Electricity Transmission

ENTER

Innovation
Annual Summary 2021/22

nationalgrid

Welcome to your interactive Annual Summary

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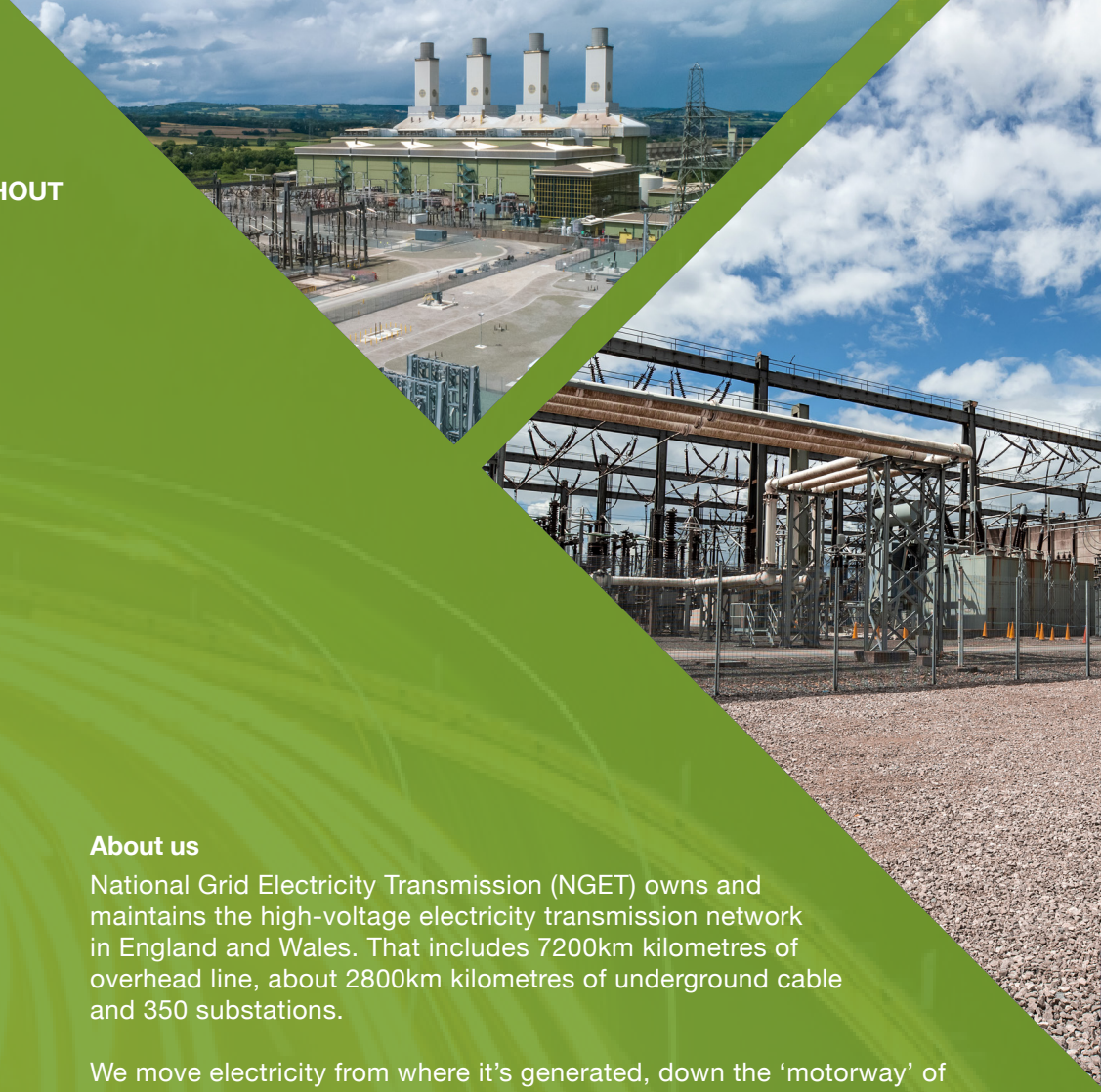


About us

National Grid Electricity Transmission (NGET) owns and maintains the high-voltage electricity transmission network in England and Wales. That includes 7200km kilometres of overhead line, about 2800km kilometres of underground cable and 350 substations.

We move electricity from where it's generated, down the 'motorway' of the electricity system, to our direct customers and to the distribution companies that deliver that power to homes and businesses. We play a vital role in connecting millions of people to the energy they use, safely, reliably and efficiently.

Through transformational engineering, we are helping our country to achieve its sustainability targets, by ensuring our network gives fair access to clean sources of energy. The transition to a low-carbon economy is one of the defining issues of the 21st century, and we can't make a bigger difference in today's, or tomorrow's, world than to create a road to net zero.

Welcome to our Innovation Annual Summary 2021/22

Welcome to our Innovation Annual Summary 2021/22.

This is our first annual summary for the RIIO-2 period and it reflects a year of transition for our industry. We've seen increases in the level of our decarbonisation ambitions in the UK, together with a renewed focus on energy security – all of which is reflected in our evolving approach to innovation during the new regulatory period.

We've also seen changes in the way innovation is funded. For RIIO-2, Ofgem has two funding mechanisms that will facilitate innovation across the energy industry: the Network Innovation Allowance (NIA) and the Strategic Innovation Fund (SIF).

Projects that are funded through these arrangements must enable the energy transition or support vulnerable consumers, which marks a development from the approach during RIIO-T1. It ensures all network companies, including NGET, will be focusing innovation to drive forward an ambitious decarbonisation agenda, while making sure no-one is left behind.

You can read about the progress we're making on our NIA-funded projects on pages 22 to 25. SIF is a new funding mechanism, which complements NIA in supporting ambitious, innovative projects that have the potential to accelerate the transition to net zero. You can read more about this on page 11, and about our first three SIF-funded projects on page 21.

To enable the transition to net zero, we'll be delivering the biggest transformation of the transmission network since it was built. Fresh thinking, great innovation and wider collaboration will have a crucial role to play in that journey. That's why we're developing new partnerships and trying new ways to collaborate, gather ideas, and get feedback on the work that we are doing. You can read more about this on page 9.

This is an incredibly exciting time for the energy industry. We're looking forward to collaborating with you, our stakeholders across the industry and beyond, so we can find ever more effective ways to work towards a carbon-free energy system.

Lydia Ogilvie
Director of Network Strategy & Operations

Meet the team

We're always on the look out for new ideas and opportunities to partner on innovation projects. If you'd like to find out more about the way our innovation process works, the NGET Innovation team would be happy to speak to you and share details of our innovation portfolio.

