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# APPENDIX A14

## INNOVATION STRATEGY

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11th December 2024

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## Executive Summary

This document outlines Northern Gas Networks' Innovation Strategy for RIIO-GD3 and has been prepared as an annex to our RIIO-GD3 business plan. This satisfies Ofgem's requirement for a detailed account of our Innovation Strategy that is summarised in the main business plan document. This document should be read alongside the overview of NGN's approach to innovation in Chapter 3 of the main business plan. We have developed this strategy in conjunction with our colleagues, customers and stakeholders.

Innovation continues to be a critical part of our RIIO-GD3 business plan and our long-term commitment to innovate; it will support the efficient and effective delivery of the outputs we expect to achieve in the next price control. We also recognise that NGN will have an important role in the energy transition and in supporting our customers, particularly those in more vulnerable situations. We will continue to collaborate with gas and electricity networks, stakeholders, and policy makers to identify future innovative approaches that enable a fair and just transition. These new challenges will only be addressed through successful innovation. NGN is committed to supporting the achievement of the UK's net-zero targets while supporting those of our customers who are in the most vulnerable situations. The Innovation Strategy sets out how we will develop new technologies and innovative practices to achieve our business plan outcomes and meet our customer priorities now and in the long-term. This document details our approach to:

- identifying the innovation work needed to build the evidence base around the energy transition
- determining our role in relation to customer vulnerability and creating solutions to minimise the potential effects and
- determining how to continue to build our digitalisation capabilities.

The document showcases projects that we have already identified to take forward during RIIO-GD3, including ongoing development of our vulnerability mapping tool and projects under way at our groundbreaking Net Zero Research Village (NeRV) site at Low Thornley. It also sets out how we are tailoring our approach to innovation in response to what we have learnt and to reflect changing priorities.

Our Innovation Strategy features across our RIIO-GD3 business plan proposal in recognition of the opportunity that exists to transform our ways of working through adoption of groundbreaking research and new technologies. Examples of this approach are provided below:

- **Environmental Action Plan:** this is the primary regulatory document that sets out the environmental impacts of our business operations as well as short-term initiatives to reduce these impacts and our long-term strategy to contribute to the government's target to reach net-zero emissions by 2050, all for the benefit of customers.
- **Secure and Resilient Supplies:** our Resilience Framework informs future system architecture and capability to meet whatever challenges we might face throughout RIIO-GD3 and beyond.
- **Whole Systems Strategy:** this section sets out our approach to adopting whole systems thinking in our business, with a focus on how we will contribute to the achievement of the UK's net-zero emissions target. Innovation projects in this space include the utilisation of NeRV, a research and demonstration centre that aims to respond to the challenges faced by the UK in achieving net zero. It is the UK's first combined whole systems research, development and demonstration facility, encompassing gas, electricity and water.
- **Vulnerability Strategy:** this document sets out our approach to working with customers in vulnerable situations (CIVS) in RIIO-GD3 and includes consideration for ensuring a whole systems focus in our approach. This innovation strategy outlines how NGN has continued its work from RIIO-GD2 with the Consumer Journey Research project which aims to provide qualified information to energy customers and policy makers alike, particularly focusing on people in fuel poverty and vulnerable situations.

In RIIO-GD3, we will continue to implement business-as-usual (BAU) innovation. We will build on our previous successes, such as the implementation of our SAP S4/HANA business systems solution, which has provided significant efficiencies across the business since its introduction in RIIO-GD1. Our digital strategy will aid the development and use of artificial intelligence (AI) and machine learning, while our customer visualisation model helped to identify, for example, areas with the highest need for fuel poverty intervention and used the data to inform a number of future energy planning projects. This will help us achieve efficiency by modernising the digital processes, techniques and systems we use to run our network, as well as developing solutions to deliver our whole energy systems plan.

Building on previous successes, such as robotic process technology and our customer visualisation tool, we have identified key focus areas that will govern our approach to innovation and help us to deliver benefits for the company, our customers and the wider sector in RIIO-GD3. We are asking Ofgem for £15.5 million of Network Innovation Allowance (NIA) funding to support delivery of our plans. A breakdown of our NIA funding request is provided below:

Topic	Theme	Appendix A3 Insight	Justification	Funding request
Customer vulnerability	IT1 Short-term solutions to assist CIVS through difficulties that have been exacerbated by cost-of-living / energy crises	3, 4, 7, 11, 15	This will help to support customers who might otherwise make unsafe choices (e.g., turning heating off, which may lead to greater long-term health issues, or tampering with their heating). In this regard, innovation can make an immediate and significant impact.	£2,320,000
	IT2 Long-term solutions supporting a fair transition and ensuring those at most risk are not left behind	3, 4, 7, 11, 15	For example, as part of the broader transition, we will support individuals who are unable to take up new technologies. Innovation can help these customers manage the energy transition by offering small-scale, bespoke solutions.  It will incorporate research and development to create enduring, collaborative, coordinated and customer-facing solutions that minimise impacts of activity and how we maintain and repair our network.	£1,595,000
Energy systems transition	IT3 Enabling decarbonisation through whole energy solutions	7, 8	This supports the overall accelerated path towards achieving net-zero emissions by 2050.  A continuing challenge relates to alternative fuel transport solutions and, in particular policy decisions, infrastructure and market forces. We will undertake a collaborative programme of research to support the whole energy system focus area relating to sustainable transport solutions.	£5,380,000
	IT4 Assisting local authorities to establish sustainable communities	6, 10		£3,450,000
	IT5 Decommissioning and repurposing of existing gas networks as we move towards future systems	7, 8, 10	We will ensure that the energy systems transition incorporates whole systems that are fit for all. We have identified links between whole systems, decarbonisation and risks for CIVS. We will innovate to ensure that CIVS are helped as we transition to net zero.	£1,595,000
Digitalisation	IT6 Maintain and improve existing digital infrastructure to increase efficiency	11	To support continued investigation into a variety of new technologies, as well as the benefits of incorporating AI. Investment during RIIO-GD3 will focus on maintaining and improving the already established systems, which is required to achieve the goals in the wider business plan.	£1,160,000
<b>Total</b>				<b>£15,500,000</b>

We are also requesting an additional £16.5 million of Totex Allowance over the RIIO-GD3 period. We are proposing to build a research hub focused on the decarbonisation of homes and the built environment on our existing NeRV research site at Low Thornley. The research hub will be called the Net Zero Research Village (NeRV) Centre. The construction of the NeRV Centre will transform the site at Low Thornley into a leading research and demonstration campus; the UK's first combined whole systems research, development and demonstration facility covering gas, electricity and water.

We welcome Ofgem's decision to retain both the Strategic Innovation Fund and Net Zero and Re-opener Development Fund use it or lose it allowance (UIOLI) for RIIO-GD3. We are requesting £12.5 million of UIOLI funding to support our energy system transition ambitions. We will continue to deliver benefit to our customers and the UK during RIIO-GD3 to support the transition to net zero.

We have tested our Innovation Strategy with both our customers and stakeholders and received an overall acceptance score of 76%. Further information on our approach to RIIO-GD3 customer and stakeholder engagement can be found in Chapter 2.

Further information on energy systems transition is set out in Chapter 4 of our main business plan along with our plans to support our customers in vulnerable situations (CIVS). Details of our activities to drive forward digitalisation are set out in Chapter 6.

## 1 Evolving our approach to innovation for RIIO-GD3

**Most indicators suggest that our work on innovation in RIIO-GD2 has gone well (see section 2 for further details on our projects). However, as a dynamic organisation we like to learn and improve, and the questions and issues that innovation can help us address are changing.**

**This section presents an outline of our approach to innovation and how it has evolved to meet changing market needs.**

### 1.1 Our innovation journey

We recognise that there has been an increase and evolution in the type, complexity, and scale of energy networks' innovation as they have matured since Ofgem introduced the first innovation stimulus funding nearly two decades ago. Our innovation model has evolved to help us adapt to this changing environment, as shown in Table 1 overleaf.

The innovation allowances available to us in the RIIO-GD2 period – primarily the Network Innovation Allowance (NIA), the Strategic Innovation Fund (SIF) and the Net Zero and Re-opener use-it-or-lose-it (UIOLI) allowance – continue to play an important role in incentivising innovation and allowing us to devote more resources to innovation trials, develop new concepts and work with a wider range of partners.

The progression of our innovation model is directly linked to NGN's culture, investment in people, and the way we encourage and support all colleagues to innovate. Table 1 sets out how NGN's priorities and innovation focus have changed over time, and the evolution of the benefits and learnings of our activities.

Table 1: Evolution of our innovation programme

Time period	Pre-2005	2005–2010	2011–2013
<b>Key business challenges</b>	<ul style="list-style-type: none"> <li>Day-to-day management of the network</li> </ul>	<ul style="list-style-type: none"> <li>Step change in commercialisation and efficiencies to meet demerger expectations</li> <li>Disciplined control of demerger costs</li> <li>Delivery of step changes in operational performance</li> </ul>	<ul style="list-style-type: none"> <li>Continue to meet stakeholders' expectations</li> <li>Continue to drive productivity and value for money</li> <li>Ensure the network can transition to a low-carbon economy</li> </ul>
<b>Key innovation</b>	<ul style="list-style-type: none"> <li>PE pipes</li> <li>Insertion</li> </ul>	<ul style="list-style-type: none"> <li>Market-tested strategic asset management model underpinned by a commercial asset services agreement</li> <li>Partnership with a strong utility provider</li> </ul>	<ul style="list-style-type: none"> <li>Total Cost of Ownership model</li> <li>New business model</li> <li>Measurable asset health</li> <li>Total Network Management</li> <li>International benchmarking</li> </ul>
<b>Learnings/ benefits from innovation</b>	<ul style="list-style-type: none"> <li>Considerable cost reductions from technical innovation and new solutions</li> </ul>	<ul style="list-style-type: none"> <li>Considerable cost reductions from technical innovation and new solutions</li> </ul>	<ul style="list-style-type: none"> <li>Cost reductions from technical innovation and new solutions</li> <li>Improved asset management/ longer life</li> <li>Improved customer satisfaction</li> </ul>

RIIO-GD1	RIIO-GD2	RIIO-GD3
<ul style="list-style-type: none"> <li>Respond to new and smarter technology</li> <li>Access other sources of gas in the network</li> <li>Potentially change usage pattern of energy</li> </ul>	<ul style="list-style-type: none"> <li>Keep bills affordable</li> <li>Improve the customer experience</li> <li>Inform policy decisions on future decarbonisation of the energy sector</li> <li>Improve the way we manage our work</li> </ul>	<ul style="list-style-type: none"> <li>Manage the uncertainty of the future role of the gas network by focussing on customer experience and keeping bills affordable</li> <li>Develop understanding of issues facing CIVS in the energy transition</li> </ul>
<ul style="list-style-type: none"> <li>A variety of technology-led solutions</li> <li>Potential new approaches to using smarter data and distributed sources of gas</li> </ul>	<ul style="list-style-type: none"> <li>Develop smarter ways to deliver core network services, with focus on the needs of CIVS</li> <li>Focus on transition to net zero</li> <li>Provide evidence to support a policy decision on hydrogen</li> <li>Explore automation and analytics to enable a technology-driven and digital network</li> </ul>	<ul style="list-style-type: none"> <li>Continuing to support CIVS</li> <li>Continuing to repurpose assets for other means, including key regulatory analysis and commercial analysis</li> <li>Working closely with local communities and local authorities to identify and develop the plans and technologies required to deliver a fair and just transition</li> <li>Working to develop emerging technologies that will support a fair and just transition</li> </ul>
<ul style="list-style-type: none"> <li>Cost reductions</li> <li>Customer service, safety and environmental improvements</li> <li>Supply chain development</li> <li>Learnings on feasibility and safety of meeting heat demand through low-carbon hydrogen</li> </ul>	<ul style="list-style-type: none"> <li>Achieve better understanding of customer vulnerability, facilitating greater third-party collaboration and targeted initiatives</li> <li>Improved understanding of hydrogen rollout (safety case, transport demand, impacts on network)</li> <li>Development of data-rich test bed for low-carbon retrofit solutions at NeRV</li> </ul>	

## 1.2 Culture

### 1.2.1 Our vision for innovation in NGN

Through innovation, NGN delivers improvements to our consumers and business processes by actively seeking ideas to help us understand the challenges of the transition to net zero. Through collaboration with colleagues, suppliers and the wider community, we're developing solutions that deliver valuable benefits and make lives easier. NGN's holistic approach drives positive change through everyday improvements and big-picture innovation projects, striving for a net-zero future with sustainable solutions that support those customers who find themselves in the most vulnerable situations.

### 1.2.2 Our innovation culture in NGN

A culture of innovation permeates our whole business. Our employees are empowered to innovate, and professional development is offered to give them the tools to innovate in their day-to-day roles. To demonstrate our commitment to continuous improvement and innovation, we recognise colleagues who encourage and make space for innovative thinking through our biennial Company We Are The Network awards. The Innovator of the Year award recognises colleagues who try new methods of working or actively seek out innovative solutions to problems (see the HyCoRe case study in Section 1.2.2.2).

This devolved approach to innovation empowers colleagues to inspire, develop, and learn new skills whilst enabling real innovative change to occur right across our business. NGN has a set of core values which reflect and reinforce our culture and support our ambition to become one of the UK's frontier companies, with a high-quality approach to business along with united and empowered teams. Below we describe in more detail the values most relevant to our innovation agenda.

#### 1.2.2.1 Trailblazing approach

**We will strive to become an effective people-first organisation that promotes pioneering collaborative thinking and revolutionary practices across all aspects of our business.**

Innovation helps to maximise the value we can deliver for our customers and unlocks the ability of colleagues to both generate ideas and deliver on them. We take a bottom-up approach to generating ideas: anyone in the business can raise an idea. For example, throughout RIIO-GD2 we have received on average five scoped out project ideas a month across all the innovation funding streams. We look externally to see what our partners, Small and Medium Enterprises (SMEs), fellow Gas Distribution Networks (GDNs), water and electricity organisations and other companies, such as academia and the catapult network, have delivered which may be beneficial to us.

