

**Electricity  
Transmission**

# Innovating for a net zero future in electricity transmission

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**nationalgrid**

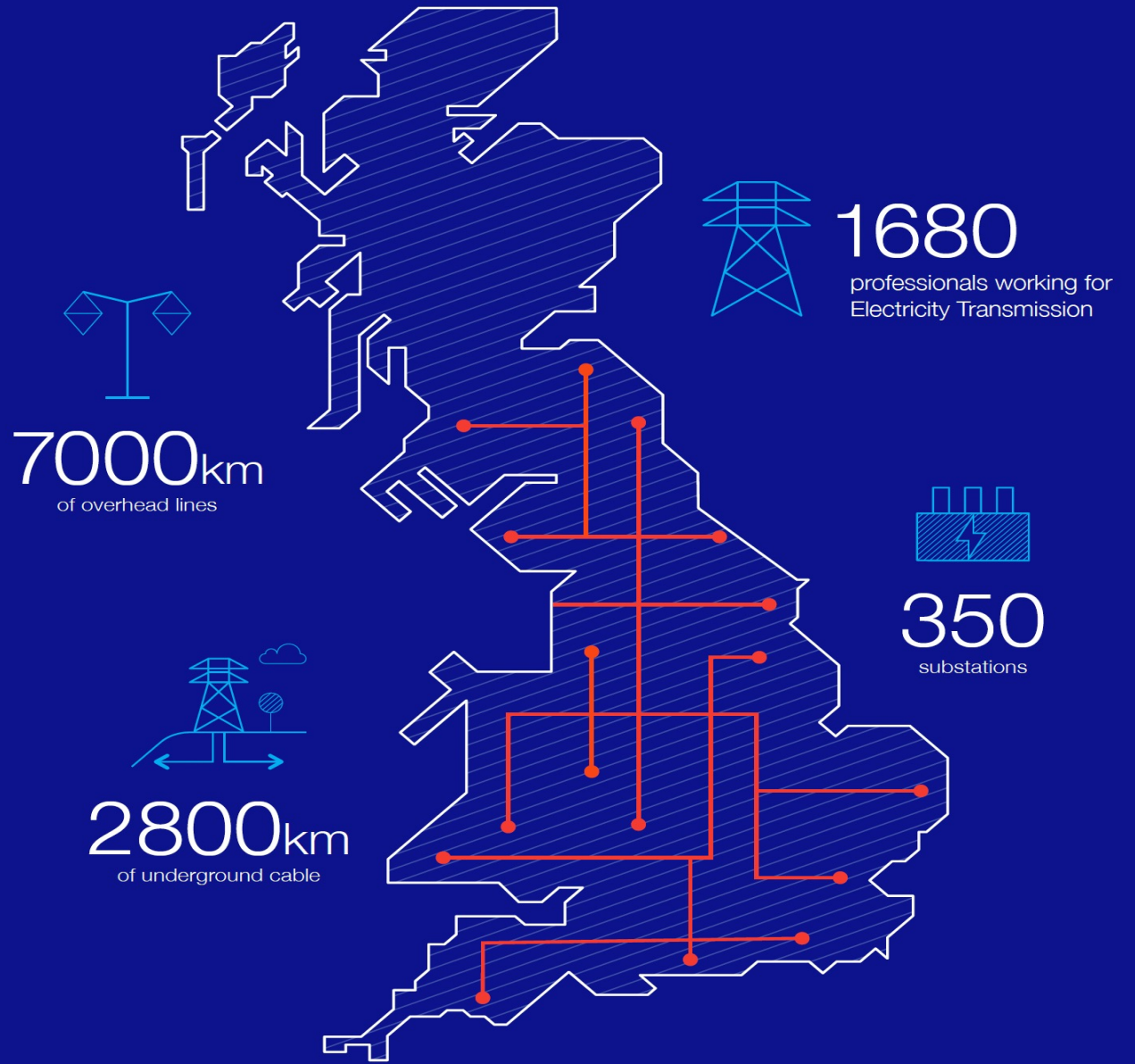


# Who we are and what we do

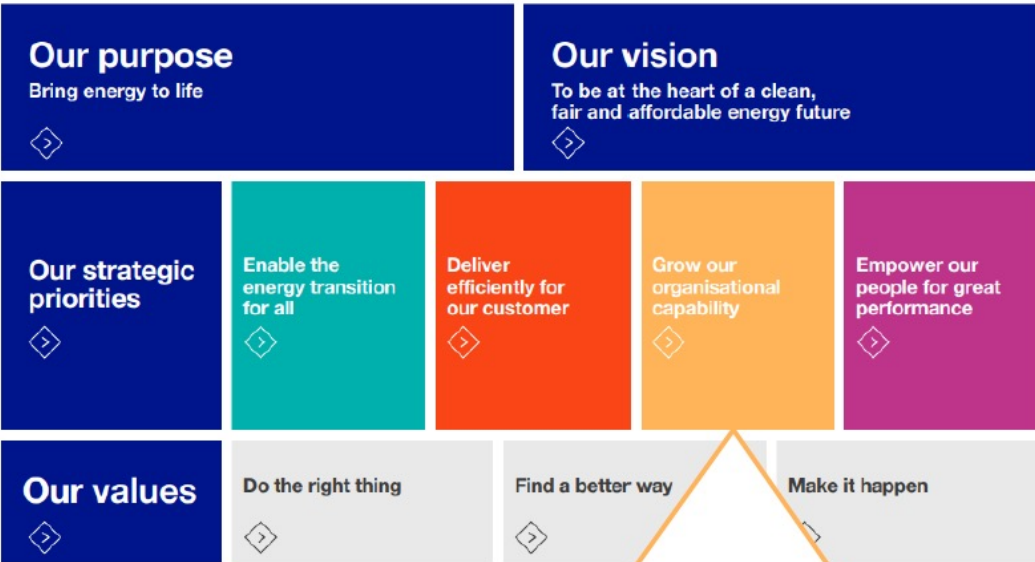
National Grid Electricity Transmission (NGET) owns and maintains the high-voltage electricity transmission network in England and Wales. Every time a phone is plugged in, or a switch is turned on, we've played a part, connecting you to the electricity you need.

We take electricity generated across England and Wales, including from windfarms and nuclear power stations, and transport it through our network, consisting of more than 7000 kilometres of overhead line, 2800 kilometres of underground cable and 350 substations, on to the distribution system, so it reaches homes and businesses.

We're investing in the network, connecting more and more low-carbon electricity – it's a crucial role and pivotal in turning the UK's net zero ambitions into reality.



