



The East Midlands

Network Development Report – East Midlands

May 2024

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East Midlands

1. Network Overview

The East Midlands is one of the four licence areas which National Grid Electricity Distribution (NGED) owns and operates as a Distribution Network Operator (DNO). There are fourteen Grid Supply Points (GSPs) within the East Midlands: Berkswell, Bicker Fen, Chesterfield, Coventry, Drakelow, East Claydon, Enderby, Grendon, Ratcliffe, Staythorpe, Stoke Bardolph, Walpole, West Burton and Willington.

The East Midlands licence area covers approximately 16,000 square kilometres and extends from Coventry and Uttoxeter in the west, to the Wash on the East Coast and from the outskirts of Sheffield in the north to Milton Keynes in the south. The area is not dominated by major conurbations; however, it has many medium-sized cities and towns including Nottingham, Derby, Leicester, Coventry, Northampton and Milton Keynes. The geography of the area ranges from low-lying farmland in Lincolnshire to the Peak District National Park in Derbyshire. This area serves approximately 2.7 million customers.

There is a high concentration of manufacturing and industrial activities in the East Midlands, with many automotive manufacturers based in the region. The business activity is generally situated along the M1 and M40 corridors; as a result, there are many distribution and logistics industries in the area. In the more rural areas, agriculture is an important part of the local economy.

The majority of distributed generation is hosted in the more built-up western half of the East Midlands licence area, with a notable amount of fossil gas generation sites located nearby to population centres along the M1 motorway, such as Nottingham and Leicester. The more rural nature of the eastern half of the licence area has driven the deployment of large-scale solar and wind projects in recent years. There are over 900 generation and storage projects, totalling 15.3 GW, that hold accepted connection offers and could connect to the East Midlands distribution network in the future.

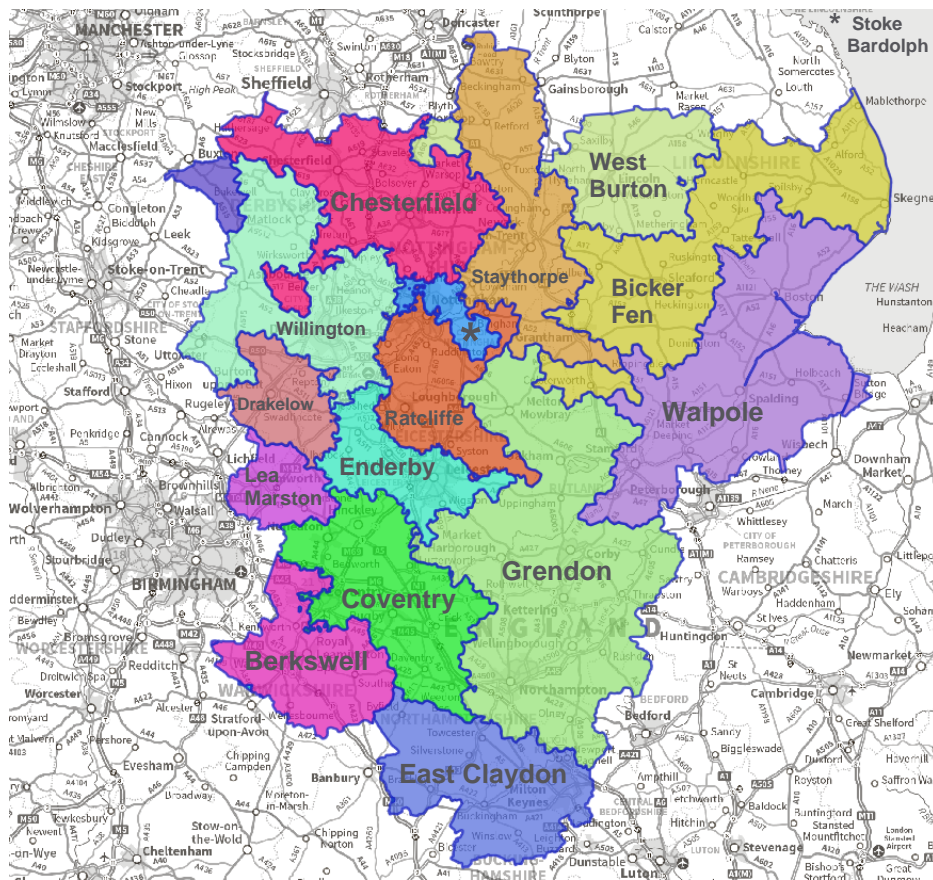


Figure 1.1.1 The East Midlands GSP geographic areas

This report gives an overview of the 54 Network Development Reports based on network areas within the East Midlands. For each of these network areas, analysis was carried out using the NGED Best View Distribution Future Energy Scenario (DFES) 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.