Net Zero Innovation team

Nicola Todd
Head of Strategy and Innovation

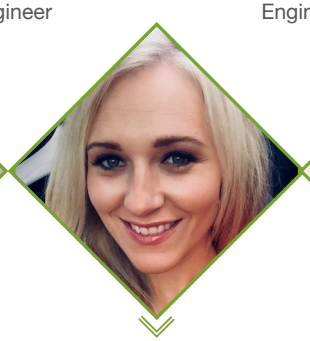
Atia Adrees
Innovation Engineer

Anusha Arva
Senior Innovation Engineer

Xiaolin Ding
Senior Innovation Engineer

Siyu Gao
Innovation Engineer

Kerri Hayes
Innovation Support



Gemma Pead
Innovation Stakeholder Lead

Amrit Sehmbi
Net Zero Innovation Manager

Gordon Wilson
Senior Innovation Engineer

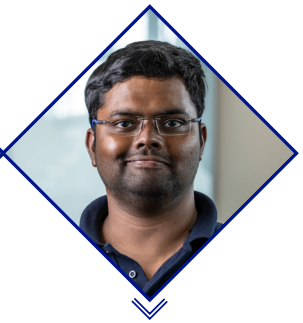
Deeside team

Sean Coleman
Deeside Centre for Innovation Manager

James (Jimmy)Deas
Senior Innovation Engineer

Tim Hughes
Senior Authorised Person (SAP)/Innovation Engineer

Ibrahim Iddrissu
Lead Test Engineer



Prem Ranjan
Test Engineer

How our projects are funded during RIIO-2

We receive funding for our innovation portfolio from two main sources – the Network Innovation Allowance (NIA) and Strategic Innovation Funding (SIF).

NIA

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

Each must:

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

There's no maximum or minimum spend criteria for projects, and each should carry a risk profile.

Network licensees need to demonstrate why they cannot fund such a project as part of their business-as-usual activities.

During RIIO-2, we'll receive £49.3m of NIA funding – a 35% increase over the first RIIO regulatory period. This funding covers 90% of the cost of our projects; the remaining 10% comes from NGET. During the five-year RIIO-2 period, we will have £54.2m to spend on our NIA projects.

SIF

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

Network companies must comply with the SIF Governance Document, and their applications for funding should respond to the innovation challenges published by Ofgem. Each of these challenge descriptions defines the problem, success criteria, funding available and other requirements.

Click here to find out about our innovation funding project phases

A year of broadening our horizons

Our highlights for the year include…

Click each icon for more information

"We want to make sure we're spending money on innovations that will deliver real value for our stakeholders and, ultimately, consumers. We also want to be strategic and deliberate when deciding which projects will go into implementation and tracking the benefits that are realised as a result. This means we can continue to improve what we do and how we do it."

Nicola Todd
Head of Strategy and Innovation, NGET

A YEAR OF TRANSITION

VALUE FOCUS

EPRI MEMBERSHIP

STRATEGIC INNOVATION FUNDING SUCCESS

NETWORK INNOVATION COMPETITION PROJECTS

EVOLVING OUR STRATEGY

WORKING WITH OTHERS

OUR INNOVATION CALLS

OUR INNOVATION CULTURE

A year of transition

The energy system context continues to evolve, and the last 12 months have seen further increases in the level of our decarbonisation ambitions in the UK. The conflict in Ukraine has also increased the political focus on energy security, and how the growth in renewable generation supply can facilitate that out to 2030 and beyond.

As an industry we are working hard to understand and manage the broader impacts of delivering net zero. This will need us to deliver the biggest transformation of the transmission system since it was built. Innovation in technology and approach are therefore critical to achieve such radical changes across the industry.

Over the last year we have also been transitioning into the RIIO-2 framework. We've been setting the foundations for the innovation work we'll be doing up to 2026 in the context of this changing industry. This has included re-establishing our project portfolios to give us momentum for the new regulatory period and getting some of our new projects started.

A real success of our innovation focus during RIIO-T1 was improving our asset management approach to ensure the continued safe and secure supply of electricity across GB. While this remains critical, we also need to increase our focus on how we maximise and grow the capability of the transmission system and ensure we can accommodate all of the new technologies that will interface with it.

Finally, we need to do all this work as efficiently as we can, so we can make sure we're supporting the energy transition in a way that's fair to all.

Evolving our strategy

Since we published our last strategy in 2020, the energy landscape has evolved significantly. We felt the time was right to consider how our approach should evolve – while being mindful of the Energy Networks Association's (ENA) work to update the broader network innovation strategy, which has included input from many stakeholders.

We're now revising our innovation strategy, to make sure it's more in line with our organisational purpose and ambition. We're looking to publish this later in 2022.

Value focus

Innovation can bring value in a number of ways – for example: safety, cost, emissions, increasing knowledge and reducing system operating costs. We are focusing on those innovations that bring the most value for consumers and stakeholders.

Value within our RIIO-2 portfolio will cover a broader range of benefits than financial savings. For example, by quantifying emissions reductions, or gaining a better understanding of the interactions between the gas and electricity networks of the future can manage the energy transition over the longer term.

Working with others

Collaboration continues to be a crucial part of the way we innovate in NGET. Sharing and being open to new ideas from across industries and academia allows us to develop projects to transform energy systems and bring the greatest possible benefits to our customers, stakeholders and end consumers.

As we decarbonise as a country, the whole energy economy is becoming more closely connected. For example, as we decarbonise transport and heat, there are inevitable interactions with the electricity and gas networks. Success will require companies within transmission and distribution working closely together, focusing on whole system approaches and finding the right solutions for consumers.

Some of the people in our team are members of industry working groups and panels that are focused on innovation, such as the **Electric Power Research Institute (EPRI)**, the **International Council on Large Electric Systems (CIGRE)** and the **Energy Networks Association (ENA)**. You can find out more about their roles in 'Meet the Team' on page 4.

We've welcomed the opportunity to resume our face-to-face engagement with stakeholders over the past year at conferences and other events.

At the same time, we've learned much about the value of hybrid and virtual events during the restrictions imposed by the global Covid-19 pandemic. For the future, this gives us the confidence and flexibility to reach ever-wider audiences, meeting them in ways that best suit their needs.

Virtual events we attended during the year included Utility Week Live and the Energy Networks Innovation Conference (ENIC), which showcased the most significant Ofgem-funded innovation projects from the UK's gas and electricity networks.

We welcome ideas, feedback and your views on our innovation work. If you'd like to get in touch, you can find our contact details on the final page of this report.

Click here to find out about our university partnership

Calls for innovation

We're finding ways to make ourselves more accessible, so we can raise greater awareness of our challenges and welcome more ideas to help us find solutions.

In March 2022, we launched an NGET-led 'call for innovation' to businesses across the UK to find a new low-carbon alternative to back-up diesel generators. The published call – which was viewed by nearly 1,600 people and led to 23 suppliers expressing interest – is a good example of how we're trying new approaches to learn what brings in fresh ideas.

This builds on the calls for innovation we've done through the Energy Innovation Centre (EIC), whose wide-ranging stakeholder base gives us new opportunities to engage with forward-thinking suppliers and innovators. It also provides us with another forum to work with other networks on common challenges.

Through our partnership with EIC, we have a transmission collaboration group comprising three transmission operators that are working closely on:

- Net zero substations
- SF_6 alternatives
- Consumer vulnerability – gaining a better understanding of the role of transmission operators on this topic. This has given rise to an NIA project on digital exclusion in conjunction with gas distribution companies.

