Skegness BSP

Network Development Report – East Midlands

May 2024

Electricity Distribution

nationalgrid

Contents

Skegness 33 kV

1. Network Overview

Skegness Bulk Supply Point (BSP) is fed from Bicker Fen Grid Supply Point (GSP) in National Grid Electricity Distribution's (NGED's) East Midlands licence area. Skegness BSP is fed from Bicker Fen via a dual 132 kV circuit to Boston BSP.

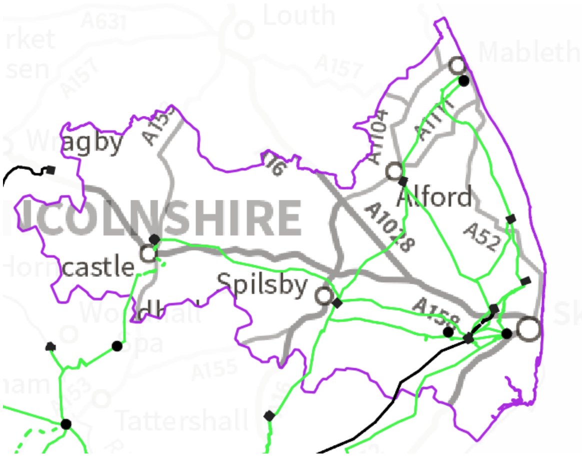

Figure 1.1 Skegness geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon identified on the 33 kV network fed from and the Grid Transformers (GTs) at Skegness 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

Skegness BSP has three 33 kV busbars fed by two 132/33 kV GTs both rated to 60/90/117 MVA. Skegness BSP feeds eight primary substations: Alford, Chapel St. Leonards, Horncastle T1, Ingoldmells, Spilsby, Trusthorpe, Warth Lane and Wrangle T2. All of the primaries fed from Skegness have two 33/11 kV transformers, with the exception of Warth Lane (which has three). Chapel St. Leonards T1 is fed via Ingoldmells primary. Trusthorpe is fed via Alford and Chapel St. Leonards primaries. Horncastle T1 and Alford T2 are both fed via Spilsby primary.

Skegness is interconnected with two other BSPs: Boston and Sleaford. The interconnection with Boston BSP is via normal open points at Wrangle and Stickney primaries. The interconnection with Sleaford BSP is via Horncastle primary, which is run parallel at 11 kV, forming a loose couple between the two BSPs.

