Bourne and Stamford BSPs

Network Development Report – East Midlands

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Electricity Distribution

nationalgrid

Contents

Bourne and Stamford 33 kV

1. Network Overview

Bourne and Stamford Bulk Supply Points (BSPs) are fed from Walpole Grid Supply Point (GSP) in National Grid Electricity Distribution's (NGED's) East Midlands licence area. Bourne BSP is fed from Walpole via a dual 132 kV circuit which also supplies Spalding and South Holland BSPs. Stamford BSP is fed via one 132 kV circuit from Bourne BSP and another from UK Power Network's (UKPN's) network.

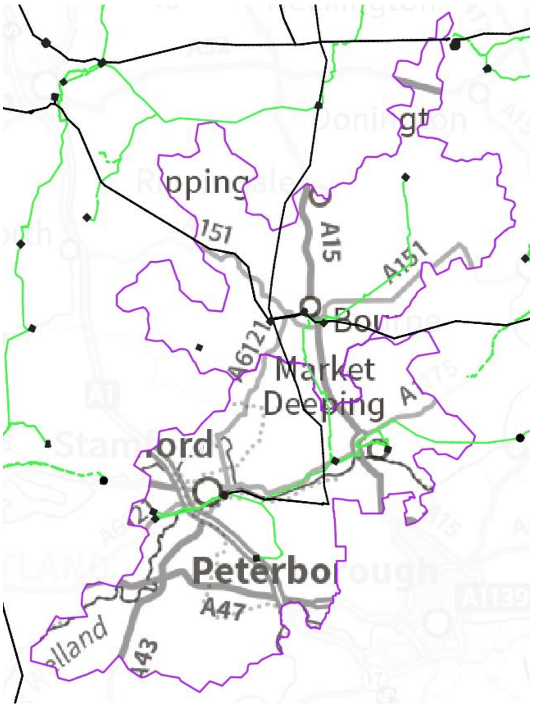

Figure 1.1 Bourne and Stamford geographic network coverage

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 Bourne and Stamford BSPs (as well as some 11 kV network relevant to the development of the 33 kV network). 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

Bourne BSP has two 33 kV busbars fed by two 132/33 kV GTs, both rated to 60/90/117 MVA. Bourne BSP feeds six primary substations: Bourne, Crowland T2, Dowsby Fen, Market Deeping T2, Tunnel Bank and West Deeping T2. Bourne primary is located at the same site as Bourne BSP.

All of the primaries fed from Bourne BSP have two 33/11 kV transformers, with the exception of Dowsby Fen, which is a single transformer primary. Bourne BSP is interconnected with Spalding BSP via Crowland primary, and with Stamford BSP via West Deeping and Market Deeping primaries.

Stamford BSP has three 33 kV busbars fed by two 132/33 kV GTs both rated to 30/60/78 MVA. Stamford BSP feeds six primary substations: Ketton Cement, Market Deeping T1, Stamford, Tinwell Road, West Deeping T1 and Wittering. Stamford primary is located at the same site as Stamford BSP. Market Deeping, West Deeping and Stamford primaries each have two 33/11 kV transformers, Tinwell Road and Wittering each have one and Ketton Cement has three.

