nationalgrid

Annex 09

RIIO-T3

Innovation Annex

National Grid Electricity Transmission's Business Plan

December 2024

Overview of this document

Purpose of this Annex

Our innovation strategy describes how our focus on innovation has benefited our consumers, customers, and communities. Innovation is integrated into our investments and plans. In this Annex, we highlight how we use stakeholder feedback to guide our innovation efforts and apply it in our delivery plans for a decarbonised energy system. We outline our four innovation priorities, developed with input from stakeholders and in collaboration with other networks, Ofgem, the Carbon Trust, and Innovate UK.

This Annex also describes the additional benefits we generate for consumers because of our position as part of the National Grid Group and through our shareholder-funded innovation arm, National Grid Partners.

How to navigate this Annex

The table below provides a short summary of each section and where information requested in the Business Plan Guidance has been provided.

Section	Detail	BPG reference[1]
1	**Executive summary**	3.9
2	**Context for innovation:** innovation and net zero	3.9
3	**Strategic approach to innovation across National Grid:** our Group-wide approach and our overarching framework	3.9
4	**Our RIIO-T2 innovation track record and rollout:** a snapshot of our realised and anticipated benefits from innovation	3.6
5	**Focus areas for RIIO-T3 innovation:** details our refreshed areas of focus for innovation	3.6, 3.7, 3.11, 3.12
6	**RIIO-T3 funding request:** our RIIO-T3 projects	3.13, 3.15
7	**How we will deliver our innovation plans:** our processes, governance and ecosystems	3.13
8	**Appendices**	3.8

Our RIIO-T3 Objectives and Commitments

Our plan is anchored around three ambitions, each underpinned by clear objectives, commitments, and success measures for the RIIO-T3 period. These allow us to target stretching levels of performance and track progress. The specific ambitions, objectives and commitments that are most relevant to this Annex are shown below:

Objectives of Our Plan		*Our Commitments: We will:*		*Success Measure / Target*
A4	Invest in the next generation of innovative technologies to make sure that we are planning and building a network that is ready for tomorrow	A4.1	‣ Embed successful innovation projects into our operations to reduce system costs for consumers and improve environmental outcomes	‣ 30 planned innovation projects will be integrated into day-to-day operations (both stimulus funded and through our business-wide approach to innovation). ‣ Maintain benefits ratio for innovation investment in excess of industry benchmark of 4:1
		A4.2	‣ Increase investment in the next generation of innovative technologies and maintain innovation spending in line with overall network growth	‣ Approximately £150M invested in innovation projects ‣ 10% of innovation spending NGET-funded ‣ Additional £46M per annum shareholder funded innovation via National Grid Partners

[1] These are the BPG requirements relevant to this Annex. These requirements may also be addressed in other business plan submission documents.

Contents

1. Executive summary

Innovation matters

Innovation at National Grid Electricity Transmission (NGET) underpins our ability to rapidly upgrade our network to the grid of tomorrow, and to decarbonise our electricity system in support of the government's Clean Power 2030 action plan.

Innovation underpins both what we do, and how we do it; from the way we model, develop and plan our network interventions and expansion, through to the optimisation, collaboration and scaled delivery of construction programmes as we deliver the Great Grid Upgrade.

How we invest in innovation

At NGET, our ability to innovate is enhanced through collaboration across an international group of organisations within the National Grid Group. This provides access to additional funding from our shareholders, collaboration and learning from different geographies and research into emerging technologies and advanced approaches.

National Grid Partners, which is the investment and innovation arm of National Grid, have invested over £360 million since 2018 in energy focused startups and emerging technologies that is helping to make our networks safer, cleaner and smarter. They have reviewed over 1,500 companies to identify credible innovations such as Pathfinder for automated transmission route planning and have enabled a further £2.35bn of innovation investment from other co-investors.

We have also invested millions into innovation, which has enabled us to be industry leading in areas such as building the UK's first SF_6 free substation and deliver the world's largest earth friendly concrete pour at our London Power Tunnels (LPT2) project.

Innovation stimulus funding has been used to drive specific investments that will accelerate the energy transition. In RIIO-T2, so far, we have invested £30m of innovation stimulus funding working with 66 project partners – over half of which are Small / Medium Enterprises. For every £1 spent on innovation work, we will create £52 of value potential for consumers.

Benefits from innovation

Across our innovation portfolio, we have delivered a range of successful projects that are deployed into our business, for example:

- Our Dynamic Line Rating (DLR) approach using a combination of BAU innovation funding through National Grid Partners, Totex, and innovation stimulus funding. LineVision was supported through shareholder funded investments and typically provides up to 8% additional capacity to circuits where it has been deployed. We have developed a weather-based ratings system using Network Innovation Allowance (NIA) funding which typically provides up to 4% additional capacity. We are also funding digital preparatory work for DLR. These combine into our 'NGET Atypical EJP T3 Enhanced Rating Strategy' to progress with rollout. In the last three years, £1.5m spent on enhanced services has resulted in a reduction of constraint costs and provided a consumer saving of over £150m. Most of these enhanced services have been enhanced ratings enabled by these projects.
- Our Smartwires technology trialled initially through innovation stimulus funding, and now funded through our business plans, has delivered 2GW of additional north-to-south power flow capacity.
- An SF_6 leak sealing solution funded through innovation stimulus has been rolled out across our business and saved 7,500 tonnes of CO_2 equivalent leaking into the atmosphere since deployment (this equates to nearly 2,000 cars off the road). This leak sealing approach has been disseminated to peer networks and another network has adopted this approach.

Our Innovation Strategy

Following a review in 2024 across the National Grid Group, we have developed our first group-wide innovation strategy. The strategy showcases how we can collectively be focused and effective with our innovation efforts to deliver greater impacts and benefits for consumers, stakeholders and environment.