Ideas are then tested and challenged, and once approved projects are delivered in a manner which ensures lessons and knowledge are fed back into the process – making innovation a self-sustaining ecosystem.

We are constantly looking to help customers by reducing their bills and improving service levels. This means having the confidence to challenge accepted thinking and to identify better approaches. We do not allow fear of failure to stifle innovation – learning from failures can be key to future success. We ensure all colleagues across the business are empowered to raise and test new ideas and understand that not all projects will progress to delivery given the inherent riskiness of innovation.

Consequently, the role of our Innovation team is not to run trials in silos, isolated from the rest of the business, but to continually identify, evolve and embed innovation as a competency across the organisation. Their role is to inform, educate and mature our culture through training, engagement and quality assurance of our ideation, development and roll-out activities.

#### 1.2.2.2 Intellectually curious

**We believe in the power of combining intelligence, experience and curiosity to deliver innovative, invigorating, future-proof and sustainable ideas.**

We encourage our people to question how we do things and to take an interest in the world outside NGN to identify improvements. As part of the delivery of innovation projects, we work with many different partners and SMEs. For example, in the 2023/24 financial year NGN worked with 69 different project partners across 43 projects. Consequently, our employees are a great sounding board for potential innovation projects, and we use digital surveys to help monitor appetite and identify potential cases for extending the use of technology.

Our staff are encouraged to get involved in innovation projects, whether that be putting forward ideas, engaging in meetings or managing the project. For example, a staff member from outside the Innovation team took ownership of the Strategic Innovation Fund (SIF) Alpha Hydrogen Cost Reduction project (HyCoRe) which explored the best way to use excess wind from offshore windfarms to generate green hydrogen, determining the optimal UK locations for production facilities.

## CASE STUDY: HYCORE

"HyCoRe has generated a huge amount of evidence and intelligence to help us drive down the cost of green hydrogen production, while also demonstrating how hydrogen can be integrated into the existing energy network to help reduce the capital expenditure required to support the transition to net zero in 2050." – NGN Colleague

We support the local economy and engage with local stakeholders who can contribute ideas, support initiatives, and bring relevant perspectives to our innovation work. In 2023/24, over a quarter of our 69 project partners were located within the NGN licence area. We also engage with the Yorkshire Gas Association and have representation on the committee of the North East and Yorkshire section of the Institution of Gas Engineers and Managers (IGEM).

We ensure our employees can listen to and learn from others in the gas industry and other sectors. This helps build our internal knowledge capital, spawn ideas and increase employee awareness of the latest technological advances. We engage with the market by assessing the suitability of solutions proposed by suppliers and by seeking specific solutions to problems via "calls for innovation" through the Energy Innovation Centre (EIC), the Basecamp process run by the Energy Networks Association (ENA) and the "calls for ideas" via UK Research and Innovation (UKRI) in the SIF process.

#### 1.2.2.3 Empowering people

**We are a business that values and encourages individuality, teamwork, passion, courage, new experiences, growth and change.**

Having given all our staff responsibility for innovation we want to empower them to change how we run our business. We do this through a "bottom-up" approach which welcomes contributions from all levels and functions, fostering a "have a go" culture where everyone feels encouraged to share their ideas.

NGN's five-step innovation management process (see Figure 3) ensures that innovative ideas are rigorously evaluated and supported throughout their development. This process frontloads engagement through an independent project sanction group, ensuring that only the most promising ideas are progressed.

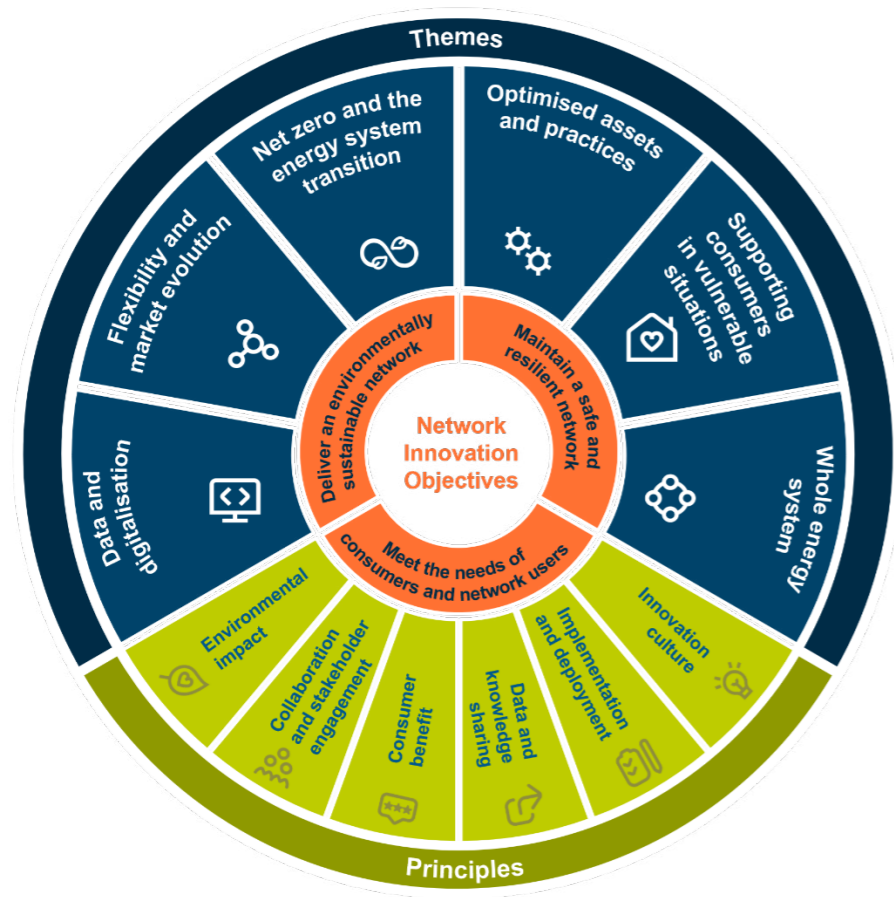
We ensure that colleagues involved in the innovation process remain engaged and informed throughout project development to encourage further ideas and collaboration. Going forward we will be organising cross-NGN innovation roadshows and hackathon events. These events will demonstrate how we are playing our part in the energy systems transition and our role in supporting CIVS. We will use our facilities, such as the Net Zero Research Village (NeRV), to showcase our innovations and live projects to colleagues.

### 1.2.3 Continual improvement

Although we are proud of our innovation culture, we also recognise that we cannot be complacent. Achieving the UK's net zero ambitions will require a significant increase in innovation and whole systems thinking, and a continued focus on innovation culture.

We therefore agreed to take part in a study led by Innovate UK in collaboration with UKRI and Ofgem to identify how we can accelerate innovation within the energy networks sector. As part of this study, Innovate UK developed an innovation culture exemplar (see Figure 1) which participating networks used as a baseline to self-assess their current alignment using employee survey data. The baseline survey indicates that alignment with the exemplar was generally "moderate" or "partial", providing a useful indication that there are still improvements to be made.

Figure 1: Innovation culture exemplar



We agree with the findings of the report and will aim to incorporate the exemplar into our innovation culture throughout RIIO-GD3, alongside our own external best practice review.

However, we also note that NGN demonstrates strong alignment with the innovation culture exemplar in several key areas:

- **Collaboration with other networks:** NGN actively collaborates with other energy networks, fostering a spirit of co-operation and knowledge sharing to drive innovation across the sector.
- **Openness to change:** NGN embraces change, recognising the need for transformation in the energy landscape. This adaptability positions us to embrace new technologies and business models, such as the transition to hydrogen.
- **Engaged and empowered business:** NGN fosters a culture of engagement and empowerment, where employees feel valued and encouraged to contribute their ideas. Our horizontal structure promotes creativity and innovation from all levels of the organisation.
- **Ambition and patience:** NGN balances ambition with patience, understanding that innovation requires long-term commitment and investment. The company's focus on diversity and workforce development ensures a sustainable pipeline of talent for the future.

- **External communications:** NGN engages effectively with stakeholders and the public, helping build trust and support for the company's innovation initiatives.
- **Strength in working with external partners:** NGN leverages its strong relationships with external partners to access expertise and resources, further enhancing its innovation capabilities.

By building on these strengths NGN is well positioned to drive innovation within the energy sector and contribute significantly to the UK's net zero ambitions.

Innovate UK also notes that there is a need to balance the inherent tension between innovation and safety/reliability. Our sector has a necessary focus on "operational excellence" to deliver a safe, reliable service which can create constraints for innovation activity. The report identified several values and behaviours that can help overcome these constraints, such as embracing and learning from "failure".

NGN promotes a "fail fast" approach to innovation. We have introduced the "Procedure for the Innovation End to End Process" that formalises several stage gates to assess project impacts. These key stage gates include a Project Scoping session, procurement assessment, Project Direction Statement review, and monthly reporting/progress reporting. This has supported accelerated development of innovative ideas, injected pace into the overall process and enabled a "fail fast" approach.

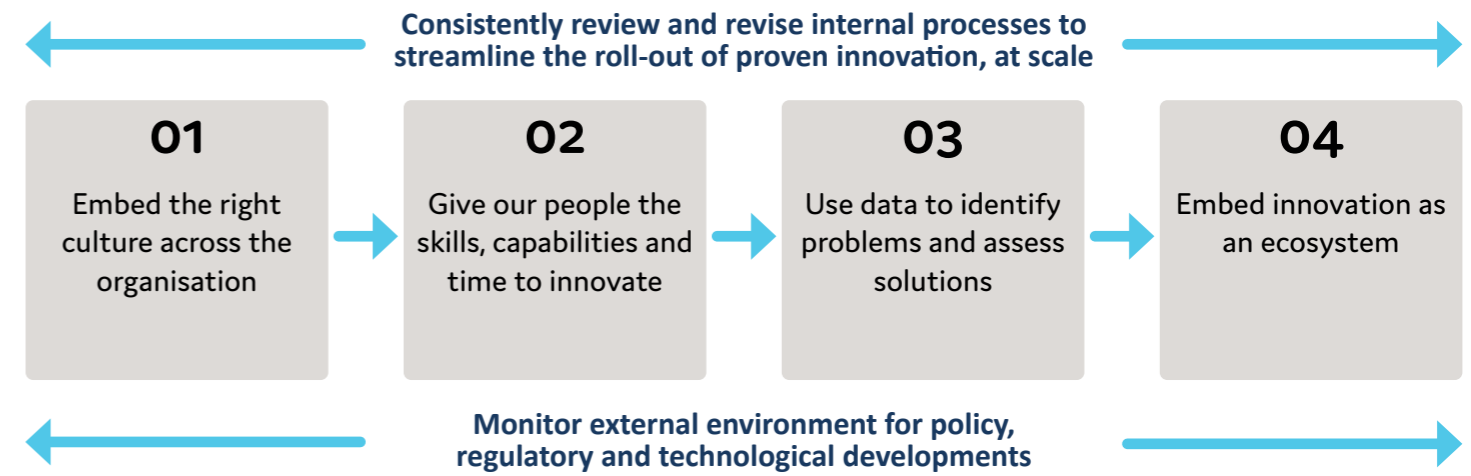
NGN's departure from the Energy Networks Association (ENA) in December 2024 and the transition to Future Energy Networks (FEN) presents a significant opportunity for NGN to take the lead in the conception and development of the new organisation. In 2024 NGN chaired the Gas Innovation Governance Group for GB GDNs, and we will continue to develop and nurture these relationships as we transition into FEN. NGN intends to leverage this platform to champion the role of "Culture" in accelerating innovation and achieving net-zero ambitions in RIIO-GD3.

### 1.2.4 Embedding innovation culture across our business

To be successful, an innovation culture must be integrated into the wider business and fostered by the individuals responsible for delivering innovative solutions. Our vision for delivering innovation has evolved across the price control periods to reflect this, from "weaving innovation into the fabric of NGN" in RIIO-GD1, to "making innovation a habitat" in RIIO-GD2. Looking ahead to RIIO-GD3, our plans to embed innovation can be summarised as "enabling an effective and successful innovation ecosystem".

Figure 2 below outlines the key stepping stones to deliver this vision.

Figure 2: Stepping stones to embedding innovation



In broad terms, we see ourselves as moving through Steps 2 and 3 of the process over the course of RIIO-GD3. To embed innovation throughout RIIO-GD3 we will:

- improve the breadth and quality of available data
- ensure this data is easily accessible to both colleagues across the business and external stakeholders and
- utilise artificial intelligence (AI) and machine learning techniques to make data access more efficient, thus freeing up resources to participate in value-add innovation activities. (Please see Chapter 6 of the main business plan for more information on our digital strategy.)

As we move through these steps, we will continue to monitor our internal process and the external environment to ensure that as a business we are well placed to respond to challenges as they emerge.

