Penn GSP Network

Network Development Report – West Midlands

May 2024

Contents

Penn GSP Network

1. Network Overview

Penn is a 132 kV Grid Supply Point (GSP) located between Birmingham and Wolverhampton, connecting over 223,000 customers. The network comprises of several 132 kV circuits distributed across the region, connecting six Bulk Supply Points (BSPs), some of which supply multiple primary substations and Extra High Voltage (EHV) customers.

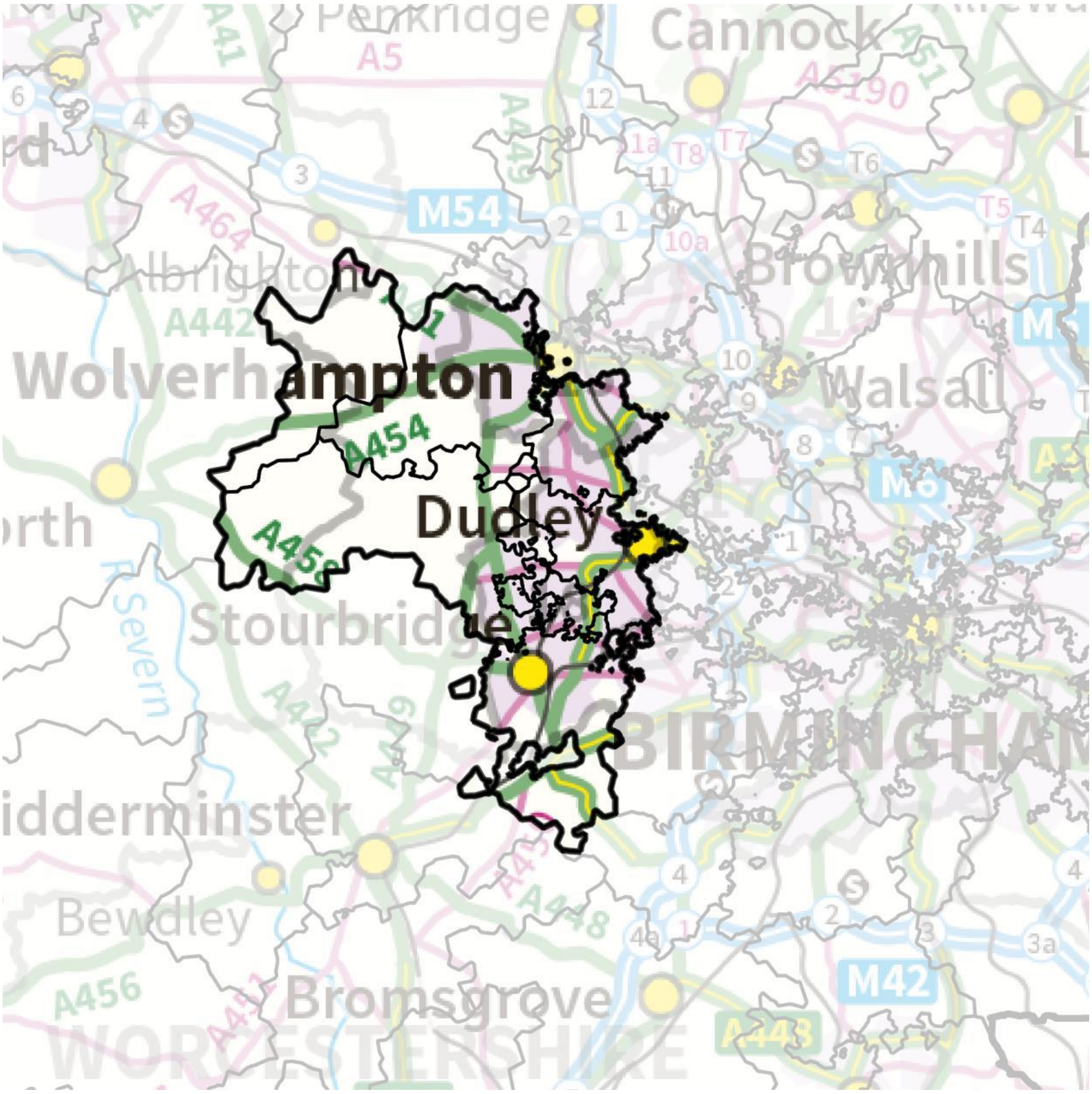

Figure 1.1 Penn GSP geographic network coverage

This report discusses existing and future network constraints over a 0-10 year horizon associated with Penn GSP and its downstream network. It uses the methodology outlined in the Network Development Plan Methodology Report with Network Operability Modelling applied as outlined further below.

For the purposes of this analysis the NGED Best View Distribution Future Energy Scenario (DFES) has been used to study each year up to and including 2034. Representative days for each of the four seasons (Winter, Intermediate Cool, Intermediate Warm, and Summer) have been studied to cover the edge case scenarios for the network.

1.1 Network Topology

Penn GSP is a 275/132 kV site fed via four 240 MVA Super Grid Transformers (SGTs) running 2+2 split on a 132 kV double busbar arrangement with four sections. It supplies the following six BSPs:

- Coseley BSP which is supplied via two 132 kV circuits from Penn, and consists of four 132/11 kV transformers that normally run split via three sections of 11 kV double busbars.
- Dudley BSP which is via two 132 kV circuits from Penn and a third circuit via Lye BSP. It consists of three 132/11 kV grid transformers connected to six 11 kV busbar sections that normally run split.
- Woodside BSP is supplied via two 132 kV feeders from Penn, and consists of two three-winding 132/11/11 kV transformers each connected to an 11 kV double busbar normally run split.
- Lye BSP is fed from two 132 kV circuits, one directly from Penn and the other via Dudley BSP. It consists of three 132/11 kV transformers each connected to an 11 kV double busbar normally run split.
