Lincoln BSP

Network Development Report – East Midlands

May 2024

Electricity Distribution

nationalgrid

Contents

Lincoln 33 kV

1. Network Overview

Lincoln Bulk Supply Point (BSP) is fed from West Burton Grid Supply Point (GSP) in National Grid Electricity Distribution's (NGED's) East Midlands licence area. Lincoln BSP is fed from West Burton via a dual 132 kV circuit.

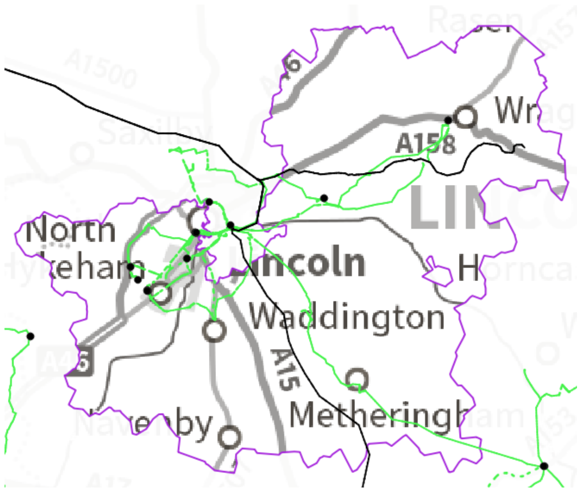

Figure 1.1 Lincoln geographic network coverage

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

Lincoln BSP has three 33 kV busbars fed by three 132/33 kV Grid Transformers (GTs), two of which are rated to 60/90/156 MVA (GT1 and GT2) and one of which is rated to 45/90/117 MVA (GT6). The three GTs are normally run in parallel.

Lincoln BSP feeds eleven primary substations: Anderson Lane, Beevor Street, Doddington Park, Fiskerton, Metheringham T1, North Hykeham, Rookery Lane, Ruston and Hornsby, South Carlton, Waddington and Wragby. Two of these primaries have three 33/11 kV transformers (Fiskerton and North Hykeham). The remaining primaries all have two transformers each (all 33/11 kV with the exception of Ruston and Hornsby, which has 33/6.6 kV transformers). South Carlton T3 is fed via Anderson Lane primary, and Wragby is fed via Fiskerton primary. Ruston and Hornsby is located at the same site as Beevor Street primary. The remaining primaries are all supplied directly from Lincoln BSP. Lincoln BSP is interconnected with Sleaford BSP via Metheringham primary (which is normally run open at both 33 kV and 11 kV).

