

nationalgrid

Innovation Strategy

2022



Electricity
Distribution

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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. The strategy looks through to 2035, yet naturally provides more detail on the shorter term priorities, requirements and proposed initiatives. This strategy also sets out our key priorities and challenges during the remainder of RIIO-ED1 and our plans for 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-ED1 Network Innovation Incentives and the UK's net zero targets have and will continue to 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.

We rely on innovation to maintain our position as a frontier performer in network performance and customer service. 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.

The way we manage and operate our network has been transformed using the learning from our Network Equilibrium project. We are now working on the roll out of system voltage optimisation, the novel real time voltage control system we designed and successfully trialled as part of that project.

We continue to innovate and ensure third party access and collaboration on our projects is achieved, most notably through our established third party call for projects.

Our innovation work enabled us to build a strong framework for creating and delivering innovation projects and provided us with the skills and knowledge needed to be able to successfully run complex innovation projects.

In RIIO-ED2, we will significantly increase our innovation activities and use the experience and skills we have built to deliver our business innovation programme which will be entirely funded by us and focus 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 making our staff passionate for innovation, encouraging and rewarding positive change and ultimately embedding a culture that celebrates innovation. This is a big part of our strategic focus for the RIIO-ED2 period.



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



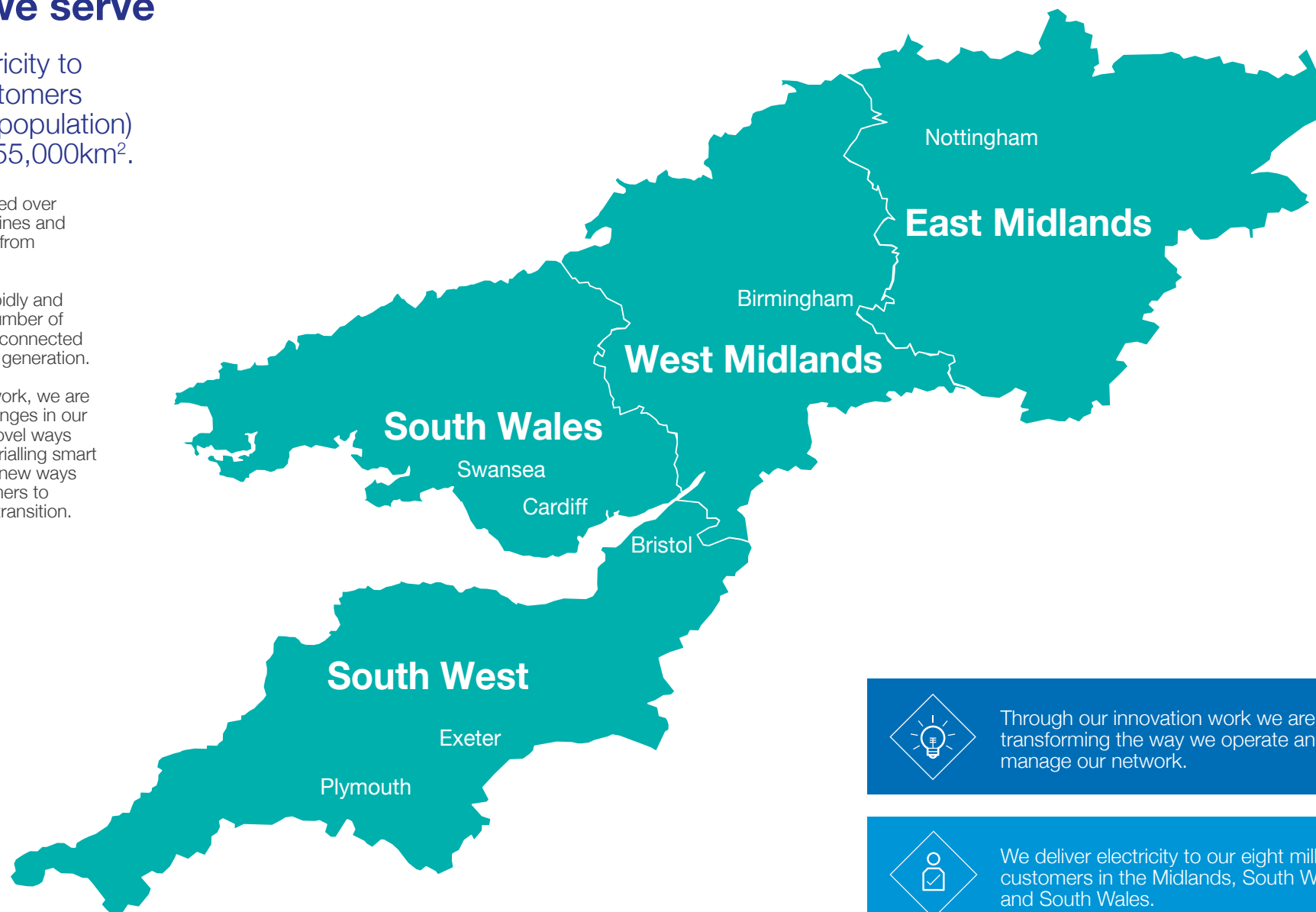
The area we serve

We deliver electricity to eight million customers (27% of the UK population) over an area of 55,000km².

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 manage 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.

The knowledge and experience we gained through our innovation work is now shaping our plans for the RIIO-ED2 period. At the same time, we have also identified new areas that we should innovate in to ensure that no one is left behind in the energy transition. Therefore, in this update of our Innovation Strategy we have added new priority areas that will be key in preparing us for RIIO-ED2. We have also outlined our plans for the RIIO-ED2 price control period.

The NGED net zero communities strategy is strongly linked with our innovation work and has influenced our new priority areas. The common aim between these two strategies is to ensure that community and local energy is a strong and resilient part of our energy system in terms of helping to achieve net zero.

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.

