Iron Acton GSP and Associated 132 kV Network

Network Development Report – South West

May 2024

Electricity Distribution

nationalgrid

Contents

Iron Acton GSP (South West)

1. Network Overview

Iron Acton Grid Supply Point (GSP) supplies a mostly urban area of 132 kV network, with the bulk of the demand centred in the City of Bristol, as well as the wider Bristol area and even some bits of the West Midlands covered in the West Midlands Iron Acton report. It is supplied by six 275/132 kV (Super Grid Transformers) SGTs at Iron Acton GSP. Iron Acton GSP South West part supplies approximately 200,000 customers.

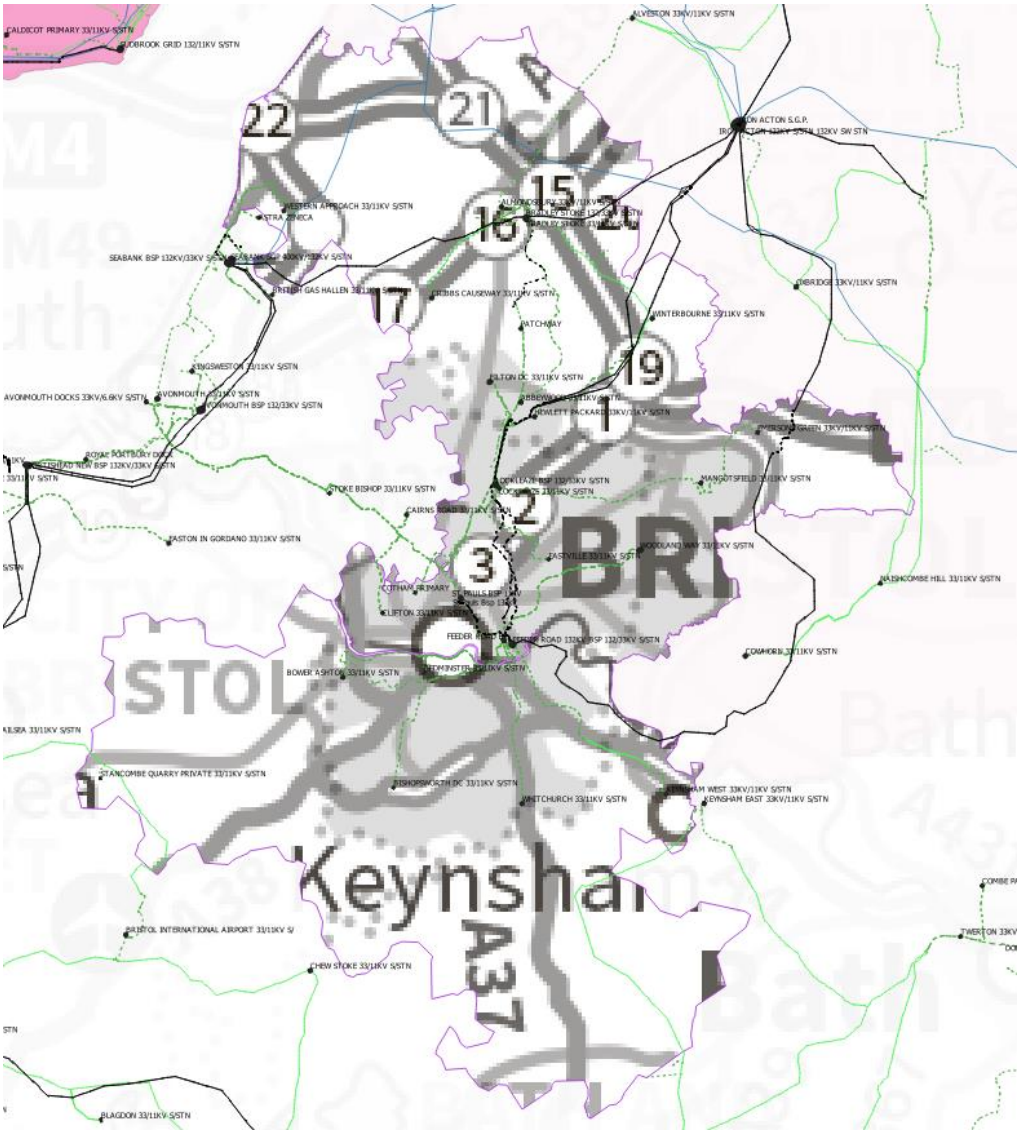

Figure 1.1 Iron Acton BSP geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon associated with the 132/33 kV transformers and 132 kV circuits which supply and are supplied by Iron Acton GSP. 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. For some cases further scenarios were studied as volume of connection applications for a certain area was larger than expected, this also matches with funding that certain local authorities got particularly Bristol City Council for their District Heat Network. 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 Iron Acton GSP (South West) network is arranged as follows:

- SGT1, SGT3 and SGT5 currently run in parallel supplying Lockleaze Grid Transformer (GT) 2 and GT3, Lockleaze GT1 and GT4 which then feeds Feeder Road GT1 and GT4, Cambridge Arms and Oldbury-On-Severn in the West Midlands licence area and one circuit in the DA route that feeds Bradley Stoke which will then feed Seabank GSP reserve Bar and then Seabank BSP.
- SGT2, SGT4 and SGT6 currently run in parallel supplying Seabank GSP reserve bar directly and Seabank BSP through one DA route cirucit, Feeder Road Bulk Supply Point (BSP) and St Pauls Primary through XW route 132 kV circuits, Cambridge Arms and Oldbury-On-Severn in the West Midlands licence area, and Chipping Sodbury BSP through PNV/PNW routes which are also in the West Midlands licence area.
- Feeder Road BSP is connected from Iron Acton GSP via four 132 kV circuits two from VV route and two from XW routes. These are then loosely coupled through the 33 kV network.
