Burton, Burton South and Gresley BSPs

Network Development Report – East Midlands

May 2024

Electricity Distribution

nationalgrid

Contents

Burton, Burton South and Gresley 33 kV

1. Network Overview

Burton, Burton South and Gresley Bulk Supply Points (BSPs) are all fed from Drakelow Grid Supply Point (GSP) in National Grid Electricity Distribution's (NGED's) East Midlands licence area. All three BSPs are supplied directly from Drakelow by three 132 kV dual circuits (with Burton South BSP being located directly adjacent to the GSP).

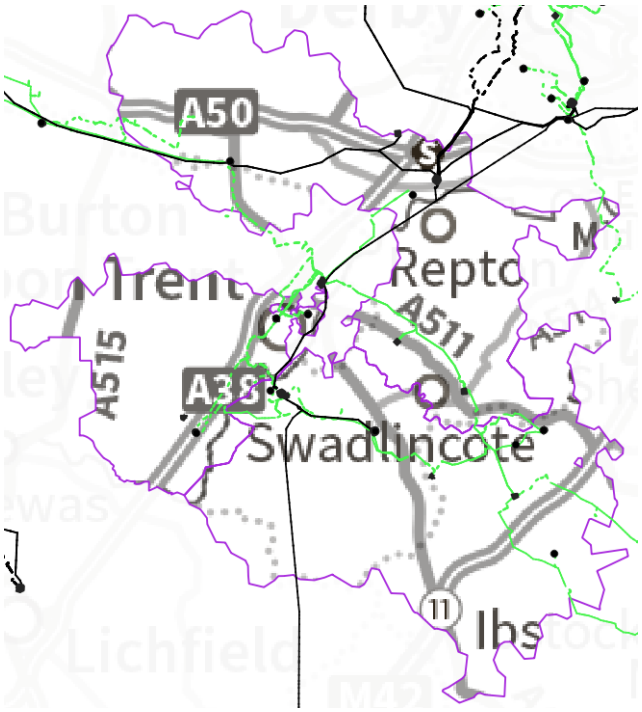

Figure 1.1 Burton, Burton South and Gresley geographic network coverage

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

Burton BSP has two 33 kV busbars fed by two 132/33 kV GTs both rated to 60/90/117 MVA. Burton BSP feeds six primary substations: Bretby, Hatton, Trent Alloys, Woodville, Station Street T2 and Wellington Street T3. Bretby and Woodville primaries are supplied via the same two 33 kV circuits. Trent Alloys is a single transformer primary, Wellington Street primary has three 33/11 kV transformers and the remaining primaries supplied from Burton BSP all have two 33/11 kV transformers.

Burton South BSP has two 33 kV busbars fed by two 132/33 kV GTs both rated to 60/90/117 MVA. Burton South BSP feeds three primary substations: Barton under Needwood, Station Street T1 and Wellington Street T1/T2. Barton under Needwood primary has two 33/11 kV transformers.

Gresley BSP has three 33 kV busbars fed by two 132/33 kV GTs both rated to 45/90/117 MVA. Gresley BSP feeds four primary substations: Ashby De La Zouch, Gresley, Moira and Willesley. Gresley primary is located at the same site as Gresley BSP, and has three 33/11 kV transformers (with T1 and T2 run in parallel, and T3 run separate). Ashby and Willesley are supplied via Moira primary.

Burton BSP is interconnected with Uttoxeter BSP via a single 33 kV circuit between Marchington and Hatton primaries (which is normally run open). It is also interconnected with Gresley BSP via two normal open points at Woodville primary, and with Burton South BSP via 11 kV bus section breakers at Station Street and Wellington Street primaries (run closed for the former and open for the latter under normal running arrangements). Gresley BSP is interconnected with Burton South via a single 33 kV circuit directly between the BSPs (which is normally run open), and with Coalville via two normal open points at Willesley primary.