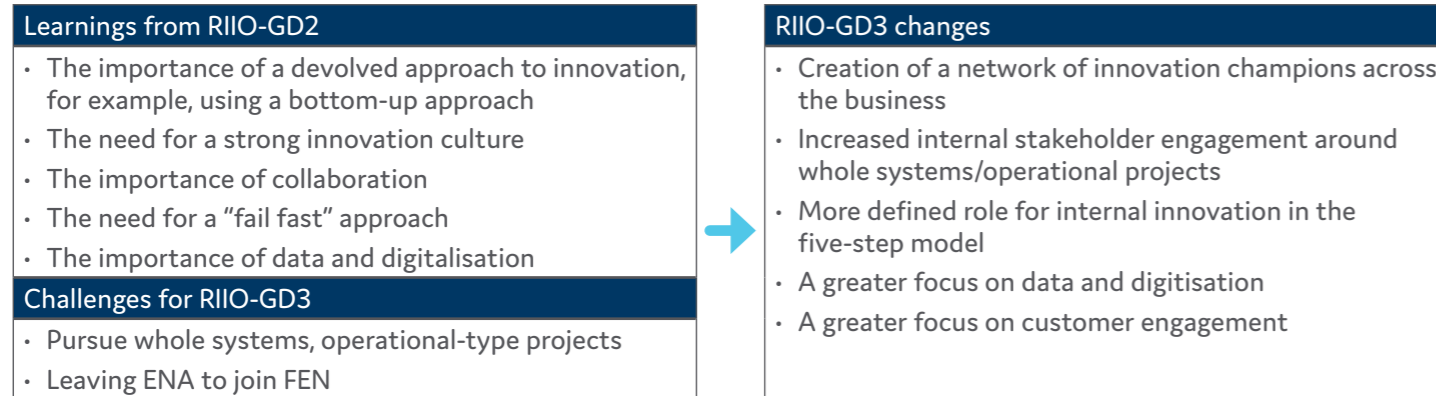
The Innovate UK Innovation Culture Report supports this approach by recognising that although innovation teams play an important role in driving innovation, particularly at the early research and development stage, the whole business must understand and act on their role to successfully deliver innovative solutions.

Therefore, despite NGN having a small core Innovation team compared to other gas networks, our innovative colleagues form an agile, "cross-flex" workforce that allows us to respond more effectively to rapid changes while at the same time fostering a culture of innovation across the business. Going forward we will enhance this by creating a network of innovation champions across NGN who are sponsored by our senior leadership team.

During RIIO-GD3, we intend to increase internal stakeholder engagement around innovation. We will pursue more ambitious, whole systems, operational-type projects that will require input from a broad range of colleagues from the wider business. In addition, we have defined the role of internal stakeholder engagement more clearly in our five-step innovation management model (see Figure 3).

### 1.2.5 Summary

The graphic below summarises how we will adapt our innovation culture in RIIO-GD3 based on new challenges and learnings from RIIO-GD2:



### 1.3 Process

Alongside culture and staff capability the right processes are critical to generate innovation and maximise the resulting benefits. These processes fall into four broad categories which are discussed below.

#### 1.3.1 Getting the right ideas into our business

Previously, NGN actively participated in the ENA, a platform for generating and sharing ideas within the energy sector. The ENA facilitated this process through the following initiatives:

- **Industry Working Groups:** These groups brought together experts from across the industry to discuss and develop solutions to specific challenges. NGN actively participated in various thematic groups, contributing its expertise, and collaborating with other members to generate innovative ideas.
- **ENA Basecamp:** Each year, the ENA and Ofgem invite UK industries to support low-carbon innovation in a bid to accelerate net-zero ambitions. The event explores the challenges facing the UK’s gas and electricity networks and the solutions being delivered to tackle all aspects of the energy trilemma. These themes include data and digitalisation, flexibility and market evolution, net-zero and energy system transition, optimised assets and practices, supporting CIVS, and the whole energy system transition.

However, NGN is leaving the ENA in December 2024 to join FEN. FEN is a collaborative organisation comprised of the owner and operator of the GB gas transmission network, National Gas, and the four GDNs – NGN, Cadent Gas, SGN, and Wales and West Utilities. Its mission aligns with NGN’s commitment to an equitable and affordable transition to Net Zero for all, with energy networks playing a crucial role in enabling this transition. FEN will lead this change by<sup>1</sup>:

- **Building an evidence base:** bringing together expertise from across the energy industry to support informed decision-making.
- **Investing in infrastructure:** member companies invest in infrastructure to transport low-carbon energy from producers to consumers.
- **Coordinating network management:** working with members and stakeholders to manage today’s networks while transitioning to the future.
- **Technical collaboration:** facilitating working groups to ensure the safe and reliable operation of networks.
- **Policy development:** leading joint policy thinking and supporting government policy development.
- **Regulation compliance:** working with members and stakeholders through regulatory compliance and price control processes.
- **Strategic direction:** coordinating member efforts to develop and deliver a shared strategic direction for the industry.

Through FEN, NGN will continue to access a network of experts and resources dedicated to driving innovation and collaboration within the energy sector. This will not only allow NGN to attract other networks and be transformational but will also enable us to work with new partners, driving new ideas that contribute to the transition to net zero. NGN and the other GB gas networks will maintain their existing relationships with the electricity networks and use the new FEN platform to engage with the wider energy and utility sector.

<sup>1</sup> See: <https://www.igem.org.uk/future-energy-networks.html>

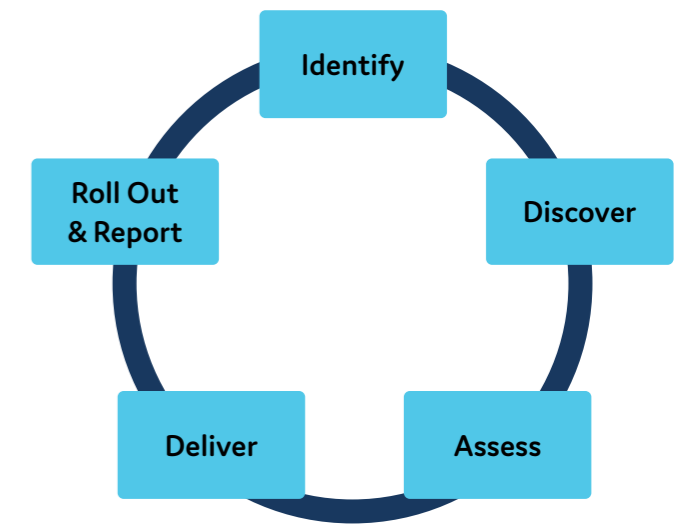
### 1.3.2 Managing innovation projects effectively

During RIIO-GD1 and RIIO-GD2, we deployed a six-step innovation management process. This became less suitable for the business as we moved from a core Innovation team delivery model to one involving teams from across the business. In addition, the six-step process was designed to control actual operational risks, e.g. those associated with trialling and implementing new equipment. Our innovation portfolio is now oriented towards low-level Technology Readiness Level (TRL) research and development projects, which do not pose physical risks. Some parts of the six-step model therefore became overly burdensome and increased project lead times.

We have therefore streamlined the process in readiness for RIIO-GD3, resulting in the creation of a more efficient five-step model:

1. **Identify:** identification of innovation opportunity and capture initial requirements
2. **Discover:** project scoping, gaining stakeholder support and tailoring the project to a specific funding mechanism as appropriate
3. **Assess:** validation of project proposals by an independent project sanction group, including relevant stakeholders, to ensure that:
  - a. the project aligns with the overall internal and external strategies and does not replicate previous work
  - b. the commercial strategy of project aligns with the benefits case and
  - c. the necessary steps have been taken to ensure compliance with the relevant governance requirements
4. **Deliver:** formal project kick-off and overall responsibility for managing the works through to completion transferred to the project manager. This includes reporting progress, spend, risks and issues at a monthly update session to the Project Manager, who then updates the central project board. This allows for control and action to be taken as required.
5. **Roll Out and Report:** implementation, whereby project outputs are validated, benefit analysis is undertaken and, if suitable funds are allocated to support full implementation of the project, the outputs are transferred into business as usual (BAU).

Figure 3: New five-step innovation management model



We have already experienced several benefits since transferring to this more streamlined process:

- Increased engagement and validation with key stakeholders
- Additional review and approval touch points
- Better tracking and documentation of ideas
- Formalisation of new roles requirements and
- Acceleration of “go/no-go” decisions.

### 1.3.3 Disseminating learnings from innovation

We understand the importance of sharing the learnings from our innovation as widely as possible. We present on our projects in a range of ways:

- **Internally:** when a project finishes, we hold an internal session with relevant NGN stakeholders to present the findings. With projects relating to customer vulnerability, we also present to external stakeholders, such as charities, so that we can gather feedback from local partners.
- **Innovation Summit:** we participate at this event organised by the ENA for GB energy networks. 2024 will be the final year we participate in this summit following the decision of the GB gas networks to operate outside of the ENA as FEN. Discussions are in progress around a GDN-hosted annual summit.
- **Annual Innovation Report:** as required by the terms of our licence we publish a yearly report detailing innovation projects undertaken.
- **Innovation Portal:** we are in the process of working with the other GDNs to set up a new online FEN portal where stakeholders can find details of ongoing innovation projects across the sector. The new online portal is expected to go live on 1st January 2025.
- **Innovation Zero:** we attend this annual gathering of the wider innovation community (including gas shippers, gas storage providers, investment firms, infrastructure builders and renewable energy generators) to listen and present on innovation projects.

### 1.3.4 Transitioning successful innovation projects into BAU

The RIIO-GD2 shift towards earlier stage innovation projects and work focused on the energy transition and consumer vulnerability means there are fewer projects that can be readily moved into BAU. At RIIO-GD3 the Innovation team will manage the transition of any BAU-ready innovation projects on an ad hoc basis. We provide examples of previous BAU innovation in the following case studies:

#### CASE STUDY: EASYASSIST ECV

The EasyAssist emergency control valve (ECV) is a large, red, stop button that disconnects a domestic low pressure gas supply as soon as you press it. If it detects dangerous temperatures such as a fire, it will automatically disconnect the gas. If the red button is pressed, the device will then mechanically turn the ECV handle to 90 degrees (which isolates the gas supply), ensuring the safety of the property and its occupants. Initially these are being rolled out via our Services Beyond the Meter team prioritising our vulnerable customers.

#### CASE STUDY: DUCTILE IRON WINDOW CUTTERS

Gaining access to PE pipe once it has been inserted inside ductile iron pipes has been a perennial challenge. We adopted a repurposed window-cutting tool to solve the problem.

This market-ready product had been previously developed by another GDN (Wales & West Utilities) with supplier Steve Vick International. We used evidence from the original project to implement the solution across our own network, improving safety and efficiency, and reducing customer disruption. There have been 370 operations of the technique in RIIO-GD1 with around £0.3m of cost benefit.

#### CASE STUDY: PROJECT ZERO "REDUCING CUSTOMER GAS SUPPLY INTERRUPTIONS"

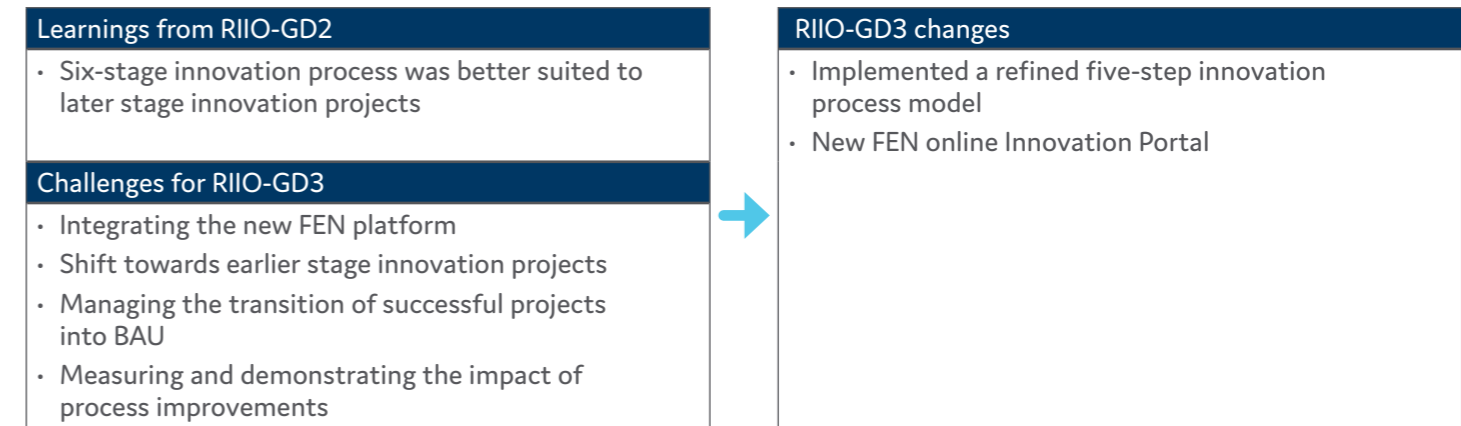
The "metallic servicecam" element of the NIA-funded Project Zero aimed to enable in-pipe camera technology. The development was planned to move from TRL 4 to TRL 7, but the agile management and rapid development of the project saw our project partner, Synthotech Ltd, invest directly and fund the accelerated development up to TRL 9. This resulted in the solution being ready for deployment significantly earlier than planned and without the need for additional NIA funding.

#### CASE STUDY: INTERNET OF THINGS PRESSURE SENSORS

Throughout RIIO-GD2 NGN completed an NIA project that looked to develop an Internet of Things low pressure sensor, that can be deployed easily onto the network for a fraction of the cost of existing sensor units. Throughout the project the sensors have been trialled on the network with positive results collecting pressure data to enable and demonstrate digitalisation of networks.

### 1.3.5 Summary

The graphic below summarises how we will adapt our innovation process in RIIO-GD3 based on new challenges and learnings from RIIO-GD2:



### 1.4 Collaboration

Collaboration between network licensees and external stakeholders on NIA projects is essential to ensure the benefits from funding are maximised. Ofgem expects network licensees to collaborate with each other and with Project Partners on RIIO-GD3 NIA projects.

We will work closely with our supply chains to explore what technological, commercial or operational arrangements can facilitate the energy system transition and/or address customer vulnerability, as well as reducing embodied carbon in the network. We will take learnings and adopt technologies from other industries, including the telecoms and information technology sectors, by undertaking regular horizon scanning exercises. We will explore the value of partnerships with technology providers and others outside the energy industry, e.g. Catapults. We will also look for opportunities to collaborate with other parties such as local authorities and universities that may be carrying out pilot studies.

We will continue to monitor the innovation portfolios of our peers in the energy sector to identify collaboration opportunities. This includes ongoing collaboration to enhance connection and injection processes, including for green gas.

