



Workshop BSP

Network Development Report – East Midlands

May 2024

**Electricity
Distribution**

nationalgrid

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Workshop 33 kV

1. Network Overview

Workshop Bulk Supply Point (BSP) is fed from West Burton Grid Supply Point (GSP) in National Grid Electricity Distribution's (NGED's) East Midlands licence area. Workshop BSP is fed from West Burton via a dual 132 kV circuit which has tees off to Retford and Checkerhouse BSPs.

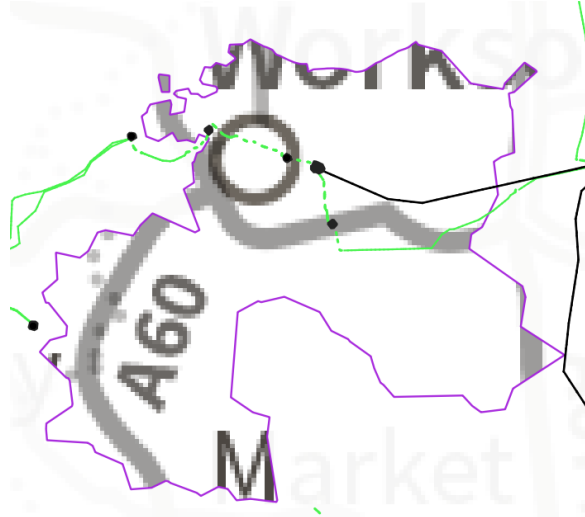


Figure 1.1 Workshop geographic network coverage

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

Workshop BSP has two 33 kV busbars fed by two 132/33 kV Grid Transformers (GTs), both rated to 30/60/78 MVA. Workshop BSP feeds three primary substations (Kilton Road, Manton and Workshop West) all of which have two 33/11 kV transformers.

Workshop West primary is fed via Kilton Road. Workshop is interconnected with Whitwell and Checkerhouse BSPs via Workshop West and Manton primaries respectively. The interconnection at both primaries is open under normal running arrangements, so Workshop is not loose coupled with any other BSPs.

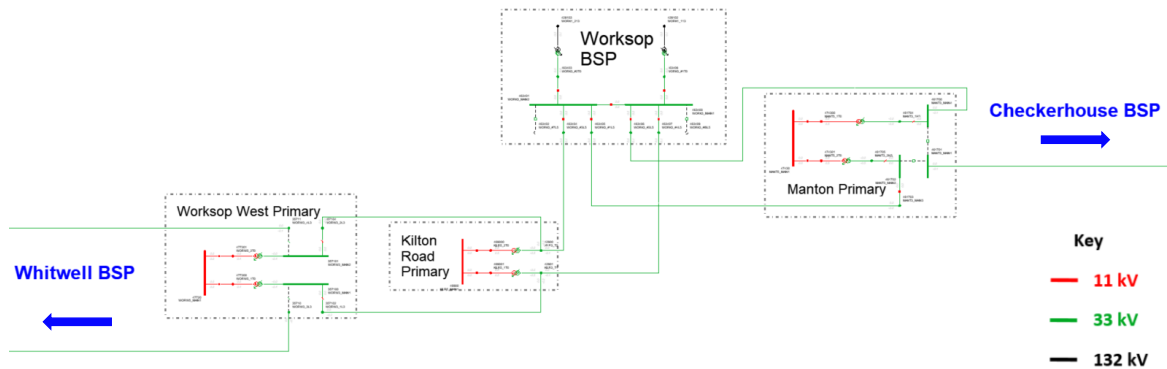


Figure 1.1.1 Worksop 33 kV network single line diagram

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 Manton or Kilton Road primaries under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.
- For an arranged outage on either infeed to Worksop West the primary is transferred into Whitwell BSP.
- The 33 kV network downstream of Worksop BSP is split for arranged outages on its 33 kV bus section breaker to prevent loose couples. This involves splitting Worksop West, Kilton Road and Manton primaries at 11 kV.

2. Network Constraints and Solution Options

2.1 Summary of Network Constraints

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

- Overloads are seen by 2034 on both of the transformers at Kilton Road primary for an arranged or fault outage on the other transformer/infeed.

2.2 Kilton Road 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
Kilton Road T1 or T2 overload	Arranged or fault outage on either transformer or circuit to Kilton Road primary	None	2034	2034	2034	-

Uncertainty under other Distribution Future Energy Scenarios: Similar overloads are observed under the Consumer Transformation scenario. Higher growth is forecast for Leading the Way, under which transformer overloads are also observed in summer (and on the 33 kV circuits to Kilton Road). No overloads are observed by 2034 under System Transformation or 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 Kilton Road primary.
2	Install a third transformer at Kilton Road primary.
Flexibility Services	
3	Procure flexibility under Kilton Road primary.

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 – Uprate the transformers at Kilton Road primary

↑ Viable

Capacity released for constraint(s) considered: Dependent on demand growth at Worksop West primary

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

Detailed description: Uprating both transformers at Kilton Road primary to 20/40 MVA units would fully alleviate this constraint and create additional headroom for future load growth. This would also benefit the condition of the transformers which are almost 55 years old. While the 33 kV circuits to Kilton Road primary are already both rated higher than 20/40 MVA transformers, they currently also supply Worksop West primary and as such become the next limiting factor.

Building two new 33 kV circuits to Kilton Road would allow the two primaries to be unstitched, freeing up circuit capacity for both and allowing the full capacity of the new 20/40 MVA transformers at Kilton Road to be utilised. As overloads on the Worksop to Kilton Road circuits are not projected to occur by 2034, these circuit works are not likely to be required until significantly after the 20/40 MVA transformers are installed.

Unstitching the two primaries will also simplify the network and improve operability. These 33 kV circuit works will likely be low cost as the existing circuits are under 1 km in length. Another way to deload these circuits could be to transfer Worksop West primary to Whitwell BSP, but this option has been discounted as although there are already two 33 kV infeeds to the primary from Whitwell, they would require uprating to accommodate this demand (which would require significantly more circuit works than keeping it supplied from Worksop BSP).

One disadvantage of unstitching the two primaries is that it will require two new 33 kV circuit breakers at Worksop BSP. This would trigger a 33 kV switchboard change at Worksop BSP to accommodate this (as the existing switchboard is non-extendable), increasing the cost of this option.

Option 2 – Install a third transformer at Kilton Road primary

Capacity released for constraint(s) considered: Minimal

 **Discounted**

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

Detailed description: Installing a third transformer at Kilton Road primary rated to 12/24 MVA (matching the existing transformers), with a new 33 kV circuit from Worksop BSP would not significantly increase the capacity of the substation. This is because there are only two 33 kV busbars at Worksop, with no current plans to add a third, so for the loss of a busbar two transformers would be lost at Kilton Road primary (as two of the circuits to Kilton Road would have to be from the same busbar).

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 and creates additional network complexity by creating a three transformer primary.

Option 3 – Procure flexibility under Kilton Road primary

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

 **Viable**

Detailed description: Flexibility services could be procured to alleviate the projected overloads seen on the primary transformers at Kilton Road. Flexibility would provide no benefit for the condition of the transformers at Kilton Road. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

The optimal reinforcement strategy identified to manage this constraint is to uprate both of the transformers at Kilton Road primary to 20/40 MVA units. Options for freeing up additional 33 kV circuit capacity to the primary have been discussed, with the most economical and strategic being unstitching Kilton Road and Worksop West primaries.



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