

**Electricity
Transmission**



Delivering our environmental future

Our energy | Our planet | Our future

nationalgrid

August 2019

Who we are and what we do

We are National Grid Electricity Transmission plc (NGET). We own and maintain the high voltage electricity network in England and Wales.

Serving England and Wales

We move electricity from where it's generated, down the superhighway of the electricity system, to our direct customers and to the distribution companies that deliver power to homes and businesses.

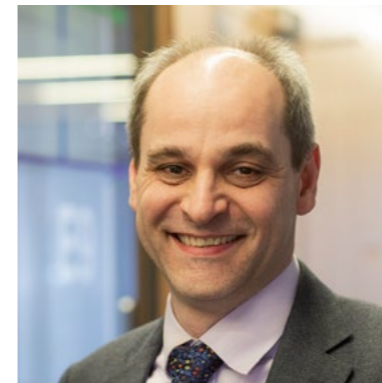
Contents

Foreword	3
2018/19 highlights	4
Context	5
Our energy update	6–13
Our planet update	14–21
Our future update	22–29
Performance summary	30
Feedback	31



Welcome to our Annual Report for 2018/19

To say that the past year has been an eventful one would be an understatement. We've continued to deliver projects that support the decarbonisation of electricity and that deliver a sustainable energy system for the future.



"It is our belief that a sustainable business is a successful business"

David Wright,
Director of Electricity Transmission

The transformation to a sustainable energy system with high shares of renewables is needed to meet the UK's climate goals. In 2018/19, we've made good progress in advancing the decarbonisation of electricity. For the first time since the 1980s, the UK electricity network ran for more than 72 hours without the need for coal generation. This new record came days after the first ever 48-hour period of no coal generation. New records for wind generation keep being set, and undoubtedly we will continue to see such energy records being broken regularly in the future.

I'm very proud of the contributions we've made to enable these changes in the energy sector. The amount of low-carbon generation directly connected to our network climbed to 16.7 gigawatts (325 megawatts of which was connected last year). In 2018/19 we developed a new engineering solution to connect smaller generators. This is supporting the connection of battery storage solutions to our network. We connected the world's largest offshore wind farm – Hornsea Project One – and completed a new 400kV overhead line between Richborough and Canterbury, to increase the sharing of energy between the UK and Europe.

We are also continuing to innovate. We have been looking at alternatives to traditional methods for network reinforcement. I'm delighted that we are now planning to employ a new type of 'power flow control device' – a smart and flexible technology – in our network as early as 2020. This is a world first for a transmission network.

However, global environmental challenges continue to grow. 2018 was the year when climate science told us to strengthen our global response to the threat of climate change. The Intergovernmental Panel on Climate Change (IPCC) 2018 special report warned there is only a dozen years for global warming to be kept to a maximum of 1.5°C. Even half a degree more will significantly worsen the risks of

drought, floods, extreme heat and poverty for hundreds of millions of people. Collins Dictionary named 'single-use' the 2018 Word of the Year in recognition of the spike in public concern over plastic pollution. In addition, the latest Living Planet Index showed an astonishing decline in wildlife populations – a 60% fall in just 40 years.

Within National Grid Electricity Transmission, we have many environmental actions to be proud of this year. We developed a stand-alone sustainability strategy separate from the National Grid Group to clarify our commitment and contribution to decarbonisation. We committed to remove single-use plastics from our offices by 2020, reduced the carbon intensity of our construction design by 50% for our major projects, and we enhanced the natural environment at 29 of our sites via a 'Natural Capital' approach.

However, while our total business carbon footprint has been reduced by 40% from a 2012/13 baseline, we saw an increase in our 'controllable' greenhouse gas emissions by 14% from last year. This was due to an increase in sulphur hexafluoride (SF₆) leaks. It is critical that we manage this better, so I am making sure that we prioritise the management of SF₆.

Preparing our network to be fit for a net-zero future is more important now than ever. That's why we have been working with the Government and engaging with a range of stakeholders on the electrification of transport. We're innovating to find more environmentally friendly solutions, and are now using an internal carbon price to support our investment decision-making. It is our belief that a sustainable business is a successful business.

As with previous years, I'd very much welcome your views on this annual statement, as it helps us to focus on delivering what's important to you.

David Wright,
Director of Electricity Transmission

2018/19 highlights



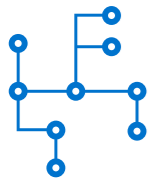
Commitment to single-use plastics

Committed to removing all single-use plastics from sale at our offices by 2020



New engineering solutions for smaller generators

Made the first customer offer to connect smaller and cleaner generators in months, not years



Improving our connections process

Launched the new National Grid Electricity Transmission website with more information and tools on how to connect to our network. www.nationalgridet.com



Using land to support the transition

Committed to working with Forum for the Future, to trial 'Powered Paired' – a digital tool to support community energy groups in finding land



Delivering system flexibility

Presented innovative electronic 'power flow control devices' as an alternative to traditional network reinforcement at the Network Options Assessment (NOA)



Increasing opportunities for shared use of renewable energy

Completed the 400kV overhead line from Canterbury to Richborough to connect Nemo – the interconnector between Belgium and GB



Electrification of transport

Influenced Government policy on the electrification of transport



Connecting renewable energy

Successfully connected the world's biggest offshore wind farm (Hornsea Project One) to our network at Killingholme



Carbon pricing

Embedded carbon pricing in our major investment decisions



Meeting the needs of our customers

Reorganised our business around the needs of our customers and stakeholders



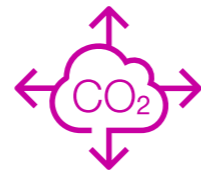
Improving the natural environment

Enhanced the natural environment at 29 of our sites via a 'Natural Capital' approach (from a 2013/14 baseline)



Delivering a cleaner energy system

Connected and facilitated 535 megawatts of clean generation



Low carbon construction

Reduced the carbon intensity of our construction design by 50% (from a 2015/16 baseline)



Environmental sustainability strategy

Published our stand-alone Environmental Sustainability strategy

Context

Our contribution to the United Nations Sustainable Development Goals



This report is the National Grid Electricity Transmission (NGET) executive-level annual statement for the Environmental Discretionary Reward (EDR). The EDR provides a financial and reputational incentive for Great Britain's electricity transmission owners, encouraging high standards of environmental management as well as facilitating the transition to a decarbonised energy system.

In addition, this statement provides an update on progress towards our recently published 'Environmental Sustainability Strategy'. Our strategic vision is to operate a sustainable electricity network which makes a positive contribution to the environment and contributes to the energy system of the future. To this end, we developed an integrated strategy based on three fundamental pillars: our energy; our planet; our future. This report is structured around the three pillars.

Throughout the year, we have implemented projects that contributed to the decarbonisation of energy, made a positive environmental impact, and made our business 'future proof'. We have structured

this report to describe our actions over the last year, and our ambition for the future. The scope of this report is focused on performance data for the financial year reporting period from 1st April 2018 to 31st March 2019.

In 2018/19, NGET continued to operate as a single business for both the Transmission Owner (TO) and the Electricity System Operator (ESO). This changed in April 2019 when a new, legally separate Electricity System Operator was established. However, as we were preparing for legal separation, it is appropriate that this report should be the first to focus solely on Electricity Transmission's activities.

Our environmental sustainability pillars:

Our energy

We will enable the decarbonisation of the electricity system. We will actively play a role in:

- Facilitating whole system outcomes
- Connecting low-carbon generation
- Considering alternatives to traditional network development

Our planet

We will make a positive contribution to the environment. We are going to:

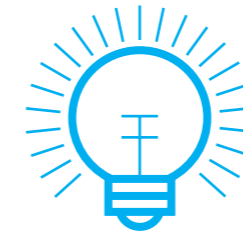
- Reduce our controllable carbon footprint
- Safeguard responsible resource use
- Care for the natural environment

Our future

We will prepare our network to be fit for a low-carbon future. We are going to:

- Innovate to find sustainable solutions
- Consider the changing needs of our customers and stakeholders in the future of energy
- Include sustainability early in our decision-making

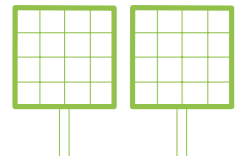
To read our environmental sustainability strategy, please visit: <https://www.nationalgridet.com/planning-together-riio/our-environmental-future>



Our energy:

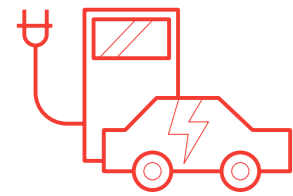
We are enabling the **decarbonisation** of the electricity system

- we are connecting **low-carbon** generation
 - we are facilitating **whole-system outcomes**
 - we are considering **alternatives** to traditional network development
-



16.7 gigawatts

of low-carbon generation is directly connected to our network



535 megawatts

of low-carbon generation was connected in 2018/19



25%

of all generation connected to our network is low-carbon

The electricity system is changing

Large amounts of low-carbon technologies need to connect to the GB network to help meet the UK's climate change targets. In 2018/19 we received over 150 customer applications; this was a 40% increase from 2017/18. This unfortunately affected the average number of days taken to send customer offers, which increased from 60 days in 2017/18 to 75 days this year. Timely electricity connections of all types are essential and we are working to make our connection process quicker and easier.

