Kettering and Kibworth BSPs

Network Development Report – East Midlands

May 2024

Electricity Distribution

nationalgrid

Contents

Kettering and Kibworth 33 kV

1. Network Overview

Kettering and Kibworth are two Bulk Supply Points (BSPs) fed from Grendon Grid Supply Point (GSP) in National Grid Electricity Distribution's (NGED's) East Midlands licence area. Both BSPs have two 132/33 kV Grid Transformers (GTs) rated to 60/90/117 MVA.

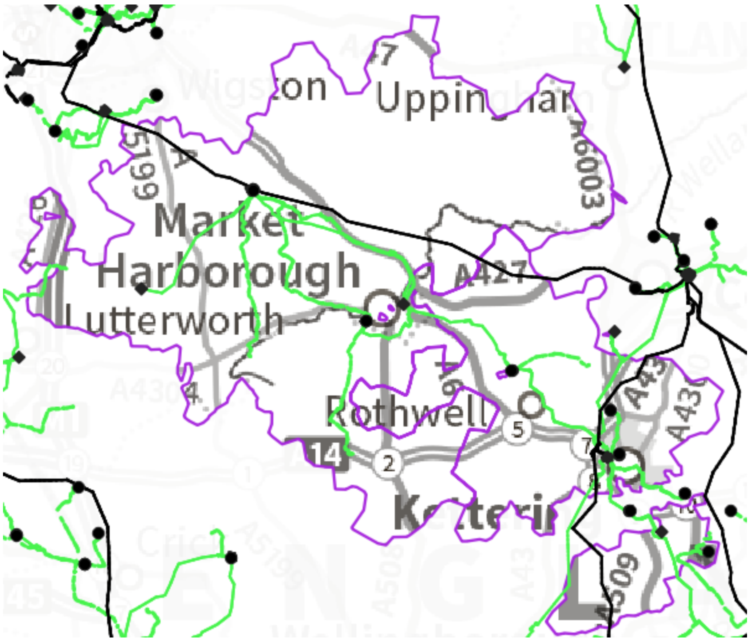

Figure 1.1 Kettering and Kibworth geographic network coverage

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

Kettering BSP feeds eight primary substations: Kettering North, Field Street, Oakley, Desborough, Hayfield, Burton Latimar T1, Pytchley Road T2 and Chapel Brampton T2. Kettering BSP is interconnected at 33 kV with Kibworth, Corby, Northampton East, Northampton West and Irthlingborough BSPs. The interconnection with Kibworth is via a 33 kV circuit between Farndon Road and Desborough primaries (which is normally run open). The interconnection with Irthlingborough is via Burton Latimar and Pytchley Road primaries (both of which straddle the two BSPs, with one transformer fed from each BSP at each primary). Two 33 kV circuits directly between Kettering and Corby interconnect the two BSPs (which are both normally run open). A 33 kV circuit to Chapel Brampton primary (which has a tee off to Northampton East BSP) interconnects Kettering with the Northampton Group.

Kibworth BSP feeds four primary substations: Kibworth, Bruntingthorpe, Market Harborough and Farndon Road. Kibworth primary is located at the same site as Kibworth BSP. Kibworth BSP is interconnected at 33 kV with Kettering and Corby BSPs via Desborough primary.

