Staveley and Whitwell BSPs

Network Development Report – East Midlands

May 2024

Electricity Distribution

nationalgrid

Contents

Document Revision and Review

Date	Comments/Changes	Department
06/07/2023	Updated style.	DSO
11/03/2024	First draft completed.	DSO

* Asterisks denote references to other NDP reports (some of which have not been published yet).

† Obelisks denote sections which will require further work.

Staveley / Whitwell 33 kV

1. Network Overview

Staveley and Whitwell Bulk Supply Points (BSPs) are fed from Chesterfield Grid Supply Point (GSP) in National Grid Electricity Distribution's (NGED's) East Midlands licence area. Both BSPs are supplied directly from Chesterfield via dedicated 132 kV dual circuits.

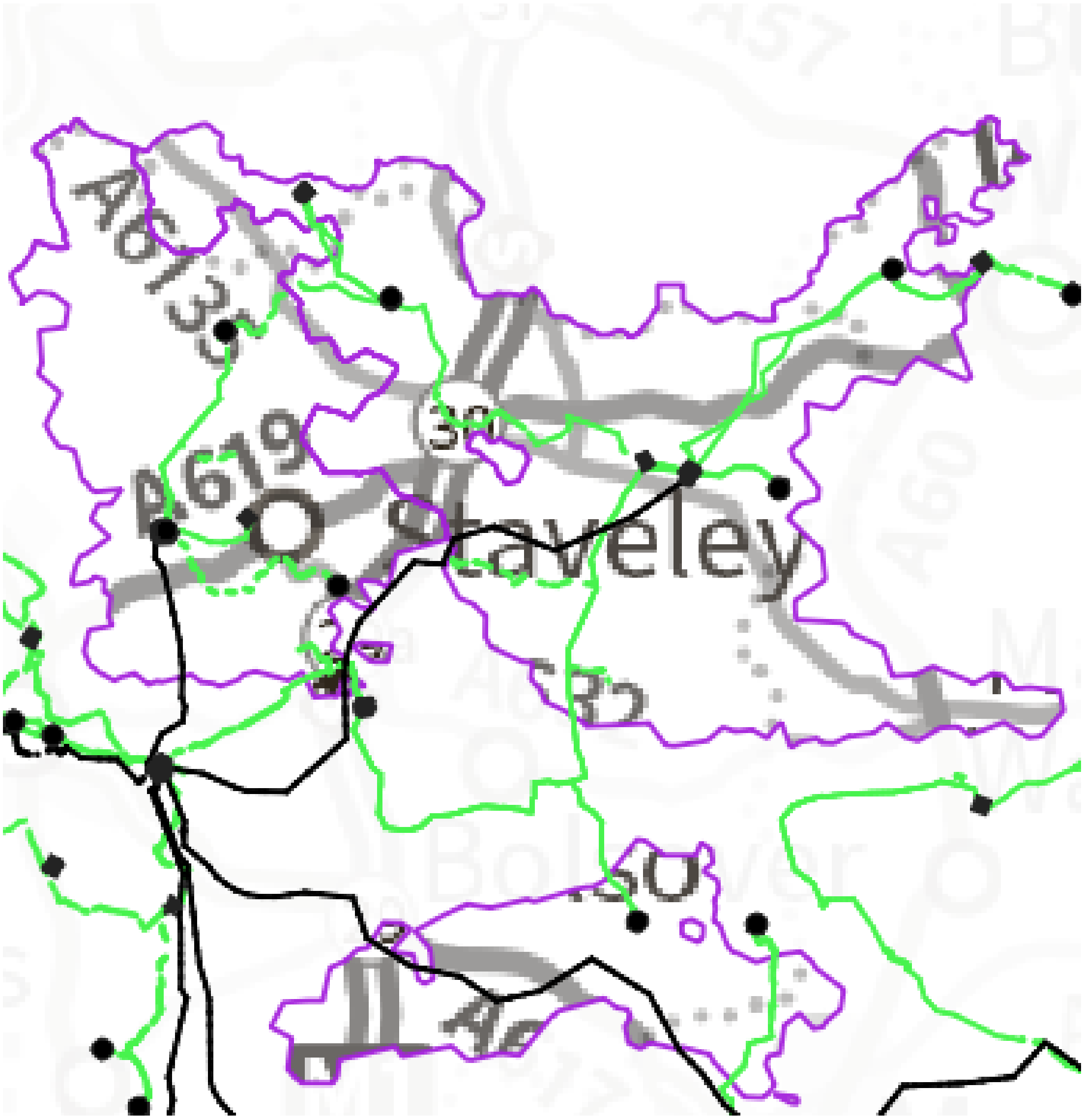

Figure 1.1 Staveley and Whitwell geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon identified on the Grid Transformers (GTs) at, and the 33 kV network supplied from Staveley and Whitwell BSPs. 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