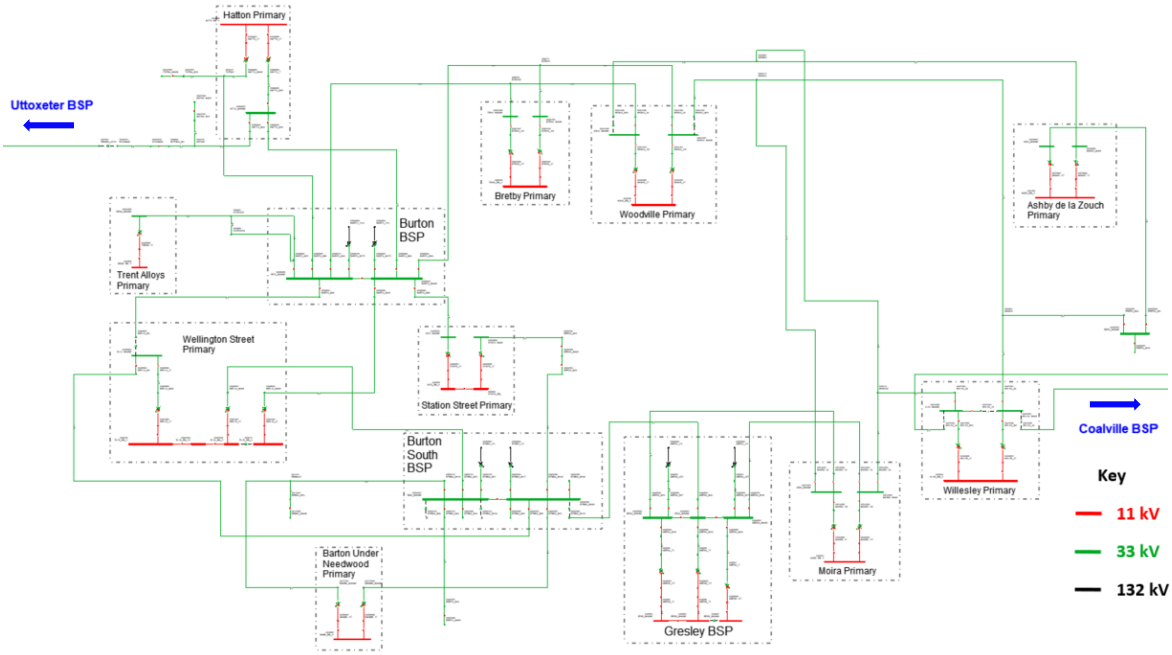

Figure 1.1.1 Burton, Burton South and Gresley 33 kV network single line diagram

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 Burton, Burton South and Gresley BSPs under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.
- The 33 kV networks downstream of Burton, Burton South and Gresley BSPs are split for arranged outages on their respective 33 kV bus section breakers to prevent loose couples:
    - For the Burton BSP 33 kV bus section this involves splitting Bretby, Woodville, Hatton and Station Street primaries at 11 kV.
    - For the Burton South BSP 33 kV bus section this involves splitting Barton under Needwood, Wellington Street and Station Street primaries at 11 kV.
    - For outages on either 33 kV bus section at Gresley BSP (or the main 2 33 kV busbar) Moira, Willesley and Ashby primaries are split at 11 kV. For outages on the 33 kV bus section breaker between main 1 and main 2 Gresley primary is also split at 11 kV between T1 and T2.
- For an outage on any of the 132 kV infeeds to or the GTs at Burton or Burton South, Station Street primary is split at 11 kV to break the loose couple between the two BSPs.
- For an outage on the main 3 33 kV busbar at Gresley BSP, or the primary transformer T3 the site is paralleled at 11 kV by closing the bus section breaker between the main 1 and main 3 11 kV busbars.
- For an outage on the 33 kV infeed to T3 at Wellington Street primary (or the transformer itself), the site is paralleled at 11 kV by closing the bus section breaker between the main 2 and main 3 11 kV busbars.
- For an outage on the 33 kV infeed to, or the 33/11 kV transformer at Trent Alloys primary, its load is backfed at 11 kV to Melbourne and Infinity Park primaries.
- Woodville primary is transferred into Gresley BSP for arranged outages on either 33 kV busbar at Burton BSP, or on the 33 kV circuits to the primary. In future year studies, this transfer is not modelled to prevent N-2 overloads from occurring.