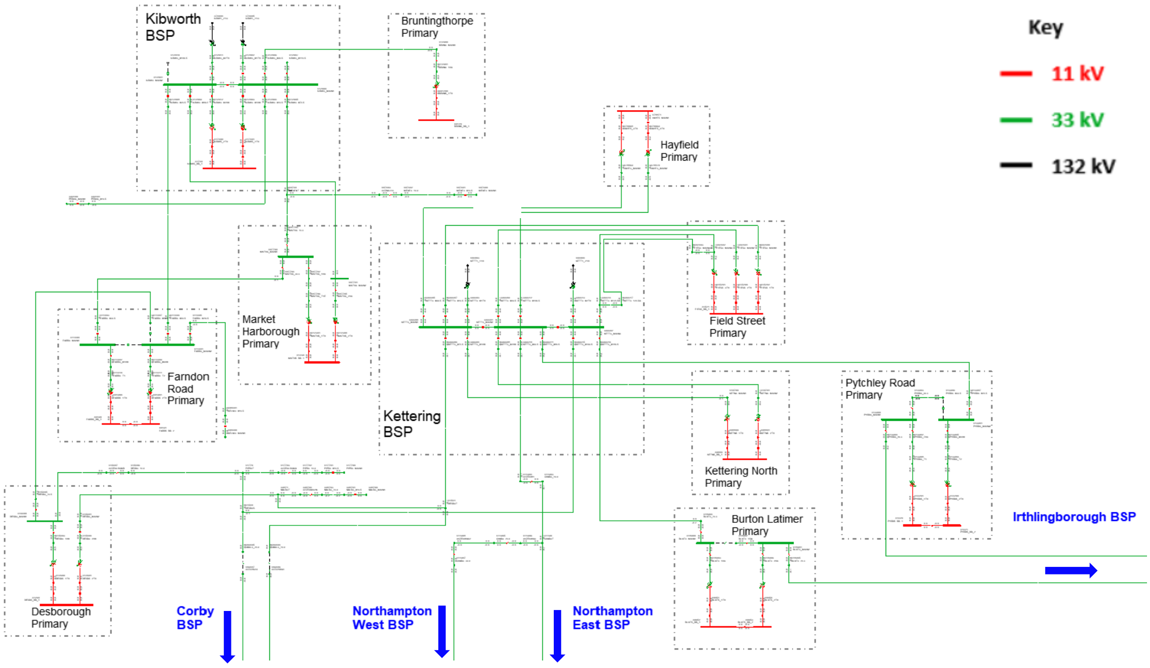

Figure 1.1.1 Kettering and Kibworth 33 kV network single line diagram

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.

- The Kettering and Kibworth 33 kV networks are both split for an arranged outage on their 33 kV bus section breakers to prevent loose couples (in the case of Kettering splits are required for outages on either of the two 33 kV bus section breakers). For Kettering BSP this involves splitting Kettering North, Desborough, Hayfield and Field Street primaries, and Burton Latimar/Pytchley Road primaries (which loose couple with Irthlingborough) at 11 kV. For Kibworth BSP this involves splitting Kibworth, Market Harborough and Farndon Road primaries (which are all fed via both bars) at 11 kV.
- For an outage on the 33 kV infeed to or the primary transformer at Bruntingthorpe, the load is backfed via Kibworth, Lutterworth and Whetstone primaries.
- For the loss of an infeed to a transformer at any of the primaries fed from Kettering and Kibworth BSPs 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:

- For various N-1 and N-2 outages at Field Street primary, overloads are observed on all three transformers and 33 kV infeeds (with N-1 overloads being seen in 2028).
- Both primary transformers at, and both 33 kV circuits to Market Harborough are forecast to be overloaded by 2028 for arranged or fault outages on the other transformer or infeed.
- Demand at Bruntingthorpe primary is currently over the nameplate rating of its 33/11 kV transformer. Constraints have also been identified on the downstream 11 kV network.
- Overloads are observed by 2028 on the GTs at Kettering BSP for N-1 (outage on the other infeed) and N-2 (arranged outage at Irthlingborough BSP followed by a fault on one of the GTs at Kettering) outage conditions.

2.2 Field Street 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
Field Street T1/T2 overloads	Arranged or fault outage on any other transformer or infeed	None	2034	2028	2028	2034
Field Street T1/T2 overloads	Arranged outage on any infeed	Fault on a second infeed	Baseline	Baseline	Baseline	Baseline
Field Street T3 overloads	Arranged or fault outage on any other transformer or infeed	None	2028	2028	2028	2034
Field Street T3 overloads	Arranged outage on any infeed	Fault on a second infeed	Baseline	Baseline	Baseline	Baseline
Kettering to Field Street T1 or T2 33 kV circuit overloads	Arranged or fault outage on any other transformer or infeed	None	2034	2034	2034	2034
Kettering to Field Street T1 or T2 33 kV circuit overloads	Arranged outage on any infeed	Fault on a second infeed	Baseline	Baseline	Baseline	2028
Kettering to Field Street T3 33 kV circuit overloads	Arranged or fault outage on any other transformer or infeed	None	2034	2034	2034	2034
Kettering to Field Street T3 33 kV circuit overloads	Arranged outage on any infeed	Fault on a second infeed	2028	Baseline	2028	2028