- Wolverhampton West BSP which is fed via two 132 kV circuits from Penn and consists of two 132/33 kV transformers that normally run in parallel The BSP supplies three primary substations; Wolverhampton West primary, Pattingham primary, and Albrighton T2A.

  At Wolverhampton West primary, T3 and T4 normally run in parallel, while T5 and T6 normally run split at 11 kV.
- Hinksford BSP which is supplied via two 132 kV circuits from Penn, and consists of two 132/11 kV transformers normally run split at 11 kV, and a 132/33 kV transformer. The 33 kV at Hinksford feeds a local 33/11 kV transformer and Kinver T2, but it also provides backfeed to Stourport BSP via the 33 kV busbars at Kinver.

1.2 Network Operability Modelling

The analysis modelling covers automation and manual switching schemes that represent how the network is generally operated. Some of the main ones are listed below.

Penn 132 kV

- During outages of any of the four SGTs, the 132 kV busbars are run solid to parallel the remaining three SGTs, and as a result some generation may need to be disconnected to maintain fault levels within network stress limits.
- Arranged or fault outages leading to loss of a grid transformer at Hinksford, Dudley, Coseley, Woodside, and Lye BSPs results in the 11 kV at these sites being closed in (and reconfigured in some scenarios) to backfeed from the other transformer(s).

Wolverhampton West

- Arranged outages that split up the 33 kV busbars results in the downstream 11 kV networks being split to avoid loose couples and back energisation, specifically with regards to T3 and T4.
- Arranged outages leading to loss of T5 results in T4 being closed in to backfeed and the parallel between T3 and T4 being split.
- Arranged outages leading to loss of T6 results in T3 being closed in to backfeed and the parallel between T3 and T4 being split.
- Arranged or fault outages leading to loss of a primary transformer at Albrighton results in the 11 kV being closed in to backfeed.

Hinksford BSP

- Arranged or fault outages leading to loss of a primary transformer at Kinver results in the 11 kV being closed in to backfeed
- Arranged outages affecting Hinksford 33 kV infeed results in:
    - Kinver 33 kV bus-section circuit breaker being closed in to backfeed Kinver T2.
    - Quatt T1 being transferred to Ironbridge BSP.
    - Curtailment of generation connected out of Hinksford 33 kV.