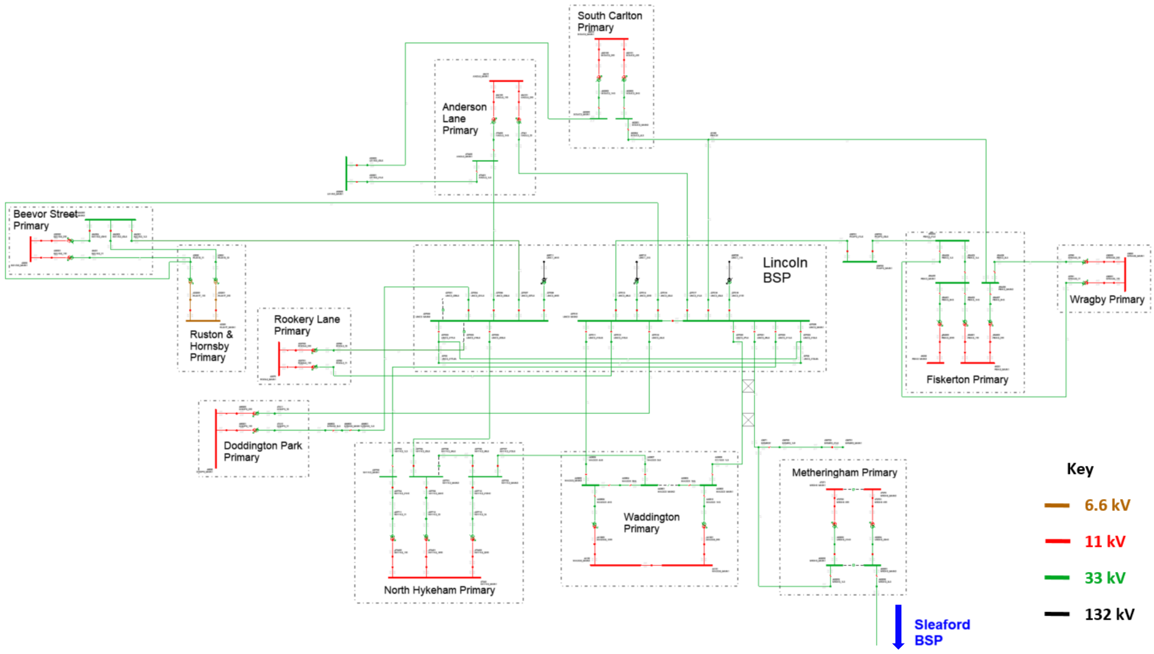

Figure 1.1.1 Lincoln 33 kV network single line diagram

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 Lincoln BSP under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.
- The following primaries are split at 11 kV or 6.6 kV for outages on the 33 kV bus section breaker between the main 1 and main 2 33 kV busbars: Fiskerton, Wragby, Waddington, North Hykeham, Doddington Park, Rookery Lane, Ruston and Hornsby and Beevor Street.
- The following primaries are split at 11 kV or 6.6 kV for outages on the 33 kV interconnector between the main 2 and main 6 33 kV busbars: South Carlton, Anderson Lane, North Hykeham, Doddington Park, Rookery Lane, Ruston and Hornsby and Beevor Street.
- The following primaries are split at 11 kV or 6.6 kV for arranged outages on the main 1 33 kV busbar: North Hykeham, Rookery Lane, Ruston and Hornsby, Beevor Street and Doddington Park.
- For an arranged outage on the 33 kV infeed to T3 at Fiskerton primary (or the transformer itself), its load is transferred onto the main 1 11 kV busbar at Fiskerton.
- For an outage on the infeed from Lincoln or Sleaford BSP, Metheringham primary is paralleled at 11 kV and fed fully from the other BSP (i.e. for an outage on the circuit from Lincoln BSP the site is fed fully from Sleaford BSP and vice versa).
- In future year studies, Ruston and Hornsby primary is decommissioned and its load transferred to Beevor Street primary.

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:

- Overloads are projected to occur on the transformers at Anderson Lane primary for the loss of the other circuit or transformer (in 2028 for intermediate cool peak demand and by 2034 for all seasons).
- The transformers at Rookery Lane are projected to be constrained for the loss of either infeed in 2034 (with demand overloads forecast for all seasons except winter).
- A generation constraint is forecast for the 33 kV circuit to Doddington Park T1 in 2034 (for N-1 outages on the other circuit).
- A generation constraint is forecast for the 33 kV circuit to Metheringham T1 in 2034 (for N-1 outages on the other circuit).
- A generation constraint is forecast for the 33 kV circuit to Fiskerton T1 (by 2028 for N-1 outages and by 2034 under intact network running).
- At Wragby primary the transformers are projected to be constrained by 2028 for demand and by 2034 for generation (in both cases, for an arranged or fault outage on either transformer or circuit from Fiskerton).

