Corby BSP

Network Development Report – East Midlands

May 2024

Electricity Distribution

nationalgrid

Contents

Corby 33 kV

1. Network Overview

Corby Bulk Supply Point (BSP) is fed from Grendon Grid Supply Point (GSP) in National Grid Electricity Distribution's (NGED's) East Midlands licence area.

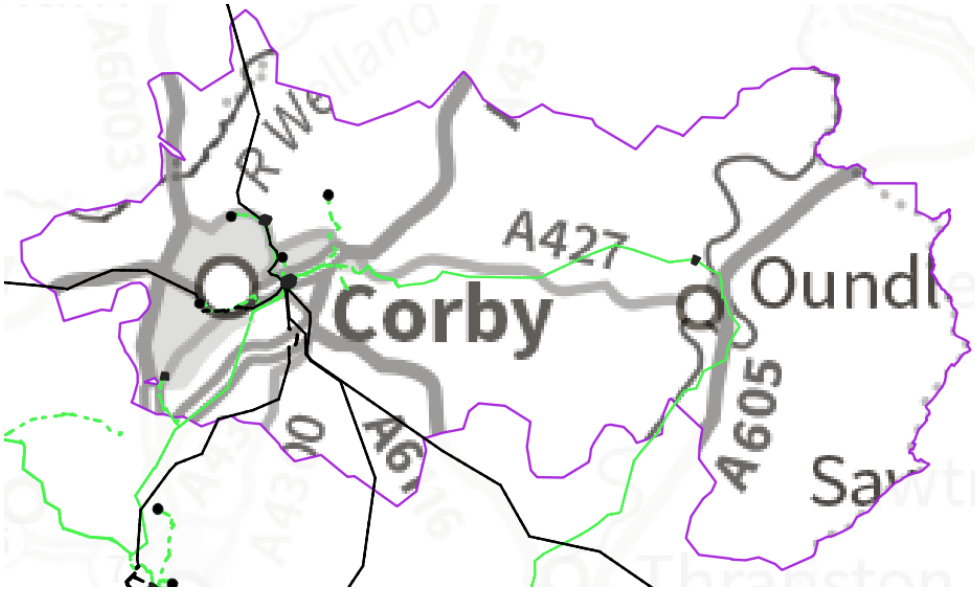

Figure 1.1 Corby geographic network coverage

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

Corby BSP has four 132 kV busbars set up in a double busbar configuration, and three 132/33 kV Grid Transformers (GTs) feeding onto five 33 kV busbars. All three GTs are rated to 60/90/117 MVA. GT1 is connected to a smaller busbar, set up such that it can feed onto either side of Corby.

Corby BSP feeds nine primary substations: Corby Central, Oakley, Earlstrees, Corby North, Corby, Hazelwood, Weldon Shanks, Oundle T1 and a dedicated customer site. All of these primaries are fed directly from Corby BSP.

The BSP is interconnected at 33 kV with Irthlingborough BSP via Oundle primary and with Kettering BSP via Oakley primary.