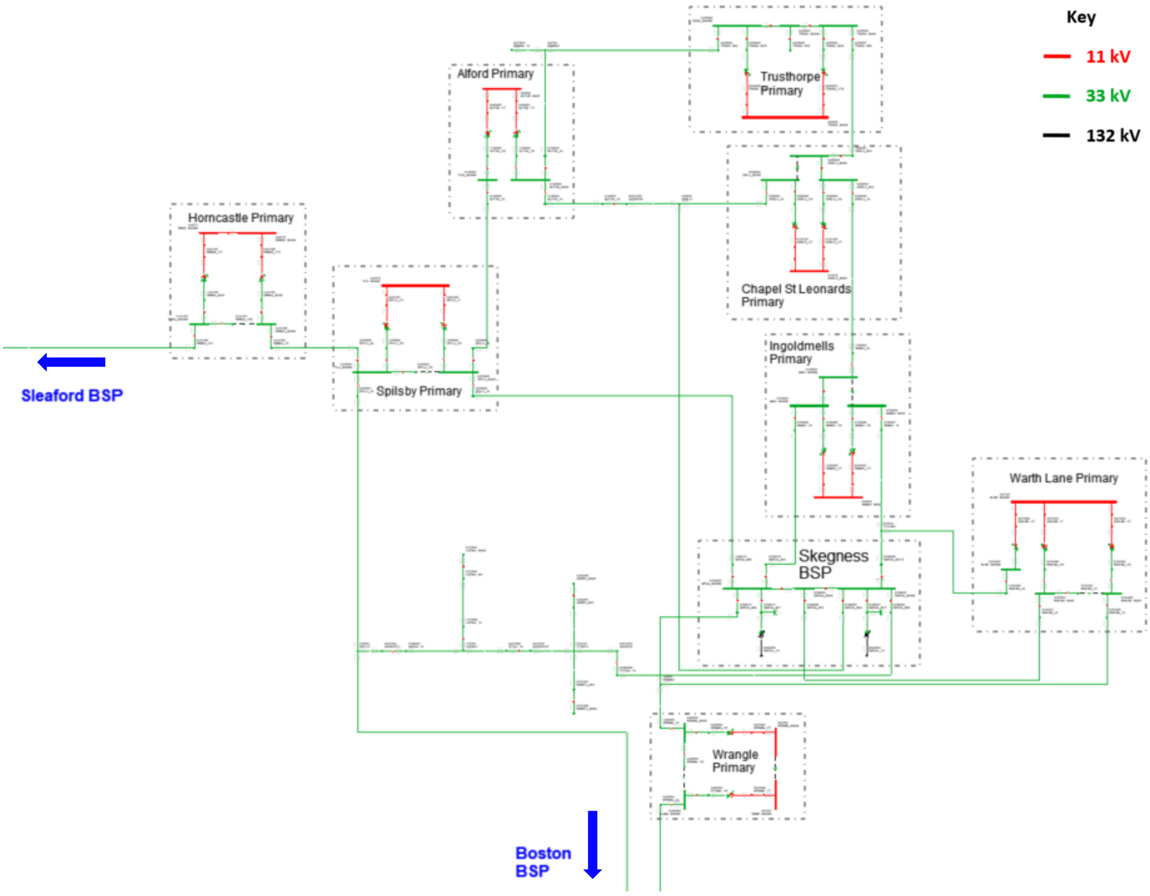

Figure 1.1.1 Skegness 33 kV network single line diagram

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 Skegness BSP under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.
- The 33 kV network downstream of Skegness BSP is split for arranged outages on either of its 33 kV bus section breakers or the main 2 33 kV busbar to prevent loose couples. This involves splitting Spilsby, Alford, Chapel St. Leonards, Ingoldmells, Warth Lane and Horncastle at 11 kV. Trusthorpe and Chapel St. Leonards are also separated at 33 kV by opening CB1H0 at Chapel St. Leonards.
- For arranged outages on either infeed to Skegness BSP, the 11 kV bus section breaker at Horncastle primary is opened.
- For arranged outages on the infeed to Chapel St. Leonards T1, CB2H0 is closed to maintain supply to Trusthorpe T1.
- For an outage on the infeed from Skegness or Boston BSP, Wrangle primary is paralleled at 11 kV and fed fully from the other BSP (i.e. for an outage on the circuit from Skegness BSP the site is fed fully from Boston BSP and vice versa).

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:

- Alford primary is constrained for demand on its primary transformers for N-1 outages on either infeed.
- In 2028 overloads are projected to occur on the transformers at Spilsby primary for demand during arranged or fault outages on either side (the same outages trigger a generation constraint in 2034).
- For arranged or fault outages on T1 at Trusthorpe, the 11 kV tail for T2 is projected to overload in 2034.
- There are a number of outage conditions which trigger demand overloads on the 33 kV circuits from Skegness BSP to Chapel St Leonards, Alford and Ingoldmells primaries (the most onerous of which are the loss of the main 1 or main 3 33 kV busbars at Skegness).
- Both demand and generation constraints are projected on both 33 kV circuits to Spilsby primary (for the loss of the other circuit from Skegness) in 2028 onwards.
- The GTs at Skegness BSP are projected to overload for a fault or arranged outage on either side in 2034. This is for both demand and generation, with the limiting factor being the 33 kV tails (but the GTs themselves also expected to be constrained).
- Thermal and voltage constraints at Horncastle primary (and its 33 kV feeder circuits) are covered in the Grantham and Sleaford 33 kV report.

2.2 Alford 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
Alford primary transformer overloads	Arranged or fault outage on the other transformer or infeed	None	2028	Baseline	Baseline	Baseline

Uncertainty under other Distribution Future Energy Scenarios: As this constraint is present in the baseline it is an issue regardless of the scenario. Overloads are also seen in winter by 2034 for all scenarios except Falling Short.

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

Viable

Capacity released for constraint(s) considered: 14 MVA

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

Detailed description: Uprating both transformers at Alford primary to 12/24 MVA units would resolve this constraint, providing enough capacity to accommodate the majority of the demand growth projected up to 2050. The site would be limited by the 33 kV circuit to T2 (but only by around 1 MVA, and if required this could be uprated by replacing a short section of limiting cable).