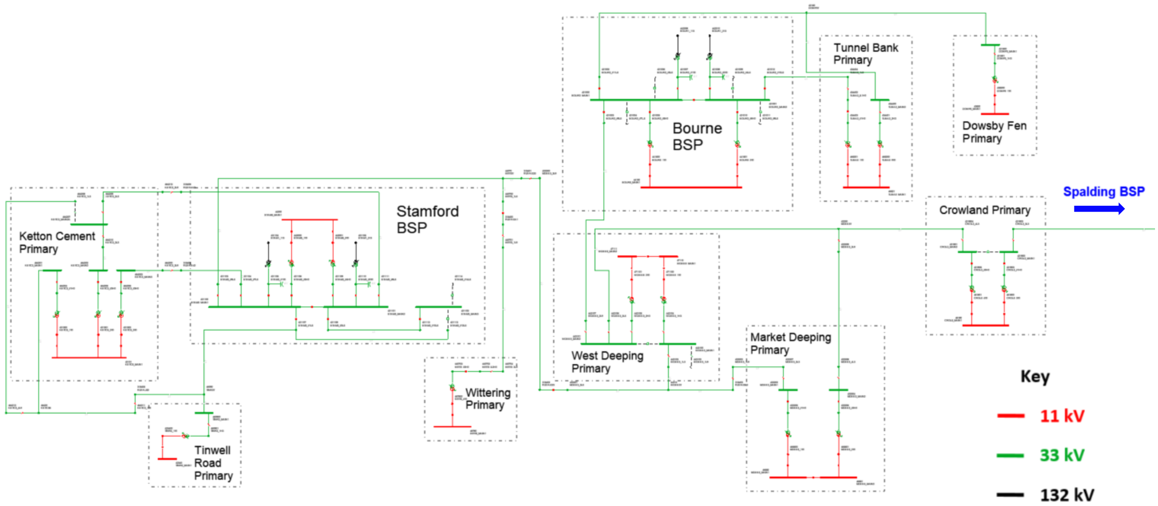

Figure 1.1.1 Bourne and Stamford 33 kV network single line diagram

1.2 Network Operability Modelling

The following network automation and manual switching schemes have been modelled in the analysis of this area, aligning to how the network is currently operated, as well as proposed actions to manage some constraints identified operationally or to account for proposed network changes.

- For the loss of an infeed to a transformer at any of the primaries fed from Bourne or Stamford BSPs under arranged outages, the lower voltage side circuit breaker is opened to prevent back-energisation.
- The 33 kV networks downstream of Bourne and Stamford BSPs are split for arranged outages on their respective 33 kV bus section breakers to prevent loose couples. The same is done for Bourne for an arranged outage on the 132 kV bus section breaker. This involves splitting Bourne, Tunnel Bank, Market Deeping and Crowland primaries at 11 kV for Bourne and splitting Stamford, Ketton Cement, Market Deeping and West Deeping primaries at 11 kV for Stamford.
- For an arranged outage on either infeed to Bourne or Stamford BSPs, the loose couples between the two BSPs are split (at 11 kV at Market Deeping and West Deeping primaries).
- For an arranged outage on either infeed to Bourne BSP, the loose couple with Spalding is split (at 11 kV at Crowland primary).
- For an arranged outage on the main 1 33 kV busbar at Stamford BSP, the supply to Tinwell Road primary can be maintained at 33 kV via the main 3 33 kV busbar at Stamford BSP (by closing the normal open point there). This would need to be done by manual switching.
- For an arranged outage on the 33 kV infeed to, or the 33/11 kV transformer at Tinwell Road primary, the load is transferred on the 11 kV network to Corby and Stamford primaries.
- For an arranged outage on the 33 kV infeed to, or the 33/11 kV transformer at Wittering primary, the load is transferred on the 11 kV network to Stamford primary.
- For an arranged outage on the 33 kV infeed to, or the 33/11 kV transformer at Dowsby Fen primary, the load is transferred on the 11 kV network to Billingborough, Tunnel Bank and Spalding Park Road primaries.
- In future year studies, different splits are modelled at Market Deeping and West Deeping primaries for outages on the infeeds from Bourne and Spalding BSPs (including splitting at the 11 kV bus section and/or splitting at T1 for either or both primaries).

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 seen on the GTs at Stamford BSP by 2034 for N-1 fault and arranged outages on the other GT. Some arranged and N-2 constraints exacerbate these overloads but can be managed operationally.
- Overloads are seen on the transformers at Stamford primary for outages which necessitate backfeeding Wittering at 11 kV, and from 2028 for N-1 outages at the primary.
- For N-2 outages on two of the 33 kV infeeds to West Deeping, Market Deeping, Wittering, Whaplode Drove and Crowland primaries, overloads are observed on the circuit from Stamford to Market Deeping and the circuit to West Deeping primary.
- A significant amount of hydrogen electrolysis is forecast to connect to the network around Stamford BSP (most of which is expected to connect between 2026 and 2035). This will necessitate upgrades to the existing network or a new substation being built.

