Electricity Transmission

Pathway to Net Zero

Stakeholder Workshop
Leeds - 17/10/23

nationalgrid

Housekeeping

Username: The Queen's Guest Internet
No password

For those here **in person:**

- No planned fire drills

For those joining us **online**:

- Please mute yourself during presentations
- Please turn your camera on during the discussions (if your internet allows)
- If you have any questions during the presentations, please use the chat function and we will endeavour to respond

After each presentation, we will host breakout discussions. For those **online**, you will be moved to breakout rooms for the discussions. These will start and end automatically. You don't need to press any buttons

We would like to record today's workshop and take some photos. If you are not comfortable being recorded, please send a message in the chat to ' Vincent Luxmoore (EQ)', or make yourself known to the team if you're here in person

After each discussion session, we will ask you to vote on a series of questions using Slido.
You will need a mobile phone or iPad to vote so please have one handy

Agenda

Registration and Networking		**09:30**
1: Background context and planning holistically		**10:00 – 10:55**
Housekeeping	EQ	10:00 – 10:10
Presentation	NGET and NGESO	10.10 – 10.25
Discussion	All	10.25 – 10.45
Electronic voting	EQ	10.45 – 10.50
2. Developing a regional planning process into a net zero future		**10.50 – 11.55**
Presentation	NGET, NPg	10.50 – 11.15
Discussion	All	11.15 – 11.50
Electronic voting	EQ	11.50 – 11.55
Coffee break		**11:55 – 12.15**
Our connections strategy		**12:15 – 13.00**
Presentation	NGET	12.15 – 12:30
Discussion	All	12.30 -12.50
Electronic voting	EQ	12.50 – 12.55
Wrap up	NG	12.55 – 13.00
Panel Q&A	NGET, NGESO, NPg	13.00 – 13.30
Lunch		**13.30**

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Introduction

Chris Bennett
Director for UK Regulation

National Grid Electricity Transmission

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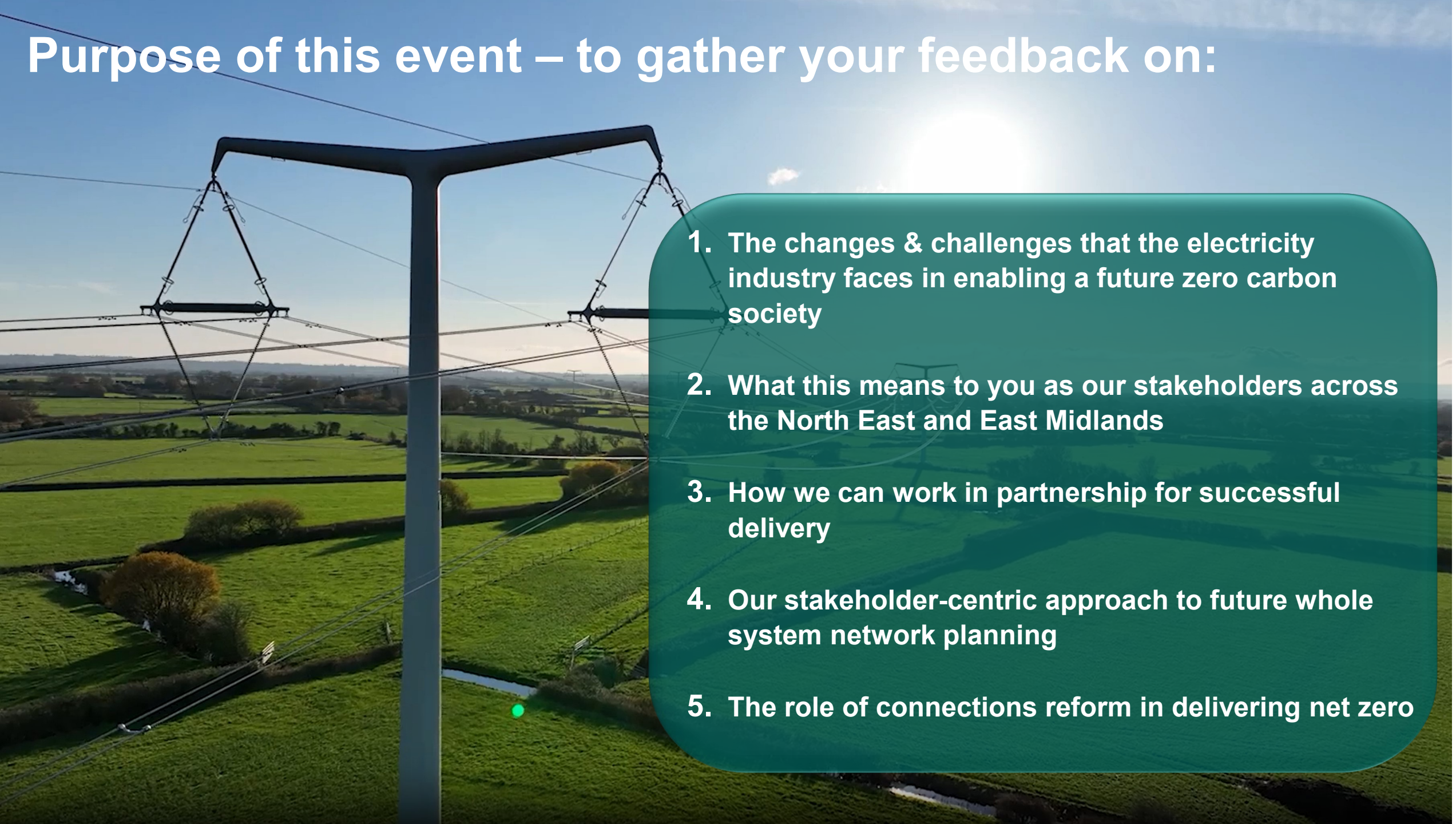
Purpose of this event – to gather your feedback on:



1. The changes & challenges that the electricity industry faces in enabling a future zero carbon society
2. What this means to you as our stakeholders across the North East and East Midlands
3. How we can work in partnership for successful delivery
4. Our stakeholder-centric approach to future whole system network planning
5. The role of connections reform in delivering net zero

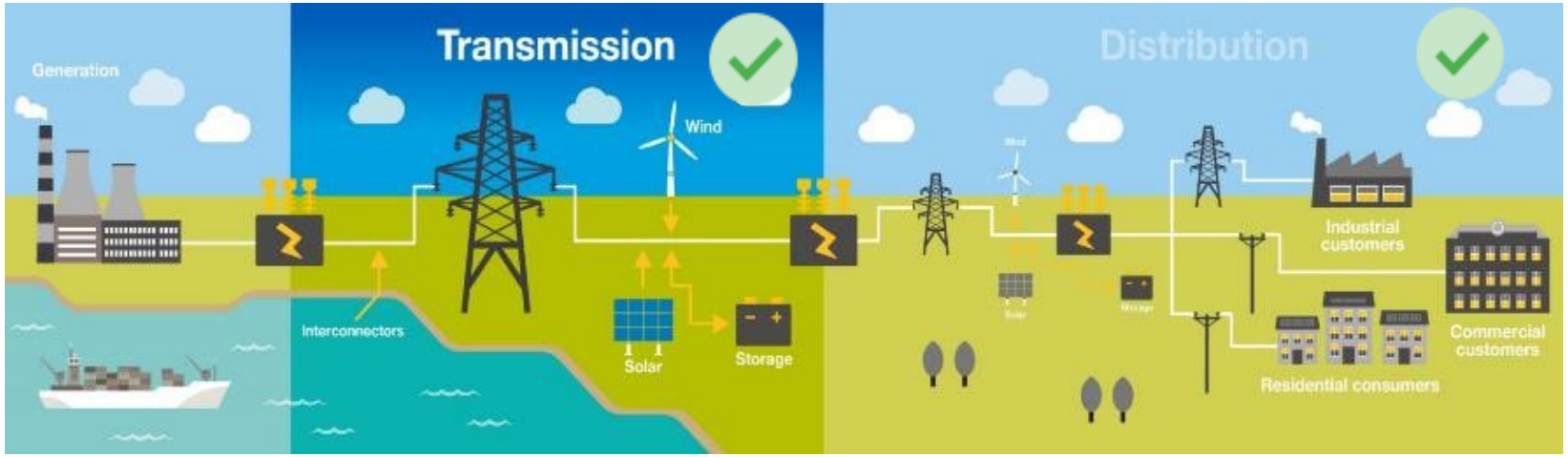
Networks in the electricity sector – who does what?

