Walpole GSP

Network Development Report – East Midlands

May 2024

Electricity Distribution

nationalgrid

Contents

Walpole 132 kV

1. Network Overview

Walpole Grid Supply Point (GSP) supplies six Bulk Supply Points (BSPs) in National Grid Electricity Distribution's (NGED's) East Midlands licence area in South Lincolnshire. A number of BSPs within UK Power Network's (UKPN's) East England licence area are also supplied from Walpole. The six BSPs within NGED's network are Boston, Bourne, Bourne West GT1, South Holland, Spalding and Stamford.

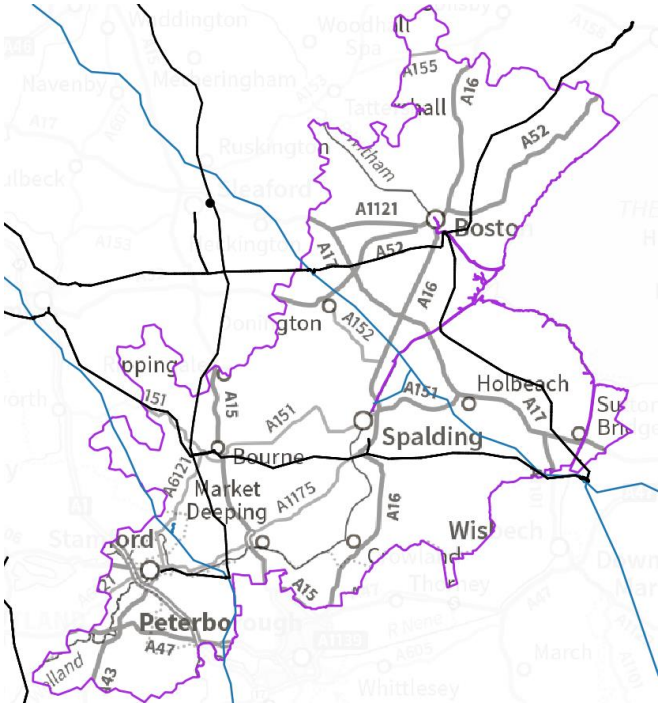

Figure 1.1 Walpole GSP geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon identified on the 132 kV network fed from Walpole GSP. 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

There are two 132 kV dual circuits out of Walpole GSP into NGED's network, one of which supplies Boston BSP, and the other of which supplies Bourne, Bourne West GT1, South Holland, Spalding and Stamford. Stamford BSP also has a 132 kV infeed from Walpole through UKPN's network. Four of NGED's BSPs supplied from Walpole have two 132/33 kV GTs, with the remaining two being Bourne West and South Holland (which have two 132/25 kV GTs and one 132/33 kV GT respectively).

Walpole is interconnected at 132 kV with three other GSPs within NGED's network: Bicker Fen, Staythorpe and West Burton. The interconnection with Bicker Fen and Staythorpe is via normal open points at Boston and Bourne BSPs respectively (which both have dual 132 kV circuits from the respective other GSP). The interconnection with West Burton is via a single 132 kV circuit from Bourne to Lincoln BSP (which is run open under normal running arrangements).

Walpole GSP itself has five 400/132 kV super grid transformers (SGTs). These feed onto four 132 kV busbars, with SGT3 being set up on a swing arrangement such that it can be switched onto either side of Walpole. The site is normally run with four SGTs in parallel, unless both Kings Lynn and Peterborough power stations are exporting, in which case the site is run with three SGTs in parallel due to fault levels.