The primary facilitators for potential collaboration opportunities are Gas Innovation and Governance Group (GIGG), Innovation Steering Group (ISG), Innovation Super Network (ISN) and Energy Innovation Centre (EIC) forums, where our involvement is led by the senior manager for innovation and supported by the broader core team. We also drive collaboration within the EIC Partnership.

#### EIC Partnership

The EIC works with NGN and eight other UK energy networks to accelerate innovation to support the net-zero transition. Through the EIC Partnership, we proactively seek innovator feedback through various channels, including industry-wide surveys and an Innovator Impact Panel, which provide a collective voice for innovators and guide the Partnership's strategic priorities. All activities undertaken through the EIC Partnership are open for collaboration and are designed to avoid duplication. These include:

- Innovation labs supporting the identification and definition of innovation challenges
- Fully managed innovation calls to innovators
- Development and delivery of innovation projects
- Annual innovator action plan to improve innovator experience and respond to feedback
- Forums to explore opportunities for collaboration and review proposals from innovators.

EIC has also developed a fully managed collaborative innovation calls process which achieved a 90% success rate for partners during 2023 and 2024. In 2024, the EIC led and funded the development of an Enhanced Economic Value Framework to improve the consistency of how benefits from NIA and BAU funded innovation projects are quantified, measured and reported across the industry. See Section 4 for further details.



### Innovation Ecosystem

It is also recognised that to innovate effectively, meeting net-zero objectives and delivering a whole systems approach, as an industry we need to develop an effective innovation ecosystem.

The initial steps will be:

- In sector:** To confirm roles and responsibilities for an ecosystem within the sector. This will include electricity and gas network businesses, EIC, ENA, Ofgem, UKRI, the Power Networks Demonstration Centre (PNDC) and the Energy Systems Catapult (ESC).
- Beyond sector:** To include water, telecoms, supply chain and wider partnerships. This will build upon the work already undertaken in RIIO-GD2, facilitated through our partnership with the EIC.

The outcome of both initiatives will reduce duplication, provide simplification of access to the industry for new market entrants, accelerate innovation into BAU and leverage resources across the industry.

#### 1.4.1 Collaborating for local net-zero planning and delivery

Collaboration between Local Authorities (LAs) and network operators is increasing. NGN will, therefore, continue to share and support new skills and capabilities. Local government and network operators should take a long-term approach to collaboration, with interaction between LAs, regional planners and network operators being essential to ensure that investment is effectively targeted to provide best value for customers and end users. Our dedicated policy team will continue to work with LAs and disseminate key information and insights around innovation (see Chapter 4 of the main business plan for more information). This includes work undertaken at the NeRV site at Low Thornley, which provides a data-rich environment to trial housing retrofit solutions which can subsequently be deployed on social housing stock.

Networks need to understand LAs' decarbonisation plans as early as possible. Open data provision supports effective decision-making and avoids duplication of effort in accessing and analysing data. Our stakeholders want NGN to use its convening power to collaborate on place-based public engagement, acting to integrate the voice of the consumer into Local Area Energy Plans (LAEPs) and into discussions with Northern Powergrid. We will engage with LAs to generate ideas for innovation projects which can help inform LAEPs.

#### 1.4.2 Working with our Independent Stakeholder Group

During RIIO-GD2 we have held discussions with our Independent Stakeholder Group and innovation leaders from varying sectors, including academia and utilities, as well as with a wide range of stakeholders to understand what good practice looks like for collaborating with colleagues internally. We also held a Colleague Ignition event that looked at case studies from across various sectors, including aerospace and the military, to understand how they embed an innovation and continuous improvement culture into their day-to-day activities. For RIIO-GD3 this will be a key area of focus for the Innovation team, as to how we ensure that colleagues participate in innovation, particularly in supporting higher TRL projects and the transition to BAU. We will be developing and implementing an engagement model in the lead-up to RIIO-GD3 with support and challenge from our Independent Stakeholder Group, ensuring it meets best practice standards and is adopted by colleagues across the business.

### 1.4.3 Summary

The graphic below summarises how we will adapt our innovation collaboration in RIIO-GD3 based on new challenges and learnings from RIIO-GD2:

Learnings from RIIO-GD2	RIIO-GD3 changes
<ul style="list-style-type: none"> <li>• Identification of good practice for internal collaboration</li> <li>• Feedback to better tailor innovator support</li> </ul>	<ul style="list-style-type: none"> <li>• Increased focus on internal collaboration to drive higher TRL projects and transition to BAU</li> <li>• Participate in development of an innovation ecosystem</li> <li>• Enhanced Economic Value Framework</li> <li>• Focus on local net-zero planning and delivery</li> <li>• Development of an Engagement Model for the Independent Stakeholder Group</li> <li>• Increase support for innovators</li> <li>• Use of innovation labs</li> <li>• Fully managed collaborative innovation calls process</li> <li>• Dissemination of innovation case studies</li> <li>• Take learnings and adopt technologies from other industries</li> <li>• Undertake horizon scanning exercises</li> </ul>
Challenges for RIIO-GD3	
<ul style="list-style-type: none"> <li>• Increased importance of local energy planning</li> <li>• Need to look outside sector for ideas to address the energy transition</li> </ul>	

### 1.5 Customer focus

Delivering direct benefits to customers will remain a key focus of our innovation activities. To ensure this, we will seek to develop our understanding of customer and stakeholder preferences and priorities. Recent customer engagement has driven four key insights<sup>2</sup>:

- The macro environment is a major influence:** The cost of living continues to have a significant impact on domestic customers in particular; 57% of domestic customers have difficulty paying their energy bills at least some of the time.
- Reliability of the service and improvements in safety are important:** Reliability and safety are consistently prioritised and have the highest value perceptions across all customer groups.
- Customers prioritise supporting customers in vulnerable situations:** Customers identified supporting CIVS through changes to the energy system as the most important area on which NGN should innovation (36% of domestic customers and 34% of non-domestic customers).
- Environmental service improvements are a lower priority:** Customers viewed two of the three service improvements (increasing building energy efficiency and partnering with suppliers that do not harm the environment or people) as NGN's direct responsibility that should be delivered at no extra cost.

Customers were also asked to rank areas for potential innovation from "most important" to "least important". The responses across both domestic and non-domestic customers were broadly similar, with a clear focus on supporting CIVS.

Figure 4: Potential innovation focus areas identified by NGN customers

	Domestic customers	Non-domestic customers
Supporting vulnerable customers through changes to the energy system	36%	34%
Using the best parts of electricity, gas and liquid fuels to cut down on greenhouse gas emissions	27%	28%
Future Energy System	26%	26%
Helping create sustainable local and regional communities	11%	12%

It was also demonstrated that over 85% of customers value mid-term and long-term innovations over short-term innovations, with a focus on innovation which supports efficiencies and a greener energy network for the future. These priorities feed through into our innovation focus areas in RIIO-GD3 (see Section 3).

<sup>2</sup> NGN Customer Value Perception, June 2024

## 2 Our innovation record during RIIO-GD2

This section sets out the key impacts from the innovation projects we have delivered to date in RIIO-GD2 and provides further detail on a series of key projects across our innovation themes.

### 2.1 Summary results of our RIIO-GD2 innovation portfolio

During RIIO-GD2, we have sought to efficiently utilise both our own TOTEX funding and that provided by the innovation funding mechanisms NIA, SIF and UIOLI, to deliver benefits and financial savings of up to £17 million for both our existing and future customers. Table 2 below provides an overview of the NIA funding allowance request for RIIO-GD2.

Table 2: Breakdown of NIA funding request for RIIO-GD2

Area	NGN funding
Customer vulnerability	£3,610,000
Energy systems transition	£7,890,000
<b>Total funding</b>	<b>£11,500,000</b>

### 2.2 RIIO-GD2 Successes

In RIIO-GD1, our innovation activities enabled us to deliver £6 million of savings to our customers. In RIIO-GD2, we are building on this success to continue to keep customer bills low, while enhancing the levels of service we provide. This investment will continue to drive lower costs for customers in RIIO-GD3 as we reflect the use of these innovations in our forecasts.

As well as direct financial benefits, NIA funding has facilitated projects exploring the energy transition. Our NIA portfolio comprises agile research and development projects that allow us to explore and de-risk solutions, helping to deliver against strategic challenges as efficiently as possible and providing vital evidence to policymakers. If we spot something today, we can innovate on it tomorrow with the help of NIA because it allows us to pivot quickly and react to changes.

The performance of these benefits has been specifically driven by a number of our innovation projects which we have taken from idea to concept and through to delivery.

Some of these specific projects are highlighted in table 3. Our innovation activities have received external recognition. NGN, alongside Synthotech, won Innovation Project of the Year at the annual IGEM Gas Awards for the work done on the Thermal Imagery Analysis SIF project and the development of the LeakVISION robotics system. NGN has also led on a project to develop the world's first hydrogen homes, which was chosen to lead an industrial scale demonstration of its unique carbon-neutral heating solution<sup>3</sup>.

**Our HyDeploy project was presented with the Innovation Award at the Gas Industry Awards 2023 organised by the Institution of Gas Engineers and Managers. HyDeploy, a collaboration project led by NGN, was the first project to blend up to 20% by volume of hydrogen with natural gas on a public gas network to supply energy for low-carbon heating and cooking to around 700 homes in Winlaton, Gateshead, for one year.**

NGN has also undertaken various projects to embed innovative solutions into BAU, including providing real-time validation of asset data at the point of entry into our S/4Hana system. Examples of innovation projects undertaken during RIIO-GD2 are provided below:

Table 3: RIIO-GD2 NIA projects

Project name	Project value	Description	Benefits	Lessons learnt
<b>Helix (Customer Vulnerability – IT1)</b>	£100,100	<p><b>Background</b></p> <p>30–60 deaths reported annually due to carbon monoxide (CO) poisoning. CO-related incidents constitute a significant burden on emergency services. CO poisoning can lead to lasting neurological damage, memory loss and difficulties in concentration.</p> <p>“First line of defence” is a CO detector supported by regular servicing and inspection of gas appliances.</p> <p>GDNs operate the gas emergency service to respond to CO alarms in order to make the situation safe.</p> <p><b>Problem</b></p> <p>No self-diagnosis option for CO poisoning.</p> <p><b>Solution</b></p> <p>Using the latest developments in sensor technology, this project developed a world's first – a wearable device capable of detecting low levels of atmospheric CO to provide a far more responsive and advanced way of protecting life.</p>	<p>Social Return on Investment (SROI) score: 76% (calculated using the NGN CBA model), reflecting the positive impact of the project on customers, the NHS, other emergency services and CIVS through prevention of death and disability, and better health.</p> <p>Improvement in wellbeing of CIVS (through having the reassurance of the monitor and ability to better manage fatigue).</p> <p>May improve productivity and reduce work/medical appointment absences.</p> <p>May generate economic benefits for the region and UK more widely through GVA improvements, job creation and export opportunities from the creation of a viable and cutting-edge product, and collaboration with universities.</p>	<p>It should be noted that the product was developed from concept. This should be taken into consideration when setting out the timelines for a project, as innovation and subsequent development can encounter a number of unseen issues.</p>

<sup>3</sup> See: <https://www.northerngasnetworks.co.uk/2022/12/14/northern-gas-networks-plays-key-role-in-world-first-hydrogen-trial/>

Project name	Project value	Description	Benefits	Lessons learnt
<b>Customer Vulnerability Mapping Tool (Customer Vulnerability – IT2)</b>	£104,666	<p>Work began in 2021 on a collaborative platform that combines data from across the business with open-source and paid-for external data to create an interactive map to allow users to: identify where CIVS are located; understand which factors affect a community's resilience; and identify gaps in provision.</p> <p>For example, it might show us that we need to run an awareness campaign on services for fuel poverty in a certain area or prepare our response for a storm or a flood in another.</p>	<p>Initiatives and activity can be better targeted to meet the needs of CIVS, saving time, money, and effort.</p> <p>Users can view areas most affected by climate impacts.</p> <p>The tool focuses on measurements of potential vulnerability, allowing users to target their activities to those customers.</p> <p>CIVS will be better served and can be offered more holistic engagement thanks to being able to view other organisations' activities and operational areas.</p> <p>The geographic nature of the data will help users to better understand a community and meet its specific needs. It also brings otherwise disparate organisations together in one area, such as different charities' operational areas, so that customers and communities can access the support available to them.</p>	<p><b>Data:</b> Census data only offers a snapshot in time; data from more frequently updated sources should be incorporated.</p> <p><b>Private data:</b> A method for organisations to use their own data in filters securely would be valuable to many teams.</p> <p><b>Automation:</b> Data import functions take more time and computer resource than initially expected to produce accurate local datasets.</p> <p><b>Consultancy:</b> There is often still a need for a person who is familiar with the tool to help interpret data and findings.</p>