Delivering a cleaner energy system

The transmission infrastructure that we build and maintain is essential in the transition to a decarbonised electricity system. Over the next decade, we will lose existing generation capacity as old and more polluting plants close. Our responsibility is to accommodate increasing levels of renewables and other generation by optimising electricity network capacity.

We welcome the UK's move to a net-zero economy. We are supporting it by connecting generators, increasing levels of network capacity in our system, and delivering new processes that make the connections process easier. 2018/19 was a transformational year for us. Below are some of the changes we've made to meet the technical and business characteristics of low-carbon generation.

Delivering connections for smaller generators

Satisfying customers in this changing landscape requires us to be flexible, collaborative and innovative. As part of our commitment to enable the connection of greener and cleaner sources of generation, this year we have offered a new engineering solution to connect smaller customers (up to 50 megawatts). This is a smaller customer than we've traditionally connected to our network.

Due to the decreasing costs of battery storage and solar, we are seeing an increase in the number of smaller renewable generators wishing to connect to our network. To prepare our transmission system to meet the needs of low-carbon and renewable generators, we are now facilitating customers (most of them low-carbon developers) to connect to the tertiary windings of our transformers. This is different from a bay connection, where connections can connect up to 1800 megawatts in size directly into a substation.



To find out more, visit:

<https://www.nationalgridet.com/get-connected>

We have years of experience using tertiary windings for connecting our own equipment and for supplies to our own sites, but we had not used them until this year for connection purposes. As a consequence, we now have 240 sites across England and Wales with tertiary connections available to offer to smaller customers, providing 12 gigawatts of connection capacity. This approach maximises the use of existing assets to meet the needs of these new customers.

We have received high levels of interest, and in 2018/19 we made connection offers to 47 transmission-connected batteries, each approximately 50 megawatts. The first of these will be delivered in late 2019.

What's next?

- We will continue to promote this new type of connection offer to current and new customers
- We are finding that the development of this new type of smaller connections is opening doors for not just batteries, but also for solar. We are expecting to connect more solar generators in future

Project benefits

- 12 gigawatts of network capacity is now available for smaller customers
- To date, we've agreed connections for 2 gigawatts of storage solutions
- We can connect these customers in months not years. This is critical if we are to advance the net zero transition in the timescales required by the IPCC

We're finding land to support low-carbon connections and community energy projects

This year, we began to offer some of our non-operational land to allow our customers to place their assets close to their connections. This development came from us responding to customers who wanted to explore land deals in addition to grid connections as part of their investment in electric vehicle charging, battery storage and other generators. We are now working with local stakeholders to utilise our non-operational estate to deliver value to the businesses and communities where we operate. In 2018/19, five projects used this initiative.

During Green GB week (15–19 October 2018), we announced that we would partner with Forum for the Future to trial 'Powered Paired', a new digital platform that matches owners of viable land and buildings with community-owned energy projects. There are some fundamental barriers which are stifling progress of this bottom-up movement, one of which is the time and effort it takes to find and secure viable sites that can be developed. The platform is now live, and it now includes 72 locations

We've continued to improve our connections process

Many of our customers are seeking to connect to the transmission network more quickly, predictably and easily, particularly as the pace of change in our industry quickens and new companies join the sector. We also recognise that these newer developers are less knowledgeable with regards to our industry.

To enable this transformation, we are improving how we prepare connection offers to enhance customers' end-to-end experience from pre-application through to completion and final cost reconciliation.

Our role is to get customers connected as efficiently as possible. In 2018/19, we developed innovative tools and systems, including:

- A new website (nationalgridET.com), launched in September 2018
- A connections process animation explaining how to plan a connection
- A Cost Estimator Tool to provide an indicative capital cost of a connection with us

providing details on available land, solar and wind potential, and links to our website for the connections process.

What's next?

- We will continue to offer our land to commercial developers and see how we can further improve the process
- In 2019/20, we will be able to evaluate how many expressions of interest we receive via 'Powered Paired' and how many will be able to use our land and connect to the electricity network

Project benefits

- Shorter physical distances to the grid connection minimises costs for our customers (and therefore consumers)
- By leasing the land, we de-risk customers' projects
- We aim to reduce the cost and time it takes to identify and secure local sites for community energy projects

- A Network Capacity Heat Map to help assess the availability of capacity on our network for both generation and demand connections. It also now includes availability of land, as well as solar and wind data from the Met Office

What's next?

- Our ambition is to keep improving the customer journey, to deliver solutions and services for our existing and future customers

Project benefits:

- Easier for customers to know how to connect
- Increased visibility of available network capacity on our network

Facilitating cleaner and greener connections

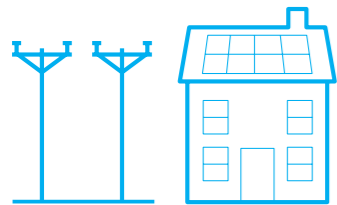


Connected Hornsea Project One – the world's largest offshore wind farm – to our network at Killingholme, North Lincolnshire. When operational, Hornsea Project One will include 174 turbines, cover 407 square kilometres and provide 1.2 gigawatts of green energy – enough to provide electricity for more than a million homes.

Completed the 400kV Richborough-Canterbury overhead line in Kent, connecting the 3.5 gigawatts Nemo Link – the interconnector between Belgium and GB. The interconnector will provide both countries access to cheaper electricity and sustainable generation for years to come.



Distributed energy resources



Accommodated **24 gigawatts**

of distributed energy resources on to the electricity distribution network

11 out of 12

DNOs in England and Wales no longer follow the 'Statement of Works' process for embedded generation connections. Instead they follow the improved 'Appendix G' process, which is easier and quicker

Whole Electricity System planning

The way GB generates and uses electricity is changing. Decarbonisation, decentralisation and digitalisation are transforming the electricity system. In the future, electricity will flow far more dynamically between transmission and distribution-connected parties.

Distributed Energy Resources (DER), made up mostly of renewable and low-carbon generators, will make a material contribution to meeting the UK's decarbonisation target. We recognise that the integration of these new resources is vital to delivering a clean and sustainable electricity network. We are therefore planning, in a coordinated way, with the ESO, Distribution Network Owners (DNOs), and other TOs, as well as other industry players, to support wider energy system objectives effectively and in a way that drives the most value to consumers.

Optimising across transmission and distribution networks

We have always coordinated the high-voltage, inter-regional transmission network with the lower-voltage regional distribution networks. However, the rapid decentralisation of electricity supply and the changing role of DNOs in today's energy landscape means we need to cooperate even more. This year we continued to work closely with DNOs to embed a robust, whole-system approach in our network development process and consider the impact of embedded generation within our transmission network.

In the past, DNOs had to contact National Grid if they believed the proposed small embedded generators (<100 megawatts) may have a significant impact on the transmission network. Historically, this was not a problem as there was less embedded generation connected, but in recent years this has grown significantly, making this connection process cumbersome not only for embedded generators, but also for us as the electricity transmission owner to review and plan for. Building on the work carried out last year, by the end of 2018/19 11 out of the 12 DNOs in England and Wales no longer follow the 'Statement of Works' process for embedded generation

connections. Instead they follow the improved 'Appendix G' process, where part of their contract shows available materiality headroom and reverse power limits.

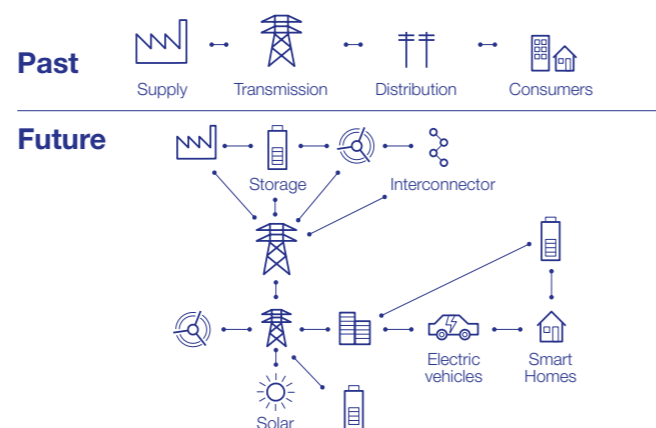
What's next?

- We aim to have all DNOs adopt the Appendix G process by 2020
- Even though Appendix Gs are an improvement, they are not the enduring solution as more DER is connected and the materiality headroom is fully used. We are now looking at the impact of DER on the distribution system beyond the materiality trigger (<250 megawatts)

Project benefits

- This provides a faster process for embedded generators to be able to connect (from 12 months to three months in offer time)
- For planning purposes, it gives us improved visibility for each of the Grid Supply Points so that assessments can be made of network capacity or constraints in the DNOs' network

Figure 1. The changing energy landscape



Supporting the ESO Regional Development Programmes

The Regional Development Programmes (RDPs) were set up between us (the TO), the ESO and DNOs to provide a whole-system detailed analysis of areas of the network that have large amounts of DER, and known transmission/distribution network issues in accommodating that DER.