Informed by our group strategy but built on consultation with our stakeholders and their priorities, we have developed four key focus areas for our innovation strategy in RIIO-T3:

- Build the future network
- Accelerate customer connections
- Enhance sustainability
- Improve resilience

Consumers have told us their biggest priorities are a reliable energy system, and long-term affordability of bills. To meet consumer needs and accelerate progress towards a net zero future, we will build on our innovation capability by focusing on:

- Deploying innovation at scale and integrating fully into our business
- Measuring the benefit of innovation deployment
- Building a culture of innovation across our organisation
- Searching for solutions and working with others to deliver net zero targets at pace
- Continuing to invest our own money through National Grid Partners

The value of our future innovation

Innovation funded through Totex and National Grid Partners investment

We plan to invest a minimum of £46m per annum on innovation in RIIO-T3 (outside of innovation stimulus funding). Our proposed innovation projects are focused on projects across our portfolio, which includes enabling the delivery of the Accelerated Strategic Transmission Investment (ASTI) projects and further schemes needed for the National Energy System Operator's (NESO) Clean Power 2030 plan. For example, we will leverage enhanced power system scenario modelling tools that we have built to evaluate the impact of any net zero scenario and develop optimised designs and plans for both the transmission network and distribution interfaces to help speed up customer connections.

We will also trial and roll out next generation conductors such as TS Conductor which provide the potential to increase network capacity in the face of growing demand. Additionally, TS conductor allows for shorter towers and wider spans for new build projects resulting in improved planning and consenting speed.

Given the scale of construction required on the transmission network, we have embedded innovation into our Great Grid Partnership. Leveraging the knowledge and capabilities of our partners, we are already developing and deploying low carbon construction techniques such as offsite manufacturing and novel methods of construction methods including Graphene Enhanced Concrete with a one-day curing time, compared with 28 days required for conventional concrete. These innovations have the potential to accelerate speed of delivery on construction projects for both connecting customers and the ASTI portfolio.

Pushing the boundaries through Innovation Stimulus funding

Our portfolio of proposed innovation stimulus funded projects for RIIO-T3 further extends our ambition to deliver necessary change at pace. We are proposing a total RIIO-T3 NIA funding pot of £150m (10% will be self-funded), which has been built from the bottom up, and half of this budget already consists of identified projects we have high confidence we want to deliver in RIIO-T3.

We are developing an early-stage concept of Ultra-High Voltage (UHV) transmission spines (the 'Ultra Grid') for Great Britain to help meet the bulk power transfer capabilities required for future renewable generation connections and demand growth beyond 2030, and to achieve net zero by 2050.

We also plan to explore a range of innovative cyber security practices and approaches, and for one of these proposed projects alone, through risk mitigation and reduced likelihood of cyber-attacks, we project a benefit to consumers of £10.4m across a 10-year period.

Conclusion

We have demonstrated that we fund innovation through a range of mechanisms and that this has resulted in innovation being deployed at scale and integrated fully into our business. Our innovation is benefits-driven and contributes towards Clean Power 2030 and net zero by 2050. We have set out an ambitious plan for innovation in RIIO-T3 and beyond, such as delivering the UK's 'ultra grid'. In this document we highlight case studies of deployed innovation, set out our RIIO-T3 plans and funding request, and outline our approach to deliver on our innovation ambition.

Our demonstrated approach to innovation through investment and collaborative partnerships will enable the decarbonisation of our energy system.

Innovation is integrated throughout our plan and our investments. This document explains how our innovation comes together and sets out our plan to invest a minimum of £46m per annum on innovation in RIIO-T3 (outside of innovation stimulus funding).

2. Context for innovation

To achieve the pace and scale required for the net zero transition, we need to do things differently, with innovation being at the forefront of this, and the scaling of innovation being more important than it ever has been.

The context for innovation in electricity transmission is the challenge to achieve zero carbon, secure and affordable energy supplies, and specifically the government's Clean Power 2030 ambition. To achieve this, the whole industry and energy networks must move faster in responding to the challenges.

Through the formation of the Mission Control for Clean Power, the government has identified four interlocking challenges: lowering energy bills, supporting jobs and industry, achieving energy security, and tackling the climate crisis. These four challenges complement both the Network Innovation Allowance (NIA) and Strategic Innovation Fund (SIF) innovation funding mechanisms and our BAU innovation. They set the stage for the reason why we need to innovate, and at pace.

The UK has ambitious plans for economic prosperity and growth, which can be accelerated through building the future transmission network and unlocking additional network capacity to allow industries and businesses to grow and scale. Speeding up connections to the network and enabling additional demand side capacity will be key for economic growth, and our innovation will target these areas of value.

In Annex A14: Cost Assessment and Benchmarking Approach Section 7, we also talk about the contribution we will make to economic growth with reference to Ofgem's new Growth Duty. This Duty ensures Ofgem considers the potential impact of their activities and decisions on economic growth for the wider UK economy, alongside or as part of their consideration of their other statutory duties. Innovation plays a core role in growth as we seek to continuously innovate our own operations.

We have UK based suppliers such as keen.ai, Rawwater, Createc and many more on our innovation projects and our funding has supported their growth. There is a strong link between the Growth Duty, pro-innovation regulation, and our ability to achieve an efficient cost base to benefit our consumers.