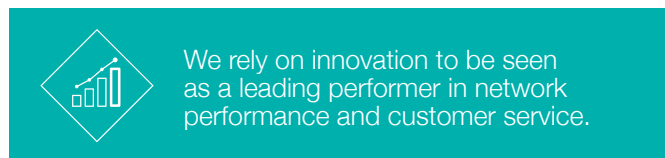
What is innovation?

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



What is the role of innovation?

Innovation is core to our Business Strategy. We innovate to adapt to the changes in our network, facilitate the delivery of net zero and continue to improve our network performance and customer service. To ensure that our network remains affordable, we are continuously providing more flexible solutions that are better, cheaper or quicker than the current ways of doing things.



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



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



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.



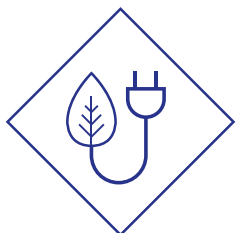
NGED innovation team

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.

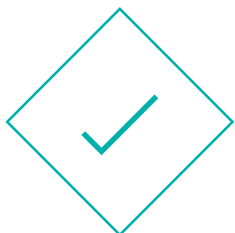
Our commitments

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 vulnerable customers 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 is 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 trialling 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.

For RIIO-ED1 we have been allocated a NIA of 0.5% of total regulated revenue, around £58 million throughout the eight year period.

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 NIC 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, Genex-LCV 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 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, below are the live projects in our programme that were being delivered between April 2021 - March 2022.

NIA Projects

ACCELERATED (Assessment of Climate Change Event Likelihood Embedded in Risk Assessment Targeting Electricity Distribution)	NEAT (Network Event and Alarm Transparency)
ACE (Active Creosote Extraction)	Optimal Co-ordination of Active Network Management Schemes and Balancing Services Market
ALARM (Automatic Location of Arc-faults through Remote Monitoring)	Overhead Line Power Pointer
ALPACA (Approach for Long term Planning Accounting for Carbon Assessment)	Peak Heat
ARC-Aid	PNPQA (Primary Networks Power Quality Analysis)
DEFENDER (Demand Forecasting Encapsulating Domestic Efficiency Retrofits)	Pre-Fix
DynaCov (Dynamic Charging of Vehicles)	Presumed Open Data
EDGE-FCLi (Embedded Distribution Generation Electronic Fault Current Limiting Interrupter)	SEAM (Spatially Enabled Asset Management)
Electric Nation - PoweredUp	SHEDD (System HILP Event Demand Disconnection)
EPIC (Energy Planning Integrated with Councils)	SMITN (Smart Meter Innovations and Test Network)
FLOWERS (Flexible Operation of Water Networks Enabling Response Services)	Take Charge
Future Flex	Temporary Event Charging
Harmonic Mitigation	VENICE (Vulnerability and Energy Networks, Identification and Consumption Evaluation)
Intraflex	Wildlife Protection
LTE Connecting Futures	

NIC Projects

EFFS (Electricity Flexibility and Forecasting System)	DC Share	EQUINOX (Equitable Novel Flexibility Exchange)
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In the period between April 2021 – March 2022 we have been delivering 29 NIA projects and three NIC projects.