Last year, to overcome constraint challenges, we worked with the ESO and two DNOs (UK Power Networks and Western Power Distribution) to develop detailed network models, enhance data sharing and establish new connections processes. This has led to the implementation of a framework in these areas, which is providing greater visibility, coordination and control across the whole network. This RDP process has helped us maximise the capacity of the existing network and provide quicker connections for DER.

In 2018/19, we continued supporting the ESO's RDPs to achieve a better 'whole-system' approach to planning and network development across both transmission and distribution networks. Together with Electricity North West, we worked closely with the ESO to analyse the Heysham Grid Supply Point (GSP) as a 'whole system'. The north-west area of the electricity network has high potential for wind resources. In particular, the Heysham GSP is at its limit in terms of thermal capacity, and by 2020, Heysham is expected to have 564 megawatts of DER connected to the distribution network. Installation of

a new Super Grid Transformer (SGT) was suggested to add more thermal capacity, however this is an expensive solution.

To deliver the most economical solution for GB consumers, we supported further analysis to assess whether a new SGT or an operational solution was the most appropriate way forward. Based on the study, it was recommended that investment in the additional SGT was not yet needed. Continuing to manage with a category two intertrip was the most economic option for the connected and contracted generation background.

What's next?

- Progress to an implementation phase from September 2019
- Continue to work with the ESO on other RDPs

Project benefits

- Whole system coordination between the ESO, TO and DNO
- Deliver the most economical solution for GB consumers

Improving the network experience for planned outages

We must take parts of our network out of service temporarily, which is called an outage. We do this to carry out our works safely, to replace and repair ageing infrastructure and assets, and to complete new connections.

Our customers and DNOs told us they want us to provide more information in advance of planned outages and to minimise any changes to them. The issues our stakeholders have raised include: our decisions on outages are not always collaborative; there can be a lack of information on when an outage might

end; and we sometimes shift outages incrementally, instead of fully re-planning the work.

We acted on their feedback and improved our Network Access Policy, which enables the ESO and Electricity Transmission to coordinate outages for the benefit of consumers. We will be using the feedback to create an improved outage experience in 2019/20.

Our Network Access Policy can be viewed here:

<https://www.nationalgrid.com/document/129926/download>

Developing a whole system plan for RIIO-T2



We are in the process of building our business plan with stakeholders for the 2021/22–2025/26 period. To reduce any technical barriers in the future, we have proactively shared our business plans with the DNOs to obtain feedback and ensure we deliver on what they need.

We used this engagement to see how our scenarios compared with their view of the future and ensure we made reasonable assumptions in demand, embedded generation, storage and flexibility. This engagement process was presented to a sub-group of the ENA Open Networks project and received positive feedback with no major changes to the proposed methodology.

Stakeholders have told us that the opportunity to input into and help shape our annual business plans is something they would like (and expect) on an ongoing basis. Thus, it is now our intent to share our load-related plans with DNOs on an annual basis.

Enabling the ongoing transition to the energy system of the future

The 2018 FES highlighted that the National Electricity Transmission System will face growing needs in the future due to the following factors:

Doubling of north-to-south transfer due to increase in **wind generation** connected across the Scottish network

6 gigawatts

Potentially **6GW in low carbon generation** in the north of England

Up to **9GW** of offshore wind on the east coast



New interconnectors with Europe

Growing impacts from **new technologies** such as electric vehicles, battery storage and heat pumps



As GB transitions to a net-zero economy, there will be fundamental challenges and opportunities for the way we plan and develop our electricity system. The proportion of electricity supplied from renewable sources will need to increase substantially. Our responsibility is to accommodate these changes by expanding the electricity network capacity at an optimal cost for consumers. Where the network is constrained, customers can't connect and this may mean developments are delayed, have to move to another location on the network, or don't proceed at all.

To mitigate potentially long lead-times for unlocking transmission capacity, we are developing a flexible electricity grid. New technologies are emerging and they are opening up new possibilities. Below are some of the ways we are planning for our network to accommodate new generation.

Planning a secure, affordable and sustainable energy system

Each year, a range of Future Energy Scenarios (FES) are developed by the National Grid ESO following extensive stakeholder consultation. These scenarios outline different credible pathways for the future of energy, considering how much energy we might need and where it could come from. In 2018, two of the four scenarios met the Paris Agreement's climate ambition of keeping the increase in global temperature to below 2°C. These scenarios are then used to establish the future need for boundary reinforcements. When transmission reinforcements are required to accommodate new generation, multiple reinforcement options are developed by us and the Scottish transmission owners.

We seek to provide options that can be delivered quickly and perhaps cheaply, as well as major reinforcements that provide step changes in capacity for the future. The costs and benefits of these transmission reinforcements are then compared by the ESO. Construction will only start when there is sufficient confidence that transmission system reinforcement will be required. This assessment is carried out via the ESO's Network Options Assessment (NOA) process.

2018/19 Network Options Assessment

The NOA results were published by the ESO in January 2019. As part of this NOA, we submitted 99 investment options for economic analysis. This included conventional and unconventional network development options. Of these, 61 options were identified by the ESO as providing an economic benefit under one or more scenarios, with 21 being recommended to 'proceed' to meet their earliest in service dates.

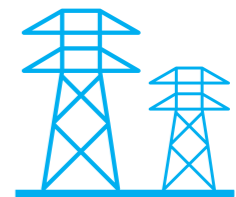
Network Development Decisions

To ensure network capacity investment decisions are holistic and consider the latest energy landscape, we formulate an up-to-date energy scenario for the electricity transmission system which captures the latest policy and industry developments.

We have reviewed the NOA 2018/19 recommendations and made our investment decisions in line with our Network Development Policy. For 90% of our investments, our NDP decision aligns with the ESO's NOA recommendation.

For more information on our Network Development Policy decisions, visit:

<https://www.nationalgridet.com/uk/publications/network-options-assessment-noa>



Delivering a smart, flexible energy system

We have the potential to drive significant value for consumers by transforming our approach to network development, particularly if we can innovate and use solutions that require minimal investment. We are always interested in finding new ways to maximise the use of our transmission network. The Network Development Team have many proactive discussions during the year to ensure the latest technologies are considered.

When our engineers face an issue on the transmission network, one option is to invest in new circuits that provide additional network capacity. Some of the other tools, such as quadrature boosters, have been available for some time. Others, such as dynamic thermal ratings of circuits, series compensation and other devices that use power electronic technologies, are more recent additions that have been used in the last few years.

This year was the first time that we have proposed a new electronic 'power flow control device' as a new technological solution.

This new solution will allow us to increase network capacity at the northern boundaries (B6/B7/B7A) – where we are finding increasing constraints – quickly and at a cheaper cost.

What's next?

- We will procure these devices in 2019 so that we can install them on our network as soon as 2020
- We will put this new technology in our type register so that in future it is considered 'business as usual'
- We will continue to assess innovative technologies so that we can deliver a smarter and more flexible energy system

Project benefits

- These devices can be deployed quickly, minimising site disruption and outage requirements
- The new electronic 'power flow control devices' are lower cost than a traditional quad booster installation, while delivering the same system benefit
- They will increase the capacity of northern boundaries (B6/B7/B7A) where we are finding increasing constraints
- It reduces the requirement for construction of new infrastructure, providing an environmental benefit
- It can be easily expanded or relocated if network conditions change

Network development

New electronic 'power flow control devices' will be installed on our network as soon as 2020. This is a world first for a transmission network.

"We believe the 2018/19 outputs from our Network Development Policy provide an appropriate balance between asset investment and operational costs to achieve the best use of consumers' money. We always seek to protect consumers' interests by ensuring that investment is made at an appropriate time"

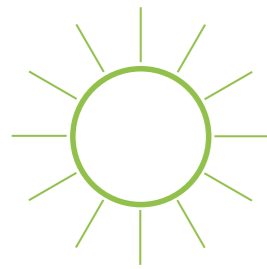
Mark Perry,
Network Development Manager



Our planet:

We are making a **positive contribution** to the **environment**

- we are reducing our **controllable carbon footprint**
 - we are promoting **responsible resource use**
 - we are **caring** for the **natural environment**
-



Carbon emissions performance in 2018/19

40% reduction

in our business carbon footprint from a 2012/13 baseline (including losses)

0.4% reduction

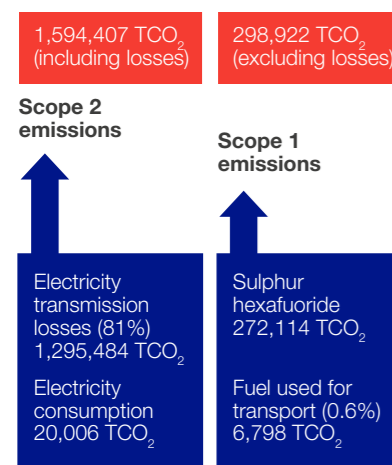
in our business carbon footprint from a 2012/13 baseline (excluding losses)

Leakage of SF₆

13,176kg

of SF₆ was leaked in 2018/19 – putting our leakage rate at 1.3%

Figure 2: Carbon footprint breakdown



Our climate commitment

Climate change is one of the greatest challenges facing society. World-leading scientists have made it clear that we are now facing a 'climate emergency'. The IPCC 2018 special report warned there is only a dozen years for global warming to be kept to a maximum of 1.5°C.