Click here to find out about our other key partnerships

Strategic Innovation Funding

Strategic Innovation Funding (SIF) is a new RIIO-2 mechanism that's delivered in partnership with Innovate UK, part of UK Research and Innovation (UKRI). It aims to find and fund ambitious, innovative projects with the potential to accelerate the transition to net zero.

Through SIF, we've been granted funds by Ofgem for three innovation projects that will accelerate Great Britain's progress towards delivering a net zero energy network at the lowest cost to consumers.

In addition to these projects, we are supporting four other companies with projects, highlighting the importance of collaboration in solving the challenges facing our industry.

You can read more about our SIF projects on page 21

Supporting EPRI's Climate READi initiative

We're supporting the Electric Power Research Institute (EPRI) Climate READi framework, which will enable global energy companies, climate scientists, regulators, and other stakeholders to address risks to energy networks from climate change disruption.

The framework will embody one of the most comprehensive, integrated approaches to physical climate risk assessment.

By facilitating the analysis and applications of climate data, the framework will enable better planning, design, and operation of resilient energy systems of the future.

Our NIC projects

Our Deeside and RICA projects are two significant areas of work that have continued from RIIO-T1.

For our RICA project, we are working to appoint our innovation partner.

We've made significant progress on our Deeside Centre for Innovation, which is due to open later this year. Over the past 12 months, we commissioned the overhead line testing area. We've also agreed the commercial framework and ownership of the centre with Ofgem – we will continue to own the site and operate it as a commercial test centre.

You can find out more about our Deeside Centre for Innovation on page 14

You can read more about our RICA project on page 18

Developing our innovation culture

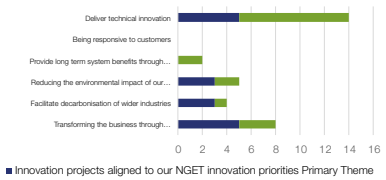
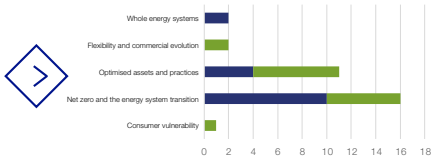
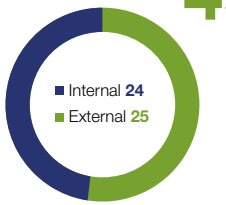
We're continuing to develop an innovative approach across all our organisational disciplines, while building capability and unlocking our people's potential.

As part of this, we recognise the importance of leadership commitment to innovation. This is why we have an NGET Board Innovation Charter, detailing the Board's commitment to our innovation ambition and the approach set out in our RIIO-2 business plan.

We're also developing our organisational culture more broadly, and innovation is an integral part of this work.

Our innovation in numbers

Higher level enablers of innovation

	Initiation & Evaluation	Demonstration, Iteration & Learning	Deployment & Optimisation
Strategy & Vision	**Strategies:** **NGET Innovation Strategy 2020** **Energy Networks Innovation Strategy**	Innovation projects aligned to our NGET innovation priorities 	Innovation projects aligned to the ENA Strategy 
Organisation & Culture	Number of collaborators involved in our NIA projects **19** Project partners **4** Supporters	**6 months** Average time taken from project approval to project start	**10** Number of FTEs working on NIA innovation projects **9%** of network company funding in innovation projects
Capability & Technology	Total number of innovative ideas **49** 	| | % No.Projects | % Spend | | TRL 2 | 38% | 25% | | TRL 3 | 25% | 42% | | TRL 4 | 6% | 0% | | TRL 5 | 13% | 25% | | TRL 6 | 13% | 5% | | TRL 7 | 6% | 2% | | TRL 8 | 0% | 0% |	**13** NGET-led registered NIA projects **3** Collaborative projects
Results & Outcomes	**49%** of innovation ideas approved for registration as NIA projects	**£3.35m** spent on NIA projects in 2021/22 (including carryover NIA)	**£6m** forecast spend on NIA projects in 2022/23

Deeside Centre for Innovation

In 2015, we secured £12m in funding through Ofgem's annual Electricity Network Innovation Competition, to create the Offgrid Substation Environment for the Acceleration of Innovative Technologies (OSEAIT) project.

We combined this with an additional £14m of National Grid investment to convert a decommissioned substation into a unique research and innovation facility – the Deeside Centre for Innovation (DCI). The first of its kind in Europe, DCI aims to deliver benefits to consumers by accelerating the deployment of technologies able to reduce both the carbon footprint and cost of present and future energy networks.

At its core are substation and overhead line test areas designed to facilitate live trials at existing distribution and transmission voltages. It will enable us and all GB network licensees to test assets associated with electricity networks, and trial new technologies and methods to address climate change and maintain security of supply – while optimising investments in a controlled, off-grid environment, 24 hours, seven days a week. While operational, the centre will also collect valuable data by monitoring performance of assets on site.

The facility will underpin the effort we, along with energy industry stakeholders, are investing in innovation and will play an essential role in delivering innovations in RIIO-2 and beyond. Over the past 12 months the project has made significant progress. We progressed with construction of substation test areas to launch testing of high voltage assets and monitoring technologies. The site will have five test areas for high voltage assets testing with capabilities up to 400kV/4,000A and even up to 600kV single phase.

One of the test areas is designed for DNO applications. Availability of the test area gives opportunities to us and other stakeholders to verify new solutions as well as update lifecycle models to predict end of life for substation assets while improving investment decision, maintenance cost and reliability of the power system.

In October 2021, Ofgem approved DCI's future business model that will allow us to offer the facilities to innovators in the UK and around the world. The centre will be operated as a commercial test facility managed by NGET and supervised by the Technical Advisory Board, comprising GB transmission and distribution networks. We have already started supporting several of NGET's innovation projects by offering the test ground to trial innovative ideas.

Alongside the site work, in October 2021, we presented DCI at the Energy Networks Innovation Conference (ENIC), which gave us the opportunity to engage with a wider innovation stakeholder audience. In November 2021 we chaired the Technical Advisory Board meeting to share the results of our work with stakeholders, including representatives from universities, utility companies and National Grid experts, and to discuss the opportunities of innovation trials for the year ahead.

Next steps

Construction works at the site have seen delays due to a range of factors, including the effects of the Covid-19 pandemic, and managing safety relating to interactions with other transmission assets installed around the centre. We are, however, now pressing forward with all construction works across the substation site and innovation trials, with the aim of completing the project by October 2022.

Throughout the coming year we'll continue to lay the foundations for future benefits for the industry, customers and consumers, by developing commercial opportunities for the centre over the long term.

Deeside Centre for Innovation continued

Cemfree

Cemfree is a special cement-free binder mix with a CO_2 footprint that's five times lower than conventional concrete. To understand its strength, how fast it cures and how we can work with it across our business, we ran a trial at DCI. Although the results demonstrated that Cemfree has lower strength than conventional concrete, we'll seek to develop uses for Cemfree (and similar products) in low risk/unreinforced applications, such as perimeter fence sill beams and ancillary concrete. This will help us significantly reduce our CO_2 impact and create a showcase for other utilities and industries to apply the technology.

