# Nechells East GSP Network

Network Development Report – West Midlands

**May 2024**

Electricity Distribution

nationalgrid

# Contents

# Nechells East GSP Network

## 1. Network Overview

Nechells East is a 132 kV Grid Supply Point (GSP) that supplies the North Eastern parts of Birmingham, connecting over 139,000 customers. The network comprises of several 132 kV circuits distributed across the region, connecting ten Bulk Supply Points (BSPs) supplying the local demand within these areas.

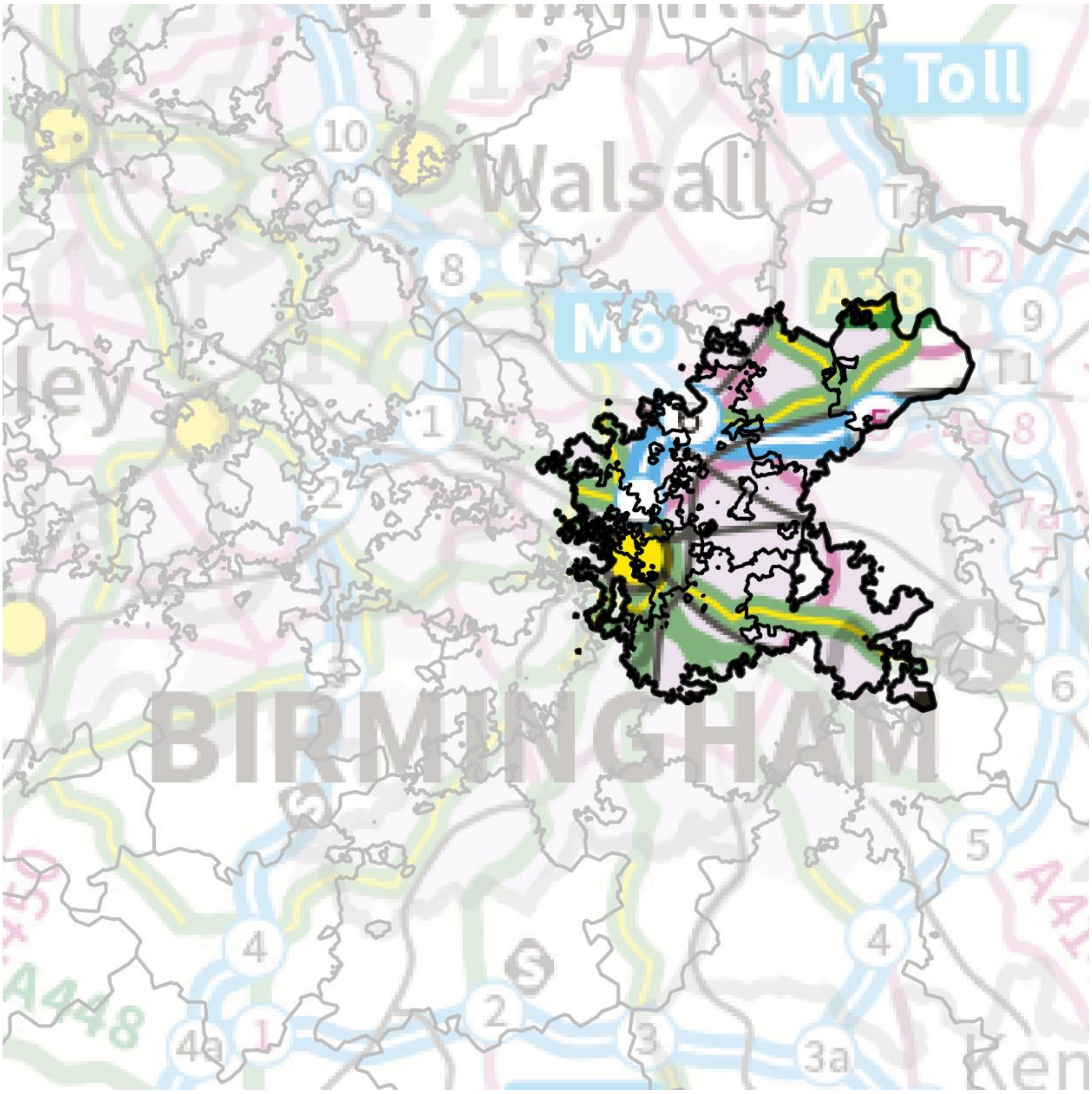


*Figure 1.1 Nechells East GSP geographic network coverage*

This report discusses existing and future network constraints over a 0-10 year horizon associated with Nechells East GSP and its downstream network. It uses the methodology outlined in the Network Development Plan Methodology Report with Network Operability Modelling applied as outlined further below.

For the purposes of this analysis the NGED Best View Distribution Future Energy Scenario (DFES) has been used to study each year up to and including 2034. Representative days for each of the four seasons (Winter, Intermediate Cool, Intermediate Warm, and Summer) have been studied to cover the edge case scenarios for the network.

