Stanton BSP

Network Development Report – East Midlands

May 2024

Electricity Distribution

nationalgrid

Contents

Stanton 33 kV

1. Network Overview

Stanton Bulk Supply Point (BSP) is fed from Willington Grid Supply Point (GSP) in National Grid Electricity Distribution's (NGED's) East Midlands licence area. Stanton BSP is fed from Willington via a dual 132 kV circuit from Spondon BSP.

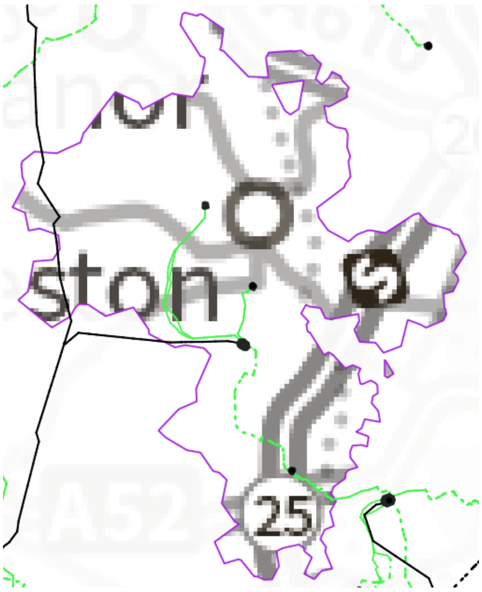

Figure 1.1 Stanton geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon identified on the 33 kV network fed from Stanton BSP. This uses the methodology outlined in the Network Development Plan Methodology Report with Network Operability Modelling applied as outlined below.

For the purposes of this analysis the NGED Best View Distribution Future Energy Scenario (DFES) has been used to study the years 2022 (baseline), 2028 and 2034, with consideration given to how proposals could change under the other scenarios. Five representative days have been studied across the four seasons: Winter Peak Demand, Intermediate Warm Peak Demand, Intermediate Cool Peak Demand, Summer Peak Demand and Summer Peak Generation.

1.1 Network Topology

Stanton BSP has two 33 kV busbars fed by two 132/33 kV GTs both rated to 30/60/78 MVA. Stanton BSP feeds three primary substations: Ilkeston, Little Hallam and Sandiacre. All three primaries are fed directly from Stanton BSP and each have two 33/11 kV transformers.

Stanton BSP is interconnected at 33 kV with Toton BSP via Sandiacre primary (this interconnection is normally run open).

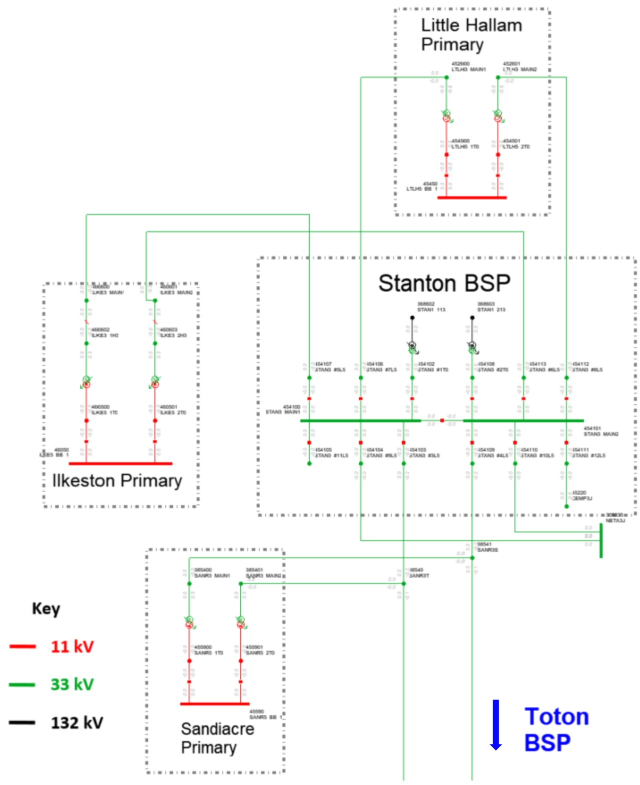

Figure 1.1.1 Stanton 33 kV network single line diagram

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 the loss of an infeed to a transformer at any of the primaries fed from Stanton BSP under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.
- The 33 kV network downstream of Stanton BSP is split for arranged outages on its 33 kV bus section breaker to prevent loose couples. This involves splitting Ilkeston, Little Hallam and Sandiacre primaries at 11 kV.