One Transmission Network Owner in England and Wales- National Grid Electricity Transmission

Transporting electricity from where it is generated to where it is needed.

Six Electricity Distribution Networks in England and Wales

Taking electricity from the transmission network and generated from other regional sources, and delivering it to homes and businesses across their respective regions.



National Grid Electricity System Operator (NGESO) operates the Great Britain's system to keep homes and businesses supplied with the energy they need 24/7, 365 days a year

National Grid businesses

Electricity Transmission and Strategic Infrastructure (ET & SI)

Electricity Distribution (ED) (previously WPD)

New York

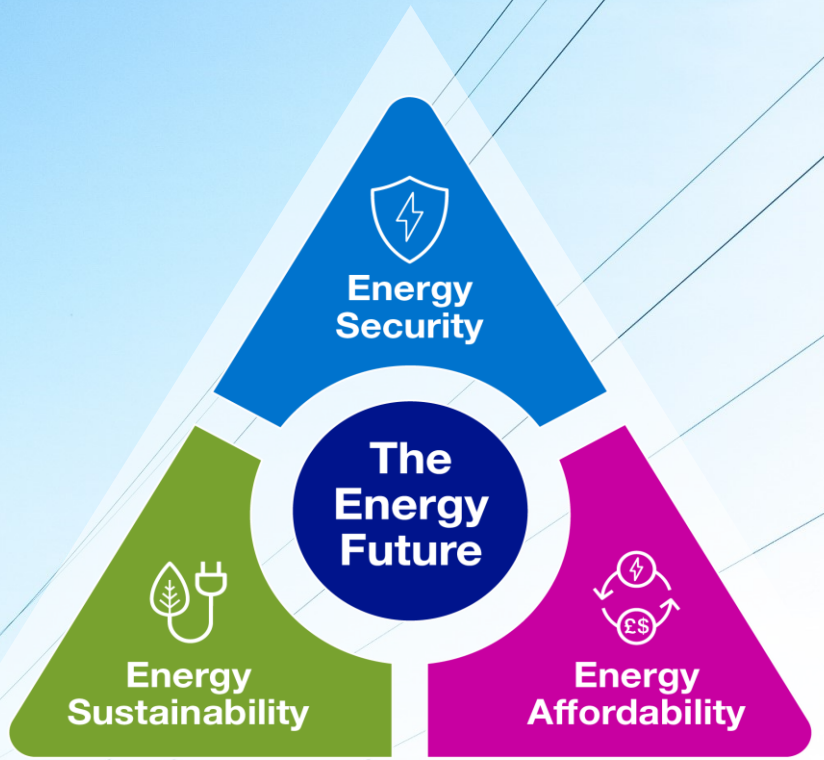
New England

National Grid Partners

National Grid Ventures

Electricity System Operator (ESO) (*to be divested*)

Delivering a **clean, fair, and affordable** energy future



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Electricity Network Planning - the national context

Owen Wilkes
Network Development Manager
National Grid Electricity Transmission

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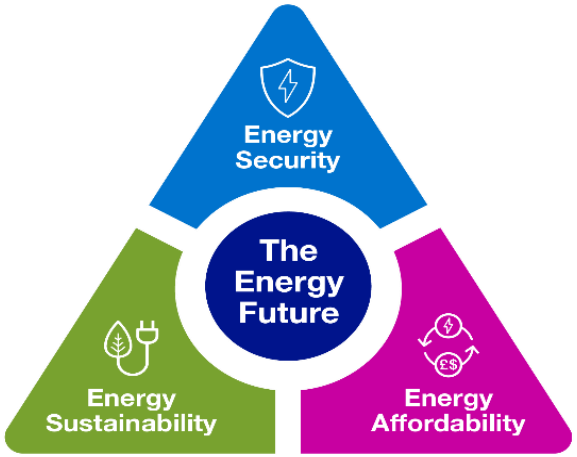
National Context – energy transition

Today - electricity networks deliver reliable & secure supply to meet societal needs

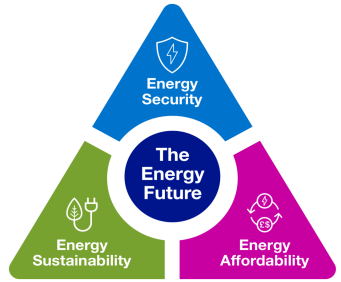
What do electricity networks need to do to enable the energy transition?

- Connect new and low carbon sources of electricity generation to our networks
- Meet increased electricity demand from decarbonising sectors such as heat and transport
- Increase future UK energy security by reducing fossil fuel dependence
- Maintain a safe and reliable electricity supply through our networks with society having a greater dependence on it for day-to-day life.
- Manage the cost impact to consumers of all network activities



We must achieve this in a way that manages the impacts of what we do on the environment and on communities

National Context – Delivering for 2035



We must systematically upgrade the E&W Transmission network to provide a sustainable 'platform' to service future electricity needs

Offshore wind

4.5 to 6 times
growth in capacity

Solar

2.5 to 5 times
growth in capacity

Interconnectors

2.5 to 3 times
growth in capacity

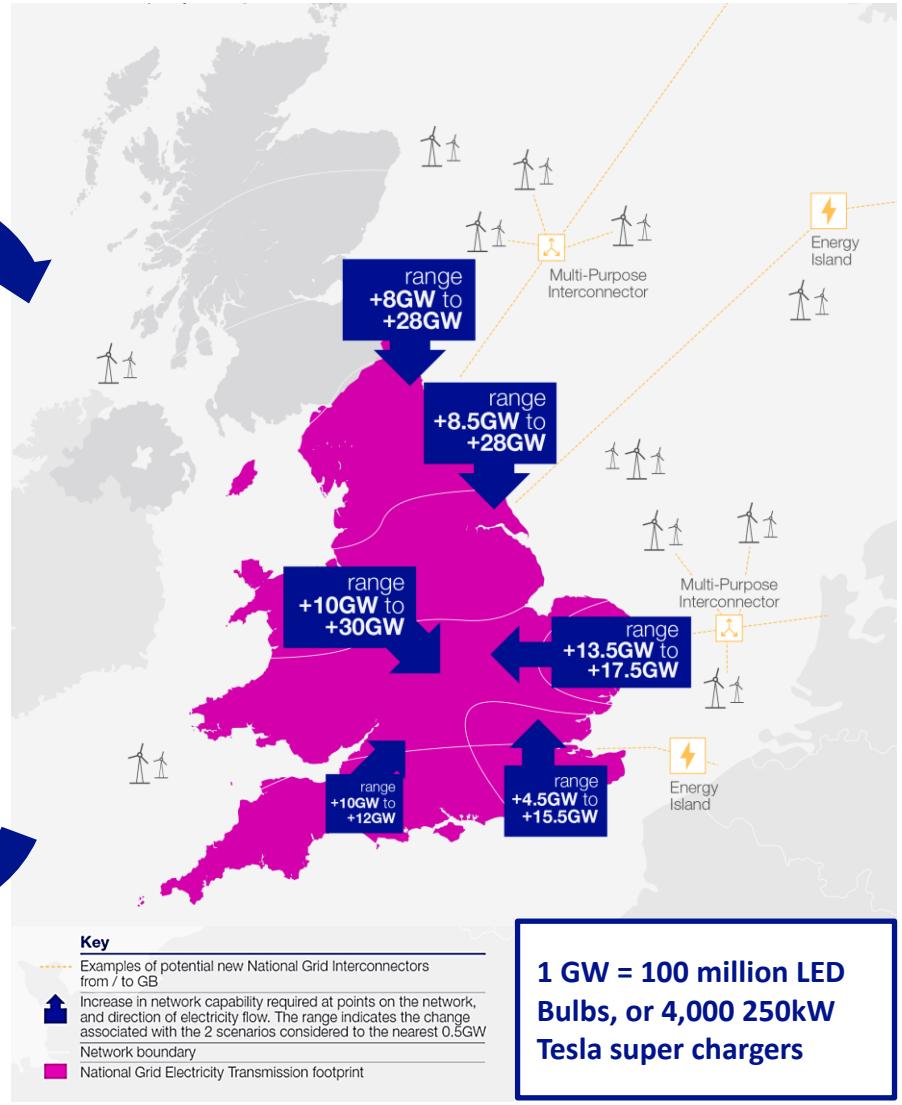
Battery storage

4.5 to 10 times
growth in capacity

At the same time cross sector electrification is expected to increase total electricity demand by around 50%.[5]

Building over
5 times more
transmission overhead or underground lines than we have built in the last 30 years.