Uncertainty under other Distribution Future Energy Scenarios: N-2 constraints seen in the baseline are present across all scenarios. By 2028 and 2034, growth under Leading the Way is similar to under Best View (and triggers overloads for the same seasons and outage combinations). Significantly higher growth is forecast under Consumer Transformation (triggering overloads for more outage combinations and seasons in 2028). Even under the lower growth scenarios (System Transformation and Falling Short) N-1 overloads are seen 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 transformers and circuits to Field Street primary.
2	Establish a new 132/11 kV BSP.
3	Build a new primary substation at Kettering BSP.
Operational Mitigation	
4	Alternative running arrangements.
Flexibility Services	
5	Procure flexibility under Field 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 Distribution Network Options Assessment (DNOA) process.

Option 1 – Uprate the transformers at Field Street primary

Viable

Capacity released for constraint(s) considered: Up to 28 MVA

New limiting factor for constraint(s) considered: 33 kV circuits to T1 and T2

Detailed description: In order to resolve this constraint and free up significant capacity at Field Street primary, all three transformer would need uprating. The new transformers would be rated to 20/40 MVA (the highest rated units used by NGED on the network). The existing T1 and T2 transformers are both almost 60 years old, so this replacement would also benefit their condition.

Uprating the 33 kV circuits to T1 and T2 at Field Street would free up under 2 MVA of additional capacity per circuit (allowing the full rating of the new 20/40 MVA transformers to be utilised). While the circuits to Field Street are only around 1 km in length, this uprating may not be economical due to the low amount of capacity released.

In order for Field Street primary to be split effectively and evenly at 11 kV during arranged outages (which will be necessary to free up the capacity created), the 11 kV switchgear will need to be rebuilt and reconfigured. A disadvantage of this option is that, as a three transformer primary, Field Street is harder to manage operationally compared to a two transformer primary. Converting Field Street into a two transformer site would however reduce the capacity of the site such that it would not be able to accommodate the projected demand growth, even in the very short term, and has consequently been discounted. The operational disadvantages of retaining three transformers at Field Street can be largely mitigated with an effective 11 kV configuration.

While this solution will free up significant capacity, the high demand growth forecast at Field Street will likely necessitate further intervention. By 2034, N-1 circuit constraints are observed, which will not be resolved by this reinforcement. Further upgrades to Field Street itself beyond this point may not be practical or economical.

Option 2 – Establish a new 132/11 kV BSP

Discounted

Capacity released for constraint(s) considered: 78 MVA or 30 MVA (depending on whether the existing Field Street primary is retained

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

Detailed description: Due to the very high demand growth forecast at Field Street primary (and its close proximity to Kettering BSP) one option considered was installing 132/11 kV GTs. This option has been discounted as there is not sufficient space at either Kettering BSP or Field Street primary. No viable sites for a new BSP have been identified nearby, and creating a new site would not be economical in comparison with options 1 or 3. Additionally, although the installation of 132/11 kV GTs would allow load to be transferred off the existing 132/33 kV GTs and help alleviate the constraint discussed in Section 2.5 of this report, it would not provide the 33 kV capacity required to support growth at the primaries outside Kettering itself.

Option 3 – Build a new primary substation at Kettering BSP

Viable

Capacity released for constraint(s) considered: 38 MVA

New limiting factor for constraint(s) considered: Combined capacity of the two primaries

Detailed description: If a new primary substation were established at Kettering BSP, demand could be transferred off Field Street primary to help alleviate this constraint. Transferring demand to the new primary would likely be inexpensive as both sites are located within a km of each other in Kettering itself.