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 frequency services to National Grid. 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-ED1 and into 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 (GSO) 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 BEIS 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 BEIS, we also employ organisations such as energy savings trust, centre for sustainable energy and RegenSW 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 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.

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 customer 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 trialling 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 2025, 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 FREEDOM project, along with Wales and West Utilities, trialled 75 hybrid heat pumps and demonstrated the benefit of shifting to electricity to provide heating and using gas as a back-up when electricity capacity was not available.

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 are now developing and trialling on-street charging network infrastructure solutions and large scale V2G solutions.



Decarbonisation and net zero, heat, transport, data, communities and consumer 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 while remaining safe and reliable.



Our focus and priorities

Data

Accurate and reliable data is paramount to facilitate the operation of a DSO. 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.

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 LCT Detection project used domestic metering information to identify LCTs, mainly EV chargers and PVs connected to the network. 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 vulnerable customers 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 vulnerable customers.



We will focus on understanding how we can best support our vulnerable customers 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

The way we approach innovation is fundamental to delivering our objectives.

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.

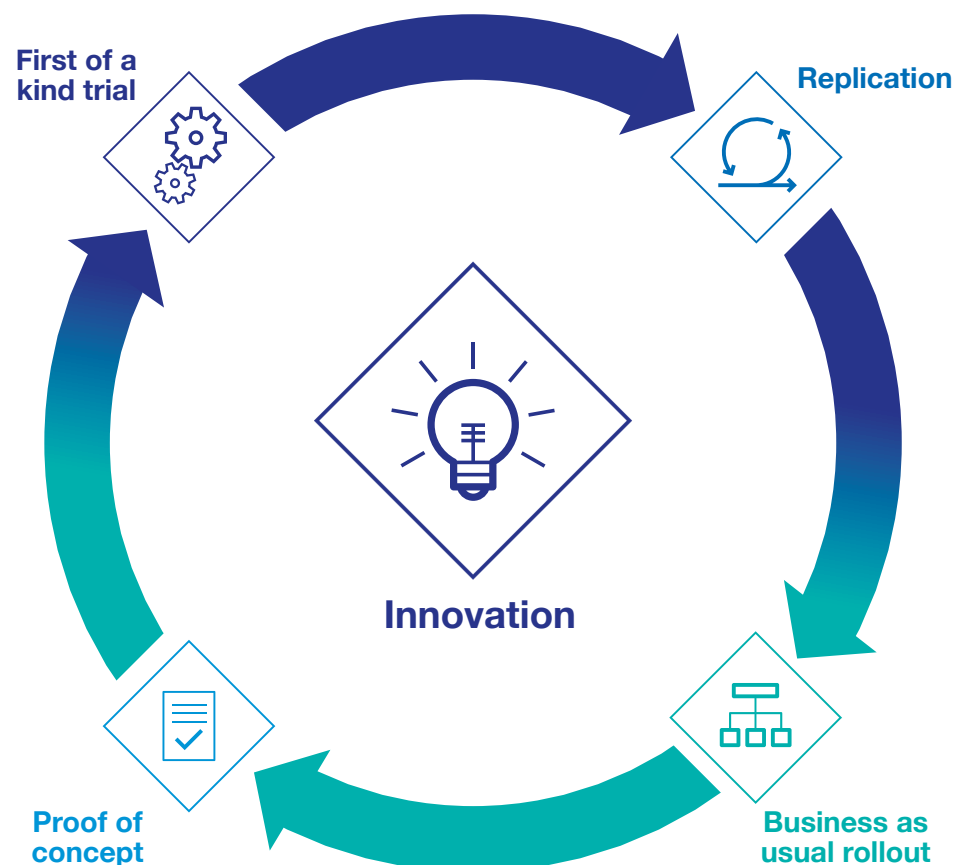
To ensure everyone benefits from the work that we do, we are sharing what we learn with other organisations and we also ensure we are learning from others.

