nationalgrid

Innovation Strategy

2023

Electricity Distribution

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Contents

Executive summary

This document sets out the detailed Innovation Strategy for National Grid Electricity Distribution (NGED). It describes our approach to innovation and how we continue to innovate within our business to improve efficiency and support net zero.

Our Innovation Strategy was originally produced as part of the RIIO-ED1 business plan and has since been reviewed, updated and re-issued annually to reflect changing external factors, business priorities and to incorporate learning from the previous 12 months. The document applies to all four NGED distribution licences of West Midlands, East Midlands, South Wales and South West.

The Innovation Strategy looks at the long term development of our distribution assets, network operations and customer service caused by changing system and customer needs. This strategy sets out our key priorities and challenges and our plans during the RIIO-ED2 period.

Innovation is the process of having new ideas, developing them into practical solutions and trialling them to investigate their effectiveness. It will provide more flexible solutions that are better, cheaper or quicker than the current ways of doing things.

The RIIO-ED2 Network Innovation Incentives and the UK's net zero targets bring huge change and significant opportunities to innovate. Innovation does not have to be on a large scale; sometimes improvements can be achieved through evolutionary change, involving incremental improvement to existing methods.

Innovation is targeted at all of the key outputs; safety, cost efficiency, customer service, reliability and environment. In the past innovation has proved beneficial by allowing us to continually improve in these areas. Future innovation will allow us to continue these improvements and will also help us to address the challenges brought about by the low carbon transition.

Our innovation project portfolio has enabled us to deliver significant learning to the wider business as well as other network operators. A key example of this is the learning as part of our Low Carbon Networks Hub project that has enabled us to roll out Active Network Management (ANM) across each of our four licence areas.

Flexibility services now delivered through the Flexible Power brand were created as part of the Entire NIA project, which developed technical and commercial requirements to utilise flexibility as a service to avoid asset investment requirements.

We continue to innovate and ensure third party access and collaboration on our projects is achieved by participating in calls for project ideas. This year we have participated in the Basecamp event held by the Energy Networks Association (ENA) and the call for ideas held by Innovate UK.

For the first time we have participated in our first projects funded by the Strategic Innovation Fund (SIF) which has replaced the Network Innovation Competition from RIIO- ED1.

In addition to using Network Innovation Allowance (NIA) and SIF funding, we plan to continue to deliver innovation projects funded by ourselves focusing on lower risk projects that can introduce cost efficiencies and pay for themselves over time.

We believe that driving innovation within our organisation is not just about delivering innovation projects.

It is about ensuring we work effectively with our stakeholders to develop new capacities to enable the delivery of our RIIO ED2 plan.

We will achieve this with a team that is passionate for innovation, encouraging and rewarding positive change and ultimately embedding a culture that celebrates innovation.

Who we are

We are the Distribution Network Operator (DNO) of the East Midlands, West Midlands, South West and South Wales.

As the DNO covering these four licence areas, we are responsible for keeping the lights on, maintaining the equipment in our distribution network, fixing any faults and connecting customers to the network.

What we do

Keep the lights on
by operating our network assets effectively

Maintain equipment
so that the network remains reliable

Fix the network
if equipment gets damaged or is faulty

Connect customers
by upgrading existing networks or building new ones

Operate a smart system
by managing two way power flows and flexible services

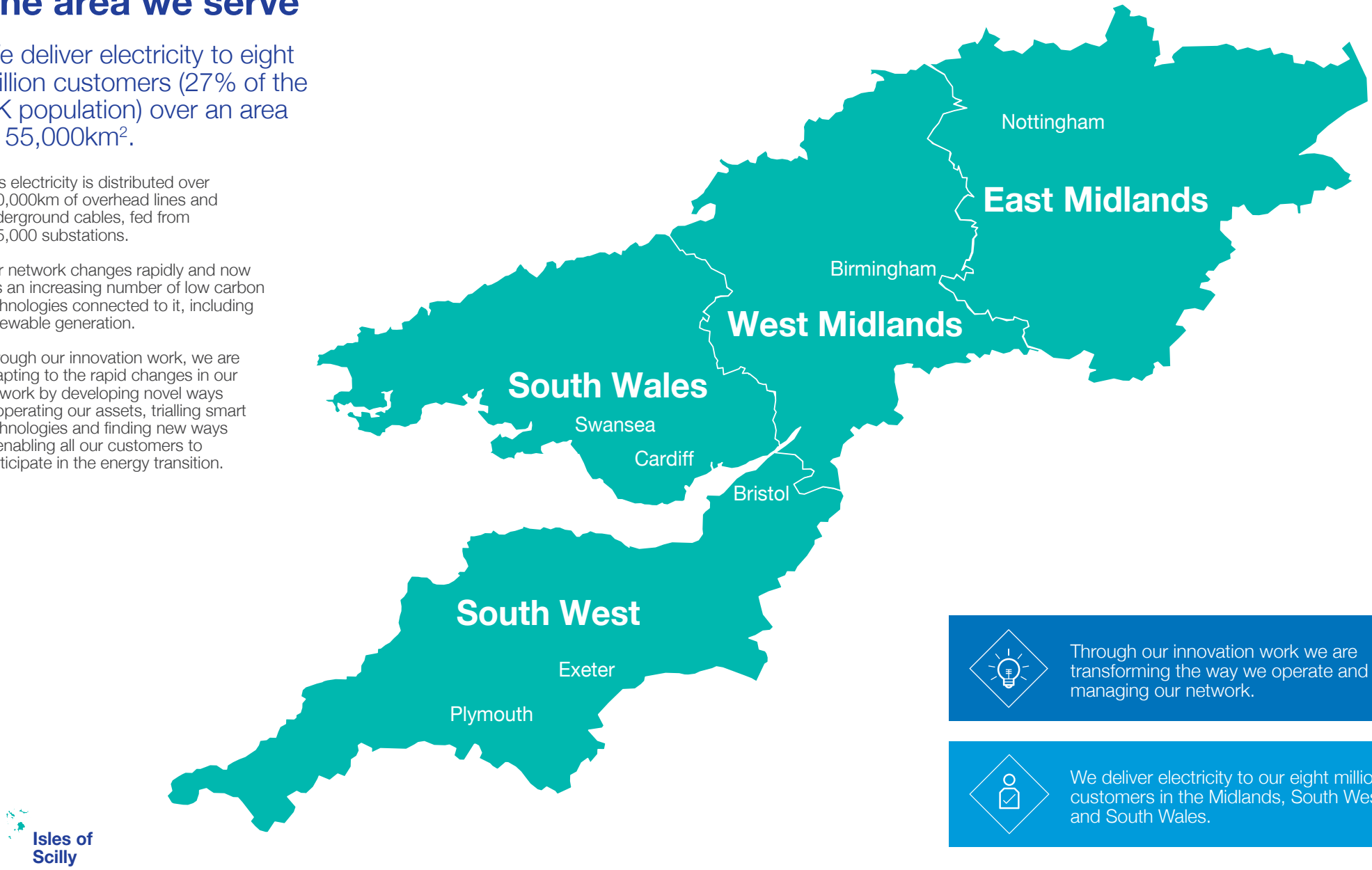
The area we serve

We deliver electricity to eight million customers (27% of the UK population) over an area of 55,000km^2.