2. Network Constraints and Solution Options

2.1 Summary of Network Constraints

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

- A reverse power flow constraint has been identified at Moira primary in the baseline for N-1 outages (the loss of either transformer or 33 kV circuit to the primary).
- Both demand and generation constraints are projected on the 33 kV circuits between Gresley BSP and Moira primary in 2034. For the loss of either circuit the other could potentially overload.
- For an arranged or fault outage on either 33 kV circuit from Burton BSP to Bretby primary, the remaining circuit could overload.
- By 2034, T1 or T2 at Wellington Street is forecast to overload for a fault or arranged outage on the other transformer, or 33 kV circuit from Burton South BSP. N-2 constraints are expected to occur sooner, but can potentially be managed operationally.

2.2 Moira 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 under Best View
			Summer (generation)
Moira primary transformer reverse power flow overload	Arranged or fault outage on either infeed to Moira	None	Baseline

Uncertainty under other Distribution Future Energy Scenarios: As this constraint is present in the baseline it will require intervention regardless of the forecasts for each scenario.

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 transformers at Moira primary.
2	Retrofit new tap-changers on the transformers at Moira primary.
Operational Mitigation	
3	Active Network Management.
Flexibility Services	
4	Procure flexibility under Moira 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.

Option 1 – Uprate both transformers at Moira primary

Viable

Capacity released for constraint(s) considered: Up to 11 MVA

New limiting factor for constraint(s) considered: Ratings of the 33 kV circuits between Gresley BSP and Moira primary

Detailed description: Uprating both 33/11 kV transformers at Moira primary to 12/24 MVA units would resolve this constraint. 20/40 MVA units have been considered, but the extra capacity this would free up would not be required (forecasts indicate that 12/24 MVA units will be sufficient to accommodate both demand and generation growth up to 2050).

The new limiting factor for growth at Moira would become the 33 kV circuits between Gresley and Moira. Mitigation options for this constraint are discussed in Section 2.3 of this report. Replacing both transformers at Moira primary will also confer an asset condition benefit, as the existing units are almost 55 years old.

Option 2 – Retrofit new tap-changers on the transformers at Moira primary

Discounted

Capacity released for constraint(s) considered: Around 3 MVA

New limiting factor for constraint(s) considered: Full reverse power flow ratings of the primary transformers

Detailed description: The transformers at Moira primary are currently limited by the tap-changers associated with each unit. These tap-changers are not automatically capable of switching full reverse power flow. Calculations indicate the tap-changers are each capable of switching to a maximum reverse power flow of 8 MVA. Retrofitting a new tap-changer to each transformer at Moira could allow the full reverse power flow rating of the transformers to be utilised (further investigation would be required to determine the feasibility of this option).

This option has been discounted, as even if it is deemed feasible following further investigation it would not free up sufficient capacity to manage this constraint. It would also not be economical or strategic given the age of the transformers (as they would likely need replacing in the near future based on their condition regardless).

Option 3 – Active Network Management

Discounted

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

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

Detailed description: Any additional connections at Moira 11 kV would be included in an Active Network Management (ANM) scheme. ANM schemes are used to manage constraints on over-committed networks. ANM will not be sufficient to manage this constraint as it is observed in the baseline.

Option 4 – Procure flexibility under Moira primary

Discounted

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

Detailed description: Flexibility is not suitable to manage this constraint as it is generation driven. Managing generation constraints using flexibility procurement is technically feasible, but NGED's internal tools and processes for calculating flexibility requirements for generation constraints are still in development.

