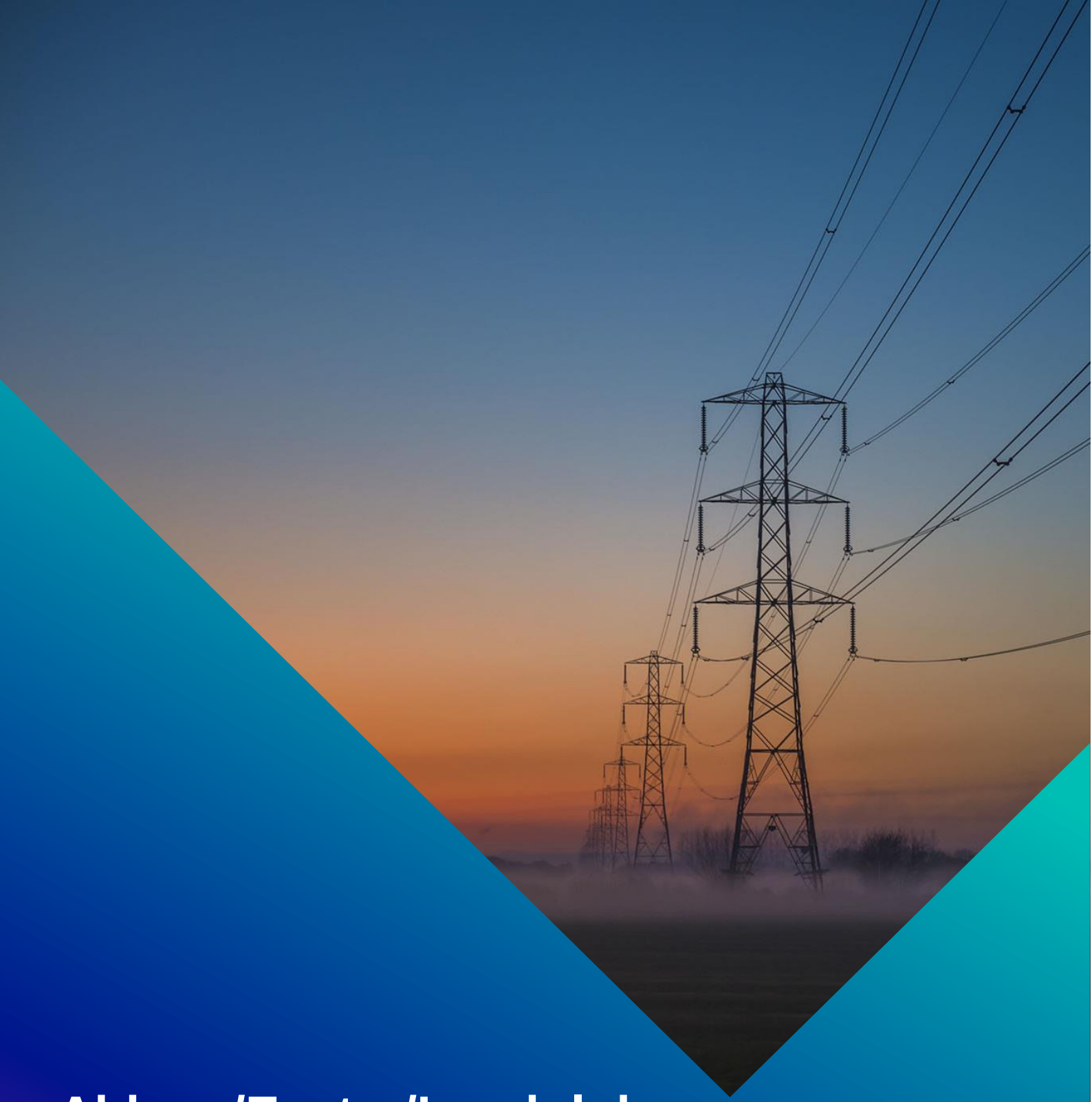

Abham/Exeter/Landulph GSP (South Devon 132 kV Network)

Network Development Report – South West

May 2024

Electricity Distribution

nationalgrid

Contents

Abham/Exeter/Landulph GSP (South Devon 132 kV Network)

1. Network Overview

The South Devon 132 kV network is fed in parallel from three grid supply points (GSPs) at Abham, Exeter & Landulph, supplying approximately 489,600 customers.

