Grendon GSP

Network Development Report – East Midlands

May 2024

Electricity Distribution

nationalgrid

Contents

Grendon 132 kV

1. Network Overview

Grendon Grid Supply Point (GSP) supplies 11 Bulk Supply Points (BSPs) in National Grid Electricity Distribution's (NGED's) East Midlands licence area around Northampton, Corby and as far north as Melton Mowbray. These 11 BSPs are: Northampton, Northampton West, Northampton East, Wellingborough, Irthlingborough, Kettering, Corby, Kibworth, Corby North, Oakham and Melton.

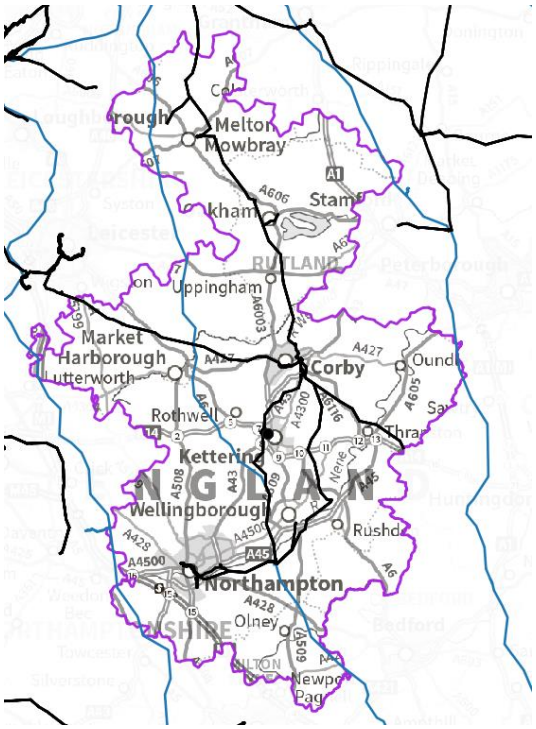

Figure 1.1 Grendon GSP geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon identified on the 132 kV network fed from Grendon GSP (excluding the 132 kV circuits to Northampton, Northampton East and Northampton West BSPs which are covered in the Northampton Group report). 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

The three Northampton BSPs form the Northampton group, which is fed directly from Grendon GSP via three 132 kV circuits (a dual circuit to Northampton BSP and a single circuit to Northampton East BSP). Northampton West BSP is fed via two 132 kV circuits from Northampton BSP. Northampton East BSP is fed via the DL route from Grendon GSP and the DR route from Northampton BSP.

Wellingborough BSP is fed directly from Grendon GSP via a dual 132 kV circuit (the DA route). Corby BSP is fed from Grendon GSP via four 132 kV circuits composed of two dual circuits. Kettering BSP is teed off the first of these dual circuits (the DJ and CG routes) and Irthlingborough BSP is teed off the other dual circuit (the CU and HF routes).

Kibworth and Corby North BSPs are both fed via dual circuits from Corby BSP (the AZ route and the CM route respectively). Corby North is a dedicated BSP for Corby Power Station. Melton Mowbray BSP is fed via a dual 132 kV circuit from Corby North BSP. Oakham BSP is fed via the HNA route which is teed off the HN route to Melton Mowbray BSP.

Grendon GSP also feeds a section of UK Power Networks' (UKPN's) network via the PX route. Huntingdon (a BSP on UKPN's network) can also be switched to be fed from Grendon GSP via a dual 132 kV circuit connected to Corby BSP (the PFZ route). Grendon is also interconnected with Staythorpe and Enderby GSPs. The interconnection to Enderby GSP is via the AZ route from Kibworth BSP to Wigston BSP, which has a normal open point (NOP) at the Kibworth end of the dual circuit. The interconnection to Staythorpe GSP is via the TZ route from Melton Mowbray BSP which leads to Staythorpe GSP (with tees to Asfordby BSP and Hawton BSP).

Grendon GSP itself has five Super Grid Transformers (SGTs). Four of these SGTs are connected to each of the four 132 kV busbars under normal running arrangements, with the fifth set-up as a swing SGT, which can be switched on to either side of Grendon GSP. The two main busbars are separated by a circuit breaker, whereas the two reserve busbars are separated by two isolators. There are also circuit breakers connecting reserve 1 to main 1 and reserve 2 to main 2.