Solution Recommendation

The optimal reinforcement solution identified is to uprate both transformers at Moira primary to 12/24 MVA units. This will (along with 33 kV circuit works discussed in Section 2.3 of this report) free up sufficient headroom at Moira primary for demand and generation growth in the area up to 2050 based on current forecasts.

2.3 Gresley to Moira 33 kV circuit 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 year constraint is observed in each season under Best View			
Demand			**Winter**	**Int Cool**	**Int Warm**	**Summer**
Gresley to Moira 33 kV circuit overload	Fault or arranged outage on either circuit or 33 kV busbar at Gresley	None	-	2034	-	-
Generation			**Summer**			
Gresley to Moira 33 kV circuit overload	Fault or arranged outage on either circuit or 33 kV busbar at Gresley	None	2034			

Uncertainty under other Distribution Future Energy Scenarios: Both demand and generation growth at Moira, Willesley and Ashby are significantly higher under Consumer Transformation and Leading the Way. For both of these scenarios demand overloads are triggered in other seasons in 2034 (but growth is not fast enough to trigger overloads for any seasons in 2028). Conversely, for System Transformation and Falling Short lower demand and generation growth is forecast (with no overloads projected to occur by 2034 for Falling Short).

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 both 33 kV circuits from Gresley to Moira.
2	Build two new 33 kV circuits from Gresley BSP.
Operational Mitigation	
3	Transfer Willesley or Ashby primaries.
4	Active Network Management.
Flexibility Services	
5	Procure flexibility under Moira, Willesley and Ashby primaries.

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 both 33 kV circuits from Gresley to Moira

Discounted

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

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

Detailed description: Uprating both 33 kV circuits between Gresley and Moira could be used to resolve this constraint. The majority of both circuits would need to be uprated to free up any capacity, and the entirety would need replacing to support the long term growth of the three sites.

It may not be practical to install circuits rated high enough to support the demand and generation growth forecast at all three sites. Given this fact, as well as the numerous network benefits that would be conferred by option 2, this option has been discounted.

Option 2 – Build two new 33 kV circuits from Gresley BSP

Viable

Capacity released for constraint(s) considered: Demand of the unstitched primary plus over 20 MVA

New limiting factor for constraint(s) considered: Transformer ratings at each primary

Detailed description: Installing two new 33 kV circuits between Gresley BSP and one of the primaries within the group (Moira, Willesley or Ashby) would allow the network to be unstitched. The existing circuits would be used as dedicated feeders to a single primary, and the new circuits would be used to supply the remaining two primaries. This option adds significantly more capacity than uprating the existing circuits as discussed in option 1 above (but it will also necessitate installing two additional 33 kV circuit breakers at Gresley BSP and some works at whichever primary is unstitched).

This option would give the unstitched primary over 40 MVA of dedicated circuit capacity. It would also free up significant circuit capacity for both of the other primaries. Of the three primaries, Moira would likely be the easiest to unstitch (being the closest to Gresley BSP) but there may be additional benefits to unstitching a different primary (such as Ashby). Further optioneering, including detailed route investigations, are required to determine the viability of unstitching each of these primaries.

Regardless of which primary is unstitched, this reinforcement would reduce network complexity, increase operability and security of supply, as well as increasing interconnection with Burton and Coalville BSPs. One other option considered is whether this reinforcement could allow Woodville primary to be transferred into Gresley BSP. This option has been discounted (as discussed in Section 2.4 of this report) as it would require significant additional circuit works to achieve without seriously derating Woodville, Ashby and Willesley primaries.