2. Summary of Network Constraints

The following constraints were identified for the Best View Scenario, for which mitigation options are covered further down in the report:

- Penn to Dudley 132 kV circuit overload
- Kinver transformer overload
- Hinksford GT overload
- Wolverhampton West primary transformer overload
- Lye GT overload

Transmission-Distribution interface

Penn GSP is a 275/132 kV site and is one of the boundaries between the transmission and distribution networks. New Connection activity at the distribution network, both demand and generation, have triggered constraint at the transmission network with regards to SGT capacity, 132 kV circuit breaker short circuit rating, and 275 kV circuit ratings. Proposals to mitigate are being considered including uprating the existing assets or establishing a new GSP at a location suitable for the wider region.

3. Network Constraints and Solution Options

3.1 Penn to Dudley 132 kV circuit overload

Constraint Overview

Generation | Demand

Dudley BSP and Lye BSP form a 132 kV ring consisting of two circuits between Penn and Dudley, one circuit between Penn and Lye, and finally an interconnector between Lye and Dudley.

The ring operates closed under normal running configuration, and the group demand make it a Class D under Engineering Recommendation P2.

The table below outlines the constraints identified for Best View, the conditions they occur under, and the triggering year per season.

Table 3.1.1 overview of constraint

Constraint	Condition	Trigger year per season			
		Winter	Inter Cool	Inter Warm	Summer
Penn_805 to Dudley_303 132 kV circuit overload	N-2: Arranged outage of disconnector 286 taking out SGT2 and Reserve 4 followed by a busbar fault at Main 3 results in Main 4 being picked up all the way round the Dudley-Lye 132 kV ring thus overloading the Penn_805-Dudley 303 circuit	2029	2030	2032	-

Uncertainty under other Distribution Future Energy Scenarios: The constraints above are identified under Best View and worsened under some of the other Distribution Future Energy Scenarios. The demand in the region is generally on an upward trend indicating constraints are potentially getting worse if not addressed, but the trigger year may vary depending on how quickly demand and/or generation materialises.

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 identified constraint(s)

Option	Description	Solves constraint	Potentially economic	Wider benefit	Viable or Discounted
1	No Intervention	×	✓	×	Discounted
Reinforcement (build) options					
2	Reinforcing the existing 132 kV circuit	✓	✓	×	Viable
Operational Mitigation					
3	Network split scheme	✓	✓	×	Viable
Load Management Schemes					
4	Post-fault inter-trips	✓	✓	×	Viable
Flexibility services					
5	Flexibility service procurement	✓	✓	×	Discounted

Solution Development

These options have been assessed on their technical viability and cost-effectiveness pending a more detailed cost benefit analysis (CBA) by the DNO. The section below covers more detail on these options.

Option 1 – No Intervention

Estimated capacity released: 0 MVA

Discounted

Detailed description: The constraint is anticipated to trigger by 2029 with the demand projected to continue increasing thereafter. Doing nothing could therefore lead to thermal overloads and safety implications on staff and the general public.

New limiting factor: Existing 132 kV circuit ratings

Option 2 – Reinforcing the existing 132 kV circuit

Estimated capacity released: 37 MVA

Viable

Detailed description: Uprating the existing 132 kV circuit, the works include:

- Restringing 11.1 km of the existing 200 mm All Aluminium Alloy Conductor (AAAC) tower line circuit with a larger conductor, being no less than 300 mm AAAC. This will be subject to surveys and where a rebuild of the line is necessary, then 500 mm AAAC should be considered to secure the network long term.
- Replacing 600 amp assets either side of the circuit that may be limiting it (circuit breakers, disconnectors, and current transformers).

