Toton BSP

Network Development Report – East Midlands

May 2024

Electricity Distribution

nationalgrid

Contents

Toton 33 kV

1. Network Overview

Toton Bulk Supply Point (BSP) is fed from Ratcliffe Grid Supply Point (GSP) in National Grid Electricity Distribution's (NGED's) East Midlands licence area. Toton BSP is fed directly from Ratcliffe via a dual 132 kV circuit which continues on to Nottingham BSP.

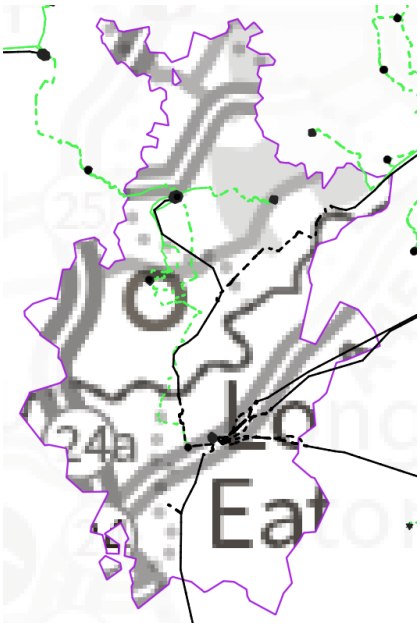

Figure 1.1 Toton geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon identified on the 33 kV network fed from Toton 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

Toton BSP has two 33 kV busbars fed by two 132/33 kV Grid Transformers (GTs), both rated to 30/60/78 MVA. Toton BSP feeds four primary substations: Chilwell, Long Eaton, Ratcliffe-on-Soar and Toton.

Toton primary is located at the same site as Toton BSP. All of the primaries listed above are supplied directly from Toton BSP, and all have two 33/11 kV transformers (with the exception of Ratcliffe-on-Soar, which is a single transformer primary).

Toton is interconnected with Stanton BSP via two 33 kV circuits to Sandiacre primary (these circuits are run with a normal open point at Toton).

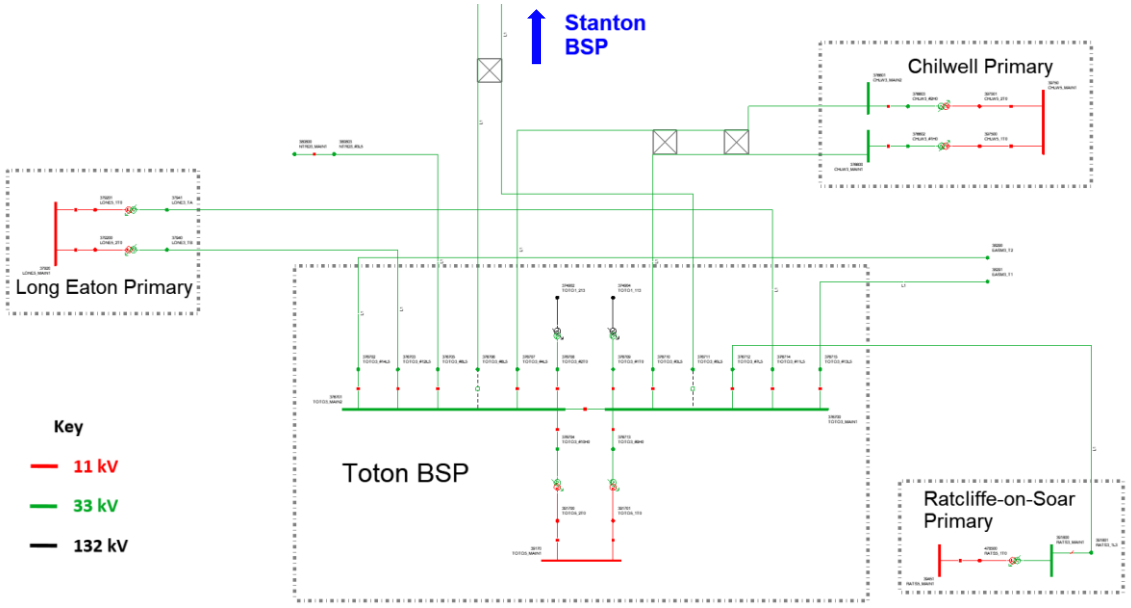

Figure 1.1.1 Toton 33 kV network single line diagram

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 Toton BSP under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.
- The 33 kV network downstream of Toton BSP is split for arranged outages on its 33 kV bus section breaker to prevent loose couples. This involves splitting Toton, Long Eaton and Chilwell primaries at 11 kV.
- For an arranged outage on the 33 kV infeed to or the 33/11 kV transformer at Ratcliffe-on-Soar primary, the load is backfed on the 11 kV network to Castle Donington, East Leake and Clifton primaries.