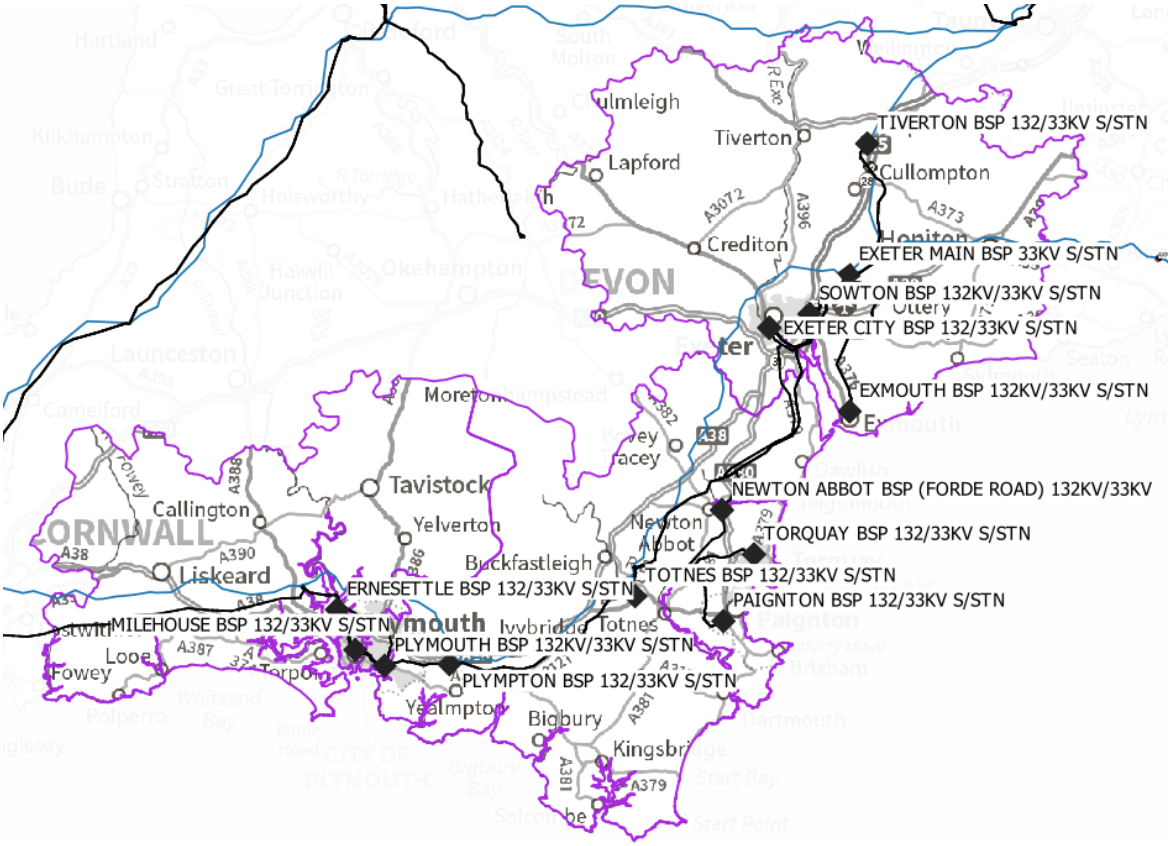

Figure 1.1 Abham/Exeter/Landulph geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon associated with the 132 kV circuits fed from these GSPs. 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 132kV South Devon network consists of the three GSPs, Landulph, Abham and Exeter which supply an interconnected 132kV network feeding 13 BSPs covering most of South Devon including the urban areas of Plymouth, Torbay & Exeter. The 132 kV network supplies the following BSPs:

- Tiverton, Exmouth, Exeter Main, Exeter City and Sowton are fed as radial feeds from Exeter Main GSP
- Newton Abbot is fed via 132 kV circuits interconnecting Exeter Main and Abham GSPs
- Torquay and Paignton are fed as radial feeds from Abham GSP.
- Totnes, Plympton, Plymouth, Milehouse and Ernesettle are fed via 132 kV circuits interconnecting between Landulph and Abham.

- A 132 kV generator is connected between Exeter Main and Exeter City.

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.

- For an arranged outage of Circuit Breaker (CB) 805 at Abham, the normal open point on CB 1005 is closed.
- For an outage on either Super Grid Transformer (SGT) at Abham CB 230 is closed.
- Following an outage of both SGTs at Abham, CB 1005 is closed.
- For an arranged outage on isolator 103 at Abham, CB 1T0 at Paignton and isolator 203 at Newton Abbot is opened to prevent a subsequent fault back-feeding Newton Abbot via the 33 kV busbars at Paignton.
- For arranged outage on CB 305 at Abham, CB 2T0 at Totnes is opened to prevent a subsequent fault back-feeding Plympton via the 33kV busbars at Totnes.

2. Network Constraints and Solution Options

2.1 Summary of Network Constraints

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

- Abham GSP to Totnes Tee 132 kV circuit overloads
- Totnes Tee to Plymouth BSP and Totnes Tee to Plympton BSP 132 kV circuit overloads
- Ernesettle BSP to Milehouse BSP 132 kV circuit overload
- Exeter Main GSP (905) to Sowton Tee 132 kV circuit overload
- Exeter Main GSP to Newton Abbot 132 kV circuit overload
- Exeter GSP to Abham GSP (805) 132 kV circuit overload
- Sowton Tee to Marsh Barton Power Station 132 kV circuit overload
- Paignton Tee- Newton Abbot 132 kV circuit overload
- Exeter Main GSP (705) to Sowton Tee 132 kV circuit overload
- Sowton to Sowton Tee circuit 132 kV circuit overloads
- Marsh Barton Power Station to Exeter City 132 kV circuit overload
- Exeter Main GSP (205) to Exeter City 132 kV circuit overload
- Plymouth BSP- Milehouse BSP 132 kV circuit overload
- Landulph GSP (605) to Ernesettle tee/Plymouth 132 kV circuit overload
- Landulph GSP (205) to Ernesettle 132 kV circuit overload
- Exeter Main GSP Supergrid transformer overload
- Landulph GSP Supergrid transformer overload
- Abham GSP Supergrid transformer overload

3. Network Constraint Details and Solution Options

3.1 Abham GSP to Totnes Tee 132 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 intermediate cool 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
Abham GSP to Totnes Tee (H110N) 132 kV cct	Landuph GSP-Ernesettle	Landulph GSP-Ernesettle Tee-Plymouth	-	Baseline	Baseline	Baseline
Abham GSP to Totnes Tee (H110S) 132 kV cct	Landuph GSP-Ernesettle BSP	Landulph GSP-Ernesettle Tee-Plymouth BSP	-	Baseline	Baseline	Baseline
Abham GSP to Totnes Tee (H110N) 132 kV cct	Langage 400 kV circuit 205	Abham GSP SGT2 & associated 400 kV circuit	-	-	-	Baseline
Abham GSP to Totnes Tee (H110S) 132 kV cct	Langage 400 kV circuit 405	Abham GSP SGT1 & associated 400 kV circuit	-	-	-	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 required.

Solution Options

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

Table 2.2.2 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	Removal of 'Totnes Tee' by laying additional 132 kV cable circuits	✓	✓	✓	**Viable**
Operational Mitigation					
2	Adopt a split 132 kV network at Plymouth	✓	✓	✓	**Viable**
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
3	Procure flexibility under various BSPs at 33 kV or below	✓	×	✓	**Viable**

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full cost benefit analysis (CBA). This CBA will be subsequently carried out by the Distribution Network Operator (DNO) to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the Distribution System Operator (DSO) as part of the Distribution Network Options Assessment (DNOA) process.