The 33 kV circuit to the Chapel St Leonards tee and the 33 kV circuit to Spilsby T1 would still limit growth at Alford (these constraints and potential mitigation strategies are discussed in Section 2.5 and Section 2.6 of this report).

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

Discounted

Capacity released for constraint(s) considered: 14 MVA

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

Detailed description: Uprating the transformers at Alford primary to 20/40 MVA units would not free up any additional capacity compared with installing 12/24 MVA units as proposed in option 1 above. This is because the 33 kV circuits to Alford would still limit the site. Significant 33 kV circuit works would be required to unlock the full capacity of 20/40 MVA units at Alford (beyond that which is already proposed in Section 2.5 and Section 2.6 of this report) such as uprating the 10 km circuit from the Chapel St Leonards tee. Based on demand forecasts for the area the investment required to install and properly utilise 20/40 MVA units is not warranted.

Option 3 – Procure flexibility under Alford 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 Alford primary. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Uprating the transformers at Alford primary would resolve this constraint. 12/24 MVA units would provide the appropriate level of capacity for the long term demand forecast for the area. 33 kV circuit works will also be required to free up capacity at Alford, which is covered in various other sections of this report (but uprating the transformers at Alford is required regardless of the overall 33 kV strategy for the area).

2.3 Spilsby 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 year constraint is observed in each season under Best View			
Demand			**Winter**	**Int Cool**	**Int Warm**	**Summer**
Spilsby primary T1 or T2 overloads	Fault or arranged outage on either transformer or circuit	None	2028	2028	2028	2028
Generation			**Summer**			
Spilsby primary T1 or T2 reverse power flow overloads	Fault or arranged outage on either transformer or circuit	None	2034			

Uncertainty under other Distribution Future Energy Scenarios: As under Best View, overloads are observed for N-1 outages in 2028 under Leading the Way and Consumer Transformation. Despite lower growth being forecast under System Transformation and Falling Short there are no scenarios under which demand overloads are not observed 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 the transformers at Spilsby primary.
Operational Mitigation	
2	Active Network Management.
Flexibility Services	
3	Procure flexibility under Spilsby 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 Spilsby primary

Viable

Capacity released for constraint(s) considered: 15 MVA or 30 MVA (assuming 33 kV circuit works are also carried out)

New limiting factor for constraint(s) considered: Initially capacity of the 33 kV circuit to T1

Detailed description: Uprating the 33/11 kV transformers at Spilsby primary would resolve this constraint, freeing up significant capacity for demand and generation growth in the area (assuming the 33 kV circuit works outlined in Section 2.6 of this report are also carried out). 12/24 MVA units are likely the optimal choice as 20/40 MVA units may not be feasible due to the feeder distances from Skegness BSP (and the associated voltage limitations).

If a new BSP were built in the area shorter feeder distances could be used to install 20/40 MVA units, but even if a new BSP is built this would be dependent on the location (as discussed in other sections of this report and in the Grantham and Sleaford 33 kV report this would be subject to further optioneering as there are a number of places where a new BSP would confer significant network benefits).

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 Spilsby 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 Spilsby, but not the projected demand constraint.

Option 3 – Procure flexibility under Spilsby primary

Viable

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

Detailed description: Flexibility services could be procured on the network supplied from Spilsby 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 Spilsby. 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. Once reinforcement is triggered the transformers at Spilsby could be uprated.

2.4 Trusthorpe T2 11 kV cable 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			
			Winter	Int Cool	Int Warm	Summer
Trusthorpe 11 kV transformer tail overload (T2)	Arranged or fault outage on T1 at Trusthorpe	None	2034	2034	2034	2034

Uncertainty under other Distribution Future Energy Scenarios: There are no scenarios under which the transformer ratings themselves are projected to be exceeded by 2034. Conversely, for Falling Short and System Transformation very slow load growth is forecast, triggering no overloads by 2034. If 20/40 MVA units were installed at Trusthorpe this would provide sufficient capacity for demand growth up to 2050 for all scenarios (provided the circuit limitations were also addressed).