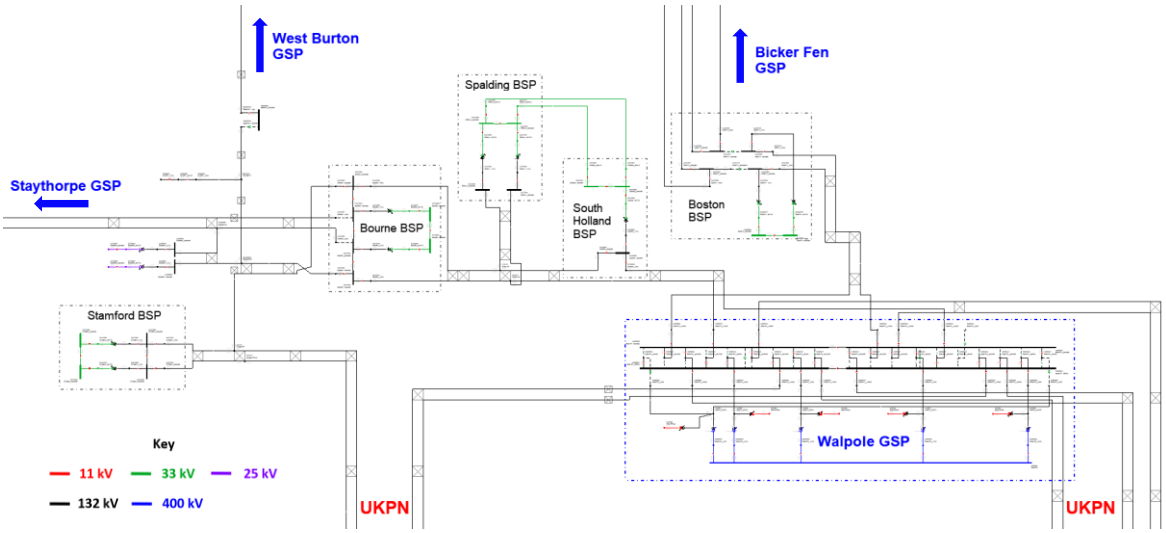

Figure 1.1.1 Walpole 132 kV network single line diagram

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.

- Arranged outages on the 132 kV busbars at Walpole GSP are modelled such that circuits are secured onto in service busbars.
- For arranged outages on any of SGTs 1, 2, 4 or 5 at Walpole, SGT3 is switched in to replace it and retain the four solid running arrangement.
- For various arranged outages at Bicker Fen GSP, or on the 132 kV circuits to Boston BSP, Skegness BSP is transferred into Walpole by closing the normal open points at Boston.
- For arranged outages on either 132 kV infeed to Boston, the BSP is transferred into Bicker Fen GSP by closing the normal open points at Boston.
- For arranged outages on either 132 kV infeed to Grantham South and Bourne West GT2 from Staythorpe, the normal open points at Bourne BSP are closed to transfer both BSPs fully into Walpole GSP.
- For arranged outages on any infeed to Bourne or Spalding, the loose couple between the two BSPs is broken by splitting Crowland primary at 11 kV.
- For arranged outages on any infeed to Bourne or Stamford, the loose couples between the two BSPs are broken by splitting Market Deeping and West Deeping primaries at 11 kV.
- Spalding and South Holland BSPs are split on the 33 kV interconnectors between the two sites, and at 11 kV at Holbeach primary, for arranged outages on either GT at Spalding.
- The 33 kV and 11 kV networks downstream of Spalding BSP are split for arranged outages on the 132 kV infeed to Stamford from UKPN's network, or on the 132 kV busbars at Bourne.
- Stamford BSP is fed fully via Bourne or fully via UKPN's network for outages on its other 132 kV infeed.

- The 33 kV and 11 kV networks downstream of the BSPs fed from Walpole GSP are split for arranged outages on the 33 kV bus section couplers (see relevant 33 kV network reports for more details). The 33 kV and 11 kV network downstream of Boston BSP is also split for arranged outages on the bus section coupler between its 132 kV main 3 and main 4 busbars.
- For the loss of an infeed to a transformer at any of the BSPs fed from Walpole GSP under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.
- For arranged outages on the 132 kV infeed to Stamford GT2, Bourne BSP is split to be fed from a single circuit. Spalding and South Holland BSPs are also split at 33 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:

- The 132 kV circuits from Walpole GSP to Bourne BSP are constrained for both demand and generation, with the most onerous outage condition being an arranged outage on the 132 kV infeed to Stamford GT2, followed by a fault on either side of the Walpole to Bourne 132 kV dual circuit.
- GT constraints at Stamford and Boston BSPs are covered in the Bourne and Stamford 33 kV and Boston 33 kV reports respectively.
- Any constraints seen on the 132 kV network fed from Walpole GSP within UKPN's East England licence area are not covered within this report.