New limiting factor: Rating of 132 kV circuits

Option 3 – Operational mitigation: Network split scheme

Estimated capacity released: 0 MVA

Viable

Detailed description: Reconfiguring the network during the arranged outage by opening a 132 kV bus-section circuit breaker at Lye BSP, thus splitting the ring and preventing an overload following an N-2 fault outage.

New limiting factor: Rating of 132 kV circuits

Option 4 – Load Management Schemes: Post-fault inter-trips

Estimated capacity released: 0 MVA

Viable

Detailed description: Implementing a load management scheme to trip the Penn_805 circuit following detection of a thermal overload.

New limiting factor: Rating of 132 kV circuits

Option 5 – Flexibility service procurement

Estimated Flexibility Required (MW): 17 MW+

Discounted

Detailed description: Flexibility services through generation turn up and/or demand turn down may be of some benefit in certain outage scenarios however due to the ringed configuration dispatching flexibility services to mitigate for this particular outage could cause an overload elsewhere under a different fault outage scenario.

New limiting factor: the existing 132 kV circuit ratings within the group

Solution Recommendation

It is recommended to pursue option 3 above (operational mitigation) as it is likely to be the most cost-effective solution and allows for better utilisation of the existing assets.

3.2 Kinver transformer overload

Constraint Overview

Generation | **Demand**

Kinver primary is a 33/11 kV site consisting of two 10 MVA transformers (commissioned in 1963), one fed from Hinksford BSP and the other from Stourport BSP (via Wribbenhall), normally operating split at 33 kV and 11 kV.

The site is Class B under Engineering Recommendation P2.

The table below outlines the constraints identified for Best View, the conditions they occur under, and the triggering year per season.

Table 3.2.1 overview of constraint

Constraint	Condition	Trigger year per season			
		Winter	Inter Cool	Inter Warm	Summer
Kinver transformer overload	N-1: Outage of either of the two transformers at Kinver	-	2033	-	-

Uncertainty under other Distribution Future Energy Scenarios: The constraints above are identified under Best View and worsened under some of the other Distribution Future Energy Scenarios. The demand in the region is generally on an upward trend indicating constraints are potentially getting worse if not addressed, but the trigger year may vary depending on how quickly demand and/or generation materialises.

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 identified constraint(s)

Option	Description	Solves constraint	Potentially economic	Wider benefit	Viable or Discounted
1	No Intervention	×	✓	×	Discounted
Reinforcement (build) options					
2	Replacing the existing transformers	✓	✓	×	Viable
3	Adding a third transformer	✓	✓	×	Viable
Operational Mitigation					
4	Load transfers	×	✓	×	Discounted
Load Management Schemes					
5	Post-fault inter-trips	×	✓	×	Discounted
Flexibility services					
6	Flexibility service procurement	✓	✓	×	Viable

Solution Development

These options have been assessed on their technical viability and cost-effectiveness pending a more detailed CBA by the DNO. The section below covers more detail on these options.

Option 1 – No Intervention

Estimated capacity released: 0 MVA **Discounted**

Detailed description: The constraint is anticipated to trigger by 2033 with the demand projected to continue increasing thereafter. Doing nothing could therefore lead to thermal overloads and to the inability to meet security of supply compliance with Engineering Recommendation P2.

New limiting factor: Rating of the transformers

Option 2 – Replacing the existing transformers

Estimated capacity released: 10 MVA Viable

Detailed description: Replacing the existing two 10 MVA 33/11 kV transformers with two 12/24 MVA units.

New limiting factor: Rating of the transformers

Option 3 – Adding a third transformer

Estimated capacity released: 15 MVA Viable

Detailed description: Installing an additional primary transformer at Kinver, the works include:

- Extending the 33 kV busbars at Kinver to include an additional bus-section circuit breaker and a new transformer bay.
- Undergrounding the last span of the 33 kV circuit from Hinksford to allow for the removal of the terminal pole on site, creating space for the busbar extension above.
- Installing a third 33/11 kV transformer rated 7.5/15 MVA.
- Installing an additional 2-section 11 kV board suitably interconnected with the existing.

