DSO

DISTRIBUTION SYSTEM OPERATOR

Opportunities and innovation in connecting data centres on the distribution network

International Workshop on Managing Global Energy Demand of AI Data Centres

Imperial College, 9th September 2025

UK Power Networks

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Key Operators in Great Britain

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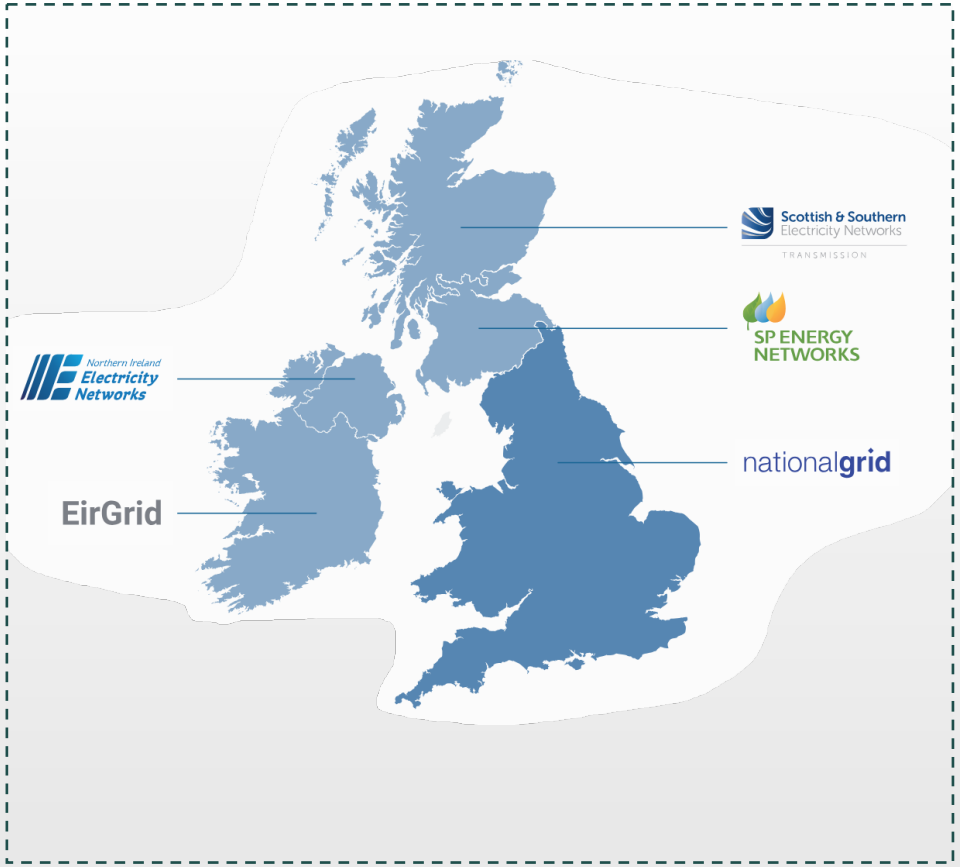
Transmission Network Operators or TOs