- St Pauls Primary is fed by two XW route 132 kV circuits loosely coupled on the 11 kV.
- Lockleaze BSP is fed by two circuits from the S route and two VV route 132 kV circuits these are loosely couple at 33 kV. Almondsbury primary is then loosely coupled to Bradley Stoke BSP on the 11 kV.
- Bradley Stoke BSP is fed from one DA 132 kV circuit with three 132 kV busbars which then connects to the Seabank GSP Reserve bar and Seabank BSP,
- Seabank BSP is fed from the DA route 132 kV circuits.
- Point to note is that the 132 kV ring off Iron Acton GSP (VV and XW route) are mostly 275 kV construction this was due to 1960s plan to establish a GSP at or around Feeder Road because of predicted demand growth.

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.

- Modelled the 33 kV auto close at Feeder Road up to the 132 kV busbar at Iron Acton. However, it currently does not cover the busbar. This will be very important if there is any thought given to go back to a three way split. If this happens maybe some intertrips will need to exist to trip St Pauls transformers to avoid backfeeds.
- Iron Acton GSP double busbar scheme that keeps the busbars split for fault level control.
- Abbeywood 11 kV split between Bradley Stoke and Lockleaze for when Seabank Reserve busbar is split.

2. Summary of Network Constraints

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

- P2 security of supply issue Feeder Road, St Pauls and Lockleaze J Bar Class E
- Voltage Step change Feeder Road 33 kV
- Lockleaze BSP circuit (S-route and Transformer capacity)
- St Paul's Primary capacity
- DA route 33 kV through flows

3. Network Constraint Details and Solution Options

3.1 P2 security of supply issue Feeder Road, St Pauls and Lockleaze J Bar Class E

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 year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Group Demand (Class E)	None	Loss of demand (St Pauls) when both XW route circuits are on outage	Baseline	Baseline	Baseline	Baseline

Uncertainty under other Distribution Future Energy Scenarios: As this constraint occurs under baseline, there is no uncertainty about future forecasts. Under the credible envelope demand is not projected to decrease which makes the risk of the solution becoming obsolete very small.