Each of these reports discusses the constraints identified over a 0-10 year horizon within that area of network. The fourteen 132 kV reports within the East Midlands cover the 14 GSPs within the licence area. The thirty nine 33 kV reports cover the sixty eight 132/33 kV Bulk Supply Points (BSPs) within the licence area. These reports are listed below, along with the number of constraints identified in each area (a total of 204 constraints are covered across the East Midlands NDP reports).

Network Area	Constraints
Bicker Fen 132 kV	3
Grantham and Sleaford 33 kV	5
Skegness 33 kV	6

Network Area	Constraints
Staythorpe 132 kV	5
Hawton 33 kV	5
Checkerhouse 33 kV	6

Network Area	Constraints
Walpole 132 kV	1
Spalding and South Holland 33 kV	4
Bourne and Stamford 33 kV	4
Boston 33 kV	5

Network Area	Constraints
Ratcliffe 132 kV	4
Loughborough 33 kV	2
Willoughby 33 kV	3
Toton 33 kV	1

Network Area	Constraints
West Burton 132 kV	2
Worksop 33 kV	1
Lincoln 33 kV	6

Network Area	Constraints
Stoke Bardolph 132 kV	1
The Nottingham Group	5

Network Area	Constraints
Enderby 132 kV	4
The Leicester Group	2
Wigston 33 kV	1
Coalville 33 kV	3

Network Area	Constraints
Drakelow 132 kV	0
Burton, Burton South and Gresley 33 kV	4

Network Area	Constraints
East Claydon 132 kV	4
Brackley and Stony Stratford 33 kV	3
Bradwell Abbey and Bletchley 33 kV	3

Network Area	Constraints
Grendon 132 kV	4
The Northampton Group	12
Corby 33 kV	2
Kettering and Kibworth 33 kV	4
Melton and Oakham 33 kV	3
Wellingborough and Irthlingborough 33 kV	7

Network Area	Constraints
Coventry 132 kV	3
Daventry, Rugby and Pailton 33 kV	8
Hinckley and Nuneaton 33 kV	4
Whitley 33 kV	1

Network Area	Constraints
Tamworth 33 kV	3

Network Area	Constraints
Chesterfield 132 kV	2
Alfreton 33 kV	3
Annesley, Clipstone and Mansfield 33 kV	8
Chesterfield, Goitside and Buxton 33 kV	10
Whitwell and Staveley 33 kV	4

Network Area	Constraints
Willington 132 kV	11
Uttoxeter 33 kV	2
Derby and Derby South 33 kV	1
Spondon and Heanor 33 kV	3
Stanton 33 kV	2
Winster 33 kV	2

Network Area	Constraints
Berkswell 132 kV	4
The Coventry Group	3
Warwick and Harbury 33 kV	5

1.1 Network Topology

Most of the fourteen GSPs in the East Midlands are operated as radial networks, although in a few instances a mesh system is utilised. Most 132 kV networks have the ability to interconnect at 132 kV to adjoining GSPs; however, they are not operated in parallel. The GSPs within the East Midlands are supplied from the 275 kV and 400 kV transmission networks via Super Grid Transformers (SGTs), with between two and five being located at each site.