This electricity is distributed over 220,000km of overhead lines and underground cables, fed from 185,000 substations.

Our network changes rapidly and now has an increasing number of low carbon technologies connected to it, including renewable generation.

Through our innovation work, we are adapting to the rapid changes in our network by developing novel ways of operating our assets, trialling smart technologies and finding new ways of enabling all our customers to participate in the energy transition.



Through our innovation work we are transforming the way we operate and managing our network.

We deliver electricity to our eight million customers in the Midlands, South West and South Wales.

Introduction to the Innovation Strategy

Overview

This document sets out our Innovation Strategy. It presents the focus areas and values of our Innovation team, which are shaped by the challenges of the industry and our ethos as a company.

By outlining our commitments and aims in this document we strive to inspire new, exciting ideas for projects that we can add to our portfolio in order to tackle the biggest obstacles to decarbonising the energy system.

Our Innovation Strategy was originally produced as part of the RIIO-ED1 business plan and has been updated annually since then to reflect the learning generated from our innovation projects and the changes in the industry.

We work closely with the business to ensure that our innovation portfolio aligns with and supports the delivery of our RIIO-ED2 plan.

We are working to establish a new Innovation Board to ensure this alignment and improve communications between our team and the rest of the business. We aim to ensure that we can develop new ideas generated within the business as well as those from external innovators.

The Innovation Strategy is just one of the annual reports produced which relate to NGED's Innovation delivery, the others are The Network Innovation Allowance (NIA) Annual Report and the Environment and Innovation Summary Report, which can be found on our website.

What is innovation?

Innovation is the process of having new ideas, developing them into practical solutions and trialling them to investigate their effectiveness.

Our Innovation Strategy is shaped by the industry challenges and our ethos as a company.

We rely on innovation to be seen as a leading performer in network performance and customer service.

We strive to inspire new, exciting ideas for projects we can add to our portfolio in order to tackle the biggest obstacles to decarbonising the energy system.

NGED innovation team

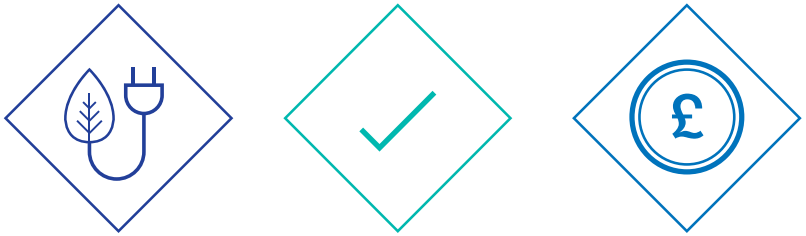
We are a team of engineers dedicated to working with our business experts, external partners and customers to identify problems, find solutions and trial them through our innovation projects.

NGED innovation team

Our commitments

We recognise that as a distribution network operator we have a very important role to play in the decarbonisation of the energy system. Therefore, through our innovation work we commit to overcome the barriers to the energy transition.

We need to ensure that our electricity distribution network is able to facilitate the increasing demand from the electrification of heat and transport while at the same time allowing the connection of more low carbon generation. We will continue to innovate to find novel ways of efficiently and effectively transforming our network and the way we operate it to meet these requirements.



Decarbonisation **Excellence** **Value for money**

Our high standards of customer service, safety and reliability need to be maintained while keeping costs low for our customers.

We will use innovation to achieve these aims and develop new technologies, commercial solutions and standards that will enable us to make the most out of our existing network and assets, reducing expensive interventions.

The changes that will be brought by the energy transition will create opportunities for people, making it even more important to ensure that those opportunities are accessible to everyone so that no one is left behind. We will work with our communities to understand how best we can support our customers with vulnerability and ensure that no one is disadvantaged.

Our values

One of our goals is to be a main contributor to decarbonisation and we aim to achieve that by having a portfolio of projects that are focusing on the right areas.

To deliver our projects successfully, we believe that it is important to work with the best people. We are always looking for new partnerships with organisations and individuals that share the same passion and values as we do so that we can achieve excellence together.

We are passionate about providing value for money to our customers and using our innovation funding the best way possible. We have internal governance processes in place to ensure that we achieve that through the way that we create, manage and deliver our projects.

We are a team of engineers dedicated to identifying problems, finding solutions and trialing them.

Everything we do evolves around contributing to decarbonisation, achieving excellence and providing value for money to our customers.

We aim to be working with the best people whose values align with ours.

Our sources of funding

Our main sources of innovation funding are managed by the Office of Gas and Electricity Markets (Ofgem), the industry regulator.

Ofgem has established a variety of funding mechanisms to develop future networks that support the delivery of net zero as shown in the table below.

Mechanism	Years
Innovation Funding Incentive	2005-2010
Low Carbon Networks Fund	2010-2015
Network Innovation Allowance	2015-2028
Network Innovation Competition	2015-2023
Strategic Innovation Fund	2023-2028

The Innovation Funding Incentive (IFI) provided an opportunity to improve the quality of research and development within the UK electricity industry.

The Low Carbon Networks Fund (LCNF) was designed to support the development of low carbon technologies and facilitate the changes brought about by the carbon plan.

It consisted of large scale projects funded through the competitive process (Tier 2) and smaller scale projects that were self-contained (Tier 1). In RIIO-ED1 the Network Innovation Allowance (NIA) and Network Innovation Competition (NIC) has replaced the previous LCNF schemes.

In RIIO-ED2 we have NIA allowance for the first three years. The NIC has been replaced by the Strategic Innovation Fund (SIF) where projects progress through three stages, Discovery, Alpha and Beta which allows for ideas to fail fast and reduces the risk for the Beta phase projects which have the largest budgets. We have also previously secured support and continue to proactively explore non-Ofgem driven funding mechanisms, from the Engineering and Physical Sciences Research Council, Energy Systems Catapult and Innovate UK.

Who we work with

We are proud to be working with a wide range of organisations and individuals, including small to large scale technology companies, manufacturers of equipment, universities, community groups, suppliers and other utilities. In fact, we have worked with over 50 different parties in our projects, a number that we want to increase even further, so if you have a great idea please do get in touch with us.

To ensure that we enable and encourage third party collaboration and interaction, we proactively seek both NIA and SIF project ideas through calls for proposals. This provides an opportunity for organisations that have a long standing relationship with the electricity industry but also organisations that have historically focused on other areas to proactively be involved in electricity innovation, often bringing a wider perspective to new problems and challenges in the industry.

We also attend a variety of well established events, such as CIRED, the Energy Innovation Summit and Utility Week Live to ensure that we facilitate a suitable opportunity for individuals and organisations to interact with our innovation and wider business teams to discuss existing and future projects.

We look to collaborate with our distribution network colleagues but also with transmission and gas network operators and system operator. We do this by participating in ENA working groups that enable close collaboration and interaction with all network operators.

