Brackley and Stony Stratford BSPs

Network Development Report – East Midlands

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Electricity Distribution

nationalgrid

Contents

Brackley and Stony Stratford 33 kV

1. Network Overview

Brackley Bulk Supply Point (BSP) and Stony Stratford BSP are supplied from East Claydon Grid Supply Point (GSP) in National Grid Electricity Distribution's (NGED's) East Midlands licence area.

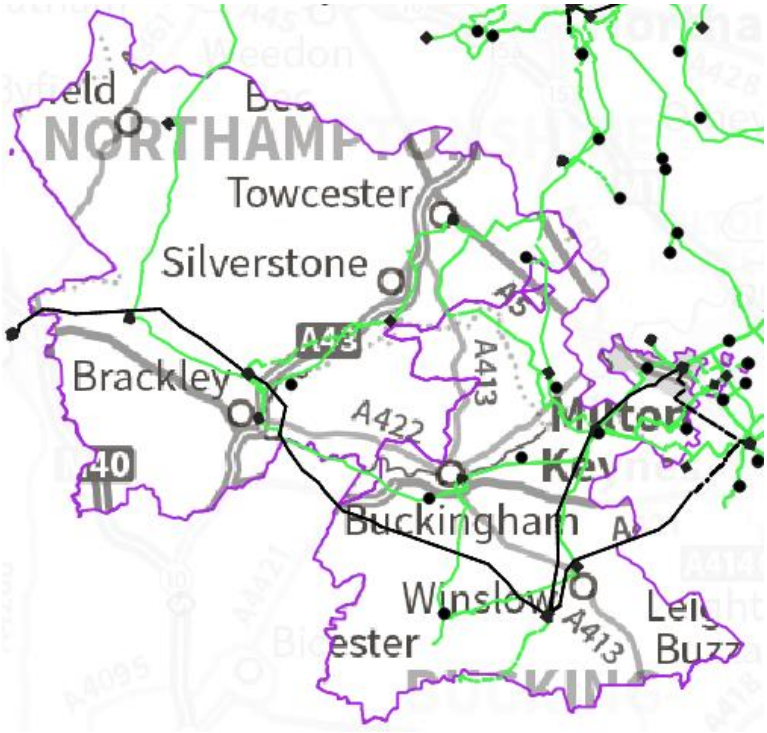

Figure 1.1 Brackley BSP and Stony Stratford BSP geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon identified on the 33 kV network supplied from Brackley BSP and Stony Stratford 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

Brackley BSP is fed from East Claydon GSP via a tee off from a 132 kV dual circuit (the CV route).

The site has two 33 kV busbars fed by two 132/33 kV Grid Transformers (GTs). Both GTs are rated to 90/117 MVA. Brackley BSP feeds five primary substations: Brackley Town, Silverstone, Thenford, Towcester and Woodford Halse. All of the primaries fed from Brackley BSP have two 33/11 kV transformers, with the exception of Towcester, which has three 33/11 kV transformers.

There is interconnection with Stony Stratford BSP and Daventry BSP. Interconnection with Stony Stratford BSP is via a loose couple at the 11 kV busbar at Towcester primary and a normally open point at Buckingham primary. Interconnection with Daventry BSP is via Woodford Halse primary, which is normally run split between Brackley BSP and Daventry BSP.