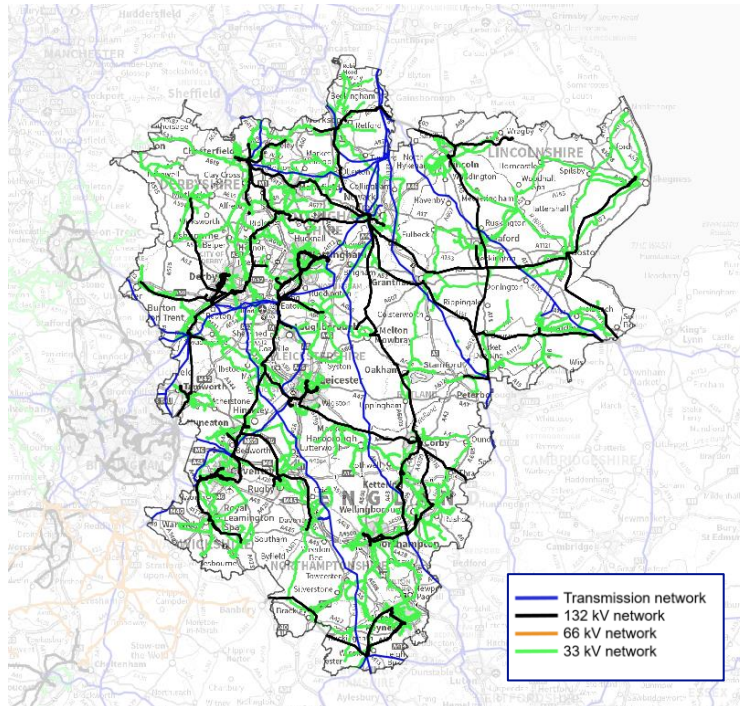


Figure 1.1.1 Network in the East Midlands (showing 400 kV, 275 kV and 132 kV circuits)

The majority of the East Midlands is supplied via the sixty eight 132/33 kV BSPs located within the licence area. These BSPs supply a total of 381 primary substations (363 at 33/11 kV sites and 18 at 33/6.6 kV sites). There are also a smaller number of 132/11 kV substations directly supplying the 11 kV network (some dedicated sites and some co-located with 132/33 kV BSPs).

The East Midlands network borders a number of other licence areas, with significant interconnection being present in various locations at each voltage level. Bordering areas include the West Midlands network (which is owned and operated by NGED) and other licence areas operated by UK Power Networks (UKPN), Electricity North West (ENWL), Scottish and Southern Electricity Networks (SSEN) and Northern Powergrid (NPG). Major points of interconnection with other licence areas include:

- Walpole GSP supplies electricity to both the East Midlands and East England operated by NGED and UKPN respectively. The two 132 kV networks are also interconnected at Stamford BSP. Another point of interconnection between these two licence areas is via the 132 kV circuit from Corby BSP (supplied from Grendon GSP) to Huntingdon BSP (supplied from Eaton Socon GSP).
- Buxton BSP (which is owned and operated by ENWL) is interconnected at 33 kV with NGED's network, supplying three primary substations within the East Midlands.
- East Claydon GSP (within the East Midlands) supplies Bicester North BSP (within the Southern England licence area operated by SSEN).
- The East Midlands and West Midlands licence areas are interconnected in a number of areas, including Tamworth Town and Tamworth Grid BSPs (located in the East Midlands but supplied from Lea Marston GSP in the West Midlands) and Banbury BSP (located in the West Midlands but supplied from East Claydon GSP in the East Midlands).

2. New Grid Supply Points

In a number of locations within the East Midlands licence area, high levels of growth in demand and generation has triggered the need to establish new GSP sites. These GSPs will be used to shift load away from heavily loaded existing sites, and in some cases can help resolve constraints on the distribution network. Any siting strategy for a new GSP is subject to extensive optioneering and engagement with National Grid Electricity Transmission (NGET) and National Grid ESO (NGESO). Factors considered in identifying the optimal location for a new GSP are discussed in more detail in the NDP Introduction and Methodology (including proximity to load centres and how easily they can be integrated into the existing network).

New GSPs are being considered to deload a number of existing GSPs within the East Midlands:

- Berkswell GSP
- Bicker Fen GSP
- Chesterfield GSP
- Coventry GSP
- Drakelow GSP
- East Claydon GSP
- Enderby GSP
- Grendon GSP
- Ratcliffe GSP
- Staythorpe GSP
- Stoke Bardolph GSP
- Walpole GSP
- West Burton GSP
- Willington GSP

Some of these new GSP locations have been considered in the NDP analysis, as depending on the chosen location they could mitigate constraints identified on the existing distribution network (aside from constraints at the GSPs themselves). Considering the impacts of new GSPs on the distribution network as part of the NDP process is essential in the economic and coordinated development of the network.