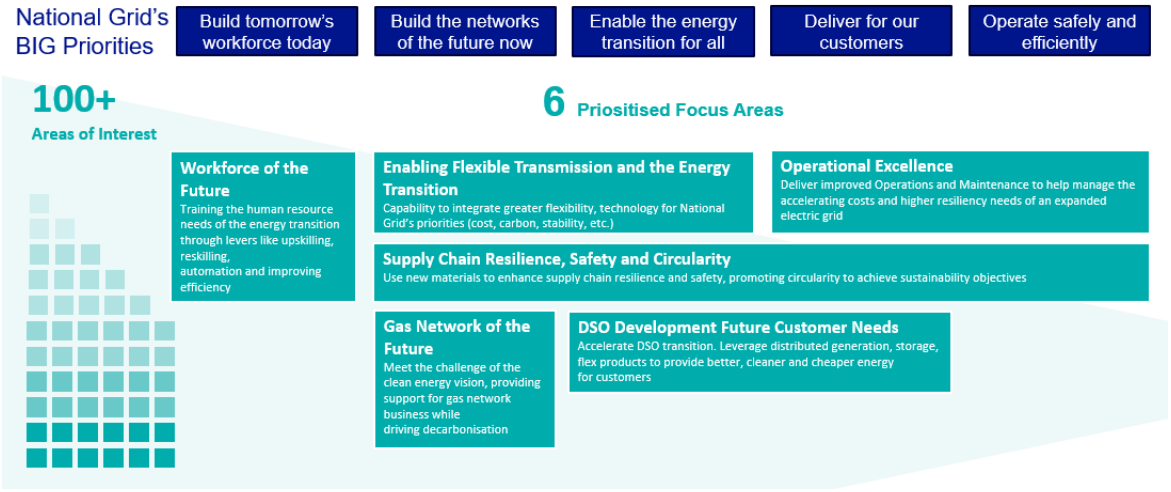
3. Strategic approach to innovation across National Grid

The original electricity transmission system was itself a pioneering and innovative development. Innovation has been part of its history since we connected the first integrated national grid in the world in 1935 and it threads through all we have done since. Innovation continues today in many shapes and sizes across all parts of our organisation.

In early 2024, innovation teams across National Grid Group came together to complete a review of how innovation is working at National Grid and to develop our first group-wide innovation strategy. Strategic direction was taken from National Grid Partners, NGET, National Grid Electricity Distribution (NGED) and IT & Digital innovation teams, National Grid Ventures, and innovation teams from our New York and New England jurisdictions in the US, as to how we can collectively be even more focused and effective with our innovation efforts to deliver greater benefits.

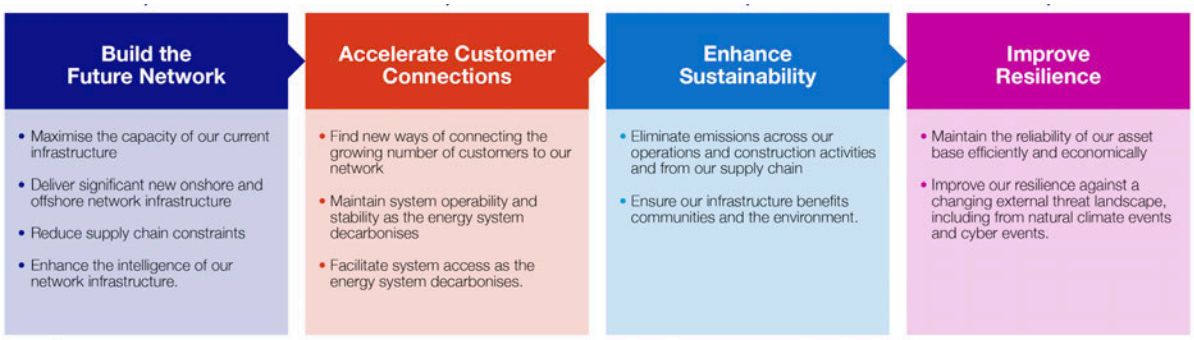
Research saw over 100 areas of innovation interest highlighted. Common themes were analysed to produce the following group-wide innovation focus areas.

Figure 1: National Grid group-wide innovation strategy focus areas



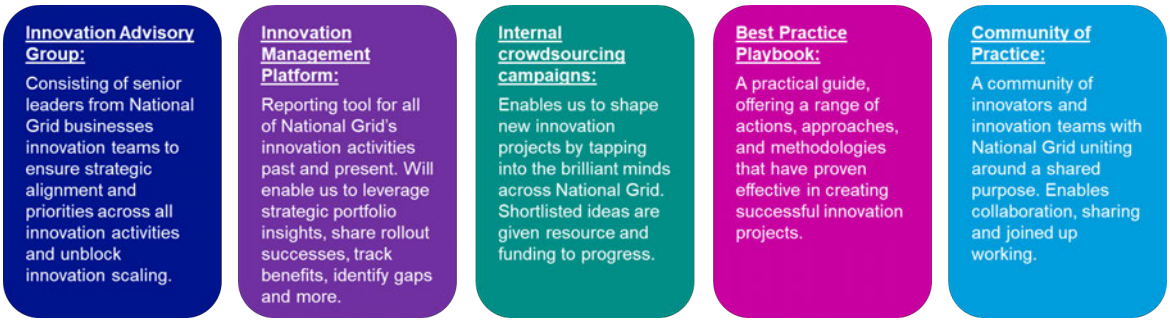
The National Grid Group Innovation Strategy sets an overarching framework and set of strategic priorities, providing the context for each of our operating businesses to develop their own, more bespoke innovation strategies. Over the course of this year, we have been engaging with our stakeholders to refresh our innovation strategy. This strategy is woven throughout our RIIO-T3 plan and is summarised below.

Figure 2: Focus areas from our updated 2025 Innovation Strategy



We also have the following mechanisms in place to support a more innovative culture at National Grid that values successes, learns from failures, and builds a supportive innovation community, with clear accountability.

Figure 3: Innovation collaboration mechanisms across our group



We believe the above will be enablers for innovation culture across our group and demonstrates our approach for collaborative and coordinated innovation.

We fund our innovation through a range of mechanisms, and in a coordinated manner. Throughout this document, when we refer to innovation funded or delivered by shareholder investments or business plan / Totex funding, we class this as BAU innovation to address Sections 3.11 and 3.12 of the Business Plan Guidance. Innovation stimulus funded innovation refers to NIA and SIF to address Sections 3.13, 3.14 and 3.15 of the Business Plan Guidance.