2.2 Stamford BSP GT 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
Stamford GT1 or GT2 overload	Fault or arranged outage on either GT at Stamford	None	2034	2034	2034	2034
Stamford GT1 or GT2 overload	Arranged 33 kV main 1 busbar outage at Bourne BSP	Fault on either GT at Stamford	2028	Baseline	2028	2028

Uncertainty under other Distribution Future Energy Scenarios: This constraint is exacerbated most significantly under the Leading the Way scenario. Under all scenarios overloads are observed for N-2 constraints if no operational mitigations are employed. The only scenario under which N-1 constraints are not observed by 2034 is 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 the GTs at Stamford BSP.
2	Install a third GT at Stamford BSP.
3	Install two 132/11 kV GTs at Stamford BSP.
Operational Mitigation	
4	Various operational mitigations.
Flexibility Services	
5	Procure flexibility under Stamford BSP.

Solution Development

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

Option 1 – Uprate the GTs at Stamford BSP

Viable

Capacity released for constraint(s) considered: 33 MVA

New limiting factor for constraint(s) considered: 132 kV infeed circuits

Detailed description: Uprating the 132/33 kV GTs at Stamford BSP to 60/90/117 MVA units would release significant demand and generation capacity at the BSP and resolve this constraint. Long term demand forecasts indicate this new capacity will be well utilised. The 33 kV switchboard would also need to be replaced as part of these works. This would also benefit the condition of the GTs, as the existing units are over 50 years old.

Option 2 – Install a third GT at Stamford BSP

Discounted

Capacity released for constraint(s) considered: 33 MVA

New limiting factor for constraint(s) considered: 132 kV infeed circuits

Detailed description: Installing a third GT at Stamford BSP would free up significant GT capacity and would resolve this constraint. This would require the main 3 (33 kV) busbar to be replaced with a full sized board. This would create space for additional feeders and would facilitate a third transformer at Stamford primary, as discussed in Section 2.3 of this report. This solution is likely not feasible due to space constraints at Stamford BSP.

Even if space were available at Stamford BSP, a third GT would also create additional operational complexity, as the network would need to be split for arranged outages on any GT to prevent overloads. This would also require the load to be appropriately split across the three 33 kV busbars to be able to fully utilise the capacity created by the new GT. Another disadvantage of this option is that the existing GTs would need to be replaced based on their condition at some point in the foreseeable future, making this solution significantly more expensive than option 1 overall (and only providing the same amount of capacity unless additional 132 kV works are carried out).

Option 3 – Install two 132/11 kV GTs at Stamford BSP

Discounted

Capacity released for constraint(s) considered: The demand of Stamford primary

New limiting factor for constraint(s) considered: Rating of existing 132/33 kV GTs

Detailed description: In this option, two 132/11 kV GTs would be installed at Stamford BSP, replacing the existing primary transformers. This would remove the 11 kV load at Stamford from the 132/33 kV GTs and alleviate this constraint in the short to medium term, and would also alleviate the constraint seen on the primary transformers at Stamford discussed in Section 2.3 of this report. This solution is likely not feasible due to space constraints at Stamford BSP.

Even if space were available at Stamford BSP, this option would be discounted as the 11 kV demand at Stamford is not projected to increase to high enough levels to warrant this level of investment. Additionally, this option does not free up as much capacity on the 132/33 kV GTs, as the other two reinforcement options discussed (despite likely being significantly more expensive than uprating the existing GTs as discussed in option 1), and the 132/33 kV GTs would require replacement at some point in the foreseeable future based on their condition regardless.

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 mitigations which have been considered, some of which could defer this constraint:

- Review seasonal ratings: as this constraint is only present in intermediate cool in the baseline (the ratings for which may be overly pessimistic as they align to the summer rating), an internal review of transformer seasonal ratings may conclude that this constraint is not present in the short term.
- Restrict outage seasons: as this constraint is only present in the baseline for N-2 outages at intermediate cool peak demand, restricting outage seasons to any of the other three seasons would mitigate this constraint in the short term.