We are also contributing to the Open Networks project which aims to transform how electricity networks work and brings together nine of the UK and Ireland's electricity grid operators, respected academics, Non-Government Organisations (NGO), government departments and Ofgem.

Through the Collaborative Energy Portfolio (CEP), we are working with other DNOs to identify common problems and deliver collaboratively funded projects to solve them.

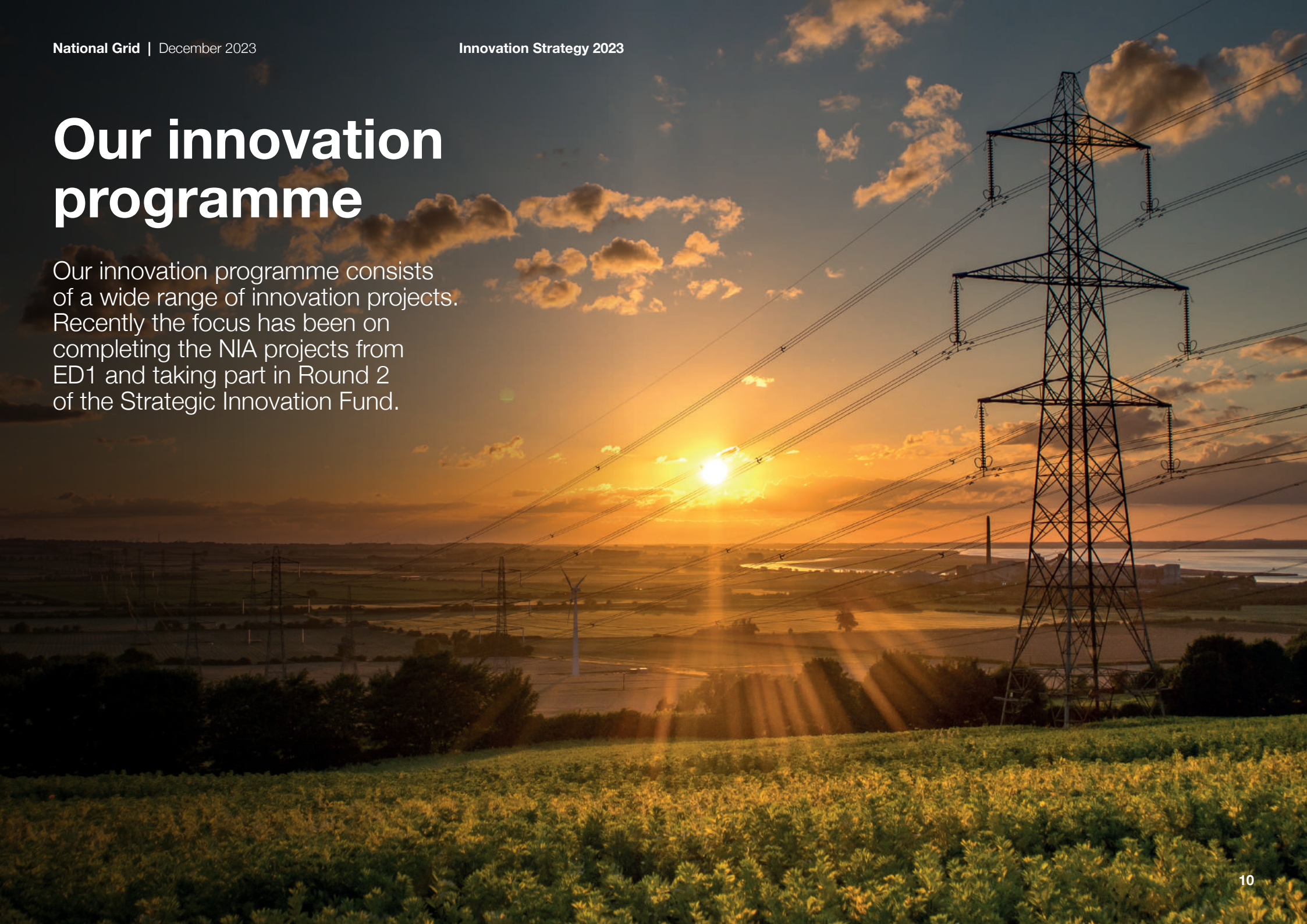
We regularly engage in conversations with our counterparts within the rest of National Grid Group with the intention of mutually benefitting from our shared experiences and incorporating them into our learning. Additionally we aim to foster collaborations that result in more joint ventures.

We proactively seek both NIA and NIC project ideas through calls for ideas.

We are proud to have worked with over 50 different organisations in our projects.

Our innovation programme

Our innovation programme consists of a wide range of innovation projects. Recently the focus has been on completing the NIA projects from ED1 and taking part in Round 2 of the Strategic Innovation Fund.



Our innovation programme

In the period between April 2022 – March 2023 we have been delivering NIA projects and one NIC project.

NIA Projects – Completed between April 2022 – March 23	Description
EPIC (Energy Planning Integrated with Councils)	Aims to create a process to generate an integrated local area energy plan.
Peak Heat	Aims to help us understand the impacts of electric heating loads, and the role that flexibility could take in helping to mitigate network impacts
SHEDD	Aims to design and test a new Low Frequency Demand Disconnection scheme and to maximise its future performance
Overhead Line Power Pointer	Fault indication and other real time network measurements to speed up restoration
Electric Nation Powered Up	Looks to install Vehicle–to-Grid (V2G) charging and control equipment in domestic properties
Arc-Aid	Trials a new type of fault indicator (MetrySense 5000) on the 33kV overhead line network.
Take Charge	Aims to specify, design, test and trial a standardised package solution for delivering capacity to Motorway Service Areas (MSAs) for rapid Electric Vehicle (EV) charging.
ALARM	Pre-fault monitors and supporting data analysis to demonstrate optimised pecking fault location data for monitored low voltage feeders.
ACE (Active Creosote Extraction)	Looks at creating a new method that extracts creosote from redundant wood poles
Pre-Fix	The purpose of the project is to develop a HV pre-fault intervention capability, providing an ability to repair networks in a planned way reducing the inconvenience to customers from unplanned outages.
Running Cool	Aims to avoid unnecessary curtailment of generation by using real time OHL conductor temperatures to update the short term post fault ratings used in an ANM system.
Headroom Whole System Thinking	Aims to evaluate the whole energy system to determine the benefit per unit of added headroom

Our innovation programme

NIA Projects – Completed between April 2022 – March 23	Description
GAMMA Flex	Builds on the learning of the Intraflex project and seeks to push our understanding of what is needed for a liquid flexibility market to the next level.
SILVERSMITH	Investigates compliance issues that are expected to grow on our LV network as low carbon technologies and distributed generation connections increase.
HERACLES	Aims to develop an understanding of where electrolytic hydrogen plants can best be deployed and identify the level of data required to ensure the optimum operation of electrolysers.
ALPACA (Approach for Long term Planning Accounting for Carbon Assessment)	Aims to develop a holistic approach to Whole Life Carbon (WLC) management
ACCELERATED (Assessment of Climate Change Event Likelihood Embedded in Risk Assessment Targeting Electricity Distribution)	Estimates the impact of climate change impacts, such as higher temperatures and more frequent high wind speed events, on the number of interruptions affecting our network by primary substation.
ANM – Balancing System Coordination (ABCD)	Builds on a previous project, which looks at options for coordination between Balancing Services and ANM systems.