# Context



### Grow our organisational capability

If we're going to thrive, we need to transform – and keep transforming – to keep pace with a changing world.

This strategic priority is where innovation, and the need to grow our organisational capability around innovation, is critical to our business. This need is integral to our objectives at the highest level of our organisation.

- Anticipating and adapting to changes in the energy sector in faster and smarter ways
- Remaining at the cutting edge of engineering and asset management
- Innovating more sustainable energy solutions.

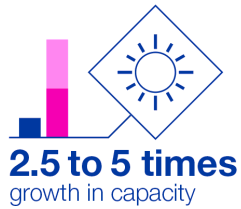
# National Context

We must systematically upgrade the transmission network to provide a sustainable 'platform' to service future electricity needs

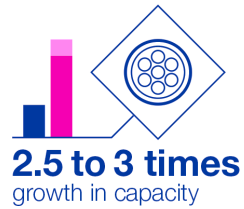
## Offshore wind



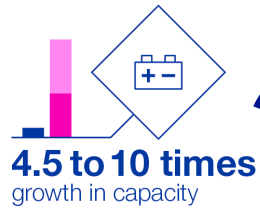
## Solar



## Interconnectors



## Battery storage



At the same time cross sector electrification is expected to increase total electricity demand by around 50%.<sup>5</sup>