- Alternative running arrangements: up to 2028, the only overloads observed are for outages where additional demand from West Deeping and Market Deeping primaries is picked up by Stamford BSP. By splitting either (or both) primaries at 11 kV, or feeding them fully from outside of Stamford during arranged outages, these overloads can be avoided. Not all outages permit the demands of both primaries to be fed from outside of Stamford. For example, for a main 2 outage at West Deeping, the entire primary has to be fed from Stamford. Another option for alleviating the N-2 constraints is to split Stamford BSP for any arranged outages, which push additional demand into the group (but this would reduce security of supply).

The operational mitigations discussed above should be sufficient to manage the N-2 constraints observed at Stamford BSP but will not be of any benefit for the N-1 fault outages seen by 2034.

Option 5 – Procure flexibility under Stamford BSP

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 GTs at Stamford BSP. This flexibility could be utilised alongside some of the operational mitigations discussed above if necessary. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

A number of mitigations have been identified to manage the projected overloads for N-2 constraints where additional load from West Deeping and Market Deeping primaries is seen at Stamford, including reviewing seasonal ratings, restricting outage seasons and utilising alternative running arrangements. These options will not be able to manage this constraint once N-1 faults are observed, at which point reinforcement will be required.

Of the three reinforcement solutions discussed, uprating the existing GTs (and the 33 kV switchboard) at Stamford BSP is likely to be the most cost effective for the capacity released. However, the optimal solution may be dependent on synergies with the options considered for the primary transformers in Section 2.3 of this report and the overall strategy for the 132 kV network discussed in the Walpole 132 kV report.

2.3 Stamford 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
Stamford T4 overload	Stamford main 1 arranged outage	None	Baseline	Baseline	Baseline	2028
Stamford T3 or T4 overload	Arranged outage on the infeed to Wittering primary	Stamford T4 or T3 fault	2028	Baseline	Baseline	2028
Stamford T3 or T4 overload	Arranged or fault outage on either transformer at Stamford primary	None	2034	2034	2034	-

Uncertainty under other Distribution Future Energy Scenarios: As this constraint is present in the baseline intervention is required regardless of scenario. Under Falling Short no overloads are observed for N-1 outages at Stamford primary in 2034 (under which Wittering is not backfed at 11 kV).

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 Stamford primary.
2	Install a third transformer at Stamford primary.
3	Build a Stamford North primary.
4	Install a second transformer and 33 kV circuit to Wittering primary.
5	Install 132/11 kV GTs at Stamford BSP.
6	Move the 33 kV circuit to Wittering primary to the main 3 busbar at Stamford BSP.
Operational Mitigation	
7	Restrict outage seasons.
8	11 kV Operational Mitigations.
Flexibility Services	
9	Procure flexibility under Stamford and Wittering 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 – Uprate the transformers at Stamford primary

Viable

Capacity released for constraint(s) considered: 15 MVA

New limiting factor for constraint(s) considered: Capacity at Wittering primary

Detailed description: Uprating the 33/11 kV transformers at Stamford primary to 20/40 MVA units would alleviate this constraint for all seasons and for all of the outage combinations outlined above in 2034. The new limiting factor for Wittering primary would become the 11 kV backfeed capacity to Stamford, which would also require intervention, as discussed in option 4 below.

Option 2 – Install a third transformer at Stamford primary

Viable

Capacity released for constraint(s) considered: 24 MVA

New limiting factor for constraint(s) considered: Capacity at Wittering primary

Detailed description: Installing a third primary transformer at Stamford would alleviate this constraint for all seasons and outage combinations in 2034 as in option 1. This third primary transformer would need to be connected to a different 33 kV busbar than the existing two transformers (otherwise two transformers could be lost for an outage on a single busbar), which would necessitate the installation of a full sized third 33 kV busbar to replace the existing main 3.

Replacing the main 3 busbar at Stamford BSP would be a significant expense, but would also facilitate the installation of a third GT at Stamford. This option therefore needs to be considered in conjunction with the options for resolving the GT constraints at Stamford BSP discussed in Section 2.2 of this report.