NIC Projects - Active after March 2023	Description
EQUINOX (Equitable Novel Flexibility Exchange)	Trialing flexibility in domestic heat pump heating systems

Our innovation programme

SIF Projects led by NGED – Round 2 Discovery Phase	Description
PRIDE (Planning Regional Infrastructure in a Digital Environment)	Using a common platform to support Local Area Energy Planning and data exchanges between Local Authorities and DNOs
TEED (Tyseley Environmental Enterprise District)	Investigates how a multi-vector energy system with significant local generation and storage can be developed using a Digital Twin.
EV Respond	Investigates methods to restore vulnerable customer supplies during a power cut, by making use of Electric Vehicles.
Shifting Currents	Building on NIA project Flowers, this project aims to develop mechanisms to shift the timing and control of operations.
PIONEER (Proportional Investment of Networks in Energy Efficiency Retrofit)	Investigating the business case for DNO funded energy efficiency improvements to buildings

SIF Projects supported by NGED – Round 2 Discovery Phase	Description
Powering Wales Renewably	Takes a whole electricity system approach to deliver a digital twin of the network, which will utilise detailed electricity system models.
Scenarios for Extreme Events	Aims to improve the approach to the identification and analysis of extreme events and their impacts on the GB energy system.
Integrated Hydrogen Hubs	Aims to explore revenue stacking and financial optimisation of electrolysers, integrating the response to multiple energy demands and facilitating efficient infrastructure provision.
NextGen Electrolysis	Looks to reduce the cost of hydrogen production by tackling the operational constraints of electrolytic production.

SIF Projects led by NGED – Round 2 Alpha Phase	Description
PRIDE (Planning Regional Infrastructure in a Digital Environment)	Using a common platform to support Local Area Energy Planning and data exchanges between Local Authorities and DNOs

Why we innovate

External trends

Creating a network with conventional methods that can support the increased electricity usage from the electrification of heat and transport would be expensive. Through our innovation projects, we create, investigate and trial affordable alternatives to postpone expensive reinforcement or provide long term network management solutions.

The changes in energy profiles, larger peaks in demand, substantial swings in distributed generation output and a more active energy market will create challenges for us.

The installation of monitoring and control systems to regulate Distributed Energy Resources (DER) which includes distributed generation, active demand and flexible storage, provides a potential solution but represents a step change in operations from our passive past.

The connection and operation proliferation of energy storage technology is continuing. They are largely providing services to manage the electricity system frequency.

However, breakthroughs are also likely, for example, in the cost and density of energy storage devices making them affordable for demand side management as demonstrated as part of our industrial and commercial storage project.

The network innovations we are developing today are designed to enable us to prepare for multiple technology and industry outcomes.

Government policy

Concerns about climate change have led the government to commit to achieving net zero greenhouse gas emissions by 2050.

New challenges will emerge for DNOs as the levels of carbon released by both heating and transport activities need to reduce significantly thereby shifting demand from oil and gas to electricity. The scale and pace of the changes are uncertain but we need to be ready to accommodate the changes when they arise.

We have already observed the effects that changes to Government policy can have. The Feed-In-Tariff (FIT) for generation led to a significant increase in the volume of applications for generation connections, with many applications being received just prior to subsidies being reduced as generator developers seek to maximise their returns from incentive mechanisms.

Devolved government policy in Wales may lead to specific demands and need for innovative solutions. Our plan is flexible and therefore able to accommodate these. We expect that some low carbon technologies will also see a high level of uptake that will be influenced by government subsidies or incentives. The strength of incentives will alter the speed and volume of uptake.

The impact of new forms of generation and demand will become clearer during RIIO-ED2 and our plans need to be flexible to respond to changing circumstances. We will accommodate any changing requirements into our Innovation Strategy as part of the annual review.

Customer focus

Through the deployment of a wide variety of new technologies, such as smart thermostats, solar photovoltaic panels, and Electric Vehicles (EVs), customers are increasingly able to control their electricity usage and spend, as well as the type of power they buy and when they use it

Some customers want the ability to self-generate and sell that power back to the grid. The demand profile for our customers is changing, and is expected to change even more drastically with the forecast uptake in EVs and the decarbonisation of heat.

As a result of this, we will need to continue developing commercial models and technical solutions that facilitate customer choice in a cost effective way, whilst at the same time managing the impact on the networks.

We believe that increased engagement and communication, as well as transparency and efficiency must be at the forefront of our ability to serve our customers' evolving needs.

We demonstrate this through active innovation participation in our stakeholder events, which range from DG forums, Member of Parliament (MP) visits to depots and innovation project sites and regional smart energy events.

We innovate to create, investigate and trial affordable alternatives to postpone expensive reinforcement or provide long term network management solutions.

We innovate to continue developing commercial models and technical solutions that facilitate customer participation in the management of the network.

Why we innovate

DSO capability

We innovate to ensure an efficient development of Distribution System Operator (DSO) capability. This is essential to drive performance and efficiency from our network and to ensure it can meet the future energy demands of all our customers.

The enhanced capabilities we are developing will also give our customers the freedom to access other opportunities within the developing energy system.

We see the planning and operation of a more active regional distribution network as a natural extension of our current role.

We believe DNOs are well placed to lead the management of an efficient and cost effective electricity system at a local level.

With DSOs managing the coordination of transmission and distribution services at a local level, it enables the GB System Operator (GBSO) to concentrate on balancing the national network using un-conflicted services competitively made available.

There is currently no singular set view of what the future energy system will look like and Ofgem and the Department of Energy Security and Net Zero (DESNZ) are looking for the industry to provide evidence to support decisions on what this future should look like.

Therefore, it is critical that we continue to both commercially and technically innovate to ensure that the DSO is developed efficiently and effectively to best serve the future energy of our customers.

Managing uncertainty

A high degree of uncertainty exists with respect to the GB Energy System and it is therefore important that we seek and use key sources of external data and guidance to ensure that we have the best forecasts possible.

Whilst we are guided by national scenarios developed by the government we also employ organisations such as energy savings trust, centre for sustainable energy and Regen to tailor them to the NGED regions.

To aid consistency in the development of operability frameworks, we have aligned future NGED scenarios to those used by National Grid Electricity System Operator in our shaping sub-transmission documents.

The detailed understanding that we gain informs the development of our innovation programme to deliver solutions for the potential problems we expect to encounter.

Wherever possible, we also ensure that our projects are scalable and capable of providing more generic solutions that can be adopted irrespective of the specific type and level of Low Carbon Technologies (LCTs) in the network.

We innovate to ensure an efficient transition to a DSO.

We innovate to find the best ways of managing future uncertainty.

Our focus and priorities

We aim to find the most efficient ways of addressing the technical challenges of the future electricity network, while at the same time keeping electricity affordable for everyone.