Staveley BSP is a two 90/117 MVA, 132/33 kV substation. The 33 kV busbar comprises two sections and is rated at 2000 A. Staveley BSP supplies five primary substations: Eckington, Erin Road, Halfway (TB), Staveley, and Westhorpe (TB). Staveley primary is located at the same site as the BSP and comprises two 33/11 kV transformers. Erin Road primary is supplied from Staveley BSP via two dedicated 33 kV circuits and 33/11 kV transformers.

Eckington primary has a dedicated 33 kV circuit supplying T1 and shares a 33 kV circuit on the T2 side with Halfway and Westhorpe primaries. Halfway and Westhorpe primaries are supplied through a single 33 kV circuit from Staveley BSP. A second 33 kV circuit is providing supplies from Whitwell BSP. The 11 kV bus section circuit breakers at both primaries are normally run closed, which creates a parallel between Staveley and Whitwell BSPs. Staveley BSP is only interconnected at 33 kV with Whitwell BSP, through Halfway and Westhorpe primaries.

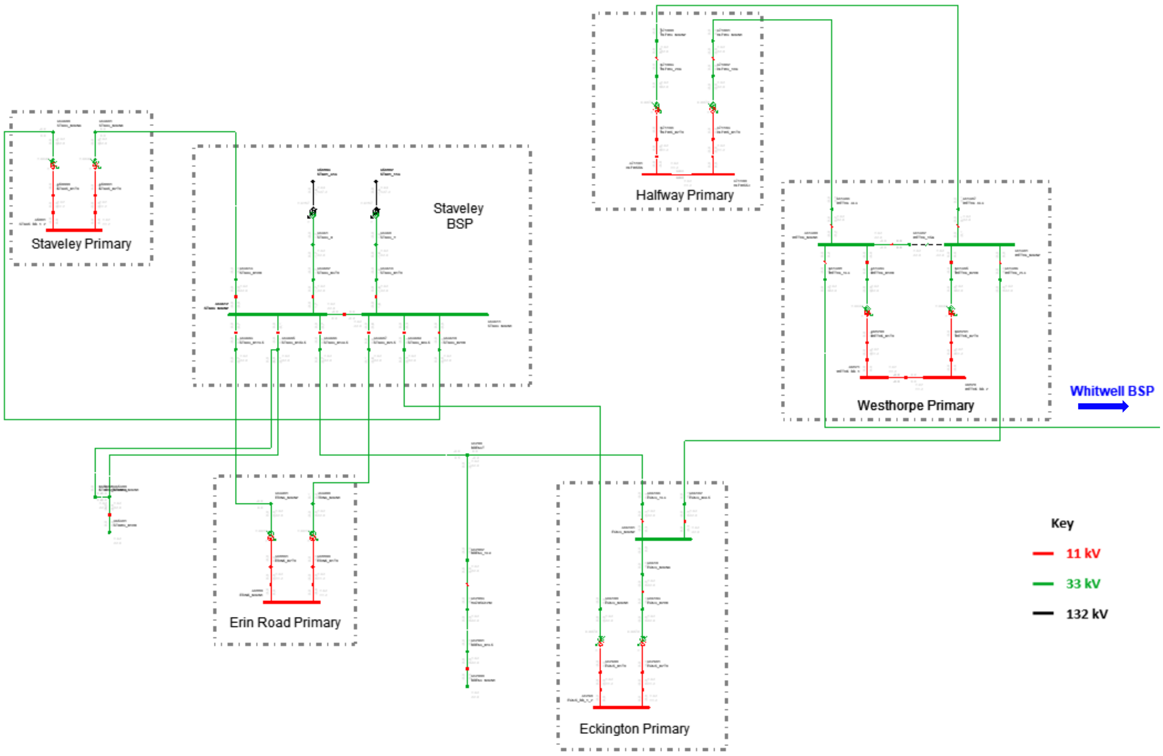

Figure 1.1.1 Staveley 33 kV network single line diagram

Whitwell BSP is a two 60/78 MVA, 132/33 kV substation. The GTs are in the process of being replaced with 90/117 MVA units. The 33 kV busbar comprises two sections and is rated at 1200 A. The 33 kV switchboard is also being replaced as part of the reinforcement project, which will increase the site's fault level capacity. The new ratings have been used in analysis. Whitwell BSP supplies six primary substations: Clowne, Craggs Lane, Halfway (TA), Holme Carr, Shirebrook, and Westhorpe (TA).