2.2 Anderson Lane 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 in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Anderson Lane primary transformer overloads	Arranged or fault outage on the other transformer or infeed	None	2034	2028	2034	2034

Uncertainty under other Distribution Future Energy Scenarios: Similar growth is forecast under Consumer Transformation as under Best View (and slightly higher growth is forecast for Leading the Way). Falling Short is the only scenario under which no overloads are projected to occur 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 both transformers at Anderson Lane primary.
2	Build a new primary substation.
Operational Mitigation	
3	Review seasonal ratings.
Flexibility Services	
4	Procure flexibility under Anderson Lane 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 both transformers at Anderson Lane primary

Viable

Capacity released for constraint(s) considered: 3 MVA

New limiting factor for constraint(s) considered: 33 kV circuit to T2

Detailed description: Uprating both transformers at Anderson Lane primary to 20/40 MVA units would resolve this constraint in the short term. The site would initially be limited by the 33 kV circuit to T2, so to free up the full capacity of the new transformers this would need uprating at some point (the 33 kV circuit to T1 has recently been uprated, but may still also a limiting factor). Replacing the transformers at Anderson Lane primary would also confer an asset condition benefit, as the existing units are almost 60 years old.

Option 2 – Build a new primary substation

Viable

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

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

Detailed description: Building a new 33/11 kV primary with two 20/40 MVA transformers nearby could allow Anderson Lane to be deloaded, alleviating this constraint. This reinforcement has also been discussed in the West Burton 132 kV report as an option to deload Lincoln Local BSP. If a suitable location can be identified a new primary would increase security of supply, support both existing sites and add needed capacity to the centre of Lincoln. A full 11 kV study would be required to determine what could be transferred from Anderson Lane primary (which would feed into the optioneering for the location of the new site).

Option 3 – Review seasonal ratings

Viable

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

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

Detailed description: Overloads are only seen by 2028 for intermediate cool. It is therefore possible that this constraint could be delayed slightly by reviewing NGED's internal policy regarding transformer ratings, which does not currently distinguish between summer and intermediate cool ratings (which may be overly pessimistic). This solution is dependent on an internal review and would not be a long term solution (as by 2034 overloads are projected for all seasons).

Option 4 – Procure flexibility under Anderson Lane 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 Anderson Lane primary. This could be used in conjunction with the operational mitigation discussed in option 3 above. Flexibility would not however provide any benefit for the condition of the existing transformers. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Uprating the transformers at Anderson Lane primary would add capacity and also confers an asset condition benefit. However, the site would still be limited by 33 kV circuit capacity (as discussed above). A more strategic solution could be to build a new primary substation (which could allow both Anderson Lane and Lincoln Local 11 kV to be deloaded).

In the short term, reinforcement could potentially be deferred through a review of seasonal transformer ratings and/or the use of flexibility. If the replacement of the transformers at Anderson Lane primary were triggered based on their condition the viability of establishing a new primary substation may be the deciding factor in what size units they are replaced with (12/24 MVA or 20/40 MVA).

2.3 Rookery Lane 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
Rookery Lane primary transformer overloads	Arranged or fault outage on the other transformer or infeed	None	-	2034	2034	2034

Uncertainty under other Distribution Future Energy Scenarios: Under Leading the Way and Consumer Transformation overloads are also seen in winter in 2034. The growth forecast under every scenario is high enough to trigger overloads for some seasons by 2034.

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 at Rookery Lane to 12/24 MVA units.
2	Uprate both transformers at Rookery Lane to 20/40 MVA units.
Flexibility Services	
3	Procure flexibility under Rookery Lane 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 at Rookery Lane to 12/24 MVA units

Discounted

Capacity released for constraint(s) considered: 1 MVA

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

Detailed description: Uprating the transformers at Rookery Lane to 12/24 MVA units would add capacity to the site. It would also confer an asset condition benefit, as the existing units are over 60 years old.

This option has been discounted as the small amount of capacity added is insufficient to accommodate the demand growth forecast for the area.

Option 2 – Uprate both transformers at Rookery Lane to 20/40 MVA units

Viable

Capacity released for constraint(s) considered: 4 MVA

New limiting factor for constraint(s) considered: 33 kV circuit to T1

Detailed description: Uprating the transformers at Rookery Lane to 20/40 MVA units would resolve this constraint, adding sufficient transformer capacity to accommodate the demand growth forecast for the area up to 2050. As with option 1 this would also provide an asset condition benefit. While initially this reinforcement would not release much more capacity than installing 12/24 MVA units, the 33 kV circuit to T1 could be uprated in the future as required (increasing the capacity of the site by a further 12 MVA). The 33 kV circuit to T2 is already rated high enough that it would not restrict 20/40 MVA transformers at Rookery Lane.