Option 0 – No intervention

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above.

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

Option 1 – Removal of Totnes Tee by laying additional 132 kV cable circuits

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

Viable

Detailed description: Laying two additional 2.3 km of at least 1000 S(segmental strand conductor)mm^2 Copper (Cu) 132 kV cable circuits between Abham and Totnes Tee will enable the teed arrangement to be removed with Totnes being fed as radial feeders using the existing cable circuits. The two new 132 kV cables will form part of the Abham to Plymouth/Plympton circuits.

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

Option 2 – Adopt a split 132 kV network at Plymouth BSP

Capacity Released for constraint(s) considered: 31.8 MVA (summer sustained)

Viable

Detailed description: Adopting a 132 kV split network enables a higher cable rating to be adopted since overloads only occur when one 132 kV cable circuit is in service. This will involve opening circuit breakers 120, 605 & 1S0 at Plymouth BSP to break the existing 132 kV network parallel between Landulph and Abham GSPs. The existing demand at Plymouth BSP will be split between both GSPs. This is adequate to prevent overloads during summer peak generation conditions, however this option without option 1 is insufficient to remove the overload on this section of the circuit for peak demand conditions.

New limiting factor for constraint(s) considered: 138.7 MVA (summer sustained cable rating with one cable in service).

Option 3 – Procure flexibility under various BSPs at 33 kV or below

Flexibility service type: Generation turn up/demand turn down

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault or arranged outages. For maximum effectiveness it may be necessary to split the 132 kV network parallel between Abham & Landulph GSPs at Plymouth. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to remove the Totnes Tee by laying additional 132 kV cable and to adopt a 132 kV split running arrangement at Plymouth BSP (Options 1 & 2). The size of the cable is to be subject to a wider whole system CBA with NESO to determine if a GSP around Plymouth area is feasible in the long term future.

3.2 Totnes Tee to Plymouth & Totnes Tee to Plympton BSP 132 kV circuit overloads

Generation Demand

Constraint Overview

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at intermediate cool peak demand.

Table 3.2.1 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
Plymouth BSP to Totnes Tee (H110N)	Landulph GSP 205 circuit bay	Landulph-Ernesettle Tee Plymouth	-	Baseline	Baseline	2025
Plympton BSP to Totnes Tee (H110S)	Landulph GSP 205 circuit bay	Landulph-Ernesettle Tee Plymouth None	-	Baseline	Baseline	2025
Plymouth BSP to Totnes Tee (H110N)	Langage 400 kV circuit 405	Abham SGT1 & associated 400 kV circuit	-	-	-	Baseline
Plympton BSP to Totnes Tee (H110S)	Langage 400 kV circuit 405	Abham SGT1 & associated 400 kV circuit	-	-	-	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	Re-profile both 132 kV circuits to obtain a higher rating by operating the conductor at 75 degrees	✓	✓	✓	**Viable**
2	Re-conductor both 132 kV circuits to increase rating	✓	✓	×	**Viable**
Operational Mitigation					
3	Adopt a split 132 kV network at Plymouth	✓	✓	✓	**Viable**
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
4	Procure flexibility under Plymouth BSP at 33 kV or below	✓	✓	✓	**Viable**

Uncertainty under other Distribution Future Energy Scenarios: As this constraint occurs under baseline there is no uncertainty about future forecasts. There is a risk that demand reduces, however this is not forecast under any scenario so mitigation against this constraint is required

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal

reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No intervention

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above.

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

Option 1 – Re-profile both 132 kV circuits to obtain a higher rating by operating the conductor at 75 degrees

Capacity released for constraint(s) considered: 27.4 MVA

Viable

(post fault intermediate cool subject to survey)

Detailed description: Subject to survey both 132 kV circuits may be uprated to operate at a higher temperature (75 degrees).

New limiting factor for constraint(s) considered: 147.9 MVA (post fault intermediate cool subject to survey)

Option 2 – Re-conductor both 132 kV circuits to increase rating

Capacity Released for constraint(s) considered: 89.2 MVA

Viable

(post fault intermediate cool subject to survey)

Detailed description: Re-conductor both 31 km of 132 kV circuits with 500 mm^2 at 75° C All Aluminium Alloy Conductor (AAAC) Rubus conductor.

New limiting factor for constraint(s) considered: 209.6 MVA (post fault intermediate cool subject to survey)

Option 3 – Adopt a split 132 kV network at Plymouth BSP

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

Viable

Detailed description: Adopting a 132 kV split network (Section 2.2 Option 2) will resolve the circuit overloads caused under peak summer generation conditions, however this option without option 1 is insufficient to remove the overload on this section of the circuit for peak demand conditions. By 2026 (best view scenario) it may become necessary to install a 4^{th} grid transformer at Plymouth to enable the transfer of demand to the Landulph GSP network and maintain the circuit loadings within rating.

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

Option 4– Procure flexibility under various BSPs at 33 kV or below

Flexibility service type: Generation turn up/demand turn down

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault or arranged outages. For maximum effectiveness it may be necessary to split the 132 kV network parallel between Abham & Landulph GSPs at Plymouth. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to re-profile both overhead line circuits for 75 degree operation and to adopt a 132 kV split running arrangement at Plymouth BSP (Options 1 & 3).

However, in the longer term a CBA between circuit reinforcement and establishing a new GSP will need to be carried out jointly between the NESO and NGED.

3.3 Ernesettle BSP to Milehouse BSP 132 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 intermediate cool 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
Ernesettle BSP-Milehouse BSP 132 kV circuit	Landulph GSP 605 circuit	None	-	Baseline	-	Baseline
Ernesettle BSP-Milehouse BSP132 kV circuit	Landulph GSP 605 circuit	Abham GSP SGT2 & associated 400 kV circuit	-	Baseline	Baseline	Baseline

Uncertainty under other Distribution Future Energy Scenarios: As this constraints 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 3.3.2 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	Overlay existing circuit with a larger 132 kV cable	✓	✓	×	**Viable**
Operational Mitigation					
2	Adopt a 132 kV split network at Plymouth & install a 132 kV bus-section circuit breaker at Ernesettle BSP	✓	✓	✓	**Viable**
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
3	Procure flexibility under various BSPs at 33kV 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: N/A **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 – Overlay existing circuit with larger cable

Capacity released for constraint(s) considered: TBC

Viable

Detailed description: Lay a new 132 kV cable to replace the existing oil filled cable and 132 kV series reactor.