Craggs Lane and Home Carr primaries are supplied from Whitwell BSP through dedicated pairs of 33 kV circuits and 33/11 kV transformers. Clowne primary has a dedicated 33 kV circuit supplying T1 and shares a 33 kV circuit on T2 side with Shirebrook, which is a single transformer primary. Halfway and Westhorpe primaries are supplied through a single 33 kV circuit from Whitwell BSP. A second 33 kV circuit is providing supplies from Staveley BSP. The 11 kV bus section circuit breakers at both primaries are normally run closed, which creates a parallel between Staveley and Whitwell BSPs.

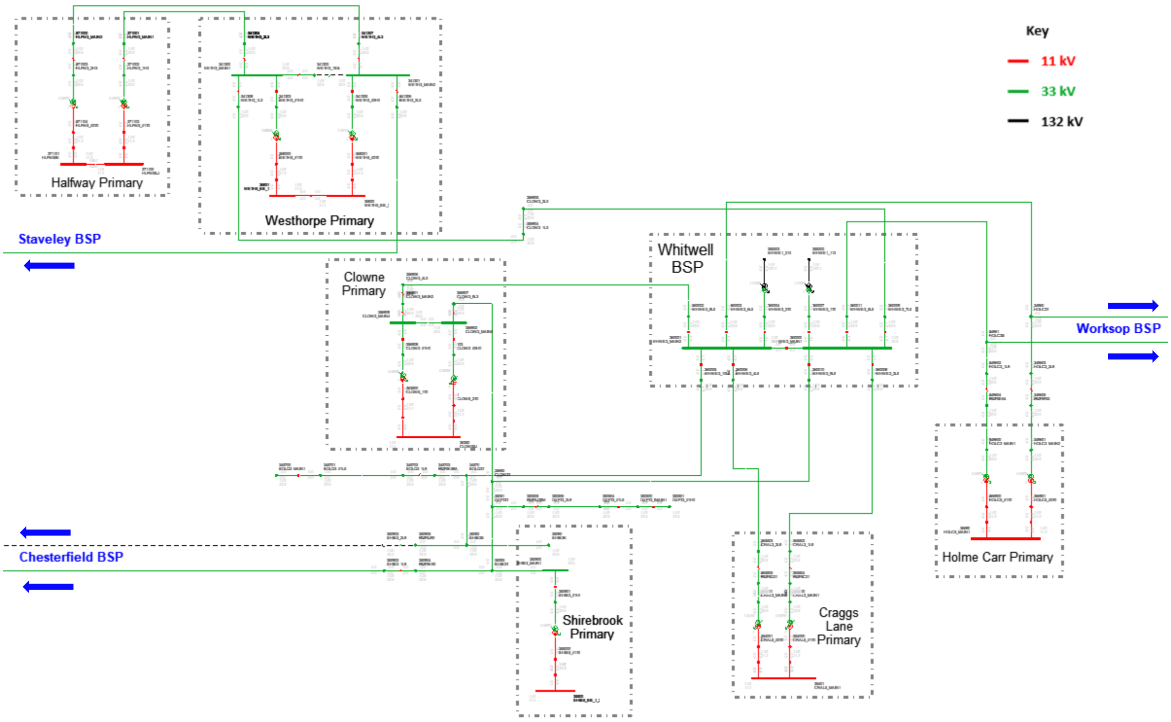

Figure 1.1.2 Whitwell 33 kV network single line diagram

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 arranged outages on any GT at Staveley or Whitwell BSPs, or their associated 132 kV infeeds, the lower voltage side circuit breaker is opened to prevent back-energisation.
- For arranged outages on any GT at Staveley or Whitwell BSPs, or their associated 132 kV infeeds, the 11 kV bus section circuit breakers at Westhorpe and Halfway primaries are opened to prevent loose couples.
- For arranged outages on the 33 kV bus section circuit breaker at Staveley BSP, the downstream network is split at 11 kV to prevent loose couples. This involves splitting Erin Road, Eckington, Staveley, Westhorpe and Halfway primaries at 11 kV.
- For arranged outages on the 33 kV bus section circuit breaker at Whitwell BSP, the downstream network is split at 11 kV to prevent loose couples. This involves splitting Craggs Lane, Clowne, Holme Carr, Halfway and Westhorpe primaries at 11 kV.
- For an arranged outage on an infeed to, or a transformer at Eckington, Erin Road, Staveley, Clowne, Craggs Lane, Halfway, Westhorpe, and Holme Carr primaries, the lower voltage side circuit breaker is opened to prevent back-energisation.
- For arranged outages between Staveley BSP and Eckington primary T1, the 11 kV bus section circuit breakers at Halfway and Westhorpe are opened to prevent the back-energisation of Eckington from Whitwell BSP.
- For arranged outages on the infeeds to Westhorpe primary, or between Westhorpe and Halfway primaries, Westhorpe is paralleled at 33 kV to prevent back-energisation and maintain security of supply.
- For an arranged outage between Whitwell and Westhorpe primary, including on Westhorpe main 1 busbar, the 11 kV bus section circuit breaker at Eckington is opened to prevent back-energisation.
- For an arranged outage on the infeed to, or the transformer at Shirebrook primary, the demand at Shirebrook is transferred to Acreage Lane primary on the 11 kV network.

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:

- Both transformers at Halfway primary overload by 2034, following a planned or unplanned outage on the other transformer or its associated 33 kV infeed.