## 1.1 Network Topology

Nechells East GSP is a 275/132 kV site fed via four 240 MVA Super Grid Transformers (SGTs), normally running 2+2 split through a two section 132 kV double busbar configuration. The GSP supplies ten 132/11 kV BSPs and a 132/25 kV site. The 132/11 kV BSPs supply the local demands within the region, and are listed below.

- Nechells West BSP consisting of three three-winding 132/11/11 kV transformers fed via three 132 kV circuits from the GSP. The transformers are connected to seven sections of 11 kV busbars, and normally run split with each other.
- Chester Street BSP consisting of three 132/11 kV transformers fed via a direct 132 kV circuits from the GSP, and another via Summer Lane BSP. The transformers are connected to six sections of 11 kV busbars, and normally run split with each other.
- Hockley BSP consisting of two three-winding 132/11/11 kV transformers fed via a direct 132 kV circuits from the GSP, and another via Summer Lane BSP. The transformers are connected to four sections of 11 kV busbars, and normally run split with each other.
- Summer Lane BSP consisting of three 132/11 kV transformers fed via two direct 132 kV circuits from the GSP, and another via Hockley BSP. The transformers are connected to six sections of 11 kV busbars, and normally run split with each other.
- Bordesley BSP consisting of two three-winding 132/11/11 kV transformers fed via two 132 kV circuits. The transformers are connected to seven sections of 11 kV busbars, and normally run split with each other.
- Cheapside BSP consisting of two three-winding 132/11/11 kV transformers fed via two 132 kV circuits. The transformers are connected to four 11 kV double busbars, and normally run split with each other.
- Sparkbrook BSP consisting of two three-winding 132/11/11 kV transformers fed via two 132 kV circuits. The transformers are connected to four 11 kV double busbars, and normally run split with each other.
- Boughton Road BSP consisting of two three-winding 132/11/11 kV transformers fed via two 132 kV circuits; one from the Nechells East network and another from Lea Marston GSP, normally run split at 132 kV. The transformers are connected to four sections of 11 kV busbars, and normally run split with each other.
- Erdington BSP consisting of two three-winding 132/11/11 kV transformers fed via two 132 kV circuits. The transformers are connected to seven sections of 11 kV busbars, and normally run split with each other.
- Castle Bromwich BSP consisting of two three-winding 132/11/11 kV transformers fed via two 132 kV circuits; one from the Nechells East network (via Erdington BSP) and another from Lea Marston GSP, normally run split at 132 kV. The transformers are connected to six sections of 11 kV busbars, and normally run split with each other.

## 1.2 Network Operability Modelling

The analysis modelling covers automation and manual switching schemes that represent how the network is generally operated. Some of the main ones are listed below.

**Nechells East 132 kV:**

- The GSP includes an automation scheme to close in CB120 during outages that take out both SGTs connected to sections Main 2 / Reserve 2 busbars (i.e. an arranged outage on one followed by a fault outage on another)
- An arranged outage on either of the SGTs on Main 1 / Reserve 1 busbars results in CB120 being closed in to parallel all three SGTs.
- Arranged or fault outages leading to loss of a Grid Transformer (GT) at any of the 132/11 kV BSPs within Nechells East GSP network results in the 11 kV being closed in (and reconfigured in some cases) to backfeed the demand.

# 2. Summary of Network Constraints

The following constraint has been identified for the Best View Scenario, for which mitigation options are covered further down in the report:

- Nechells East to Cheapside/Sparkbrook tee circuit overload

# 3. Network Constraints and Solution Options

## 3.1 Nechells East to Cheapside/Sparkbrook tee circuit overload

### Constraint Overview

Generation **Demand**

The 132 kV circuit between Nechells East GSP and Cheapside/Sparkbrook tee normally picks up about half of Cheapside BSP demand, and part of Sparkbrook and Boughton Road BSPs.

During an arranged outage affecting the 132 kV infeeds to Kitts Green BSP from the Lea Marston GSP network, Kitts Green's 132 kV busbars are run split and the 132 kV bus-section circuit breaker at Boughton Road is closed in. This adds a substantial level of demand on the Nechells East-Cheapside/Sparkbrook tee circuit potentially causing it to thermally overload.

The group supplied via this circuit is Class D under Engineering Recommendation P2.

The table below outlines the constraints identified for Best View, the conditions they occur under, and the triggering year per season.

*Table 3.1.1 overview of constraint*

| Constraint | Condition | Trigger year per season | | | |
|---|---|---|---|---|---|
| | | Winter | Inter Cool | Inter Warm | Summer |
| Nechells East to Cheapside/Sparkbrook tee circuit overload | N-1: Arranged outages of the infeeds to Kitts Green (from Lea Marston network) resulting in demand transfer to the circuit from Nechells East.<br>N-2: The arranged outage above followed by a fault outage of the Nechells East-Sparkbrook 132 kV circuit. | 2034 | 2032 | - | - |

**Uncertainty under other Distribution Future Energy Scenarios:** The constraints above are identified under Best View and worsened under some of the other Distribution Future Energy Scenarios. The demand in the region is generally on an upward trend indicating constraints are potentially getting worse if not addressed, but the trigger year may vary depending on how quickly demand and/or generation materialises.