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 11 kV transformer tails at Trusthorpe primary.
2	Uprate the transformers at Trusthorpe to 20/40 MVA.
Flexibility Services	
3	Procure flexibility under Trusthorpe 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 11 kV transformer tails at Trusthorpe primary

Viable

Capacity released for constraint(s) considered: 8 MVA

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

Detailed description: The 33/11 kV transformers at Trusthorpe primary are limited by the 11 kV tails to 16.7 MVA and 14.8 MVA (winter cyclic) for T1 and T2 respectively. As shown above this leads to T2 being constrained first. By uprating both of these 11 kV tails (which could be carried out at a relatively low cost) the full ratings of the transformers could be utilised. This alone would not be sufficient to accommodate all of the future load growth forecast for the area, but is the clear optimal initial reinforcement strategy (being a low cost and low regret option).

Option 2 – Uprate the transformers at Trusthorpe to 20/40 MVA

Viable

Capacity released for constraint(s) considered: Up to 15 MVA

New limiting factor for constraint(s) considered: 33 kV circuit capacity and voltage regulation

Detailed description: Uprating both transformers at Trusthorpe to 20/40 MVA units may be required to free up further capacity beyond that which would be provided by the works outlined in option 1. Due to the feeder distances from Skegness BSP this would only be possible if Trusthorpe was transferred into a new BSP located closer to the site. This would have to be considered alongside the overall 33 kV strategy for the area (as noted elsewhere, if a new BSP is established there are a number of nearby sections of network which could benefit significantly which need to be considered as part of any siting strategy).

Option 3 – Procure flexibility under Trusthorpe primary

Discounted

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

Detailed description: Flexibility services could be procured to alleviate the projected overloads on the 11 kV transformer tails at Trusthorpe primary. Due to the low cost of this reinforcement flexibility is likely not economical. Flexibility could however be utilised in deferring further reinforcement. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

In the first instance, uprating the 11 kV tails at Trusthorpe primary would add capacity to the site at a low cost, allowing the 12/24 MVA transformers at the site to be fully utilised. Beyond this, uprating the transformers at Trusthorpe to 20/40 MVA units may be necessary (but this would only be possible if a new BSP is established in the area first). As load develops in the area, it will become clearer if there is a need case for adding additional capacity at Trusthorpe beyond uprating the 11 kV tails.

2.5 Skegness to Ingoldmells, Chapel St Leonards and Alford 33 kV circuit overloads

Constraint Overview

Generation | **Demand**

The table below outlines the nature of the network constraints identified in the network analysis. A number of N-2 constraints (including the loss of any two infeeds to Warth Lane primary) have been excluded as they could be managed operationally. By 2034 slight generation overloads are also projected on the Skegness to Chapel St Leonards and Ingoldmells (this does not affect the overall reinforcement strategy discussed in the options below).

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
Skegness to Ingoldmells T2 33 kV circuit overload	Arranged or fault outage on the main 1 33 kV busbar at Skegness BSP	None	Baseline	Baseline	Baseline	2034
Skegness to Ingoldmells T2 33 kV circuit overload	Arranged or fault outage on the Skegness to Chapel St Leonards tee 33 kV circuit	None	2034	2034	2034	-
Skegness to Chapel St Leonards tee 33 kV circuit overload	Arranged or fault outage on the main 3 33 kV busbar at Skegness BSP	None	2028	2028	2028	2034
Skegness to Chapel St Leonards tee 33 kV circuit overload	Arranged or fault outage on the Skegness to Ingoldmells T2 circuit	None	2034	2034	2034	-
Skegness to the Warth Lane tee 33 kV circuit overload	Arranged or fault outage on the main 3 33 kV busbar at Skegness BSP	None	2034	2034	2034	2034

Uncertainty under other Distribution Future Energy Scenarios: As this constraint is present in the baseline it is an issue regardless of the scenario (although under System Transformation and Falling Short overloads are triggered in less seasons for the various outage conditions outlined above). Demand growth at Alford, Chapel St Leonards, Trusthorpe, Warth Lane and Ingoldmells is slightly higher under Consumer Transformation as under Best View (and significantly higher under Leading the Way).

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	Build new 33 kV circuits north from Skegness BSP.
2	Uprate the existing 33 kV circuits.
3	Build a new BSP.
Operational Mitigation	
4	Utilise alternative running arrangements.
Flexibility Services	
5	Procure flexibility under the northern Skegness primaries.

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full CBA. This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the DNOA process.

