upgraded to facilitate load growth. This would involve replacing several sections of overhead line and cable and making the necessary joints, as well as any Current Transformer (CT) and protection upgrades required. The sections to be replaced include:

For 4L5 about:

- 3000 m of 0.1 in² Hard Drawn Copper (HDC) (Baseline)
- 1000 m of 70 mm² HDC (Baseline)
- 5800 m of 0.15 in² HDC (2031)
- 1200 m of 0.3 in² Copper (Cu) (2034)

For 8L5:

- 4000 m of 0.15 in² HDC (Baseline)

- 500 m of 0.3 in² Cu (Baseline)

For 6L5:

- 3300 m of 0.15 in² HDC (Baseline)
- 800 m of 0.3 in² Cu (Baseline)

For 1L5:

- 6500 m of 0.15 in² HDC (2028 – until Fremington after that it is needed in 2031)
- 1000 m of 0.3 in² Cu and 300 mm² Al (2034)

The above circuits should be replaced with 200 mm² All Aluminium Alloy Conductor (AAAC) operating at 75°C or equivalent and underground circuits be replaced with 240 mm² Cu. However some of the circuits will reach their limits in 10 years' time with larger reinforcement schemes needed after that looking at the predicted growth after 2034.

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

Option 2 – Install additional 33 kV circuits and trasnformer

Capacity released for constraint(s) considered: 20 MVA **Viable**

Detailed description: Installing a 1200 m circuit between Barnstaple BSP and Barnstaple Town Quay Primary substation will allow to transfer it out of the current ring deloading the circuits. It would also help with the loading of the Fremington ring. If this was done Option 1 for later years may not be needed. The recommended size would be 200 mm² AAAC operating at 75°C or equivalent and underground circuits with 240 mm² Cu as there may be a thought of extending that circuit to potentially deload the ring further by putting Braunton on an auto changeover to Barnstaple this would be on the correct side of the river which would benefit the network.

To help with the Ilfracombe transformer issues another transformer at Georgeham will be needed, if 11 kV reinforcement is possible that would help deload Ilfracombe and potentially Braunton in the future years.

Also a circuit from Braunton primary connected generator towards Georgeham can give the extra capacity needed in the area and allow for the second transformer described above. The size of the Barnstaple to Barnstaple Town Quay Primary allow Braunton/Georgeham to be fed from Barnstaple, potentially on an auto changeover or a third bar section would be needed to have the interconnector land in a place that will allow for Braunton to be fed and feed through two normally closed circuits.

Fremington has a good interconnection with neighbouring sites. The recommendation would be to uprate the current transformer to 7.5/15 MVA transformer.

In the late 2030s reinforcement of the remaining Barnstaple to Barnstaple Town Quay Primary substation may be needed up to 200 mm² AAAC or equivalent and underground circuits with 240mm² Cu.

New limiting factor for constraint(s) considered: Capacity of new circuits and transformers.

Option 3 – Transfer demand to other Primaries

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

Detailed description: As Ilfracombe, Braunton and Georgeham are close to the sea there are not many options to deload these sites.

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

Option 4 – 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 5 – Procure flexibility

Estimated Flexibility Required (MVA): 10 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 is recommended to assess the feasibility of offering flexibility in the Ilfracombe, Georgeham and Braunton ring.

To facilitate longer term growth it is likely that a mixture of Options 1 and 2 will be needed. Option 1 being the quickest to deliver will need to mitigate all Baseline issues mainly the lines that have 0.1 in² HDC or 70 mm² HDC, as these will need reinforcing with 200 mm² AAAC operating at 75°C or equivalent.

Option 2 requires building new circuits and new transformers, it is the recommended option if it can be delivered on time.

3.2 Park Lane and Bideford Main 33 kV 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 3.2.1 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
Park Lane transformer capacity linked with Northam backfeed capacity	Loss of one transformer	None	2030	2030	2026	2027
Bideford Main transformer capacity	Loss of one transformer	None	2032	2033	2035	2040
Low voltage at Park Lane and Bideford Main including switchgear overloads at Bideford Main of 2L5 and 1S0 isolators	East Yelland Main 1 arranged outage	None	Baseline	Baseline	Baseline	Baseline
Bideford Main to East Yelland BSP circuit capacity	East Yelland Main 1 arranged outage	None	Baseline	Baseline	Baseline	Baseline
Park Lane to East Yelland circuit	East Yelland Main 2 fault	None	2029	2030	2031	2032
Park Lane to Bideford Main circuit	East Yelland Main 1 arranged outage	None	2034	2035	2040	2040
Great Torrington to Bideford Main circuit capacity	Arranged outage of Barnstaple to Great Torrington circuit	None	2031	2032	2033	2031 (generation)

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 33 kV circuits and transformers	✓	×	✓	Viable
2	Install additional 33 kV circuits and transformers	✓	✓	✓	Viable
3	Reinforce 11 kV circuits to transfer demand to other Primaries	×	×	×	Discounted
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 Park Lane and Bideford Main primary substations.