Although this solution may not be required in the short term if reinforcement of Field Street primary itself is progressed (as proposed in option 1), this option may be required to support longer term growth in the area. This option could, in theory, be progressed before the reinforcement of Field Street, but this would require building new 11 kV network immediately out of Kettering BSP (and due to the age of T1 and T2 at Field Street their replacement may be triggered in the near future based on their condition regardless).

The primary at Kettering would require minimal 33 kV circuit works (being located at the BSP itself). In the first instance two 20/40 MVA transformers could be installed, with the potential to add a third to accommodate growth even further into the future.

Option 4 – Alternative running arrangements

Viable

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

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

Detailed description: In the short term this constraint could be managed by splitting Field Street at 11 kV during arranged outages on any of its 33 kV infeeds or primary transformers. Even assuming the demand can be split perfectly at 11 kV, this option is only viable in the short term as it would not help alleviate the constraints seen for N-1 outages by 2028.

Even if used in conjunction with other operational mitigations (such as reviewing seasonal ratings and restricting outage seasons), Field Street will not be manageable operationally by 2028 as constraints during N-1 fault outages are seen across multiple seasons.

Option 5 – Procure flexibility under Field 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 transformers at Field Street primary. This could be used in conjunction with the operational mitigation discussed in option 4. Flexibility will not however benefit the condition of the transformers at the primary. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Upgrading all three primary transformers at Field Street has been identified as the optimal reinforcement strategy in the first instance. Operational mitigation options have been discussed, but will not be sufficient to defer reinforcement for long. An option identified for adding further capacity to the area is installing new primary transformers at Kettering BSP.

2.3 Market Harborough 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 2.3.1 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
Market Harborough primary transformer overloads	Arranged or fault outage on the other transformer or infeed	None	2028	2028	2028	2028
Wellingborough to Market Harborough 33 kV circuit overloads	Arranged or fault outage on the other transformer or infeed	None	2028	2028	2028	2028

Uncertainty under other Distribution Future Energy Scenarios: Similar demand growth is projected under all five scenarios, with intervention triggered before 2028 even under the lowest growth scenario (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 transformers and circuits to Market Harborough primary.
2	Install a third transformer and circuit to Market Harborough primary.
3	Build a new primary substation.
4	Build a new BSP.
Flexibility Services	
5	Procure flexibility under Market Harborough 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 both transformers and circuits to Market Harborough primary

Viable

Capacity released for constraint(s) considered: 16 MVA

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

Detailed description: Uprating both of the transformers at Market Harborough primary would help alleviate this constraint (the transformers would be uprated to 20/40 MVA units), but would not add sufficient capacity to accommodate the long term growth forecast at the site. As the existing transformers are over 60 years old, their replacement may also be triggered based on their condition.

In order to free up the full capacity of the new 20/40 MVA transformers, the 33 kV circuit to T2 would also need to be uprated (the circuit to T1 is already highly rated enough). The entire circuit would need to be replaced to not become a limiting factor (requiring around 13 km of circuit works). A second circuit could be built at the same time to allow Farndon Road to be unstitched from Market Harborough and facilitate future upgrades at that site (as discussed in option 3). Retaining the existing 33 kV circuit as well could be considered, but no strategic need has been identified at this stage for doing so.

Option 2 – Install a third transformer and circuit to Market Harborough primary

Discounted

Capacity released for constraint(s) considered: Minimal

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

Detailed description: Installing a third transformer and 33 kV circuit to Market Harborough primary would not free up significant capacity at the site. This is due to the fact that there are only two 33 kV busbars at Kibworth BSP, so two of the primary transformers would need to be supplied from a single busbar and would consequently both be lost for a fault on that busbar. This solution would also not benefit the condition of the existing transformers, and would introduce additional network complexity by creating a three transformer primary (such as having to split the 11 kV network for arranged outages).