- Both transformers at Holme Carr primary overload by 2034, following a planned or unplanned outage on the other transformer or its associated 33 kV infeed.
- Both transformers at Eckington primary overload by 2028, following a planned or unplanned outage on the other transformer or its associated 33 kV infeed.
- The 33 kV circuit between Whitwell BSP, Clowne and Shirebrook primaries is non-compliant with Engineering Recommendation P18 regarding circuit complexity, restricting new connections on the 33 kV network.

2.2 Halfway primary transformer overloads

Constraint Overview

Generation | **Demand**

The table below outlines the nature of the network constraints identified in the network analysis.

Table 2.2.1 constraint(s) and conditions under which constraint(s) occur

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
Halfway primary transformer overloads	Arranged or fault outage on the other infeed or transformer	None	-	2034	2034	2034

Uncertainty under other Distribution Future Energy Scenarios: The constraint is present under Leading the Way, Customer Transformation and Best View by 2034. By 2050, all scenarios forecast an overload on the existing transformers.

Solution Options

A list of each of the options considered for this constraint is given 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	Reinforce both transformers with 12/24 MVA units	✓	×	✓	Viable
2	Reinforce both transformers with 20/40 MVA units	✓	×	✓	Viable
3	Install a third transformer on site	✓	×	×	Viable
Operational Mitigation					
4	Transfer demand to other primaries	✓	×	✓	Viable
Flexibility services					
5	Procure flexibility under Halfway primary	✓	×	✓	Viable

Solution Development

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

Option 1 – Reinforce both transformers with 12/24 MVA units

Capacity released for constraint(s) considered: approximately 6.2 MVA (winter) Viable

New limiting factor for constraint(s) considered: 33 kV circuits supplying Halfway primary

Detailed description: Uprating both primary transformers at Halfway to 12/24 MVA units will increase capacity across all seasons from the current 10/14.5 MVA. The 11 kV switchboard is rated at 1200 A and will therefore not require replacement.

The primary substation's winter firm capacity will be 20.7 MVA, limited by approximately 3.3 km of circuits between Westhorpe and Halfway. Further upstream, additional 33 kV circuit works will be required to release more capacity across Halfway and Westhorpe, as they share two 33 kV circuits, one from Whitwell BSP and one from Staveley BSP.

The circuit from Staveley is also shared with Eckington primary, which creates further limitations.

It is anticipated that the new capacity released at Halfway primary by installing 12/24 MVA transformers will be exceeded between 2034 and 2050. The replacement of the transformers is also triggered by their condition (the existing units are over 60 years old).