Responding to climate change is therefore a key priority for us. We are fully committed to making tangible progress in reducing carbon emissions, mitigating climate change and being a key facilitator in the transition to a net-zero economy. You can see our 2018/19 performance below.

Our greenhouse gas emissions performance

Most of our emissions are the result of electricity transmission losses from our network. These occur because of electricity lost through heat when transmitting power. Emissions from these losses fall as the carbon of electricity falls, and this is largely out of our control. The carbon emissions that we can control largely come from the energy use in our buildings, transport and leakage of sulphur hexafluoride (SF₆) used as an insulating gas in high-voltage equipment. As we have little control over emissions from losses, we are reporting two carbon footprints (with transmission losses and without transmission losses) to demonstrate where we are impacting the areas that are in our direct control. As we work to minimise these factors, we are striving to reduce our controllable carbon footprint and have set ourselves the target of achieving a 20% reduction by 2020.

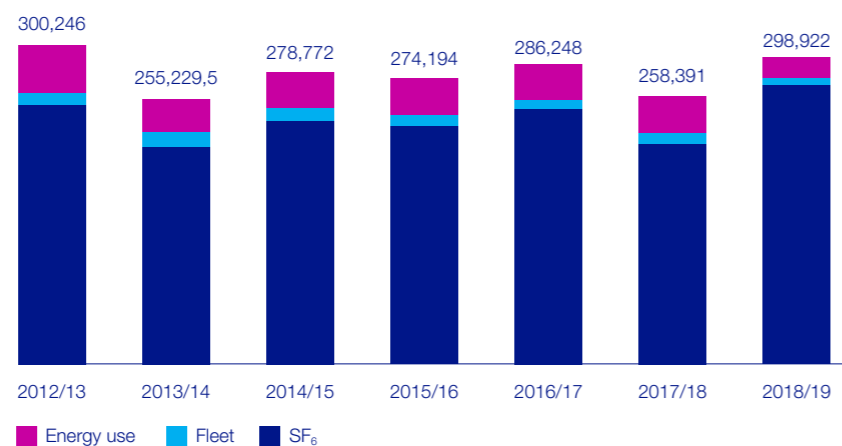
In 2018/19 we achieved a 40% reduction in our business carbon footprint from 2012/13 levels. The reduction is mainly attributed to reductions in emissions from transmission losses, as the carbon intensity of electricity continues to fall. However, this year we saw an increase in our 'controllable' greenhouse gas emissions by 14% from 2017/18. This was due to an increase in SF₆ leakage rates at some sites,

which outweighed the overall fall in leakage across our network. There were 15 assets that experienced an overall increase of 215% in leakage rates in comparison with the previous year and that were responsible for 28% of total SF₆ emissions. The top leaking asset jumped from 0.23kg to 1.78kg in a day. This has now been fixed, though it took us some time to fix due to difficult operational decisions. We are fully committed to improving our SF₆ emissions performance through the review of our asset strategies and SF₆ management framework.

Looking forward

- It is likely that this is an outlier year, as historical data suggests. The highest-leaking assets have either been repaired or have a planned intervention for as soon as we can get access. This should put us back on track to achieve our 2020 target
- We are working closely with innovation partners to continue our search for alternatives to SF₆ that have a lower Global Warming Potential (GWP). Please see page 24 for more information
- We are creating a strategy to remove SF₆ from our operations by 2050

Figure 3. Greenhouse gas emissions (without losses) TCO₂e



Low-carbon construction

We play a vital role in connecting low-carbon generation to the transmission network. This can require the development of new infrastructure to support the existing network.

For us, the scale of construction can be significant; for example we are connecting the new nuclear power plant at Hinkley Point C which will provide low-carbon electricity for around 6 million homes. We are also embarking on the second phase of the London Power Tunnels, a 32km electricity superhighway deep below the capital.

To do this in the most sustainable way, we need to continue driving down carbon emissions throughout the entire lifecycle of our projects – from construction and development of new assets, through operation and maintenance and finally through the decommissioning process.

Delivering major infrastructure projects safely, efficiently, collaboratively and in a sustainable manner is central to how we operate. We are supporting the UK's decarbonisation commitments while reducing our own environmental impact by:

- **Setting clear targets:** We have set a target to reduce by 50% the carbon intensity of our construction projects by 2020 (from a 2015/16 baseline).
- **Embedding carbon in our decision-making:** Since 2015, we have been using a Carbon Intensity Tool to help us identify solutions that are lower carbon during our tendering process. We compare the proposed carbon footprint of each bidder's proposal and evaluate these as part of our selection process.

- **Working with our suppliers:** We work closely with our contractors to ensure that carbon efficiency opportunities identified during design are delivered on site. We have set up a group, called the Contractors Resource Forum, with representatives from our supply chain.

- **Collaboration across the industry:** Meeting our ambitious environmental targets will not happen in isolation and collaboration is critical. Not only must we work with our supply chain to deliver projects sustainably but we must also share knowledge with the wider industry. Engaging with networks such as MIROG (the Major Infrastructure Resources Optimisation Group) alongside other key clients and organisations allows us to foster collaboration and tackle challenges together.

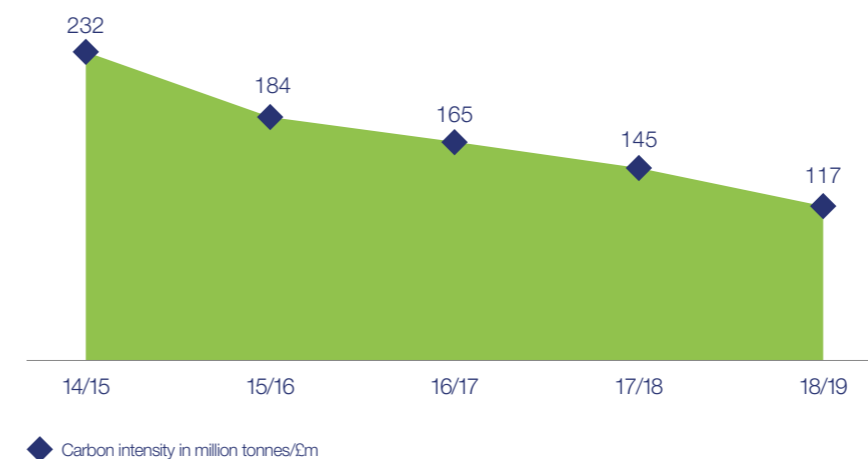
Looking forward:

- We will continue working with our supply chain to reduce carbon as much as is feasibly possible

Project benefits:

- 50% reduction in the carbon intensity of our construction design from a 2015/16 baseline
- Our carbon intensity performance for 2018/19 was 117tCO₂/£m against a target of 152tCO₂/£m

Figure 4. Reduction in carbon intensity design from our major infrastructure projects



Carbon intensity of our construction design

50% reduction

from a 2015/16 baseline

Suppliers reporting greenhouse gas emissions

In 2018/19

85% of our top 250 suppliers

disclosed their emissions via CDP (Carbon Disclosure Project)

Electrification of our operational fleet

We're making good progress in reducing the impact of our operational fleet. We have committed to converting 100% of our fleet to Alternative Fuel Vehicles by 2030. We also committed to deploying 30 electric vans by 2020 as a first step. We ordered the 30 electric vans during the scheme year and we will be deploying them from January 2020.

National Grid gets an 'A' for its work on climate change

In 2018, we retained our place on the CDP Climate Change A-list for the third consecutive year. This accolade recognises our continued actions to mitigate climate-related risks and drive the transition towards a low-carbon economy. We are one of only 126 companies globally to be awarded a place.

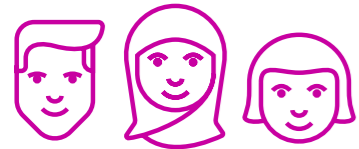


Enhancing the environment

29 sites

are being proactively enhanced with a Natural Capital approach.