One disadvantage of creating a three transformer primary is that it presents additional network operability issues (such as needing to split the 11 kV network for an arranged outage on any transformer/circuit).

Option 3 – Build a Stamford North primary

Viable

Capacity released for constraint(s) considered: 23 MVA

New limiting factor for constraint(s) considered: Capacity at Wittering primary

Detailed description: There is a significant load centre to the north of Stamford BSP. Building a new primary to the north would alleviate the constraints seen on the transformers at Stamford primary, as a significant portion of the load could be transferred to this new primary.

This option would be more expensive than upgrading Stamford primary itself, as discussed in options 1 and 2, but would confer additional network benefits. Firstly, it would obviate the need for additional 11 kV circuits from Stamford BSP north, which would be required if a new primary were not built. Secondly, it would increase network security compared to having all of Stamford supplied by a single primary as it currently is.

Building Stamford North primary would require additional 33 kV feeders from Stamford BSP which would necessitate the replacement of the existing 33 kV board at Stamford. This would incur additional cost but there are a number of other triggers for this work regardless, including the condition of the existing 33 kV assets.

Option 4 – Install a second transformer and 33 kV circuit to Wittering primary

Viable

Capacity released for constraint(s) considered: The demand of Wittering primary

New limiting factor for constraint(s) considered: Stamford primary transformer ratings for N-1 constraints

Detailed description: Installing a second transformer and 33 kV circuit to Wittering primary would alleviate this constraint in the short term, as Wittering would no longer rely on 11 kV backfeeds to Stamford primary under outages. This option would also resolve the forecast constraints on the 11 kV backfeeds to Wittering which are forecast to be insufficient in the near future.

This option is significantly more expensive than upgrading the 11 kV backfeeds to Wittering primary, but provides significantly more capacity and operability for the network. Additionally, if the upgrades to the 11 kV network were aimed at increasing the backfeed capacity to Stamford this would not help alleviate the constraint on the primary transformers at Stamford. The new limiting factor for Wittering with the new transformer and circuit installed will become the existing 33 kV circuit to the site, which is rated slightly lower than the 12/24 MVA transformer (but significant capacity will still be released).

Option 5 – Install 132/11 kV GTs at Stamford BSP

Discounted

Capacity released for constraint(s) considered: Up to 55 MVA

New limiting factor for constraint(s) considered: Capacity at Wittering primary

Detailed description: Installing two 132/11 kV GTs at Stamford BSP and transferring the 11 kV demand at Stamford to these new GTs would alleviate the constraints on the 33/11 kV primary transformers. These transformers could then be redeployed elsewhere on the network. This solution would also help alleviate the constraints on the 132/33 kV GTs discussed in Section 2.2 of this report.

The viability of this option is dependent on sufficient space being available at Stamford BSP. The forecast load growth on the Stamford 11 kV network does not currently warrant this level of investment, as the cheaper options discussed in options 1, 2 and 3 all provide sufficient capacity.

Option 6 – Move the 33 kV circuit to Wittering primary to the main 3 busbar at Stamford BSP

Viable

Capacity released for constraint(s) considered: Minimal (unless used in conjunction with other options discussed)

New limiting factor for constraint(s) considered: Stamford primary capacity for N-2 outages

Detailed description: By moving the 33 kV circuit to Wittering primary to the main 3 busbar at Stamford BSP, Wittering primary would not need to be backfed at 11 kV for outages on the Stamford main 1 busbar. This would alleviate the constraint for that particular outage combination, but would not resolve the N-2 and N-1 constraints forecast. This option alone is therefore insufficient to manage these constraints.

Option 7 – Restrict outage seasons

Viable

Capacity released for constraint(s) considered: The demand of Wittering primary

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

Detailed description: As this constraint is only present for arranged outages in the baseline, restricting outage seasons could help to alleviate this constraint. This solution is not sufficient to manage the network in the long term, as by 2028 overloads are seen in all seasons for outages where Wittering is backfed at 11 kV, and overloads for N-1 fault outages at Stamford are seen in 2034. One disadvantage of this solution is that it reduces network operability.