How we fund innovation across our group broadly falls into the three categories below:

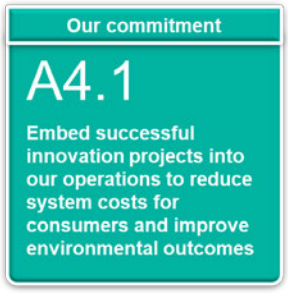
- Shareholder funded investments – led by National Grid Partners
- Business plan / Totex funded innovation – funded through regulatory price controls
- Innovation stimulus funded innovation in the UK - NIA, SIF, Network Innovation Competition

National Grid Partners portfolio companies, which they have invested in, will help us to design, build and operate our existing network and expand it faster and more affordably. As this is delivered as a group-wide activity, we can leverage benefits across all our transmission and distribution businesses in the UK and US.

Our business units in the UK and US deliver innovation funded through the business plan / Totex, for example on existing construction schemes or capital programmes, as well as delivering new digital capabilities. Further, we are developing an innovation heatmap to consider and prioritise innovation from early development through to construction and commissioning for our ASTI portfolio projects. We have opportunities to explore innovation through our Great Grid Partnership as well. In these long-term strategic contractual relationships, our partners will work collectively as an enterprise to drive value and innovation and secure delivery.

Innovation stimulus funding has helped us drive innovation on the UK transmission system with the bulk of innovation here focusing on achieving energy system transition. To date, we have showcased leading innovations and new approaches that we plan to leverage in RIIO-T3 to maximise value for the consumer and accelerate progress to net zero. Key examples include developing technology to fix leaking transformers much faster (2 days versus 2 months) which significantly reduces outage windows, and our drone projects which have helped influence a recent change by the Civil Aviation Authority (CAA) to allow drones to fly Beyond Visual Line of Sight (BVLOS) for infrastructure inspections of overhead lines.

4. Our RIIO-T2 innovation track record and rollout



Across our transmission business, we have numerous examples of delivering impactful innovation throughout RIIO-T2. We have used this section to callout our highlights and key case studies, more case studies for RIIO-T2 track record can be found in Appendix A.

The table below provides a summary of realised and anticipated benefits for a selection of our deployed or live innovation projects across a range of benefit areas such as increased network capacity and reduced carbon impact. These have been taken from cost benefit analysis and do not include all live projects or anticipated benefit for any late RIIO-T2 or RIIO-T3 projects, and therefore these benefit estimates will significantly increase as we deliver more innovation projects and rollout. The reason a selection is used is because it is often difficult to track the benefit of innovation. This is why we are committing to improved innovation benefit tracking in RIIO-T3 (see Section 7.5).

Table 1: Realised and expected benefits from a selection of our current innovation projects

Source / type of saving	Realised benefit	Future benefit
Constraint cost savings / additional capacity benefit	[redacted]	[redacted]
Net benefit from SF_6 / CO_2 savings	[redacted]	[redacted]
Asset operations cost efficiencies	[redacted]	[redacted]

4.1 National Grid Partners (shareholder funded) track record – BAU innovation

LineVision (Dynamic Line Rating): A key decarbonisation challenge is expanding transmission capacity for renewable power. However, building new transmission lines is costly and time consuming. Transmission line capacity is currently based on conservative seasonal assumptions that include a large safety buffer. A line can safely carry more power if weather conditions are favourable. Technologies called Grid Enhancing Technologies (GETS) such as Dynamic Line Rating (DLR) offer significant scope to address these challenges and DLR has the potential to deliver large savings by scaling the successful trials we and NESO / Scottish TO's have delivered under the SOTO incentive.

LineVision offers non-contact transmission line monitoring technology, which is fast, easy, and safe to install, requires no line outages, and is capable of rapidly scaling. LineVision's sensor technology allows us to gain additional capacity vs static ratings[2]. Within the UK, we have already deployed LineVision trials, initially an 11 sensor trial on a circuit took place and this demonstrated a constraint cost saving on one of our boundaries of [redacted] in the first year of deployment. Following this success, we have expanded LineVision onto additional circuits near London, which has enabled an operating temperature enhancement that is projected to provide constraint cost savings of over [redacted] in 2024. We are proposing a nationwide approach to deploying these technologies where there is a clear consumer case, collaborating with NESO and the other transmission operators to deliver this.

Sensat: A "digital twin" technology that through imaging creates a detailed 3D image of real-world assets to within a few centimetres of accuracy. Planners can then manipulate and add objects to the 3D images to allow early planning and optioneering before manual site surveys are required. At present, this technology has been rolled out within our customer connections business unit and for strategic infrastructure ASTI schemes, with further rollouts being planned. The primary benefit demonstrated is time saved, in that a process that would take months previously in planning and design can now be completed in a few weeks with great certainty and accuracy.

[2] Ratings increase potential referenced here and in the Executive Summary are benchmarked to the National Grid UK conductor system and based on UK conditions.

Automated route planning: Aligned with *accelerating electricity transmission network deployment: Electricity Networks Commissioner's recommendations*[3], which suggested we implement Electricity Transmission Design Principles, we partnered with Swiss company Gilytics to implement an automated route planning tool (Pathfinder). This tool accelerates energy network expansion by using AI and data to quickly determine optimal powerline routes, increasing transparency for stakeholders. Traditionally, route planning was slow and manual, but Pathfinder provides rapid solutions and can be customised based on regulations. With its use, we significantly shorten project timelines, contributing to net zero goals and accelerated customer connections. Future improvements aim to enhance route planning by incorporating more complex parameters.