Option 3 – Transfer Willesley or Ashby primaries

Discounted

Capacity released for constraint(s) considered: 33 kV circuit capacity and network complexity

New limiting factor for constraint(s) considered: Neither transfer is feasible

Detailed description: Two potential transfers have been considered to deload the Gresley to Moira 33 kV circuits and help mitigate this constraint (both of which have been discounted):

- Transferring Willesley primary into Coalville BSP: Coalville BSP itself has recently been reinforced and could have headroom to accept additional demand. However, the two 33 kV circuits to Willesley are not rated high enough to accept the demand of Willesley on top of their existing demand (and are long enough that reinforcement would not be economical). Transferring Willesley would also lead to a non-compliance for network complexity under Engineering Recommendation P18 on one of the circuits.
- Transferring Willesley or Ashby primaries into Burton BSP: neither of these transfers are feasible due to the ratings of the 33 kV circuits from Burton BSP. Even if the Burton to the Bretby tee 33 kV circuits are reinforced (as discussed in Section 2.4 of this report) the Bretby to Woodville and Woodville to the Ashby/Willesley tee point circuits would still be unable to accept the necessary additional demand. Reinforcing these circuits would be significantly more expensive than the reinforcement options discussed above. Finally, as Willesley T2 and Ashby T2 are fed by the same 33 kV circuit transferring only one primary would not be possible. Transferring both primaries is not feasible either, due both to the aforementioned thermal limitations and network complexity issues which would be created.

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 the Gresley to Moira 33 kV circuits 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 projected generation constraint, but not the projected demand constraint.

Option 5 – Procure flexibility under Moira, Willesley and Ashby primaries

Viable

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

Detailed description: Flexibility services could be procured on the network supplied via the Gresley to Moira 33 kV circuits to alleviate the projected demand overloads. Flexibility would however not be suitable for managing the generation constraint. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Building two new 33 kV circuits from Gresley BSP to Moira primary would allow Moira, Ashby or Willesley to be unstitched from the other two primaries. This would resolve this constraint, add circuit capacity to all three primaries to accommodate future load growth and simplify the network. In the short term a combination of ANM and flexibility procurement could potentially be used to manage the generation and demand constraints on these circuits.

2.4 Burton to Bretby 33 kV circuit 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 year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Burton to Bretby 33 kV circuit overload	Fault or arranged outage on either circuit or 33 kV busbar at Burton	None	2028	Baseline	2028	-

Uncertainty under other Distribution Future Energy Scenarios: As this constraint is present in the baseline it will require intervention regardless of scenario. Under Consumer Transformation and Leading the Way overloads are also projected to occur in summer.

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)

Option	Description
Reinforcement	
1	Uprate both 33 kV circuits from Burton to the Bretby tee.
2	Install two new 33 kV circuits from Burton to the Bretby tee.
Operational Mitigation	
3	Transfer Woodville primary into Gresley BSP.
Flexibility Services	
4	Procure flexibility under Bretby and Woodville primaries.

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 both 33 kV circuits from Burton to the Bretby tee

Discounted

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

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

Detailed description: Uprating both 33 kV circuits between Burton BSP and the tee off to Bretby primary could be used to resolve this constraint. While some capacity could be released by uprating a few relatively short sections of circuit, to free up more than 3 MVA (which will be required to support the sites long term) the majority of both circuits would need replacing.

Given this option requires a similar amount of circuit works as building new 33 kV circuits, as discussed in option 2 below (with less network benefits conferred), this option has been discounted.

Option 2 – Install two new 33 kV circuits from Burton to the Bretby tee

Viable

Capacity released for constraint(s) considered: Demand of either primary

New limiting factor for constraint(s) considered: Transformer ratings at each primary

Detailed description: Installing two new 33 kV circuits between Burton BSP and the tee off to Bretby primary could be used to resolve this constraint. The existing circuits feed both Bretby and Woodville, so installing new circuits would allow the two primaries to be unstitched. The new circuits would be used to feed Woodville primary (as long term demand forecasts for Woodville are higher than for Bretby). The two new circuits would also require associated 33 kV circuit breakers at Burton BSP.