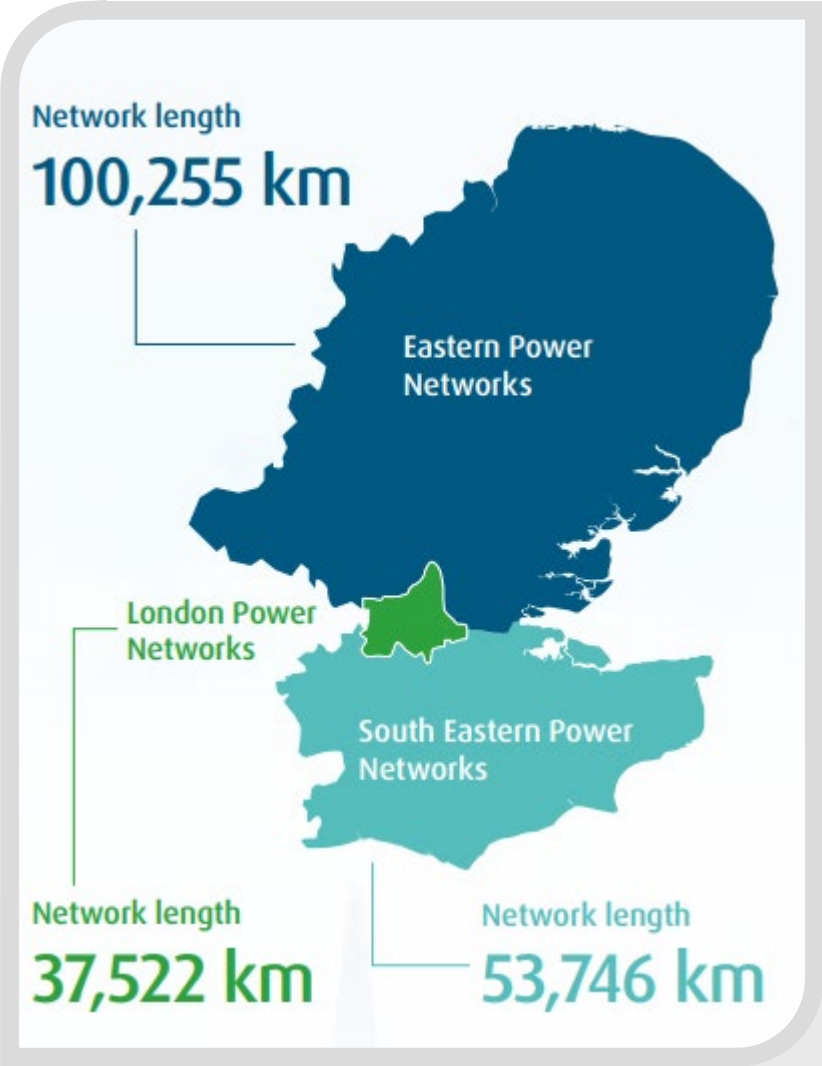
Distribution Network Operators (DNOs)

System Operator

NESO National Energy System Operator

ENA

About UK Power Networks



8.5m homes and businesses

28% of UK Total

16+ GW peak demand

33% of UK Total

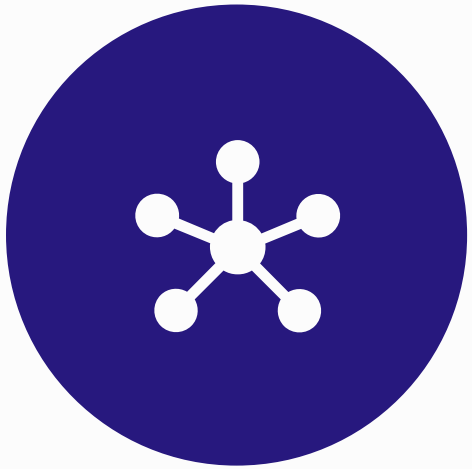
10+ GW distributed generation

>30% of UK Total

Why do we need a DSO?

Old World

DO WHAT WE HAVE ALWAYS DONE: DELIVER ALL NEW CAPACITY USING NETWORK ASSETS



New World

NEW WORLD: EMBRACE DIGITAL, DATA AND FLEXIBILITY. NEW CAPACITY A MIX OF NETWORK ASSETS & FLEXIBILITY.

Electricity demand will double over the coming decades as we electrify our economy. DNOs need to take a different approach that ensures we can protect consumers.

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How do the DNO and DSO Interact?

Our objective:
Ensure electricity networks are fit for purpose and not a blocker to Net Zero

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Best-value solution for customers:

- Right capacity
- Right place
- Right time
- Lowest cost

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- Delivers capacity required efficiently and on time
- Manages connections
- Improves health of network
- Strives to deliver a 10/10 customer service
- Improves reliability and resilience
- Ensures safety of employees and members of the public

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What are the DSO Roles?

- Developing flexibility products and services, as well as the market through which we offer them.
- Flexibility is a way of using existing infrastructure intelligently to save costs and work towards Net Zero.
- Flexibility can be both demand turn-up/down, or generation turn-up/down.

Using data and insights to:

- demonstrate how our network can best meet future capacity needs.
- facilitate connections (including through coordination with the transmission network).
- Determine the most cost-effective means to expand distribution network capacity where required.

All while centring customers through a cost-effective, transparent approach and incorporating them into local authorities' decarbonisation plans.

- Ensuring the flexibility services and products we've developed are used efficiently and transparently in our Control Room.

Delivering for Customers

CO-ORDINATION

- Speeding up connection of 4GW of generation and storage
- Driving standardisation nationwide.

DATA AND INFORMATION

- Self-service curtailment assessment tool.
- New datasets for Connections customers.
- Dedicated Local Area Energy Planning Open Data portal.