Building around
4 times more
transmission marine cables than our current offshore network.



1 GW = 100 million LED Bulbs, or 4,000 250kW Tesla super chargers

National Grid

The Great Grid Upgrade

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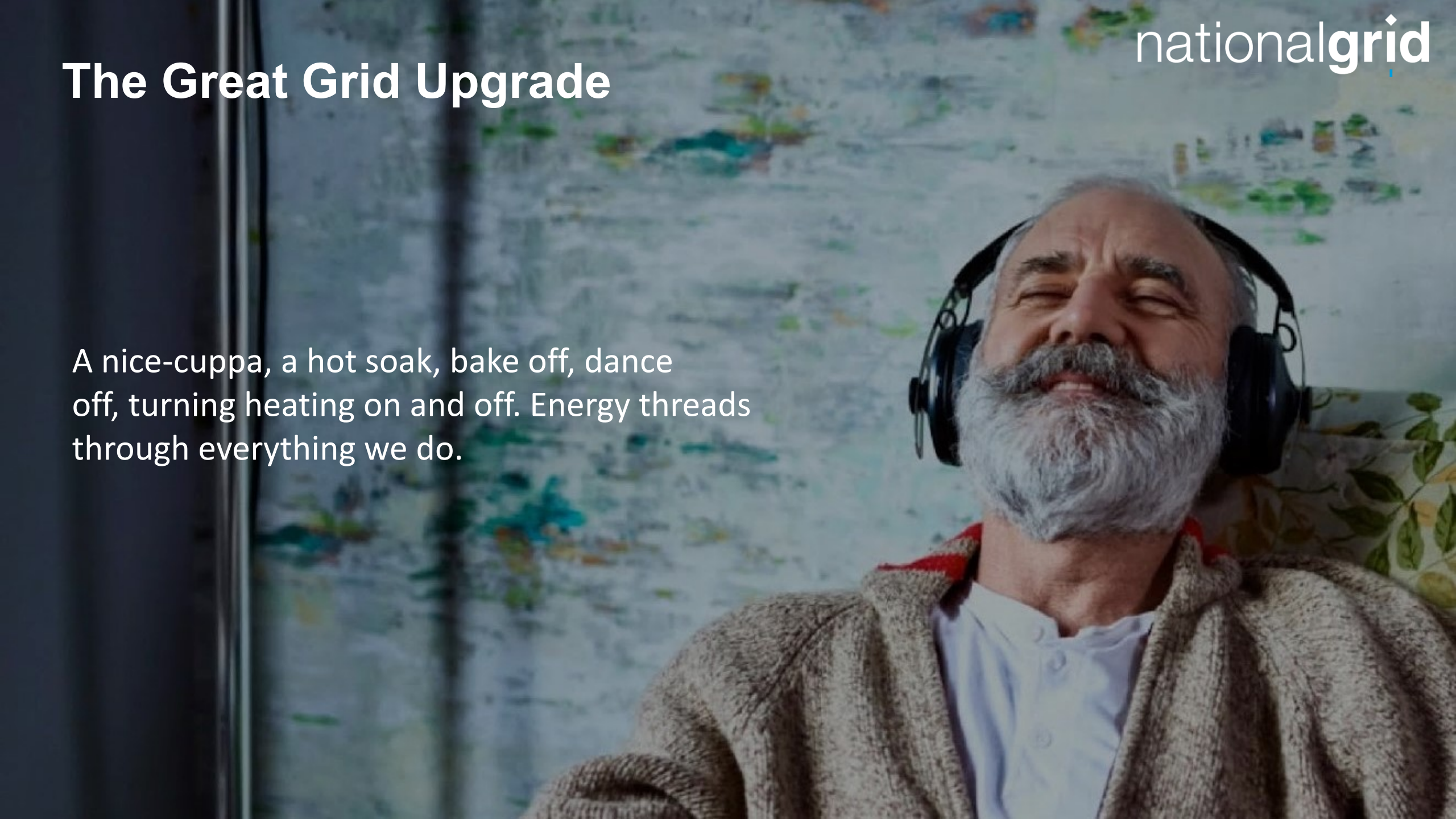
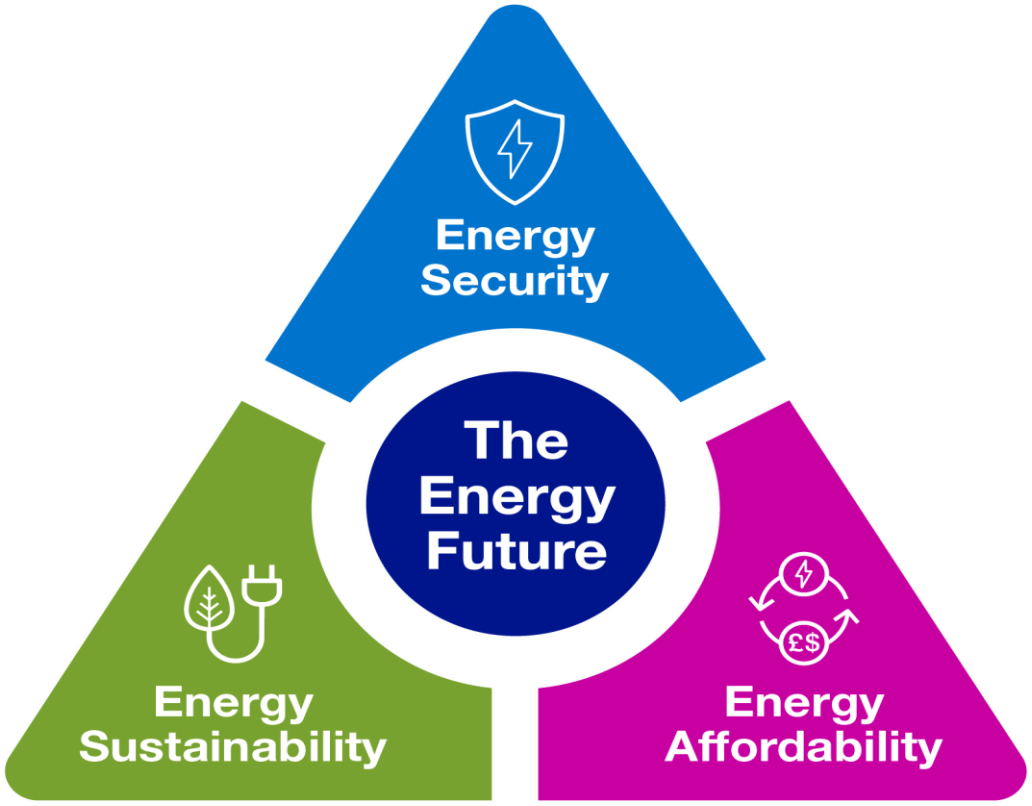
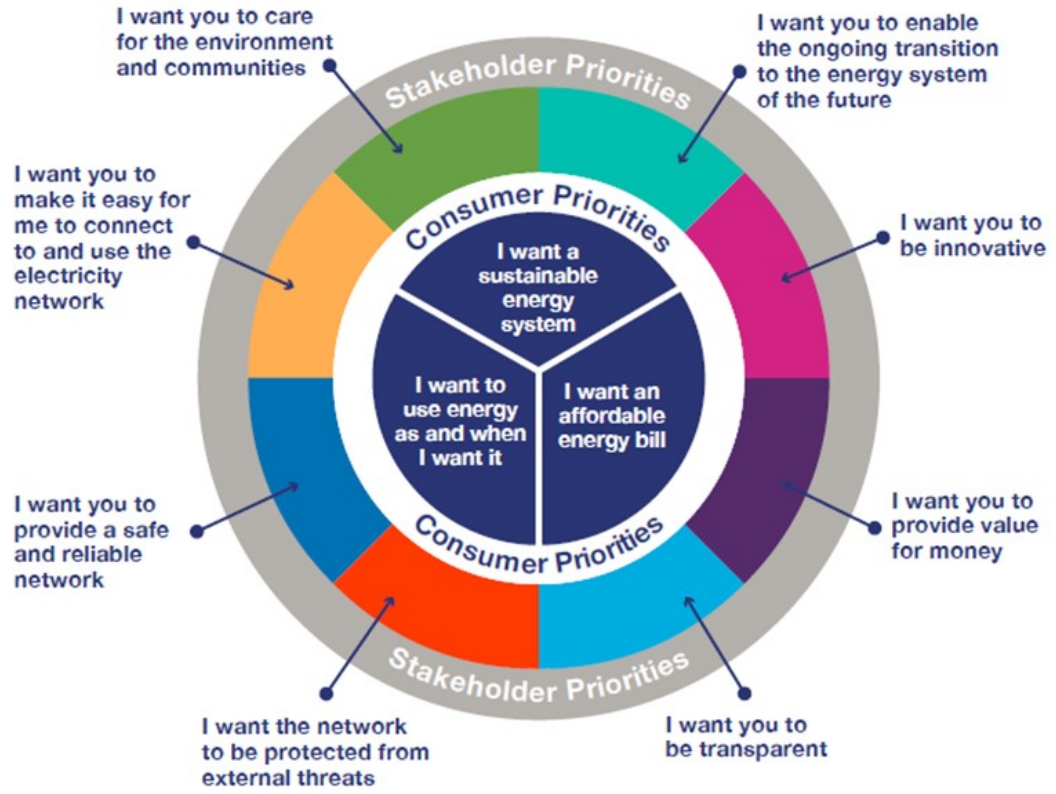
A nice-cuppa, a hot soak, bake off, dance off, turning heating on and off. Energy threads through everything we do.