That's a **34% increase** in Natural Capital since we started the programme in 2014



Supporting environmental education

40,239

people visited our four Environmental Education Centres in Bishops Wood, Iver, Skelton Grange and West Boldon in 2018/19

“The Government’s 25-year environmental plan aligns with many aspects of National Grid’s own environmental sustainability programme and what’s important to us”

Chris Plester, Sustainability Specialist

Caring for the natural environment

One of the most important challenges facing humanity, together with the climate emergency, is the closely linked, escalating crisis in global biodiversity. There’s a severe decline in natural ecosystems and alarming statistics on the number of species at risk of extinction. The fragmentation and degradation of our ecosystems and loss of species has a direct impact on the sustainability and prosperity of our global economy and population.

It is therefore important that we manage the land we own in ways that recognise, preserve and create the most value for us and our stakeholders, and seek to make a contribution to the wider environment in which we operate. Through our Natural Grid programme, we’re working with local communities and stakeholders to find new opportunities to make the best of our natural assets and efficiently manage them in ways that benefit local communities and nature. Natural assets – such as trees, water sources and green spaces – are important for society and provide essential services that help to mitigate the impacts

of climatic change, from carbon capture and storage to temperature regulation, flood control and air quality. Our approach seeks to safeguard them for the long term. To guide us, we’ve developed a tool that puts a ‘Natural Capital’ value on the benefits and services our natural assets provide, both for us and others. This helps to inform our proactive approach to land management and helps us build a business case for challenging conventional ways of working.

Enhancing the value of our natural assets

We are already improving the natural value of 29 sites on non-operational land by creating new wildflower meadows, community woodlands, ponds and wetland features that not only enhance biodiversity in the local areas but which are also helping us to operate more efficiently and make a contribution to the wider strategic ecological drivers of our partners and collaborators.

In 2018/19, our graduate intake worked with local stakeholders to improve the land around eight of our sites. As an example, at one of our sites this year, local stakeholders in Kitwell told us they were concerned about anti-social behaviour issues including drug-taking materials being left in the woodland, near to a school. The team worked closely with the local Wildlife Trust to complete an ecological assessment and the team then thinned out the woodland so it no longer provided shelter for drug

use, and to improve biodiversity. This was a huge benefit to the local community and the primary school.

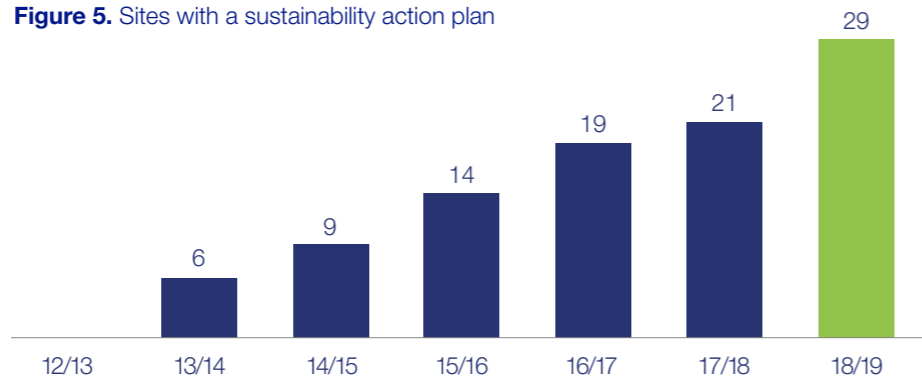
What’s next?

- We are on track to exceed our target of 30 sites by 2020; we’ve achieved this by working in partnership with over 40 local groups and organisations such as the Wildlife Trust, councils and local beekeepers
- We will continue to assess our non-operational land and work with stakeholders to carry out further environmental enhancements beyond our target

Project benefits:

- We have achieved a 34% increase in Natural Capital on these sites since we started in 2014, having enhanced and enriched a range of natural ecosystems

Figure 5. Sites with a sustainability action plan



Delivering ‘Net Gain’ in environmental value in our construction projects

As we connect to new sources of renewable and low-carbon generation and storage, it is essential that we do so in ways that seek to reduce the fragmentation of our habitats and species, prevent permanent habitat loss, and deliver new opportunities to reconnect the landscape and enhance the natural environment. Our Net Gain approach, which goes hand-in-hand with our Natural Capital assessment process, helps us to better understand and quantify our impacts, informing better and more effective landscaping and enhancement designs. We are currently working to drive Net Gain in environmental value on all our major construction projects by 2020.

In 2018/19 we selected 22 schemes over one acre of permanent land within or in close proximity to significant environmental features to apply the assessment methodology. 11 of the 22 schemes were at the detailed design stage, which allowed us to refine design and inform improved landscape/planting schemes.

What’s next?

- Our primary focus for 2019/20 is to apply the approach to all applicable schemes at detailed design

Project benefits:

- A transparent methodology that quantifies impacts
- The creation of new biodiversity units/ Natural Capital value through creation of new habitats on or offsite
- The enhancement of existing habitats on or off site
- A combination of both these methods

What is ‘Net Gain’?

Net Gain is development that leaves the environment in a better state than before, resulting in an overall improvement in the condition, health and functionality of the natural environment.

When does it apply?

The Net Gain target is applied to major schemes that lead to permanent or temporary habitat loss or negative impacts on the habitat condition or provision of the ecosystem function – for example, screening, flood management or recreation.



“The VIP project is unique in the scale of its ambition to reduce the landscape and visual impact of electricity transmission infrastructure”

Michelle Clark, VIP Project Manager

Reducing our visual impact in Dorset

The Dorset Area of Outstanding Natural Beauty (AONB) will be receiving the Visual Impact Provision “VIP” treatment, following Ofgem’s decision to approve £116m funding. This will allow us to underground 8km of overhead lines in Dorset and permanently remove 22 pylons to enhance the existing landscape. This section of line was identified by an independent landscape study as having landscape impacts of high importance.

approval of this project even more of a significant milestone as it demonstrates our commitment to the protection and enhancement of the environment where we operate.

What’s next?

- On-site works in Dorset will begin in late 2019 and will complete in 2022
- Dorset is the first of National Grid’s three VIP schemes to receive planning consent, with proposals for projects in Peak District and Snowdonia National Parks expected to be submitted for planning consideration in 2019

Since 2015, we have held a series of technical workshops for stakeholders and public ‘drop-in’ events in the AONB. The stakeholder workshops included representatives from the AONB Partnership, Natural England, Historic England, Dorset County Council, West Dorset District Council and the South Dorset Ridgeway Partnership. Burying the cables underground was the preferred option of the stakeholders and members of the public that attended the event. It was felt that screening or camouflaging pylons would not have sufficient impact.

Project benefits:

- Reduce the visual impact of National Grid’s overhead line near the villages of Martinstown and Winterbourne Abbas
- Opportunity to conserve and enhance the natural beauty, wildlife and environmental heritage of the Dorset landscape

The VIP project is the first known initiative in the world to mitigate the impacts of existing high-voltage transmission lines on the landscape. This makes the

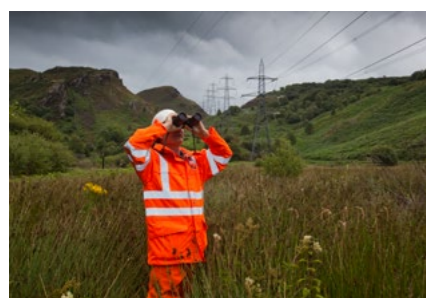
Responsible resource use



Diversion from landfill

93%

diversion from landfill from our operational sites in 2018/19



To build and maintain energy networks that perform safely and reliably, we need to use finite – or non-renewable – resources, such as steel for pylons and aluminium for overhead lines.

As populations and economies grow, we're seeing rising demand for these resources. This not only leads to price rises and volatility, but also increases the environmental impact of extracting them. We need to make the most of the materials we own and buy. We don't view ageing assets or materials as waste. We're rethinking how we source, reuse and recycle them.

Making the most out of assets

- **Asset refurbishment:** Our aim is to make the most out of our assets and prolong asset life. Every asset has an underlying set of failure modes that ultimately decide its operating lifetime. If these cannot be addressed by maintenance activities, interventions fall into one of the following hierarchy: Refurbishment -> Replacement -> Disposal.

Asset refurbishment is possible for certain asset classes and usually involves stripping down and rebuilding the asset back to an acceptable standard for reinstallation. We have considerable expertise in high-voltage

assets within our dedicated refurbishment facilities. For example, we can refurbish air blast circuit breakers, where it is more cost-effective than replacing the asset.

- **Oil replacement or reconditioning:** Our Oil Management Units in Doncaster and Dartford also allow us to reuse oil from circuit breakers. We remove dirty oil from assets during maintenance and, on completion of the maintenance work, reconditioned oil is then used to refill the circuit breaker – reusing 100% of the oil.

Our commitment to remove all single-use plastics from sale at our offices by 2020

Many plastic products are designed to be used only once. But the plastic we generate is gradually suffocating the world's oceans. It's critical we reduce our use of throwaway plastic now, and move towards more environmentally sustainable products and services. We owe this to present and future generations, and to the creatures our oceans support.