FLEXIBILITY MARKET DEVELOPMENT

- Dispatching 7.8GWh+ of flex across multiple horizons (long-term to day-ahead).
- Faster payments and greater participation at scale

DECISION-MAKING

- Independent scrutiny of £470m of investment decisions
- Transparency through our Distribution Network Options Assessment

NETWORK PLANNING

- Dedicated Local Net Zero team
- Proactive support to all 133 local authorities we serve

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In the News…

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GOV.UK

Home > Business and industry > Media and communications > Communications and telecomms

Press release

Data centres to be given massive boost and protections from cyber criminals and IT blackouts

Data including vital NHS, financial, and personal smartphone data is set to be safer from cyber attacks, environmental disasters, and IT blackouts as part of government's drive for economic growth.

From: Department for Science, Innovation and Technology and The Rt Hon Peter Kyle MP

Published 12 September 2024

6 min

10 September 2024

AWS plans to invest £8 billion in the UK, supporting 14,000 jobs annually in local businesses

Written by Amazon staff

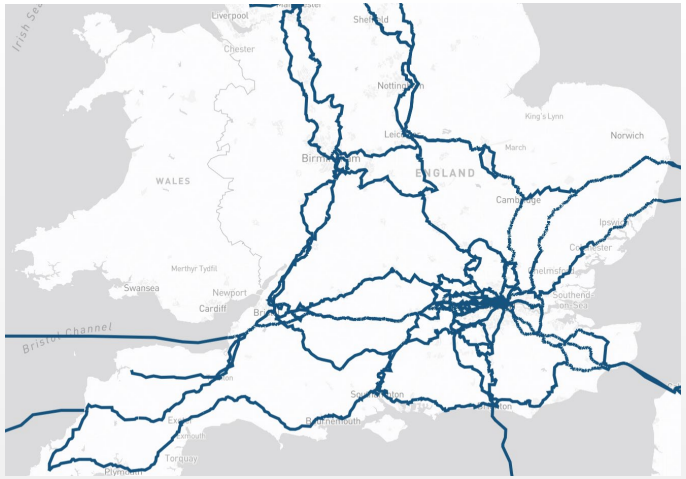
Technology

Data centre power use 'to surge six-fold in 10 years'

26 March 2024 · 275 Comments

Data Centres – Context

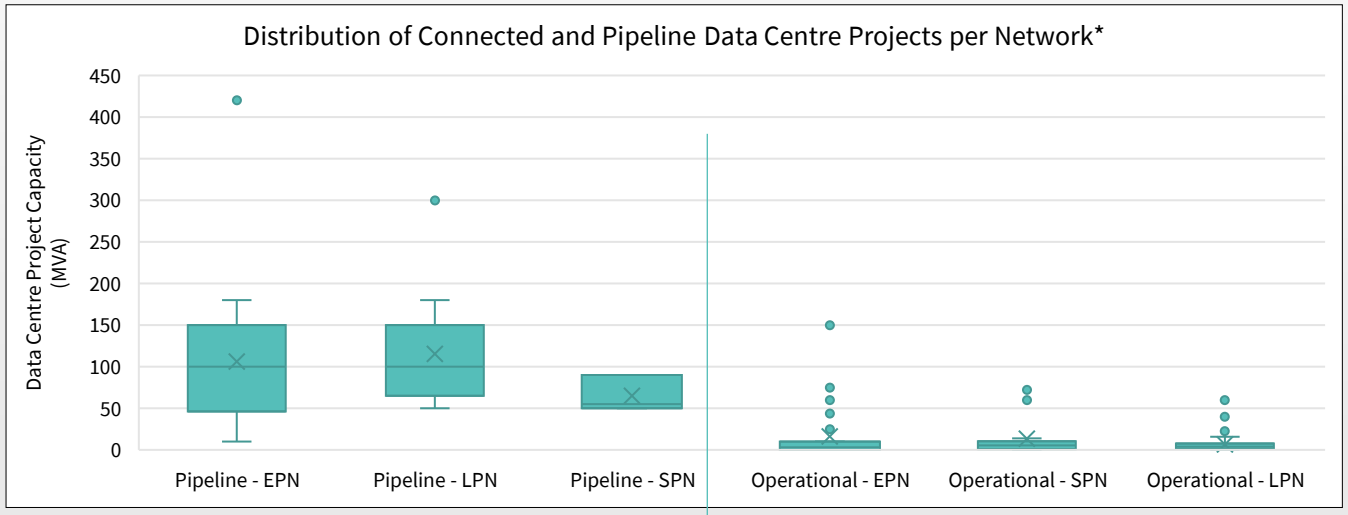
- Data Centres (DCs) are rapidly appearing across the country, driven by a demand for data, technology, telecommunications, the Internet of Things (IoT) and Artificial Intelligence.
- **Technology companies are increasingly investing in the UK, reaching £25bn since Summer 2024**.
  - Four major technology firms committed £6.3bn at the International Investment Summit in October 24.
  - **Amazon** (£8bn), **Google** ($1bn) and **Microsoft** (£2.5bn) have also announced UK investments.
- The UK Government has welcomed the investment and **designated Data Centres as Critical National Infrastructure** in September 2024.
- **South-East England a key area – DCs connect to high-speed fibre optic networks that flow to Europe and the US.**
  - Want to use the internet "superhighway" (G652D cables), with superior transmission characteristics. The closer the data centre is to it, the lower the latency (critical for trading, split-second decisions such as driverless cars, etc.).
- ***Beyond the UK…***
  - Ireland's Data Centre consumption has jumped from 5% of total metered consumption in 2015 (1,238GWh), to 21% in 2023 (6,334GWh). This contrasts with the NESO's estimate of 2.5% in March 2022 for the UK.
    - In November 2021, Ireland's regulator issued a de-facto moratorium on developing Data Centres in Ireland until 2028, by compelling new Data Centre applications to bring on their own onsite generation equal to their demand (to try and reduce network impact).