Architecture for substation secondary systems

One key aspect of digitalisation is the opportunity to replace hard-wired signals with fibre optic networks and configure communication links between devices from different manufacturers using a common protocol. Prior to roll-out of the digital substation solutions, the interoperability between devices has to be examined. We also have to consider the associated cyber security risks and mitigation measures that are inherently linked to digital systems connected via communication networks.

The trial at DCI investigated the risks of extending process bus networks between substations, where applications require it; this offers opportunities to reduce the number of protection devices and hence the design, engineering, installation, commissioning, maintenance and replacement costs will also be reduced as well as the environmental impact. On the other hand, connections leaving the substation will require cyber security controls to ensure the integrity of protection, automation and control schemes. Both aspects have been successfully demonstrated in the trial.

SF_6 leak management and repair techniques

We have engaged with a company Rawwater, which has developed a solution for rapidly repairing pipe leaks, mainly used in gas systems. We have also concluded our investigations into this solution's potential to repair SF_6 leaks on our circuit breakers. The SF_6 gas that is widely used to insulate high voltage assets has a greenhouse gas impact that's more than 20,000 times higher than CO_2. Emissions associated with leakage of SF_6 gas from our assets are the second-highest contributor to our carbon footprint. The trial has been successful and we've started to use the solution in our operations, significantly reducing our carbon footprint coming from SF_6 loss.

Textured insulators

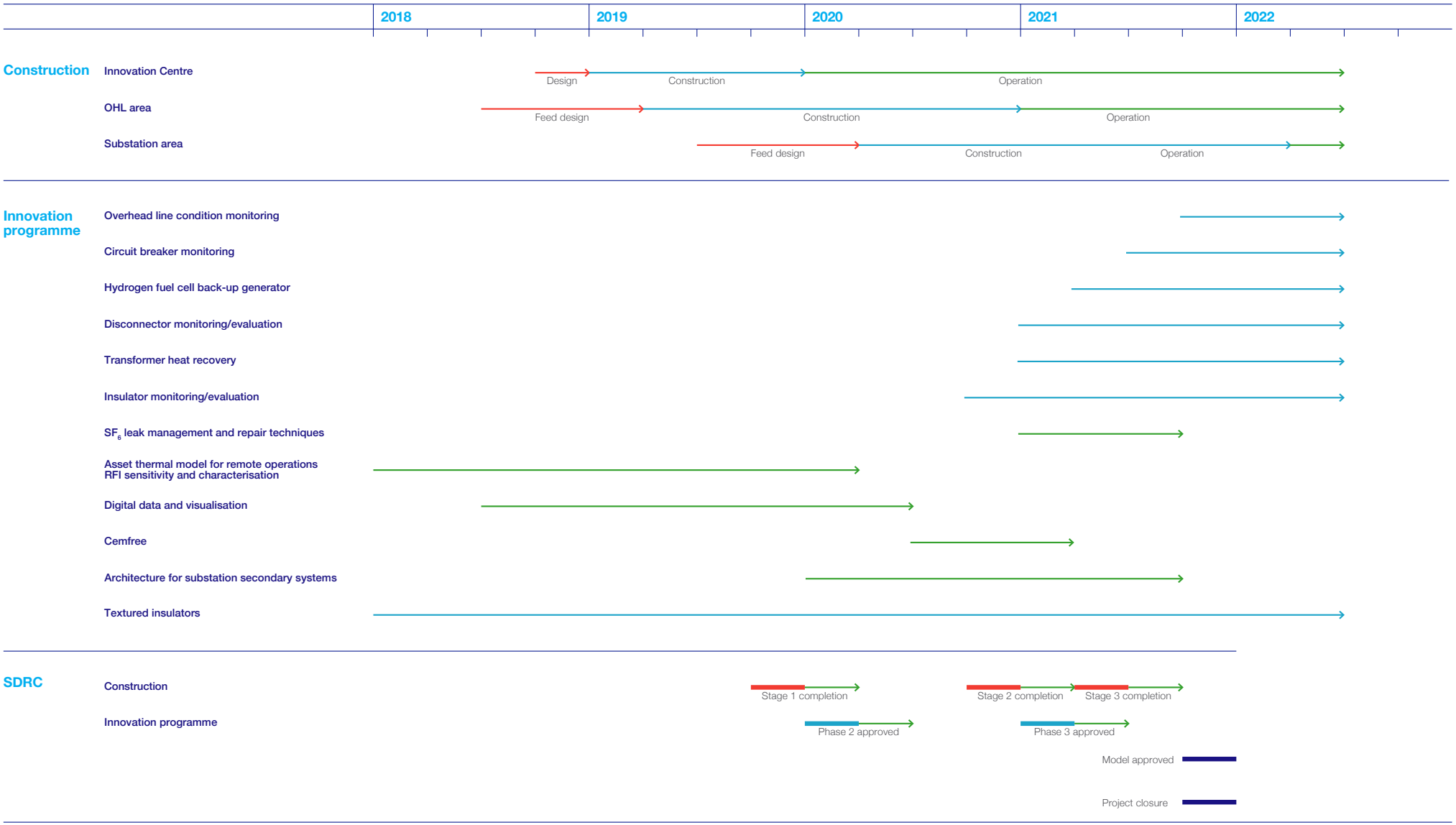
Textured composite insulators have a specifically designed texture imbued into the surface of the insulation material. This surface can improve the leakage current, thermal and flashover performance of these insulators, allowing them to last longer, while providing a cheaper alternative to glass or porcelain insulators and helping reduce day-to-day risks.

Our Innovation team worked with Cardiff University and Allied Insulators, and has now developed these textured composite insulators into a 400kV product. The prototype has been installed at DCI to monitor real-life performance of the composite insulation material. This technology, if it successfully passes the tests, could also be used to replace glass and porcelain insulators, making our network safer and enabling more efficient investment.