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:

- Overloads are seen in 2028 on the transformers at Ilkeston primary for an arranged or fault outage on the other transformer/infeed at times of peak demand in a number of seasons. Overloads are also seen in 2034 for similar outages at times of peak generation.
- Overloads are seen in 2034 on the transformers at Little Hallam primary for an arranged or fault outage on the other transformer/infeed (for arranged outages only at winter peak demand).

2.2 Ilkeston 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			
Demand			**Winter**	**Int Warm**	**Int Cool**	**Summer**
Ilkeston T1 or T2 overload	Arranged or fault outage on the other infeed to Ilkeston	None	2034	2028	2028	2034
Generation			**Summer**			
Ilkeston T1 or T2 overload	Arranged or fault outage on the other infeed to Ilkeston	None	2034			

Uncertainty under other Distribution Future Energy Scenarios: The generation constraint at Ilkeston is present by 2034 under all scenarios (and is not present in 2028 under any scenario). The demand constraint at Ilkeston is present under all scenarios by 2028 for some seasons (only for intermediate cool under System Transformation and Falling Short).

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)

Option	Description
Reinforcement	
1	Uprate the transformers at Ilkeston primary.
2	Install a third transformer at Ilkeston primary.
Operational Mitigation	
3	Review seasonal ratings.
4	Active Network Management.
Flexibility Services	
5	Procure flexibility under Ilkeston primary.

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 Distribution Network Options Assessment (DNOA) process.

Option 1 – Uprate the transformers at Ilkeston primary

Viable

Capacity released for constraint(s) considered: 5 MVA

New limiting factor for constraint(s) considered: 33 kV circuits to Ilkeston

Detailed description: Uprating the two 33/11 kV transformers at Ilkeston primary to 20/40 MVA units would alleviate this constraint (both for demand and generation) and provide additional capacity for future growth. The new limiting factor would become the 33 kV infeeds to Ilkeston, which could then be uprated at a future date if required to further increase the firm capacity of the site.

High demand growth is projected at Ilkeston, which will likely eventually necessitate uprating the circuits, but analysis indicates this will not be required by 2034. This option would also benefit the condition of the transformers which are over 60 years old.

Option 2 – Install a third transformer at Ilkeston primary

Discounted

Capacity released for constraint(s) considered: Minimal

New limiting factor for constraint(s) considered: Ratings of the existing transformers

Detailed description: Installing a third transformer at Ilkeston primary rated to 20/40 MVA, with a new 33 kV circuit from Stanton BSP would not significantly increase the capacity of the substation. This is because there are only two 33 kV busbars at Stanton, with no current plans to add a third, so for the loss of a busbar two transformers would be lost at Ilkeston primary (as two of the circuits to Ilkeston would have to be from the same busbar).

Feeding a third transformer from another BSP would not be economical, with the closest other BSP being Heanor which is around 5.5 km away (with the required circuit length likely being significantly longer than this). This would also introduce additional operational complexity by creating a three transformer primary fed from two BSPs.

This option has been discounted, as in addition to the issues discussed above it would also not benefit the condition of the existing transformers as option 1 described above would (so the existing transformers would likely need replacing based on their condition soon regardless).

Option 3 – Review seasonal ratings

Viable

Capacity released for constraint(s) considered: Dependent on review

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

Detailed description: Overloads are only seen in 2028 for intermediate cool and intermediate warm. It is therefore possible that this constraint could be delayed slightly by reviewing NGED's internal policy regarding transformer ratings, which does not currently distinguish between summer and intermediate cool and intermediate warm ratings (which may be overly pessimistic). This solution is dependent on an internal review and would not be a long term solution given the fact that by 2034 overloads are observed in all seasons (and for generation as well).

Option 4 – Active Network Management

Viable

Capacity released for constraint(s) considered: Dependent on curtailment

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

Detailed description: Any additional connections downstream of Ilkeston primary could be included in an Active Network Management (ANM) scheme. ANM schemes are used to manage constraints on over-committed networks. This option could help manage the generation constraint at Ilkeston, but not the demand constraint.

Option 5 – Procure flexibility under Ilkeston primary

Viable

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

Detailed description: Flexibility services could be procured to alleviate the projected overloads seen on the transformers at Ilkeston primary. Flexibility may not be suitable to manage this constraint in the long term as it would not benefit the condition of the transformers at Ilkeston, and would not be suitable to manage the generation constraint once it materialises. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Uprating the transformers at Ilkeston primary is likely to be the optimal long term solution to this constraint. In the short term, reviewing seasonal ratings, the use of ANM and/or procuring flexibility services may be suitable to defer the requirement for this reinforcement (although this deferral would be limited if the transformers required replacing based on their condition).