For us, at National Grid, the belief that what we do goes beyond the confines of our business is at the heart of who we are. We strive to be a responsible business and we believe we can affect real change. Therefore, in June 2018, we made a commitment to remove single-use plastics from sale at our offices by 2020.

Over the last year, we've been collaborating with our suppliers to eliminate the sale of these products from our main Warwick office. This has also involved engaging with employees and inspiring them to change their behaviours around reusing and recycling. Evie O'Grady, the seven-year-old daughter of one of our employees, helped us shape a campaign called 'Save Evie's Whale' to encourage employees to think about the impact of single-use plastics and how they end up in our oceans. Evie drew her favourite sea creature – a whale – because she was so

upset about the number of whales dying due to the increasing volumes of plastic pollution in our oceans.

What's next?

- 'Save Evie's Whale' is being rolled out to main offices in the coming year. It is also being rolled out to schools and local groups, transforming behaviour of children and parents
- We will be looking at the plastic we purchase in our supply chain

Since the launch of our 'Save Evie's Whale' campaign, in our main Warwick office we have:

- Eliminated plastic straws and plastic stirrers
- Replaced plastic cutlery with metal cutlery and implemented a cutlery return scheme
- Eliminated over 46,000 polystyrene containers and 22,000 plastic containers going into general waste annually
- Avoided plastic cups (c.1 million annually) by removing hot drinks vending machines
- Created significant cost savings by reducing the use of consumables, improving recycling rates and cutting the volume of waste generated



Fostering outstanding levels of environmental management

Investing in and operating electricity networks can affect the environment and the communities we serve. We actively work to prevent pollution that may result from our activities, continually improve our environmental management system to protect the environment, reduce the risks of environmental incidents and satisfy our compliance obligations to which we subscribe. We aspire to world-class performance.

Our Environmental Sustainability strategy goes hand-in-hand with our ISO 14001:2015 certified environmental management systems (EMS), which provides us with the widely recognised good practice of 'Plan-Do-Check-Act' to manage environmental sustainability and promote continual improvement.

Reviewing the environmental risk posed by our sites

Protecting communities and sensitive environmental areas is one of our key priorities. We actively manage the risks associated with our assets, but we recognise there is always room for improvement.

What's next?

- Our target is for 100% of our assets, on our land, to undergo the risk assessment by 2020

Project benefits

- Communities and sensitive areas are protected
- Assets on our land are adequately risk-assessed
- Allows the business to target investment at the most sensitive sites
- Pre-empt issues that might occur and inform training
- Allows the quick assessment of unfolding environmental incidents and helps inform the response plan

Part of our ISO 14001 continuous improvement work is to look at the siting of our operational sites and the potential impact that any environmental incident or release might have. This includes the location of local residents, groundwater sensitivity, watercourses, protected/sensitive habitats, number of bird species, the potential for ground contamination and whether the site has a coastal location.

This year we developed a scoring criteria that will adequately assess environmental risk at our substations and electricity transmission sites. This scoring methodology was formulated on 15 parameters, such as risk to water courses.

"To maintain our ISO 14001 Certification, we need to show that we improve year on year. Last year, we moved from the 2004 to the 2015 standard. Progressing from this we have demonstrated a greater level of leadership commitment and a move from managing risks to identifying both risks and opportunities"

Laura Bartle,
Environmental Manager

Retaining our ISO14001: 2015 certification



Following a successful ISO14001 audit, we have retained our certification to the 2015 environmental management standard. Having the certification is important to National Grid as it helps us mitigate our environmental risk and seek opportunities to have a positive impact. The audit covered all our operational business areas, including Electricity Transmission.

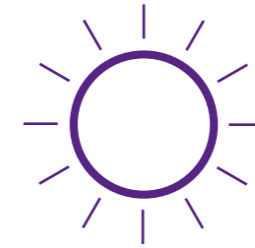
Our certification demonstrates our continued improvement in and commitment to environmental sustainability performance. The audit highlighted a number of good and best practices, which will be shared across the business, as well as a minor weakness that we can resolve.



Environmental incidents

Three

significant environmental incidents in 2018/19. Two were our own fault and one was due to third-party actions (this is an internal categorisation of incident design to promote continual improvement)



Our future:

We are preparing our electricity network to be fit for a net-zero future

- we are innovating to find **sustainable solutions**
- we are considering the **changing needs of our customers** and stakeholders in the future of energy
- we are including **sustainability** early in our decision-making

Innovative thinking

Innovative approach to reduce noise disturbance



For the last three years, we have been engaging with local residents in South Ealing following noise complaints about the Almond Avenue Substation, which we jointly operate with SSE Networks. The council had noted that humming from our transformers was creating a public nuisance, especially at night when other noises died away. The cost of replacing the four transformers (which were otherwise operationally sound) was estimated at £15–20 million, which did not seem like an efficient, viable option. So we engaged with acoustic noise specialists and local residents to discuss possible options.

This engagement led us to the design solution of erecting a noise barrier, which met the needs of the local people but was also a lower-cost solution for consumers in general. Our engagement activities and the resultant technical solution were recognised as a great example of community cooperation and education, with a creative and innovative approach to solving noise pollution, by the Noise Abatement Society. In December 2018, the works to build this barrier were completed. We received the John Connel Local Authority Award for this project.

“The development of an SF₆ alternative is critical to operate environmentally friendly High Voltage (HV) Switchgear”

Mark Waldron,
Switchgear Technical Expert

Against the backdrop of unprecedented change in our industry, innovation has never been so important. New technologies, processes and solutions for our electricity transmission network will help us meet the future needs of our stakeholders and make possible the energy systems of tomorrow.

Our work is driven by stakeholder feedback, future technological developments and business objectives. We're constantly seeking new people and organisations that are willing to learn about our industry and help us develop our network for the future. During the past year, we've continued to engage with stakeholders on a project-by-project basis, allowing us to share expertise and knowledge.

Finding lower global warming alternatives to SF₆

Sulphur hexafluoride (SF₆) is a highly effective electrical insulator used in high-voltage electrical applications. However, it is a greenhouse gas with a GWP of 22,800 times that of carbon dioxide (CO₂), making it a significant contributor to our business carbon footprint. We have been at the forefront of the global development of low-carbon alternatives to SF₆. In April 2017, we commissioned the world's-first pilot installation of 420kV, SF₆-free gas-insulated busbar at our Sellindge substation. By using a novel alternative gas mixture developed by GE Grid Solutions and known commercially as g3 (green gas for grid), we have reduced the potential GWP by more than 98%. g3 delivers the same technical performance as SF₆ but with a much lower GWP of around 345 times that of CO₂. We plan to extend our adoption and understanding of this technology, in conjunction with Scottish Power Energy Networks, through the construction of a fully SF₆-free 132kV gas-insulated substation.

In parallel with our work with g3, we are exploring other alternatives to SF₆ as well as associated technologies such as SF₆-capture and leak repair techniques. We are engaged with international developments through organisations such as International Electrotechnical Commission (IEC) and International Council of Large Electric Systems (CIGRE), and in

2018 we signed an Innovation Partnership with Siemens to research and develop the use of Gas Insulated Lines (GIL). Within this partnership, we aim to develop an alternative to SF₆ with a GWP of less than 10. This year, tests were carried out within the Partnership to evaluate gases that might meet this criterion and be suitable for use in GIL. These tests confirmed that design changes will be necessary to existing GIL equipment, such as an increase in tube diameter, to enable the use of these alternative gases.

What's next?

- Further innovations are under development to minimise the increase in GIL diameter, potentially allowing the existing GIL design to be used with low GWP insulation

Project benefits:

- The objective is to develop an alternative to SF₆ for GIL that reduces the global warming potential from 22,800 to less than 10 – dramatically reducing the harmful impact on the environment
- If successful, this could be used by other network owners around the world to extend the benefit globally



The future of transformers on our network

Traditionally, high-voltage transformers have been filled with mineral oil which forms part of the transformer's electrical insulation and cools its active parts (core and windings). High-voltage transformer designs vary but they can hold up to 100,000 litres of oil. Large volumes of fluid require careful environmental management and while spills are rare and fires rarer, our oil-filled transformers have been banded to minimise environmental risk.

As a responsible business, we use Best Available Techniques to optimise environmental protection measures which means that we are constantly reviewing how our equipment is designed, built, maintained, operated and decommissioned. As part of this, National Grid funded long-term research into the use of alternative fluids at transmission voltages. The outputs from this research enabled the development of a mineral oil-free 400kV substation at Highbury, London.

In February 2019, we completed commissioning tests on the MIDEL 7131-filled, heat-recovered transformers at Highbury; MIDEL 7131 is a synthetic ester, which is a low fire fluid, making it attractive in an urban setting. The use of a low fire fluid has enabled a reduced fire protection design and coupled with the heat recovery scheme, this has reduced the footprint (both physical and carbon) of the substation.

What's next?