A future business plan for a fair energy transition





James Whiteford

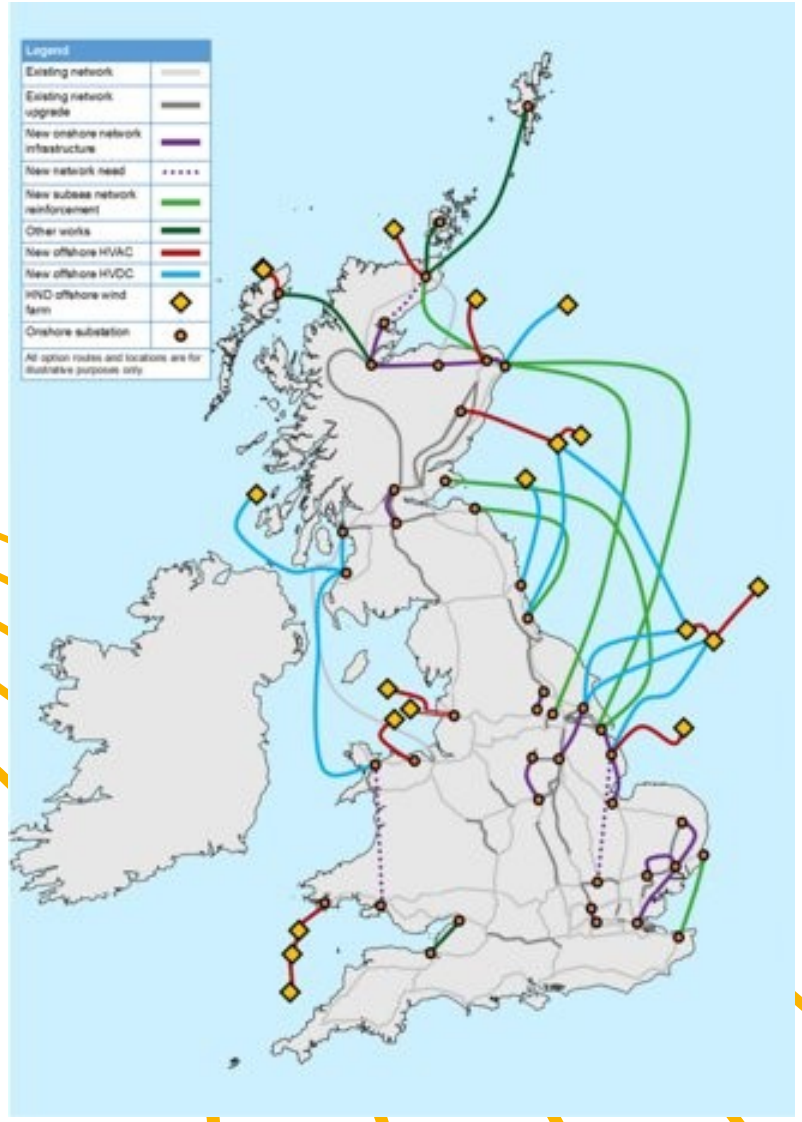
Electricity Modelling and Regional Strategy Manager

Electricity System Operator

Transitioning into an independent system body responsible for energy network planning

nationalgridESO

What does Electricity System Operator do?



- We are the electricity system operator for Great Britain. We operate the transmission networks, whereas Distribution Network Owners operator local networks.
- Our control room moves electricity around the country second by second to ensure that the right amount of electricity is where it's needed, when it's needed across Great Britain 24/7, 365 days a year.
- We don't generate or sell electricity – that's down to other companies. We also do not own the infrastructure the electricity travels through.
- One of our key responsibilities is to strategically plan the electricity network, through creating high level designs for companies to take forward and build. We currently do this GB wide for on and offshore electricity infrastructure.
- We are legally separated company within the National Grid Group. In 2024, we will transition into the Independent System Operator and Planner – a public body.

A new public body – Independent System Operator and Planner

An **independent** organisation with a mandate to deliver **net zero system operation**, with enhanced **data and digital capability**

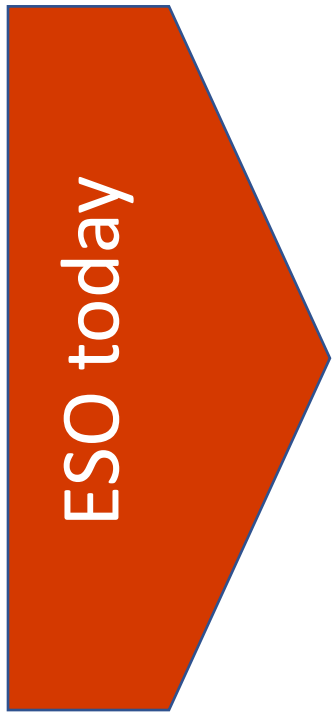
Act with a **whole energy system view**, bringing parties together to support **optimised decision-making and action** in the decarbonisation of power, heat and transport

Working with policy makers and regulators, and advising more broadly across the energy sector, to **unlock value and accelerate the net zero transition**

Roles and responsibilities of the new public body

The ISOP is about the creation of an expert and impartial body with duties to facilitate net zero whilst also maintaining resilient and affordable whole energy system

Now



‘Day 1’ of the ISOP

2024

We will introduce the **whole energy system capability** for:

- **Whole Energy Planning – including gas**
- **Gas Markets Strategy** and **Whole Energy Markets Strategy**
- The **Advisory** role to support DESNZ/Ofgem in decision making
- **Emergency Preparedness Activities**

Future of ISOP

2025+

Future responsibilities **may** extend to the following:

- **Regional System Planning**
- **Hydrogen**
- **Heat**
- **Transport**
- **CCUS**

Whole energy systems planning: regional system planner

Ofgem are currently consulting on the future of local energy planning and have proposed a new function – Regional System Planners – that the ISOP may be responsible for.

These will facilitate, develop and own a single plan per region optimising across vectors for the region and its customers against considerations of consumer value, net zero and security of supply.

Aim and responsibilities of the Regional System Planner

- Consistency across regions and coherent and coordinated with national energy system planning
- Coordinate, facilitate and ensue **effective participation** between local actors
- Governance arrangements to ensure there is **transparency**, **democratic accountability** and a proportionate allocation of risk.
- Whole system –leading to coordinated development across multiple vectors
- Ensure investment is made when and where it is needed to drive forward decarbonisation at pace – requires regional context to be embedded within planning assumptions
- Develop and own critical planning assumptions, using and collating inputs from local actors
- Provide independent **technical analysis and advice** to support decision making,

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Discussion

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Developing a regional planning process for a net zero future

Ben Haggerty
Future Network Blueprints Manager

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Delivering the electricity network that enables Net Zero

Our vision is to be at the heart of a clean, fair and affordable energy future.

Physical space at substations is becoming increasing challenging.

Network development, the **characteristics of the power system and the challenges** it faces are becoming more complex (power quality & reactive power)

The **number and variety of customer connections** is significant, and driving a need to transform our approach

Distribution Network Owners (DNOs) are telling us **they need more capacity** in their networks in order to grow

In days gone by the network was powered by large fossil fuel power stations

The modern network is powered by multiple sources, including low carbon fuels such as solar, wind, hydro and hydrogen.

Energy evolution from large fossil fuelled power stations to a modern renewables network.