New limiting factor for constraint(s) considered: TBC

Option 2 – Adopt a split 132 kV network at Plymouth BSP

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

Viable

Detailed description: Adopting a 132 kV split network (Section 2.2 Option 2) & installing a 132 kV bus-section (120) circuit breaker at Ernesettle reduces the circuit loading and removes the requirement for reinforcement (eg. overlay of the circuit) until 2032 (best view scenario).

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

Option 3 – Procure flexibility under various BSPs at 33 kV or below

Flexibility service type: Generation turn up/demand turn down

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault or arranged outages. For maximum effectiveness it may be necessary to split the 132 kV network parallel between Abham & Landulph GSPs at Plymouth. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to adopt a split 132 kV running arrangement at Plymouth BSP and to install a '120' 132 kV bus-section circuit breaker at Ernesettle BSP (Option 2).

3.4 Exeter Main GSP (905) to Sowton Tee 132 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 intermediate cool peak demand.

Table 3.4.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First studied year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Exeter Main GSP 905 to Sowton Tee 132kV cct	Exeter Main GSP 205 132kV circuit	Exeter 705 circuit		Baseline	Baseline	2028
Exeter Main GSP 905 to Sowton Tee 132kV cct	Exeter Main GSP 705 132kV circuit	Exeter Main GSP 205 132kV circuit		Baseline	Baseline	2028
Exeter MaIn GSP 905 to Sowton Tee 132kV cct	Exeter Main GSP 205 132kV circuit	None		2030	2030	2034

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

Solution Options

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

Table 3.4.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	**Discounted**
Reinforcement					
1	Re-profile the existing circuit to obtain a higher rating by operating the conductor at 75 degrees	✓	✓	✓	**Viable**
2	Accommodate increase in demand on other BSPs	✓	✓	✓	**Viable**
Operational Mitigation					
3	For an arranged outage on Exeter 205 cct switch out Sowton GT3 or on Exeter 705 cct switch out Exeter City GT3 to prevent circuit overload following subsequent fault	✓	×	✓	**Discounted**
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
4	Procure flexibility under Sowton or Exeter City BSP at 33kV or below	✓	✓	✓	**Viable**

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No intervention

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above.

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

Option 1 – Re-profile the existing circuit to obtain a higher rating by operating the conductor at 75 degrees

Capacity released for constraint(s) considered: 36 MVA (Intermediate cool)

Viable

Detailed description: Subject to survey the circuit may be re-profiled to enable operation at a higher temperature (75 degrees). This reinforcement will be sufficient until 2028 when the post fault ratings are exceed for intermediate cool peak demand conditions.

New limiting factor for constraint(s) considered: 191 MVA (Intermediate Cool capacity @ 75 degrees)

Option 2– Accommodate increase in demand on other BSPs

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

Viable

Detailed description: Accommodate the increase in demand on both Sowton & Exeter City BSP by demand transfers to a new Primary substation to the east of Exeter and fed from Exeter Main BSP along with a new Primary substation in the south west of Exeter fed from a new BSP in the area.

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

Option 3 – For an arranged outage switch out a GT to prevent an overload for a subsequent fault

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

Discounted

Detailed description: For an arranged outage on 205 at Exeter Main GSP switch out GT3 at Sowton BSP to prevent a circuit overload in the event of a subsequent fault. For an arranged outage on 705 at Exeter Main GSP switch out GT3 at Exeter City BSP to prevent a circuit overload in the event of a subsequent fault. Whilst this will prevent overloads it will result in the loss of either Sowton or Exeter City BSP for a subsequent fault.

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

Option 4 – Procure flexibility under Sowton or Exeter City at 33 kV or below

Flexibility service type: Generation turn up/demand turn down

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads during any outages on circuits 205 or 705 at Exeter Main GSP. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to re-profile the Exeter Main GSP (905) to Sowton Tee 132 kV overhead line circuit and to further develop proposals for demand transfers from Exeter City & Sowton BSPs to other BSPs to prevent future circuit overloads (Options 1 and 2)

3.5 Exeter Main GSP to Newton Abbot BSP 132 kV circuit overload

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 summer peak generation.

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
Exeter Main GSP to Newton Abbot 132 kV cct	Exeter Main GSP 305 circuit	Abham SGT 1 & associated 400kV circuit	-	-	-	Baseline
Exeter Main GSP to Newton Abbot 132 kV cct	Abham SGT1 & associated 400 kV circuit	Abham SGT2 & associated 400 kV circuit	-	-	2034	-

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

Solution Options

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

Table 3.5.2 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	Re-profile the existing circuit to enable the circuit to be operated at 75 degrees	✓	✓	✓	**Viable**
2	Re-conductor the circuit	✓	✓	×	**Viable**
Operational Mitigation					
3	Close CB 230 & 1005 at Abham GSP for arranged outage	✓	✓	✓	**Viable**
4	Split 132kV network at Plymouth BSP	✓	✓	✓	**Viable**
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
5	Turn down generation at 33kV or below	×	×	×	**Discounted**

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No intervention

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above.

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

Option 1 – Re-profile the exiting circuit to enable operation at 75 degrees

Viable

Capacity released for constraint(s) considered: 31.4 MVA (intermediate cool post-fault rating (75 degrees)

Detailed description: Subject to survey circuit may be operated at a higher operating temperature (75 degrees)

New limiting factor for constraint(s) considered: 148 MVA (intermediate cool post-fault rating @75 degrees).