You can read more about SF_6 on page 21

Deeside Centre for Innovation continued

Delivery Programme

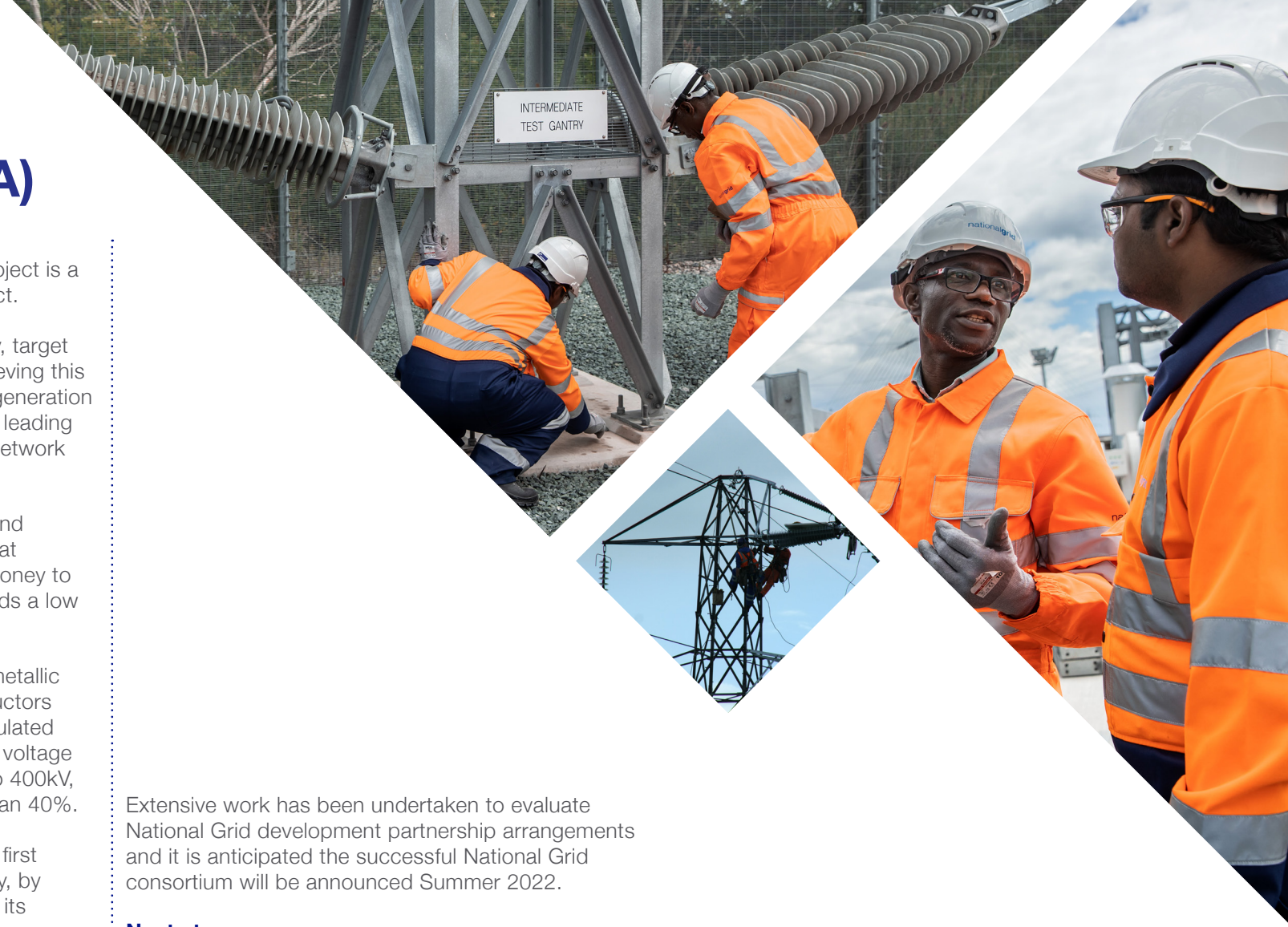


Deeside Centre for Innovation continued

Successful delivery reward criteria reference table

Ref	Criteria	Description	Status
9.1	Formal agreement on Terms of Reference with Technical Advisory Board members	In order to achieve the efficiency required to meet the project's objectives it is essential that the other Transmission Licensees fully engage in the Technical Advisory Board. An early indication that this project will succeed will be the Board agreeing the Terms of Reference.	Complete
9.2	Detailed design of the facility completed and approved	The completion of both the infrastructure and technical layout designs are an important milestone on the way to delivery of the overall project as they will determine the level of testing and evaluation that can be carried out and at which stage.	Complete
9.3	Design, develop and publish internet site	One of the fundamental knowledge and dissemination channels for the project is the utilisation of the facility website, which will provide a secure area to share the outputs with the other Transmission Licensees.	Complete
9.4	Scope of work for the phase 1 innovation programme approved	With there being a phased handover of assets it is essential to the project's success that a detailed plan be put in place, based on the assets available and trials proposed during this phase. This plan will include costs of the proposed trial projects, the estimated benefits and justification for how the trials satisfy the Electricity NIC criteria. The plan will also include any (NIA) projects that are able to be undertaken at this time.	Complete
9.5	Completion of stage 1 construction works	The completion of the Innovation Centre building renovation and the transfer of the protection and control panels to the telecoms and control room are a key milestone to the effective functioning and monitoring of the facility.	Complete
9.6	Scope of work for the phase 2 innovation programmes approved	The continuation of the phased handover of assets is essential to the project's success and a detailed plan is to be put in place, based on the assets available and trials proposed during this phase. This plan will include costs of the proposed trial projects, the estimated benefits and justification for how the trials satisfy the Electricity NIC criteria. The plan will also include any NIA projects that are able to be undertaken at this time.	Complete
9.7	Completion of stage 2 construction works	The completion of the construction of the internal access road is a key milestone to the effective functioning of the facility, as this will enable the necessary vehicles to access all areas of the facility. Completion of OHL test area is a key milestone to deliver innovation programme for OHL technologies.	Complete
9.8	Scope of work for the phase 3 innovation programme approved	The continuation of the phased handover of assets is essential to the project's success and that a detailed plan is put in place, based on the assets available and trials proposed during this phase. This plan will include costs of the proposed trial projects, the estimated benefits and justification for how the trials satisfy the Electricity NIC criteria. The plan will also include any NIA projects which can be undertaken at this time.	Complete
9.9	Commencement of phase 3 innovation programme	The delivery of the innovation programme testing and evaluation is a key milestone within the project and the ability to commence operations at the facility is fundamental to the measurement of its success.	Complete
9.10	Completion of stage 3 construction works	The completion of the construction of the substation area is a key milestone to the effective functioning of the facility, as this will enable the delivery of HV equipment testing and evaluation projects.	Sep-22
9.11	"Approval of model for enduring facility"	"The Technical Advisory Board will determine, based on the flow of projects, the future of the facility."	Complete
9.12	Project close down	All project learning will be consolidated and disseminated appropriately.	Oct-22

Retrofit Insulated Cross Arms (RICA)



The Retrofit Insulated Cross Arms (RICA) project is a Network Innovation Competition (NIC) project.

The UK has set an ambitious, but necessary, target of net zero carbon emissions by 2050. Achieving this target will require an increase in renewable generation and the electrification of transport and heat, leading to the need for the increased transmission network capacity.

Through our RICA project, we're aiming to find innovative ways to deliver network capacity at minimum cost – providing better value for money to consumers and accelerating the drive towards a low carbon future.

Insulated cross arms replace the standard metallic cross arms from which insulators and conductors are attached and/or suspended. Retrofit insulated cross arms enable licensees to upgrade the voltage rating on their existing towers from 275kV to 400kV, increasing transmission capacity by more than 40%.

This project provides a pathway for Britain's first full-scale implementation of RICA technology, by mitigating technology risks and accelerating its adoption onto the network. The project will remove the current process, technology, and specification hurdles that have prevented licensees from adopting RICA previously.

Since the project launch, we have worked with the project's Technical Advisory Board (TAB) to establish working groups required to deliver the project.