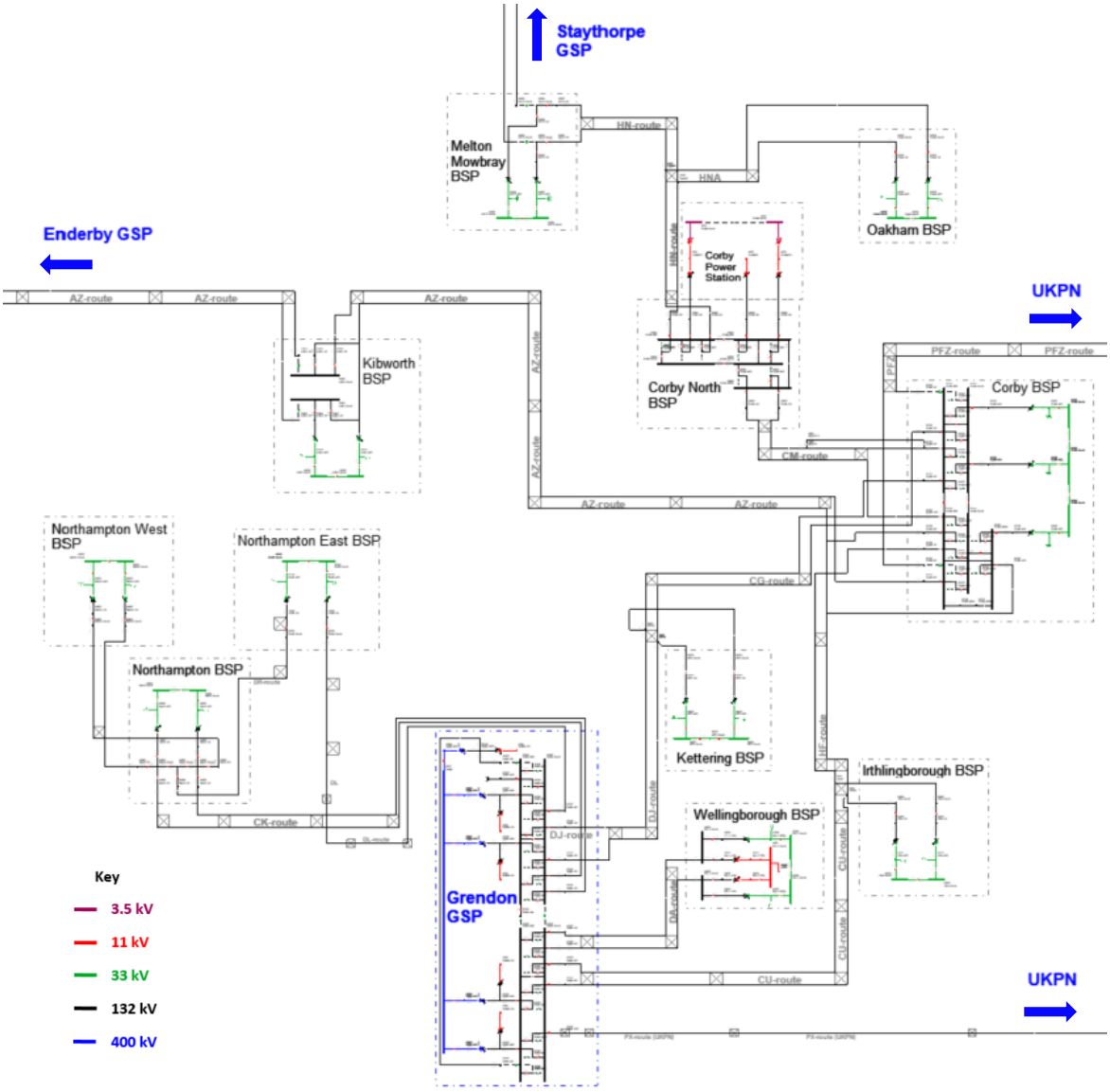

Figure 1.1.1 Grendon 132 kV network single line diagram

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 busbars or bus section breakers at Grendon GSP, Corby BSP and Corby North BSP are modelled such that circuits are secured onto in service busbars.
- Various primaries are switched out of the Northampton group for an outage on the DL route to Northampton East BSP (Earls Barton and Denton into Wellingborough BSP, Chapel Brampton T1 into Kettering BSP and Roade into Stony Stratford BSP).
- The Northampton group is split between Northampton East BSP and Northampton BSP for an outage on one of the CK route circuits to Northampton BSP (split at Brackmills 11 kV and on the 132 kV circuit between the BSPs).
- For an outage on one of the four 132 kV circuits from Grendon GSP to Corby BSP, or on one of the 132 kV circuits from Corby BSP to Corby North BSP, Oakham, Melton and Corby Power Station's gas turbine 2 are transferred to Staythorpe GSP. For an outage on one of the circuits to Oakham and Melton Mowbray BSPs, only these two BSPs are transferred into Staythorpe.
- For an arranged outage on any of SGTs 1-4 at Grendon GSP, SGT5 is switched in to replace it and maintain the 2+2 running arrangement.
- For arranged outages on circuit breaker 130 or 230 at Grendon GSP, all of the circuits and SGTs on the affected side of Grendon GSP are moved to the main 1 or main 2 busbar.
- For an arranged outage which takes out the main 1 or main 2 busbar at Grendon GSP and an SGT, Kibworth, Melton Mowbray and Oakham are transferred out of Grendon (and the associated loose couples broken at Desborough and Chapel Brampton primaries).
- Huntingdon BSP is switched into Grendon GSP for an arranged outage at Eaton Socon GSP (or either 132 kV infeed to Huntingdon).
- An autoclose scheme is set up to parallel the three remaining SGTs at Grendon GSP if any of the SGTs fault during an arranged outage on another SGT. This does not operate if Corby Power Station is exporting, due to fault levels.
- An autoclose scheme is set up to close in SGT5 for an N-1 fault on any of the other SGTs at Grendon GSP.