This reinforcement would create sufficient 33 kV circuit capacity for Bretby primary to allow the full capacity of 12/24 MVA units to be unlocked. Uprating the existing 33/11 kV transformers is likely to be carried out in the near future, driven either by load growth at the site (which is forecast to take Bretby to close to its firm capacity by 2034) or asset condition (the existing transformers are close to 60 years old). With 12/24 MVA transformers and the existing 33 kV circuits as dedicated feeders Bretby would have sufficient capacity to accommodate the forecast demand growth up to 2050.

This reinforcement would also reduce network complexity and increase operability. The possibility of this reinforcement facilitating the transfer of Ashby and/or Willesley primaries into Burton BSP to alleviate the projected constraint on the 33 kV circuits between Gresley BSP and Moira primary has been considered. This option was discounted as it would either derate Woodville, Willesley and Ashby primaries or trigger extensive additional 33 kV circuit works (as outlined in Section 2.3 of this report).

Option 3 – Transfer Woodville primary into Gresley BSP

Discounted

Capacity released for constraint(s) considered: Demand of Woodville primary

New limiting factor for constraint(s) considered: Moira to Woodville 33 kV circuit capacity

Detailed description: Transferring Woodville primary into Gresley BSP to alleviate this constraint would not be possible without unstitching Moira, Ashby or Willesley primary first as discussed in Section 2.3 of this report (due to both thermal and network complexity limitations). As this constraint is present in the baseline, these works would need to be brought forward significantly.

Even if this was done, the 33 kV circuits between Moira and Woodville would need uprating as well (requiring a significant length of circuit works). In comparison to option 2 this reinforcement would be more expensive and not confer any additional network benefits (option 2 would create sufficient circuit capacity at Bretby and Woodville to accommodate most of the demand growth projected up to 2050).

Option 4 – Procure flexibility under Bretby and Woodville primaries

Viable

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

Detailed description: Flexibility services could be procured at Bretby and/or Woodville primaries to alleviate the projected demand overloads on the Burton to Bretby 33 kV circuits. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Building two new 33 kV circuits from Burton BSP to the Bretby tee would allow Bretby and Woodville primaries to be unstitched. This would resolve this constraint and add capacity to both primaries (with the next reinforcement step likely being uprating the transformers at Bretby).

2.5 Wellington Street primary transformer overloads

Constraint Overview

Generation | Demand

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

Table 2.5.1 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
Wellington Street T1 or T2 overload	Arranged or fault outage on T1 or T2 (or either 33 kV circuit from Burton South BSP)	None	-	2034	2034	2034
Wellington Street T1 or T2 overload	Arranged outage on T3 or the 33 kV circuit from Burton BSP	Fault on T1 or T2 (or either 33 kV circuit)	2028	Baseline	2028	2028

Uncertainty under other Distribution Future Energy Scenarios: Irrespective of the demand growth in the different scenarios, the reinforcement works outlined below are also triggered on an asset condition basis. Higher growth is forecast under the Leading the Way and Consumer Transformation scenarios (but for both the reinforcement proposals in options 1 and 2 below would still provide the requisite capacity to accommodate demand growth up to 2050). The lowest demand growth is seen under Falling Short, but overloads are still projected to occur for N-1 outages by 2034 in this scenario.

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)

Option	Description
Reinforcement	
1	Uprate T1 and T2 at Wellington Street primary to 20/40 MVA.
2	Add a second 12/24 MVA transformer at Wellington Street primary.
Operational Mitigation	
3	Various operational mitigations.
Flexibility Services	
4	Procure flexibility under Wellington Street 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 T1 and T2 at Wellington Street primary to 20/40 MVA

Viable

Capacity released for constraint(s) considered: 12 MVA

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

Detailed description: Uprating both T1 and T2 at Wellington Street primary to 20/40 MVA units would alleviate this constraint and add significant capacity to the site. T1 and T2 are both over 60 years old and are due for replacement based on their condition. This replacement will provide an economic opportunity to uprate to 20/40 MVA.