Option 8 – 11 kV Operational Mitigations

Viable

Capacity released for constraint(s) considered: Minimal (unless used in conjunction with other options discussed)

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

Detailed description: The only primary which Wittering has significant 11 kV interconnection with to be used for backfeeding during outages is Stamford. Any demand transfers between these two primaries (either temporary or permanent) will not help alleviate this constraint as the demand will still all be supplied by Stamford primary for the outages outlined above. Some 11 kV transfers out of Stamford to other primaries (such as Tinwell Road) may be possible but are not of sufficient magnitude to alleviate this constraint in the long term, and also introduce additional operational complexity and reduced network security.

Splitting the 11 kV network downstream of Stamford primary would alleviate this constraint in the short term only for the N-2 constraint of an arranged outage on an infeed to Wittering followed by a fault on a transformer at Stamford primary, but would not help alleviate the equally onerous outage of main 1 at Stamford BSP, meaning this strategy alone would be insufficient to manage the constraint.

Option 9 – Procure flexibility under Stamford and Wittering primaries

Viable

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

Detailed description: Flexibility services could be procured on the network downstream of Stamford primary to alleviate the projected overloads seen on the transformers at Stamford. Flexibility procured on the network downstream of Wittering primary could also help alleviate constraints for outage conditions where Wittering is backfed at 11 kV (but flexibility procured here would not provide any benefit for N-1 outages at Stamford primary). The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

A number of possible short term mitigations have been identified, including splitting at 11 kV, restricting outage seasons and moving the 33 kV feeder to Wittering. For moving the 33 kV feeder to Wittering a CBA will be required to determine if this strategy is able to defer the constraint for long enough to be worth the expenditure required. For the operational mitigations these can be employed at low cost.

One of uprating the primary transformers, adding a third transformer or building a new primary is likely the optimal long term solution for the constraint at Stamford (which solution is taken forward will be subject to further 11 kV studies and a full CBA, as a new primary confers the most network benefit but would also be the most expensive option). These options will need to be considered alongside the possible solutions to the GT constraints discussed in Section 2.2 of this report. As these solutions will not address the constraint expected at Wittering (running out of 11 kV backfeed capacity), adding a second transformer and circuit to the primary will also be required. The phasing of the works at Stamford and Wittering should be considered as part of the CBA as the reinforcement of Wittering would defer the need for reinforcement of Stamford primary (as discussed above).

2.4 33 kV Circuits to Market Deeping and West Deeping Overloads

Constraint Overview

Generation | **Demand**

The table below outlines the nature of the network constraints identified in the network analysis. Studies have also identified significant voltage constraints for some outage conditions. These have been excluded as the thermal constraints observed are initially more onerous and trigger intervention first, but the effect on the voltages seen on the network have been considered for all solutions discussed.

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
Stamford – Wittering Tee 33 kV circuit overload	Arranged outage on the infeed to Crowland primary from Spalding BSP	Fault on the Bourne – West Deeping 33 kV circuit	2028	2028	2028	2028
Bourne – West Deeping 33 kV circuit overload	Arranged outage on the infeed to Crowland primary from Spalding BSP	Fault on the Stamford – West Deeping 33 kV circuit	2028	2028	2028	2034

Uncertainty under other Distribution Future Energy Scenarios: These constraints are exacerbated most significantly under the higher growth scenarios (Leading the Way and Consumer Transformation). Under these scenarios the operational mitigations discussed below become insufficient to manage the constraints sooner and reinforcement is consequently triggered earlier. Demand growth is forecast to be slowest under Falling Short, but intervention is still required before 2034 based on the growth in this 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 circuits to Market Deeping and West Deeping primaries.
2	Build a new primary substation.
Operational Mitigation	
3	Restrict outage seasons.
4	Alternative running arrangements.
Flexibility Services	
5	Procure flexibility under various 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 – Uprate the 33 kV circuits to Market Deeping and West Deeping primaries

Viable

Capacity released for constraint(s) considered:

New limiting factor for constraint(s) considered: Market Deeping Tee – Crowland primary 33 kV circuit thermal rating, network voltages and firm capacities at each primary

Detailed description: Uprating the 33 kV circuit from Stamford BSP to West Deeping primary, and the 33 kV circuit from Bourne to West Deeping primary, would alleviate this constraint and provide additional capacity for this group of primaries. For the 33 kV circuit from Stamford to West Deeping, a new circuit is being laid, which will replace the existing one.