Option 3 – Upgrade Farndon Road primary

Viable

Capacity released for constraint(s) considered: 15 MVA at Farndon Road primary

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

Detailed description: By 2034, overloads are observed on the 33 kV circuit to T1 at Market Harborough, which indicates that the proposed upgrades to the primary will not be sufficient alone to manage this constraint in the long term. Farndon Road primary is also located within Market Harborough itself (to the south-west as opposed to Market Harborough primary in the east). One option for further increasing capacity in the area is therefore to also uprate Farndon Road.

Uprating Farndon Road could be achieved by replacing both of its existing transformers with 20/40 MVA units. To free up this capacity, no upgrades will be required to the 33 kV circuit to T2, as it is already rated higher than the transformers would be. Upgrades would be required on the infeed to T1, but this could be achieved economically by installing two circuits when building a new circuit to Market Harborough primary. With only around 700 m of additional circuit works on the existing 33 kV circuit between the two primaries, the two sites could both have two dedicated infeeds and the circuit capacity to fully utilise their 20/40 MVA transformers. This would provide enough capacity to accommodate the demand growth projected until at least 2050.

Upgrading Farndon Road before Market Harborough is technically feasible but has been discounted as Market Harborough is expected to be constrained far sooner. The transformers at Market Harborough are also significantly older, so replacing those with 20/40 MVA units first is preferable from an asset condition perspective.

Option 4 – Build a new BSP

Discounted

Capacity released for constraint(s) considered: None

New limiting factor for constraint(s) considered: 132 kV network complexity

Detailed description: Due to the high demand growth forecast within Market Harborough, and the proximity of the two existing primaries to the existing 132 kV network (with the dual circuit between Corby BSP and Kibworth BSP passing within 3 km of the town to the north), one option considered was building a new BSP. This BSP could either be a 132/11 kV site designed to deload or replace the existing primaries, or a 132/33 kV site to reduce the circuit works required back to Kibworth BSP.

This option has been discounted for a number of reasons:

- Network complexity on the Corby – Kibworth 132 kV circuits would not permit the addition of extra addresses under Engineering Recommendation P18. This issue could however be resolved if a new GSP were built in the area to the north of Grendon. The new BSP could in that case be supplied directly from this GSP. The location of this GSP is subject to further optioneering and would likely not be built in time to help resolve this constraint regardless.
- Building a new BSP here would lead to significant underutilisation of Kibworth BSP (which based on current demand forecasts will have sufficient GT capacity up to at least 2050).
- Even with the 132 kV network being relatively close, the overall costs associated with this reinforcement would be significantly higher than the other options discussed.

Option 5 – Procure flexibility under Market Harborough 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 transformers at Market Harborough primary. Flexibility will not however benefit the condition of the transformers at the primary. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

The optimal reinforcement strategy identified to upgrade Market Harborough primary itself is to upgrade both of its transformers to 20/40 MVA and install a new 33 kV circuit to supply T1 (replacing the existing lower rated circuit). A second 33 kV circuit should also be installed at the same time to then feed Farndon Road primary, which could also be upgraded to a 20/40 MVA site to further increase capacity in the area.

2.4 Bruntingthorpe primary transformer overloads

Constraint Overview

Generation | Demand

The table below outlines the nature of the network constraints identified in the network analysis. Constraints have been identified on the 11 kV network fed from Bruntingthorpe primary which are also present in the baseline.

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			
			Winter	Int Cool	Int Warm	Summer
Bruntingthorpe primary transformer overloads	None	None	Baseline	Baseline	Baseline	Baseline

Uncertainty under other Distribution Future Energy Scenarios: Relatively low demand growth is projected under all five scenarios. As this constraint is present in the baseline, regardless of the scenario some form of mitigation is required. Under the higher growth scenarios (Leading the Way and Consumer Transformation) operational mitigation and flexibility procurement may not be capable of managing the constraint for as long (which would trigger reinforcement earlier).

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 a second transformer and circuit to Bruntingthorpe primary.
2	Uprate the transformer at Bruntingthorpe primary.
3	Build a new single transformer primary.
Flexibility Services	
4	Procure flexibility under Bruntingthorpe 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 has been carried out for this constraint as part of the RIIO-ED2 Business Plan. The optimal reinforcement solution identified will be periodically tested against market provided flexibility by the DSO as part of the DNOA process.