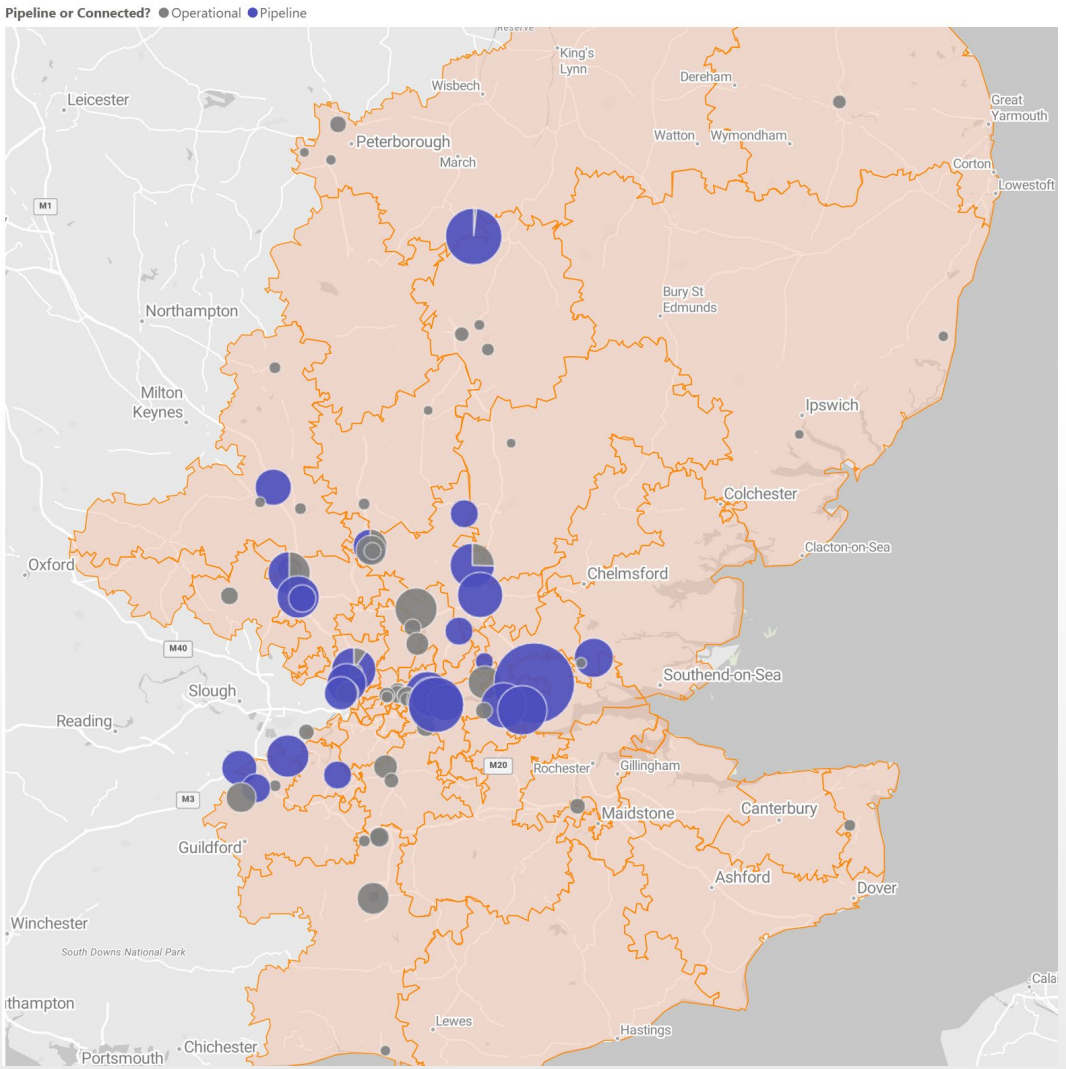


Data Centres in UKPN: Then and Now

Many more DCs now want to connect, and they dwarf those currently connected.

- However, the following hypotheses are noted for UKPN's regions (pipeline and connected sites):
  - **LPN**: prioritise being close to optical fibre cabling, specifically the G652D network (superior transmission characteristics, low impedance) that runs to Europe and North America). Smaller DCs are planned – potentially due to space.