Luminance: An AI-driven tool designed to assist with legal processes, particularly for managing contracts. It allows non-legal teams to generate contracts, enhances negotiations by highlighting risks and missing clauses, and provides a chatbot for understanding contract terms without legal advice. It also analyses executed contracts to identify patterns, termination dates, and sections needing updates due to regulatory changes. Initially used by National Grid's procurement teams, Luminance is set for wider rollout with additional functionality planned.

4.2 Business plan funded track record – BAU innovation

London Power Tunnels 2 (LPT2) SF_6 free substation: The LPT2 project features a new SF_6-free substation at Bengeworth Road, using Hitachi's EconiQ 420 kV gas-insulated switchgear and lines. SF_6 is highly harmful to the environment, with a global warming potential 25,000 times greater than CO_2. The EconiQ gas (C4FN), used as a replacement, significantly reduces this impact. Bengeworth Road will be one of the UK's first SF_6-free 400kV substations, with forecast operational carbon savings of 12,663 tCO_2e. C4FN also has eco-friendly properties, decomposing naturally over 30 years without accumulating in ecosystems.

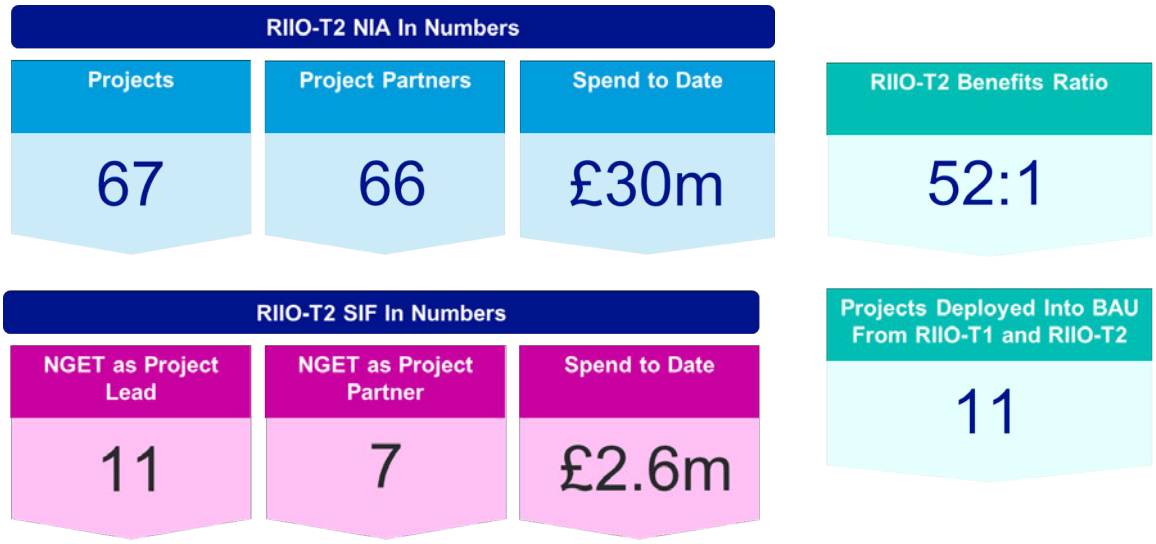
Neptune and Triton tools: Our Strategy and Innovation team developed two tools, Neptune and Triton, to support net zero goals. Neptune models the whole transmission system, assessing net zero scenarios and producing optimised network reinforcement plans. It helps visualise the network's future needs based on scenario impacts. Triton focuses on the interface between transmission and distribution systems, helping to design future networks by evaluating the need for reinforcing grid supply points or creating new ones. Triton is now used with distribution network operators to develop regional strategies for net zero. These tools support with unlocking additional network capacity, and additional optionality for how we plan, unlocking new ways to plan the future network.

4.3 Innovation stimulus funded track record

We received £54m NIA (£68.2m in 23-24 price base) funding for RIIO-T2. As of March 2024, we have 67 active NIA projects addressing challenges from our Innovation Strategy. Our RIIO-T2 innovation portfolio of projects spans 66 project partners from academia to technology providers and includes a wide and well distributed range of Technology Readiness Levels (TRL) levels with quantified benefits of 52x investment across the NIA portfolio. When these benefits are realised, they will benefit consumers through a range of project outcomes including cost savings, efficiencies, and reduced outages. We also have examples of NIA projects implemented into BAU which are already adding value. Figure 4 illustrates that our current RIIO-T2 benefit ratio is well above the industry benchmark of 4:1, and demonstrates additional metrics related to NIA and SIF from RIIO-T2.

[3] https://www.gov.uk/government/publications/accelerating-electricity-transmission-network-deployment-electricity-network-commissioners-recommendations

Figure 4: NIA and SIF highlights in numbers



In addition to examples already referenced in our Executive Summary, a further selection of our NIA innovation rollout successes and benefits are below:

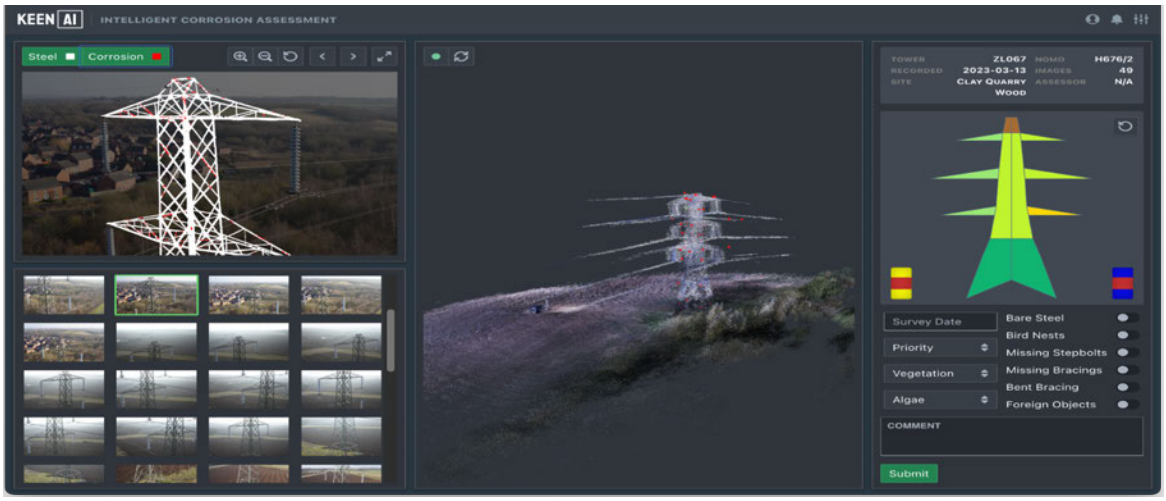
Automated Weather Alerts (AWA) (NIA2_NGET0005): AWA is our severe weather prediction and risk mitigation tool embedded within our transmission control centre. The initial rollout included weather event alerts for heavy rainfall, flooding and erosion risks to our substations and overhead lines. AWA improves network resilience and enables the control room to better manage and mitigate against incoming weather events (for example by highlighting assets most at risk from incoming weather and providing a risk rating for each asset to enable more advanced incident planning and management). Further climate resilience projects will be added into the AWA software increase capabilities for a wider range of weather events. For example, THERMAL (NIA2_NGET0054) will add and extreme heat alerts and risk management.

Voltage source converter based series controlled impedance technology (Smartwires) (NIA_NGET0017): Installed SmartValve modular power flow control (MPFC) technology at three substations in northern England to provide power flow control across five circuits, with further installations in planning for RIIO-T3. [redacted] is estimated to be saved over a seven year period due to reduced constraint costs and avoided expenditure on new infrastructure build, with over 2GW of north-south power flow capacity being unlocked. These installations are also easily expanded or relocated if network conditions change, avoiding stranded assets.

Figure 5: Smartwires deployed at a UK substation

Visual inspection and condition assessment of OHL tower steelwork (VICAP) (NIA2_NGET0009): This rollout includes the use of AI to identify corrosion on our towers and is integrated into our existing condition monitoring system. This project has enhanced condition assessment practice with capabilities such as autonomous drone flight 'Beyond Visual Line of Sight' (BVLOS) and artificial intelligence / machine learning driven automated image processing that enables us to inspect the network in an optimal, safe and resource efficient manner. This advancement will enable us to adopt efficient new asset management practices and offers a saving for consumers of [redacted] per annum.

Figure 6: An OHL tower digital twin from our VICAP project with marked up corrosion points completed by AI analysis



400kV Synthetic Ester Filled Transformers (NIA_NGET0080): Has led to us adopting synthetic ester in large power transformers. These types of transformers (identified by their blue colour) are installed across multiple substations and continue to be used where required. Lifetime savings for installing synthetic ester transformers as opposed to traditional mineral oil transformers are approx. [redacted] per transformer. We have 22 synthetic ester transformers either built or in active construction (9 deployed, 13 under construction) which equates to a [redacted] cost reduction and therefore consumer benefit. This benefit is in addition to wider benefits from synthetic ester transformers including: environmental benefit vs traditional mineral oil, reduced CO_2, reduced onsite footprint, predicted longer life for transformer, option to provide community heating from waste heat.

Figure 7: Synthetic ester transformer deployed at UK substation

5. Focus areas for RIIO-T3 innovation

Our commitment

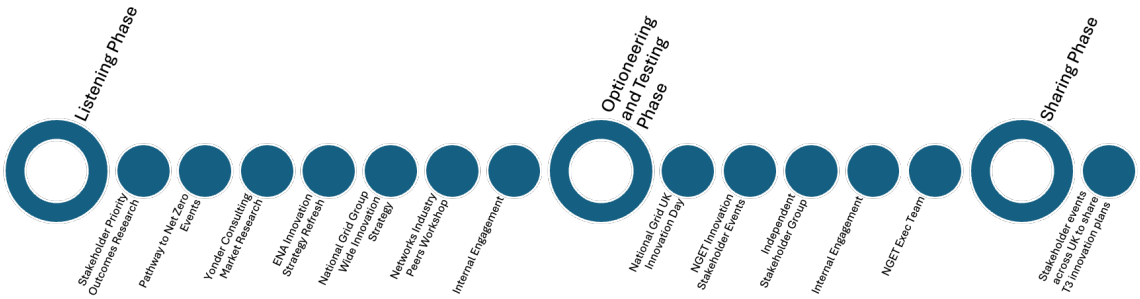
A4.2

Increase investment in the next generation of innovative technologies and maintain innovation spending in line with overall network growth

5.1 How stakeholder influence shaped our plans

We have undertaken stakeholder engagement for our RIIO-T3 innovation plan which started back in 2023. This research has shaped our plan and the identification of innovation focus areas. The timeline below highlights the steps and events we have undertaken to allow stakeholders to influence our innovation strategy and plans.

Figure 8: Our innovation strategy and planning stakeholder engagement timeline



There are 3 phases to our stakeholder research:

1. Listening phase – to seek and listen to feedback from stakeholders on a range of broad topics
2. Optioneering and testing phase – to share proposed plans for RIIO-T3, and our innovation strategy for feedback
3. Sharing phase – will be undertaken during 2025, to playback to stakeholders what has gone into our plan and how their feedback helped shape our plan.

We understand that we need to make connecting easier and faster, we need to build with the future in mind and we need to consider the vulnerable and the environment throughout our work.