Option 1 – Build new 33 kV circuits north from Skegness BSP

Viable

Capacity released for constraint(s) considered: Dependent on new circuits installed

New limiting factor for constraint(s) considered: Downstream 33 kV circuits

Detailed description: Building new 33 kV circuits from Skegness BSP towards the northern primaries could be used to mitigate this constraint. This would also improve voltage regulation on the network up towards Trusthorpe. This could involve the following works:

- Building a new 33 kV circuit to the Chapel St Leonards tee. This would require around 6 km of 33 kV circuit works (subject to detailed route investigation and land rights). Doing so would allow Chapel St Leonards and Alford primaries to be unstitched, resolving constraints seen on the existing single circuit.
- Building a new 33 kV circuit to the Warth Lane tee. This would require around 3 km of 33 kV circuit works (subject to detailed route investigation and land rights) and allow Warth Lane primary to be unstitched from Ingoldmells, resolving constraints projected for this circuit.

These new circuits would not only add thermal and voltage capacity to a number of primaries; it would also simplify the network and improve operability.

Option 2 – Uprate the existing 33 kV circuits

Discounted

Capacity released for constraint(s) considered: Different for each circuit

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

Detailed description: Uprating the existing circuits which are projected to overload would require a similar length of circuit works to creating new circuits (without the additional associated benefits discussed in option 1 above). It would also not be as beneficial for network security, as with the current arrangement a number of primaries can be left supplied by a single circuit for busbar outages.

Option 3 – Build a new BSP

Viable

Capacity released for constraint(s) considered: Dependent on which primaries are transferred and how the new BSP is stitched into the existing 33 kV network

New limiting factor for constraint(s) considered: New 33 kV interconnection capacity

Detailed description: If a new BSP were built to the north of Skegness BSP, some of the primaries could be transferred over (deloading the existing circuits). This option would confer a number of other benefits such as deloading Skegness BSP itself. However, there would be significant challenges to overcome with regards to supplying a new BSP at 132 kV (as discussed in Section 2.7 of this report).

A new BSP in the area would be highly advantageous for the existing 33 kV network, but even if it is deemed the optimal reinforcement solution to deload Skegness BSP it may not be progressed in time to resolve the circuit constraints outlined above.

Option 4 – Utilise alternative running arrangements

Viable

Capacity released for constraint(s) considered: Subject to protection review

New limiting factor for constraint(s) considered: 33 kV circuit capacity for circuit outages

Detailed description: Paralleling Ingoldmells and/or Chapel St Leonards at 33 kV could reduce the impact of 33 kV busbar faults at Skegness BSP and help mitigate this constraint. This would however necessitate significant protection upgrades. A full protection assessment would be required to determine the impacts of this alternative running arrangement (as well as thermal and voltage studies).

Even if deemed feasible from a thermal, voltage and protection perspective at best this would be a short term management strategy (as shown there are a number of outages which are projected to create constraints which would not be affected by paralleling at these primaries).

Option 5 – Procure flexibility under the northern Skegness primaries

Viable

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

Detailed description: Flexibility services could be procured to alleviate the projected overloads on the 33 kV circuits described above. As this is a relatively complex constraint the impact of procuring flexibility at various primaries on the different circuit constraints would need to be assessed. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Assuming a new BSP is not built to the north of Skegness BSP, new 33 kV circuits will need to be built from Skegness to at least the Chapel St Leonards tee and the Warth Lane tee. This reinforcement would add thermal and voltage capacity to a number of primaries and improve network operability. An alternative running arrangement which could potentially help manage this constraint in the short term has been considered, the feasibility of which needs assessing as part of a full protection study.

2.6 Skegness to Stickney 33 kV circuit overloads

Constraint Overview

Generation | Demand

The table below outlines the nature of the network constraints identified in the network analysis. The N-2 constraint identified could be managed operationally but given the fact that numerous N-1 constraints have also been identified this would not be a suitable long term mitigation strategy.