New limiting factor: Rating of the transformers

Option 4 – Operational mitigation: Load transfers

Estimated capacity released: Limited Discounted

Detailed description: Kinver primary has limited 11 kV interconnections to other primary substations, which are insufficient to mitigate the constraints above.

New limiting factor: Rating of the transformers

Option 5 – Load Management Schemes: Post-fault inter-trips

Estimated capacity released: 0 MVA Discounted

Detailed description: Kinver primary is Class B under Engineering Recommendation P2 which would require restoration of the demand minus 1 MW within 3 hours following a first circuit outage; therefore demand disconnection schemes (or similar) could make the site non-compliant.

New limiting factor: Engineering Recommendation P2 non-compliance

Option 6 – Flexibility service procurement

Estimated Flexibility Required (MW): 1 MW+ Viable

Detailed description: Flexibility services through generation turn up and/or demand turn down could help alleviate the constraint and defer reinforcement. This option would be subject to a cost benefit analysis closer to the time, including all necessary sufficiency checks.

New limiting factor: Rating of the transformers

Solution Recommendation

With regards to reinforcement build options, it would be recommended to pursue option 2 above (uprating the transformers) as it is likely to be the most cost-effective solution especially when considering the age of the transformers.

Any reinforcement solution however would be subject to a CBA by the DNO, and in this case, it may be tested against the flexibility market as part of the Distribution Network Options Assessment (DNOA) process.

3.3 Hinksford Grid Transformer overload

Constraint Overview

Generation | **Demand**

Hinksford BSP consists of three Grid Transformers (GTs): two 132/11 kV transformers normally run split at 11 kV, and a 132/33 kV transformer supplying a couple of primaries including a 33/11 kV transformer at Hinksford, normally run split with the 132/11 kV GTs.

The site is Class C under Engineering Recommendation P2.

The table below outlines the constraints identified for Best View, the conditions they occur under, and the triggering year per season.

Table 3.3.1 overview of constraint

Constraint	Condition	Trigger year per season			
		Winter	Inter Cool	Inter Warm	Summer
Hinksford grid transformer overload	N-1: Outage of either grid transformer at Hinksford BSP	2031	-	-	-

Uncertainty under other Distribution Future Energy Scenarios: The constraints above are identified under Best View and worsened under some of the other Distribution Future Energy Scenarios. The demand in the region is generally on an upward trend indicating constraints are potentially getting worse if not addressed, but the trigger year may vary depending on how quickly demand and/or generation materialises.

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 identified constraint(s)

Option	Description	Solves constraint	Potentially economic	Wider benefit	Viable or Discounted
1	No Intervention	×	✓	×	Discounted
Reinforcement (build) options					
2	Adding a fourth transformer	✓	✓	×	Viable
3	Uprating the existing 33/11 kV transformer	✓	✓	×	Viable
Operational Mitigation					
4	Load transfers	✓	✓	×	Viable
Load Management Schemes					
5	Post-fault inter-trips	×	✓	×	Discounted
Flexibility services					
6	Flexibility service procurement	✓	✓	×	Viable

Solution Development

These options have been assessed on their technical viability and cost-effectiveness pending a more detailed CBA by the DNO. The section below covers more detail on these options.

Option 1 – No Intervention

Estimated capacity released: 0 MVA

Discounted

Detailed description: The constraint is triggered by 2031 with the demand projected to continue increasing thereafter. Doing nothing could therefore lead to thermal overloads and the inability to meet security of supply compliance with Engineering Recommendation P2.

New limiting factor: Existing transformer constraint as outlined in Table 3.3.1.

Option 2 – Add a fourth transformer

Estimated capacity released: 38 MVA **Viable**

Detailed description: Adding a fourth transformer on the site, the works include:

- Extending the 132 kV busbars at Hinksford BSP to include an additional bus-section circuit breaker and a new bay
- Relocating one of the incoming circuits from Penn to the extended end busbars
- Installing a third 132/11 kV transformer, rated 15/30 MVA
- Installing an additional 2-section 11 kV board suitably interconnected with the existing
- Carrying out site checks allowing the existing grid transformers at Hinksford (especially GT1B and GT2B) to utilise their cyclic ratings

It is anticipated that the extension and new assets would fit within the existing site boundary.