Our focus and priorities

As part of this, we want to understand how we can best support our customers and our communities so that no one is left behind in the energy transition. To achieve that, our projects are shaped around the key priority areas of decarbonisation and net zero, heat, transport, data, communities and customers with vulnerability.

Decarbonisation and net zero

Our innovation work focuses on enabling us to facilitate the low carbon transition, so that our network can support the connection of low carbon technologies while remaining safe and reliable. This involves transforming network operation to make it smarter, using our assets in novel ways to make the most out of our existing network and empowering our customers to be part of the transition by facilitating flexibility markets.

Through our innovation projects, we are creating and trialing the new technologies, systems and commercial arrangements we need to transform as a business and become a distribution system operator.

We have already begun the transformation through the capabilities developed from our projects.

This has shaped critical areas of our business including alternative connections, data and digitalisation, flexibility services and our network management system

Heat

Providing energy for heating currently accounts for around 32% of all UK emissions. In order to reduce this, we need to increase heating from low carbon electricity and move away from traditional gas solutions. From 2035, no new homes will be able to be gas heated. This will lead to a significant increase in electrically heated homes creating higher demand on the network.

As existing properties transition to low carbon heating solutions such as Heat Pumps (HP), it is important to understand the impact they will have on the network.

Our EQUINOX project is investigating how domestic customers with heat pumps can provide network flexibility using two different approaches for control and payments.

Understanding dense clusters of purely electric HPs on the network, will show how to design new build networks and how and when to reinforce existing infrastructure.

Transport

We are supportive of the government's clean growth strategy. This sets ambitious targets to have near zero emissions from transport by 2050. A significant challenge and opportunity exists as a large proportion of vehicles will become electric. These vehicles will need to be able to charge in a manner that suits the customer but avoid the need for large scale reinforcement caused by additional significant peaks on the electricity network.

To date, our innovation programme has invested significantly in EV trials. Our Electric Nation and LV Connect and Manage projects have enabled us to generate industry leading learning on the capability, acceptance and benefits of managed and smart charging EVs. This has fed directly in to and shaped our current EV Strategy.

As part of our Electric Nation - PoweredUp project, we have developed and trialled on-street charging network infrastructure solutions and large scale V2G solutions.

Decarbonisation and net zero, heat, transport, data, communities and consumers with vulnerability. These are our priority areas.

Our innovation work aims to enable us to facilitate the low carbon transition.

We are transforming our network so that it can support the electrification of heat and transport.

Our focus and priorities

Data

Accurate and reliable data is paramount to facilitate the operation of a DSO, but also to support new self-service facilities for new connections customers. Our innovation projects have focussed on the creation of increased data sets, such as monitoring to understand the operation of the LV network to a level and granularity not previously possible and to improve the quality of the data we use.

The increased granularity of data more widely is vital to operating and managing effectively a distribution network, from understanding when and where to invest, to determining optimal flexibility services and solutions for customers.

As highlighted in the energy data task force report, companies are to be recognised for innovative mechanisms for using data to provide greater infrastructure visibility and support productive collaboration. This means that the level and depth of data made freely available by all licence network operators will have to significantly increase.

We are committed to making data available for third parties so that they can understand our networks and utilise advanced analytics to support our network knowledge.

Previous innovation projects have demonstrated the value and benefit of increased data and network visibility. OpenLV has shown the appetite for third parties to utilise our data and generate additional information.

Our Smart Meter Innovations and Test Network project (SMITN) looked at how voltage data from smart meters could be used to determine the phase to which a single phase customer is connected. This will help us understand and reduce network imbalance. Network imbalance reduces the effective capacity of our LV networks and could worsen as more LCTs are installed unless it is managed.

Generating, accessing and interpreting data effectively, will provide us and customers significant benefits.

Communities and consumer vulnerability

The rapid changes in the electricity network are bringing challenges for DNOs but are also introducing new opportunities for our customers. We want to ensure that all of our customers have access to those opportunities so that they can be part of the energy transition.

To do that, we will work with community and local energy groups to understand how we can collaborate together to help our future networks to be flexible and achieve net zero. We will build on our existing community energy work and strengthen the links we have with our communities even more.

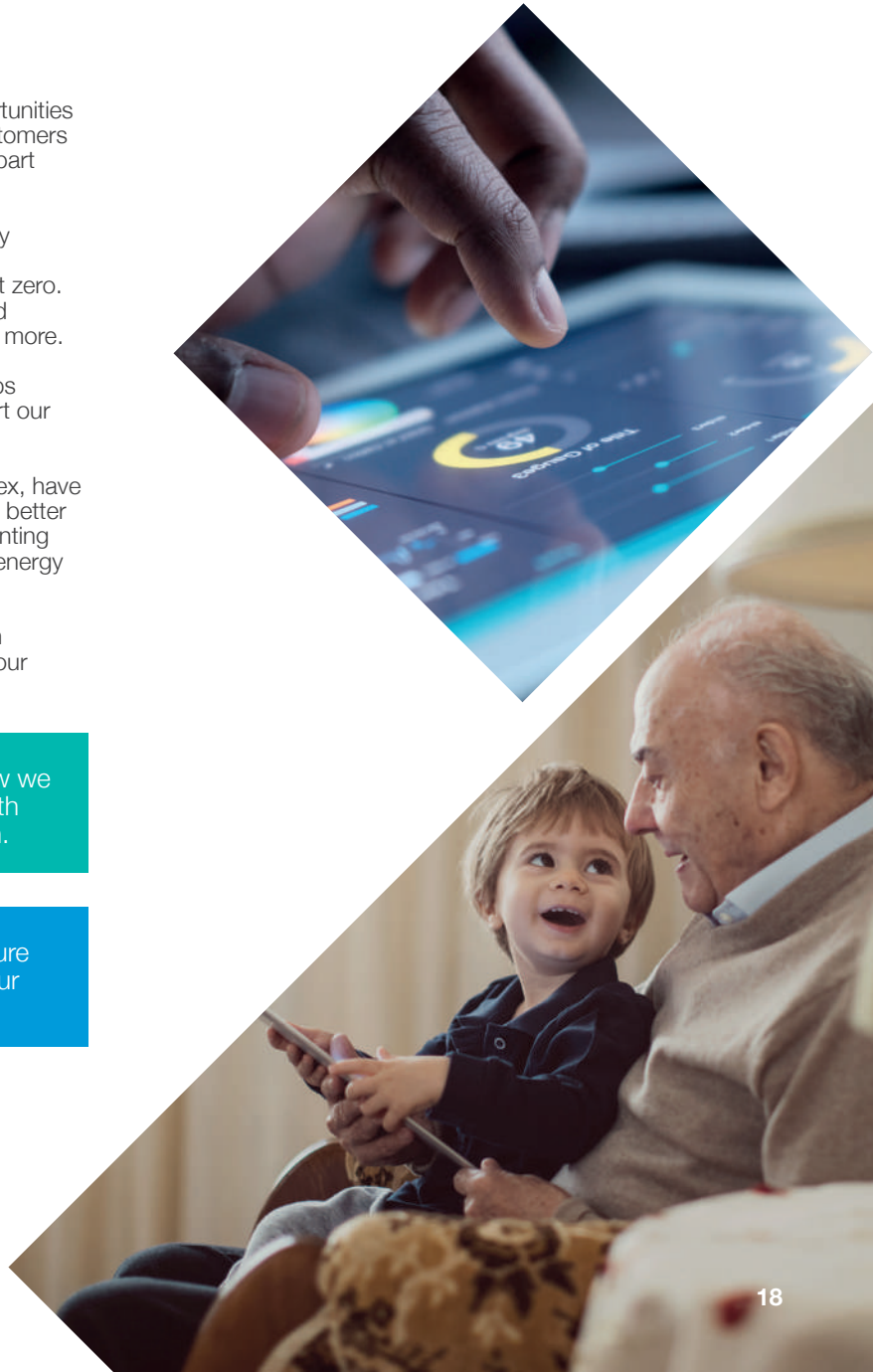
Most importantly, with the help of local community groups we will focus on understanding how we can best support our customers with vulnerability through this transition.