  - **EPN**: prioritise being close to optical fibre cabling and the strategic road network (SRN, motorways and A-roads).
  - **SPN**: like EPN, but lack of DCs may be due to sparser optical fibre cabling and GSPs.





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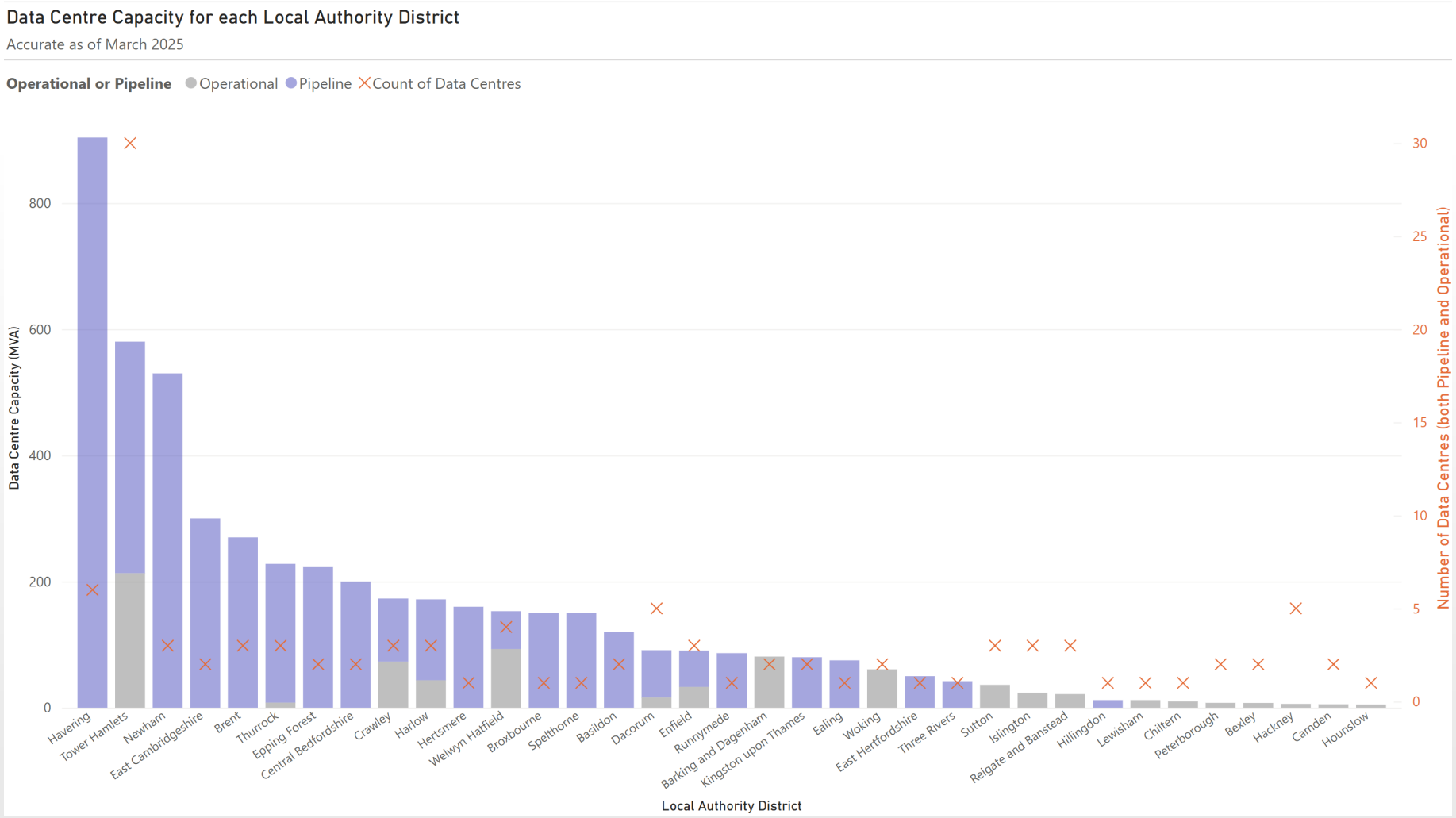
Data Centre Hotspots within Local Authority Districts