3. 6.6 kV Network Areas

There are significant benefits to upgrading sections of 6.6 kV network to 11 kV (including releasing significant thermal capacity, improving voltage regulation and increasing interconnectivity). These benefits are discussed in more detail in the NDP Introduction and Methodology. The advantages of upgrading to 11 kV need to be weighed against the associated costs for each area. The impacts of upgrading 6.6 kV networks on the upstream 33 kV network are highlighted in a number of East Midlands NDP reports.

Of the 381 primaries within the East Midlands, 18 sites have 33/6.6 kV transformers supplying 6.6 kV networks. The largest of these 6.6 kV network areas are located in Coventry, Chesterfield and Leicester. A small amount of 6.6 kV network is also present in Lincoln, fed from Ruston and Hornsby primary (which is being decommissioned, with its demand being transferred onto the nearby 11 kV network). A list of the primaries supplying 6.6 kV network within the East Midlands is given in Table 3.1 below.

Table 3.1 – 33/6.6 kV primaries within the East Midlands licence area

GSP	BSP	Primaries
Berkswell	Coventry Central	Courtaulds, Courthouse Green, Cox Street, Dunlop, Holbrook Lane and Sandy Lane
Berkswell	Coventry South	Spon Street
Berkswell	Coventry West	Coventry West and Hawkesmill Lane
Chesterfield	Goitside	Goitside and Sheffield Road
Coventry	Whitley	Gulson Road and London Road
Enderby	Leicester East	Leicester East, Salutation and Stoneygate
Enderby	Leicester North	Lero
West Burton	Lincoln	Ruston and Hornsby

4. Single Transformer Primaries

Of the 381 primaries within the East Midlands, 44 are single transformer primary sites. In addition to these, there are a small number of other primary sites which rely on interconnection at 6.6 kV or 11 kV to maintain security of supply. For example, Courthouse Green (fed from Coventry Central BSP) has three primary transformers, but only one 33/6.6 kV transformer. A list of all constraints identified at single transformer primaries is given in Table 4.1 below.

Table 4.1 – Single transformer primary constraints identified within the East Midlands up to 2034

GSP	BSP	Primary	Most onerous constraint	First studied year constraint is identified
Chesterfield	Alfreton	Wessington	11 kV backfeeds exceeded	2028
Chesterfield	Goitside	Wingerworth	11 kV backfeeds exceeded	2034
Coventry	Daventry	Weedon	11 kV backfeeds exceeded	2034
Enderby	Coalville	Worthington	Primary transformer overloads	Baseline
Grendon	Kibworth	Bruntingthorpe	Primary transformer overloads	Baseline
Grendon	Wellingborough	Sharnbrook	11 kV backfeeds exceeded	2028
Staythorpe	Checkerhouse	Checkerhouse	Primary transformer overloads	2034
Staythorpe	Checkerhouse	North Wheatley	Primary transformer overloads	2034
Staythorpe	Checkerhouse	Tuxford	Primary transformer overloads	2028
Staythorpe	Checkerhouse	Woodbeck	11 kV backfeeds exceeded	2034
Staythorpe	Hawton	Sibthorpe	Primary transformer overloads	2034
Staythorpe	Hawton	Westborough	Primary transformer overloads	2034
Walpole	Boston	Langrick	Primary transformer overloads	Baseline
Walpole	Boston	Stickney	Primary transformer overloads	Baseline
Willington	Winster	Cromford	11 kV backfeeds exceeded	2028
Willington	Winster	Hopton	11 kV backfeeds exceeded	2028

5. Network Operability

Restricting outage seasons is proposed as a potential mitigation strategy for many of the constraints triggered only by N-2 or arranged outages. Restricting outages across the network could lead to resources and network access being insufficient to complete the necessary work in the shorter time scales. Strategic planning must consider this aspect when making decisions about potential solution options. This is important to assess not just on a case by case basis, but looking at the East Midlands as a whole to get a full view of the impact of restricting outage seasons on NGED's ability to effectively operate and maintain the network.