Our innovation projects, including OpenLV and Future Flex, have shown that communities are interested in understanding better how their local electricity network operates. They are wanting to find ways to participate in the decarbonisation of the energy system in order to benefit their own communities.

Through our innovation programme, we want to build on our existing work and explore more ways of supporting our communities and customers with vulnerabilties.

We will focus on understanding how we can best support our customers with vulnerabilities through this transition.

We will continue to innovate to ensure maximum value is extracted from our data both internally and externally.



How we innovate

Approach to innovation

Our innovation process is in line with the Energy Networks Innovation Process developed with the Energy Networks Association.

The complete detailed end-to-end industry process for reporting, collaboration and dissemination of learning can be seen in their **Energy Networks Innovation Process Document**.

We actively involve staff from across the business in the generation of ideas, development of solutions and the implementation of our projects.

We avoid theoretical research or innovation that does not have clear objectives or benefits.

Instead we define clear objectives for each project so that delivery can be focussed and progress can be accurately tracked.

To ensure everyone benefits from the work that we do, we are sharing what we learn with other organisations and we also ensure we are learning from others.

How we innovate

Stages of innovation

The scale of the work that we do ranges from lower Technology Readiness Level (TRL) projects which are generally concept investigation projects to higher TRL demonstration projects.

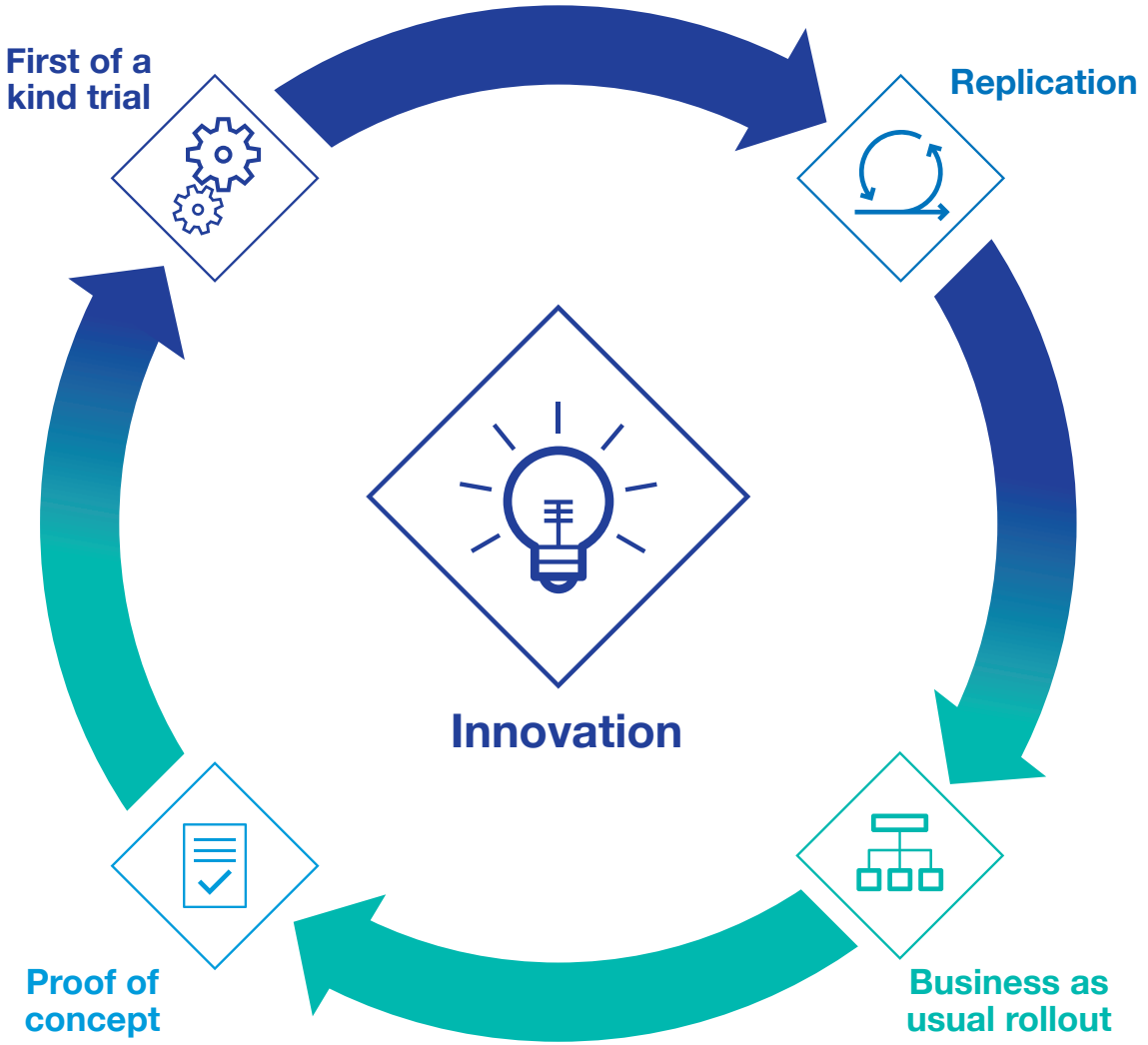
Our lower TRL projects allow us to capitalize on the knowledge gained from exploring and evaluating those solutions. They are anticipated to pave the way for tangible outcomes that can be effectively implemented into a higher TRL or learning for the business. The higher TRL projects usually involve real life trails of new technologies, systems and processes.

The full research to implementation timescale can often be between five and ten years. In all of our projects, we focus on creating solutions in such a way that they will be suitable for a 'Business as Usual' (BAU) roll out. That is why our internal teams have a great input on higher TRL projects.

Generating ideas

Generating innovation project ideas is critical to the success of a portfolio of balanced projects. Our ideas come from a wide variety of sources both internally and externally.

Internally, we ensure that staff are engaged in innovation project activities through regular dissemination. An example is the company's internal Share-Point site, which provides staff the opportunity to understand that we are actively developing innovative project proposals and delivering these. We also ensure that our core innovation team are all regionally located to enable staff the opportunity to discuss problems and any challenges they identify.



We actively involve our experts within the business in the generation of ideas, development of solutions and implementation of projects.