2.3 Little Hallam 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
Little Hallam T1 or T2 overload	Arranged outage on the other infeed to Little Hallam	None	2034	2034	-	-
Little Hallam T1 or T2 overload	Fault on the other infeed to Little Hallam	None	-	2034	-	-

Uncertainty under other Distribution Future Energy Scenarios: Under the Leading the Way and Consumer Transformation scenarios this constraint is also present at intermediate warm peak demand in 2034. Under the System Transformation and Falling Short scenarios this constraint is not present for any season in 2034.

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)

Option	Description
Reinforcement	
1	Uprate the transformers at Little Hallam primary.
2	Install primary transformers at Stanton BSP.
Operational Mitigation	
3	Various operational mitigations.
Flexibility Services	
4	Procure flexibility under Little Hallam primary.

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 – Uprate the transformers at Little Hallam primary

Viable

Capacity released for constraint(s) considered: 9 MVA

New limiting factor for constraint(s) considered: New transformer ratings

Detailed description: Uprating the two 33/11 kV transformers at Little Hallam primary to 20/40 MVA units would alleviate this constraint and provide additional capacity for future growth. The 33 kV circuits to Little Hallam are rated high enough that they would not become a limiting factor even after the transformers are uprated, so the full ratings of the transformers will be able to be utilised. This option would also benefit the condition of the transformers which are almost 60 years old.

Option 2 – Install primary transformers at Stanton BSP

Viable

Capacity released for constraint(s) considered: Up to 38 MVA

New limiting factor for constraint(s) considered: Total transformer capacity between Little Hallam and the new Stanton primary or 11 kV transfer capacity to the new primary

Detailed description: Installing two 33/11 kV transformers at Stanton BSP and creating a new primary could be used to alleviate this constraint by transferring demand from Little Hallam to this new primary. This would not require any 33 kV circuit works, but would necessitate 11 kV works as there is currently no 11 kV network fed directly from Stanton BSP (but would likely not be prohibitively expensive as Stanton BSP is only around 1.3 km away from Little Hallam primary).

This option is technically viable but will not be required in the short term as the transformers at Little Hallam are likely to be replaced in the near future due to their condition regardless, which will provide an economic opportunity to uprate them as described in option 1. In the long term if demand growth at Little Hallam exceeds its new firm capacity this solution may at that point be required. A new primary could also be used to reduce the load at the other primaries fed from Stanton BSP (Ilkeston, which is also constrained as described in Section 2.2 of this report and Sandiacre), but likely to a lesser extent than for Little Hallam as they are significantly further away from Stanton BSP.

Option 3 – Various operational mitigations

Viable

Capacity released for constraint(s) considered: Dependent on mitigation

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

Detailed description: There are a number of operational mitigation options which, if used together, could potentially be sufficient to manage this constraint by 2034 (but would provide no benefit for the condition of the transformers at Little Hallam, and would not be long term solutions):

- Restrict outage seasons: as this constraint is only present for arranged outages at winter peak demand, restricting outages could help mitigate against winter overloads. One disadvantage of this option is that it reduces network operability.
- Transfer demand at 11 kV to Ilkeston primary: This option would be subject to a full 11 kV study but could be viable given Ilkeston is only around 2 km from Little Hallam, provided the uprating of the transformers at Ilkeston described in Section 2.2 of this report were carried out before any reinforcement of Little Hallam primary (which would likely be the case as the transformers at Ilkeston are older and demand constraints are observed earlier). This could however bring forward a constraint on the 33 kV circuits to Ilkeston primary.
- Review seasonal ratings: an internal review of transformer seasonal ratings may conclude that overloads will not be seen at intermediate cool peak demand in 2034.

Option 4 – Procure flexibility under Little Hallam primary

Viable

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

Detailed description**:** Flexibility services could be procured to alleviate the projected overloads seen on the transformers at Little Hallam primary. Flexibility may not be suitable to manage this constraint in the long term as it would not benefit the condition of the transformers at Little Hallam. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Uprating the transformers at Little Hallam primary is likely to be optimal initial solution to manage this constraint, with establishing a new primary at Stanton BSP discussed as a possibility to create additional capacity if required further into the future. In the short term, a number of operational mitigations (including load transfers at 11 kV, reviewing the seasonal ratings and restricting outage seasons) have been considered, which could potentially be used to manage this constraint in 2034 (along with the procurement of flexibility if required).