Option 2 – Re-conductor the circuit to increase the rating

Capacity released for constraint(s) considered: 77 MVA (Summer sustained)

Viable

Detailed description: Re-conductor the existing circuit with 300 sq.mm AAAC UPAS conductor

New limiting factor for constraint(s) considered: 166 MVA (Summer sustained)

Option 3 – Close 230 & 1005 at Abham GSP for arranged outage

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

Viable

Detailed description: Closing CBs 230 & 1005 at Abham GSP for an arranged 400 kV outage on either circuit between Exeter Main GSP/Abham GSP/Langage Power Station will prevent overloads for summer peak generation conditions. This appears sufficient until 2028 (best view scenario) when it will be necessary to re-profile the circuit. The projected timescales are based upon the 132 kV network parallel between Abham & Landulph GSPs being maintained.

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

Option 4 – Adopt a split 132 kV network at Plymouth BSP

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

Viable

Detailed description: Adopting a 132 kV split network (Section 2.2 Option 2) will resolve the circuit overloads caused under peak summer generation conditions. However it will cause overloads for intermediate cool & warm peak demand conditions in the baseline year.

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

Option 5 – Turn down generation

Flexibility service type: Generation turn down

Discounted

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault/outage resulting, however volume required may not be cost effective. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to re-profile the overhead line circuit to enable operation at 75 degrees and to adopt a split 132 kV running arrangement at Plymouth BSP (Options 1 and 4)

3.6 Exeter Main GSP to Abham GSP 132 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 summer peak generation.

Table 3.6.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First studied year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Exeter Main GSP to Abham GSP 805 circuit	Exeter Main SGT	Abham SGT and 400 kV cct	-	-	-	Baseline
Exeter Main GSP to Abham GSP 1005 circuit	Abham SGT	Abham SGT	-	-	-	2031

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

Solution Options

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

Table 2.7.2 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	Re-profile the existing circuits to enable the circuit to be operated at 75 degrees	✓	✓	✓	Viable
2	Re-conductor the circuit	✓	✓	×	Viable
Operational Mitigation					
3	Close Abham CB 1005 following the arranged outage to prevent the overload	✓	✓	✓	Viable
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
4	Turn down generation at 33 kV or below	×	×	×	Discounted

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 1 – Re-profile the existing circuit to enable the circuit to be operated at 75 degrees

Capacity released for constraint(s) considered: 50 MVA (summer) Viable

Detailed description: Re-profile the circuit to enable 75 degree operation. This will become necessary by 2029 (Abham 805 cct) and 2031 (Abham 1005 cct). In addition this may become necessary if the 132kV network parallel between Abham GSP and Landulph GSP be broken by splitting at Plymouth (peak demand conditions) at an earlier date.

New limiting factor for constraint(s) considered: 139 MVA (summer post-fault)

Option 2 – Re-conductor the circuit

Capacity Released for constraint(s) considered: 109 MVA (summer) Viable

Detailed description: Re-conductor the circuit with 300 Sq.mm AAAC (UPAS) conductor.

New limiting factor for constraint(s) considered: 198 MVA (summer post-fault)

Option 3 – Close Abham CB 1005 following the first circuit outage

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

Detailed description: Closing CB 1005 at Abham GSP for an arranged 400 kV outage an SGT at Exeter GSP will prevent overloads for summer peak generation conditions until 2028.

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

Option 4 – Procure flexibility under at 33 kV or below

Flexibility service type: Generation turn down Discounted

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault/outage resulting. However, this option is unlikely to resolve overloads during peak summer generation conditions. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to close circuit breaker 1005 at Abham GSP for arranged 400 kV outages to prevent overloads in the short term (Option 3) and to re-profile the circuit to enable operation at 75 degrees in 2028 (Option 1).

3.7 Sowton Tee to Marsh Barton Power station 132 kV circuit overload

Generation | Demand

Constraint Overview

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads initially seen at summer peak generation.

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
Sowton Tee-Marsh Barton Power Station	Exeter 205 circuit	none	-	2031	2034	Baseline

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

Solution Options

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

Table 3.7.2 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	Re-conductor circuit with larger conductor (300 UPAS)	✓	✓	×	Viable
2	Re-profile circuit to operate at 75 degrees	✓	✓	✓	Viable
3	Utilise spare conductor between towers	✓	✓	✓	Viable
Operational Mitigation					
-	*None Identified*	-	-	-	-
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
4	Procure flexibility under Sowton BSP or Exeter City BSP at 33 kV or below	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 1 – Re-conductor circuit with larger conductor

Capacity released for constraint(s) considered: 81 MVA — Viable

Detailed description: Re-conductor circuit with larger conductor (300 sq.mm AAAC UPAS)

New limiting factor for constraint(s) considered: 181 MVA (summer)

Option 2 –Re-profile circuit to operate at 75 degrees

Capacity Released for constraint(s) considered: 25 MVA

Viable

Detailed description: Re-profile existing circuit to operate at 75 degrees, which will be sufficient until 2032

New limiting factor for constraint(s) considered: 135 MVA (Intermediate cool)

Option 3 –Utilise spare 132 kV conductor between towers D87 and AE192A

Capacity Released for constraint(s) considered: 110 MVA (Intermediate cool)

Viable

Detailed description: Bunch the existing circuit between towers D87 and AE204R and AE203R and AE192A.

New limiting factor for constraint(s) considered: 220 MVA (Intermediate cool)

Option 4 – Procure flexibility under at 33 kV or below

Viable

Flexibility service type: Generation turn up/demand turn down (demand related overloads)

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault/outage on Exeter Main GSP 205 circuit (or bay) on either Exeter City BSP or Sowton BSP. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to re-profile the circuit to enable operation at 75 degrees which is sufficient until 2032 (Option 2). Utilising the spare 132 kV conductor between tower D87 and AE192A should prevent overloads beyond 2032 based upon the best view scenario.