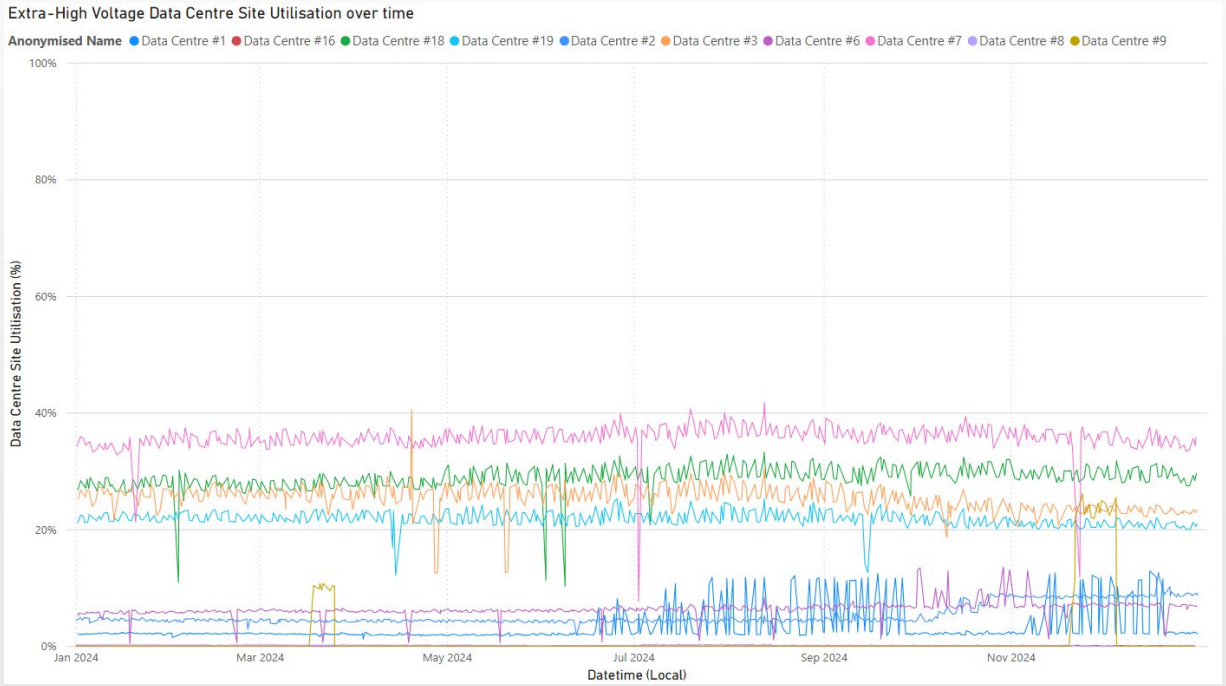
Majority of capacity is concentrated in a few Local Authority Districts.