Extensive work has been undertaken to evaluate National Grid development partnership arrangements and it is anticipated the successful National Grid consortium will be announced Summer 2022.

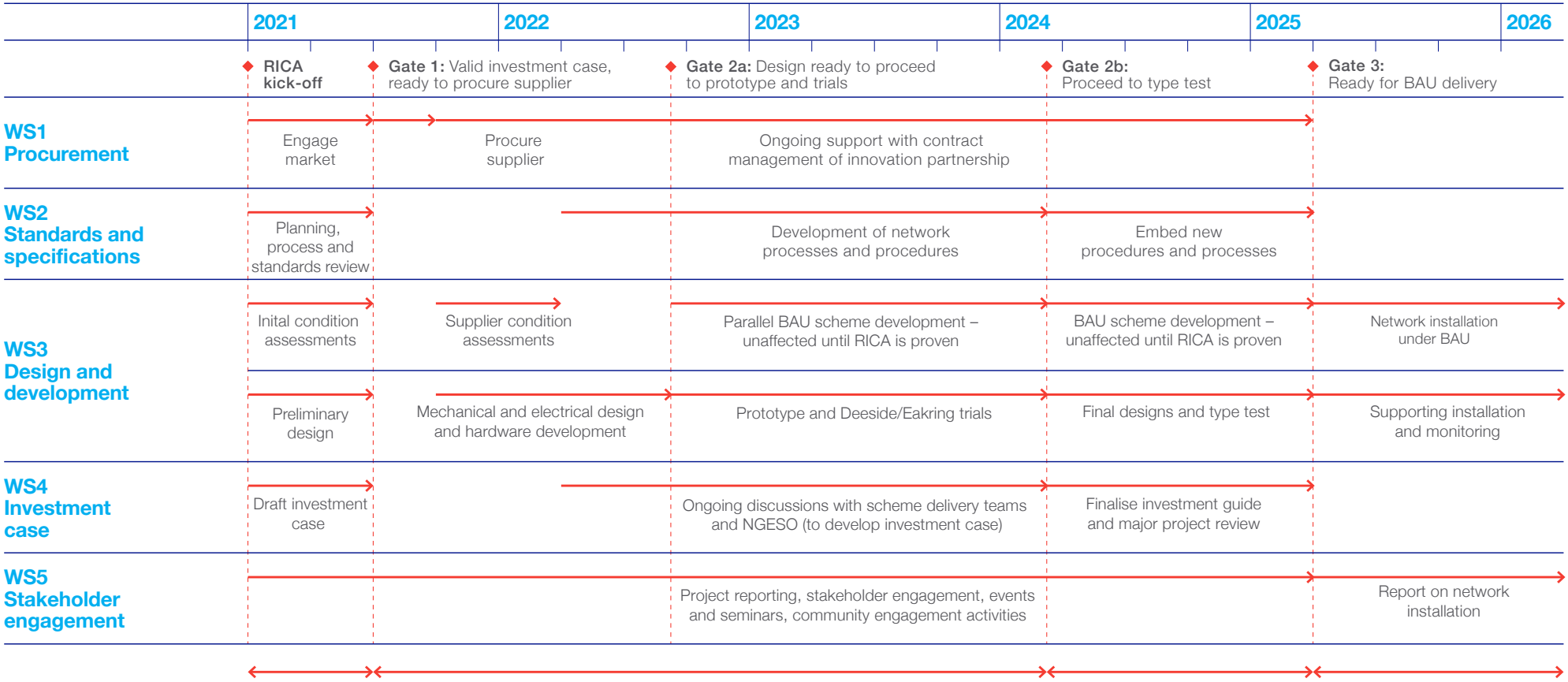
Next steps

In the next 12 months, with the development partners selected, we will produce the first generation design works.

This work will be focused on 275kV to 400kV uprating on L3 and L66 tower families and includes having prototypes of RICA for testing and trials.

Retrofit Insulated Cross Arms (RICA) continued

Delivery Programme



Retrofit Insulated Cross Arms (RICA) continued

Successful delivery reward criteria reference table

Ref	Criteria	Description	Status
D.S1.1	Detailed requirement definition	• Report consisting of all the information required for potential suppliers to accurately gauge the level of work that will be involved in Stage 2. • Shared with licensees through TAB.	Delivered Jul-21
D.S1.2	Preliminary investment case	• Report on the preliminary investment case. • Shared with licensees through TAB. • Workshop with TAB members to review benefits from technology on their networks.	Delivered Jul-21
D.S2a.1	Draft functional specification	• Draft functional specification. • Workshop with stakeholders to incorporate feedback into specifications. • Disseminated through TAB.	Sep-22
D.S2a.2	First generation product design portfolio	• RICA designs for first generation. • Workshop with stakeholders to review impact of different design choices on investments and applications. • Disseminated through TAB.	Dec-22
D.S2a.3	Report detailing trial outcomes and lessons learned	• Report on hardware trials of RICAs. • Evidence of workshops and lessons learned from trials. • Non-confidential information disseminated through industrial conference or journal. • Report disseminated to licensees through TAB.	Jul-24
D.S2b.1	NGET processes and procedures for RICA	• Updated technical specifications. • Guidance note on rationale behind specification. • Guidance on investment case development. • Installation practices recorded in report. • Disseminated to licensees through TAB, and non-confidential information through industrial conference or journal.	Aug-24
D.S2b.3	Full suite of documentation issued	• Final technical specifications, published. • Final guidance note on rationale behind specification. • Final Installation practices recorded in report. • Materials disseminated through TAB.	Feb-25
D.S2b.2	Detailed uprate methodology (final investment case)	• Report on scheme delivery plan and methodology. • Disseminated through TAB to licensees. • Final guidance on investment case development. • Non-confidential learnings disseminated through industrial conference or journal paper.	Feb-25
D.S3.1	Enhanced stakeholder engagement	• Record of RICA engagement with stakeholders. • Materials for stakeholder engagement posted publicly.	Mar-25
Common	Comply with knowledge transfer requirements of the Governance Document	**1** Annual Project Progress Reports which comply with the requirements of the Governance Document. **2** Completed Close Down Report which complies with the requirements of the Governance Document. **3** Evidence of attendance and participation in the Annual Conference as described in the Governance Document.	End of project

Our Strategic Innovation funding projects

In February 2022 we were granted Strategic Innovation Funding (SIF) by Ofgem to deliver the Discovery Phase of three projects.

SIF, which has replaced the Network Innovation Competition (NIC), is delivered in partnership with Innovate UK, part of UK Research and Innovation (UKRI). It funds ambitious, innovative projects that have the potential to accelerate the transition to net zero.

The Discovery is the first of a three-phase SIF competition grant. This stage comprises a solution feasibility study to identify challenges and benefits to end consumers. Successful delivery of this phase opens up the opportunity to receive further funding in Alpha and Beta phases to develop and demonstrate the solutions.