3.8 Paignton Tee to Newton Abbot BSP 132 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 summer peak generation.

Table 2.9.1 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
Paignton Tee- Newton Abbot BSP	Exeter GSP 400 kV 305 circuit	Abham GSP SGT1 & associated 400 kV circuit	-	-	-	Baseline
Paignton tee- Newton Abbot BSP	Exeter GSP 132 kV Main 1 busbar fault		2028	2028	-	-

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

Solution Options

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

Table 2.9.2 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	Re-conductor circuit with larger conductor	✓	✓	×	Viable
2	Re-profile circuit to operate at 75 degrees	✓	✓	✓	Viable
Operational Mitigation					
3	Close CB 1005 at Abham GSP for an arranged outage	✓	✓	✓	Viable
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
4	Procure flexibility under various BSPs at 33 kV or below	×	×	×	Discounted

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 1 – Re-conductor circuit with larger conductor

Capacity released for constraint(s) considered: 81 MVA ↑ Viable

Detailed description: Re-conductor circuit with larger conductor (300 sq.mm AAAC UPAS).

New limiting factor for constraint(s) considered: 181 MVA (summer)

Option 2 –Re-profile the circuit to operate at 75 degrees

Capacity Released for constraint(s) considered: 27.4 MVA (summer)

Viable

Detailed description: Re-profile existing circuit to operate at 75 degrees. This will be required by 2028 to avoid circuit overloads for peak demand conditions.

New limiting factor for constraint(s) considered: 127.8 MVA (summer)

Option 3 - Close 230 & 1005 at Abham GSP for arranged outage

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

Viable

Detailed description: This will resolve the baseline overload during peak summer generation conditions. Closing 230 & 1005 at Abham GSP and also if the 132 kV network is run split at Plymouth this will also resolve the overloads for peak demand conditions.

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

Option 4 – Procure flexibility under at 33 kV or below

Flexibility service type: Generation turn up/demand turn down

Discounted

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault/outage resulting. However, this option is unlikely to resolve overloads during peak summer generation conditions. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to close circuit breakers 230 &1005 at Abham GSP for arranged outage of an SGT at Exeter GSP and to re-profile the circuit to enable operation at 75 degrees by 2028 (Options 3 & 2)

3.9 Exeter Main GSP (705) to Sowton Tee 132 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 intermediate cool peak demand.

Table 3.9.1 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
Exeter Main GSP 705 to Sowton tee c132 kV circuit	Exeter Main GSP 903 132 kV circuit or Sowton GT3	None	-	2028	2030	2030

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios.

Solution Options

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

Table 3.9.2 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	Remove restricted rating & re-profile circuit to operate at 75 degrees	✓	✓	✓	Viable
Operational Mitigation					
-	*None Identified*	-	-	-	
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
2	Procure flexibility under Sowton at 33 kV or below	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full 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 – Remove restricted rating and re-profile circuit to operate at 75 degrees

Capacity released for constraint(s) considered: 32 MVA — **Viable**

Detailed description: Remove the restricted rating and re-profile the circuit to operate at 75 degrees.

New limiting factor for constraint(s) considered: 110 MVA (Intermediate cool)

Option 2 – Procure flexibility under Sowton BSPs at 33 kV or below

Flexibility service type: Generation turn up/demand turn down

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault or arranged outage on Circuit 905 at Exeter Main GSP. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to remove the restricted rating and re-profile the circuit to operate at 75 degrees.

(Option 1).

3.10 Sowton BSP to Sowton Tee 132 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 intermediate cool peak demand.

Table 3.10.1 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
Sowton BSP Main1 busbar to Sowton tee	Exeter Main GSP 905 132 kV circuit or Sowton BSP GT3	None	-	2028	2030	2030
Sowton BSP Main 3 busbar to Sowton Tee	Exeter Main GSP 705 132 kV circuit or Sowton BSP GT1	None	-	2028	2030	2030

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios.

Solution Options

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

Table 3.10.2 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	Remove restricted rating and re-profile circuit to operate at 75 degrees	✓	✓	✓	**Viable**
Operational Mitigation					
-	*None Identified*	-	-	-	
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
2	Procure flexibility under Sowton at 33 kV or below	✓	✓	✓	**Viable**

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full 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 – Remove restricted rating and re-profile circuit to operate at 75 degrees

Capacity released for constraint(s) considered: 32 MVA

Viable

Detailed description: Remove the restricted circuit ratings and re-profile the conductor to operate at 75 degrees

New limiting factor for constraint(s) considered: 110 MVA (Intermediate cool).

Option 2 – Procure flexibility under Sowton at 33 kV or below

Viable

Flexibility service type: Generation turn up/demand turn down

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault or arranged outage on either Exeter Main GSP circuits 905/Sowton BSP GT3 or Exeter Main GSP/Sowton BSP GT1. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to remove the restricted circuit ratings and re-profile the conductor to operate at 75 degrees (Option 1).

3.11 Marsh Barton Power station to Exeter City BSP (Main 3 busbar) 132 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 intermediate cool peak demand.

Table 3.11.1 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
Marsh Barton Power Station to Exeter City BSP (Main 3 busbar) 132kV cct	Exeter Main GSP 205 132kV circuit/Exeter city BSP GT2	None	-	-	2034	-
Marsh Barton Power Station to Exeter City BSP (Main3 busbar) 132kV cct	Exeter Main GSP 705 circuit	Exeter 205 – Exeter City GT2	-	-	2034	-

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios

Solution Options

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

Table 3.11.2 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	Re-profile circuit to operate at 75 degrees	✓	✓	✓	Viable
Operational Mitigation					
-	*None Identified*	-	-	-	
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
2	Procure flexibility under Exeter City BSP at 33 kV or below	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No intervention

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above.

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

Option 1 – Re-profile circuit to operate at 75 degrees

Capacity released for constraint(s) considered: 25 MVA

Viable

Detailed description: Re-profile the conductor to operate at 75 degrees.

New limiting factor for constraint(s) considered: 135 MVA (Intermediate cool)

Option 2 – Procure flexibility under Exeter City at 33 kV or below

Viable

Flexibility service type: Generation turn up/demand turn down

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault or arranged outage on Exeter Main GSP 205 132 kV circuit/Exeter City BSP GT2. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to investigate if it is possible to re-profile the circuit to operate at 75 degrees by 2034 (Option 1).