Option 1 – Install a second transformer and circuit to Bruntingthorpe primary

Viable

Capacity released for constraint(s) considered: 18 MVA

New limiting factor for constraint(s) considered: Existing 33 kV circuit rating

Detailed description: Installing a second transformer at, and 33 kV circuit to Bruntingthorpe primary would mean that the existing transformer would not supply the full demand of the site under normal, intact running arrangements, alleviating this constraint. To fully resolve this constraint, the existing transformer would also need to be replaced. Two 12/24 MVA transformers would be sufficient to comfortably accommodate the demand growth forecast up to 2050 at Bruntingthorpe.

A new 33 kV circuit directly back to Kibworth BSP would require around 9 km of circuit works (subject to detailed route investigation and land rights). Bruntingthorpe is around 6 km away from another circuit from Kibworth to another site (which is rated high enough that it would not limit the capacity of Bruntingthorpe). Teeing a new 33 kV circuit to Bruntingthorpe off this circuit could allow a second infeed to be created with less 33 kV circuit works required, but this is still overall an expensive option. One of the 33 kV circuits at Kibworth would also need to be moved over to the main 2 (33 kV) busbar, as both are currently fed from the main 1 (33 kV) busbar.

Option 2 – Uprate the transformer at Bruntingthorpe primary

Discounted

Capacity released for constraint(s) considered: None

New limiting factor for constraint(s) considered: 11 kV network

Detailed description: If the 33/11 kV transformer at Bruntingthorpe was uprated to a 12/24 MVA unit, this would resolve the thermal constraint seen on the transformer itself. This reinforcement would not free up significant capacity, as constraints have also been identified on the 11 kV network fed from Bruntingthorpe, which would not be resolved by this option. Extensive 11 kV reinforcement would be required to resolve these constraints, and by 2034, further reinforcement would be required to resolve projected 11 kV voltage constraints. Compared with option 1, uprating the transformer at Bruntingthorpe alone is not a strategic or economic solution due to the extent of the 11 kV works which would also be required.

Option 3 – Build a new single transformer primary

Discounted

Capacity released for constraint(s) considered: Dependent on 11 kV transfers

New limiting factor for constraint(s) considered: 11 kV network

Detailed description: A new single transformer primary could be built which could allow demand to be transferred away at 11 kV from Bruntingthorpe. The two primaries could then support each other during outages on their respective transformers/infeeds. This new primary could be supplied from either Kibworth or Pailton (as a 33 kV circuit from Pailton ends just over 4 km away from Bruntingthorpe primary).

This option has been discounted as compared to option 1 this would not create as much capacity or network security, but would still require significant expenditure to create a new substation (and the associated 11 kV works to stitch it into the network).

Option 4 – Procure flexibility under Bruntingthorpe 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 transformer at Bruntingthorpe. This could be utilised in conjunction with the operational mitigation discussed in option 4 above. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Installing a second transformer at Bruntingthorpe and a new 33 kV infeed to feed it has been identified as the optimal reinforcement solution to resolve the constraints on the transformer at the primary as well as on the downstream 11 kV network. This could potentially be achieved by teeing off an existing 33 kV circuit as discussed above.

2.5 Kettering BSP GT 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
Kettering BSP GT overloads	Arranged or fault outage on the other GT or 132 kV infeed	None	2034	2028	2034	-
Kettering BSP GT overloads	Arranged outage at Irthlingborough BSP	Fault on either GT at Kettering BSP	2028	2028	2028	2034

Uncertainty under other Distribution Future Energy Scenarios: Similar demand growth is forecast under Leading the Way as under Best View. Under Consumer Transformation overloads are observed for N-1 outages under other seasons in 2028. Even under the lower growth scenarios (System Transformation and Falling Short) N-1 overloads are observed by 2034.