To realise this vision, we must therefore:

1. **Systematically upgrade** our electricity transmission network to ensure it remains fit for future, resilient, intelligent and efficient to deliver net zero.
2. **Make our network plans transparent**, easy to understand and engage with for our stakeholders.

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Introducing Future Network Blueprints

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Future Network Blueprints

Stakeholder centric approach levering the power and importance of whole system thinking

Consider a combination of known and anticipatory network drivers looking out to 2050

Known network drivers

- Customer Connection applications
- Asset Health of the current network
- Transmission network reinforcement (on and offshore)
- Environmental targets

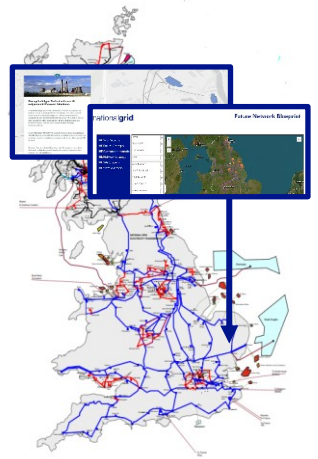
Anticipatory network drivers

- Customer Connection applications
- Future Energy Scenario modelling
- Local and combined authority energy plans

Be a single live 'best view' of the required network development within regions

Future Network Blueprints…

- Pre-date the idea of regional system planners
- All transmission and distribution network inputs together.
- A more coordinated approach to network development
- Ultimately saving bill payers money!



As a network owner, we still need future network blueprints to help us shape and form a more rounded network plan.

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Manomay Roy
Senior Power System Lead

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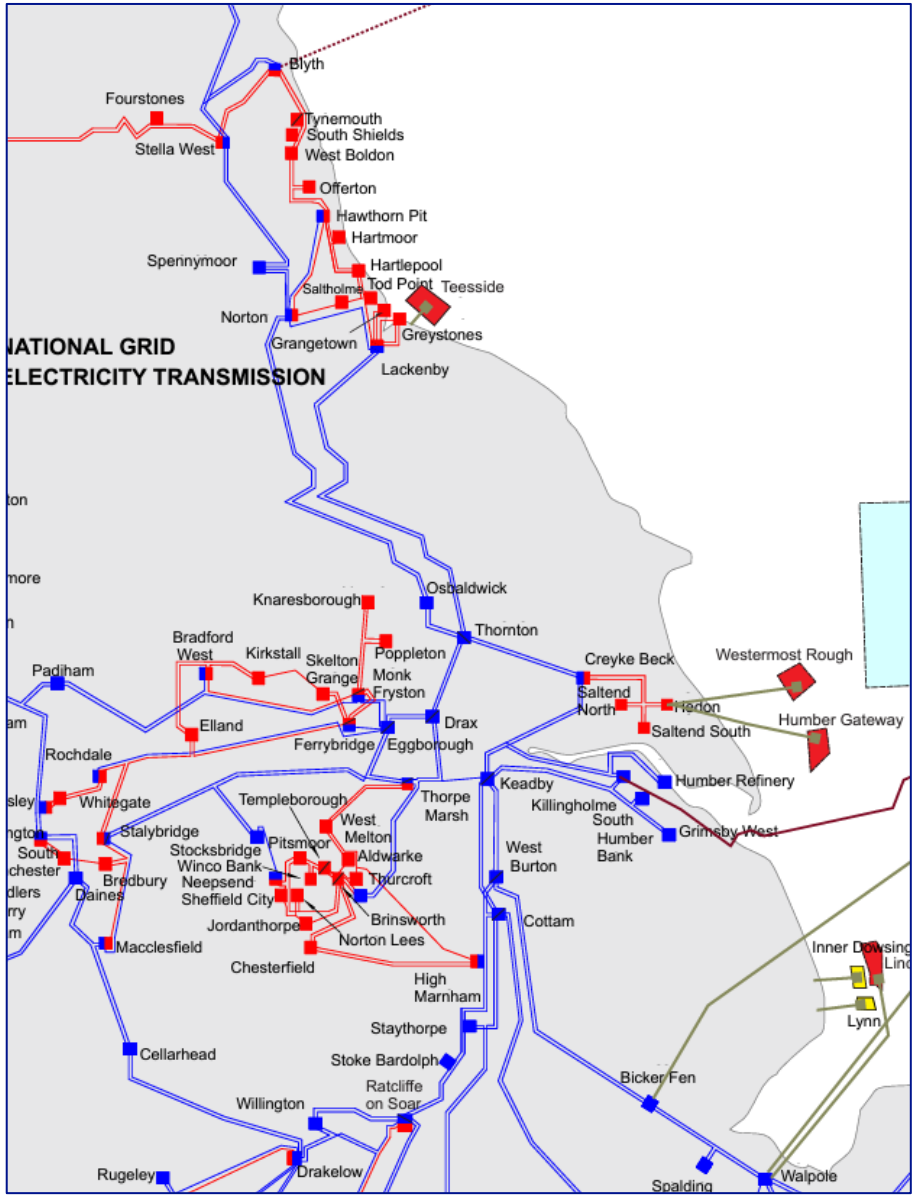
North East and East Midlands



The network in the North East and East Midlands today

- In addition to meeting the electricity needs of homes and businesses in the region, today's North East and East Midlands transmission network is critical for North to South power flow.
- The North East ring, the Aire Valley and the Humber regions are considered as **net power exporting** groups that connect large volumes of electricity generation.
- The South & West Yorkshire transmission network areas are considered as **net power importers** due high localised industrial electricity demand.
- Trent Valley and South Lincolnshire is traditionally a **net power exporting** group due to location of some large thermal power stations. This group is **strategically important** to the E&W network.
  - ➢ Four long 400kV routes help to transfer excess power generated in this group, the North east and Scotland. This can assist demand centres or surplus can be exported through interconnection with Europe.

North East and East Midlands

How the North East and East Midlands network needs are evolving:

- A significant increase in network connection interest along the east coast is causing established substations to reach capacity, and increasing the need for expansion of the network,
- Including new substations to provide connection hubs to serve the region's electricity generation and demand needs for the future.
- Significant amounts of renewable power generated to the north of the region (~28GW into NW and NE England combined) will significantly surpass regional demand.
    - ➢ Network reinforcements will be required to bulk transfer significant surplus power south to other demand centres.
- We are exploring the opportunity to re-use transmission assets and proximate NGET land post power station closures.
- Local authorities plan for regional development such as housing, EV charging, business and energy parks and Hydrogen production.

What we are planning for:

- More **network upgrades** due to the high volume of generation connecting to this region and future decarbonised demand needs
- **Reinforcement of the existing electricity network** where incremental capacity increases are sufficient or can act as a 'stop gap' whilst strategic infrastructure is delivered
- **Strategic upgrades** that consider network needs to 2050 and beyond wherever possible to enable Net Zero (balancing certainty of need, timely delivery and decisions that do not preclude any uncertain net zero futures)

North East and East Midlands

Major Projects under development

https://www.easterngreenlink1.co.uk/welcome

Eastern Green Link 1

Proposed 2GW high voltage direct current (HVDC) electrical 'superhighway' to be built between the Torness area in East Lothian, Scotland and Hawthorn Pit in County Durham, England. Jointly developed with Scottish Power Energy Networks.

Currently nearing the end of the development phase, construction work is planned to commence in 2024, with the new connection due to be operational in 2029.

https://www.easterngreenlink2.co.uk/

Eastern Green Link 2

Proposed 2GW high voltage direct current (HVDC) electrical 'superhighway' cable link to be built between Peterhead in Aberdeenshire, Scotland and Drax in North Yorkshire, England. Jointly developed with Scottish and Southern Electricity Networks Transmission.

Currently in the development phase, construction work is planned to commence in 2024 with the new connection due to be operational in 2029.

https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/infrastructure-projects/north-humber-to-high-marnham

North Humber to High Marnham

Proposing to build a new high voltage electricity transmission line and associated works between a new substation north of Hull at Creyke Beck in the East Riding of Yorkshire and a new substation at High Marnham in Nottinghamshire. First stage of the public consultation is closed and feedback will be incorporated into the next stage of public consultation in 2024.