## Solution Options

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

*Table 3.1.2 solution options to identified constraint(s)*

| Option | Description | Solves constraint | Potentially economic | Wider benefit | Viable or Discounted |
|---|---|---|---|---|---|
| 1 | No Intervention | × | ✓ | × | Discounted |
| **Reinforcement (build) options** | | | | | |
| 2 | Reinforcing the existing 132 kV circuit | ✓ | ✓ | × | Viable |
| 3 | Installing a new circuit from Nechells East | ✓ | ✓ | × | Viable |
| **Operational Mitigation** | | | | | |
| 4 | Restricted outage window | ✓ | ✓ | × | Viable |
| **Load Management Schemes** | | | | | |
| 5 | Post-fault inter-trips | × | ✓ | × | Discounted |
| **Flexibility services** | | | | | |
| 6 | Flexibility service procurement | ✓ | ✓ | × | Viable |

## Solution Development

These options have been assessed on their technical viability and cost-effectiveness pending a more detailed cost benefit analysis (CBA) by the DNO. The section below covers more detail on these options.

### Option 1 – No Intervention

**Estimated capacity released:** 0 MVA **Discounted**

**Detailed description:** The constraint is anticipated to trigger by 2032 with the demand projected to continue increasing thereafter. Doing nothing could therefore lead to thermal overloads, as described above, and to the inability to meet security of supply compliance with Engineering Recommendation P2.

**New limiting factor:** Rating of the 132 kV circuit

### Option 2 – Reinforcing the existing 132 kV circuit

**Estimated capacity released:** 35 MVA **Viable**

**Detailed description:** Uprating the existing 132 kV circuit between Nechells East and Cheapside/Sparkbrook tee (Adderley Park); the works include:

- Replacing approximately 800 metres of 0.5 in copper oil filled cable
- Replacing approximately 500 metres of 630 mm copper 3-core cable

Both of the above are to be replaced with a circuit rated over 200 MVA summer cyclic which is anticipated to require a minimum of 1000 mm copper cable

**New limiting factor:** Rating of the 132 kV circuit

## Option 3 – Installing a new circuit from Nechells East

**Estimated capacity released:** 140 MVA — Viable

**Detailed description:** Adding an additional feeder into the group, the works involve:

- Establishing a new 132 kV bay at Nechells East GSP
- Installing a new 5 km 132 kV circuit between Nechells East and Sparkbrook/Cheapside tee, to unstitch it

**New limiting factor:** Rating of the 132 kV circuit

## Option 4 – Operational mitigation: Restricted outage window

**Estimated capacity released:** 0 MVA — Viable

**Detailed description:** The constraints are only present under an arranged outage (for N-1), or and arranged outage followed by a fault outage (for N-2), therefore two mitigation measures are possible:

- Restricting the arranged outages to the summer and intermediate warm months only since the constraints so for only appear in the winter and intermediate cool seasons, or
- Transferring sufficient demand out of the group during the arranged (via Cheapside and/or Kitts Green).

**New limiting factor:** Rating of the 132 kV circuit

## Option 5 – Load Management Schemes: Post-fault inter-trips

**Estimated capacity released:** 0 MVA — Discounted

**Detailed description:** The group is Class D under Engineering Recommendation P2 which, for a first circuit outage, would require immediate restoration of the demand minus 20 MW, and full group demand within 3 hours; therefore demand disconnection schemes (or similar) could make the site non-compliant.

**New limiting factor:** Engineering Recommendation P2 non-compliance

## Option 6 – Flexibility service procurement

**Estimated Flexibility Required (MW):** 6 MW+ — Viable

**Detailed description:** Flexibility services through generation turn up and/or demand turn down could be procured to help alleviate the constraint and defer reinforcement. This option would be subject to a cost benefit analysis closer to the time, including all necessary sufficiency checks.

**New limiting factor:** Rating of the 132 kV circuit

## Solution Recommendation

It would be recommended to pursue option 4 above (operational mitigation) as it is likely to be the most economical solution and would allow for better utilisation of the existing assets.

Longer term, and where outage window restrictions become unfeasible and transfer capacity becomes limited, then option 2 above (uprating the existing circuit) could be the next viable reinforcement option.

Any reinforcement solution however would be subject to a CBA by the DNO, and in this case, it may be tested against the flexibility market as part of the Distribution Network Options Assessment (DNOA) process. The flexibility option however, although may be technically viable, is not likely to be as cost-effective as the operational mitigation option.