Building over  
**5 times more**



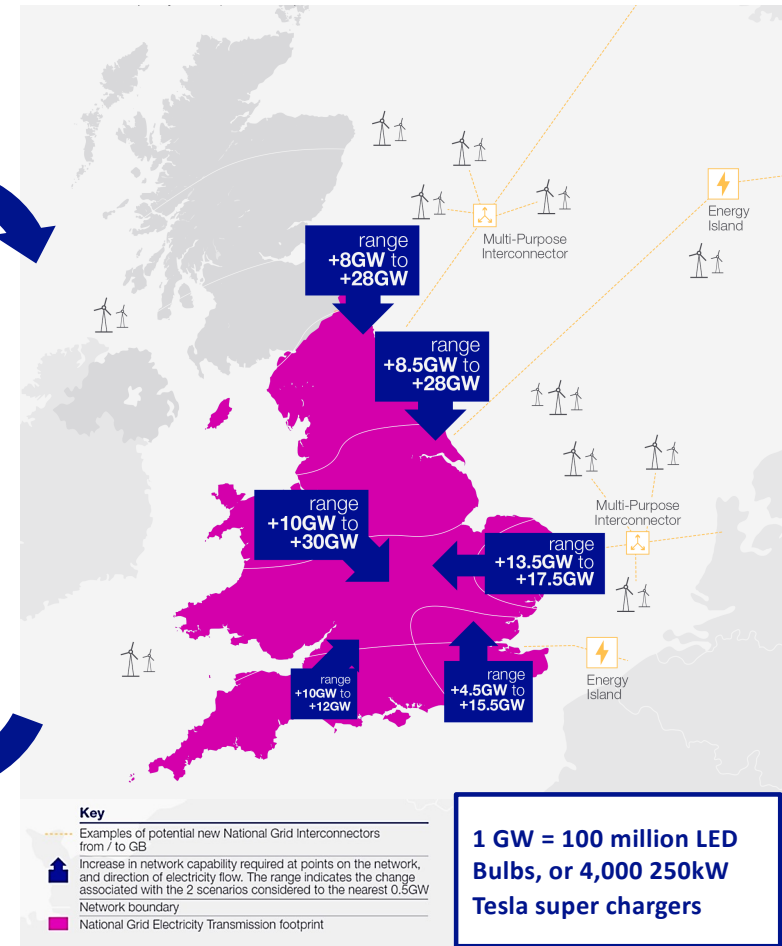
transmission overhead or underground lines than we have built in the last 30 years.

Building around  
**4 times more**



transmission marine cables than our current offshore network.

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# Our Innovation Strategy

## Enabling us to facilitate net zero for GB

1. Maximise the use of our current network capacity
2. Accelerating connections for our customers
3. Effectively interface and integrate new transmission and customer equipment across the network
4. Maintain the health of an ageing asset base efficiently and economically
5. Facilitate system access for all work as demand grows
6. Understand the role of whole energy system solutions and their impact on the transmission system
7. Deliver significant new onshore and offshore network capacity while minimizing impact on communities and the environment

## Enabling us to decarbonize our own operations

8. Reduce the emissions associated with our SF6 inventory to achieve net zero by 2050, as well as interim reduction targets
9. Reduce the emissions of construction activity, moving to net zero by 2026
10. Ensuring we can maintain resilience against a more challenging external threat landscape, both from natural climate events and cyber events

# Our Tactical Priority Areas

Enduring challenge	Tactical priority (where we need your help)
1. Maximise the use of our current network capacity.	<ul style="list-style-type: none"> <li>• Increase useful capacity of existing substation and overhead line assets.</li> <li>• Enable significant uprating of existing transmission routes.</li> </ul>
2. Accelerating connections for our customers.	<ul style="list-style-type: none"> <li>• Developing new design solutions to enable more standardised and modular approaches to customer connections.</li> </ul>
3. Effectively interface and integrate new transmission and customer equipment across the network.	<ul style="list-style-type: none"> <li>• Understand and optimise power controller interaction.</li> <li>• Understand and manage a low fault-level, low inertia transmission system.</li> </ul>
4. Maintain the health of an ageing asset base efficiently and economically.	<ul style="list-style-type: none"> <li>• Improve understanding of the condition of our assets and failure modes.</li> </ul>
5. Facilitate system access for all work as demand grows.	<ul style="list-style-type: none"> <li>• Develop enhanced asset management practices, such as non-intrusive condition monitoring.</li> <li>• Develop technology to enhance understanding of real-time system performance.</li> </ul>
6. Understand the role of whole energy system solutions and their impact on the transmission system.	<ul style="list-style-type: none"> <li>• Digitise processes for design, development, construction, maintenance and operation of the network.</li> <li>• Improve approach to evaluating the societal impact of NGET activities.</li> <li>• Develop and understand capabilities of whole energy system modelling.</li> </ul>
7. Deliver significant new onshore and offshore network capacity while minimising impact on communities and the environment.	<ul style="list-style-type: none"> <li>• Increased capacity/lower cost onshore transmission routes.</li> <li>• Explore ultra-high voltage technology for use on the onshore network.</li> <li>• Develop offshore HVDC technologies and our modelling capability for those technologies</li> </ul>