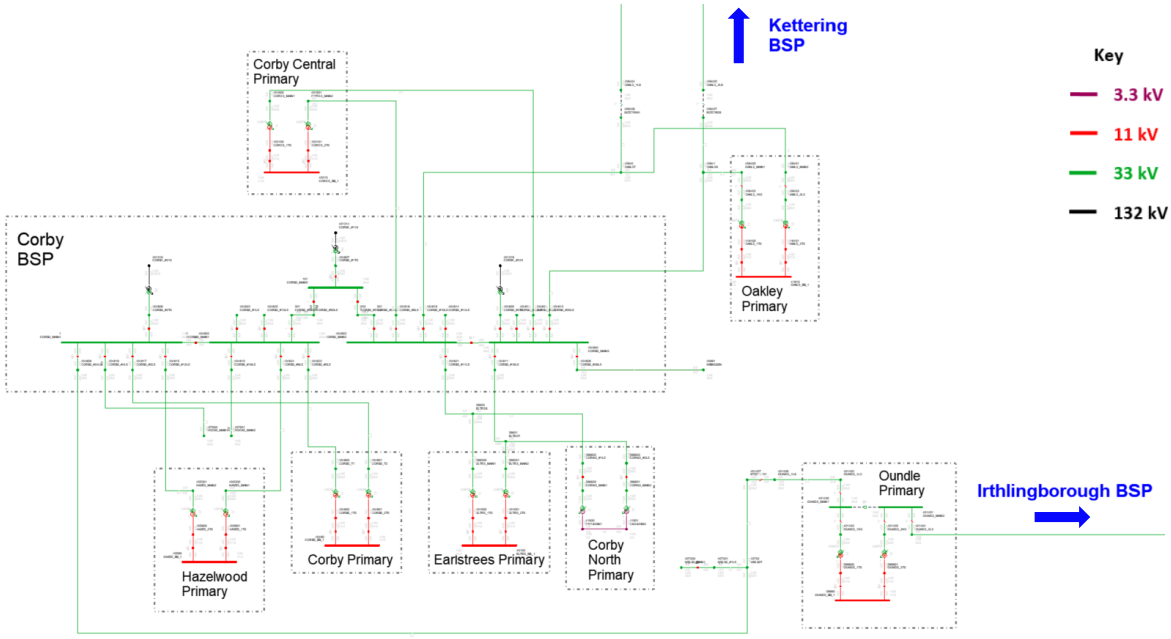

Figure 1.1.1 Corby 33 kV network single line diagram

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, as well as proposed actions to manage some constraints identified operationally or to account for proposed network changes.

- For an arranged outage on the 33 kV bus section breakers on each side of Corby BSP, the downstream network is split to prevent loose couples. For the GT2 side, this involves splitting Hazelwood and Corby primaries at 11 kV. For the GT3 side, this involves splitting Earlstrees, Corby North, Corby Central and Oakley primaries.
- For an outage on either side of Corby (on GT2 or GT3), GT1 is used to solely feed that side of Corby by splitting from the other side. For an outage on GT1, Corby BSP is also split such that each side is fed by GT2 or GT3 respectively.
- For outages on any infeed to Corby BSP (or the 33 kV busbars) the loose couple with Irthlingborough BSP at Oundle primary is split.
- For the loss of an infeed to a transformer at any of the primaries fed from Corby BSP under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.

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:

- By 2028, overloads are projected to occur on the 33 kV cable to Corby primary T1 for the loss of the other infeed to Corby primary. By 2034, overloads are forecast for the other cable and for both transformers, under similar N-1 outages in every season.
- Both transformers at Hazelwood primary are forecast to overload for arranged or fault outages on the other circuit or transformer by 2034.

2.2 Corby primary transformer and circuit 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
33 kV cable to Corby primary T1 overload	Arranged or fault outage on the 33 kV infeed to Corby primary T2	None	2028	2028	2028	2034
33 kV cable to Corby primary T2 overload	Arranged or fault outage on the 33 kV infeed to Corby primary T1	None	2034	2034	2034	2034
Corby primary transformer overloads	Arranged or fault outage on either transformer at Corby primary	None	2034	2034	2034	2034

Uncertainty under other Distribution Future Energy Scenarios: As under Best View, this constraint is present in 2028 under the Leading the Way and Consumer Transformation scenarios. Under the lower growth scenarios overloads are only forecast for the 33 kV cables by 2034.

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 cables to the Corby primary transformers.
2	Establish a second Corby primary.
Operational Mitigation	
3	Transfer demand to other primaries.
Flexibility Services	
4	Procure flexibility under Corby 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 cables to the Corby primary transformers

Viable

Capacity released for constraint(s) considered: Up to 13 MVA

New limiting factor for constraint(s) considered: Transformer rating

Detailed description: As Corby primary is located at the same site as Corby BSP, uprating the 33 kV cables to the transformers could be carried out at a relatively low cost. This would resolve the constraint on the two cables and free up the full capacity of the 20/40 MVA transformers at Corby primary. The transformers themselves could not be uprated, as they are already the highest rated units utilised by NGED as standard on the distribution network (so this option alone does not free up sufficient capacity for the demand growth forecast up to 2050).

Option 2 – Establish a second Corby primary

Viable

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

New limiting factor for constraint(s) considered: Total primary transformer capacity

Detailed description: A second primary substation located at Corby BSP with two 20/40 MVA transformers would allow the existing Corby primary to be deloaded, resolving this constraint. This reinforcement is significantly more expensive than option 1, so would not be utilised in the first instance, but may be necessary to support the high long term demand growth forecast for the area. A new primary substation located at Corby BSP would also make it easier to balance demand between the two halves of the site.