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 Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	132 kV busbar at Feeder Road	✓	✓	×	Viable
2	132 kV busbar at Lockleaze	✓	✓	×	Viable
Operational Mitigation					
3	Transfer demand to Lockleaze K bar	✓	×	✓	Viable
4	Split Feeder Road BSP on the couplers	✓	✓	✓	Viable
Load Management Schemes					
5	Post-fault transfers	×	×	×	Discounted
Flexibility services					
6	Procure flexibility around XW and VV routes	×	×	✓	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. This would lead to an inability to meet the Security of Supply requirements of Engineering Recommendation P2 for St Pauls, Lockleaze J Bar and Feeder Road.

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

Option 1 – 132 kV busbar at Feeder Road

Capacity Released for constraint(s) considered: 60 MVA — **Viable**

Detailed description: This option will allow for a mesh corner at Feeder Road 132 kV site which would mean the four circuits could be fully utilised as the busing point will allow for different feeds from different circuits without compromising security of supply.

New limiting factor for constraint(s) considered: BSP capacity at Feeder Road, St Pauls and half of Lockleaze.

Option 2 – 132 kV busbar at Lockleaze

Capacity released for constraint(s) considered: 60 MVA — **Viable**

Detailed description: Very similar to the previous option but on a different site. At Lockleaze the main difference would be potential lack of space. It would still allow for the full utilisation of all circuits but it would make it slightly difficult to solve the St Paul's loss of XW route without having to add another buspoint.

New limiting factor for constraint(s) considered: BSP capacity at Feeder Road, St Pauls and half of Lockleaze.

Option 3 – Transfer demand to Lockleaze K Bar

Capacity Released for constraint(s) considered: Up to 30 MVA in 2028 — **Viable**

Detailed description: To reduce the group size there could be some load transfers (potentially Filton Primary) from Lockleaze J Bar to Bradley Stoke/Lockleaze K Bar. Currently that would be around 30 MW but that number would decrease with general load growth. It would reduce the group Class from E to D which would allow for some demand to be dropped for Second Circuit Outage. This assumes Lockleaze GTs will pass SD8C checks.

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

Option 4 – Split Feeder Road BSP on the couplers

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

Up to 22 MVA in 2028 (dependent on general load growth take up in the subsequent years)

Detailed description: Splitting Feeder Road BSP on the couplers would decrease the Class of Supply of the group from E to D. This would allow for an interim solution before the reinforcement goes ahead. The 22 MVA assumes the Feeder Road BSP will pass the SD8C checks and have its cyclic ratings enabled.

New limiting factor for constraint(s) considered: Feeder Road 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 this is a security of supply issue for a n-2 condition.

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

Option 6 – Procure flexibility

Estimated Flexibility Required (MVA): 0 MVA

Discounted

Detailed description: Flexibility services are not appropriate to use in this case as demand needs to be restored in full.

Solution Recommendation

It is recommended that SD8C policy checks are carried out for the Feeder Road and Lockleaze GTs as soon as possible to enable their cyclic ratings. After that the preferred way of decreasing group demand would be by splitting Feeder Road on the couplers. This would be an interim solution before the 132 kV busbar and 132/11/11 kV Feeder Road Primary goes in.

3.2 Voltage Step change Feeder Road 33 kV

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 year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Voltage Step Change	Loss of one leg of XW route (which loses St Pauls transformer)	Loss of second leg of VV route	2028	2028	2028	2028

Uncertainty under other Distribution Future Energy Scenarios: Due to being a voltage issue and having very similar limits across the scenarios there is little benefit in giving a spread for this type of constraint.

Solution Options

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

Table 3.2.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	**Discounted**
Reinforcement					
1	132 kV busbar at Feeder Road	✓	✓	✓	**Viable**
2	132 kV busbar at Lockleaze	✓	×	✓	**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 Power Quality requirements of Engineering Recommendation P28 and Internal Design policy SD2.

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

Option 1 – 132 kV busbar at Feeder Road

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

Detailed description: This option will allow for a mesh corner at Feeder Road 132 kV site which would mean the four circuits could be fully utilised as the busing point will allow for different feeds from different circuits without compromising security of supply.