- An autoclose scheme is set up to parallel the two main busbars at Grendon GSP for a fault on one of the reserve busbars.
- For an outage on one of the 132 kV circuits feeding Kibworth BSP (the AZ route), Kibworth is transferred into Enderby GSP.
- For the loss of an infeed to a transformer at any of the BSPs fed from Grendon GSP under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.
- Loose couples are broken on the 33 kV network for arranged outages on the infeeds to some of the BSPs fed from Grendon GSP (see relevant 33 kV network report for more details).
- The 33 kV and 11 kV networks downstream of the BSPs fed from Grendon GSP are split for arranged outages on the 33 kV bus section couplers (or in the case of some BSPs outages on the centre busbar) (see relevant 33 kV network reports for more details).

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:

- The four 132 kV circuits between Grendon GSP and Corby BSP are constrained for both demand and generation. The most onerous constraints are for N-2 outages on two of the four circuits, but overloads are also projected for N-1 outages and under normal network running arrangements.
- For an arranged or fault outage on either 132 kV circuit between Corby BSP and Corby North BSP, the remaining circuit could overload at summer peak generation.
- For various arranged and fault outages, the SGTs at Grendon GSP are projected to overload for both demand and generation.
- The group demands for Irthlingborough and Kettering BSPs are both forecast to grow significantly between now and 2034. This will eventually necessitate reinforcement to ensure sufficient demand can be restored following N-2 outages to comply with Engineering Recommendation P2.
- Constraints identified on the 132 kV circuits to the Northampton group (as well as the GTs at the three BSPs and the downstream 33 kV network) are covered in the Northampton Group report.
- Constraints identified on the GTs at, or 33 kV networks supplied from each of the BSPs within the Grendon group are covered in the relevant 33 kV reports.