2.2 Walpole to Spalding, South Holland and Bourne 132 kV circuit overloads

Constraint Overview

Generation | Demand

The table below outlines the nature of the network constraints identified in the network analysis. By 2028 and 2034, low voltage conditions were also identified on the 132 kV network for certain outage conditions (the most onerous of which involve the loss of the infeed to Stamford from UKPN's network). The worst voltages were seen at Stamford BSP itself.

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

Constraint	N-1 Condition	Subsequent N-2 Condition	First year constraint is observed in each season under Best View			
Demand			**Winter**	**Int Cool**	**Int Warm**	**Summer**
Walpole to South Holland BSP 132 kV circuit overload	Arranged outage on the infeed to Stamford GT2	Fault on the 132 kV circuit to Spalding GT2	Baseline	Baseline	Baseline	2028
Walpole to South Holland BSP 132 kV circuit overload	Fault on the other circuit or the Walpole 132 kV reserve 3 busbar	None	2034	2034	2034	-
Walpole to Spalding tee 132 kV circuit overload	Arranged outage on the infeed to Stamford GT2	Fault on the 132 kV circuit to South Holland	Baseline	Baseline	Baseline	2028
Walpole to Spalding tee 132 kV circuit overload	Fault on the other circuit or the Walpole 132 kV reserve 4 busbar	None	2034	2034	-	-
South Holland to Spalding tee 132 kV circuit overload	Arranged outage on the infeed to Stamford GT2	Fault on the 132 kV circuit to Spalding GT2	2028	2028	2028	2034
Overloads on either Spalding tee to Bourne 132 kV circuit	Arranged outage on the infeed to Stamford GT2	Fault on either Walpole to Bourne 132 kV circuit	2034	2034	2034	2034
Generation			**Summer**			
Overloads on either 132 kV circuit from Walpole to Spalding and South Holland	Arranged outage on the infeed to Stamford GT2	Fault on either Walpole to Spalding 132 kV circuit	2034			

Uncertainty under other Distribution Future Energy Scenarios: Demand growth on the four BSPs supplied by the Walpole to Bourne 132 kV circuits is slightly higher under Consumer Transformation and significantly higher under Leading the Way than under Best View. Lower demand growth is forecast under the other two scenarios, but as overloads are observed in the baseline for certain outage conditions some form of operational mitigation is required regardless of scenario. The long term reinforcement strategy for the area is also unaffected by the growth seen under each scenario, as there are a number of drivers for a new GSP as discussed below.

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 132 kV circuits from Walpole GSP to Bourne BSP.
2	Establish a new GSP.
Operational Mitigation	
3	Restrict outage seasons.
4	Alternative running arrangements.
5	Active Network Management.
Flexibility Services	
6	Procure flexibility under Spalding, South Holland, Bourne and Stamford BSPs.

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.

One of the options discussed below involve works on the transmission network and will therefore require a modification application and discussions with National Grid Electricity Transmission (NGET) and National Grid ESO to ensure the optimal solution for the whole system (considering both the distribution and transmission systems) is taken forward.

Option 1 – Uprate the 132 kV circuits from Walpole GSP to Bourne BSP

Viable

Capacity released for constraint(s) considered: Dependent on sections uprated

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

Detailed description: Uprating the 132 kV circuits from Walpole to Bourne would alleviate this constraint. This would, however, require a significant length of circuit works, as the total length between Walpole and Bourne is over 16 km. If the network can be managed operationally until a new GSP can be built using the methods described in options 2-6 below, then these works would not be required. If necessary, only the most limiting section (or sections) of 132 kV circuit could be uprated (such as the Walpole to South Holland circuit).

Option 2 – Establish a new GSP

Viable

Capacity released for constraint(s) considered: The demand of Stamford BSP (as well as a large amount of generation and potential to transfer out additional demand in the future)

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

Detailed description: If a new GSP were built to the west of Walpole, Stamford BSP could be transferred out of Walpole GSP. This would deload the Walpole to Bourne 132 kV circuits and free up significant demand capacity. There is also a large amount of future generation in the area which could also be transferred into a new GSP. If the 132 kV circuit from Bourne, which currently supplies Stamford GT1, were converted to a dual circuit, Bourne (and even Spalding) could be transferred into the new GSP as well.