Project name	Project value	Description	Benefits	Lessons learnt
<b>Alternative Power for Equitable Communities (APEX) (Energy Systems Transition – IT3)</b>	£177,000	<p>Introduced an innovative method for localised and community-centred energy systems.</p> <p>Aim was to leverage the capabilities of power-to-hydrogen (PtH<sub>2</sub>) technology within community settings while optimising utilisation of current gas infrastructure.</p> <p>Harnesses excess local renewables to produce hydrogen.</p> <p>Project output is a report detailing the selection and evaluation of the model communities for the project based on a set of criteria. The areas were selected to cover a broad range of variables that are duplicated and located around the remainder of the UK.</p>	<p>Enhancing energy system flexibility, thereby increasing use of renewables, while reducing reliance on fossil fuels. This will lower overall energy costs for a range of consumers.</p> <p>Utilise surplus local renewable energy and redistribute it as hydrogen, easing the strain on energy grids during peak demand and reducing pressure on costs for heating and hot water, with the potential for cost savings.</p> <p>Community benefits including employment opportunities and improved health outcomes.</p> <p>Boosted community engagement by providing customers the opportunity to actively participate in shaping energy solutions for their communities.</p>	<p>There was an agreement amongst stakeholders that in the future, a pipeline or hydrogen backbone will be necessary to connect production with off-take.</p> <p>To achieve peak value under current subsidies, electrolyzers need to run as much as possible.</p> <p>Co-located projects with industrial off-takers are ideal because they bypass distribution issues.</p> <p>Transport fleets are also viable off-takers for hydrogen if heavily subsidised.</p> <p>Waste heat for heat networks is not currently a priority, as it is not commercially mature.</p>
<b>Visualising the Opportunity for Pipeline Hydrogen for Mobility Applications (Energy Systems Transition – IT3)</b>	£123,100	<p>UK government has committed to making new heavy-duty vehicles (HDVs) zero emission by 2040. Hydrogen is a promising low-carbon option.</p> <p>The project was developed alongside Element Energy and Transport for the North (TfN) to create a dynamic visualisation tool that demonstrated the feasibility of hydrogen as an alternative transport fuel.</p> <p>The tool identifies and maps potential HDV hydrogen demand and suitable connection points to the gas network.</p> <p>We have used it to identify sites where hydrogen refuelling stations should be sited, and the visualisation tool will let us plan how to utilise the gas network to deliver hydrogen to these sites.</p>	<p>Identifies how our existing pipe network can deliver hydrogen, eliminating the need for costly new networks or refuelling vehicles (reducing emissions and traffic).</p> <p>The project has been adopted by TfN and communicated to the Department for Transport (DfT).</p>	<p>The project has highlighted to DfT the use of gas infrastructure to transport hydrogen to future refuelling stations as a cheaper, lower emission alternative to tube trailers.</p>

Project name	Project value	Description	Benefits	Lessons learnt
<b>Wider Impacts of Hydrogen (Energy System Transition – IT4)</b>	£236,224	<p>This year-long research project (in collaboration with other GB gas networks) bridged gaps around the impact of hydrogen conversion on the network resulting from different physical characteristics of the gas (velocity, density and viscosity).</p> <p>National Engineering Laboratory in Scotland assessed impacts using Computational Fluid Dynamics (CFD) modelling technology</p> <p>The project produced a report detailing the behaviour of hydrogen across a range of GDN applications.</p>	<p>Computational fluid dynamics allowed very accurate modelling of natural gas.</p> <p>Helped build evidence that transporting hydrogen through the existing gas network is safe and viable.</p> <p>Minimal physical testing required, saving time and money.</p>	<p>These reports helped build the evidence case for repurposing gas assets for hydrogen conversion.</p> <p>Identified issues which need further investigation as we convert to hydrogen.</p>
<b>Domestic Hydrogen Safety Controls (HyBreak) (Energy System Transition – IT4)</b>	£560,133	<p>Government decision on hydrogen conversion requires the safety case to be established, i.e. future hydrogen system must be as safe as current natural gas system.</p> <p>The project developed an automated solution to monitor domestic pressures, monitor flow rates, isolate supplies in case of an emergency and communicate directly with the customer/gas network.</p> <p>The scope of the project included Natural Gas, Hydrogen and Hydrogen Blends, and resulted in the completion of comprehensive in-house and field testing, third-party certification for ATEX hazardous area approval, and the delivery of 10 fully certified units that will be available for further field trials in different facilities around the UK.</p>	<p>Supports case that domestic hydrogen deployment can be safe, reliable and cost effective.</p> <p>ATEX approval ensures the design is safe for installation in the hazardous area and the complete solution provides significant health and safety benefits to gas customers by ensuring gas supplies are shut off in the case of a leak.</p> <p>The shutting-off of gas supplies will eliminate or minimise associated emissions.</p>	<p>Further integration of CV measurement would allow customers to be billed for exactly what they are using, reducing customer bills.</p>

Project name	Project value	Description	Benefits	Lessons learnt
<b>Internet of Things (IoT) Pressure Sensor Pilot (Energy System Transition – IT5)</b>	£779,350	<p>We partnered on this ground-breaking project with local Internet of Things experts, Render Systems, to develop a revolutionary new product – a Smart Cap, which has been designed to seamlessly integrate onto existing gas network infrastructure.</p> <p>The product consists of an everyday plastic cap component containing an integrated pressure sensor which monitors gas pressure and transmits data to NGN's cloud in real time. The technology can evolve to monitor temperature, moisture and gas composition in the future, allowing even more efficient decisions to be made, unlocking new analytical approaches to supply management, and opening up the opportunity to involve advanced AI systems in the future.</p>	<p>Provides far more advanced notification of network issues than is currently possible with today's technology.</p> <p>Improves efficiencies and increases resilience of the network.</p> <p>Supports NGN's role in delivering the Energy System Transition.</p> <p>Quick to deploy.</p> <p>Significantly lower cost than a traditional data-logger solution, once deployed at scale.</p>	<p>Physical sensors' functionality proved throughout various simulated scenarios at NeRV site.</p> <p>Five purge tees with the smart caps fused onto a live 90mm PE pipe- these were secured by NGN operational teams. Once the caps were attached this left the sensor units in a gas free environment allowing for the project partners to attach the data loggers and battery units.</p>

Project name	Project value	Description	Benefits	Lessons learnt
<b>LeakVISION (Energy System Transition – IT5)</b>	£525,075	<p>LeakVISION is a miniature robot that uses thermal imaging to locate leaks inside the gas pipe network.</p> <p>Up until now, the standard method for detecting leaks has been to make holes in the ground along the length of a pipeline where a leak is suspected, before taking gas readings to locate the exact leakage location. This is time consuming, expensive and invasive.</p> <p>In contrast, LeakVISION is small enough to be inserted directly into a pipe and travel along it to detect exactly where a leak is, before mapping it and updating records digitally.</p> <p>The robot was developed with our partners, Synthotech, using NIA funding, and the first phase of the project involved us creating a prototype robot and testing it in our network.</p> <p>We then secured SIF funding to take the project to the Alpha Phase, which included further testing of the prototype in other networks, including hydrogen networks, and further miniaturisation to allow the robot to fit inside pipes that are just four inches wide.</p>	<p>Leak detection process quicker, cheaper and less disruptive to public.</p> <p>Data obtained will allow us to understand pipe conditions inside and out, rather than having to rely on the human eye, improving pipe condition assessment and repair prioritisation.</p>	<p>The Project suffered difficulties with identifying and delivering field trials in a timely manner due to issues with identifying work that would provide sufficient and beneficial evidence for the project, this was relieved by working more closely with NGN Operational Teams and using the existing STASS Team.</p> <p>Use of the STASS Team, who are already highly experienced in using robotics on NGNs network resulted in a smooth transition and minimal operational issues when deploying LeakVISION for field trials.</p>

Project name	Project value	Description	Benefits	Lessons learnt
<b>NeRV, Project 1: Energy Efficiency (Energy System Transition – IT6)</b>	£1,655,274	<p>The NeRV in Low Thornley, Gateshead, is a pioneering project that will help the energy industry discover the best technologies to use for adapting and retrofitting existing UK homes to achieve net zero by 2050.</p> <p>In partnership with Newcastle University and with funding support from North East LEP, we have built a whole energy systems village that comprises nine different properties that closely replicate the UK's existing housing stock in terms of materials and building regulations in place at time of construction.</p> <p>Customers will utilise this infrastructure as a research facility where they can test their solutions in as close to real world conditions as possible.</p> <p>The site will also be used to demonstrate different products and train individuals on how to retrofit a wide variety of house types, as well as location where landlords and social housing providers can understand the performance of various solutions before making investment decisions.</p>	<p>Real-life testbed for SMEs and businesses who are developing net-zero solutions for domestic retrofits.</p> <p>Rich data will be collected from tests to inform future product development.</p> <p>Data collected will also be used by us to engage with academia, the public and private sectors, and the government, about the most effective net-zero technologies for existing homes.</p>	<p>Lessons learnt from the implementation of NeRV will be carried forward in RIIO-GD3.</p> <p>Procurement time for sensors has been longer than anticipated.</p> <p>Additional time was allowed for data to be cleaned and sense checked.</p> <p>Sensors can be prone to going offline from time to time. Where sensors are of critical importance it is recommended that additional resilience is built in. This may be in the form of additional analogue sensors capturing primary fields such as gas, electricity consumption, and temperature/humidity.</p> <p>Installation times can also vary with the availability of resource.</p> <p>Ensuring NGN has the resources required to approve installations following formal procedures.</p>

## 2.3 Outcomes from Totex allowance investment and other funding sources

NGN rely on various sources to fund innovation projects outside the NIA, SIF and UIOLI, including other GDNs and our own Totex allowance.

We have also undertaken various BAU innovation projects throughout RIIO-GD2. At NGN, BAU innovation refers to innovation projects of an operational or maintenance type that have reached a high level of technology readiness whereby they are capable of generating clear financial efficiencies. As a result, they are inherently less risky and do not qualify for innovation allowance funding. Instead, they are primarily funded by our own Totex allowance.

A stand-out BAU innovation projects that was funded through our Totex allowance in RIIO-GD2 is provided below:

### CASE STUDY: UIS VALVE TRAK

Valve Trak hardware is fitted to a valve chamber and transmits an audible alert via a Bluetooth device. The technology enables us to monitor and locate our assets around the clock. The transmitter allows our engineers to pinpoint the exact location of the valve if it needs isolating, for example. This is a significantly more cost-effective approach than trying to locate a valve via traditional methods. The project was funded entirely from our Totex allowance at a cost of £602k.

## 3 Building on priorities for RIIO-GD3

This section sets out our innovation priorities for RIIO-GD3 which have been informed through customer, stakeholder and colleague engagement. Alongside these priorities we have provided case studies which are a subset of a broader portfolio of projects that are being considered and have been included as examples, rather than the entirety of the proposed project portfolio.

### 3.1 Building on previous innovation work around the energy transition

Across previous price controls we have been a “first mover” on innovation projects to test the feasibility and deliverability of hydrogen as part of the low-carbon/net-zero transition. This includes major initiatives as outlined below:

- **HyDeploy (2019–2022):** conducted in two phases (at Keele University and subsequently in Winlaton). The first project of its kind in the UK, it supplied a natural gas/hydrogen blend (hydrogen content up to maximum of 20%) to a variety of customer types (homes, schools, university campuses, small businesses, churches). The Health and Safety Executive were satisfied with the safety of the blended fuel. The project established that blended gas does not interact negatively with materials used in existing infrastructure. The project also allowed for extensive monitoring of hydrogen appliances. These projects helped inform the UK government’s strategic decision in 2023 to support blending of up to 20% hydrogen into GB gas distribution networks.
- **Spadeadam Microgrid (2021 onwards):** a first of a kind microgrid to understand changes to gas network operational procedures if the networks are to transport up to 100% hydrogen in the future.
- **Leeds City Gate (H21) (2015–2016):** study to determine the technical and economic feasibility of converting the existing natural gas network in Leeds to 100% hydrogen.

During RIIO-GD2, NGN had planned to build on these projects with a larger scale “village trial” in Redcar, supplying residents with 100% hydrogen. However, in 2023, the government took the decision not to go ahead with this trial. A wider government decision about the role hydrogen will play in decarbonising domestic heating is due to be made in 2026.

Regardless of the outcome of future policy decisions, our previous work has positioned us well to continue to lead in net-zero innovation in RIIO-GD3. The insights from these projects will continue to inform our work around East Coast Hydrogen.

### 3.2 An overview of our RIIO-GD3 innovation priorities

In RIIO-GD3, we will continue the move away from traditional operational efficiency projects to focus on even more ambitious changes to achieve net zero and protect customers. We have engaged extensively with customers, stakeholders and colleagues to understand and inform our approach for RIIO-GD3 (see A3 Stakeholder Engagement and Decision-Making Log). We believe our focus is clear and that our efforts should be deployed on the approach to innovation in these areas. Building on the success outlined in Section 2, we have identified key focus areas which will govern our approach to innovation and help us to deliver real and tangible benefits for the company, our customers and the wider sector. These are:

- **Customer vulnerability:** we will build on RIIO-GD2 successes such as the Vulnerability Mapping Tool by undertaking further innovation projects to develop wearable sensor devices to protect customers from the dangers of carbon monoxide
- **Repurposing and Future Systems:** we will continue to innovate to support the deployment of the East Coast Hydrogen project. This will build on the pre-FEED (front-end engineering design) and FEED studies that will have been completed by the end of RIIO-GD2 in order to support the roll out of hydrogen to Industrial and Commercial (I&C) customers from the late 2020s.
- **Sustainable Communities:** this area will start to become more prominent in the coming years, with the inception of LAEPs and Regional Energy Strategic Plans (RESPs) playing an increasing role in the energy sector. This will build on work previously done within RIIO-GD2 that focused on a place-based approach to future energy scenarios.
- **Whole Energy Systems:** We continue to pursue cross-vector collaboration, deliver key projects to strengthen our network capabilities, and align with government policy to facilitate the transition to net zero.

We believe data and **digitalisation** will form the golden thread that flows through all of our plans in RIIO-GD3 and enable us to facilitate a net-zero energy sector while protecting those customers who are most at risk. In RIIO-GD2, we invested significantly in the digitalisation space, launching a variety of brand-new technologies, including the Process Optimisation Programme and the Open Data Portal, as well exploring the benefits of incorporating AI into the business’s data quality management system, such as providing real-time validation of asset data at the point of entry into our S/4Hana system. This investment has allowed us to develop a sector-leading, entirely cloud-based digital platform that has streamlined our processes and enabled our colleagues to make decisions based on data that is always available, up-to-date, and consistent.

<sup>4</sup> Please refer to A12 - Digitalisation Strategy and Action Plan.

As a result, investment during RIIO-GD3 will focus on maintaining and improving the already established systems, which is required to deliver against our wider business plan as specified in our Digitalisation Strategy<sup>4</sup>. Refer to Chapter 6 of the main business plan for further details of the digital projects to be pursued in RIIO-GD3.