3.12 Exeter Main GSP (205) to Exeter City BSP 132 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 intermediate cool peak demand.

Table 3.12.1 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
Exeter Main GSP (205) to Exeter City BSP 132 kV cct	Exeter Main GSP (905) circuit or Exeter City BSP GT3	None	-	2034	2034	-

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios.

Solution Options

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

Table 3.12.2 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	Re-profile circuit to operate at 75 degrees	✓	✓	✓	Viable
Operational Mitigation					
-	*None Identified*	-	-	-	
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
2	Procure flexibility under Exeter City at 33 kV or below	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No intervention

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

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above.

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

Option 1 – Re-profile existing circuit to operate at 75 degrees

Capacity released for constraint(s) considered: 25 MVA — Viable

Detailed description: Re-profile the conductor to operate at 75 degrees.

New limiting factor for constraint(s) considered: 135 MVA (Intermediate Cool).

Option 2 – Procure flexibility under Exeter City at 33 kV or below

Flexibility service type: Generation turn up/demand turn down

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault or arranged outage on Exeter Main GSP 905 circuit/Exeter City BSP GT3. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to re-profile the circuit to operate at 75 degrees from 2034 (Option 1).

3.13 Plymouth BSP to Milehouse BSP 132 kV cable 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 intermediate cool peak demand.

Table 3.13.1 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
Plymouth BSP 605-Milehouse 132 kV circuit	Landulph GSP 205 - Ernesettle circuit	Plymouth BSP 305 –Milehouse BSP cct	-	-	-	2034
Plymouth BSP 305-Milehouse 132 kV circuit	Landulph GSP 605 132 kV circuit	Plymouth BSP 605- Milehouse BSP cct	-	-	-	2034

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios

Solution Options

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

Table 3.13.2 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	Overlay existing circuits with a larger 132 kV cable	✓	✓	×	Viable
Operational Mitigation					
2	Adopt a 132 kV split network at Plymouth	✓	✓	✓	Viable
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
3	Procure flexibility under at 33 kV or below	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full 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 – Overlay existing circuits with larger cable

Capacity released for constraint(s) considered: TBC — Viable

Detailed description: Overlay both 132 kV (oil filled cable) circuits with larger cable.

New limiting factor for constraint(s) considered: TBC

Option 2 – Adopt a split 132 kV network at Plymouth

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

Viable

Detailed description: Adopting a 132 kV split network will prevent this overload from occurring (Section 3.1 Option 2).

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

Option 3 – Procure flexibility under various BSPs at 33 kV or below

Flexibility service type: Generation turn up/demand turn down

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault or arranged outage. . For maximum effectiveness it may be necessary to split the 132 kV network parallel between Abham & Landulph GSPs at Plymouth. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to adopt a 132 kV split network at Plymouth BSP in order to prevent this overload (Option 2).

3.14 Landulph GSP (605)-Ernesettle Tee-Plymouth BSP 132 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 intermediate cool peak demand.

Table 3.14.1 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
Landulph GSP (605) to Ernesettle tee	Abham SGT1	Landulph - Ernesettle	-	2034	2034	-
Ernesettle Tee – Plymouth BSP	Landulph GSP (205)-Ernesettle BSP	Abham SGT	-	-	2034	2034

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios. Should the 132 kV cable between Ernesettle BSP and Milehouse BSP be overlaid the loading on this circuit approaches 100% of the rating in 2028 (best view scenario) which will bring forward the need for reinforcement.

Solution Options

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

Table 3.14.2 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	Re-conductor existing circuit	✓	×	✓	**Discounted**
2	Re-profile circuit to operate at 75 degrees	✓	×	✓	**Discounted**
3	Establish a 132 kV circuit between Landulph GSP and Milehouse BSP	✓	✓	✓	**Viable**
Operational Mitigation					
4	Adopt a 132 kV split network at Plymouth	✓	✓	✓	**Viable**
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
5	Procure flexibility under various BSPs at 33 kV or below	✓	✓	✓	**Viable**

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No intervention

Capacity Released for constraint(s) considered: 0 MVA

Discounted

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above.

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

Option 1 – Re-conductor existing circuit

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

Discounted

Detailed description: Re-conductor the circuit with larger conductor. Subject to survey it may be possible to re-conductor the circuit between Landulph GSP and Ernesettle Tee, however the Ernesettle Tee- Plymouth BSP section already has the largest conductor operating at an increase temperature. This option therefore is unlikely to be feasible.

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

Option 2 – Re-profile circuit to operate at 75 degrees

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

Discounted

Detailed description: Re-profile the circuit to operate at 75 degrees. Subject to survey it may be possible to re-profile the circuit between Landulph GSP and Ernesettle Tee, however the Ernesettle Tee- Plymouth BSP section already has the largest conductor operating at an increase temperature. This option therefore is unlikely to be feasible.

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

Option 3 – Establish a new 132 kV circuit between Landulph GSP and Milehouse BSP

Capacity Released for constraint(s) considered: TBC

Viable

Detailed description: Lay a new 132 kV cable circuit between Landulph GSP and Milehouse BSP to create a 3rd circuit infeed into the group from Landulph.

New limiting factor for constraint(s) considered: TBC

Option 4 - Adopt a split 132 kV network at Plymouth

Capacity Released for constraint(s) considered: TBC

Viable

Detailed description: Adopting a 132kV split network (Section 2.2 Option 2) reduces the circuit loading. However on the basis the Ernesettle-Milehouse circuit is overlaid in 2032, the circuit loading approaches 100% of the rating in 2034 (best view scenario).

New limiting factor for constraint(s) considered: TBC

Option 5 – Procure flexibility under various BSPs at 33 kV or below

Flexibility service type: Generation turn up/demand turn down

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault or arranged outage. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to adopt a 132 kV split network at Plymouth BSP in order to prevent this overload (Option 4).

3.15 Landulph GSP (205)-Ernesettle BSP 132 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 intermediate cool peak demand.