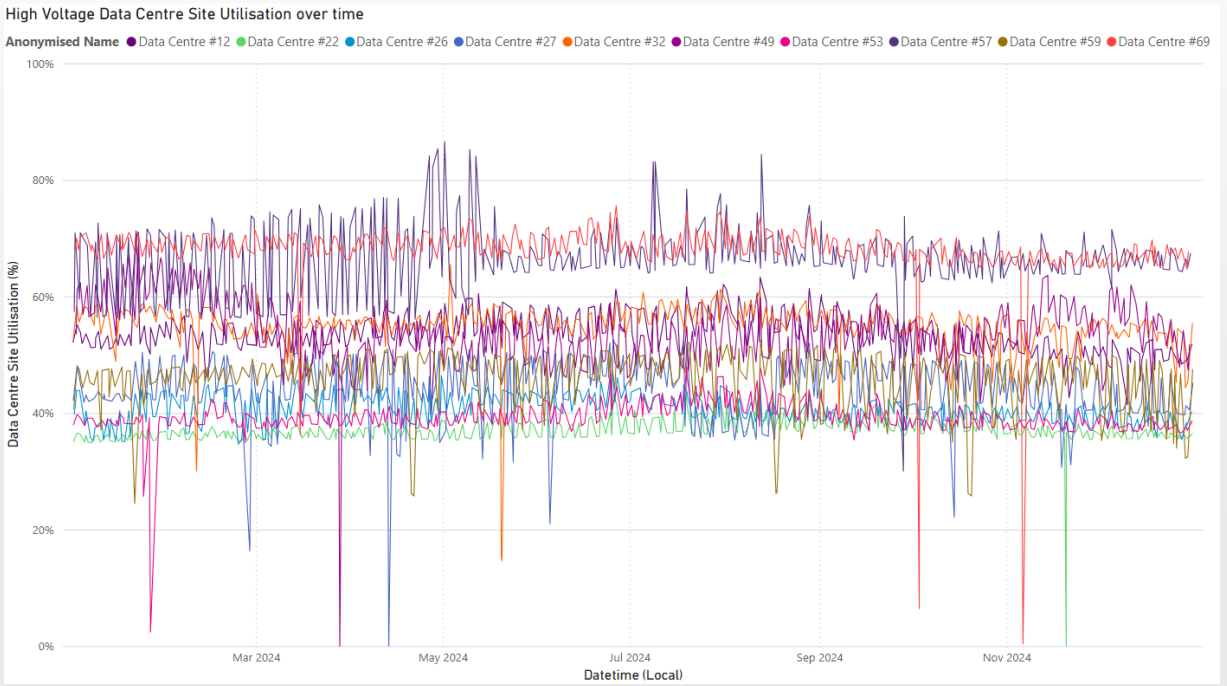
- ***Havering***: *Clay Tye Data Centre.*
- ***Tower Hamlets and Newham***: *adjoining LAs east of London encompassing Canary Wharf, high fibre density. Finance sector-driven.*
- ***East Cambridgeshire***: *growing cluster in spacious industrial parks. More space to build, and fibre runs through Cambridge.*
- ***Brent***: *adjoins SSEN-D in West London, data centres creating availability zones.*

Data Centre Utilisation

Across all voltage levels, operational data centres show **steady-state utilisation throughout the year.**

- **Relatively little utilisation volatility** for most sites, banding between 20% - 60%.
    - However, “black box” is breaking down the proportion of IT load and cooling with the overall load if we just look at meter data.





Connecting Demand Sites

Opportunity to accelerate connections

Unconstrained Demand

- Default position: apply for capacity and work is done to connect the site, on the basis the power is available 24/7.
- Applicant spends money on network upgrades and sole use assets.
- **Large demand sites face a long wait time to connect, due to size and subsequent works required.**

Ramped Connections

- Supply a metered exit point at the requested “Power On” date with an initial capacity, with a commitment to increase capacity in line with agreed schedule, up to the maximum capacity applied for.
- Assurance capacity will be met for future expansions, with reduced charges early on.

Profiled Connections

- A flexible connection where the maximum import capacity of a site can be varied over a given day.
- For example, for overnight electric bus fleets where the required maximum import capacity is higher overnight, that it is during the day.

Curtailed Connections (DERMS)

- A flexible connection using an autonomous, software-based control system that monitors grid conditions and issues instructions to flexible connection or other field devices to keep the distribution network within operating limits.