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.

The higher TRL projects involve real life trials of new technologies, systems and processes. These projects usually follow smaller projects that we have completed so that we can build on the learning previously generated from investigating and assessing those solutions.

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.



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

We run external calls for ideas for our NIA and NIC 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.

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 magazine, 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.

How we innovate

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

- releasing NIA and NIC 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. NIA projects are subject to project level approval by the electricity system manager or operations director, depending on budget. Projects registered in NIC are subject to project level authorisation by the by operations director.

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 all our LCNF and NIC projects and any NIA project with a value greater than £1 million.

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 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 they have 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-ED1 and into RIIO-ED2.

Our RIIO-ED1 business plan set out expectations for how smart interventions will reduce our investment plans by £128 million across the period.

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



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.



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 will we 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 by the operations director.

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.

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.



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 RegenSW, 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 Business, Energy and Industrial Strategy (BEIS) 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 and increased the number of substations utilising flexibility to avoid asset investments from 71 in 18/19 to 122 in 19/20.

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 than 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.

Until the end of RIIO-ED1 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.

Through the network equilibrium project we have developed and successfully trialled our System Voltage Optimisation (SVO) technology which has revolutionised the way we operate our network in real time and proved the significant network capacity benefits it can offer. We are now planning the roll out of SVO which will enable us to make the most out of our existing network.

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



System Voltage Optimisation, successfully designed and trialled in the Network Equilibrium project, has revolutionised the way we operate our network. Our Network Management System is now changing to facilitate the roll out of SVO.



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.

How we will continue to transform our business

Our focus in the RIIO-ED2 period will be on using the skills, knowledge and experience we have built in previous price control periods to lead innovation within the business, deliver projects that can reduce costs, roll out successfully proven innovation and establish a business culture that celebrates innovation and embraces change.

We will do that by running a business innovation programme alongside our Ofgem funded innovation programme.

We define Business Innovation, or otherwise referred to as BAU Innovation, as lower risk innovation that cannot be funded through the Ofgem driven mechanisms (NIA and SIF) but can provide benefits to our network and our customers by reducing our costs and introducing efficiencies.

Additionally, the roll out of innovation that will be proven in the RIIO-ED2 period by us or other DNOs will also be delivered as part of our business innovation programme during the RIIO-ED2 period in order to accelerate the adoption of successful innovation within the business.

We recognise that driving change within our organisation is not just about delivering projects.

It is about changing perceptions so that innovation is not seen as scary, complicated or difficult.

It is about rewarding innovation, encouraging continuous improvement and embracing change. It is about embedding a culture that celebrates innovation.

That is exactly what we want to achieve within our business. In RIIO-ED2 we will see our main business teams driving innovation.

We aim to do that by creating internal innovation performance metrics which will be used to assess on a monthly basis the innovation performance of each business department including all distribution areas, control systems, network design, finance and other teams.

These innovation performance metrics will formalise the need for our BAU teams to be driving the changes needed to make their processes more efficient and provide the reporting mechanisms necessary to be tracking progress.

We aim to create a competitive spirit between our internal teams that encourages the efficient delivery and adoption of innovation.

At the same time we will reward teams that collaborate with each other in order to successfully implement their innovation activities.

Even though the delivery of business innovation projects will be managed by the innovation team, each business innovation project will also be jointly owned with the senior manager responsible for the business area the project is delivered in, strengthening the link between innovation and main business.

Each business team will also have a dedicated innovation ambassador who will be responsible for driving innovation within their team and encouraging the creation of new ideas.



In RIIO-ED2 we will be significantly increasing our Innovation activities by running two innovation programmes instead of one. Our core innovation programme will continue to run but we will also be delivering our business innovation programme which will focus on introducing efficiencies and accelerating the adoption of innovation.



Driving change within the organisation is not just about delivering projects. It is about embedding a culture that celebrates innovation.



In RIIO-ED2 we will see our main business teams driving innovation.



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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