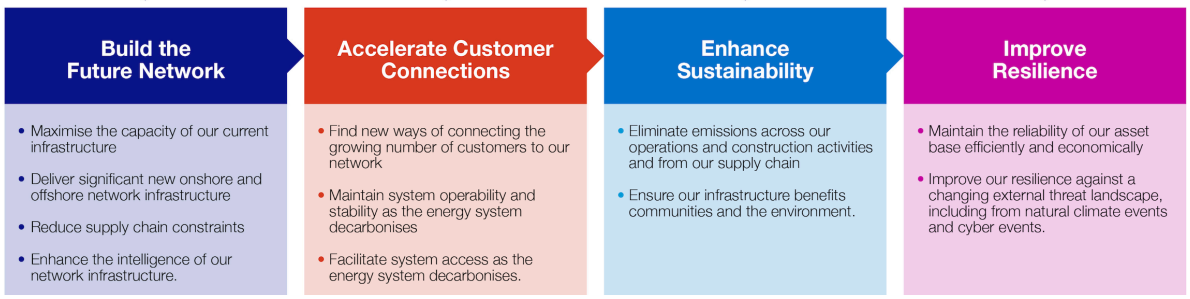
This has shaped our refreshed four innovation focus areas, ensuring they target activities that accelerate the UK's net zero goals, decarbonise our own operations, and positively impact communities. Stakeholders also told us we should spend more on innovation to reach ambitious net zero targets with pace.

Our consumer research showed us that minimising costs in the long term and reliability of network supply are top ranking priority outcomes. Consumers also want us to ensure that what we do today will not be obsolete in 5-10 years' time. Our innovation plan addresses these key areas, by ensuring our focus is on building a reliable future network (and building it right first time), and innovating to accelerate the energy transition, both of which will contribute to long term affordability of consumer bills. Appendix D details stakeholder events, feedback, research and polls.

5.2 RIIO-T3 focus areas

Our key focus areas for transmission innovation in RIIO-T3 and shown in Figure 9 below.

Figure 9: Focus areas from our updated 2025 Innovation Strategy



A particular focus is on technologies and systems that will enable us to achieve Clean Power 2030, and Net Zero 2050 – those that will help us design, build and operate the existing network and expand it faster, sustainably and more affordably. We also ensure that our NIA innovation projects align to the NIA eligibility criteria which will remain similar for RIIO-T3. Below we summarise how each of our refreshed innovation focus areas aligns to the NIA criteria.

5.2.1 Build the future network

Facilitating the energy system transition:

- Advanced infrastructure: Developing and deploying next-generation infrastructure that can handle increased loads from renewable sources, and electric vehicles.
- Faster development and build times: Helping to develop faster technologies and processes for delivering updated government targets.
- Smart grid technologies: Allowing for better management of energy, integrating renewable energy sources more effectively.

Benefiting consumers in vulnerable situations:

- Enhanced reliability: A future-ready network can reduce the risk of outages that can disproportionately affect vulnerable consumers, e.g. if they rely on electronic assistance.
- Affordable energy: Technological advancements can lead to efficiencies and cost savings that are passed on to consumers.
- Inclusive technology: Ensuring new technologies are designed to be accessible and beneficial to all, including those in vulnerable situations.

5.2.2 Accelerate customer connections

Facilitating the energy system transition:

- Quick integration of renewables: Accelerating connections for renewable energy sources helps increase the share of clean energy in the grid, driving the energy transition.
- Support for distributed energy resources: Faster customer connections can support the integration of distributed energy resources (DERs), such as rooftop solar and batteries.
- Scalability: Enabling rapid scaling of new, cleaner technologies across the network.

Benefiting consumers in vulnerable situations:

- Lower energy prices: Increased competition and supply from renewable sources can drive down energy prices, benefiting all consumers.
- Community projects: Faster connections can support community-based renewable energy projects, directly benefiting local and vulnerable communities.
- Job creation: Accelerated deployment of new energy projects can create jobs and economic opportunities in local communities.

5.2.3 Enhance sustainability

Facilitating the energy system transition:

- Environmental impact: A focus on sustainability ensures that the network's operations have minimal environmental impact, which is essential for long-term ecological health.
- Resource efficiency: Implementing sustainable practices in building and operating the network can lead to more efficient use of resources and lower carbon emissions.
- Long-term viability: A sustainable network is designed to be adaptable and resilient, supporting the energy transition over the long term.

Benefiting consumers in vulnerable situations:

- Health and environment: Reducing environmental impacts such as pollution and noise can improve health outcomes, particularly for vulnerable populations living in high-risk areas.
- Energy equity: Ensuring that the benefits of a sustainable network are accessible to all consumers, through inclusive policies and practices.
- Cost savings: Sustainable practices often lead to cost savings that can be passed on to consumers, reducing energy bills for vulnerable households.

5.2.4 Improve resilience

Facilitating the energy system transition:

- Adaptability: A resilient network can adapt to the challenges posed by increased renewable energy integration, ensuring a stable supply.
- Disaster preparedness: Enhancing the network's resilience to extreme weather events, which are becoming more frequent, supports continuous energy supply.
- Cybersecurity: Protecting the network against cyber threats is crucial as the energy system becomes more digital and interconnected.

Benefiting consumers in vulnerable situations:

- Reliable service: Ensuring a resilient network means fewer disruptions in service, which is critical for vulnerable consumers who may not have alternative energy sources.
- Protection from extreme events: A network resilient to extreme weather and other disruptions can better protect all consumers from prolonged outages.
- Support systems: A resilient network can better support emergency services and critical infrastructure that serve vulnerable populations.

In summary, each of these four innovation focus areas aligns with the criteria of facilitating the energy system transition and benefiting consumers in vulnerable situations by enhancing reliability, integrating renewable energy, ensuring sustainability, and promoting equitable access to energy resources. We will continue to build our innovation portfolio of projects aligned to the NIA criteria and to our four innovation focus areas.

5.3 Live innovation projects that are planned for RIIO-T3 rollout

We have identified 30 projects that are either already live or in development that will be deployed into day-to-day operations in RIIO-T3 (both stimulus funded and through our business wide approach to innovation). We showcase a selection of live innovation projects that are being scaled for rollout within RIIO-T3 below. Additional case studies for RIIO-T3 rollout are in Appendix A.