In order to deliver against these key focus areas that reflect the key challenges facing the sector and customers during RIIO-GD3 we will require innovative, long-term, NIA-funded solutions to address them.

### 3.3 Innovation funding for RIIO-GD3

In its Sector Specific Methodology Decision (SSMD) publication, Ofgem confirmed that it will retain the core funding streams which the industry has used during RIIO-GD2. We are supportive of this decision and outline below the funding required to support delivery of innovation within the RIIO-GD3 period.

#### 3.3.1 SIF

This funding stream will be available to UK gas and electricity networks to access between 2026 and 2031. Unlike the NIA allowance, this more targeted funding is available for projects that evidently accelerate the transition to net zero, to help the UK become a “Silicon Valley” of energy. The fund has two phases to take a project from development to final delivery of a demonstration project.

#### 3.3.2 NIA

The backbone of innovation, this funding stream is allocated to a wide range of innovation projects assessed and approved by NGN. In RIIO-GD3, we anticipate spending £15.5 million on projects which will support CIVS and help facilitate the transition to net zero.

#### 3.3.3 UIOLI

In its RIIO-GD2 Final Determination, Ofgem established a net zero and Re-opener Development Fund use it or lose it allowance (UIOLI). The purpose of the UIOLI is to enable network licensees to fund small net-zero facilitation projects and allow for early development work on projects that network companies intend to bring forward at a later stage through other net-zero-related mechanisms. Ofgem intend to retain similar levels of UIOLI allowances for RIIO-GD3, of which £4.5 million was allocated to NGN at RIIO-GD2.

However, we are requesting £12.5 million of UIOLI funding to support our energy system transition ambitions. Further details on the projects and costs can be found in Chapter 4 and Chapter 6 of our Business Plan.

### 3.3.4 Other uncertainty mechanisms

This funding application is consistent with Ofgem's Sector Specific Methodology (SSM) for both RIIO-GD2<sup>5</sup> and RIIO-GD3<sup>6</sup>, which highlight the use of Uncertainty Mechanisms (UMs) (including the Net Zero Pre-construction and Small Projects (NZASP) re-opener) to account for uncertainty relating to the future hydrogen economy under different policy and market pathways for the energy transition.

## 3.4 Network Innovation Allowance funding for RIIO-GD3

We are seeking additional NIA funding to support these priorities. The breakdown of our NIA funding request is shown in the table below and NGN will match fund 10% of the requested amount, in line with the existing NIA arrangements. Appendix One provides a breakdown of the types of projects we will deliver associated with each of the Innovation Themes outlined below. This funding will only be used if it meets our criteria and delivers demonstrable value. Any funding not used will be automatically returned to customers.

**Table 4: Breakdown of NIA funding request for RIIO-GD3**

Topic	Theme	Appendix A3 Insight	Justification	Funding request
Customer vulnerability	<b>IT1</b> Short-term solutions to assist CIVS through difficulties that have been exacerbated by cost-of-living / energy crises	3, 4, 7, 11, 15	This will help to support customers who might otherwise make unsafe choices (e.g., turning heating off, which may lead to greater long-term health issues, or tampering with their heating). In this regard, innovation can make an immediate and significant impact.	£2,320,000
	<b>IT2</b> Long-term solutions supporting a fair transition and ensuring those at most risk are not left behind	3, 4, 7, 11, 15	For example, as part of the broader transition, we will support individuals who are unable to take up new technologies. Innovation can help these customers manage the energy transition by offering small-scale, bespoke solutions.  It will incorporate research and development to create enduring, collaborative, coordinated and customer-facing solutions that minimise impacts of activity and how we maintain and repair our network.	£1,595,000
Energy systems transition	<b>IT3</b> Enabling decarbonisation through whole energy solutions	7, 8	This supports the overall accelerated path towards achieving net-zero emissions by 2050.  A continuing challenge relates to alternative fuel transport solutions and, in particular policy decisions, infrastructure and market forces. We will undertake a collaborative programme of research to support the whole energy system focus area relating to sustainable transport solutions.	£5,380,000
	<b>IT4</b> Assisting local authorities to establish sustainable communities	6, 10	We will ensure that the energy systems transition incorporates whole systems that are fit for all. We have identified links between whole systems, decarbonisation and risks for CIVS. We will innovate to ensure that CIVS are helped as we transition to net zero.	£3,450,000
	<b>IT5</b> Decommissioning and repurposing of existing gas networks as we move towards future systems	7, 8, 10	To support continued investigation into a variety of new technologies, as well as the benefits of incorporating AI. Investment during RIIO-GD3 will focus on maintaining and improving the already established systems, which is required to achieve the goals in the wider business plan.	£1,595,000
Digitalisation	<b>IT6</b> Maintain and improve existing digital infrastructure to increase efficiency	11		£1,160,000
<b>Total</b>				<b>£15,500,000</b>

<sup>5</sup> Ofgem, RIIO-2 Sector Specific Methodology Decision, 2019

<sup>6</sup> Ofgem, RIIO-3 Sector Specific Methodology Decision for the Gas Distribution, Gas Transmission and Electricity Transmission Sectors, 2024

The next section provides more detail about our innovation focus areas and potential projects for RIIO-GD3:

## 3.5 How our focus areas will be delivered

The activities planned under the customer vulnerability and energy system transition innovation focus areas are low in technology readiness and require significant learning to be generated before they can become market ready. Without NIA funding the uncertainty of the outcome of such research would result in minimal work being undertaken. We plan to follow this research with additional investment using the other funding mechanisms and transition the innovation through the TRL stages as appropriate and prepare to transition this into BAU.

Details of the customer vulnerability and energy system transition innovation activities that will be pursued using funding have been included below.

### 3.5.1 Customer vulnerability

Customer vulnerability can come in many forms, and usually has complex and deep-rooted causes. Our customers have experienced a number of crises in recent years that have put significant strain on households including Covid-19 from spring 2020, the energy crisis from autumn 2021 and the wider cost of living crisis from late 2021. Across the UK, 6.5 million households are now estimated to be in fuel poverty, 2 million more than at the beginning of the energy crisis<sup>7</sup>, with 57% of domestic customers saying they have difficulty paying their energy bills at least some of the time<sup>8</sup>. The increased pressure on customers can have a detrimental impact on their behaviour, which is explored more below. It is here that innovation can make an immediate and significant impact.

As well as cost pressures, customer vulnerability will be affected by the energy transition, with some groups unable to take up new technologies, thus running the risk of being "left behind". Innovation can help these customers manage the energy transition by offering small-scale, bespoke solutions that meet their needs, alongside projects looking at the possibilities of decarbonisation at scale through hydrogen.

In RIIO-GD3 we will continue to use NIA funding to undertake research and development that has a specific focus on exploring solutions that are targeted to ensure support for our CIVS. The research undertaken in this area will provide essential evidence that will support the onward development through the innovation processes utilising the various funding mechanisms.

<sup>7</sup> NEA UK Fuel Poverty Monitor 2024: <https://www.nea.org.uk/news/30096/>

<sup>8</sup> NGN Customer Value Perception, June 2024.

<sup>9</sup> English Housing Survey 2022 to 2023: Headline Report: <https://www.gov.uk/government/collections/english-housing-survey-2022-to-2023-headline-report#:~:text=More%20than%20a%20quarter%20of,%25%20in%202022%2D23>.

We will use both the NIA and UIOLI allowances to be creative in initiating, scaling up and embedding effective innovation. Our portfolio will commence with NIA research that will provide evidence and enable assessment of the potential for change. If deemed appropriate, subsequent progression through to the demonstration phase projects will follow. Once the necessary evidence has been determined, we will progress through the innovation phases and fund developments via the dedicated "use it or lose it" fund, our Community Partnership fund, Customer support fund, the Vulnerability and Carbon Monoxide Allowance (VCMA), the TOTEX allowance or by leveraging other third-party funding.

### 3.5.1.1 Safety

In order to combat rising bills, customers are being forced to change their behaviours, including switching off their heating more regularly. This can have broad implications, one of which is that it creates a more suitable environment for the spread of damp and mould. In 2022, 4% of dwellings had a problem with damp, an increase from the pre-pandemic level of 3%, with private rented dwellings rising from 7% to 9% between 2019 and 2022<sup>9</sup>. The detrimental impact damp and mould can have on an occupier's health was brought into sharp focus following the death of toddler in December 2020. This incident resulted in the introduction of Awaab's Law in July 2023, which sets out new requirements for landlords to address hazards such as damp and mould in social housing.

Retrofitting UK homes is of crucial importance to decarbonise the UK's housing stock given that 80% of the houses that will be in use in 2050 have already been built today. However, research shows that the UK is lagging behind on the home retrofits required to reach net zero. For example, by 2028, the UK will need to reach a peak of nearly two million energy efficient measures, such as the installation of loft and wall insulation, and over 600,000 heat pumps. In 2022, the UK installed just 50,000 heat pumps and in 2023, installation figures for the government's flagship energy efficiency scheme fell to their lowest level since the scheme was introduced.

We believe that by dedicating funds to projects that explore home efficiency improvements in RIIO-GD3, we can make a meaningful impact in this space and develop innovative solutions that will improve heat retention in properties and limit the spread of damp and mould. An example of a selected project is set out below. It should be noted that the case studies presented throughout this section are a subset of a broader portfolio of projects that are being considered and have been included here as examples, rather than the entirety of the proposed project portfolio:

## CASE STUDY: SUPPORTING CIVS WITH HOME EFFICIENCY MEASURES

We will explore a range of options for home heating retrofit for CIVS giving them a choice around how they reduce carbon emissions from their homes. We will work alongside other GB networks, key stakeholders and relevant project partners to deliver under this project area.

This is expected to help reduce customers' bills by making their homes more efficient with energy consumption, as well as providing additional options to customers more broadly. It may also reduce the risk of damp within a property, which allows customers to have their homes at a safe temperature. Additionally, it will support the removal of consequences of carbon monoxide within a property related to the gas boiler system and will reduce emissions emitted from burning natural gas in a boiler.

There is evidence of even riskier behaviours being adopted by customers in trying to reduce their bills. Electricity North West's Stakeholder Engagement and Consumer Vulnerability Survey reported a 400% increase in meter tampering and the use of unsafe heating in the home, such as using wood scraps in log burners and the use of portable gas heaters<sup>10</sup>. A by-product of this has been an increase in cases of suspected carbon monoxide poisoning across the North East, Yorkshire and Cumbria, up 40% since 2021.

We agree with Ofgem that the GDNs play an important role in supporting customers in relation to carbon monoxide safety and will look to build on the successful delivery of Project Helix in RIIO-GD2 (see Section 2) by investing further in wearable technology with the aim of protecting users from the dangers associated with CO.

### 3.5.1.2 Fair and just transition

Although the transition to net zero may provide opportunities and benefits to many, we recognise it will contain significant barriers to entry facing those customers in vulnerable circumstances. One such barrier will be the significant upfront costs required to disconnect the existing gas supply (with current estimates ranging between £500 and £1,500 per household), to install new low-carbon technologies, such as heat pumps and hydrogen boilers, and to ensure the efficient running of such technologies, i.e. suitable levels of insulation and sealing gaps and cracks.

Geographic location represents another barrier to whether customers will be able to benefit from the energy transition. For example, there is concern that heat pumps, one of the most popular low-carbon technologies, may not be suitable for use within rural homes because of infrastructure limitations and high installation and running costs, c. £12k higher than in urban areas<sup>11</sup>.

When we tested this issue in our Customer Value Perception survey, customers identified supporting CIVS through changes to the energy system as the most important area for NGN to focus innovation on during RIIO-GD3 (ranked first by 36% of domestic customers and 34% of non-domestic). An example of a selected project is set out below:

## CASE STUDY: CONSUMER JOURNEY RESEARCH

We will lead cross-sector research on customer transition to net zero via decarbonisation of in-home appliances, reduction in energy consumption and implementation of smart energy controls. Collaboration with local authorities, academia, GB networks and other stakeholders will be vital.

This project will build on work previously done within the RIIO-GD2 portfolio and aims to provide qualified information to energy customers and policy makers alike, particularly focusing on people in fuel poverty and vulnerable situations. The work will cover a broad range of end users, following the journeys of those domestic customers in rural and urban locations but also covering the industrial and commercial users who make up a significant proportion of our network.

This is expected to improve customer awareness of optimum solutions, which may ultimately enable us to better meet individual customer needs.

### 3.5.2 Energy systems transition

The UK is legally committed to reaching net zero emissions by 2050 and is on an accelerated pathway to reducing emissions across our entire society, from industry to transport, and to changing how we generate our power and heat our homes. According to national energy scenarios such as the 2024 Future Energy Pathways, gas has a significant role to play in whole systems decarbonisation regardless of the policy direction that might materialise in the future, be that hydrogen, hydrogen blending, biomethane or alternative fuels.

Supporting net zero is a key priority for our stakeholders. The evidence for this comes from our 2024 Stakeholder Conference at which stakeholders were asked to vote for their priorities for 2026–2031. Making progress towards net zero gained the most votes (75%). As described in Section 4.5 of our Business Plan, innovation will play a key role in contributing to the successful delivery of our energy transition strategy by strengthening our whole systems capabilities, which will enable us to robustly adapt to changes in the policy landscape. We are aiming to fund a number of whole energy system projects using NIA and UIOLI funding.

Our innovation programme will use research, development and demonstration projects to inform policy decisions on the future decarbonisation of the energy sector, while enabling a positive environmental impact from network activities throughout RIIO-GD3. We are aware that the challenge of meeting the 2050 net-zero target is significant and requires action from a broad range of players. We will work with gas and electricity partners, and also across industry beyond the existing regulatory boundaries.