It would also allow for potential other BSPs off the XW route in the future if needed and solve the voltage step change constraint.

New limiting factor for constraint(s) considered: BSP capacity at Feeder Road, St Pauls and half of Lockleaze.

Option 2 – 132 kV busbar at Lockleaze

Capacity released for constraint(s) considered: 0 MVA

Viable

Detailed description: Very similar to the previous option but on a different site. At Lockleaze the main difference would be potential lack of space. It would still allow for the full utilisation of all circuits but it would make it slightly difficult to solve the St Paul's loss of XW route without having to add another buspoint.

New limiting factor for constraint(s) considered: BSP capacity at Feeder Road, St Pauls and half of Lockleaze.

Solution Recommendation

It is recommended that the Feeder Road 132 kV busbar goes ahead to solve voltage step change constraints in the 33 kV busbar at Feeder Road. Flexibility and other type of solutions were discounted due to the complexity of the issue.

3.3 Lockleaze BSP circuit (S-route and Transformer 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 year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
GT capacity at Lockleaze and fault level	Fault of one GT as fault level does not allow parallel of three GTs	None	2032	2032	2032	2032

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2030 and under falling short is it predicted to arise in 2040.

Adding the large connection predicted to connect in 2025 at 33 kV the reinforcement dates could be pulled forward to as close as 2028 if SD8C checks are passed or 2025 issue if they fail.

Solution Options

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

Table 3.3.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	New BSP at or around Emersons Green including 132 kV circuits	✓	✓	×	Viable
2	Lockleaze B	✓	✓	×	Viable
2	Auto-close	×	✓	×	Discounted
Operational Mitigation					
3	Transfer demand to Lockleaze K bar	✓	×	✓	Viable
4	Transfer 11 kV demand to Feeder Road/Avonmouth BSPs or St Paul's Primary	✓	×	✓	Viable
Load Management Schemes					
5	Post-fault transfers	×	×	×	Discounted
Flexibility services					
6	Procure flexibility around Lockleaze BSP	✓	×	✓	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 – New BSP at or around Lockleaze

Capacity Released for constraint(s) considered:

Viable

114 MVA or 78 MVA (if 132/11/11 kV solution chosen)

Detailed description: This option would be a traditional 2 GT site with circuits coming from XW routes as they are the two larger 132 kV circuits. There are old 132 kV running at 33 kV circuits between Mangotsfield and Lockleaze but the conversion of these would have to be assessed as these may not be suitable anymore the end bit would also be. This additional capacity would be in an area with some prospective enquiries for large amounts of demand, it would also help further deload Lockleaze which would benefit the load growth at that BSP.

For P18 reasons the Feeder Road 132 kV busbar would need to be triggered if the BSP was to go at Emmersons Green.

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

Option 2 – Lockleaze B

Capacity Released for constraint(s) considered: 114 MVA

Viable

Detailed description: This option would use the existing 132 kV circuits into Lockleaze and would require a 132 kV busbar at Lockleaze. It probably would require to look into existing freehold and possibility of using that land to build extension of the site.

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

Option 3 – Auto-close

Capacity released for constraint(s) considered: 60 MVA

Discounted

Detailed description: This option may not be feasible as even with the new switchgear/busbar at Lockleaze it is not possible to parallel three GTs together because of the excessive fault level.

New limiting factor for constraint(s) considered: Capacity of two Grid Transformers.

Option 4 – Transfer demand to Lockleaze K Bar

Capacity Released for constraint(s) considered: Up to 30 MVA in 2028

Viable

Detailed description: To reduce the overloads there could be some load transfers (potentially Filton Primary) from Lockleaze J Bar to Bradley Stoke/Lockleaze K Bar. Currently that would be around 30MW but that number would decrease with general load growth. This assumes Lockleaze GTs will pass SD8C checks and there is a possibility cyclic ratings will be applied.