Option 2 – Reinforce both transformers with 20/40 MVA units

Capacity released for constraint(s) considered: approximately 6.2 MVA (winter) Viable

New limiting factor for constraint(s) considered: 11 kV switchboard at, and 33 kV circuits supplying Halfway primary

Detailed description: Uprating both primary transformers at Halfway to 20/40 MVA units will increase capacity on the transformers even further than in Option 1; however, the 11 kV switchboard will also require reinforcement to align with the new transformer ratings.

The primary substation's winter firm capacity will still be limited to 20.7 MVA, until the 33 kV circuits from Halfway primary to Staveley and Whitwell BSPs are upgraded.

Although the solution doesn't release more capacity initially compared to Option 1, it will provide enough transformer capacity at the primary site for up to 2050. Various options can be explored for releasing 33 kV circuit capacity, including potential re-configuration of the 33 kV network arrangement in the area.

Option 3 – Install a third transformer on site

Capacity released for constraint(s) considered: approximately 6.2 MVA (winter) Viable

New limiting factor for constraint(s) considered: 33 kV circuits supplying Halfway primary

Detailed description: Installing a third 33/11 kV transformer at Halfway could increase capacity; however, it will require additional works such as a third section of 11 kV switchboard and transferring of 11 kV feeders.

There are only two 33 kV circuits feeding Halfway, therefore the options would be to either install additional 33 kV equipment and re-configure the network arrangement, or to install a third circuit from either Staveley BSP or Whitwell BSP. At the BSP, the third circuit would need to be supplied from the side of the switchboard that doesn't already supply the site, to avoid the risks associated with a busbar fault.

Space within Halfway BSP for additional 33 kV switching equipment and an additional transformer will likely to be a limiting factor for this solution, subject to a full survey and detailed design.

Option 4 – Transfer demand to other primaries

Capacity released for constraint(s) considered: Depending on transfers

Viable

New limiting factor for constraint(s) considered: As before

Detailed description: Transferring demand out of Halfway primary to adjacent primary substations through the 11 kV network will be assessed as part of a full 11 kV study. This may not be a viable long term solution for constraint management, especially given the location of Halfway and limited options for demand transfers.

Eckington primary has already been highlighted as requiring reinforcement in Section 2.4; however, part of the new capacity released at Eckington could be used to supply additional demand from Halfway primary.

Westhorpe primary could potentially also accommodate additional demand on the existing transformers, but may have limited or no capacity on the 11 kV network without further reinforcement.

Option 5 – Procure flexibility under Halfway primary

Flexibility service type: Generation turn up/demand turn down.

Viable

Detailed description: Flexibility services could be procured to alleviate the projected overloads on the 33/11 kV transformers at Halfway primary. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Installing 20/40 MVA transformers on site would be the optimal long term solution that reduces future expenditure at Halfway primary. However, significant 33 kV circuit works will be required in order to release this capacity upstream. It is anticipated that installing 12/24 MVA transformers at Halfway will be sufficient for beyond 2034, and since the exceedance above 12/24 MVA transformers forecasted in 2050 isn't greatly over this rating under Best View scenario, it is likely that demand transfers on the 11 kV will be more cost-effective. Should the demand at Halfway increase in line with the higher growth scenario forecasts, and be beyond 11 kV transfer capacity, further upgrading can be undertaken, with the potential of re-purposing the standard 12/24 MVA units. Regardless of the rating of the new units replacing the transformers at Halfway primary will also confer an asset condition benefit.

2.3 Holme Carr primary transformer overloads

Constraint Overview

Generation | **Demand**

The table below outlines the nature of the network constraints identified in the network analysis.

Table 2.3.1 constraint(s) and conditions under which constraint(s) occur

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
Holme Carr primary transformer overloads	Arranged or fault outage on the other infeed or transformer	None	2034	2034	2034	2034

Uncertainty under other Distribution Future Energy Scenarios: Overloads are observed on both transformers for N-1 outage conditions for every scenario by 2034. By 2050, the forecasted demand exceeds the capacity of a 12/24 MVA substation under all scenarios.