2. Network Constraints and Solution Options

2.1 Summary of Network Constraint

The following constraint has been identified for the Best View Scenario, for which mitigation options will be discussed:

- By 2028, overloads are projected to occur on both transformers at Toton primary for arranged or fault outages on the other transformer or 33 kV busbar at Toton BSP. By 2034 these overloads occur for outages in any season.

2.2 Toton 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
Toton primary transformer overloads	Arranged or fault outage on the other transformer or 33 kV busbar at Toton BSP	None	2034	2028	2028	2034

Uncertainty under other Distribution Future Energy Scenarios: Significantly higher demand growth is forecast under the Leading the Way and Consumer Transformation scenarios, triggering overloads for other seasons in 2028. While lower growth is forecast under System Transformation and Falling Short, intervention is still triggered before 2034 for both of these scenarios.

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 both primary transformers at Toton primary.
2	Install a third transformer at Toton primary.
3	Install two 132/11 kV GTs at Toton BSP.
Operational Mitigation	
4	Review seasonal ratings.
Flexibility Services	
5	Procure flexibility under Toton 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 both transformers at Toton primary

Viable

Capacity released for constraint(s) considered: 15 MVA

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

Detailed description: Uprating both of the transformers at Toton primary would resolve this constraint and provide significant headroom to accommodate future load growth in the area. The transformers would be uprated to 20/40 MVA units (the highest rating used by NGED as standard on the network).

As the primary transformers at Toton are relatively new, the existing units could potentially be redeployed elsewhere on the network. Minimal 33 kV circuit works will be required to free up this capacity as Toton primary is located at the same site as Toton BSP.

Option 2 – Install a third transformer at Toton primary

Discounted

Capacity released for constraint(s) considered: Minimal

New limiting factor for constraint(s) considered: Transformer ratings for a busbar fault

Detailed description: Installing a third transformer at Toton primary would not free up significant capacity at the site. This is due to the fact that there are only two 33 kV busbars at Toton BSP, so two of the primary transformers would need to be supplied from a single busbar and would consequently both be lost for a fault or arranged outage on that busbar. It would also introduce additional network complexity by creating a three transformer primary.

Option 3 – Install two 132/11 kV GTs at Toton BSP

Viable

Capacity released for constraint(s) considered: 15 MVA

New limiting factor for constraint(s) considered: 11 kV LV circuit breakers for the new GTs

Detailed description: Replacing the two primary transformers at Toton with 132/11 kV GTs would resolve this constraint, as well as reducing loading on the 132/33 kV GTs at Toton BSP. 15/30/39 MVA units would provide similar capacity to 20/40 MVA primary transformers, which would be sufficient for the majority of the load growth up to 2050.

If higher rated 132/11/11 kV units were instead installed, this could free up the possibility of transferring load at 11 kV from Long Eaton primary (which is under 2 km south of Toton BSP). Although no constraints have been identified at Long Eaton before 2034, long term forecasts predict high growth at the primary (exceeding the firm capacity of the site, which already has two 20/40 MVA transformers).

This reinforcement solution would provide sufficient GT capacity at Toton BSP for the demand growth forecast up to 2050 (although some 132 kV circuit works would be required to free up this full capacity, especially if higher rated 132/11 kV GTs were utilised). The significant additional cost required for this solution in comparison to option 1 will need to be weighed against the benefits provided by deloading the existing 132/33 kV GTs (if this option were not progressed a third 132/33 kV GT would likely be required at Toton at some point in the future) and the potential to deload Long Eaton primary long term.

One other benefit of this option is that it could free up additional GT capacity to allow Sandiacre primary to be transferred into Toton (either temporarily or on an enduring basis). This would reduce demand at Stanton BSP (the advantages of which are discussed in the Willington 132 kV report).

Option 4 – 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 by 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.

Option 5 – Procure flexibility under Toton 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 Toton primary. This could be utilised alongside the operational mitigation discussed in option 4 above. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Uprating the 33/11 kV transformers at Toton primary to 20/40 MVA units would alleviate this constraint and provide significant capacity for future growth in the area. Another option considered is replacing the primary transformers with 132/11 kV GTs, which would confer additional network benefits in the long term as discussed above. Demand growth at Toton, as well as the other primaries fed from Toton BSP (namely Long Eaton), will be monitored to determine whether the additional expenditure required to carry out this reinforcement is justified. Reinforcement may potentially be deferred in the short term by a review of NGED's seasonal transformer ratings, but this would not be an enduring solution.

DSO | nationalgrid electricity distribution

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