New limiting factor: Rating of the transformers

Option 3 – Uprating the existing 33/11 kV transformer

Estimated capacity released: 15 MVA **Viable**

Detailed description: Uprating the existing 33/11 kV transformer on site, the works include:

- Replacing the existing 15 MVA 33/11 kV transformer on site with a 20/40 MVA unit

  [The existing transformer's 11 kV circuit breaker is rated 2000 amp and hence not anticipated to need replacement.]
- Utilising this new 33/11 kV transformer to pick up sufficient demand (to avoid an overload) during a 132/11 kV GT outage
- Carrying out site checks allowing the existing grid transformers at Hinksford (especially 132/11 kV GTs) to utilise their cyclic rating

New limiting factor: Rating of the transformers

Option 4 – Operational mitigation: Load transfers

Estimated capacity released: 7.5 MVA **Viable**

Detailed description: Utilising all transformers on site during an outage, this is split into two parts:

Part 1: Redistributing the demand, during a transformer outage, between the remaining two transformers in-service. (This may be achieved via the existing 11 kV configuration consisting of 5 sections of busbars.)

Part 2: Carrying out site checks allowing the existing grid transformers at Hinksford (especially 132/11 kV GTs) to utilise their cyclic rating

Part 1 only resolves the constraint until 2031, beyond which part 2 will be required.

New limiting factor: Rating of the transformers

Option 5 – Load Management Schemes: Post-fault inter-trips

Estimated capacity released: 0 MVA **Discounted**

Detailed description: Hinksford 11 kV group demand is Class C under Engineering Recommendation P2 which would require restoration of the demand within 15 minutes for a circuit outage; therefore demand disconnection schemes (or similar) would make the site non-compliant.

New limiting factor: Engineering Recommendation P2 non-compliance

Option 6 – Flexibility service procurement

Estimated Flexibility Required (MW): 26 MW+ **Viable**

Detailed description: Flexibility services through generation turn up and/or demand turn down could help alleviate the constraint and defer reinforcement. This option would be subject to a cost benefit analysis closer to the time, including all necessary sufficiency checks.

New limiting factor: Existing transformer ratings

Solution Recommendation

It is recommended to pursue option 4 above (operational mitigation) as it is likely to be the most cost-effective solution and allows for better utilisation of the existing assets.

Any reinforcement solution however would be subject to a CBA by the DNO, and in this case, it may be tested against the flexibility market as part of the DNOA process. The flexibility option however, although may be technically viable, is not likely to be as cost-effective as the operational mitigation option.

3.4 Wolverhampton West primary transformer overload

Constraint Overview

Generation **Demand**

Wolverhampton West primary consists of four 33/11 kV transformers: T3, T4, T5 and T6.

T3 and T4 are each 15 MVA transformers (commissioned in 1969) that run in parallel at 11 kV, whereas T5 (commissioned in 1994) and T6 (commissioned in 2001) are 20/27 MVA transformers run split at 11 kV.

The site is Class C under Engineering Recommendation P2.

The table below outlines the constraints identified for Best View, the conditions they occur under, and the triggering year per season.

Table 3.4.1 overview of constraint

Constraint	Condition	Trigger year per season			
		Winter	Inter Cool	Inter Warm	Summer
Transformer T3 or T4 overload	N-1: Outage of T5 overloads T4 as it picks up the demand; and similarly outage of T6 overloads T3	2028	2029	2033	-
Transformer T5 or T6 overload	N-1: Outage of a 33 kV busbar at Wolverhampton West primary results in T3 or T4 being backfed by T6 or T5 respectively, thus overloading them	-	2029	2033	-

Uncertainty under other Distribution Future Energy Scenarios: The constraints above are identified under Best View and worsened under some of the other Distribution Future Energy Scenarios. The demand in the region is generally on an upward trend indicating constraints are potentially getting worse if not addressed, but the trigger year may vary depending on how quickly demand and/or generation materialises.