2.2 Grendon to Corby 132 kV 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			
Demand			**Winter**	**Int Cool**	**Int Warm**	**Summer**
Grendon to the Irthlingborough tee 132 kV circuit overloads	Arranged outage on either Grendon – Kettering – Corby 132 kV circuit	Fault on either Grendon – Irthlingborough – Corby 132 kV circuit	2028	2028	2034	2034
Grendon to the Irthlingborough tee 132 kV circuit overloads	Arranged or fault outage on either circuit	None	2034	2034	-	-
Irthlingborough tee to Corby 132 kV circuit overloads	Arranged outage on either Grendon – Irthlingborough – Corby 132 kV circuit	Fault on either Grendon – Kettering – Corby 132 kV circuit	2034	2034	2034	2034
Irthlingborough tee to Corby 132 kV circuit overloads	Arranged or fault outage on either circuit	None	2034	2034	2034	-
Kettering tee to Corby 132 kV circuit overloads	Arranged outage on either Grendon – Irthlingborough – Corby 132 kV circuit	Fault on either Grendon – Irthlingborough – Corby 132 kV circuit	2028	2028	2028	2028
Kettering tee to Corby 132 kV circuit overloads	Arranged or fault outage on either Grendon – Irthlingborough – Corby 132 kV circuit	None	2034	2034	-	-
Generation			**Summer**			
Grendon to the Irthlingborough tee 132 kV circuit overloads	Arranged or fault outage on either circuit	None	2028			
Grendon to the Kettering tee 132 kV circuit overloads	Arranged outage on either Grendon – Irthlingborough – Corby 132 kV circuit	Fault on either Grendon – Kettering – Corby 132 kV circuit	Baseline			
Grendon to the Kettering tee 132 kV circuit overloads	Arranged or fault outage on either circuit	None	2034			
Irthlingborough tee to Corby 132 kV circuit overloads	Arranged outage on either Grendon – Irthlingborough – Corby 132 kV circuit	Fault on either Grendon – Kettering – Corby 132 kV circuit	Baseline			
Irthlingborough tee to Corby 132 kV circuit overloads	Arranged or fault outage on either circuit	None	2028			
Kettering tee to Corby 132 kV circuit overloads	None	None	Baseline			

Uncertainty under other Distribution Future Energy Scenarios: As this constraint is present in the baseline, it requires mitigation regardless of scenario. Under the higher growth scenarios (Leading the Way and Consumer Transformation) overloads are seen in 2028 and 2034 for additional seasons and outage conditions compared to Best View.

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 existing 132 kV circuits.
2	Build new 132 kV circuits.
3	Establish a new GSP.
Operational Mitigation	
4	Alternative running arrangements.
5	Active Network Management.
Flexibility Services	
6	Procure flexibility on the network supplied by the Grendon to Corby circuits.

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 existing 132 kV circuits

Discounted

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

New limiting factor for constraint(s) considered: Grendon SGT capacity

Detailed description: Uprating the existing 132 kV circuits is not a viable reinforcement strategy to resolve this constraint for a number of reasons. This reinforcement would be prohibitively expensive. The total length of the four circuits is over 130 km, most (if not all) of which would require uprating to add the capacity required based on demand and generation growth projections. Sections of these circuits could also need to be completely rebuilt, as the existing towers could not accommodate larger conductors, raising the cost even further.

Uprating the existing circuits would still not free up much additional capacity, as growth would still be limited by the capacity of Grendon GSP itself (with the SGTs constrained for both demand and generation as described in Section 2.4 of this report). As a new GSP to deload Grendon would be needed even if the Grendon to Corby 132 kV circuits were uprated, these works would be largely wasted upon the establishment of a new GSP.

Option 2 – Build new 132 kV circuits

Discounted

Capacity released for constraint(s) considered: Minimal

New limiting factor for constraint(s) considered: Grendon SGT capacity

Detailed description: Building new 132 kV circuits from Grendon GSP to Corby BSP would be equally (if not more) expensive than uprating the existing circuits. As with option 1, this reinforcement would not be a good strategic choice. In addition to the disadvantages of uprating the existing circuits discussed above, new 132 kV circuits would be difficult (if not impossible) to accommodate at Grendon and Corby.

Option 3 – Establish a new GSP

Viable

Capacity released for constraint(s) considered: Demand and generation at Melton, Oakham and Kibworth BSPs (and potentially Corby BSP), and the surrounding 132 kV network

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

Detailed description: By establishing a new GSP to the north of Grendon, significant load could be transferred off the Grendon to Corby 132 kV circuits, resolving this constraint and providing the capacity required for the high demand and generation growth forecast for the area. The location of the new GSP is subject to further optioneering, considering the effects on both the distribution and transmission networks. A new GSP to the north of Grendon would help alleviate a number of other constraints as discussed in Section 2.3, Section 2.4 and Section 2.5 of this report.

Option 4 – Alternative running arrangements

Discounted

Capacity released for constraint(s) considered: None

New limiting factor for constraint(s) considered: Security of supply requirements

Detailed description: Splitting the network supplied via the Grendon – Corby 132 kV circuits is not a viable mitigation strategy, as doing so would reduce security of supply and lead to non-compliance with Engineering Recommendation P2. This is due to the fact that the BSP group has a group load of over 300 MW, falling into class of supply E. Constraints are also projected for N-1 outages and normal running arrangements, which could not be mitigated in this way regardless.