North East and East Midlands

Major Projects under development

https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/infrastructure-projects/grimsby-to-walpole

Grimsby to Walpole

The Grimsby to Walpole proposed upgrade includes building a new 400kV overhead electricity transmission line from proposed new substations to be built in the vicinity of Grimsby West and the Walpole area, via two new substations in land from the Lincolnshire coast, to connect proposed new sources of renewable energy to the new line.

https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/infrastructure-projects/yorkshire-green

Yorkshire Green Energy Enablement (GREEN) Project

Proposal to build ~7km of new overhead lines, underground cables and two new substations at Overton and Monk Fryston, to link two existing overhead lines and to reinforce the system to increase the capacity of the network in the Yorkshire area.

https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/infrastructure-projects/brinsworth-high-marnham-uprating

Brinsworth to High Marnham Uprating

Proposal to uprate existing 275kV overhead lines to 400kV and develop three new substations at Brinsworth, Chesterfield and High Marnham to help carry more green power from the North of England to the Midlands. Doing so means we can get the most out of the existing network before needing new lines.

North East and East Midlands

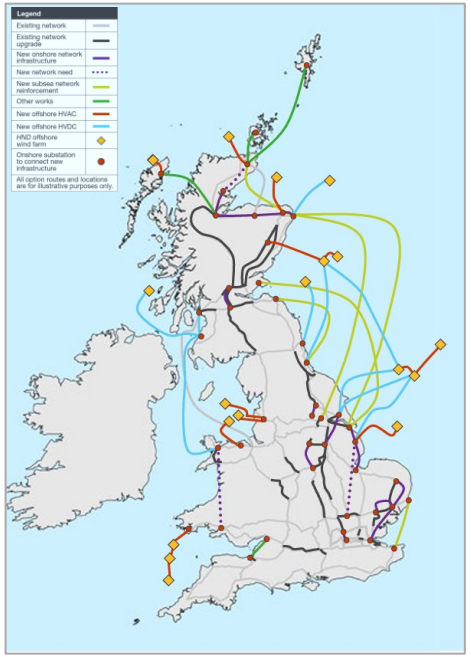
Defined network needs with solutions under early development

In 2022 the Electricity System Operator (ESO) led a Holistic Network Design (HND) activity that determined a coordinated offshore electricity network design to support connection of large-scale offshore wind to help to meet government decarbonisation ambitions. A subsequent onshore network assessment (NOA Refresh) confirmed the need to further develop solutions for the following:

- **Eastern Green Link 3 -** 2GW offshore HVDC link to be built between Peterhead in Scotland and in the Walpole area in England.
- **Eastern Green Link 4 -** 2GW offshore HVDC link to be built between East Scotland and in the Walpole area in England.
- **East Midlands overhead line -** New 400kV overhead line across East Midlands to increase east-west power flow capacity.

Expected Future network needs with solutions to be developed

- A Holistic Network Design follow-up exercise (HNDFUE) is being undertaken in 2023 to further assess increased Scottish wind generation, followed by a subsequent onshore assessment:
  - Process ongoing with ESO publication expected late 2023/ early 2024.
  - The publication will provide further signals for developing bulk transfer solutions to the significant N-S power transfer challenge.
  - Post publication, NGET will commence detailed development of the solutions in conjunction with our Future Network Blueprints.



Pathway to Net Zero Workshop

Northern Powergrid supporting regional decarbonisation

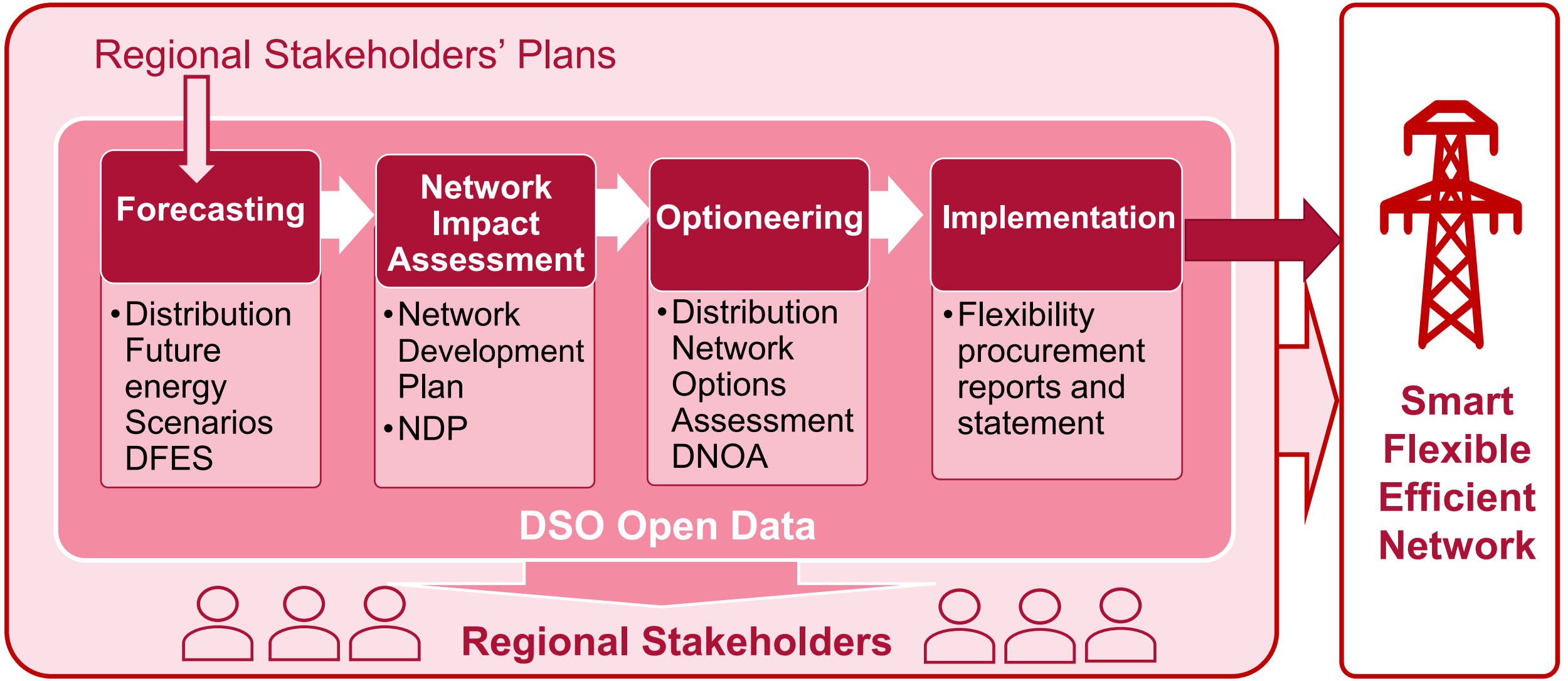
Gillian Williamson
Head of System Forecasting

17th October 2023

Introducing Northern Powergrid

- Northern Powergrid is responsible for the **electricity distribution network** covering voltages from 132kV down to 230V in the North East, Yorkshire and Northern Lincolnshire.
- We are the enabler of a **net zero** future for our region and 8 million customers.
- Together with our fellow energy network operators, we must be on the **front foot of decarbonisation** as we face the biggest change in networks since their formation.
- £2.8bn of investment over the five year period to prepare our network whilst continuing to deliver safe and reliable power to the people we serve.

Northern Powergrid's enhanced approach to network planning



Northern Powergrid's Local Area Energy Plan Support

Local Area Energy Systems team

- Facilitate quicker and more efficient developments by ensuring you can make informed decisions.
- Offering support, guidance and advice with:
  - Understanding our network
  - Interpreting our network data
  - Understanding our connection and planning processes
- Give you the ability to influence our strategic network development
- Our Local Authority Portal enables intelligence sharing in a secure and accessible way

Areas for dialogue – we need to understand your plans as early as possible

Residential Decarbonisation – High volume heat pump installations

Local Area Energy Planning – Strategic 'place based' plans

Electric Vehicle (EV) Infrastructure Developments

Non-residential Decarbonisation

Collaboration with NGET

Together with other network operators, we are making rapid changes to support customers' decarbonisation and improve how they connect to the distribution network.

Transmission Congestion Initiatives

NORTHERN POWERGRID	**Northern Powergrid internal initiatives** • Improving information and engagement • Heat map improvement & publish Project progressions • Pathfinders
ena energynetworks association	**ENA Strategic Connections Group** 3 step plan • T&D Queue Management • Queue Management Pre/Post 2017 & Optimisation • Battery Assumptions
nationalgridESO nationalgrid	**ESO 5 Point Plan initiatives to deliver faster connections** • Construction planning assumptions 30-40% • TEC amnesty • Battery design assumptions • ESO transmission milestones • Non firm interim connections - Technical Limits

Other Collaborative Forums

- ENA Open Networks
- Regular Joint technical liaison meetings

Next steps:

- DFES/FES coordination group
- Regional System Planner for improved whole systems solutions

To conclude…

- Northern Powergrid are committed to enable decarbonisation in our region.
- We are working in partnership with you to incorporate local plans into our forecasting so that our network is an enabler for our stakeholder's net zero ambitions.
- As our customers' needs change, our services are adapting including provision of Local Area Energy Systems support.
- We work collaboratively with National Grid (NGET and ESO) using well established processes for communicating our customers' needs and checking that the transmission network can cope with our customers' connections.