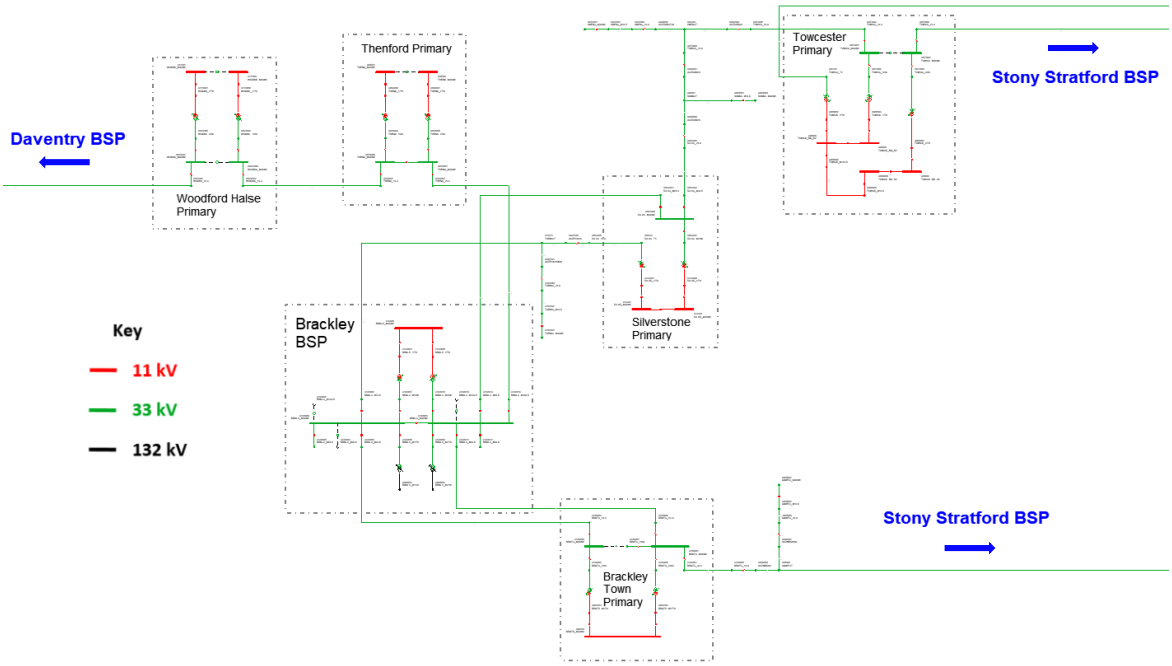

Figure 1.1.1 Brackley BSP 33 kV network single line diagram

Stony Stratford BSP is fed directly from East Claydon GSP via a 132 kV dual circuit (CJ route).

The site has two 33 kV busbars fed by two 132/33 kV GTs. Both GTs are rated to 90/114 MVA. Stony Stratford BSP feeds nine primary substations: Buckingham, Eldergate, Kiln Farm, Shenley Wood, Steeple Claydon, Tattenhoe, Towcester, Wicken and Winslow. All of the primaries fed from Stony Stratford BSP have two 33/11 kV transformers, with the exception of Towcester, which has three 33/11 kV transformers.

Stony Stratford is interconnected with Brackley BSP, Bradwell Abbey BSP, Bletchley BSP, and Northampton BSP. Interconnection with Brackley BSP is via a loose couple at the 11 kV busbar at Towcester primary and a normally open point at Buckingham primary. Interconnection with Bradwell Abbey BSP is via normally open points at Portway and Kiln Farm primaries. Interconnection with Bletchley Stratford BSP is via a loose couple at the 11 kV busbar at Tattenhoe primary and normally open points at Portway and Kiln Farm primaries. Interconnection with Northampton BSP is via a normally open point at Towcester primary.