- We aim to increase the use of synthetic esters in transformers for urban substation designs

Project benefits:

- Synthetic ester-filled transformers have a lower fire risk and the fluid is readily biodegradable, making it more environmentally friendly than mineral oil

“This work has commissioned the future for transformers on our network. Our engineers are constantly stretching themselves and the whole industry, by innovating to create real societal benefit”

David Wright,
Director of Electricity Transmission



Supporting the decarbonisation vision for South Wales

Our collaboration and innovation projects extend to how we can support the net-zero transition. To achieve net-zero, all energy vectors need to substantially decarbonise. To date, most progress has been made in electricity. However, little progress has been made in heat, industry and transport.

We are working together across industry, academia, and local and regional governments to develop a realisable vision for the future of South Wales. South Wales is a heavily industrialised area with substantial emissions (~18MTe CO₂/yr from industry alone). Therefore, the use of decarbonised gas and a reduction in industrial emissions are a particular focus.

This innovative collaboration has unlocked the opportunity to work on the first decarbonisation project on a regional scale and directly address one of the largest decarbonisation challenges in the UK. It also provides greater scope for learnings about the whole energy challenge and best practice innovation that can be implemented across further priority decarbonisation regions nationwide.

The aim of this innovation project is to produce a roadmap for achieving significant decarbonisation of the area and to identify the role of each energy vector. The Network Innovation Allowance project started in November 2018 and will last nine months.



Meeting the changing needs of customers and stakeholders



“Electric Vehicles (EVs) are only part of the story. We need the right infrastructure in place, particularly in terms of charging, for EVs to be adopted widely”

Graeme Cooper,
Director of Electric Vehicles

Our customers increasingly want low-carbon, low-cost solutions that can be easily, efficiently and quickly deployed, are modular and can cope with changing needs.

As the energy system becomes more interdependent, we are critically considering how an integrated energy network incorporating electricity, gas, heat and transport could work. We are also proactively considering the needs of future customers.

Transitioning to a world of electric vehicles

Transport has a big role to play in the net-zero transition. The sector now accounts for the greatest share of greenhouse gas emissions in the UK. To meet the country's climate targets, emissions from transport need to be significantly reduced. To improve air quality and reduce emissions, the Government needs to speed up its preparations for the uptake of Electric Vehicles (EVs) and provide the right environment to support and encourage the transition.

Consumer range anxiety is a key blocker to the uptake of EVs

It is estimated that EVs will reach price equivalency with internal combustion engine vehicles by the mid-2020s. However, consumers will only switch to an EV if they are confident that it will present minimal disruption to their daily lives. However, there is anxiety that their battery will run out of charge en route, due to lack of sufficient charging points, and that it will take too long to charge their vehicle. To overcome this range anxiety and remove early barriers to EV uptake, a viable network of ultra-rapid EV charge points will be vital.

There is a network solution to overcome range anxiety by 2025 if infrastructure delivery begins in 2019

We have examined the links between the strategic road network and the electricity transmission network in England and Wales to understand the minimal viable infrastructure requirement to overcome consumer range anxiety. With a network of 54 sites, 99% of all EV drivers could be within 50 miles of charging points, in any direction. We have also assessed the electricity infrastructure required to support enough ultra-rapid charge points to provide confidence to EV drivers and avoid queues at peak times.

We have identified a cost-efficient solution, which could include a combination of utilising existing distribution networks, where there is enough capacity, and directly connecting to the transmission network. With 60% of the strategic road network in England and Wales being within 5km to our existing electricity transmission network, it makes us well placed to deliver a cost-efficient infrastructure solution at many of the Motorway Service Areas, with the remainder better served by a DNO solution. This year we have engaged with the Government and industry to help shape the debate. We offered our expertise in helping enable EV charging infrastructure in the UK and participated in a working group with Highways England, BEIS and OLEV to understand the problem in more detail.

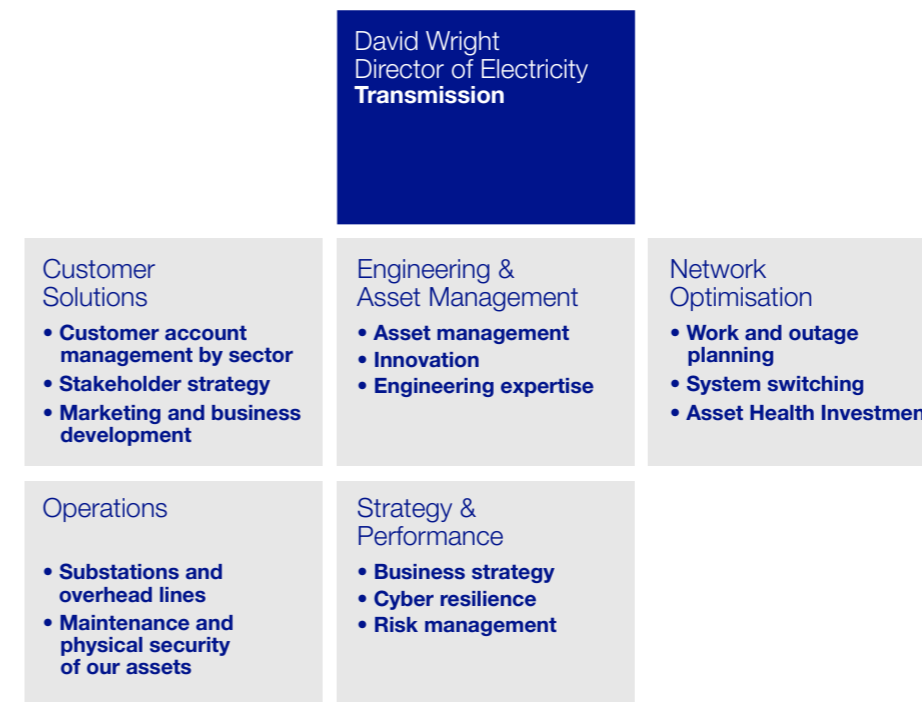
What's next?

- We will continue engaging with government and industry to develop a pilot project where we can use learnings for future roll-out

Project benefits:

- We are well placed to deliver a cost-efficient infrastructure solution to ultra-rapid charging stations
- EVs charged with electricity from renewable sources can considerably decarbonise road transport
- We are supporting the UK Government Road to Zero strategy towards cleaner road transport

Figure 6. Our new organisational structure



We've changed the ways our business is organised

In 2018, we changed the structure and focus of our Electricity Transmission business. The changes in the energy system were a key driver for much of this change.

One example of this change is the structure change of our connections team. This was to provide a clear central point of contact to customers with specific technology types throughout the connections process, and increase expertise in customer bases. We now have three sector teams:

I) Onshore and storage, II) Interconnectors, offshore and nuclear, and III) Demand and DNOs. Each customer segment is made up of multi-disciplinary teams, underpinned by bringing power system engineers, feasibility engineers and account managers together into one team.

Our key focus is to keep customers and stakeholders at the forefront of everything we do. We measure customer and stakeholder satisfaction, while also maintaining engagement with these groups and improving service levels.

7.9

Customer and stakeholder satisfaction

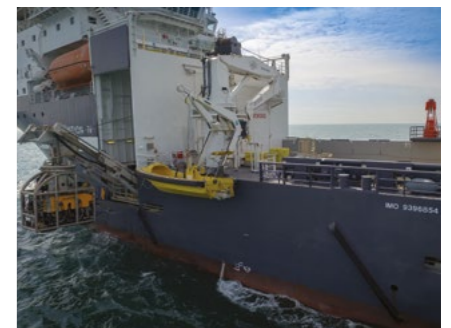
7.9 out of 10 was our score for both customer and stakeholder satisfaction in 2018/19

Future of maritime

Decarbonisation is transforming every industry – even shipping. The future of shipping will require change to drive decarbonisation of maritime transport. Short-term increased electrification of shore supplies will feature heavily to reduce in-port environmental impact. Moving forward biofuels will be part of the solution, but ammonia and hydrogen produced from renewable energy are likely to contribute a major part of the fuel mix in future.

The Environmental Defense Fund (EDF) has been invited to support the Clean Maritime Council's 2050 strategy for Maritime and we have supported their work. The drive

of this project to reduce the carbon intensity of shipping through electrification and alternative fuel types aligns with our business direction and values. We have produced an initial high-level assessment of the major ports EDF would like to explore – showing that most are close to existing infrastructure with capacity. The next steps for this work will follow when the potential power demand at each port is understood and we can develop more detailed feasibility reports for EDF and the Maritime Council.





What is an internal carbon price?

An internal carbon price places a monetary value on greenhouse gas emissions, which businesses can then factor into investment decisions and business operations.

In 2018/19, we used the shadow carbon price of **£45/\$60** per tonnes of carbon.



Putting sustainability into our decision-making

As a business, we make decisions daily. We are continually investing in the maintenance and modernisation of our network. To ensure we build a sustainable network, we are putting sustainability at the heart of our decision-making.

We can only meet our carbon-reduction targets if sustainability becomes a central component of our decision-making process, from beginning to end. Decisions made today will have an effect on our future ability to meet our carbon targets. We've made some considerable progress in 2018/19.