Table 3.15.1 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
Landulph GSP (205) to Ernesettle BSP 132 kV circuit	Abham SGT	Landulph GSP (605) – Ernesettle Tee/Plymouth BSP 132 kV cct	-	2034	2034	2034
Landulph GSP (205) to Ernesettle BSP 132 kV circuit	Plympton BSP 132 kV Main 2 busbar	Landulph GSP (605)- Ernesettle Tee/Plymouth BSP 132 kV cct	-	-	2034	-

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios. Should the 132 kV cable between Ernesettle BSP and Milehouse BSP be overlaid this circuit becomes overloaded in 2028 (best view scenario).

Solution Options

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

Table 3.15.2 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	Re-conductor the existing circuit	✓	✓	✓	Viable
2	Re-profile circuit to operate at 75 degrees	✓	✓	✓	Discounted
3	Establish a 132 kV circuit between Landulph GSP and Milehouse BSP	×	✓	✓	Viable
Operational Mitigation					
4	Adopt a 132 kV split network at Plymouth	✓	✓	✓	Viable
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
5	Procure flexibility under various BSPs at 33 kV or below	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 0 – No intervention

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

Detailed description: Doing nothing to mitigate the constraint would result in overloads for the conditions described above.

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

Option 1 – Re-conductor existing circuit

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

Detailed description: Subject to survey it may be possible to re-conductor 5 km of circuit.

New limiting factor for constraint(s) considered: TBC

Option 2 – Re-profile circuit to operate at 75 degrees

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

Detailed description: Re-profile the circuit to operate at 75 degrees. Subject to survey it may be possible to re-profile the circuit between Landulph GSP and Ernesettle Tee, however the Ernesettle Tee- Plymouth BSP section already has the largest conductor operating at an increase temperature. This option therefore is unlikely to be feasible.

New limiting factor for constraint(s) considered: TBC

Option 3 – Establish a new 132 kV circuit between Landulph GSP and Milehouse BSP

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

Detailed description: Lay a new 132 kV cable circuit between Landulph GSP and Milehouse BSP to create a 3rd circuit infeed into the group from Landulph.

New limiting factor for constraint(s) considered: TBC

Option 4 – Adopt a split 132 kV network at Plymouth

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

Detailed description: Adopting a 132 kV split network (Section 2.2 Option 2) reduces the circuit loading. However on the basis the Ernesettle-Milehouse circuit is overlaid in 2032, the circuit loading approaches 100% of the rating in 2034 (best view scenario).

New limiting factor for constraint(s) considered: TBC

Option 5 – Procure flexibility under various BSPs at 33 kV or below

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

Detailed description: Flexibility services could be procured to alleviate projected overloads during any fault or arranged outage. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to adopt a 132 kV split network at Plymouth BSP in order to prevent this overload (Option 4).

3.16 Exeter Main GSP Super Grid Transformer (SGT) 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 intermediate cool peak demand.

Table 3.16.1 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
Exeter Main SGT 4 Overload	Exeter Main SGT 1 outage	Exeter Main SGT 7 fault	-	2032	-	-

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios. Therefore, the timing should be assessed on a frequent basis.

The post fault loading of the SGT is in excess of the sustained transformer rating, however within the 6 hour rating requiring the restoration of an arranged outage within 6 hours.

Solution Recommendation

It is recommended to coordinate with National Grid ESO, who are responsible for assessing and mitigating SGT loading, to refine study results and determine the best solution option. Modelling further diversity and different battery behaviour may solve or defer this constraint.

Exeter Main GSP is a 400/132 kV site and is one of the boundaries between the transmission and distribution networks. It currently runs in parallel with Landulph & Abham GSPs. New Connection activity at the distribution network, both demand and generation, have triggered constraints on the transmission network with regards to SGT capacity and distribution network. Several proposals to mitigate are being considered including uprating the existing assets, establishing another GSP to the east of Plymouth, and/or if additional SGTs are required at existing sites.

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3.17 Landulph GSP Super Grid Transformer (SGT) 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 intermediate cool peak demand.

Table 3.17.1 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
Landulph SGT 1 Overload	Landulph SGT outage	Landulph SGT 7 fault	-	2032	-	-

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios. Therefore, the timing should be assessed on a frequent basis.

The post fault loading of the SGT is in excess of the sustained transformer rating, however within the 6 hour rating requiring the restoration of an arranged outage within 6 hours.

Solution Recommendation

It is recommended to coordinate with National Grid ESO, who are responsible for assessing and mitigating SGT loading, to refine study results and determine the best solution option. Modelling further diversity and different battery behaviour may solve or defer this constraint.

Landulph GSP is a 400/132 kV site and is one of the boundaries between the transmission and distribution networks. It currently runs in parallel with Exeter Main & Abham GSPs. New Connection activity at the distribution network, both demand and generation, have triggered constraints on the transmission network with regards to SGT capacity and distribution network. Several proposals to mitigate are being considered including uprating the existing assets, establishing another GSP to the east of Plymouth, and/or if additional SGTs are required at existing sites.

3.18 Abham GSP Super Grid Transformer (SGT) 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 intermediate warm peak demand.

Table 2.17.1 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
Abham SGT1 Overload	Plymouth BSP 120	Abham SGT 2 & 400 kV cct fault	-	-	2032	-
Abham SGT 2 Overload	Plymouth BSP 120	Abham SGT 1 & 400 kV cct fault	-	-	2032	-

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios. Therefore, the timing should be assessed on a frequent basis.

Solution Recommendation

It is recommended to coordinate with National Grid ESO, who are responsible for assessing and mitigating SGT loading, to refine study results and determine the best solution option. Modelling further diversity and different battery behaviour may solve or defer this constraint.

Abham GSP is a 400/132 kV site and is one of the boundaries between the transmission and distribution networks. It currently runs in parallel with Exeter & Landulph GSPs. New Connection activity at the distribution network, both demand and generation, have triggered constraints on the transmission network with regards to SGT capacity and distribution network. Several proposals to mitigate are being considered including uprating the existing assets, establishing another GSP to the east of Plymouth, and/or if additional SGTs are required at existing sites.

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