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: Active Network Management (ANM) is currently being utilised to manage this constraint. ANM, while essential to managing the network in the short term, will not be sufficient alone to manage the network in the longer term (necessitating further intervention).

Option 6 – Procure flexibility on the network supplied by the Grendon to Corby circuits

Viable

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

Detailed description: Flexibility services are being procured to manage the demand constraint on the Grendon – Corby 132 kV circuits (see the latest DNOA report for more details). This is not an enduring solution, due to the fact that generation constraints are also present and there are numerous other investment drivers for establishing a new GSP to the north of Grendon.

Solution Recommendation

The establishment of a new GSP to the north of Grendon is the only viable reinforcement strategy to manage this constraint in the long term. This will allow significant demand and generation to be taken off the Grendon – Corby 132 kV circuits. In the interim, the use of ANM and/or flexibility services could be used to manage this constraint until reinforcement can be carried out.

2.3 Corby to Corby North 132 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 studied year constraint is observed under Best View
			Summer (generation)
Corby to Corby North 132 kV circuit overloads	Arranged or fault outage on either circuit	None	Baseline

Uncertainty under other Distribution Future Energy Scenarios: As this constraint is present in the baseline, it requires mitigation regardless of scenario.

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 Corby to Corby North 132 kV circuits.
2	Establish a new GSP.
Operational Mitigation	
3	Active Network Management.
Flexibility Services	
4	Procure flexibility on the network supplied by the Corby – Corby North circuits.

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 the Corby to Corby North 132 kV circuits

Viable

Capacity released for constraint(s) considered: Dependent on new conductor size

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

Detailed description: Uprating the 132 kV circuits between Corby BSP and Corby North BSP (which are just under 3 km in length) would alleviate this constraint. This could be achieved by reconductoring the overhead line (subject to a detailed assessment to ensure the existing towers can accommodate this).

Option 2 – Establish a new GSP

Viable

Capacity released for constraint(s) considered: Dependent on new running arrangement

New limiting factor for constraint(s) considered: Total 132 kV circuit capacity

Detailed description: A new GSP could be built to the north of Grendon (which would alleviate a number of constraints as discussed in other sections of this report). New 132 kV circuits would be required to stitch this new GSP fully into the existing network. If a new dual 132 kV circuit were built from the new GSP to Corby North BSP, this could be used to deload the Corby to Corby North 132 kV circuits. Whether this would alleviate this constraint is dependent on the new running arrangement with the new GSP (further study work is required, including a full fault level assessment, to determine the optimal running arrangement).

Option 3 – 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 generation connections on the network supplied via the Corby to Corby North 132 kV circuits could be included in an Active Network Management (ANM) scheme. ANM schemes are used to manage constraints on over-committed networks.

Option 4 – Procure flexibility on the network supplied by the Corby – Corby North circuits

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

Uprating the 132 kV circuits between Corby BSP and Corby North BSP would alleviate this constraint, and could be carried out at a relatively low cost as the circuits are under 3 km in length. Until reinforcement is carried out ANM will be used as required to manage this constraint. In the longer term the establishment of a new GSP could deload these circuits, depending on the new running arrangement (including how Corby and Corby North are run and where the network between the two GSPs is split).

2.4 Grendon GSP SGT 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 studied year constraint is observed in each season under Best View			
Demand			**Winter**	**Int Cool**	**Int Warm**	**Summer**
Grendon SGT2/3/5 overload	Arranged outage on SGT2, SGT3 or SGT5	Fault on SGT2, SGT3 or SGT5	Baseline	Baseline	Baseline	2028
Grendon SGT1/4 overload	Arranged outage on SGT1, SGT4 or SGT5	Fault on SGT1, SGT4 or SGT5	2028	2028	2028	2034
Grendon SGT1/2/3/4 overload	Fault on any 132 kV busbar	None	2028	2028	2028	2034
Grendon SGT2/3 overload	None	None	2034	2034	2034	-
Grendon SGT1/4 overload	None	None	2034	2034	-	-
Generation			**Summer**			
Grendon SGT1/4/5 reverse power flow overload	Arranged outage on SGT1, SGT4 or SGT5	Fault on SGT1, SGT4 or SGT5	Baseline			
Grendon SGT1/4 reverse power flow overload	Fault on either 132 kV reserve busbar	None	2028			
Grendon SGT2 and SGT3 reverse power flow overload	Arranged outage on a Grendon – Irthlingborough 132 kV circuit	Fault on the remaining Grendon – Irthlingborough 132 kV circuit	2028			

Uncertainty under other Distribution Future Energy Scenarios: As this constraint is present in the baseline it requires mitigation regardless of scenario. Demand and generation growth for Grendon is high under every scenario.