A list of the constraints identified as part of the NDP, for which one of the proposed mitigation options is restricting outage seasons, is given in Table 5.1 below. Restricting outage seasons is, in most cases, not a permanent solution; as loading increases, overloads are typically seen across more seasons (and for N-1 fault conditions which cannot be mitigated against in this way).

Table 5.1 – Constraints identified within the East Midlands for which restricting outage seasons is a potential mitigation strategy

NDP Report	Section	Constraint
Annesley, Mansfield and Clipstone 33 kV	2.3	Sutton Junction primary transformer overloads
Berkswell 132 kV	2.4	Warwick 132/33 kV BSP GT overloads
Bourne and Stamford 33 kV	2.2	Stamford BSP GT overloads
Bourne and Stamford 33 kV	2.3	Stamford primary transformer overloads
Bourne and Stamford 33 kV	2.4	33 kV circuits to Market Deeping and West Deeping overloads
Burton, Burton South and Gresley 33 kV	2.5	Wellington Street primary transformer overloads
Chesterfield, Goitside and Buxton 33 kV	2.5	Goitside to Walton Main 1 33kV circuit overloads
Chesterfield, Goitside and Buxton 33 kV	2.10	Chesterfield BSP GT overloads
Chesterfield, Goitside and Buxton 33 kV	2.11	Goitside BSP GT overloads
Kettering and Kibworth 33 kV	2.5	Kettering BSP GT overloads
Ratcliffe 132 kV	2.5	Ratcliffe GSP SGT overloads
Stanton 33 kV	2.3	Little Hallam primary transformer overloads
Stoke Bardolph 132 kV	2.2	Nottingham East GT overloads
The Northampton Group	2.3	Northampton East to Earls Barton tee 33 kV circuit overloads
The Northampton Group	2.10	Northampton West BSP GT overloads
The Northampton Group	2.11	Northampton East BSP GT overloads
The Northampton Group	2.12	Northampton BSP GT overloads
Walpole 132 kV	2.2	Walpole to Spalding, South Holland and Bourne 132 kV circuit overloads
Willington 132 kV	2.5	Winster BSP GT overloads
Willington 132 kV	2.6	Uttoxeter BSP GT2 overloads
Willington 132 kV	2.8	Derby BSP 132/33kV GT overloads

6. Transformer Ratings

Cyclic Ratings

Across the East Midlands, BSPs and primaries have transformers that do not always have their cyclic ratings fully utilised. In order to utilise these cyclic ratings, further assessments and site checks are usually required. Sites where these checks are required have not been captured in the East Midlands NDP reports.

Intermediate Seasonal Ratings

As noted in the NDP Introduction and Methodology, currently policy within National Grid records a rating for transformers in two seasons, summer and winter. Transformer ratings for intermediate cool and intermediate warm used in analysis carried out for the NDP align to the summer ratings (which may be overly pessimistic). At a number of sites, transformer overloads were identified only in intermediate cool and/or intermediate warm. The majority of these constraints were not captured within the East Midlands NDP reports (with some exceptions where the constraint needs to be cross-referenced with other constraints or network solutions).

The sites at which transformer constraints were identified only in intermediate cool and/or intermediate warm before 2034, that have not been captured in the relevant NDP reports are listed below.

Primary sites

- Desborough
- Matlock
- Millclose
- Stonegate
- Thurmaston
- Groby Road
- Thurnby
- Southwell
- Carlton-on-Trent
- Sneinton
- Keyworth
- Bretby
- Sleaford Road
- Mount Bridge
- New Beacon Road
- Sleaford
- Coalville
- Desford
- Nailstone
- Osbaston
- Union Street
- Hillmorton
- West Haddon
- Barwell
- Gypsy Lane
- Langdale Drive
- Nuneaton
- Sapcote
- Whittleford
- Corby Central
- Earlstrees

BSP sites

- Hinckley 132/11 kV
- Loughborough 132/11 kV
- Nottingham North 132/11 kV
- Rugby 132/11 kV
- Daventry



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