Solution Options

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

Table 2.3.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Reinforce both transformers with 12/24 MVA units	✓	×	✓	Discounted
2	Reinforce both transformers with 20/40 MVA units	✓	×	✓	Viable
3	Install a third transformer on site	×	×	×	Discounted
Operational Mitigation					
4	Transfer demand to other primaries	✓	×	✓	Viable
Flexibility services					
5	Procure flexibility under Holme Carr primary	✓	×	✓	Viable

Solution Development

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

Option 1 – Reinforce both transformers with 12/24 MVA units

Capacity released for constraint(s) considered: around 8.3 MVA (winter) **Discounted**

New limiting factor for constraint(s) considered: The new transformers and existing 11 kV switchboard at Holme Carr primary

Detailed description: Uprating both primary transformers at Holme Carr to 12/24 MVA units will increase capacity across all seasons from the current 10/14.5 MVA. This would also confer an asset condition benefit, as the existing units are over 60 years old. The 11 kV switchboard is rated at 1200 A and will therefore not require replacement.

The primary substation's winter firm capacity will be 22.8 MVA, limited by the 11 kV switchboard rating.

It is anticipated that the new capacity released at Holme Carr primary by installing 12/24 MVA transformers will be exceeded between 2034 and 2050, which will require further upgrading the transformers, alongside 11 kV switchboard and 33 kV circuit reinforcement. This option has therefore been discounted as it does not provide an enduring solution to this constraint.

Option 2 – Reinforce both transformers with 20/40 MVA units

Capacity released for constraint(s) considered: approximately 8.3 MVA (winter) / 23.5 MVA (winter) after 11 kV and 33 kV circuit works **Viable**

New limiting factor for constraint(s) considered: 11 kV switchboard at, and 33 kV circuits supplying Holme Carr primary

Detailed description: Uprating both primary transformers at Holme Carr to 20/40 MVA units will increase capacity on the transformers even further than in Option 1 (and confers the same asset condition benefit). However, the primary substation's winter firm capacity will still be limited to 22.8 MVA. In order to release the full capacity of the new transformers, the 11 kV switchboard and both 33 kV circuits supplying Holme Carr will require upgrading.

The 33 kV circuits comprise of mostly 300 HDA overhead lines, which are suitable for the new transformer rating, and only approximately 1 km of cables will require reinforcement across the two circuits. The new circuit length may vary, subject to full route survey and land rights.

Option 3 – Install a third transformer on site

Capacity released for constraint(s) considered: None **Discounted**

New limiting factor for constraint(s) considered: Transformer ratings for a busbar outage at Whitwell BSP

Detailed description: Installing a third 33/11 kV transformer at Holme Carr would not materially increase the site's capacity as there are only two 33 kV busbars at Whitwell, thus two transformers would need to be fed from a single busbar at Whitwell (which would both be lost for a busbar outage).

If a third GT were required at Whitwell BSP, then this option could potentially become viable. Either another 33 kV circuit, or additional 33 kV switching equipment and re-configuration will be required at Holme Carr.

Creating a three transformer primary would also present additional network operability complexity (such as needing to split the 11 kV network for an arranged outage on any transformer).

Due to all of the above, this option has been discounted.

Option 4 – Transfer demand to other primaries

Capacity released for constraint(s) considered: Depending on transfers

Viable

New limiting factor for constraint(s) considered: As before

Detailed description: Transferring demand out of Holme Carr primary to adjacent primary substations through the 11 kV network will be assessed as part of a full 11 kV study.

This may not be a viable long term solution for constraint management.

Option 5 – Procure flexibility under Holme Carr primary

Flexibility service type: Generation turn up/demand turn down.

Viable

Detailed description: Flexibility services could be procured to alleviate the projected overloads on the 33/11 kV transformers at Holme Carr primary. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

As overloads are expected shortly after 2034 following the installation of 12/24 MVA transformers, the recommendation for Holme Carr primary is to install new 20/40 MVA transformers, replace the 11 kV switchboard, and reinforce the 33 kV cables between Whitwell BSP and Holme Carr primary.

This provides a long term solution for the forecasted demand growth in the area.

2.4 Eckington primary transformer overloads

Constraint Overview

Generation | **Demand**

The table below outlines the nature of the network constraints identified in the network analysis.

Table 2.4.1 constraint(s) and conditions under which constraint(s) occur

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
Eckington primary transformer overloads	Arranged or fault outage on the other infeed or transformer	None	2034	2028	2028	2034

Uncertainty under other Distribution Future Energy Scenarios: Under high growth scenarios, Leading the Way and Customer transformation, overloads are expected across all seasons by 2028. Overloads are observed under System Transformation and Falling short as well, between 2028 and 2034.