We will work with stakeholders to facilitate sustainable whole energy solutions such as using hydrogen as a transport fuel. Our clear strategy focuses on how we can support the roll-out of the required infrastructure to enable compressed natural gas (CNG), hydrogen and electric vehicles. Working with the key stakeholders in our network area we will build on their learned experience providing support to aid the roll out of net zero projects. It is essential that a commercial and customer focus is incorporated as the projects progress from research and development into demonstration and towards deployment. A challenge in this area relates to policy decisions, infrastructure and market forces. Our innovation activity in this area will, therefore, focus on the challenges faced by the gas network in supporting this whole system objective.

Data-driven systems will create an opportunity for proactive intervention that will have immediate positive impacts for our customers. Digital systems will automate decision-making and create opportunities where solutions can deliver efficiency improvements and valuable benefits for customers throughout RIIO-GD3. They will also provide evidence to support the energy systems transition. Proactive notification of potential issues or maintenance requirements enables them to be rectified in ways beneficial to the customer, such as, acting in advance of a customer's supply being interrupted or avoiding the need to excavate a property or to deploy an engineer.

Working with academia, third parties and cross-sector organisations, we will continue to explore technology and data capabilities. The transition to a future energy system requires modern networks that can operate as cross-connected network systems. The solutions will use real-time data to enable automated, optimised decision-making and create an active network that enables cross-sector connectivity.

#### 3.5.2.1 East Coast Hydrogen (ECH2)

Despite some uncertainty pending the government's 2026 Hydrogen for Heat policy decision and their decision not to pursue the hydrogen home-heating trial in Redcar, hydrogen will continue to play a key role in decarbonising the UK economy by 2050. There is specific emphasis on the I&C sector, with the National Infrastructure Commission's second National Infrastructure Assessment recommending the development of a core network of hydrogen pipelines connecting the most likely initial sites of hydrogen demand, production and storage (i.e. industrial hubs) by no later than 2035.

We are fully supportive of the UK government's ambitions for hydrogen and have established the ECH2 project in partnership with Cadent and National Gas with the objective of identifying and ultimately delivering the network infrastructure required to support the deployment of low-carbon hydrogen, facilitating the decarbonisation strategies of energy generators and users in the East Coast region. This represents a whole energy system approach aimed at providing resilience and flexibility by connecting hydrogen-fuelled power stations, long-term storage sites and green hydrogen production facilities.

The focus on the East Coast region will also put local communities at the heart of this project. We believe this is crucial to increasing public engagement and the best way to mitigate fears and bring people into the transition story and process.

The ECH2 project has been scoped as a 15-year programme from feasibility through to commissioning of new build and repurposed pipeline. The Feasibility Study was launched in December 2021 and established the case for the project and set out the roadmap for completing further investigation and design of the infrastructure required. By the end of RIIO-GD2, the project will have completed pre-FEED studies, which provide detailed insights on hydrogen demand, the technical feasibility of the project and routing options, and FEED studies, which will provide more detailed analysis of commercial, construction and engineering requirements, and allow continued engagement with stakeholders and ensure permission is granted by the relevant authorities.

The focus moving into RIIO-GD3 will be to take the learnings from the FEED studies and apply them to the preparations for infrastructure delivery as we progress to Phase 2 of the project:

- **Phase 1:** By 2028, we aim to connect 60 large I&C customers in the Humber and Teesside regions, supplying up to 5 TWh/year of low-carbon hydrogen.
- **Phase 2:** By 2030, we aim to extend to 80 large I&C customers and three pilot towns supplying 11.4 TWh/year of low-carbon hydrogen (exceeding the UK government's 10 GW by 2030 target in a single region).
- **Phase 3:** By 2037, we aim to extend to 108 I&C customers across Yorkshire, Teesside and Scarborough supplying 12.6 TWh/year of low-carbon hydrogen.

<sup>10</sup> ENWL SECV 2022/23: [https://www.enwl.co.uk/globalassets/stakeholder-engagement/documents/secv-doc/secv-2023/enwl-secv-2022\\_23-part-two.pdf](https://www.enwl.co.uk/globalassets/stakeholder-engagement/documents/secv-doc/secv-2023/enwl-secv-2022_23-part-two.pdf)

<sup>11</sup> Rural England, Decarbonising in Rural Off-Gas Areas



An example of a selected project is set out below:

## CASE STUDY: TRANSITIONING INDUSTRIAL AND COMMERCIAL (I&C) USERS

The project will look at the transition process for I&C customers moving towards lower carbon fuel alternatives and the role GDNs will play. Specifically focussing on the adoption of hydrogen, the connections process and all of the relevant changes that will need to be made to the customers' systems.

This is intended to provide an opportunity for businesses and industry to convert to a low emission fuel source, and ultimately lead to a reduction in overall industry emissions.

### 3.5.2.2 Other low-carbon fuel options

One of the key insights from our stakeholder steering group was that we should focus on "low regret" innovation and development to support decarbonisation through alternative low-carbon fuels. Low regret decisions were introduced in the UK government's Net Zero Strategy and defined as "actions that are cost-effective now and will continue to prove beneficial in the future".

One such low-carbon option is hydrogen blending. Given the ambiguity over the direction of the government's hydrogen policy decision, the announcement in December 2023 that confirmed the government's support for blending up to 20% hydrogen in the distribution network is significant as it provides some clarity and puts blending at the forefront of the decarbonisation journey during RIIO-GD3. Blending is an important stepping stone in developing a hydrogen market which depending on government decisions could help reduce costs for industrial, commercial and domestic users.

To support hydrogen blending, we will seek funding to train NGN personnel on all stages of the process: how the hydrogen is created and then injected, and the changes that will be needed in work procedures. The work would look to provide a comprehensive training scheme for engineers who will be working on the gas network with a blend of up to 20% hydrogen. This will enable staff to work safely and efficiently on a multi-gas network.

Alongside hydrogen blending, we also expect biomethane to play an important role in the decarbonisation of the gas distribution network as we transition to net zero. During RIIO-GD2, we continued to support and enable the connection of new biomethane plants to our network, and we now have 21 such sites connected across the UK.

In RIIO-GD3, we will continue to engage with stakeholders and prioritise biomethane injection into our network. For example, we intend to trial the smoother operation of biomethane sites by stabilising the Calorific Value (CV) of gas for injection into the network. We anticipate this will reduce CV capping events and provide operational benefits for biomethane producers. An example of a selected project is set out below:

## CASE STUDY: BIOMETHANE ECOSYSTEM

The project would aim to develop the biomethane ecosystem and make it easier for sites to inject into the gas grid. The project would look at the current connections process, detailing the barriers to entry for new sites to come online but also existing sites for continual operation. The project would benefit from other proposed projects that would increase the telemetry on the network allowing for an update on the customer billing methodology based on more local calorific value metrics.

The network would be using lower emission gas that is compatible with existing infrastructure and home appliances. Customers would require very little change to how they live now.

### 3.5.2.3 Transport

GB Gas Networks' ongoing work to promote hydrogen as a clean transport fuel will continue, in support of the government's commitment to reducing carbon emissions. NGN will also continue its work to further develop the extensive infrastructure for hydrogen adoption and to repurpose the existing network. This will speed up deployment and help reduce construction costs. By making full use of the infrastructure and the available expertise, the gas networks are not only aiding the UK's decarbonisation efforts but also positioning hydrogen as a viable, sustainable alternative to conventional fuels in the transport sector. Further collaboration with automotive manufacturers and energy providers will continue to drive innovation in hydrogen storage and distribution for use in transport.

### 3.5.2.4 Industrial and Commercial

NGN will play a crucial role in supporting I&C users in the transition to cleaner energy. As the non-domestic sector strives to reduce their carbon emissions, GDNs will facilitate the switch from natural gas to green alternatives such as hydrogen and biofuels. The role of the GDN will be instrumental in repurposing and upgrading the infrastructure to make it fit for alternative energy sources, ensuring safe, reliable and efficient delivery to the consumer. Collaborating with other networks and industrial partners will drive the development of technologies and systems that integrate low-carbon gases into the network. The transition of the energy system will not only help industries meet their regulatory targets but also foster economic growth and sustainability in the UK's industrial sector, positioning the country as a front-runner in the worldwide shift towards greener industrial practices.

As the energy sector works towards its net zero targets, one vital area will be the reduction in emissions both through business activities and through associated secondary emissions. As detailed in our Environmental Action Plan, there are some key areas that we will be targeting. Successful delivery of this plan will require innovation and close partnership with our environment and sustainability team. Detecting emissions will be an important part of RIIO-GD3. We will do this at various levels: from low-level ground readings to deploying vehicles equipped to use of satellite technology. We will work to ensure we make the most efficient use of the low-carbon refuelling sites within our network.

### 3.5.2.5 Repurposing and decommissioning gas networks

Although the future direction of decarbonisation in the UK remains uncertain, one thing that is clear is that GDNs will need to consider the implications of RIIO-GD3 reducing and ending the use of natural gas as a fuel to heat buildings. There are several ways innovation will contribute to this process:

- We will make full use of our testing facilities at NeRV.
- We will develop portable, rapid-install digital monitoring equipment to support network operations. This will draw on the successful delivery of and lessons learnt from other monitoring equipment projects (e.g. IoT pressure sensors and UIS Valve Trak described in Section 2.2 and 2.3).
- We will develop the work needed for network sectorisation, detailing the requirements for the scope of works but also the sizing of areas that could be sectorised.

- We will repurpose or recycle existing gas pipeworks and other equipment by:
  - Developing technologies that remove the need for nitrogen purging
  - Capturing purged natural gas to prevent emissions – essential if converting large proportions of LTS or wider <7bar systems
  - Using robotics to scan system for any iron materials
  - Developing systems that can operate over longer distances to minimise the number of holes that have to be repurposed
  - Developing more sophisticated temporary connection systems to enable fast connections to maintain supplies and provide data back to central control
  - Developing monitoring and measurement systems to accurately report on volumes of purged gas – what was released vs. what was captured.

An example of a selected project is set out below:

## CASE STUDY: AREA SUITABILITY

The project will take a place-based approach, targeting specific locations and detailing the energy opportunities within the area. It will allow networks to make more targeted decisions in relation to the local energy infrastructure. As part of the work, we will look to work with LAEPs and the RESPs to develop certain approaches for specific areas within their remit. The project will build on work previously done within RIIO-GD2.

There are many uncertainties around the future role of gas networks. This work will take a high-level look at the opportunities each area offers and detail the prospects for each asset base. The work will build on previous areas of work that have looked at the repurposing of infrastructure for alternative use cases.

This is intended to provide the best options for customers, specific to the areas they live in.

### 3.6 Supporting customers through energy transition

We are proposing a bespoke performance commitment to build a research hub focused on the decarbonisation of homes and the built environment on our existing NeRV research site at Low Thornley. The research hub will be called the Net Zero Research Village (NeRV) Centre. The construction of the NeRV Centre will transform the site at Low Thornley into a leading research and demonstration campus; the UK's first combined whole systems research, development and demonstration facility covering gas, electricity and water.

Further details and costings of this request can be found in the NeRV Centre Engineering Justification Paper. The funding request outlined in this submission will be used to:

1. Complete the detailed engineering design of the NeRV Centre;
2. Procure and construct the NeRV Centre, and;
3. Operate the NeRV Centre and surrounding Low Thornley Campus throughout the RIIO-GD3 period.

#### CASE STUDY: NERV CENTRE

The overarching benefit of the NeRV Centre project is that it will enable the existing Low Thornley campus to accelerate the decarbonisation of UK homes and buildings. This will be achieved through the provision of individual property and whole energy system insights, which can be used to inform policymakers and decision makers across the local, regional and national spectrum. Energy consumers and households will also be direct beneficiaries of the research and innovation outputs of the NeRV Centre, in the form of improved energy policy, products and real-world insights into the effectiveness of low carbon technologies. The NeRV Centre is strongly aligned to our RIIO-GD3 Innovation Themes IT2, IT4 and IT6.

### 3.7 How our focus areas will be delivered – BAU

Alongside the NIA funding, we will use TOTEX funding, along with other third-party funding, and continue to adopt innovations and learnings from other GDNs, energy businesses and our supply chain.

The outcomes we are seeking to deliver with this funding are:

- reductions in the impact of network activities on all stakeholders through the development of solutions that reduce the time that our customers are exposed to disruption and inconvenience
- increased use of real-time data to create streamlined digitised delivery models and utilisation of artificial intelligence to transform the service we offer to our customers
- operational practices that utilise cutting-edge safety and environmental practice.

Our successful innovations during the last price control period allow us to continue to invest in innovation. We recognise that a commitment to continuous improvement and innovation is fundamental to a sustainable business that can continue to deliver value for our customers.

In RIIO-GD3, we will seek to leverage funding from a broader range of sources to reduce our reliance on regulatory funding streams. We will publish details of funding opportunities, to allow suppliers and partners to collaborate and co-fund proposals. We will continue to innovate to further develop industry best practice techniques and other solutions that can minimise the impact of network activities on local communities.

We believe that our supply chain and project partners are well placed to take more of the risk of innovation – either by committing time to projects or by providing additional funding. We are in a unique position to help them test and develop cutting-edge products and to provide them with a clear route to market. As such, we would expect them to undertake more of the conceptual development of new products and technologies themselves.

As part of our engagement with stakeholders, specifically our supply chain partners, we will undertake regular horizon scanning exercises to ensure that we keep informed of new and emerging technologies. We test the market for both new and existing technologies directly with our existing supply chain network but also with the EIC. We will continue to work with the EIC's "Call for innovation" process to launch challenges with the 10,000 strong global SME innovator community. We are the most active UK GDN using this community. In RIIO-GD3 we will continue with our current approach.

In collaboration with other EIC Partners, we have developed a BAU Readiness Framework that includes 14 key "BAU Readiness Indicators" (see overview in [Innovation deployment guidance](#)). These indicators are assessed at the project's start and throughout its lifecycle to ensure that innovations are rolled out successfully. Developed using the EIC Partnership's extensive project experience, the framework was co-created with multiple innovators and validated beyond the energy sector by water companies.