Another option to create two infeeds to Rookery Lane with sufficient capacity for 20/40 MVA units could be to use one of the 33 kV circuits to Doddington Park primary (which passes close to Rookery Lane) by swapping the two feeders. In order to achieve this the reconfiguration of Lincoln 33 kV would also need to be carried out (as discussed in the West Burton 132 kV report) to maintain security of supply for busbar outages). This circuit would also need uprating (but not as much as the existing circuit to Rookery Lane). Carrying out this option would also mean this circuit could not be utilised as discussed in Section 2.4 of this report.

Option 3 – Procure flexibility under Rookery Lane 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 Rookery Lane primary. Flexibility would not however provide any benefit for the condition of the existing transformers. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Uprating the transformers at Rookery Lane primary would resolve this constraint. 20/40 MVA units are the clear strategic choice for the new transformers, providing the capacity needed for the long term demand growth forecast for the area. The 33 kV circuit to T1 would also need uprating (or one of the 33 kV circuits to Doddington Park utilised), which could either be carried out alongside the transformer replacement or at a later date.

2.4 Lincoln to Doddington Park T1 33 kV circuit overload

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 under Best View
			Summer (generation)
Doddington Park 33 kV infeed to T1 circuit overload	Lincoln – Doddington Park T2 circuit arranged or fault outage	None	2034

Uncertainty under other Distribution Future Energy Scenarios: Even under Falling Short (which sees the lowest generation growth at Doddington Park) overloads are projected to occur by 2034 (so some form of intervention is required regardless of 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	Uprate the 33 kV circuit to Doddington Park T1.
2	Transfer 33 kV generation.
Operational Mitigation	
3	Active Network Management.
Flexibility Services	
4	Procure flexibility under Doddington Park 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 the 33 kV circuit to Doddington Park T1

Viable

Capacity released for constraint(s) considered: 14 MVA

New limiting factor for constraint(s) considered: 33 kV circuit to Doddington Park T2 rating

Detailed description: Uprating the 33 kV circuit to Doddington Park T1 could be used to alleviate this constraint. Only around 3 km of circuit would need to be uprated (as the rest of the circuit is already rated significantly higher). By carrying out these works, it would also reduce the cost required to add demand capacity if it is ever needed at Doddington Park in the future (although current forecasts do not indicate this will be required). This option does however conflict with the use of this circuit discussed in Section 2.3 of this report (i.e. both reinforcement proposals cannot be utilised).

Option 2 – Transfer 33 kV generation

Viable

Capacity released for constraint(s) considered: Generation output of the 33 kV generator

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

Detailed description: A large proportion of the generation on the circuit to Doddington Park T1 is from generation connected at 33 kV. If this generator was transferred onto a nearby circuit (for example one of the circuits supplying North Hykeham primary which is under 1 km away) the Lincoln to Doddington Park T1 circuit would be deloaded significantly, resolving this constraint. This would not compromise North Hykeham primary in any way, as there is less generation connected there (and generation growth is forecast to be lower than at Doddington primary).

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 connections at Doddington Park 11 kV 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 under Doddington Park 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

ANM may be used to manage this constraint in the short term. If reinforcement is triggered, then either the existing circuit could be uprated, or the potential to transfer 33 kV generation to another circuit could be explored. Generation growth in the area (specifically at Doddington Park and North Hykeham primaries) will be assessed on an ongoing basis, to determine if additional generation capacity is required before any works are carried out.

As noted in option 1 uprating the existing circuit conflicts with one of the options discussed to reinforce Rookery Lane primary in Section 2.3. If this constraint can be managed using ANM then that option may be carried out, with this constraint addressed either through transferring generation as discussed in option 2 or through additional reinforcement at a later date.