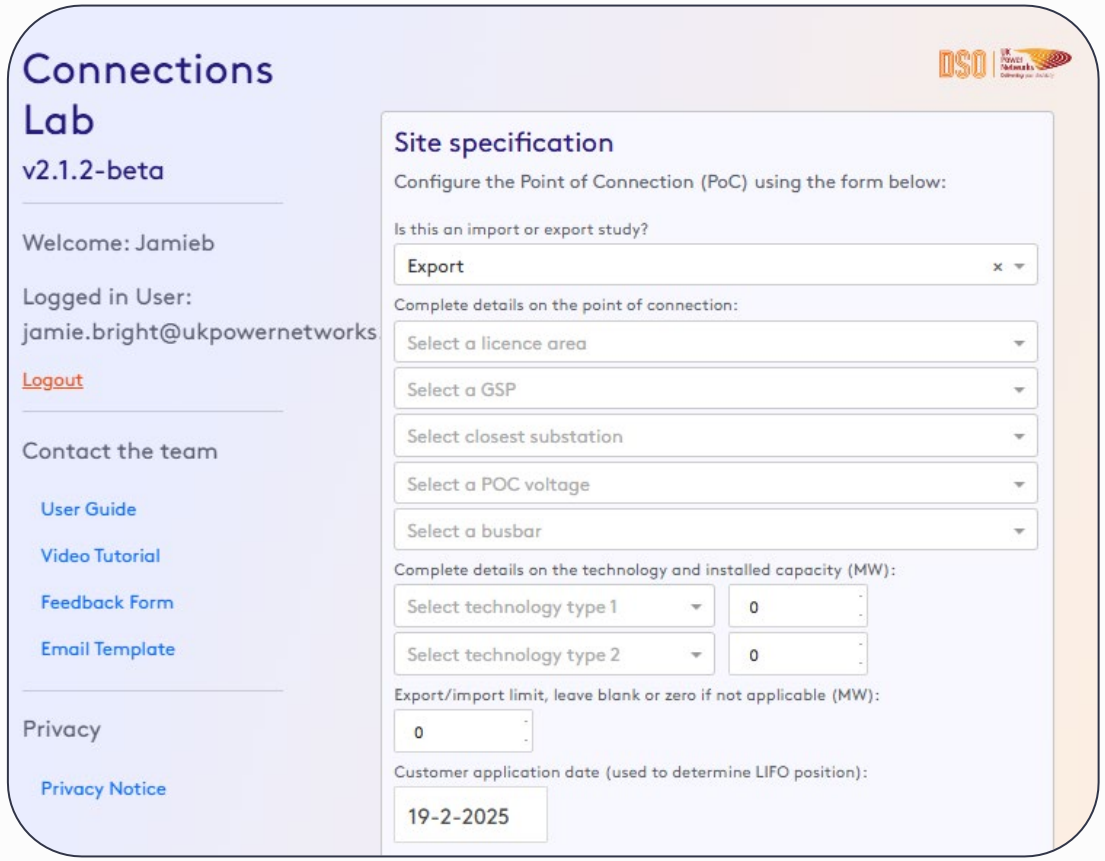
The Connections Lab

Allows users to model site connected to any GSP/Grid/Primary and get an estimate of the level of curtailment.

User can change parameters such as who is in the queue, generation profiles, ratings etc.

Both Import and Export curtailment

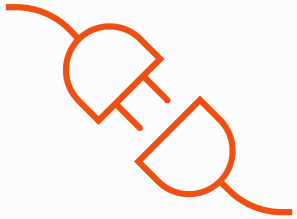
Free, Unlimited, Public, Online.



Remember to log in!

The Connections Lab

How can Data Centres Provide Flexibility to the Grid?



- Connect on a **constrained** basis to accelerate connection (real-time or profiled).
- **Ramp up** DC operations in line with a ramped connection

- Participate in **flexibility markets**, such as:
  - DSO Demand Turn-up and Turn-down.
  - NESO Demand Flexibility Service.

- Unlock **whole-system benefits, such as**:
  - Heat network integration (UKPN Innovation trial: "**Hot Chips**"
  - 24/7 Green.

All hinges on strong engagement – understanding our complimentary needs and capabilities to deliver solutions

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What does the Future Look Like?

- Further **evolution** of…
  - Flexible Connection offering to demand sites.
  - Flexibility Markets (e.g., NESO Demand for Constraints)
  - Data and transparency (e.g., strategic spatial planning of large demand sites).
- **Increased Government interest** in data centres and connecting “strategic” demand.
  - UK Government Modern Industrial Strategy: **Connections Accelerator Service**.
  - AI Growth Zones.
- Further **innovation** in the space to translate needs and capabilities of the different types of data centres, to grid products.
  - Network Innovation on the GB electricity network.
  - Worldwide innovation (the Electric Power Research Institute’s DCFlex project).

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Thank you!

Any questions?