Our three projects to accelerate network innovation towards net zero:

Sustainable Electrical Gas Insulated Lines (SEGIL)

We are collaborating with industry and academia partners to investigate the feasibility of a SF_6 free gas insulated line (GIL). This aims to provide high-capacity transmission connections over 2,000MVA, increasing available network capacity for new offshore wind generation.

Currently, GILs are filled with sulphur hexafluoride (SF_6), a potent greenhouse gas that's 23,500 times more environmentally harmful than CO_2. This project will look at the options to replace SF_6 with alternative low-carbon gases as a viable means of GIL insulation. The solution will have much lower visual impact and faster capacity delivery than overhead lines. It's also anticipated to be more cost effective than cable systems thanks to lower construction and equipment costs.

Super Conductor Applications for Dense Energy Transmission (SCADET)

Through this project, we're looking at the benefits that can be provided by replacing conventional cables with high temperature superconductor (HTS) cable technology. The aim is to increase network capacity in urban environments.

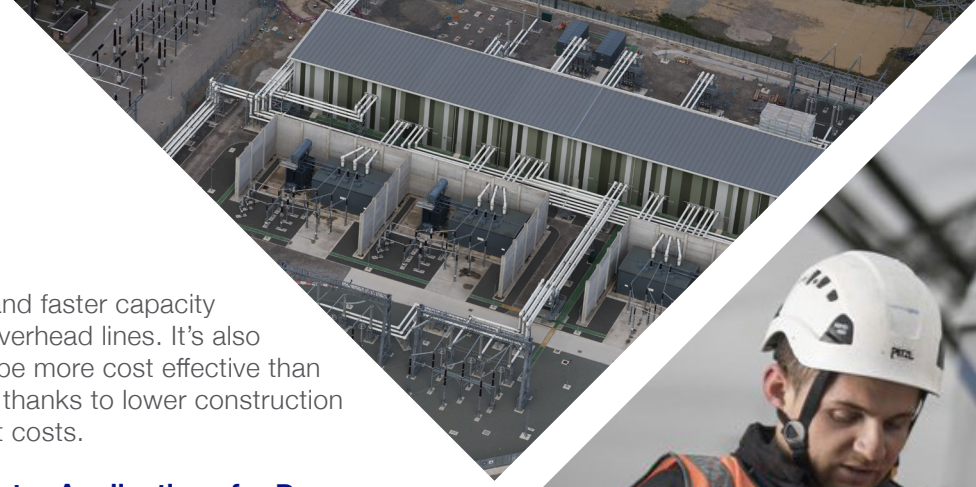
Eye in the Sky

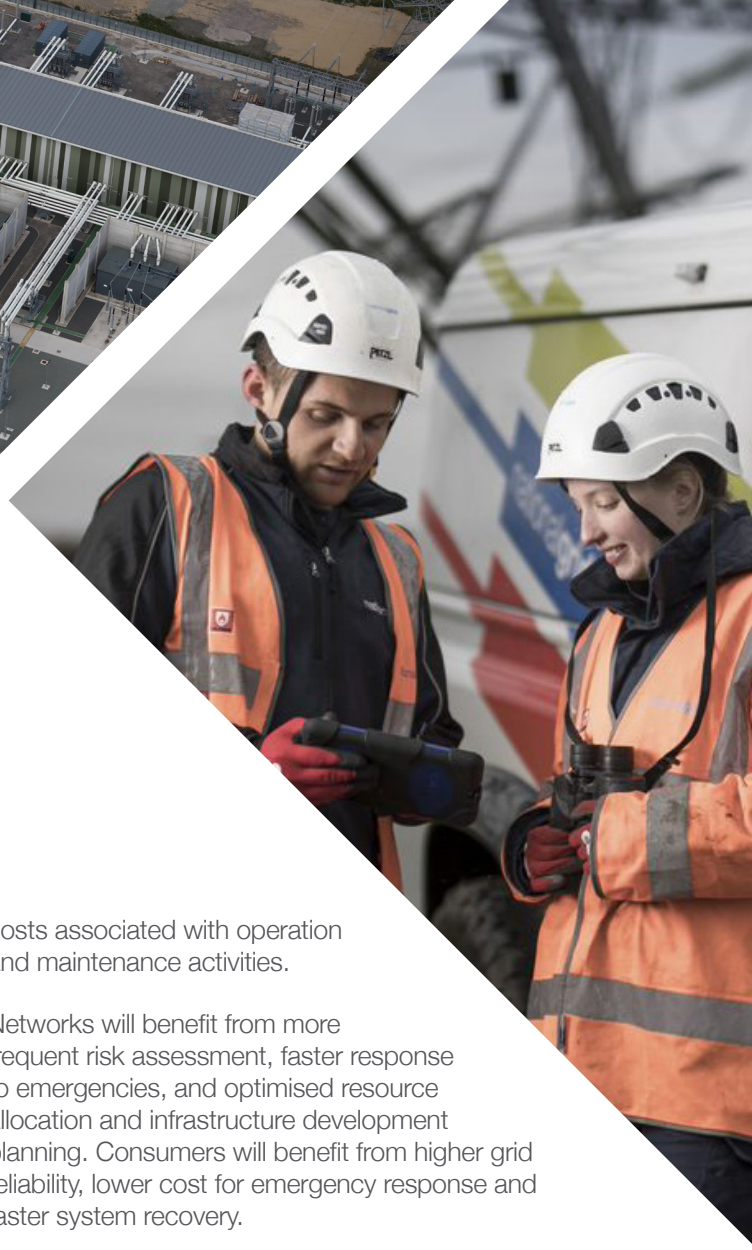
Collaborating with partners, our Eye in the Sky project team is investigating new satellite data analytics solutions. These have the potential to help Great Britain networks improve the visibility of infrastructure and assets and emergency response, while assessing the effects of climate change.

The team is assessing how novel uses of data and digital platforms can significantly improve network planning, modelling and forecasting capabilities. By using satellite data, we hope to improve the response to climate change effects such as flooding, strong winds, snowstorm or wildfire – and enabling networks to improve planning and resource allocation during extreme weather events.

The solution should significantly reduce the requirements for manual ground and aerial based monitoring. This can better inform GB networks about network conditions, while lowering emissions and costs associated with operation and maintenance activities.

Networks will benefit from more frequent risk assessment, faster response to emergencies, and optimised resource allocation and infrastructure development planning. Consumers will benefit from higher grid reliability, lower cost for emergency response and faster system recovery.





Click here to find out about the benefits of HTS technology

Our NIA innovations

- **5G – Exploring the art of the possible**
- **UK-first trials to develop fully automated asset inspection**
- **Whole system thinking for the future energy landscape**

Exploring the art of the possible

Title: 5G – The art of the possible

Innovation priority: Transforming the business through digitalisation

Project number: NGGT0175

Project overview

Using 5G to provide high-speed and reliable wireless communications can potentially enable the digitalisation of operational processes and applications. These could include digital image inspection-based condition and health monitoring of high-value assets, as well as field force enablement via improved connectivity and applications for operational staff.

Through this project we've delivered the UK's first feasibility assessment that examines the opportunity for adopting 5G within the electricity and gas transmission networks.

What stage is the project at now?