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

Option 5 – Transfer 11 kV to Feeder Road/Avonmouth BSPs or St Paul's Primary

Capacity Released for constraint(s) considered:

Viable

Up to 40 MVA in 2028 (dependent on general load growth take up in the subsequent years)

Detailed description: Probably not the best option as the neighbouring BSPs are also high growth BSPs which may impact the growth in some areas. If this option is chosen should only be used as a temporary solution and reinforcement will need to be planned and on the delivery track.

New limiting factor for constraint(s) considered: Feeder Road GT capacity.

Option 6 – Post-fault transfers

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Post fault transfers cannot be utilised as this is a security of supply issue for a n-1 condition.

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

Option 7 – Procure flexibility

Estimated Flexibility Required (MVA):

Discounted

15 MVA for worst case scenario by 2032

Detailed description: Flexibility services are not appropriate to use in this case as demand needs to be restored in full.

Solution Recommendation

It is recommended that SD8C policy checks are carried out for the Lockleaze GTs as soon as possible to enable cyclic ratings on the GTs. Recommended solution would be to procure flexibility ahead of reinforcement. It is recommended that an Emersons Green BSP fed from the XW route is built and a 132 kV busbar at Feeder Road is triggered off the back of this to not allow more than three transformers to be banked on the sam circuit. This would support new developments in the North of Bristol.

3.4 St Paul's Primary 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 3.4.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
St Paul's Transformer capacity	Loss of one 132/11/11 kV transformer	None	2033	2033	2033	2033

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way Scenario, this constraint is predicted to arise in 2032 and under falling short is it predicted to arise in 2040.

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 Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Feeder Road 132/11/11 kV	✓	✓	×	Viable
2	Emersons Green BSP	✓	✓	×	Viable
Operational Mitigation					
3	Transfer demand to other Primaries	✓	×	✓	Discounted
Load Management Schemes					
4	Post-fault transfers	✓	×	✓	Discounted
Flexibility services					
5	Procure flexibility at St Paul's primary	✓	✓	✓	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 St Paul's primary.

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

Option 1 – Feeder Road 132/11/11 kV

Capacity Released for constraint(s) considered: 78 MVA ↑ **Viable**

Detailed description: Feeder Road 132/11/11 kV will deload St Paul's and Feeder Road BSP which will support the 11 kV network in the area

New limiting factor for constraint(s) considered: Existing circuit sections on 20L5 which do not require upgrading

Option 2 – Emersons Green BSP

Capacity released for constraint(s) considered: 114 MVA ↑ **Viable**

Detailed description: By creating BSP capacity in the Northern part of the city it will deload Lockleaze which in turn it will help deload St Paul's. Extensive 33 kV and 11 kV works will be needed to deliver this option.

New limiting factor for constraint(s) considered: XW and VV circuits capacity

Option 3 – Transfer demands to other primaries

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

Detailed description: As the city centre is a densely populated area there are some primaries nearby that could accept some demand. However, these have also high forecasted load growth, so it is not recommended to transfer demand to neighbouring primaries.

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 St Paul's Primary transformers.

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

Option 5 – Procure flexibility at St Paul's Primary Substations

Estimated Flexibility Required (MVA): 3 MVA+ ↑ **Viable**

Detailed description: Flexibility services could be procured at St Paul's primary to alleviate projected overloads.

Solution Recommendation

It may be possible to procure flexibility at St Paul's Primary substation to defer the reinforcement requirements, subject to a cost benefit analysis confirmation through the DNOA process.

However, longer term extra BSP capacity in the area will be beneficial, for example Feeder Road 132/11/11 kV transformers. This allied with a 132 kV busbar at Feeder Road will solve potential step change and security of supply issues.

3.5 DA route 33 kV through flows

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 year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
33 kV through flows at Bradley Stoke	Loss of one of the DA infeeds	Loss of Rolls Royce Bradley Stoke Busbar	Baseline	Baseline	Baseline	2025

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

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 Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Bradley Stoke twin feed from DA route	✓	✓	×	Viable
2	Intertrips for n-2	✓	×	✓	Viable
3	132 kV Seabank BSP to Seabank GSP feeds	✓	✓	×	Discounted
4	132 kV circuit from Iron Acton to Bradley Stoke	×	✓	×	Discounted
Operational Mitigation					
5	Reduced outage window and pre-emptive split	✓	×	✓	Viable
Load Management Schemes					
6	Post-fault transfers	✓	✓	✓	Viable
Flexibility services					
7	Procure flexibility at and between Seabank BSP and Bradley Stoke BSP	✓	×	✓	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 overload in the DA route circuits.