We use external calls for ideas for our NIA and SIF projects. Through these calls, we aim to discover first of a kind solutions that can resolve industry challenges and benefit our customers.

We select the best ideas based on the level of risk and benefits they can offer.

How we innovate

We also actively explore external involvement in the generation of ideas for new projects through a variety of mechanisms:

- using NIA and SIF third party calls to the wider industry to identify potential projects and solutions as identified in our Distribution System Operability Framework (DSOF) document, Innovation Strategy and ENA's electricity innovation strategy.
- identifying learning and best practice development from other DNOs' projects that can be either integrated in to our 'business as usual' practices or developed further through innovation trials.
- interacting with wider stakeholder groups such as community energy groups and DG operators' forums to understand their needs and challenges to shape our project programme.
- investigating activities and innovations being developed outside of our direct industry to understand what can be learnt and adopted to improve our wider business operation.

Selecting and prioritising ideas

We assess each project against each of our priority areas in order to select the correct breadth and ensure a suitable balance is achieved in our innovation programme.

Key elements used to select and prioritise a project are the positive impacts it has on our customers, the level of risk and the cost benefit analysis outcome.

Governance arrangements

All innovation projects are delivered as part of the innovation programme. The programme is the delivery mechanism for the Innovation Strategy detailing ongoing and new projects.

All business innovation projects are delivered from the area of the business that has the specific expertise to be able to develop the idea.

On an individual basis, projects are approved in line with our financial approvals process. All projects and works are subject to the same controls and authorisations as other engineering projects in the business.

Project progress is tracked through normal monthly business reporting arrangements. All major projects have a nominated senior management sponsor and progress review group. Major projects undergo regular review by their progress review group during which an assessment is made of the risks that exist to the overall success of that project.

All our projects are managed in accordance with recognised project management methodologies. There is a suite of standard documents and templates which are tailored for the specific requirements of each project and all covered under a wider project governance guidelines document.

Innovation projects are delivered in line with regulatory governance requirements and regular reports are provided to review the progress of individual projects against their targets. Six-monthly reviews are made publicly available for our NIC and SIF Beta phase projects.

Research partners and supplier arrangements

We have links with a wide range of universities, research establishments and manufacturers, both in the UK and across the world (e.g. Hitachi in Japan and the Electric Power Research Institute in the USA).

We monitor UK and worldwide research to identify concepts and developments that may provide benefits to us in the future. We are active members of CIRED, the forum where the international electricity community meets. To maximise the effect of research and innovation, we actively participate in industry wide forums.

Although our projects vary in terms of scale, we avoid theoretical research that does not have clear objectives or benefits.

We deliver our projects based on our robust internal governance processes.

We track the progress on our projects through regular reporting arrangements

How we innovate

These forums bring together the best industry knowledge in a cost effective way to pool and manage research which is of use to all DNOs.

Through the ENA, the DNO trade body, we also actively participate in a variety of groups and panels which review and develop industry wide learning. The issues and challenges facing NGED are the same as those for other network operators and we share knowledge wherever possible.

We are currently developing the Innovation Metric Framework which will be used to report details of our portfolio, typical project timescales and the benefits that have been gained from implementation into Business as Usual.

We proactively support knowledge sharing and the development of best practice guides which can benefit the whole industry. It is important that we learn from others and do not spend time or energy duplicating effort on topics which have been well researched. Benefits for industry and society can be more effectively applied when the specialist experience gained from running innovation projects is shared.

Staff in our Innovation Team review other DNO projects in tandem with their own work to deliver our projects.

They become our key contact to other DNO dissemination events and ensure we learn as much as we can from the other projects. We have allocated one person as the key contact to each other DNO group.

We support research that is led by suppliers and manufacturers and share our knowledge and experience to help them develop solutions. Providing this support enables us to influence the research so that it provides a benefit to us.

We work with UK based Small and Medium-sized Enterprises (SMEs), who are playing an increasingly important role in the delivery of new technologies and solutions. Over 75% of our projects suppliers are UK SMEs.

We also provide feedback on the limitations of existing products so that they can be improved. Partners can also trial products or solutions on our network which generates useful practical experience for the developer and allows us to understand how the products can be integrated into existing systems.

Our academic partners enable us to draw on the specific expertise which enables us to cover a wide range of topics and specialisms with people who have in depth knowledge.

Some projects include technology which is not from the electricity industry and we work with partners who might not be obvious choices but provide us with the best resource.

We choose product suppliers using our well established procurement systems. We use the utilities vendor database system, Achilles and have worked with Achilles to develop new product codes to cover elements of network innovation.

Developing plans for Innovation

Innovation in smart solutions will help us to accommodate low carbon technologies through RIIO-ED2.

Our innovation plans are regularly reviewed against new information from UK industry, worldwide research, learning from Network Innovation projects and outputs from the Open Networks project.

We look for ideas that follow on from earlier innovation projects to maximise the benefits of investments already made.

Innovation in smart solutions will help us to accommodate low carbon technologies through RIIO-ED1 and into RIIO-ED2.

Reviewing our plans

Keeping the strategy up to date

Our innovation plan is subject to review to ensure that it continues to provide solutions in line with business requirements. We review our plans with our stakeholders to ensure that we allow them to challenge our proposals and shape what we do. Our plans will remain flexible so that we are able to address changing demands.

We are working closely with the ENA to ensure that the industry has a common approach when tackling the challenges of the future. Through our innovation work, we aim to provide solutions that align with the shared network innovation themes defined in the ENA Innovation Strategy.

We regularly review and update our Innovation Strategy and plans to incorporate new information from the UK industry, worldwide research and learning from innovation projects.

External factors will influence our plan and feature as part of the review process. We will take account of results from our trials and other DNO projects. Manufacturers will often develop products through DNO trials and we will assess their suitability for adoption as part of our review process.

Our review will also take into account existing government incentives and potential changes which may impact on customer behaviour. The Innovation Strategy is approved annually.

Coordinated business approach

A coordinated approach is required to ensure that innovation is focussed on supporting the wider business. This centres on a close working relationship with the engineering and commercial teams, specifically policy, strategy and distribution system operation teams.

A number of documents produced by these departments are at the centre of driving our innovation portfolio:

- **Distribution system operability framework**
  This document details the future technical and commercial challenges that inform our near term priorities and calls for projects from third parties.
- **Shaping sub-transmission networks**
  Each of our four licence areas has a shaping sub-transmission document produced and periodically reviewed, which details the forecast requirements of the 33kV, 66kV and 132kV networks. This is based on projected integration of DG and low carbon technologies. This data is used to provide justification for the business case produced for new innovation projects, where appropriate, prior to approval.
- **DSO transition plan**
  We recognise that the change from a distribution network operator to a DSO is essential to driving performance and efficiency from our network and to ensure it can meet the future energy demands of all our customers.

  Therefore, we have produced a detailed DSO transition plan that has a clear plan for the transition. Suitable innovation projects are shaped and delivered to support the technical and commercial needs of operating as a DSO.