Implementing an internal price of carbon in our major investment decisions

In July 2017, it was agreed by the Group Executive Committee that a group Carbon Pricing Policy should be developed to help us factor in carbon to inform our major investment decisions, alongside the many other factors that are used to inform our decisions, such as cost, legislative compliance, planning considerations and stakeholder feedback.

This year, an internal price of carbon (£45/tonne of carbon) was adopted by Electricity Transmission in existing policies and procedures for investment decision-making and sanctioning. The carbon knowledge of the Investment Team has also been increased via specific training sessions delivered during 2018/19. Since January 2019, sanction papers for major investment decisions now include carbon. This in practice means that Investment Delivery Engineers multiply carbon emissions by the internal carbon price. The results are then taken to the Electricity Transmission Investment Committee to review.

What's next?

- By 2020 every major investment decision will use carbon pricing
- We will measure how the carbon price impacts our investment decisions
- We will report on progress

Project benefits:

- An internal carbon price will prepare us for the policy of the future by mitigating any future risk of carbon taxes
- Helps us shift investments to low-carbon alternatives
- Emissions become visible and meaningful to financial decision-makers

Designing lean and sustainable infrastructure

New infrastructure is needed to connect new greener and cleaner sources of energy. However, failure to address carbon emissions at the earliest project design stages can significantly hamper efforts to reduce the environmental impact of our infrastructure schemes. Designing lean and sustainable infrastructure is therefore a core business priority for us. To support our decision-making, this year we developed a Sustainable Portal with a Sustainability Asset Database. This has been specifically created for Investment and Delivery Engineers to illustrate options to design and build more sustainable schemes.

The aim of the Sustainability Asset Database is to provide engineers with:

- The sustainability rating of the scheme
- A list of potential sustainability opportunities that should be embedded in the design

The output from the system is a sustainability register that acts as a live project document, which follows the project throughout its life and ensures that the opportunities are realised in delivery.

Looking forward:

- Integrate the outputs into the tender process, reflect it in the 'works information' and ensure this is embedded at contract
- Continue looking for new opportunities for lean and sustainable infrastructure

Bulls Lodge – value engineering



Using the Sustainable Asset Database, we identified:

- 15 opportunities
- Approx. £1.2m in savings
- 318 tCO₂ in savings
- 7% reduction in the scheme's carbon footprint

Figure 7. Embedding sustainability in our Network Development Process



Embedding sustainable procurement practices

We recognise that our environmental influence extends across many boundaries and this also includes our own supply chain. We take seriously the impact our procurement activities may have on the environment. For our major infrastructure projects, we include a 5% weighting on carbon as part of the tender evaluation process. We have done this since 2015.

In 2018/19, to continue embedding sustainable procurement in our Strategic Sourcing Process, a heat map with more detailed sustainability questions was created to help buyers evaluate in detail the impact – both social and environmental – of the products and services purchased by National Grid. Buyers now have specific questions to ask suppliers on certain issues (for example, carbon/resources/natural environment), depending on the category of product or service that is being purchased. These questions act

as an additional layer of sustainability evaluation on top of the environmental and social questions already asked at a pre-qualification stage.

What's next?

- We aim to embed the heat mapping approach in buyers' ways of working so that sustainability is fully embedded and considered in our procurement decision-making

Project benefits:

- A heat mapping approach supports buyers with focusing on the issues that are material to the tender event
- Heat mapping can uncover strategically important sustainability risks and opportunities

“We have also been working with our supply chain to improve our social impact. The Business and Human Rights Resource Centre recently identified National Grid as part of a small cluster of leaders tackling modern slavery and human trafficking”

Nathalie Ritchie,
Supply Chain CSR Manager

To find out more, visit:
https://www.business-humanrights.org/sites/default/files/FTSE_100_Briefing_2018.pdf



Progress towards our strategy

Our energy

Our planet

Our future

Metric	RAG status	2018/19 performance
Reduce transmission-related constraints by continuing to work closely with DNOs on materiality limits	●	11 out of 12 DNOs are now using Appendix Gs. We are also looking at what we could do, once the materiality limit is used up
Increase network capacity visibility via our Network Capacity Heat Map	●	The Network Capacity Heat Map was launched in September 2018, with five key updates delivered until the end of the financial year – including: land, tertiary, solar, wind and distance from project
Reduce the average time to develop a customer connection offer from 89 to 55 days	●	Our time to develop a customer offer was 75 days
Use our non-operational land and existing assets to facilitate new connections	●	Land is now offered to customers and we are trialling 'Powered Paired' – a new tool to support community energy projects
Deliver system flexibility by deploying new 'non-built' alternatives	●	New electronic 'power flow control devices' have been approved by NOA and we are expecting to deploy them as soon as 2020
Invest to strengthen the capacity of our network at a minimum whole-life cost	●	Transmission reinforcements have been tested against a range of energy scenarios
Reduction in controllable carbon footprint by 20% (from 2012/13 baseline)	●	We've had 0.4% reduction (from a 2012/13 baseline) – this was due to a 14% increase in our SF ₆ emissions
Reduction in carbon intensity of construction design by 50% (from 2015/16 baseline)	●	We achieved a Carbon Intensity measure of 117TCO ₂ e/£m. This is equivalent to a 50% reduction in carbon intensity from a 2015/16 baseline
Deployment of 30 Alternative Fuel Vehicles	●	We ordered the 30 vehicles and we will be deploying them in 2020
Maintain a landfill diversion rate of 95%	●	We achieved 93% of waste diverted from landfill which is a decrease in performance from 95% last year
Enhance the value of natural assets in more than 30 sites	●	29 sites have been enhanced with a Natural Capital value from a 2013/14 baseline
Achieve net environmental gain in construction by 2020	●	22 schemes have been selected for net gain
Reduce the visual impact of our transmission assets in at least one AONB/National Park	●	The Dorset Area of Outstanding Natural Beauty has been selected and will receive funding from Ofgem. Works will begin in 2019
Maintain certification to ISO 14001:2015	●	ISO 14001:2015 has been retained
Risk assess 100% of our assets, on our land	●	We have developed the scoring criteria that will adequately assess environmental risk
Investigate and trial alternatives to gases (i.e. SF ₆)	●	Our partnership with Siemens continued in 2018/19 to find alternatives to SF ₆ with a GWP of less than 10
Implement new environmental and low-carbon technologies	●	We energised the world's first super grid transformers insulated with biodegradable Midel Oil
Pilot low-carbon solutions for new industry sectors	●	We are working closely with stakeholders to pilot new solutions for the electrification of transport, including EVs and shipping
Work closely with industry to obtain an improved understanding of the needs of future customers	●	We have engaged with over 200 stakeholders as part of our stakeholder engagement activities to improve our understanding of the needs of future customers
Implement carbon pricing on all major investment decisions	●	Carbon pricing has been implemented in our investment decision-making process
Include carbon and environmental considerations as part of the evaluation criteria in our procurement tenders	●	A heat map with more detailed sustainability questions has been created
Embed environmental risk and consequences in asset health interventions	●	A monetised risk approach is being developed to systematically evaluate environmental risk by 2020
Continuously improve customer and stakeholder satisfaction score	●	Both customer and stakeholder satisfaction scores were 7.9 – an incremental improvement from last year

● Achieved ● On-plan ● Off-track

Let us know what you think

We welcome all feedback – because it helps us make sure we're focusing on the right areas and delivering the right things.

We'd really like to receive your views and ideas on these six questions:

- Do you think we are doing enough to manage our impact on the environment?
- Do you think we are doing enough to manage the transition to a low-carbon future?
- Do you agree with our key areas of focus?
- Is there anything else you would like us to include in the Annual Statement?
- Is the statement easy to navigate/read?
- Is there anything else you would like to comment on or share with us?

You can either use the survey link to respond, e-mail your responses to carolyn.gardner@nationalgrid.com, or tweet us using the hashtag #SustainableNGET

You can also use the above e-mail address for queries and to ask for more information.



Acronyms

AONB	Area of Outstanding Natural Beauty	GB	Great Britain
CO₂	Carbon Dioxide	GSP	Grid Supply Point
DER	Distributed Energy Resources	kV	Kilovolt
DNO	Distribution Network Operator	NOA	Network Options Assessment
EDR	Environmental Discretionary Reward	MW	Megawatts
EMS	Environmental Management System	RDP	Regional Development Programmes
ESO	Electricity System Operator	SSP	Strategic Sourcing Process
EVs	Electric Vehicles	SF₆	Sulphur Hexafluoride
FES	Future Energy Scenarios	SGT	Super Grid Transformer
GW	Gigawatts	TO	Transmission Owner
GWP	Global Warming Potential	UK	United Kingdom

National Grid Electricity Transmission
National Grid House
Warwick Technology Park
Gallows Hill Warwick
CV34 6DA

www.nationalgridET.com

Registered in England and Wales No. 4031152