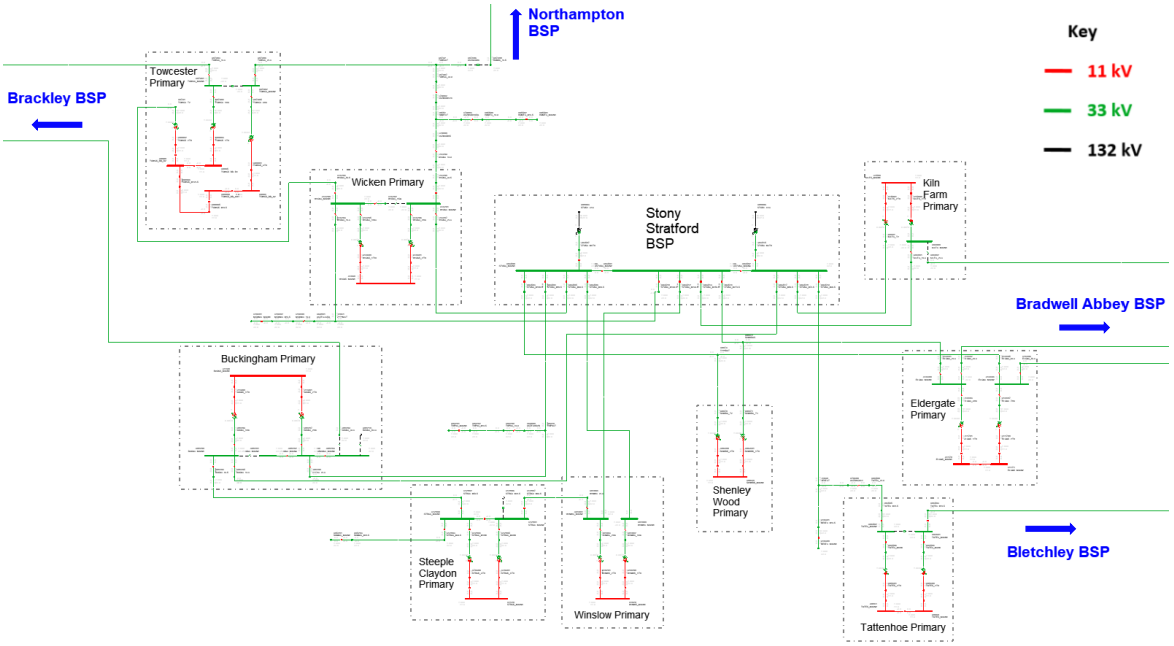

Figure 1.1.2 Stony Stratford BSP 33 kV network single line diagram

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.

- There are a number of loose couples within the Bletchley, Bradwell Abbey, Brackley and Stony Stratford BSP group. For any arranged outage affecting infeed in to any GT, loose couples are split by opening the 11 kV bus section circuit breaker at Childs Way, Fox Milne, Tattenhoe and Towcester primaries.
- For an arranged outage of the Brackley to Thenford circuit, the normally open 33 kV bus section circuit breaker is closed to transfer Thenford and Woodford Halse in to Daventry BSP.
- For an arranged outage of either infeed in to Woodford Halse, the normally open 11 kV bus section circuit breaker is closed.

2. Network Constraint Details and Solution Options

2.1 Summary of Network Constraints

The following constraints were identified for the Best View Scenario, for which mitigation options will be discussed:

- The 33 kV circuits to Towcester primary and both of its transformers are projected to overload by 2028 for arranged or fault outages on either infeed.
- For an N-1 outage on either infeed to Wicken primary the remaining transformer is projected to overload by 2028.
- Overloads are projected on the 33 kV circuits between Stony Stratford BSP and Buckingham primary for outages affecting any of the other circuits within the Buckingham – Steeple Claydon – Winslow ring.

2.2 Towcester primary transformer and 33 kV circuit overloads

Constraint Overview

Generation **Demand**

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

Table 2.2.1 constraint(s) and condition under which constraint occurs

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
Towcester primary transformers	Fault or arranged outage affecting the other transformers or infeeds	None	2028	2028	2028	2028
Towcester 33 kV circuits	Fault or arranged outage affecting the other infeeds in to Towcester	None	2028	2028	2028	2028

Uncertainty under other Distribution Future Energy Scenarios: The constraint occurs under all scenarios and seasons. Under the higher growth scenarios, Consumer Transformation and Leading the Way, it may occur sooner.

Solution Options

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

Table 2.2.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Add a fourth transformer with uprated 33 kV circuits	✓	×	✓	Viable
2	Establish a new primary substation	✓	✓	✓	Viable
Operational Mitigation					
3	Transfer demand to other primaries	×	×	✓	Discounted
Flexibility services					
4	Procure flexibility under Towcester primary	✓	×	✓	Viable

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 – Add a fourth transformer with uprated 33 kV circuits

Capacity Released for constraint(s) considered: Up to new ratings. Viable

New limiting factor for constraint(s) considered: Rating of the primary transformers

Detailed description: Install a fourth primary transformer at Towcester, along with uprating the 33 kV circuits to Towcester (Silverstone – Towcester and Wicken – Towcester).

Option 2 – Establish a new primary substation

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

Viable

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

Detailed description: Establish a new primary substation within the Towcester area, consisting of two 33/11 kV 20/40 MVA transformers and two 33 kV circuits. The new primary could be fed from Brackley BSP, Stony Stratford BSP or Northampton BSP, dependent upon available capacity and the location of new developments within the Towcester area.

Option 3 – Transfer demand to other primaries

Capacity Released for constraint(s) considered: Dependent on demand transfers.

Discounted

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

Detailed description: The potential for demand transfers have been investigated, but is unlikely to be viable, given the large amount of demand that has to be transferred to nearby primaries and their available capacities.