Northern Powergrid resources and contacts

Resources

- Open data portal
  Open Data | Northern Powergrid (opendatasoft.com)
- DFES
  Northern Powergrid Distribution Future Energy Scenarios (odileeds.github.io)
- Local Area Energy Systems portal
- https://www.northernpowergrid.com/local-area-energy-systems

- Connections

Contact us

- LAEP@Northernpowergrid.com
- opendata@northernpowergrid.com
- getconnected@northernpowergrid.com

National Grid Electricity Distribution (NGED)

Peter Gaskin
DSO Engineer
System Planning

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About National Grid Electricity Distribution

Formerly *Western Power Distribution*, we are now part of the National Grid plc group.

National Grid Electricity Distribution are responsible for electricity distribution across the Midlands, South West and South Wales.

Our business serves over 8 million customers and we employ over 6,500 members of staff. National Grid employs 29,000 members of staff worldwide.

The distribution network includes voltages from 132 kV to low-voltage (415 V).

Strategic planning process

Distribution strategic planning process

Following this process allows NGED to understand the electricity needs of customers now and into the future, and to develop our network in an economic, efficient and coordinated manner to accommodate these ambitions.

Development of strategic planning process

2016 - published our long-term scenario forecasts for the South West licence area

2016 to 2020 - published ‘Shaping Subtransmission’ analysis report for all licence areas at 132 kV

2021 - Published DNOA report to assess the use of flexibility versus conventional reinforcement

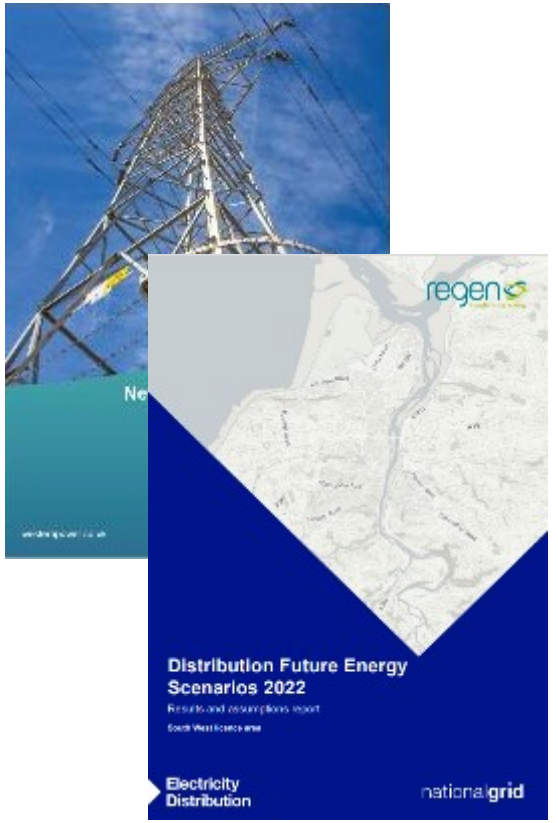
2022 - marked the first publication of the Network Development Plan as a Licence Condition

Examples of East Midlands projects include:

- Willington 132 kV
- The Northampton Group
- Annesley BSP

2016/17

2022



Strategic planning: distribution-transmission interface

Alignment with existing processes	**Processes exist currently between DNOs and ESO/TOs to highlight future transmission capacity requirements.** • How do these need to be reformed with Future Network Blueprints, and alignment between demand and generation triggered investment.
Interaction with connections queue	**The connections queue has already triggered significant works across the transmission network** • The development of the whole electricity system needs to be coordinated and aligned to current actions being implemented by DNOs and ESO.
Benefits of local engagement	**Requirement for engagement with local stakeholders to be coordinated between transmission and distribution, to avoid duplication.** • This could be achieved through better visibility of distribution forecasts with transmission, to enable the wider system benefits to be quantified.

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Discussion

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Electronic voting

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Coffee Break

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The connections challenge

Ruth Shaw
Customer & Stakeholder Experience Manager - NGET

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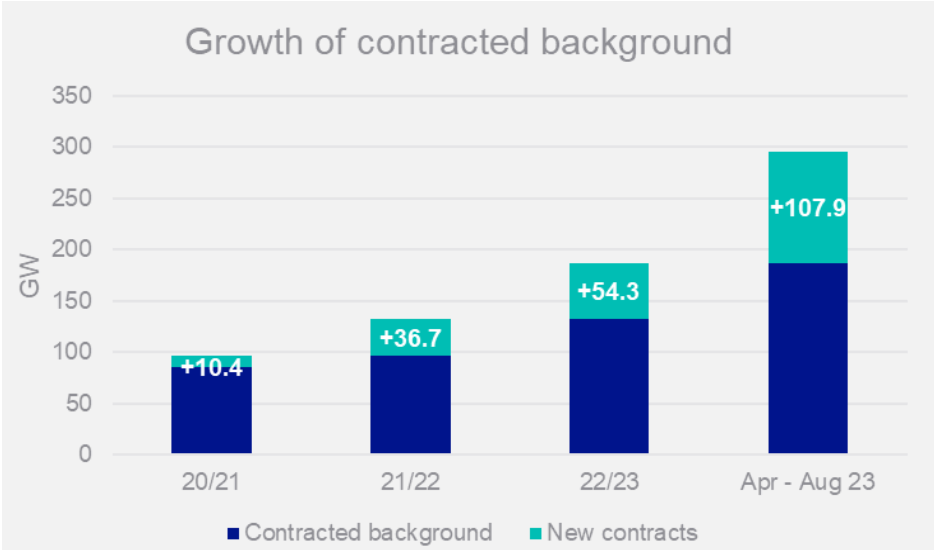
The pace and scale of change in the connections landscape is vast

The connection landscape has undergone an extensive transformation in the past 10 years, we have moved from a fossil fuel led energy mix, to clean low carbon generation and innovative demand technologies, all of which require connection to the Transmission or Distribution networks

We're keeping up with the challenge to connect over 60GW of low-carbon generation by 2035 to meet net-zero targets.

The market has responded to Government targets with significant volume of low-carbon technologies coming forward to connect – and the volume is still increasing!

We have gone from connecting a handful of large-scale developments per year, to managing a **contracted background of almost 300GW and over 700 contracts** (for England & Wales alone).