2.5 Lincoln to Metheringham T1 33 kV circuit overload

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 under Best View
			Summer (generation)
Metheringham 33 kV infeed to T1 circuit overload	Tattershall – Metheringham circuit or Tattershall main 2 arranged or fault outage	None	2034

Uncertainty under other Distribution Future Energy Scenarios: Very high generation growth at Metheringham is forecast for all scenarios (especially under Leading the Way and Consumer Transformation). On the demand side, there are no scenarios under which the Tattershall to Metheringham circuit is not constrained by 2045.

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 33 kV circuit to Metheringham T1.
2	Build a new 33 kV circuit.
Operational Mitigation	
3	Active Network Management.
Flexibility Services	
4	Procure flexibility under Metheringham 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 the 33 kV circuit to Metheringham T1

Viable

Capacity released for constraint(s) considered: Around 10 MVA

New limiting factor for constraint(s) considered: 33 kV infeed to Metheringham T2

Detailed description: Uprating the 33 kV circuit to Metheringham T1 would add generation capacity for the primary, alleviating this constraint. This would require around 8 km of 33 kV circuit works, mostly overhead line. The cost of this option is mainly dependent on what conductors could be accommodated on the existing structures (as if larger conductors could not be installed a full rebuild may be required which would be significantly more expensive).

Option 2 – Build a new 33 kV circuit

Viable

Capacity released for constraint(s) considered: Generation output of the 33 kV generator

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

Detailed description: If a new 33 kV circuit were built from Lincoln BSP to provide dedicated infeeds for 33 kV generation, the existing circuit would be deloaded (resolving this constraint). While this option is likely more expensive than simply reinforcing the existing circuit, it does create additional benefits. Firstly, it would free up more generation capacity at Metheringham 11 kV. Secondly, it reduces network complexity. Finally, this new circuit could at some point be extended on to Metheringham primary itself. This would allow the site to be fully transferred into Lincoln BSP.

Transferring the other half of Metheringham primary into Lincoln BSP would improve network operability and security of supply, allowing Metheringham to be paralleled at 11 kV (as it would no longer form a loose couple between two GSPs). It would also deload the Tattershall / Metheringham / Woodhall Spa / Horncastle 33 kV network and improve voltage regulation (doing so would help alleviate a constraint in the area which is outlined in the Grantham and Sleaford 33 kV report). Some form of intervention may be required at some point regardless, as the 33 kV circuit between Tattershall and Metheringham is not rated high enough to support the long term demand or generation growth forecast for the site. Building a new 33 kV circuit out of Lincoln BSP would however require a new 33 kV circuit breaker at the site (so achieving this reinforcement may be dependent on carrying out the works discussed for the site in the West Burton 132 kV report).

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 connections at Metheringham 11 kV could be included in an ANM scheme. ANM schemes are used to manage constraints on over-committed networks.

Option 4 – Procure flexibility under Metheringham 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

There are a number of options for increasing the generation capacity at Metheringham primary (which may be required if ANM is not capable of managing this constraint in the long term). The existing circuit could be uprated, or a new 33 kV circuit built from Lincoln BSP (with the former likely being less expensive but the latter creating a number of network benefits as outlined above).

2.6 Lincoln to Fiskerton T1 33 kV circuit overload

Constraint Overview

Generation Demand

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

Table 2.6.1 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)
Fiskerton 33 kV infeed to T1 circuit overload	Lincoln – Fiskerton T2 circuit arranged or fault outage	None	2028
Fiskerton 33 kV infeed to T1 circuit overload	None	None	2034

Uncertainty under other Distribution Future Energy Scenarios: Generation growth at Fiskerton and Wragby primaries is very high under every scenario (with the highest growth being forecast under Consumer Transformation).

Solution Options

A list of each of the options considered for this constraint is given below.

Table 2.6.2 solution options to solve constraint(s)

Option	Description
Reinforcement	
1	Uprate the 33 kV circuit to Fiskerton T1.
2	Unstitch 33 kV generation.
Operational Mitigation	
3	Active Network Management.
Flexibility Services	
4	Procure flexibility under Fiskerton and Wragby 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.