This has two additional benefits; firstly it will allow the 33 kV overhead line between the Wittering Tee and West Deeping to be decommissioned as its condition is deteriorating, and secondly, it will allow the existing circuit to the Wittering Tee to be utilised as a dedicated feeder to Wittering primary. This will free up circuit capacity to Wittering primary and facilitate the future upgrade of Wittering by adding a second transformer and 33 kV infeed (as discussed as in Section 2.2 of this report).

Option 2 – Build a new primary substation

Discounted

Capacity released for constraint(s) considered: Up to 40 MVA

New limiting factor for constraint(s) considered: Capacity of the 11 kV network to transfer demand into the new primary substation

Detailed description: Building a new primary substation could deload the existing primaries in the area (namely Market Deeping and West Deeping) and help alleviate this constraint. This option has been discounted, as this it would be significantly more expensive than the upgrades outlined in option 1 above, and would not provide some of the benefits discussed (replacing the deteriorating 33 kV overhead line and providing a dedicated feeder for Wittering primary). The new primary would also be significantly underutilised, as the load growth at West Deeping and Market Deeping primaries is not forecast to be high enough to warrant such an investment.

Option 3 – Restrict outage seasons

Viable

Capacity released for constraint(s) considered: Dependent on seasonal loadings

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

Detailed description: As these constraints are only present for N-2 scenarios, restricting outage seasons could be used to alleviate this constraint in the short term. However, by 2028 for the Stamford – Wittering Tee circuit and by 2034 for the Bourne – West Deeping circuit, overloads are observed in every season. This solution is therefore only viable in the short term, and it also reduces network operability for this group of primaries.

Option 4 – Alternative running arrangements

Viable

Capacity released for constraint(s) considered: Half or all of the demand of Market Deeping and West Deeping primaries depending on the outage condition

New limiting factor for constraint(s) considered: 33 kV circuits to Crowland primary ratings

Detailed description: By splitting the network in this group of primaries during arranged outages (namely at West Deeping and Market Deeping primaries), overloads can be prevented for subsequent faults. This strategy could be effective in the short term (especially for splits where additional demand can be picked up by the highly rated circuit from Spalding BSP), and could be used in conjunction with the restriction of outage seasons as described in option 3 above.

This option carries a number of disadvantages which make it unsuitable to manage these constraints in the long term. Firstly, splitting the network in this way reduces network security, as load would be lost for subsequent faults. Secondly, certain splits shift the limiting factor to the circuits either side of Crowland primary. Thirdly, this option does not confer the benefits to the network discussed in option 1 for Wittering primary and the condition of the circuit to West Deeping primary. Even ignoring these drawbacks, the network could not be managed in this way ad infinitum as between 2028 and 2034 network loading is projected to increase to a level which will make any network splits untenable and reinforcement unavoidable.

Option 5 – Procure flexibility under various primaries

Discounted

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

Detailed description: Flexibility services could be procured on the network downstream of Market Deeping, West Deeping, Crowland, Whaplode Drove and Wittering primaries to help manage the constraints discussed. However, flexibility is likely not a viable long term solution for deferring reinforcement as severe voltage constraints are forecast to arise in 2028 and beyond. Additionally, flexibility will not be able to address any condition related issues with the 33 kV overhead lines. The complexity of these constraints also makes flexibility less viable, but the use of flexibility will still be investigated in more detail as part of the DNOA process.

Solution Recommendation

A number of possible mitigations have been identified which could be used to manage these constraints in the short term, including restricting outage seasons and utilising alternative running arrangements. In the longer term the optimal reinforcement solution identified is to uprate the 33 kV circuits to Market Deeping and West Deeping primaries. In the case of the circuit from Stamford BSP to West Deeping primary, a new circuit is being installed which will confer additional network benefits which are discussed above.