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 identified constraint(s)

Option	Description	Solves constraint	Potentially economic	Wider benefit	Viable or Discounted
1	No Intervention	×	✓	×	Discounted
Reinforcement (build) options					
2	Uprating transformers T3 and T4	✓	✓	×	Viable
3	Adding a fifth 33/11 kV transformer	✓	✓	×	Viable
Operational Mitigation					
4	Load transfers	×	✓	×	Discounted
Load Management Schemes					
5	Post-fault inter-trips	×	✓	×	Discounted
Flexibility services					
6	Flexibility service procurement	✓	✓	×	Viable

Solution Development

These options have been assessed on their technical viability and cost-effectiveness pending a more detailed CBA by the DNO. The section below covers more detail on these options.

Option 1 – No Intervention

Estimated capacity released: 0 MVA **Discounted**

Detailed description: The constraint is triggered by 2028 with the demand projected to continue increasing thereafter. Doing nothing could therefore lead to thermal overloads and the inability to meet security of supply compliance with Engineering Recommendation P2.

New limiting factor: Rating of primary transformers

Option 2 – Uprating transformers T3 and T4

Estimated capacity released: 24 MVA **Viable**

Detailed description: Uprating the 15 MVA 33/11 kV transformers T3 and T4 with 20/40 MVA units. (The 11 kV board is 2000 amp rated and is therefore not anticipated to require replacement.)

The fault levels would need to be reassessed with consideration of running the new transformers split at 11 kV if necessary.

New limiting factor: Rating of primary transformers

Option 3 – Adding a fifth 33/11 kV transformer

Estimated capacity released: 18 MVA **Viable**

Detailed description: Adding a 5th 33/11 kV transformer on site, the works include:

- Installing a new 33 kV switchgear board, interconnected with the exiting, to create three busbar sections
- Installing an additional two section 11 kV board suitably interconnected with the existing
- Installing a fifth 33/11 kV transformer rated 12/24 MVA
- Assessing the fault levels with possible split running configuration

New limiting factor: Rating of primary transformers

Option 4 – Operational mitigation: Load transfers

Discounted

Estimated capacity released: Limited

Detailed description: Wolverhampton West primary has limited 11 kV interconnection to other primaries, which are insufficient to mitigate the constraints above.

New limiting factor: Rating of primary transformers

Option 5 – Load Management Schemes: Post-fault inter-trips

Discounted

Estimated capacity released: 0 MVA

Detailed description: The site is Class C under Engineering Recommendation P2 which would require restoration of the group demand within 15 minutes for a circuit outage; therefore demand disconnection schemes (or similar) would make the site non-compliant.

New limiting factor: Engineering Recommendation P2 non-compliance

Option 6 – Flexibility service procurement

Viable

Estimated Flexibility Required (MW): 8 MW+

Detailed description: Flexibility services through generation turn up and/or demand turn down could help alleviate the constraint and defer reinforcement. This option would be subject to a cost benefit analysis closer to the time, including all necessary sufficiency checks.

New limiting factor: Rating of primary transformers

Solution Recommendation

With regards to reinforcement build options, it would be recommended to pursue option 2 above (uprating existing transformers T3 and T4) as this is likely to be the most cost-effective solution, especially when considering the age of the transformers, and it also avoids complicating the 11 kV configuration by adding more transformers on site.

Any reinforcement solution however would be subject to a CBA by the DNO, and in this case, it may be tested against the flexibility market as part of the DNOA process.

3.5 Lye Grid Transformer overload

Constraint Overview

Generation | Demand

Lye BSP consists of three 132/11 kV transformers that run split at 11 kV and are supplied via two 132 kV infeeds, one directly from Penn GSP and one from Dudley BSP.