Option 1 – Uprate the 33 kV circuit to Fiskerton T1

Viable

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

New limiting factor for constraint(s) considered: 33 kV circuit to the Fiskerton tee

Detailed description: Uprating the 33 kV circuit to Fiskerton T1 could be used to alleviate this constraint. This would involve uprating various sections of underground cable, as well as undergrounding or reconductoring some overhead line.

Option 2 – Unstitch 33 kV generation

Viable

Capacity released for constraint(s) considered: Generation output of the 33 kV generator

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

Detailed description: Building a new circuit from Lincoln BSP to unstitch 33 kV generation could be used to deload the existing circuit. This option would likely be more expensive than uprating the existing circuit, but would also reduce network complexity. In the longer term a large amount of generation is projected to connect in the area around Fiskerton and Wragby primaries (reinforcement at Wragby is discussed in Section 2.7 of this report), so a new highly rated 33 kV circuit from Lincoln BSP into the area could prove advantageous. As noted in Section 2.5 a new 33 kV circuit out of Lincoln BSP may not be possible without the site being reinforced/rationalised as discussed in the West Burton 132 kV report*.

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 connections at Fiskerton 11 kV or Wragby 11 kV could be included in an ANM scheme. ANM schemes are used to manage constraints on over-committed networks.

Option 4 – Procure flexibility under Fiskerton and Wragby primaries

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

ANM may be used to manage this constraint in the short term. The two reinforcement options for the area are to uprate the existing 33 kV network or to build a new 33 kV circuit into the area. Both would help resolve this constraint but a new circuit could help futureproof this section of network as well (which may be required if the high generation forecast at Fiskerton and Wragby primaries materialises).

2.7 Wragby primary transformer overloads

Constraint Overview

Generation | Demand

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

Table 2.7.1 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**
Wragby primary T1 or T2 overloads	Fault or arranged outage on either transformer or circuit	None	-	2028	2028	2028
Generation			**Summer**			
Wragby primary T1 or T2 reverse power flow overloads	Fault or arranged outage on either transformer or circuit	None	2034			
Wragby primary T2 reverse power flow overload	None	None	2034			

Uncertainty under other Distribution Future Energy Scenarios: Relatively low demand growth is forecast at Wragby under all scenarios (with the lowest being projected for Falling Short). On the generation side far higher load growth is expected.

Solution Options

A list of each of the options considered for this constraint is given below.

Table 2.7.2 solution options to solve constraint(s)

Option	Description
Reinforcement	
1	Uprate the transformers at Wragby primary.
Operational Mitigation	
2	Active Network Management.
Flexibility Services	
3	Procure flexibility under Wragby 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 Wragby primary

Viable

Capacity released for constraint(s) considered: 15 MVA

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

Detailed description: Uprating the transformers at Wragby primary to 12/24 MVA units would resolve this constraint and add significant demand and generation capacity to the site. The two 33 kV circuits to Wragby primary from Fiskerton primary are already rated high enough that they would not restrict the capacity of 12/24 MVA units. The Lincoln to Fiskerton 33 kV circuits however could become a limiting factor for growth at Wragby (options for increasing this capacity, specifically for generation on the 33 kV circuit to Fiskerton T1, are discussed in Section 2.6 of this report).

Option 2 – 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 Wragby primary 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 at Wragby, but not the projected demand constraint.

Option 3 – Procure flexibility under Wragby primary

Viable

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

Detailed description: Flexibility services could be procured on the network supplied from Wragby primary to alleviate the projected demand overloads seen on the transformers. Flexibility would not be suitable for managing the reverse power flow constraint projected at Wragby. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

As this constraint is projected to occur for both demand and generation, in order to manage it in the short term to defer reinforcement the use of both ANM and flexibility would be required. Beyond this, uprating the transformers at Wragby would significantly increase demand and generation capacity at the site. 12/24 MVA units are likely the strategic choice to replace the existing transformers, providing an appropriate amount of capacity for load growth forecast for the area (which is much higher for generation than for demand).

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