Option 3 – Transfer demand to other primaries

Viable

Capacity released for constraint(s) considered: Dependent on demand transfers

New limiting factor for constraint(s) considered: 11 kV transfer capacity and total primary capacity in Corby

Detailed description: Transferring demand to other nearby primaries such as Hazelwood, Corby Central or Earlstrees could be used to manage this constraint. However, Hazelwood primary is also projected to be constrained by 2034 as described in Section 2.3 (and Earlstrees/Corby Central are both forecast to be near or at their firm capacity by 2034 as well). Reinforcing the transformers at Earlstrees and/or Corby Central primaries to 20/40 MVA units (and the 33 kV circuits to both sites) could be used to add capacity to the area.

Option 4 – Procure flexibility under Corby 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 33 kV cables to, and the transformers at Corby primary. Flexibility is unlikely to be economical in deferring the uprating of the cables at Corby primary (due to the low cost associated with this), but could potentially be used to defer further reinforcement. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Uprating the 33 kV cables to the transformers at Corby primary would be a low cost option for adding capacity to the site and alleviating this constraint, allowing the full capacity of the 20/40 MVA transformers to be utilised (making it the clear optimal reinforcement solution in the first instance).

Beyond this reinforcement, more costly intervention will be required to add the capacity needed to support the high demand growth in the area in the longer term. The best way to achieve this would be dependent on where within Corby demand growth materialises, as well as any constraints or challenges in adding or transferring load at 11 kV. Options discussed above include a second primary at Corby BSP itself and uprating Corby Central and/or Earlstrees primaries. Constraints at the various primaries within Corby itself should be considered in conjunction, to ensure the most strategic method of adding capacity to the area is progressed.

2.3 Hazelwood 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
Hazelwood primary transformer overloads	Arranged or fault outage on either transformer at Hazelwood primary	None	2034	2034	2034	-

Uncertainty under other Distribution Future Energy Scenarios: Demand growth at Hazelwood primary is similar under Leading the Way as under Best View, and slightly lower under Consumer Transformation. Overloads are not projected to occur by 2034 for the lower growth scenarios (System Transformation and Falling Short) but there is still a clear need case for investment in the area in the longer term.

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 Hazelwood primary.
2	Install a third transformer at Hazelwood primary.
Flexibility Services	
3	Procure flexibility under Hazelwood 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 Hazelwood primary

Viable

Capacity released for constraint(s) considered: 3 MVA

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

Detailed description: Uprating both primary transformers at Hazelwood to 20/40 MVA units would alleviate this constraint and add capacity. The replacement of these transformers would also confer an asset condition benefit, with the existing units being over 55 years old. The two 33 kV circuits to Hazelwood primary are both already rated high enough to support the full rating of 20/40 MVA units, so minimal 33 kV circuit works would be required to free up this capacity.

The capacity released by this reinforcement is insufficient to support Hazelwood in the longer term, so at some point a new primary may need to be established in the area (or demand transferred to other existing primaries). Various options for adding primary capacity to Corby are highlighted in Section 2.2 of this report.

Option 2 – Install a third transformer at Hazelwood primary

Discounted

Capacity released for constraint(s) considered: Up to 35 MVA

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

Detailed description: Installing a third transformer at Hazelwood would add capacity to the site and help alleviate this constraint, but is not a viable reinforcement strategy for a number of reasons:

- As noted in option 1, the existing transformers at Hazelwood are over 55 years old and likely to need replacing based on their condition in the near future regardless.
- A third transformer would require a third 33 kV circuit from Corby BSP. This would require a significant length of 33 kV circuit works, and would create a loose couple across the two halves of Corby BSP (as the new transformer would need to be supplied from a different busbar to the existing two).
- A three transformer primary site would present additional network operability issues (such as needing to split the 11 kV network for an arranged outage on any transformer/circuit).

Option 3 – Procure flexibility under Hazelwood 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 primary transformers at Hazelwood. Utilising flexibility would not provide any benefit for the condition of the primary transformers at Hazelwood (but could potentially be used to defer further reinforcement in the area). The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Uprating the transformers at Hazelwood primary to 20/40 MVA units would add capacity to the site, resolving this constraint in the short to medium term. It would also confer an asset condition benefit. In the longer term, additional capacity will likely be required in Corby, which could be achieved either by creating a new primary site, or by reinforcing existing sites. This is discussed in Section 2.2 of this report, where it is noted that the primaries within Corby, including Hazelwood, will need to be consider together to identify a reinforcement strategy which accommodates the high demand growth forecast for the area.

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