Solution Options

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

Table 2.4.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Reinforce both transformers with 12/24 MVA units	✓	×	✓	Viable
2	Reinforce both transformers with 20/40 MVA units	✓	×	✓	Viable
3	Install third transformer on site	×	×	×	Discounted
Operational Mitigation					
4	Transfer demand to other primaries	✓	×	✓	Viable
Flexibility services					
5	Procure flexibility under Eckington primary	✓	×	✓	Viable

Solution Development

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

Option 1 – Reinforce both transformers with 12/24 MVA units

Capacity released for constraint(s) considered: approximately 9.3 MVA (winter) ⬆ **Viable**

New limiting factor for constraint(s) considered: The new transformers and existing 11 kV switchboard at Eckington primary

Detailed description: Uprating both primary transformers at Eckington to 12/24 MVA units will increase capacity across all seasons from the current 10/14.5 MVA. The 11 kV switchboard is rated at 1250 A and will therefore not require replacement.

The primary substation's winter firm capacity will be 23.8 MVA, limited by the 11 kV switchboard rating. The replacement of the transformers is also triggered by their condition (the existing units are over 60 years old).

Option 2 – Reinforce both transformers with 20/40 MVA units

Capacity released for constraint(s) considered: approximately 9.3 MVA, 16 MVA after 11 kV switchboard replacement, and 23.5 MVA after 33 kV circuit works (winter) ⬆ **Viable**

New limiting factor for constraint(s) considered: 11 kV switchboard at, and 33 kV circuits supplying Eckington primary

Detailed description: Uprating both primary transformers at Eckington to 20/40 MVA units will increase capacity on the transformers even further than in Option 1. However, the primary substation's winter firm capacity will still be limited to 23.8 MVA. In order to release the full capacity of the new transformers, the 11 kV switchboard and one of the 33 kV circuits supplying Eckington primary will require upgrading.

The circuit on T1 side has sufficient capacity to accommodate the full 30 / 38 MVA of summer / winter capacity. However, due to the fact that the T2 33 kV circuit is shared with Halfway and Westhorpe primaries, the capacity is more limited on this side, and 33 kV circuit reinforcement will be required. In order to release the full capacity of 20/40 MVA transformers, a full optioneering and cost benefit analysis will be undertaken to determine the optimal circuit reinforcement solution. This will include re-configuration options, specifically to unstitch Eckington from Halfway and Westhorpe.

The capacities mentioned above are subject to demand growth at Halfway and Westhorpe as well, and may vary depending on growth magnitude and distribution.

Option 3 – Install a third transformer on site

Capacity released for constraint(s) considered: None ⬇ **Discounted**

New limiting factor for constraint(s) considered: Transformer ratings for a busbar outage at Staveley BSP

Detailed description: Installing a third 33/11 kV transformer at Eckington primary would not materially increase the site's capacity as there are only two 33 kV busbars at Staveley BSP, thus two transformers would need to be fed from a single busbar at the BSP (which would both be lost for a busbar outage).

If a third GT were required at Staveley BSP, then this option could potentially become viable. Either another 33 kV circuit, or additional 33 kV switching equipment and re-configuration will be required at Eckington primary.

Creating a three transformer primary would also present additional network operability complexity (such as needing to split the 11 kV network for an arranged outage on any transformer).

Due to all of the above, this option has been discounted.

Option 4 – Transfer demand to other primaries

Capacity released for constraint(s) considered: Depending on transfers

Viable

New limiting factor for constraint(s) considered: As before

Detailed description: Transferring demand out of Eckington primary to adjacent primary substations through the 11 kV network will be assessed as part of a full 11 kV study. This may not be a viable long term solution for constraint management.

Option 5 – Procure flexibility under Eckington primary

Flexibility service type: Generation turn up/demand turn down.

Viable

Detailed description: Flexibility services could be procured to alleviate the projected overloads on the 33/11 kV transformers at Eckington primary. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

For the short to medium term, installing 12/24 MVA transformer at Eckington primary will support the local demand growth for up to 2040 according to our Best View forecast. However, the long term solution for this site is to install 20/40 MVA units and replace the 11 kV switchboard. The final step of releasing the full capacity at Eckington will be 33 kV circuit works. The replacement of the transformers at Eckington is triggered both by load growth and their condition.