Option 4 – Procure flexibility under Towcester primary

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

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

Flexibility could be procured at Towcester to defer the reinforcement requirements, subject to a CBA confirmation through the DNOA process.

Establishing a new primary substation within the Towcester area has been identified as the optimum long term reinforcement solution. The timing and triggering of the new substation is dependent upon new developments materialising.

2.3 Wicken 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 condition under which constraint occurs

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
Wicken primary transformers	Fault or arranged outage affecting the other transformer or infeed	None	2028	2028	2028	2028

Uncertainty under other Distribution Future Energy Scenarios: Under the higher growth scenarios, Consumer Transformation and Leading the Way, the constraint is worse, and may occur sooner. Under the lower growth scenarios (Falling Short and System Transformation), the constraint occurs between 2034 and 2050.

Solution Options

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

Table 2.3.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Uprate both transformers at Wicken	✓	✓	✓	Viable
Operational Mitigation					
2	Transfer demand to other primaries	✓	×	✓	Viable
Flexibility services					
3	Procure flexibility under Wicken primary	✓	×	✓	Viable

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 Wicken

Capacity Released for constraint(s) considered: Up to new ratings

Viable

New limiting factor for constraint(s) considered: Rating of the primary transformers

Detailed description: Uprate both transformers at Wicken to 12/24 MVA units. This would alleviate the constraint and will provide long term capacity.

Option 2 – Transfer demand to other primaries

Capacity Released for constraint(s) considered: Dependent on demand transfers **Viable**

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

Detailed description: Transferring approximately of 3 MVA demand to another primary will alleviate constraints seen within 2028, but will not provide long term capacity. As demand keeps growing across the wider network, this option becomes less and less viable.

Option 3 – Procure flexibility under Wicken primary

Flexibility service type: Generation turn up/demand turn down **Viable**

Detailed description: Flexibility services could be procured to alleviate projected overloads. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to assess the feasibility of transferring demand from Wicken primary to other primaries via the existing 11kV circuits. If the 11kV circuits do not offer sufficient capacity then flexibility could be procured at Wicken to defer the reinforcement requirements, subject to a CBA confirmation through the DNOA process.

The uprating of both transformers at Wicken primary has been identified as the optimal long term reinforcement solution.

2.4 Stony Stratford BSP – Buckingham 33 kV circuit 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 condition under which constraint occurs

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
Stony Stratford BSP – Buckingham 33 kV circuit overloads	Fault or arranged outage affecting the other circuits within the Buckingham – Steeple Claydon – Winslow ring	None	-	2034	2034	-

Uncertainty under other Distribution Future Energy Scenarios: Under the higher growth scenarios, Consumer Transformation and Leading the Way, the constraint is worse, and may occur sooner.

Solution Options

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

Table 2.4.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Uprate the existing 33 kV circuits	✓	✓	✓	Viable
Operational Mitigation					
2	Transfer demand to other primaries	✓	×	✓	Viable
Flexibility services					
3	Procure flexibility under Buckingham primary	✓	×	✓	Viable

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 existing 33 kV circuits

Capacity Released for constraint(s) considered: Dependent on new circuit rating ⬆ Viable

New limiting factor for constraint(s) considered: Rating of the primary transformers

Detailed description: Uprate the existing Stony Stratford – Buckingham 33 kV circuits. This will involve reconductoring the existing 0.15 in^2 All Aluminium Alloy conductor (AAAC) H-pole double circuit with a larger conductor. To cater for long term growth, a circuit rating approaching 50 MVA should be considered.

Option 2 – Transfer demand to other primaries

Capacity Released for constraint(s) considered: Dependent on demand transfers **Viable**

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

Detailed description: Transferring approximately of 2 MVA demand to another primary will alleviate constraint, but will not provide long term capacity. As demand keeps growing across the wider network, this option becomes less and less viable.

Option 3 – Procure flexibility under the Buckingham primary

Flexibility service type: Generation turn up/demand turn down **Viable**

Detailed description: Flexibility services could be procured to alleviate projected overloads. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to assess the feasibility of transferring demand from Buckingham primary to other primaries via the existing 11kV circuits. If the 11kV circuits do not offer sufficient capacity then flexibility could be procured at Buckingham to defer the reinforcement requirements, subject to a CBA confirmation through the DNOA process.

The uprating of the Stony Stratford BSP – Buckingham 33 kV circuit has been identified as the optimal long term reinforcement solution.

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