There are a number of other benefits for the network of establishing a new GSP in this area, including deloading Walpole itself. The location of a new GSP is subject to optioneering (considering the impacts on both the distribution and transmission networks) as well as extensive engagement with NGET and NGESO.

Option 3 – Restrict outage seasons

Viable

Capacity released for constraint(s) considered: Dependent on seasonal loadings

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

Detailed description: As this constraint is only present under N-2 conditions for certain seasons in the baseline, restricting outages to summer could be used to help manage this constraint. This could be used in conjunction with splitting the network during outages, as discussed in option 4 below. This option is not suitable for managing the network in the long term, as by 2028 overloads are projected for all seasons, and by 2034 overloads are also expected to occur for N-1 outages. A disadvantage of this option is that it reduces network operability for both NGED and UKPN's networks.

Option 4 – Alternative running arrangements

Viable

Capacity released for constraint(s) considered: Demand at Stamford BSP

New limiting factor for constraint(s) considered: 132 kV circuit capacity for N-1 constraints

Detailed description: In order to prevent overloads for subsequent faults, the 132 kV network is split during certain arranged outages. These arrangements are also highlighted in Section 1.2 of this report. For outages on the 132 kV infeed to Stamford BSP from UKPN's network (which as shown in the table above leads to some of the most onerous constraints), the network can be split at Bourne, Spalding and South Holland BSPs (balancing load as evenly as possible between the two 132 kV circuits). For arranged outages on the Spalding, South Holland and Bourne network, Stamford BSP can be fed fully from UKPN's network by splitting between Bourne and Stamford.

Splitting the network in these ways is required to manage the network in the short to medium term, and can be used alongside restricting outage seasons if required. Some of these splits are, however, operationally challenging, and by 2034 overloads are projected for N-1 outages, which cannot be managed in this way. This option is therefore unsuitable for managing the network in the long term. Transfers at 33 kV would provide limited to no benefit, as the four BSPs fed via these circuits (Spalding, South Holland, Bourne and Stamford) are only interconnected with each other.

One other running arrangement which has been considered is transferring Bourne BSP into Staythorpe GSP. This cannot be carried out under normal running arrangements for a number of reasons. Firstly, it would lead to non-compliance with Engineering Recommendation P18 by exceeding the allowable addresses on the 132 kV circuits from Staythorpe B. Secondly, due to the arrangement of Bourne BSP, it could not be transferred without also splitting the ring set up on the network (splitting up this ring would lead to other constraints being created). Finally, Staythorpe GSP is projected to be constrained on its SGTs for both demand and generation, as outlined in the Staythorpe 132 kV report, which would only be exacerbated by transferring in Bourne BSP. This transfer is therefore unsuitable for managing this constraint in the short to medium term, but may eventually be implemented if a new GSP is established in the area.

Option 5 – 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 on the dual 132 kV circuit from Walpole GSP would 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 projected generation constraint on the circuits, but not the projected demand constraint. This option is also not a permanent method of managing this constraint due to the amount of generation connecting in the area.

Option 6 – Procure flexibility under Spalding, South Holland, Bourne and Stamford BSPs

Viable

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

Detailed description: Flexibility services could be procured on the network supplied from Spalding, South Holland, Bourne and Stamford BSPs to alleviate the projected demand overloads seen on the 132 kV circuits from Walpole GSP. Flexibility would however not be suitable for managing the corresponding generation constraint, but could be used in conjunction with the operational mitigations discussed in options 3, 4 and 5 above. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Utilising ANM and/or flexibility services, as well as the operational mitigations described above (restricting outage seasons and alternative running arrangements) could be used to manage the demand and generation constraints on the 132 kV circuits from Walpole to Bourne in the short to medium term. In the long term, establishing a new GSP to the west of Walpole (which has a number of triggers and associated benefits) is expected to alleviate this constraint. If required, sections of the 132 kV circuits could be uprated to manage the constraint in the interim (but this would only be carried out if the various lower cost options highlighted above were exhausted).

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