Additionally, a "Deployment Ready Hub" is currently under development to facilitate "fast follow" and to accelerate the adoption of innovation in the sector (beta version available; industry release date expected Q1 2025). The aim is to increase visibility and provide easy access to innovations that are ready for deployment, already deployed, or in the process of being deployed in the energy and other sectors.

We understand that the supply chain is often best placed to advise us of what challenges the industry is facing on a global scale. We intend to focus on developing these strategic relationships in RIIO-GD3 as this provides opportunities for NGN and the supply chain to actively engage and co-fund the innovative development and subsequent testing to ensure that risk is shared and that any final solution developed is suitable for use in the UK industry and therefore relevant for all UK GDNs.

We believe that it is our role to provide a clear route to market for technology and to provide innovation providers with confidence of success. We would, therefore, expect them to undertake more of the conceptual development of new products and technologies themselves.

We plan to build upon existing stakeholder engagement and explore opportunities with other stakeholders for aligning with existing models of innovation funding. We would expect this funding to be for academic research.

We will concentrate on projects that are at a more mature stage of development and see both the supply chain and Totex allowance used to support development across the whole process, from initial idea to the customer's front door.

In RIIO-GD3, we will seek to leverage greater innovation funding from other third-party sources such as Innovate UK grants, academia and the supply chain.

### 3.7.1 Digitalisation

As is evident throughout this strategy, digitalisation is the golden thread that flows through all of our plans in RIIO-GD3. The development of our Customer Vulnerability Mapping Tool during RIIO-GD2 highlighted how diverse and multifunctional the tool could become with the correct funding. Therefore, we intend to continue to invest to improve the functionality of the tool and expand its application to the wider business.

#### CASE STUDY: UTILISING OPEN MAPS WITH AI

Greater use of open maps will facilitate collaboration with other networks to inform the decision-making and ensure not only that the open maps give the best representation of the data sets available but also that they are available for use.

This is intended to provide more targeted help for CIVS and will also enable customers to be more represented while engaging with networks.

Other areas of proposed investment for RIIO-GD3 include:

- expanding our Open Data Portal to include an API library and a smart visualisation interface
- exploring the potential for an automated data triage process using conversational AI
- control room enhancements, preparing for the future energy system

### 3.8 Customer and stakeholder acceptability of the Innovation Strategy

We have tested our Innovation Strategy with both our customers and stakeholders and received an overall acceptance score of 76%. Further information on our approach to RIIO-GD3 customer and stakeholder engagement can be found in Chapter 2 of our main business plan.

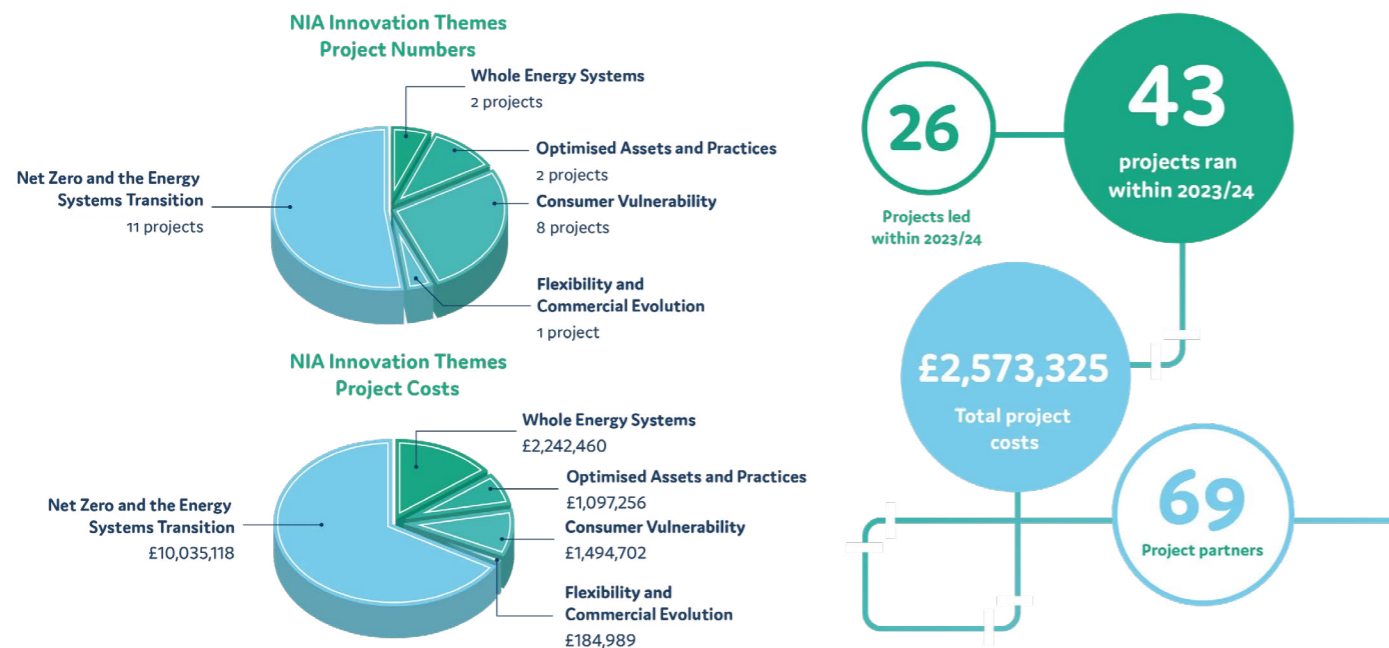
## 4 Reporting and dissemination on the impacts of our innovation

The challenge of accurately measuring the impact and value of an innovation project is complex. In recent years we have worked with the EIC and other GDNs and DNOs to develop a collaborative, industry-wide Economic Value framework to report on the outputs and outcomes of innovation. The framework enables comparable review. In RIIO-GD3 we understand that clear and detailed reporting of the return on investment is required. Additionally, where projects have proved to be successful and have been deployed into BAU, we will report on performance against the cost of investment.

Alongside the Economic Value framework and ahead of RIIO-GD3, we plan to conduct a full market review of leading cost benefit assessment models which will enable accurate recording of financial benefits, especially for the riskier, low TRL, research and development-type innovation projects, where defining benefits has typically been a challenge. We are also working closely with our Customer Vulnerability team to look at ways of incorporating the established Social Return on Investment model to our customer-related innovation projects to ensure we report in a consistent and formalised manner.

The benefits derived from our portfolio of projects will form part of a wider dashboard reporting tool which will be shared with the wider business and our Independent Stakeholder Group to enable trend analysis and allow clear visualisation of our successes and learnings.

Figure 5: Innovation Dashboard



Externally, we will continue to report our progress in an annual summary report, project completion reports, the FEN Smarter Networks Portal and at annual industry conferences.

## 5 Conclusion

In collaboration with colleagues, customers and stakeholders, we have developed our innovation strategy as part of our five-year business plan for RIIO-GD3, with emphasis on how we can continue to decarbonise the sector to achieve net zero and support more customers in vulnerable circumstances.

We are focussing on five core workstreams:

- **Whole energy systems**, for example, looking at how we can support a fair transition to alternative energy supply
- **Sustainable communities**, which will involve working closely with local communities and local authorities to identify and develop the plans and technologies required to deliver a fair transition
- **Customer vulnerability**, for example, exploring how we can support our customers with specific needs and how we can use emerging technologies to improve our services to them
- **Repurposing of our gas network** safely and effectively to support the transition to alternative energy supplies e.g. hydrogen
- **Adoption of advanced technology**, leaving behind more traditional methods to achieve better business results and customer benefits, for example, using AI and Machine Learning to simplify data collection and analysis

We have a strong track record of taking large-scale innovation projects and products from ideation to completion, transforming how our industry behaves and operates. Many of these projects began with SIF, NIA and UILOI funding, and we are always eager to partner with other businesses and SMEs to create innovative solutions and products that will shape the future of the energy market.

Each innovation project is inspired by Ofgem's push for efficiency and the need to provide evidence for better, safer services. We have enhanced our operational capabilities, further integrated innovation into our business, and shifted away from the conventional operational efficiency and gas innovation projects. Our focus for this next period is on future-orientated data and digitisation projects, ensuring that all customers, especially those in vulnerable situations, are supported as we start to transition to a new energy system.

## Appendix One: Proposed innovation projects by theme

### Appendix One: RIIO-GD3 Innovation Project Delivery Themes

Customer Vulnerability	
Innovation Projects IT1 £2.3m	Innovation Projects IT2 £1.6m
<ul style="list-style-type: none"> <li>Engage with domestic and residential customers to understand their drivers and support needs as we work to optimise energy throughout the next price control period.</li> <li>Engage with Industrial and Commercial customers to understand their drivers and support needs as we work to optimise energy throughout the next price control period.</li> <li>Explore customer understanding of energy systems transition options, and identify any preconceptions in relation to heating systems, controls, and fabric improvement.</li> <li>Boiler flue suitability assessment, potentially offering a bespoke solution enabling customers to decarbonise boiler emissions at source through innovative and novel solutions.</li> <li>Digital Exclusion work to understand the digital divide and how innovation can help close or bridge this either through research and development, or engagement activities with customers, communities, and 3rd sector organisations.</li> </ul>	<ul style="list-style-type: none"> <li>Improving customer outcomes to maintain or improve health and wellbeing within homes and properties.</li> <li>Supporting CIVS with energy / home efficiency measures, which could be practical or advisory in nature.</li> <li>Energy systems area suitability project, understand the specific needs and of customers and communities as we journey towards net zero.</li> <li>Innovate support provisions for customers who may have complex needs during future extreme weather events and understand the varying issues that vulnerable customers and communities will face, and how these risks can be reduced or removed for our customers.</li> </ul>

Digitalisation £1.2m
Innovation Projects IT6
<ul style="list-style-type: none"> <li>Development of a systematic approach to creating AI bots that enhance situational awareness and support decision-making through sensor analysis. The activity will ensure that the bots are effective, reliable, and aligned with user needs.</li> <li>Development of new site telemetry systems will lead to enhanced management and control, streamlined information flows, and significant cost reductions, ultimately improving overall operational efficiency.</li> <li>Develop integration opportunities with an electricity management centre to facilitate data sharing and knowledge exchange to enhance operational efficiency and decision-making leading to a more resilient energy infrastructure.</li> <li>Developing a multi-fuel connection framework that integrates data, telemetry, and control requirements across gas and electricity involves a structured approach to ensure efficiency and cost-effectiveness.</li> <li>Integrating AI and machine learning into energy management systems, particularly for forecasting and low-pressure management, to significantly enhance operational efficiency, resilience, and situational awareness.</li> <li>Development of advanced systems to support emergency response at a sub-local distribution zone (LDZ) level across multi-gas systems which integrate real-time data, predictive analytics, and robust communication protocols.</li> </ul>

Energy Systems Transition		
Innovation Projects IT3 £5.3m	Innovation Projects IT4 £3.5m	Innovation Projects IT5 £1.6m
<ul style="list-style-type: none"> <li>Develop a commercial scale offer to understand the role of electricity and gas to decarbonisation and what information is required to manage the service. Test bed for commercial scale H2, H2Hybrid systems.</li> <li>Cross connectivity to Power systems to aid the transition to a net zero energy landscape for the UK.</li> <li>Understanding the future control room, what will their role be throughout the energy systems transition and how will they need to adapt when more embedded generation comes onto the network.</li> <li>Supporting DNOs with flexibility management through the electricity grid, reviewing the options and capabilities GDNs may have to assist.</li> <li>Further understanding of GDNs role for hydrogen in the transport sector and how their pipelines can be utilised to drive the cost of hydrogen down.</li> <li>Development of new standby generator solutions for remote working e.g. battery and fuel cell systems.</li> <li>Development of portable, rapid install digital monitoring equipment to support network operations now and during transition.</li> <li>Development of systems to better understand customer connections to identify what equipment sits beyond the meter and determine impact from multi-fuel blends.</li> <li>Understanding fuel cell technology and the role they can play to support DNOs minimise grid capacity issues.</li> </ul>	<ul style="list-style-type: none"> <li>Collaboration with local authorities, academia, and wider stakeholders in researching how domestic and non-domestic customers may transition to net zero at a dwelling, street, and upper tier distribution level. Assessment of consumer journeys in various future energy scenarios which will be essential in people-centric energy planning such that nobody gets disadvantaged or left behind in the journey to Net Zero.</li> <li>Understand the feasibility of developing a valve sectorization plan and increasing the pressure monitoring capabilities on the network.</li> <li>Future billing methodology and models, the increase of telemetry on the network will help with the measurement of Calorific Value for biomethane and hydrogen. Reducing the requirement to propanoate the fuel.</li> <li>Enabling the reduction in the cost of connection e.g. for both bio methane and future H2 connections/blending.</li> </ul>	<ul style="list-style-type: none"> <li>Understand the regulatory modifications required for decommissioning and the impact on consumers.</li> <li>Further developing an understanding of the future opportunities for GDNs and how they might repurpose/optimize stranded assets progressing towards developing a trial.</li> <li>Understanding future disconnection and decommissioning needs of the network and assess impact across various customer sub-groups to enable a just transition. Monitoring interruption performance to better understand asset risks and conduct asset resilience surveys which we will use to inform our decommissioning strategy. This will help us assess the minimum viable network structure that needs to be in place to enable Net Zero and inform plans to remove obsolete equipment.</li> <li>Gap analysis from LTS Futures activity - projects looking at proving that certain assets can be used with hydrogen and any changes that would be required.</li> <li>Future requirements for policies and procedure updates suitable for deploying hydrogen within GDNs network.</li> <li>Further developing hydrogen blending capabilities, by enhancing the implementation efficiencies and detailing the training requirements for staff.</li> <li>Developing further understanding and enhancing the management and/or velocity of gas to reduce the impacts on shrinkage and leakage.</li> </ul>