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

Option 1 – Reinforce existing 33 kV circuits and transformers

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

Detailed description: Several sections of the existing East Yelland 3L5 and 2L5 circuits would have to be upgraded also the circuits between Park Lane and Bideford Main and Bideford Main and Great Torrington. This would involve replacing several sections of overhead line and cable and making the necessary joints, as well as any CT and protection upgrades required. The sections to be replaced include:

For 3L5:

- 6000 m of 0.15 in² HDC
- 2300 m of 0.3 in² CU

For 2L5:

- 8000 m of 0.15 in² HDC

For Park Lane to Bideford Main:

- 2000 m of 0.3 in² CU

For Great Torrington to Bideford Main:

- 8000 m of 100 mm² ACSR

These sections when uprated should be to 200 mm² AAAC operating at 75°C or to 240 mm² CU cable. The sections that will support the position of the new BSP should be prioritised. The current proposed location would be Great Torrington, this is better described in the East Yelland GT constraint.

Besides the circuits in this option it would include uprating Park Lane and Bideford Main transformers to 12/24 MVA units. Option 2 would be preferred for transformer reinforcement as some load could be transferred to Northam if the second transformer is built.

New limiting factor for constraint(s) considered: Reinforced circuits and transformers

Option 2 – Install additional 33 kV circuits and transformers

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

Detailed description: A new 2000 m 240 mm² CU circuit between Northam and Park Lane would enable a new 12/24 MVA transformer at Northam which would alleviate Park Lane deferring the need for the new transformer and circuit reinforcement. The idea is for in the future to have Park Lane on an auto changeover to the new BSP and East Yelland. There could be a chance in the longer term to take Northam and Park Lane onto East Yelland and Bideford Main/Great Torrington and Clovelly auto changeover onto the new BSP.

The current circuit that feeds Park Lane from East Yelland can be used to make a ring into East Yelland and therefore allowing for the future BSP to have this new created ring in the future years. This includes using the circuit between Barnstaple and Great Torrington.

New limiting factor for constraint(s) considered: New circuits and transformers

Option 3 – Reinforce 11 kV circuits to transfer demand to other Primaries

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

Detailed description: As there are no two transformer primary substations near to Park Lane and Bideford Main supplied by different 33 kV circuits there are no options to reduce load on the ring.

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: As there are no primary substations ear to Park Lane and Bideford Main supplied by different 33 kV circuits there are no options to reduce load on the ring.

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 Park Lane and Bideford Main primary substations to alleviate projected overloads.

Solution Recommendation

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

However, longer term a mix of option 1 and option 2 will be needed with Baseline issues needing to be fixed now and option 2 to solve the longer term issues. Both options should be carried out to enable the future BSP in the area.

3.3 East Yelland 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 3.3.1 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
East Yelland Grid Transformer capacity	Arranged outage of 5L5 breaker at Barnstaple	Fault of Barnstaple GT2 and East Yelland GT1	2028	2029	2030	Baseline (generation)

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	Replace existing units with 60/90 MVA transformers	✓	✓	✓	Viable
2	New BSP	✓	✓	×	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 East Yelland BSP.

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

Option 1 – Replace existing units with 60/90 MVA transformers

Capacity Released for constraint(s) considered: 36 MVA

Viable

Detailed description: Reinforce existing transformers with larger 60/90MVA transformers. The growth in the area is more than both East Yelland and Barnstaple will be able to cope with existing GTs and even more if both sites were reinforced. There is also the limit of the 132kV circuits that may suggest the BSP around Great Torrington being the better wide scheme solution but the larger transformers would still be needed.

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

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 and a single transformer BSP 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.

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

Option 3 – 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 4 – Procure flexibility

Estimated Flexibility Required (MVA): 1 MVA+

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads. This could defer reinforcement.

Solution Recommendation

It is recommended to procure flexibility at East Yelland BSP 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 60/90 MVA units will be required. As part of the wider strategy a new BSP at or around a customer on the north part of Barnstaple will also be required. This will take several primaries relieving thermal overloads and will give a strong infeed point into the northern area of East Yelland and Barnstaple group.

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