Our external engagement

Engaging with stakeholders

Innovation is a key theme of all stakeholder engagement sessions. Our stakeholder engagement process for innovation is the same as for all other areas of our business. We welcome ideas from our stakeholders and openly encourage them to put forward their suggestions.

Innovation remains a key theme for our customer panel, which helped us to prioritise future projects. In addition to innovation projects, the panel supports our work to assist the distributed generation community. We also involve our customer engagement group in our innovation plans to ensure that they align with our customers' expectations.

As well as our stakeholder engagement process, we look for feedback on innovation at other panels and groups wherever possible. We work closely with Regen, a renewable energy group in the South West of England, who are keen to support the introduction of renewable generation across their area.

We use the distributed generation forums, to seek other views and to compare our initiatives with those from other DNOs. We support the Major Energy Users Council (MEUC) and have presented our innovation proposals to them for comment and feedback.

We also engage with Department for Energy Security and Net Zero (DESNZ) and Department for Environment, Food and Rural Affairs (DEFRA) on related matters such as Climate Change Adaptation (CCA) that looks at the longer term effects of climate change on the UK electricity industry.

Additionally, we have close political engagement with MPs and locally elected representatives and actively engage in the development of regulatory and legislative policy. Our learning from innovation projects informs the proposals we make in our responses to consultations.

Sharing the learning

We aim to ensure that we extract maximum value out of every project we do, whatever the outcome. Therefore, we publish the results of all of our projects and make them freely available via our website, so that all stakeholders benefit from our learning.

When our projects involve the installation of equipment on our network or require a change to business processes we do this in the same way as our standard engineering activities using the skills and efficiencies of our engineering teams.

That involves creating new policies and standards which are incorporated within the business before we start our project trials, ensuring successful integration of new processes with existing ways of working.

We welcome ideas from our stakeholders and openly encourage them to put forward their suggestions.

We aim to ensure that we extract maximum value out of every project we do, whatever the outcome.

Advancing commercially and technologically

Innovation progress

For us, innovation is an embedded activity. All projects and solutions ranging from small scale innovations through to larger scale trials need to be designed and implemented in a way that they will be suitable for 'Business as Usual' integration.

Our wide and varied programme of innovation has enabled us to be suitably placed to support our changing needs as a business and our customers' increasing demands and requirements.

Most notably, we have developed and rolled out Active Network Management (ANM) solutions across our four licence areas.

We worked to understand the network requirements that can be supported through flexibility offerings and customers' willingness to participate and in what format. This has enabled the development of the Flexible Power brand.

We have purposely innovated in a wide number of technical and commercial areas. We developed technical solutions for active management of domestic EV charging as part of our LV Connect and Manage project and undertook a feasibility study on the applicability and suitability of utilising superconducting cables, with far greater power carrying capacity that traditional infrastructure.

As part of the Network Equilibrium project, we have explored, designed and successfully trialled new systems that optimise the operation of our network and control our assets in ways that we have never been able to do before. We recognise how these capabilities are important for a DSO and since the project ended in June 2019, we are working on their BAU roll out.

We plan to have a network that is truly flexible, combining commercial flexibility solutions and advanced technological solutions, all of which were generated from our innovation work.

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How we have transformed our business

Delivering benefits from innovation

We have been continuously building on the learning generated from our projects. For example, fault currents were explored as part of a collaborative IFI project, demonstrated within FlexDGrid, an LCNF Tier-2 project, and now being refined and made suitable for small scale rapid deployment as an output of our EDGE-FCLi NIA project.

As outputs are delivered, they are developed into new learning that can be taken forward and developed as business as usual. Outputs obtained from other DNO projects are fed into this process to ensure that we gain maximum benefit from innovation projects.

All solutions rolled out from innovation follow the same route as our other policies and techniques introduced into the company. Policies are reviewed by the senior network managers before they are introduced. The roll out process includes implementation plans and, where appropriate, training and dissemination sessions. We monitor all the projects as they develop and make use of learning and outcomes as they are reported.

Innovative solutions can also improve the security of electricity supplies by ensuring generation matches demand in local areas. Solutions could enable sections of the electricity network to be run in isolation for short periods of time. Distribution network technology will continue to advance and we can gain benefits by adopting it.

Our experience shows that new solutions available today will become standard in the near future. For example, ANM was bespoke when our low carbon hub project started in 2011.

ANM is now business as usual and we have a framework agreement in place with three vendors, with multiple zones currently active. A critical evolutionary change is the increase of LCTs such as EVs and electrified heating solutions on the distribution network. Challenges and opportunities have been demonstrated by our Electric Nation and FREEDOM projects.

Our Lincolnshire low carbon hub project developed a practical application of active network management which is part of our alternative connections policy suite.

Alternative connections are available to all generation customers seeking a connection where significant reinforcement is required.

Export limitation devices have been developed by manufacturers to locally balance generation and demand. However, due to the lack of an industry standard, the variance in the quality and method of operation of these devices is wide. We developed a policy for acceptance of these schemes which outlines the minimum requirements to achieve compliance with the new NGED policy. This policy was circulated to the other DNOs and following further refinement was developed in conjunction with manufacturers to form a new UK standard - ENA Engineering Recommendation G100.

Our Wildlife Protection project developed and trialled methods of reducing wildlife interactions with our overhead lines. The project provided the learning needed on which devices can be rolled out, how they can be installed and how they will act during their life on the network. Some of the devices are now available within our stores system for use on the network and updates have been made to policies to support their use. Other changes have already started to be made to the way we build, replace and refurbish our overhead structures following learning from the project.

The ENTIRE project explored the technical and commercial requirements to utilise flexibility as a service to avoid asset investment requirements. Through trialling over 47MWh of flexibility and generating policies and procedures, this enabled the Flexible Power brand to be developed and is now offering ‘Business as Usual’ flexibility solutions to the whole business.

Our Presumed Open data project built on the work from OpenLV and the Carbon Portal to make our data more available to third parties.

Our Statistical Ratings project revised values for overhead lines which have now been implemented across all UK DNOs. In our RIIO ED2 business plan we included more than 16 Engineering Justification Papers, totalling over £100m of investment, which built on the learning delivered from previous innovation projects. Our innovation projects pave the way for real changes to our networks.

Our innovation work is transforming our network and the way we operate as a business.

Our statistical ratings project created a more accurate way to view network ratings through the year.

Our OpenLV, Carbon Portal and Presumed Open Data projects have made our data widely available.

ANM, trialled in the Low Carbon Hub project, is now business as usual, giving our customers more ways to connect to our network.

The ENTIRE project enabled our Flexible Power brand to be developed and is now offering ‘Business as Usual’ flexibility solutions.

Our Wildlife Protection project has changed the way we carry out overhead line construction to protect wildlife whilst also reducing faults on our network.

Our passion

We are passionate about driving the changes needed in the electricity industry to decarbonise the energy system and we aim to continue leading the innovation work in our sector.

We want to be working with the best people to achieve excellence and provide value for money to our customers, in everything that we do.

If you have a great idea on how to tackle any of the challenges we are facing, we would like to hear from you.

How to get in touch

Find out more about all our projects, request access to project data and view upcoming innovation events at:

nationalgrid.co.uk/innovation

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