Table 2.6.1 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**
Skegness to the Spilsby/Stickney tee 33 kV circuit overload	Arranged outage on the main 1 33 kV busbar at Boston BSP	Fault on the other 33 kV circuit to Spilsby primary	2034	2028	2028	2034
Skegness to the Spilsby/Stickney tee 33 kV circuit overload	Arranged outage on the main 1 33 kV busbar at Boston BSP	None	-	2034	-	-
Skegness to the Spilsby/Stickney tee 33 kV circuit overload	Arranged or fault outage on the other 33 kV circuit to Spilsby primary	None	-	2034	-	-
Skegness to Spilsby T1 33 kV circuit overload	Arranged or fault outage on the main 1 33 kV busbar at Skegness BSP	None	2034	2034	2034	2034
Generation			**Summer**			
Skegness to Spilsby T1 33 kV circuit overload	Arranged or fault outage on the main 1 33 kV busbar at Skegness BSP	None	2028			
Skegness to the Spilsby/Stickney tee 33 kV circuit overload	Arranged or fault outage on the main 1 33 kV busbar at Boston BSP	None	2028			
Skegness to Spilsby T1 33 kV circuit overload	None	None	2034			
Skegness to the Spilsby/Stickney tee 33 kV circuit overload	None	None	2034			

Uncertainty under other Distribution Future Energy Scenarios: High load growth is forecast at Spilsby under Best View, Consumer Transformation and Leading the Way (for both demand and generation). Load growth at Alford primary follows a similar trend (which is relevant to this constraint as the 33 kV circuit to Spilsby T1 also supplies Alford T2).

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	Build a new 33 kV circuit to Spilsby primary.
2	Build a new 33 kV circuit to unstitch a number of generators.
Operational Mitigation	
3	Active Network Management.
Flexibility Services	
4	Procure flexibility under Spilsby 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 – Build a new 33 kV circuit to Spilsby primary

Viable

Capacity released for constraint(s) considered: Demand and generation at Alford as well as increased rating

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

Detailed description: Building a new 33 kV circuit from Skegness to Spilsby primary would allow the existing circuit to be used as a dedicated feed to Alford primary (facilitating an increase in capacity there, alongside the transformer and circuit works outlined in Section 2.2 and Section 2.5 respectively). This existing circuit would provide sufficient capacity to not limit 12/24 MVA transformers at Alford primary. The new circuit would then be used to supply Spilsby T1, which would be suitably rated to allow 20/40 MVA transformers to be installed at some point in the future if required (as highlighted in Section 2.3 of this report).

Building a new 33 kV infeed to Spilsby would require around 12 km of circuit works (subject to detailed route investigation and land rights). This makes this an expensive reinforcement proposal, but one which is necessary to resolve this constraint and benefits both Spilsby and Alford primaries.

Option 2 – Build a new 33 kV circuit to unstitch a number of generators

Viable

Capacity released for constraint(s) considered: 17 MVA

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

Detailed description: Building a new 33 kV circuit from Skegness BSP would allow a number of 33 kV generators to be unstitched from the existing circuit to Spilsby T2 (the existing circuit would continue to supply the generators). This would not require an excessive length of circuit works. There are a number of benefits to this:

- With the new 33 kV circuit used to continue on to Spilsby T2, the whole circuit would be rated higher than 40 MVA (facilitating the potential installation of 20/40 MVA units at Spilsby).
- By unstitching a number of 33 kV generators from the circuit, additional generation capacity would be freed up at Spilsby primary.
- Unstitching these sites would alleviate a complexity issue on the existing 33 kV circuit (which currently has over four addresses).
- By freeing up demand and generation thermal capacity, as well as reducing the number of addresses on the 33 kV circuit to the Spilsby / Stickney tee, A second 33/11 kV transformer could be installed at Stickney primary (the requirement for which is covered in the Boston 33 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 downstream of Spilsby 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 on the 33 kV circuits to Spilsby, but not the projected demand constraint.

Option 4 – Procure flexibility under Spilsby primary

Viable

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

Detailed description: Flexibility services could be procured on the network supplied from Spilsby primary to alleviate the projected demand overloads seen on the 33 kV feeder circuits. This could overlap with any flexibility procured to manage the primary transformer constraint discussed in Section 2.3 of this report, but would not be suitable for managing the generation constraint. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

With a new 33 kV circuit to Spilsby and a new 33 kV circuit being used to unstitch a number of 33 kV generators, both Spilsby and Alford would have the circuit capacity to accommodate the long term demand and generation growth forecast for the area. This reinforcement proposal is expensive (mainly due to the length of circuit required for a new Skegness to Spilsby circuit) but has a number of benefits as discussed (including allowing a second transformer to be installed at Stickney primary) and futureproofs the network.