The project concluded in March 2022.

What have we learned?

We now understand the costs and capabilities of the technology required for the deployment of private 5G networks. We've also determined a number of use case categories, such as safety, process digitalisation and asset monitoring.

This means that when we're designing a solution for remote connectivity, we'll know its cost, what it can deliver and how it compares to alternatives – so we can choose the right technology for the right application. One key feature we can include in the assessment is cyber security, where 5G offers significantly enhanced capabilities compared to its predecessors.

Among the use cases we've identified is internet of things (IoT) asset health monitoring. This can enable a rapid deployment of sensors to provide information about our assets and means we can design more timely interventions – whether it's refurbishment, maintenance or replacement.

What are the next steps?

We're now working with colleagues within our business to determine where we can best make use of 5G technology – it's now another option within our toolbox. We're also liaising with external stakeholders on new developments in this area.

"5G technology has the potential to play a major part in the digitalised net zero energy system."

Thomas Charton
Senior Innovation Engineer,
NGET

UK-first trials to develop fully automated asset inspection

Title: Visual Inspection and Condition Assessment Platform for OHL Steelwork (VICAP)

Innovation priority: Deliver technical innovation

Project number: NGET0009

Project overview

We, as the owners of approximately 21,900 steel lattice pylons, inspect around 3,650 of them each year, to better understand the health of the network and to plan condition-based interventions. This involves capturing high definition still colour images of steelwork using helicopters and manually flown drones where there are access issues for the helicopters. Currently these images are captured and processed manually by a pool of inspectors.

We're looking to fully automate the capture and processing of corrosion-related condition assessment data for the steelwork on our steel lattice pylons. Collaborating with deep tech start-ups Keen AI and sees.ai, we're developing a process that uses automated drones flown 'beyond visual line of sight' (BVLOS). These will gather close-quarter data of the overhead line steel lattice pylons, which is then processed using artificial intelligence (AI).

We'll also be making an application to the Civil Aviation Authority for connected and autonomous drones to be flown nationally under licence for this specific use case – under the supervision of remote operators in a secure remote operation centre.

What are the benefits of the project?

Automating data capture and processing for these assessments will:

- Enable the capture of data that's optimal for automated processing, linking the images to exact positions on the tower and geographic locations on the network
- Increase efficiency and consistency of data processing
- Reduce the risk and environmental impact of data capture.

If the trials are successful and we implement this innovation, we anticipate savings of around £1.2 million for UK consumers by 2031. This includes benefits realised from reducing the use of helicopters, avoiding fuel costs, and faster processing times for assessments.

What stage is the project at now?

The project is in its early stages. We've made an initial selection of AI algorithms we'll need and chosen which lattice towers we're going to observe. We have four flights planned, the first of which is scheduled for July/August 2022, contingent on gaining appropriate access permissions to the reference tower sites. We'll iteratively improve the data capture and AI algorithms to ensure automated and accurate assessments for corrosion levels on our overhead line towers.

Watch the video here

Anusha Arva
Senior Innovation Engineer

John McKenna
CEO, sees.ai

Amjad Karim
CEO, Keen AI

Whole system thinking for the future energy landscape

Title: Gas and electricity transmission infrastructure outlook

Innovation priority: Facilitate decarbonisation of wider industries

Project number: NGGT0184

What is this infrastructure outlook seeking to achieve?

As energy networks evolve, transportation systems in the UK and surrounding countries, across transmission and distribution, will need to interact in order to balance energy production and use. The potential solutions for the decarbonisation of transport, heat, industry and power also interact and compete with several that have the opportunity to overlap.

Thinking about whole energy has increasing relevance for operating and developing the gas and electricity transmission systems, and is a vital activity at this stage of our transition.

This project is a first step in understanding the increasing interactions between gas and electricity for the UK transmission networks as we progress towards net zero.

We don't know for sure what the system of the future will be, but through this project we're looking to take a considered view.

What stage is the project at now?

To date, we've focused mostly on Future Energy Scenarios for gas, electricity and evolving consumer behaviour in terms of how people use energy and how this affects peak demand. We've considered how these should be modelled in the network, as well as what the system requirements would be for these scenarios.

We are looking at how the electricity, gas and hydrogen infrastructure evolves in different credible scenarios. So, the next stage will be to consider sensitivities to assess the impact of different variables on the outlook of gas and electricity infrastructure.

Who are you collaborating with?

We're working with National Grid Gas Transmission (NGGT), the Electricity System Operator (ESO) and the Guidehouse consultancy. We'll also be engaging with stakeholders, including industry and academia, to raise awareness of how ESO, NGET and NGGT are keen to use a whole system approach. We'll welcome ideas on how stakeholders would like to be part of this process.

"If we look at gas, electricity and transport as a whole, planning the system can be far more efficient as we progress towards net zero. This project will provide us with a foundation, showing us what practical steps we'll need to take in a whole system approach."

Atia Adrees
Innovation Engineer

Live project portfolio

Project Ref	Name	Partners
NIA2_NGET0001	Impedance scanning and stability analysis tools for PSCAD studies	National Renewable Energy Laboratory
NIA2_NGET0002	Role and value of electrolysers in low-carbon GB energy system	I C CONSULTANTS LIMITED
NIA2_NGET0003	Retrofitting Oil Source Heat Recovery to Transformers	Therma-Mech Ltd
NIA2_NGET0004	Centralised PAC	UK Grid Solutions Limited
NIA2_NGET0005	Environmental Risk and Assurance (ERA)	Frazer-Nash Consultancy, University of Liverpool, Previsico
NIA2_NGET0006	Non-invasive In-situ Monitoring and Interpretation of SF_6 Alternatives in GIS Equipment	University of Manchester
NIA2_NGET0007	EPRI Research Collaboration on Electric & Magnetic Fields Health & Safety (P60) 2021-25	EPRI
NIA2_NGET0008	EPRI Substations (P37) and Analytics (P34) 2021-2025	EPRI
NIA2_NGET0009	Visual Inspection and Condition Assessment Platform for OHL Tower Steelwork (VICAP)	Keen AI, sees.ai
NIA2_NGET0011	Alternative Approaches to Tower Painting Preparation	Hive Composites Ltd
NIA2_NGET0012	EPRI Research Collaboration on Underground Transmission (P36) 2021-2025	EPRI
NIA2_NGET0013	Overhead Line Sagging Monitoring Using 5G Signals	Warwick University
NIA2_NGET0014	Secure Edge Platform	Capula Ltd
NIA_NGGT0175	5G - The art of the possible	Led by National Grid Gas Transmission. Partner: Digital Catapult
NIA_NGGT0184	Gas and electricity transmission infrastructure outlook	Led by National Grid Gas Transmission. Partner: Guidehouse
NIA_SPEN_0064	Cyber Security for Active and Flexible Energy Networks (Cyber-SAFEN)	Led by SPEN. Partner: University of Manchester

Contact us

We'd really like to hear from you – our communities, consumers, customers, employees, investors and stakeholders. We want to make sure we're focusing on the right areas and delivering the right results.

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