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	Install additional 240 MVA SGTs.
2	Establish a new GSP.
Operational Mitigation	
3	Utilise the short term ratings of the SGTs at Grendon GSP.
4	Transfer load away from Staythorpe GSP.
5	Active Network Management.
Flexibility Services	
6	Procure flexibility under Grendon GSP.

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.

A number 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 – Install additional 240 MVA SGTs

Discounted

Capacity released for constraint(s) considered: Minimal

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

Detailed description: Installing a sixth SGT at Grendon GSP would not add significant capacity due to the configuration of the site at 132 kV and 400 kV. Even if the full rating of a new SGT could be utilised at Grendon, further reinforcement of the existing GSP would not be a strategic strategy (as it would not resolve any constraints on the 132 kV network or add capacity near the centre of load growth). A single new SGT would also be insufficient to manage the demand and generation growth projected for Grendon.

In addition to the limitations listed above, a new SGT may not even be achievable at the existing Grendon site. This option has therefore been discounted.

Option 2 – Establish a new GSP

Viable

Capacity released for constraint(s) considered: Demand and generation at Melton, Oakham and Kibworth BSPs (and potentially Corby BSP) and the surrounding 132 kV network

New limiting factor for constraint(s) considered: Total capacity of the two GSPs

Detailed description: By establishing a new GSP in the area, significant load could be transferred away from Grendon GSP, resolving this constraint and providing the capacity required for the high demand and generation growth forecast for the area. A new GSP to the north of Grendon would be closer to much of the existing and projected future load. The location of the new GSP is subject to further optioneering, considering the effects on both the distribution and transmission networks. A new GSP to the north of Grendon would help alleviate a number of other constraints as discussed in Section 2.2, Section 2.3 and Section 2.5 of this report.

Option 3 – Utilise the short term ratings of the SGTs at Grendon GSP

Viable

Capacity released for constraint(s) considered: Dependent on short term ratings

New limiting factor for constraint(s) considered: Short term SGT ratings

Detailed description: The SGTs at Grendon GSP are equipped with short-term ratings which allow them to run above their nameplate rating for a short period of time. This allows the control engineers to reconfigure the network (which could include transferring load away on the 132 kV network to other GSPs) before the equipment can be damaged. This may help to mitigate this constraint, but is not a long term solution due to the high demand and generation growth forecast for Grendon.

Option 4 – Transfer load away from Grendon GSP

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

Discounted

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

Detailed description: Grendon GSP is interconnected with Enderby, Staythorpe and Eaton Socon GSPs at 132 kV. No transfers out of Grendon are possible on the existing network under normal running arrangements due to network complexity and thermal limitations on all of the interconnecting circuits, as well as insufficient capacity at the three other GSPs to accept additional load.

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: Active Network Management (ANM) schemes are used to manage constraints on over-committed networks such as Grendon GSP. ANM is utilised to manage the constraints on the SGTs at Grendon. The use of ANM is not a permanent solution for this constraint but will be used as required to manage the network in the short term.

Option 6 – Procure flexibility under Grendon GSP

Viable

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

Detailed description: Flexibility services could be used to help manage the demand constraints on the SGTs at Grendon GSP. Managing the 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. Due to the multiple investment drivers for a new GSP, and the high level of load growth projected, deferral using flexibility services would not be possible, but flexibility could potentially be beneficial to help manage the network in the short term while reinforcement is progressed.

Solution Recommendation

Building a new GSP would allow significant demand and generation to be transferred from Grendon GSP, resolving this constraint. A new GSP to the north of Grendon would also allow constraints on a number of 132 kV circuits to be alleviated as outlined in Section 2.2 and Section 2.3 of this report. The location of the new GSP is subject to further optioneering, considering the effects on both the distribution and transmission networks. This reinforcement would create the capacity required to accommodate load growth in the area on an enduring basis, creating significant option value and effectively allowing the Grendon group to be split in half.

2.5 Irthlingborough BSP and Kettering BSP N-2

Constraint Overview

Generation **Demand**

The table below shows the projected growth in group load between now and 2034 under the Best View scenario for Irthlingborough BSP and Kettering BSP. These are two separate groups but are being discussed together due to the similarities in the mitigation options.