2.5 Stamford 33 kV Hydrogen Electrolysis

Constraint Overview

Generation | **Demand**

The table below summarises the scale of the hydrogen electrolysis forecast to connect to the Stamford 33 kV network up to 2034. The constraints this could cause and the network upgrades required to mitigate against them will be dependent on the geographic locations of the connecting electrolysers and their sizes.

Table 2.5.1 Total demand from hydrogen electrolysis forecast to connect to Stamford BSP

DFES Scenario	Demand			
	Baseline	**2025**	**2028**	**2034**
Best View	0 MW	0 MW	5.8 MW	11.6 MW
System Transformation	0 MW	0 MW	5.8 MW	11.6 MW
Leading the Way	0 MW	0 MW	8.0 MW	21.2 MW
Consumer Transformation	0 MW	0 MW	1.2 MW	4.5 MW
Falling Short	0 MW	0 MW	1.3 MW	3.1 MW

Uncertainty under other Distribution Future Energy Scenarios: As shown in the table above the Best View scenario is aligned to System Transformation for this area, with significantly higher hydrogen electrolysis forecast under Leading the Way and significantly lower forecast under Consumer Transformation and Falling Short.

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 existing primaries supplied from Stamford BSP.
2	Build a new primary substation.
3	Build a new 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 as part of the connections planning process.

Option 1 – Uprate the existing primaries supplied from Stamford BSP

Viable

Capacity released for constraint(s) considered: Dependent on the reinforcement strategy for each affected primary

New limiting factor for constraint(s) considered: Stamford GT capacity

Detailed description: If the forecast demand of hydrogen electrolysis is split among a high number of smaller electrolysers which are geographically dispersed within the area supplied by Stamford BSP a single point of connection would not be practical or economical. If this is the case reinforcing the existing network would be the optimal reinforcement strategy. This could involve bringing forward some of the reinforcement options discussed in each of the other sections of this report, such as uprating the primary transformers at Stamford and installing a second transformer and circuit to Wittering primary.

One other option for economically adding capacity to the Stamford network is to make Tinwell Road a two transformer primary. This option would require another 33 kV circuit to Tinwell Road from Stamford (around 5 km of circuit works subject to detailed route investigation and land rights). If the existing transformer were replaced and a new transformer installed up to 40 MVA of capacity could be made available at Tinwell Road (as the existing circuit is highly rated enough to not be the limiting factor if these works were carried out).

Option 2 – Build a new primary substation

Viable

Capacity released for constraint(s) considered: Up to 40 MVA

New limiting factor for constraint(s) considered: Stamford GT capacity

Detailed description: If the forecast demand from hydrogen electrolysis is made up of a smaller number of electrolysers which are located in close proximity to each other and not to any of the existing substations supplied from Stamford BSP then building a new primary substation may be the optimal solution to accommodate this demand.

This option would create significant additional capacity which could be further utilised to deload some of the existing primaries and alleviate or push back some of the forecast constraints at each substation. The technical and economic feasibility of such transfers would be heavily dependent on both the location of the new primary and the capacity of the existing 11 kV network.

Option 3 – Build a new BSP

Discounted

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

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

Detailed description: The forecast volume of hydrogen electrolysis located around Stamford is not of sufficient magnitude to warrant a dedicated 132 kV connection. Unless this changes and a large single hydrogen electrolysis customer wishes to connect this solution is likely to remain prohibitively expensive compared to the options discussed above which involve accommodating the electrolysers on the 33 kV and/or 11 kV networks.

Solution Recommendation

The forecast demand from hydrogen electrolysis expected to connect to the network fed from Stamford BSP is not of sufficient magnitude to trigger a dedicated 132 kV connection. Options for accommodating the demand on the 33 kV and 11 kV networks include building a new primary and fortifying the existing primaries. The optimal solution will be heavily dependent on the size and location of the electrolysers and will be considered in depth as part of NGED’s connections planning process (and in future NDP reports to consider the synergies with other constraints).

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