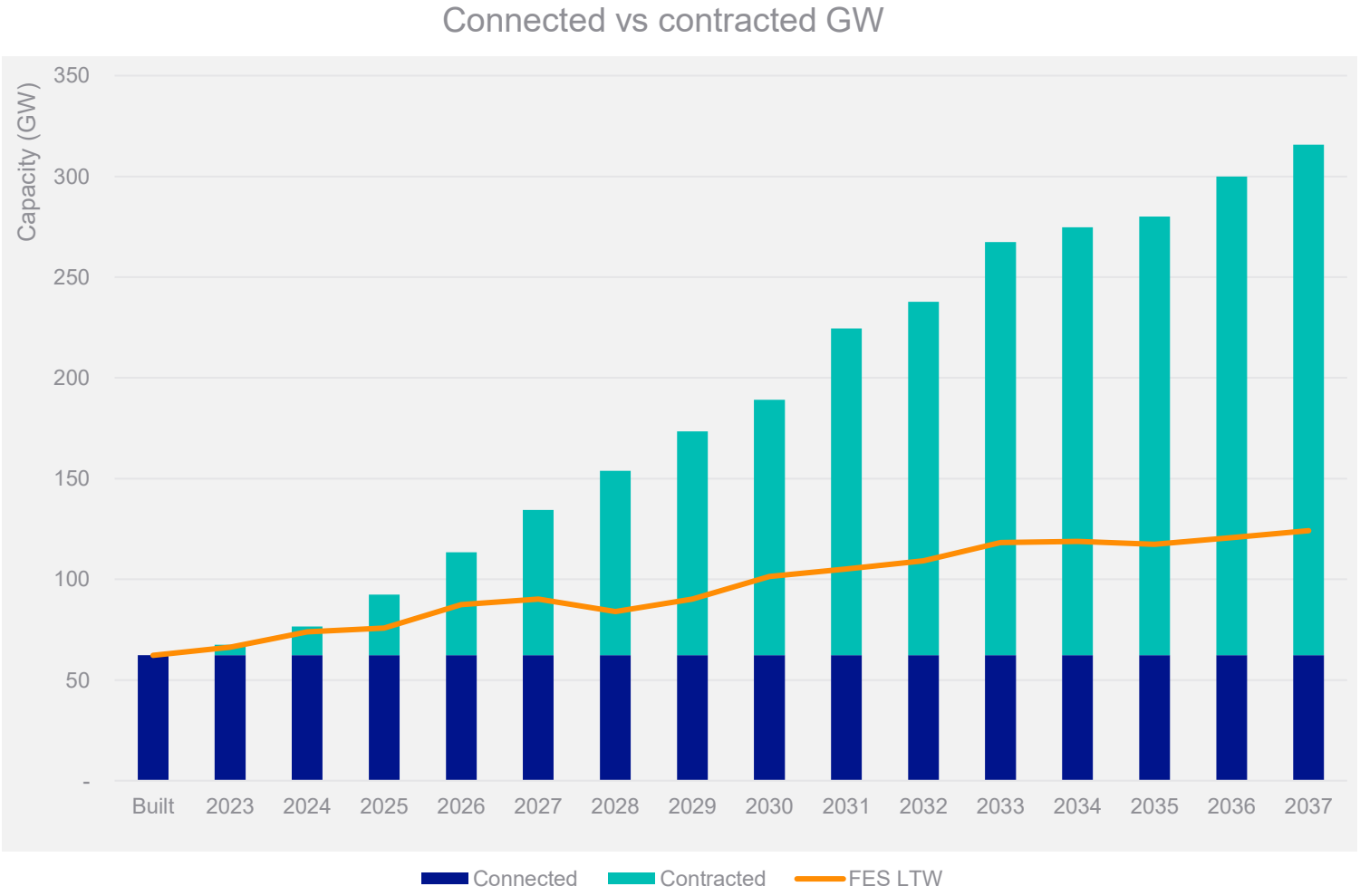


The volume of contracted connections is more than we will ever need and continues to grow at pace

The volume is there to meet net-zero targets and future demand requirements.

However, problems arise with this volume;

- **Complexities of connecting on a live network** that is required 24/7
- Lengthening **connection timescales for customers** applying to connect
- **Uncertainty around who will connect** (the ESO suggest only 20-30% will progress)



What's caused these problems?

There is not one problem nor one solution

Market

- Customers can **apply when they want**, for what they want and **get allocated capacity** on a **first come first served basis** – resulting in a pipeline of **almost 300GW of generation and demand connections** to the network in England and Wales

Contract

- **Lack of contractual discipline and authority** to effectively manage customer contracts and ensure efficient connections for connecting customers

Physical works

- **Required network investment is based on a view of those wanting to connect** (currently an extreme unlikely reality of almost 300GW – and roughly only 70GW required to connect to meet net zero and 2035 demand)

NGET ambition for future connections

A collaborative effort is required

Market

- The market sends the **right signals** for **customers to act rationally** in line with Government ambition and energy strategy
- There are appropriate levels of **entry criteria** to ensure **only viable applications**

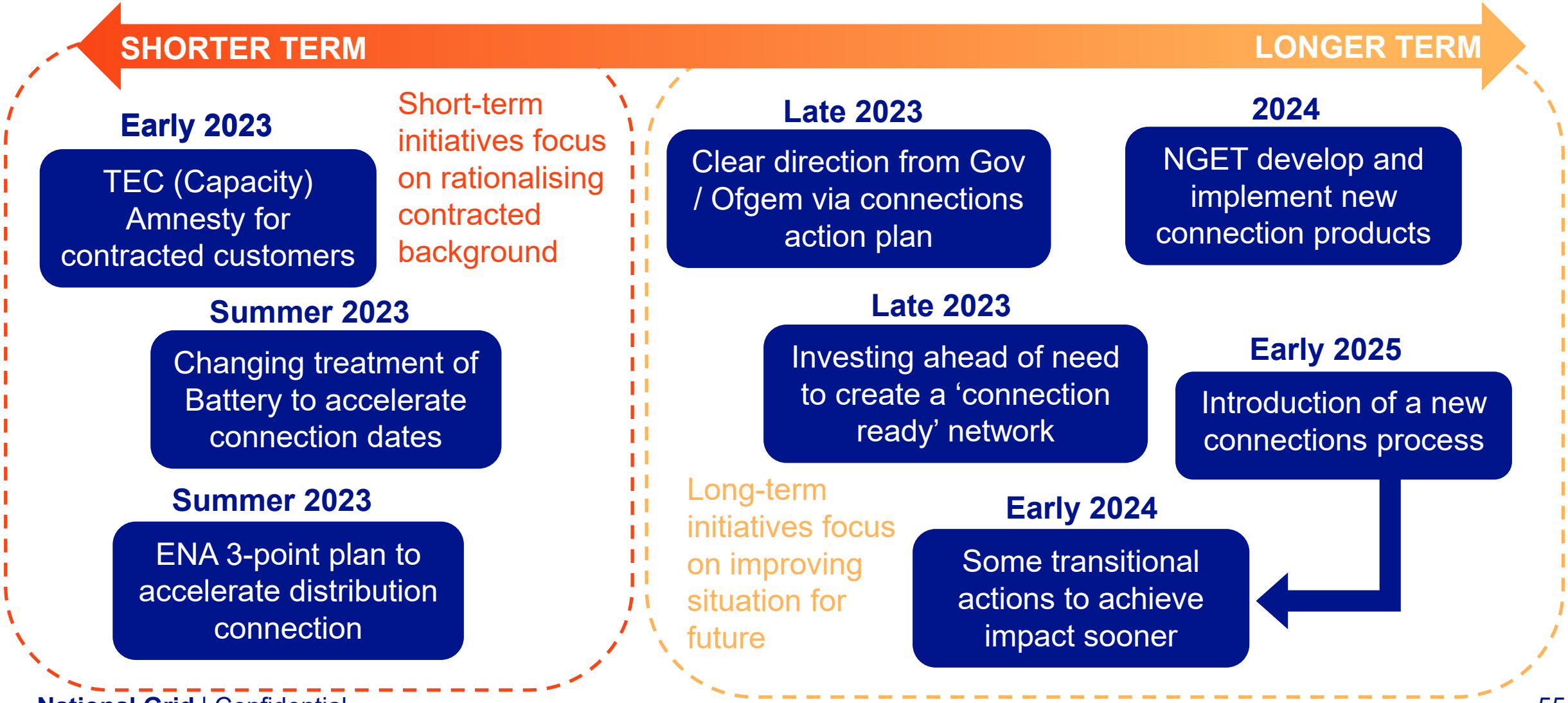
Contract

- Customers are encouraged to **'connect or move'** to **allow others to progress**
- **Contracts and allocated capacity** have the **flexibility** needed to **ensure connections are delivered efficiently**

Physical works

- **Network investment takes place ahead of need to ensure a 'connection ready' network**
- **Innovative connection products** are available to help deliver **faster connections**

What is being done to improve connection timescales for customers and communities?



Connections - Relationship with Future Network Blueprints

Future Connections Require:

- The right signals for customers to act in line with government ambition and energy strategy
- Contracts and allocated capacity to have the flexibility to deliver connections efficiently
- Network investment to take place ahead of need –i.e. a 'connection ready' network

Future Network Blueprints are:

- A single coordinated best view of network investment in the context of delivering net zero.
- A baseline from which we will refine, evolve and enhance our future network plans based on our engagement with stakeholders.
- Coordinating complex electricity network requirements across multiple time horizons - when and how to replace, expand and/or strategically upgrade our infrastructure.

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Next steps

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Thank you

To keep in touch, or if you have any questions, please contact us on the below email:

pathwaytoNZ@nationalgrid.com

We will:

- Gather and record all the valuable feedback we receive today through the polls, discussion sessions plus Q&A
- Follow up on any clarifications, reinforce the new stakeholder links formed from today
- Liaise across network businesses to incorporate and evidence todays feedback into our network plans
- Research study by our partners at Yonder. This will be emailed out and be grateful if you can fill it in.

Keeping you updated

Please scan the QR code to to keep the conversation going and to sign up for regular updates.

Electricity Transmission

Q&A

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