2.5 Whitwell – Clowne – Shirebrook Network Complexity

Constraint Overview

Generation | Demand

The table below outlines the nature of the network constraints identified in the network analysis. Engineering Recommendation P18/2 applies to new circuits and significantly modified circuits (the addition of a new end or site). This constraint is included to ensure that is considered for any modification works happening in the area.

Table 2.5.1 constraint(s) and conditions under which constraint(s) occur

Constraint	Asset	Making dead		Protection clearance		Isolating	
		Sites	Ends	Sites	Ends	Sites	Ends
Complexity of 33 kV circuit under P18 (existing network)	33 kV circuit from Whitwell BSP to Clowne and Shirebrook primaries	4	4	4	4	5	5

Uncertainty under other Distribution Future Energy Scenarios: This constraint is present in the baseline, and the level of growth seen in each scenario will not affect this constraint as it is a circuit complexity issue.

Solution Options

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

Table 2.5.2 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	Install an additional 33 kV circuit to Clowne primary	✓	✓	✓	Viable
2	Install an additional 33 kV circuit towards Shirebrook primary	✓	✓	✓	Viable
Operational Mitigation					
3	Move Shirebrook primary into Chesterfield BSP	✓	×	×	Discounted
Flexibility services					
3	Procure flexibility under Clowne and Shirebrook primaries	×	×	×	Discounted

Solution Development

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

Option 1 – Install an additional 33 kV circuit to Clowne primary

Capacity released for constraint(s) considered: Resolves P18 issue ⬆ Viable

New limiting factor for constraint(s) considered: As before

Detailed description: In order to solve the complexity constraint, a new 33 kV circuit could be installed from Whitwell BSP to Clowne primary, which is approximately 1 km away. This will remove one of the sites from the circuit. The final circuit length is subject to route determination and land rights. A new 33 kV circuit breaker is required at Whitwell BSP.

The new circuit would supply Clowne, while the existing circuit will remain in place to supply Shirebrook primary. The added benefit of this solution is that is releases more capacity at both primary substations, by separating them onto different circuits. Furthermore, by installing the circuit to Clowne, this can be sized accordingly to support the long term forecasted primary demand.

Option 2 – Install an additional 33 kV circuit towards Shirebrook primary

Capacity released for constraint(s) considered: Resolves P18 issue ⬆ Viable

New limiting factor for constraint(s) considered: As before

Detailed description: As an alternative to Option 1, a new 33 kV circuit could be installed between Whitwell BSP towards Shirebrook primary, if it is more economical from a delivery perspective. The end result will be the same, of removing one site from the circuit.

The new circuit would join onto the existing one to supply Shirebrook, while the existing circuit will remain in place to supply Clowne primary. Dismantling / removal of existing circuits may be required. The disadvantage of this option is that although the solution releases capacity at both sites by separating them, the overall circuit capacity does not change, as this only adds a section to an existing, long circuit.

Option 3 – Move Shirebrook primary into Chesterfield BSP

Capacity released for constraint(s) considered: None ⬇ Discounted

New limiting factor for constraint(s) considered: As before

Detailed description: Another option of removing one site from the circuit is to move Shirebrook into Chesterfield BSP, as a 33 kV circuit already exists between Bolsover primary and Shirebrook, normally open at Bolsover. A new 33 kV normally open point needs to be created between Whitwell BSP and Shirebrook primary to enable the separation, which will be subject to land rights. The 33 kV circuit from Chesterfield BSP to Bolsover primary will require reinforcement to accommodate the demand at Shirebrook beyond 2034. Due to the length of circuit from Chesterfield BSP to Shirebrook, the remote voltage will become an issue as Shirebrook demand grows further. In addition, the GTs at Chesterfield BSP are already constrained, as discussed in the Chesterfield / Goitside / Buxton 33 kV report*, and adding more demand will further exacerbate this.

Due to all of the above considerations, this option has been discounted.

Option 4 – Procure flexibility under Clowne and Shirebrook primaries

Flexibility service type: N/A ⬇ Discounted

Detailed description: Due to the nature of this constraint, flexibility is not a suitable solution as it will not have any impact on the circuit complexity.

Solution Recommendation

Given the proximity of Clowne primary to Whitwell BSP, it is recommended that a new circuit is installed between these two substations. The existing circuit will remain in place to supply Shirebrook primary alone, and any associated 33 kV connections. This solution creates 33 kV circuit capacity at both Clowne and Shirebrook primaries.