The two 33 kV circuits which feed T1 and T2 from Burton South BSP are both already rated high enough that they would not limit 20/40 MVA transformers for any season (so minimal 33 kV circuit works will be required to free up this capacity). The 11 kV switchboard is however only rated to 1250 A so would also need uprating as part of the works to free up this capacity.

20/40 MVA transformers, while adding significant capacity, would not allow the site to accommodate the forecast demand growth up to 2050. Further intervention may therefore be required, such as adding a new 12/24 MVA transformer as discussed in option 2 below. This solution is however still the clear strategic choice to uprate the site in the first instance (driven both by load growth and the condition of T1 and T2).

Option 2 – Add a second 12/24 MVA transformer at Wellington Street primary

Viable

Capacity released for constraint(s) considered: Dependent on load balance at 11 kV (with the load balanced appropriately the firm capacity of the site could be up to 61 MVA)

New limiting factor for constraint(s) considered: Total transformer capacity of the two halves of Wellington Street

Detailed description: Beyond uprating T1 and T2 at Wellington Street as discussed in option 2 above, further intervention may be required to increase the firm capacity of the site. Installing a second 12/24 MVA transformer at Wellington Street would allow effectively two primaries to be created at Wellington Street; one with two 20/40 MVA transformers fed from Burton South BSP and one with two 12/24 MVA transformers fed from Burton BSP.

There are already two 33 kV circuits from Burton BSP to Wellington Street primary which are both rated high enough to support the full capacity of 12/24 MVA transformers. Minimal 33 kV circuit works would therefore be required to facilitate this reinforcement project. A new 20/40 MVA transformer could be installed but this option has been discounted as to free up additional capacity, both T3 and its 33 kV infeed circuit would then need uprating (and current forecasts do not support the need for this additional expenditure). In the short term T3 at Wellington Street should be maintained in preparation for this reinforcement.

These works will also leave the network significantly less complex and easier to operate, with two primaries each with direct radial feeds from two BSPs (as opposed to the existing three transformer arrangement split over two BSPs).

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 for managing this constraint. These could be utilised to manage the demand constraint in the short term at Wellington Street before T1 and T2 are replaced based on their condition.

- Restrict outage seasons: as this constraint is only present for an N-2 scenario at intermediate cool peak demand in the baseline, restricting outage seasons to any of the other three seasons would mitigate this constraint. One disadvantage of this option is that it reduces network operability.
- Alternative running arrangements: splitting Wellington Street at 11 kV during arranged outages could be used to help manage the N-2 constraints outlined (but this option is limited by the topology and load balance of the 11 kV network fed from Wellington Street). This would be unsuitable for helping manage N-1 constraints also forecast to occur.
- Review seasonal ratings: as this constraint is only present in intermediate cool in the baseline (the ratings for which may be overly pessimistic as they align to the summer rating), an internal review of transformer seasonal ratings may conclude that this constraint is not present until 2028.

Option 4 – Procure flexibility under Wellington Street primary

Viable

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

Detailed description: Flexibility services could be procured to alleviate the projected overloads on the primary transformers at Wellington Street. As the replacement of T1 and T2 is also triggered based on their condition, the use of flexibility will not be able to defer this expenditure. However, in the longer term flexibility could be utilised to defer further reinforcement (which is outlined in option 2 above). Flexibility could also be used in conjunction with the operational mitigation options discussed above. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

A number of operational mitigations have been identified to manage the constraint at Wellington Street primary in the short term. Beyond this, uprating T1 and T2 at the primary is the optimal reinforcement solution (triggered by both demand growth in the area and the condition of the assets). If required to accommodate the forecast long term demand growth in the area, a second 12/24 MVA transformer could be installed (to effectively create two primaries fed from Burton South and Burton BSPs respectively).

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