Enduring challenge	Tactical priority (where we need your help)
8. Reduce the emissions associated with our SF6 inventory to achieve net zero by 2050, as well as interim reduction targets.	<ul style="list-style-type: none"> <li>• SF<sub>6</sub> alternatives, retro-filling assets with new gases.</li> <li>• Leak detection and repair.</li> <li>• Lifecycle management.</li> </ul>
9. Reduce the emissions of construction activity, moving to net zero by 2026.	<ul style="list-style-type: none"> <li>• Low-carbon materials for construction.</li> </ul>
10. Ensure we can maintain resilience against a more challenging external threat landscape, both from natural climate events and cyber events.	<ul style="list-style-type: none"> <li>• OT (operational technology) cyber security: automated detection and management.</li> <li>• Understand and develop mitigation measures for network and asset resilience in the face of climate change.</li> </ul>

# How are we going to achieve this?

Our strategy lays out three key focus areas that are critical for us to move towards our ambition:

- Continue to improve our **innovation culture**
- **Collaborate**, working in partnership with others
- Improve the transition of our **projects into BAU**



# Types of Innovation Funding

## Network Innovation Allowance (NIA)

Ofgem's NIA provides an allowance to network licensees to fund research, development and demonstration trials that must meet six specific eligibility requirements.

1. Facilitate energy system transition and/or benefit consumers in vulnerable situations
2. Have the potential to deliver a net benefit to consumers
3. Involve research, development or demonstration
4. Develop new learning
5. Be innovative
6. Not lead to unnecessary duplication.

## Strategic Innovation Fund (SIF)

For RIIO-2, Ofgem replaced its Network Innovation Competition (NIC) framework with Strategic Innovation Funding (SIF), with £450m available for GB networks over the five-year regulatory period.

## Self Funded Innovation

Innovation is self-funded through various projects; most recent examples are:

- London Power Tunnels concrete pour
- New Plug and Switch System (PASS) bay at Willesden Substation
- Shunt Reactor Bay at Stalybridge Substation
- Bengeworth Road SF6-free substation



# Our innovation in numbers

**NIA Projects**  
**£6.582m**  
spend on NIA projects in 22/23

**£15m**  
forecast spend on NIA projects in 23/24

**19**  
NIA projects registered in 22/23

**10**  
number of Innovation Engineers working on NIA innovation projects

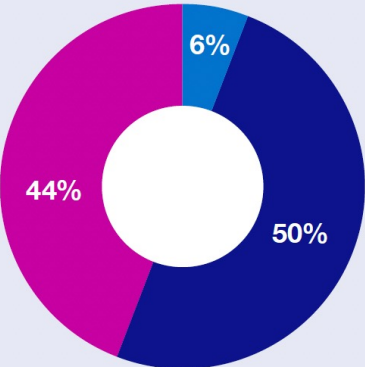
**32**  
RIIO-2 NIA live projects

**Number of collaborators involved in our RIIO-2 NIA live projects**

**35** project partners      **8** project supports

**Distribution of Technology Readiness Level by volume of NIA projects in RIIO-2**

- Demonstration (TRL 7-8) 6%
- Research (TRL 2-3) 50%
- Development (TRL 4-6) 44%



**NIC Projects**  
**2**  
ongoing NIC Projects



**SIF Projects**  
**2**  
SIF led Alpha projects registered 22/23

**3**  
SIF led discovery projects worked on

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# **Harnessing the power of drones and AI**

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## OHLs

- The VICAP project has proven and tested that we can automate the capture and processing of corrosion related condition assessment data for the steelwork on our lattice pylons.



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## Substations

- The AATIS project is investigating how we can use drones and Artificial Intelligence (AI) to automatically monitor the thermal condition of our substation assets.



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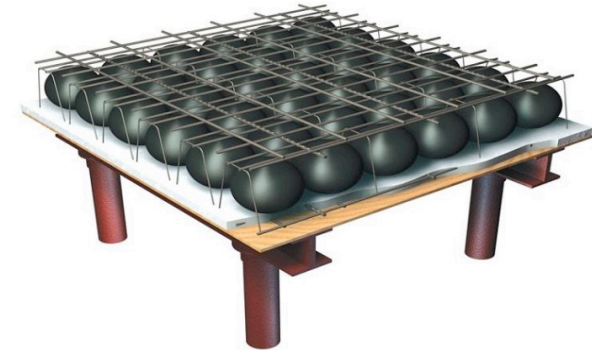
# Net zero construction

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# Use of innovative materials and techniques for construction

- This project is exploring the viability of novel construction materials such as: weathering steel, polymer materials, bubble and waffle slabs, ashcrete, graphene enhanced concrete and 3D printing.
- We're conducting feasibility and testing of products and assessing: strength, weight, carbon footprint, ease of construction ie reduced earthing, asset management and decommissioning.



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**Q&A**

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