Two of the transformers, GT1 and GT2A (commissioned in 1966), are rated 15/30 MVA each and fully backfeed each other under an outage; GT3 (commissioned in 1975) is rated 10/20 MVA and is backfed from GT2A during an outage.

The site is Class C under Engineering Recommendation P2.

The table below outlines the constraints identified for Best View, the conditions they occur under, and the triggering year per season.

Table 3.5.1 overview of constraint

Constraint	Condition	Trigger year per season			
		Winter	Inter Cool	Inter Warm	Summer
Lye grid transformer overload	N-1: Outage of one of the grid transformers	Baseline	Baseline	Baseline	2027

Uncertainty under other Distribution Future Energy Scenarios: The constraints above are identified under Best View and worsened under some of the other Distribution Future Energy Scenarios. The demand in the region is generally on an upward trend indicating constraints are potentially getting worse if not addressed, but the trigger year may vary depending on how quickly demand and/or generation materialises.

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 identified constraint(s)

Option	Description	Solves constraint	Potentially economic	Wider benefit	Viable or Discounted
1	No Intervention	×	✓	×	Discounted
Reinforcement (build) options					
2	Uprating transformer GT3	✓	✓	×	Viable
Operational Mitigation					
3	Load transfers	✓	✓	×	Viable
Load Management Schemes					
4	Post-fault inter-trips	×	✓	×	Discounted
Flexibility services					
5	Flexibility service procurement	✓	✓	×	Viable

Solution Development

These options have been assessed on their technical viability and cost-effectiveness pending a more detailed CBA by the DNO. The section below covers more detail on these options.

Option 1 – No Intervention

Estimated capacity released: 0 MVA

Discounted

Detailed description: The constraint is imminent and the demand is projected to continue increasing. Doing nothing could therefore lead to thermal overloads and the inability to meet security of supply compliance with Engineering Recommendation P2.

New limiting factor: Rating of the transformers

Option 2 – Uprating transformer GT3

Estimated capacity released: 10 MVA

Viable

Detailed description: Uprating the existing transformer at Lye BSP, the works include:

- Replacing 132/11 kV transformer GT3 with a 15/30 MVA unit
- Carrying out site checks allowing the existing grid transformers at Lye BSP to utilise their cyclic ratings

New limiting factor: Rating of the transformers

Option 3 – Operational mitigation: Load transfers

Estimated capacity released: 10 MVA

Viable

Detailed description: Utilising all 132/11 kV transformers on site during an outage, this is split into two parts:

Part 1: Redistributing the demand, during a transformer outage, between the remaining two transformers in-service. (This may be achieved via the existing 11 kV configuration consisting of 3 double busbars.)

Part 2: Carrying out site checks allowing the existing grid transformers at Lye to utilise their cyclic rating

Part 1 only resolves the constraint until 2033, beyond which part 2 will be required.

New limiting factor: Rating of the transformers

Option 4 – Load Management Schemes: Post-fault inter-trips

Estimated capacity released: 0 MVA

Discounted

Detailed description: Lye GSP is Class C under Engineering Recommendation P2 which would require restoration of the demand within 15 minutes for a circuit outage; therefore demand disconnection schemes (or similar) would make the site non-compliant.

New limiting factor: Engineering Recommendation P2 non-compliance

Option 5 – Flexibility service procurement

Estimated Flexibility Required (MW): 27 MW+

Viable

Detailed description: Flexibility services through generation turn up and/or demand turn down could help alleviate the constraint and defer reinforcement. This option would be subject to a cost benefit analysis closer to the time, including all necessary sufficiency checks.

New limiting factor: Rating of the transformers

Solution Recommendation

It is recommended to pursue option 3 above (operational mitigation) as it is likely to be the most cost-effective solution and allows for better utilisation of the existing assets.

Any reinforcement solution however would be subject to a CBA by the DNO, and in this case, it may be tested against the flexibility market as part of the DNOA process. The flexibility option however, although may be technically viable, is not likely to be as cost-effective as the operational mitigation option.

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