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 the GTs at Kettering BSP.
2	Install a third 132/33 kV GT at Kettering BSP.
3	Establish a new 132/11 kV BSP.
Operational Mitigation	
4	Various operational mitigations.
Flexibility Services	
5	Procure flexibility under Kettering BSP.

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 GTs at Kettering BSP

Discounted

Capacity released for constraint(s) considered: N/A

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

Detailed description: Uprating the 132/33 kV GTs at Kettering BSP would alleviate this constraint. This option is not viable as the GTs are already the highest rating NGED uses on the network as standard. Utilising non-standard equipment creates a number of issues, such as finding replacements if serious faults occur.

Option 2 – Install a third 132/33 kV GT at Kettering BSP

Viable

Capacity released for constraint(s) considered: Up to 114 MVA

New limiting factor for constraint(s) considered: N-2 restoration capacity

Detailed description: A third GT could be installed at Kettering to resolve this constraint. To allow the capacity of the new GT to be fully utilised, it would be set up such that it can feed onto either of two 33 kV boards (with an existing GT feeding onto each of those boards). This would allow each side to be loaded up to the full capacity of a GT, and the site to be easily split in half for arranged outages on any GT.

This solution would create sufficient GT capacity for the demand growth forecast at Kettering up to around 2050. Additional load could also be transferred into Kettering to support other nearby BSPs. The two nearest BSPs to Kettering are Irthlingborough and Corby, but significant load transfers would not be appropriate for a number of reasons. Firstly, the capacity created at Kettering is expected to be highly utilised by 2050, so transferring too much extra demand into the BSP could trigger costly further works. Secondly, demand growth at both Corby and Irthlingborough is high enough that both BSPs will need reinforcing at some point regardless so any 33 kV works carried out to facilitate transfers would be largely wasted.

One primary which could potentially be transferred without significant 33 kV works is Oakley (there are two existing 33 kV circuits from Kettering to Oakley). This transfer would also be easily reversible. The demand at Oakley is however not high enough to significantly affect the GT constraints seen at either Kettering or Corby BSPs. It could also lead to a constraint on the section of 33 kV circuit which also feeds Desborough T2 (before the tee off to Oakley).

Option 3 – Establish a new 132/11 kV BSP

Discounted

Capacity released for constraint(s) considered: 78 MVA (if the new BSP could be fully utilised)

New limiting factor for constraint(s) considered: Existing 132/33 kV GT capacity

Detailed description: Installing new 132/11 kV GTs at either Kettering BSP, Field Street primary or a new site could allow demand to be transferred off the existing 132/33 kV GTs and help alleviate this constraint. This option has been discussed in Section 2.2 of this report and subsequently discounted.

There is not sufficient space at either existing site for two 132/11 kV GTs, and establishing a new site (if possible) would be prohibitively expensive). This option would also not free up sufficient capacity for the long term growth forecast at Kettering (which installing a third 132/33 kV GT as discussed in option 2 does).

Option 4 – 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 which could potentially help manage this constraint and defer reinforcement. However, none of these are sufficient to manage the network in the longer term as by 2034 overloads are observed for N-1 outages in every season except summer.

The options considered are:

- Restrict outage seasons: in 2028 restricting outage seasons may help with managing this constraint as the most onerous network condition is an N-2 outage condition. One disadvantage of this option is that it reduces network operability.
- Alternative running arrangements: For arranged outages where one of Burton Latimar or Pytchley Road primaries is transferred fully into Kettering, the other primary could be fed fully from Irthlingborough to help manage the constraint seen for N-2 outages.
- Review seasonal ratings: as this constraint is only present in intermediate cool for N-1 outages in 2028 (the ratings for which may be overly pessimistic as they align to the summer rating).

Option 5 – Procure flexibility under Kettering BSP

Viable

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

Detailed description: Flexibility services could be procured on the network supplied from Kettering BSP to alleviate the projected demand overloads seen on the GTs. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

The optimal reinforcement strategy to alleviate the projected constraints on the GTs at Kettering BSP is to install a third GT. A number of operational mitigation options have been identified to help manage this constraint, but even if used in conjunction these will not be sufficient to prevent overloads in the long term.

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