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

Option 1 – Bradley Stoke twin feed from DA route

Capacity Released for constraint(s) considered: 60 MVA — **Discounted**

Detailed description: This option would permanently stop any 33 kV throughflows on the DA route. Physically it will be one of the most challenging options due to Bradley Stoke already being designed with space saving in mind. Which means potentially cabling a 132 kV circuit from a neighbouring tower into the site.

Consideration would need to be given to introducing a 120 breaker at Seabank BSP. Because of this suggested running arrangement would have feeds off Iron Acton, Seabank GSP 132kV bar could potentially return to a full double busbar site without the current loop through.

New limiting factor for constraint(s) considered: Bradley Stoke Transformer capacity followed by DA route circuit capacity

Option 2 – Intertrips for n-2

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

Detailed description: For a condition when one of the DA route circuits in on outage an intertrip between DA circuits outgoing breakers and Bradley Stoke, would trip and post fault transfers would need to be relied on to establish Security of Supply. This would be acceptable as this smaller group is in Class D and a third of group demand could be returned from Seabank if necessary.

New limiting factor for constraint(s) considered: Transfer capacity to Lockleaze

Option 3 – 132 kV Seabank BSP to Seabank GSP feeds

Capacity Released for constraint(s) considered: 80 MVA — **Discounted**

Detailed description: This option probably is not the most practical or possible due to the lack of available bays at Seabank GSP. However, it would stop most of the through flows for now. The DA route seems to have a few storage sites connecting that would invalidate this option or when they connect Bradley Stoke would still have to be twin teed.

New limiting factor for constraint(s) considered: Bradley Stoke capacity

Option 4 – 132 kV circuit from Iron Acton to Bradley Stoke

Capacity Released for constraint(s) considered: 60 MVA — **Discounted**

Detailed description: This would be the most expensive option and would release the most capacity. Breaker availability at Iron Acton GSP would potentially be a problem.

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

Option 5 – Reduced outage window and pre-emptive split

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

Detailed description: Pre-emptive splitting the 33 kV at Bradley Stoke and breaking the network loose couple will allow for demand to drop and not overload the Transformer circuit.

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

Option 6 – Post fault transfers

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

Detailed description: Post fault transfers allied with a pre-emptive split would allow for some extra capacity in the DA-route. It would still be P2 compliant if anything above 26 MW can be restored within 3 hours, this can be easily achieved through Seabank GSP and a bit through Lockleaze.

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

Option 7 – Procure flexibility at and between Seabank BSP and Bradley Stoke BSP

Estimated Flexibility Required (MVA): 10 MVA+ — **Viable**

Detailed description: Flexibility services could be procured at the two BSPs either Seabank or Bradley Stoke or in the 132 kV DA route circuit in between them. A cost benefit analysis may be needed to understand if cost of flexibility will be cheaper than having Customer Interruptions (CIs) and CMLs.

Solution Recommendation

Main solution would be to sectionalise the network for an arranged outage of a DA route circuit. This can be achieved by breaking the loose couple at Abbeywood pre-emptively and open a 33 kV breaker at Bradley Stoke to drop demand for next fault. Demand at Seabank BSP and Bradley Stoke BSP would then be dropped to be restored later on as part of a post fault transfer. For Class D there is a 3 hour limit which should be plenty of time to restore some demand.

Due to the increased potential impact in CIs and CMLs for a double circuit outage flexibility could be considered as a support depending on the outcomes of a thorough cost benefit analysis.

From 2025 due to large storage connections the reinforcement of this area will be needed. Recommended route for reinforcement would be to use n-2 intertrips to maintain network integrity.

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Registered Office: Avonbank, Feeder Road, Bristol BS2 0TB
nationalgrid.co.uk