Table 2.5.1 N-2 condition and group load forecasts

Constraint	N-1 Condition	Subsequent N-2 Condition	Group load			
			Baseline	2025	2028	2034
N-2 restoration requirements	Arranged outage on either 132 kV circuit to Irthlingborough BSP	Fault on the remaining 132 kV circuit to Irthlingborough BSP	57 MW	106 MW	116 MW	131 MW
N-2 restoration requirements	Arranged outage on either 132 kV circuit to Kettering BSP	Fault on the remaining 132 kV circuit to Kettering BSP	76 MW	89 MW	106 MW	129 MW

Uncertainty under other Distribution Future Energy Scenarios: The group load for both BSPs is set to grow faster for the higher growth scenarios (Leading the Way and Consumer Transformation) and slower under the lower growth scenarios (System Transformation and Falling Short). The group loads for both BSPs exceed 100 MW by 2034 under every scenario, but the N-2 restoration requirements vary in magnitude.

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	Loop Irthlingborough and Kettering BSPs into their respective 132 kV circuits.
Operational Mitigation	
2	Utilise the 33 kV interconnection to Irthlingborough and Kettering BSPs.
Flexibility Services	
3	Procure flexibility under Irthlingborough and Kettering BSPs.

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 – Loop Irthlingborough and Kettering BSPs into their respective 132 kV circuits

Viable

Capacity released for constraint(s) considered: Up to 128 MVA per BSP (assuming no utilisation of interconnection at 33 kV)

New limiting factor for constraint(s) considered: GT ratings at each site

Detailed description: If Irthlingborough and Kettering BSPs were looped into their respective 132 kV circuits, it would create four infeeds to each site, allowing the sites to be fully restored for N-2 outages on the circuits from Grendon GSP. This would be significantly easier to achieve at Irthlingborough BSP, as the site is only around 50 m from the tee point (whereas Kettering BSP is around 1.4 km from its tee point). As outlined in the Wellingborough and Irthlingborough 33 kV and Kettering and Kibworth 33 kV reports, there are plans to install a third GT at both sites. Increasing the N-2 restoration capacity of both sites will allow the full capacity created by a third GT to be utilised at Irthlingborough and Kettering.

A new GSP located to the north of Grendon could allow the BSPs to be restored using the circuits to Corby BSP. New BSPs supplied from the new GSP could even be considered if load continues to grow at a high rate, to add even more capacity to the area.

Option 2 – Utilise the 33 kV interconnection to Irthlingborough and Kettering BSPs

Viable

Capacity released for constraint(s) considered: Demand of various primaries

New limiting factor for constraint(s) considered: 33 kV interconnection to various BSPs

Detailed description: Irthlingborough and Kettering BSPs are both interconnected at 33 kV with each other and with other BSPs (in the case of Irthlingborough with Corby and Wellingborough and in the case of Kettering with Corby, Kibworth and Northampton East). This 33 kV interconnection could be used to support either site for the loss of both 132 kV infeeds. Further analysis is required to get a more accurate view of how much demand could be restored via this interconnection for each site (and therefore how much group load can be accommodated while remaining compliant with Engineering Recommendation P2).

Option 3 – Procure flexibility under Irthlingborough and Kettering BSPs

Viable

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

Detailed description: Flexibility procurement is not suitable to manage this constraint directly as it is a security of supply requirement and flexibility cannot be used to reduce the class of supply of a group. Flexibility could however potentially be utilised to facilitate 33 kV transfers required to maintain security of supply. The viability of utilising flexibility will be assessed as part of the DNOA process.

Solution Recommendation

The N-2 restoration requirements of both Irthlingborough and Kettering BSPs can be met in the short to medium term using the 33 kV interconnection with other nearby BSPs as outlined above. In the longer term, each site could be looped into the 132 kV circuits between Grendon GSP and Corby BSP, creating four 132 kV infeeds to each site, a large increase in security of supply and ample N-2 restoration capacity (allowing the full capacity of three GTs to be utilised at each site). This reinforcement would be supported by a new GSP to the north of Grendon to facilitate restoration once the two sites are looped in. Reinforcement at the two sites would not need to be carried out at the same time; it would be triggered based on demand growth at each BSP (and the capability of the 33 kV interconnection).

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