2.7 Skegness BSP GT 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**
Skegness GT1 or GT2 overload	Fault or arranged outage on either GT at Skegness	None	2034	2034	2034	-
Generation			**Summer**			
Skegness reverse power flow GT overload	Fault or arranged outage on either GT at Skegness	None	2034			

Uncertainty under other Distribution Future Energy Scenarios: No demand overloads are projected to occur under System Transformation or Falling Short. The highest demand growth is projected for Consumer Transformation (although still not quite high enough to trigger overloads in 2028). Under every scenario the group demand is forecast to rise to well in excess of 100 MW between now and 2050.

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 33 kV GT tails at Skegness BSP.
2	Install a third 132/33 kV GT at Skegness BSP.
3	Build a new BSP.
Operational Mitigation	
4	Active Network Management.
Flexibility Services	
5	Procure flexibility under Skegness 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 33 kV GT tails at Skegness BSP

Viable

Capacity released for constraint(s) considered: 16 MVA

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

Detailed description: The winter rating of the 132/33 kV GTs at Skegness BSP are limited by the capacity of the 33 kV cables from the low voltage side of the transformers. These could be uprated at a relatively low cost, which would free up some capacity at Skegness (although not as much for other seasons as for winter). This reinforcement is likely the best method for increasing the capacity of Skegness BSP in the first instance, but is not sufficient to accommodate the projected load growth in the longer term (necessitating further intervention, options for which are discussed below).

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

Viable

Capacity released for constraint(s) considered: Minimal (without a third 132 kV infeed)

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

Detailed description: A third 132/33 kV GT (and the associated 33 kV switchgear required to fully utilise it) would resolve the constraint on the existing GTs for both demand and generation. It would not however add significant demand capacity to the site. This is due to the fact that as demand at Skegness exceeds 100 MW there is a requirement under Engineering Recommendation P2 to restore demand for an N-2 event (the loss of both 132 kV circuits to the BSP).

While a small amount of demand could be restored through interconnection at 33 kV to Sleaford and Boston primaries, this is not sufficient to meet P2 requirements in the long term. A third 132 kV infeed would be the only way to meet N-2 restoration requirements on an enduring basis. Building a new 132 kV circuit to Skegness BSP would however be extremely expensive due to the distances involved. If a new GSP were built in the area this distance could be reduced significantly (Skegness could even be transferred into the new GSP). The possibility of building a new GSP in the area is considered in the Bicker Fen 132 kV report but is very early in the optioneering process.

Option 3 – Build a new BSP

Viable

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

New limiting factor for constraint(s) considered: 33 kV transfer capacity to the new site

Detailed description: A new BSP in the area would allow both demand and generation to be transferred away from Skegness BSP, alleviating this constraint. If the new site were located to the north of Skegness, it could also significantly reduce the 33 kV circuit works required for the area (which are outlined in Section 2.5 of this report) and help add capacity to Trusthorpe primary (as discussed in Section 2.4 of this report).

A new BSP could not be supplied via the same 132 kV circuits as Skegness BSP for two reasons. Firstly, there are no spare addresses on these circuits (so adding another would lead to a noncompliance under Engineering Recommendation P18). Secondly, it would lead to the same issue outlined in option 2 of N-2 restoration capacity limiting demand growth (as the two BSPs would form a demand group and would both be lost for the loss of the circuits from Bicker Fen GSP). This new BSP would therefore need to be supplied from either an existing GSP or a new one (if fed from an existing GSP the same issue of cost as creating a new 132 kV circuit to Skegness BSP due to the distances involved would be run into).

Option 4 – Active Network Management

Viable

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

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

Detailed description: Any additional connections downstream of Skegness BSP 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 on the GTs at Skegness, but not the projected demand constraint.

Option 5 – Procure flexibility under Skegness BSP

Viable

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

Detailed description: Flexibility services could be procured on the network supplied from Skegness BSP to alleviate the projected demand overloads seen on the GTs. If flexibility were used to defer this reinforcement, it would need to be considered in conjunction with the 33 kV circuit constraints discussed in previous sections (as a new BSP near Skegness would also help alleviate some of these constraints). The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Building a new BSP and reinforcing Skegness BSP itself are both technically viable reinforcement strategies to resolve this constraint, but both run into the same issue of creating new 132 kV circuits into the area being very expensive. These two options need to be considered in conjunction with the overall development of the surrounding 132 kV network (which is discussed in the Bicker Fen 132 kV report).

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