5.3.1 National Grid Partners (shareholder funded) planned rollout – BAU innovation

TS Conductor (next generation conductors): is a direct contributor towards Clean Power 2030. We know as we look to 2050 that demand will at least double, and so as we reconductor lines (and build new lines) there is a case to use next gen conductors that can unlock additional capacity and power transfer capabilities. TS conductor is one such next generation conductor, one of the portfolio companies that National Grid Partners has invested shareholder money into to develop the technology. Our baseline plan and EJP's for reconductoring are currently based on known / proven conductors but if (as we hope) TS conductor proves effective, we would want to have the flexibility to be able to change to TS conductor and will be seeking a mechanism to allow for this. TS conductor now has type registration (formally tested and approved for use on the transmission network) and we plan to quicky install and pilot them on transmission towers (L2) so we can understand cost and performance.

Figure 10: Spools of next generation TS Conductor

5.3.2 Totex funded planned rollout – BAU innovation

Intelligent substations: Improving substation data availability and accessibility to open opportunities in the future including automation of processes, and remote access to data. Designing and implementing more intelligent substations in RIIO-T3 will allow us to reduce time / effort for certain tasks i.e. reduction of callouts by providing remote access to key substation data. It will improve data to support timely decisions, enabling predictive / preventative maintenance based on enriched asset data. Intelligent substations will also reduce build time for Protection and Control (P&C) and simplify drawings and commissioning times (new builds).

Low carbon construction: We will be focusing on the rollout of known and proven carbon reduction initiatives such as low-carbon concrete, low-carbon steel, alternatives to diesel etc within RIIO-T3, and much of this will build on existing research from our NIA portfolio into these technologies and whether they are applicable for use within our construction activities. This is linked to our Low Carbon Construction EJP[4] and the outputs of this work will allow up to 100% use of low carbon concrete and up to 50% use of low carbon steel on our RIIO-T3 construction. It will also deliver low carbon opportunities - providing certainty to the supply chain on decarbonisation while giving a pathway to market for outputs of innovation investments. We anticipate 30-40% carbon savings across the portfolio compared to using traditional construction materials.

5.3.3 Innovation stimulus funded planned rollout

Retro-insulated cross arms (RICA): One of our live SIF projects and a direct contributor towards Clean Power 2030 – RICA offers the opportunity to upgrade the capability of the existing system, using routes and assets that are already in place. Retrofitting standard metallic cross arms on transmission towers with insulated cross arms to allow voltage uprating on existing towers. RICAs can boost network capacity without new OHL builds, upgrading existing transmission from 275kV to 400kV, increasing capacity by over 40%. This reduces steel and concrete use for new OHLs, potentially cutting carbon emissions by 30% by 2050, could improve the speed of connection of renewable generation, help lower constraint cost, and would enable routes with lower losses.

Sprayed Metal for Effecting Leaking Transformer Repairs (SMELTER): A novel spray and application method using a robot to seal transformer leaks. We have seen mineral oil leaks rise from 250,000 to 700,000 litres per year. This novel solution reduces the time to repair leaks from approx. two months down to two days with a primary benefit of maximising network capacity by reducing maintenance outages. The estimated benefit is [redacted] consumer savings over 20 years. Note the first successful trial deployment of this leak seal on our network took place in November 2024 with further rollout planned.

5.4 Stimulus funded innovation projects we plan to develop in RIIO-T3

For RIIO-T3, we outline below our plans and ambitions for each of our Innovation Strategy focus areas. We highlight key projects / innovation problem statements for each area that we have a high confidence we will undertake using NIA funding within RIIO-T3. Refer to Appendix 8.3 for a full list of proposed RIIO-T3 NIA projects aligning to each focus area.

5.4.1 Build the future network plans

Outcomes:

- Maximise the capacity of our current infrastructure
- Deliver significant new onshore and offshore network infrastructure
- Reduce supply chain constraints
- Enhance the intelligence of our network infrastructure

Innovation in this area is crucial for achieving Clean Power 2030 and Net Zero 2050 targets and will focus largely on the technologies that will help us achieve these goals, such as grid enhancing technologies, ultra-high voltage, superconductors etc. In addition to these core focus areas, we also need to innovate to ensure the future network that we build remains stable, and that we can

[4] NGET_Atypical_EJP_UIOLI Provision for Emerging Low Carbon Opportunities

manage and control the network in smart and digital ways. Challenges that innovation can solve also lie in how we plan, optimise and maintain a growing asset base with critical national importance. Example projects or problem statements identified for RIIO-T3 within this focus area are:

Superconductors:

Our T3 focus will primarily be around understanding the best routes for system integration and demonstration of the feasibility in large scale system integration (primarily paired with HVDC systems). Superconductors can provide increased network capacity, lower losses, reduced environmental impact, reduced consenting lead times, reduced overall cost vs conventional cables and increased protection against extreme weather.

ACDC integration and monitoring:

Our Holistic Network Design (HND) solutions indicate increasing deployment of high voltage direct current (HVDC) technology in both offshore wind connections and transmission network reinforcement requiring integration to the AC and DC network. Innovation is required to develop suitable models for analysis, understand the risks, identify the right technologies and control requirements to be deployed in the GB network.

Intercompatible cable repair 2:

Scaling the T2 iCARE proof of concept project via a full-scale demonstrator of the new underground HV cable repair technique, ensuring the solution is deployment ready. The solution will improve cable repair times from weeks to 3 days therefore reducing constraint costs and directly reducing consumer costs. Additionally, the deployment will reduce T3 cable repair costs by up to £3m.

Ultra-high voltage DC ultra grid plans:
The Beyond 2030 National Blueprint published in March 2030 by ESO, the Holistic Network Design (HND) and Holistic Network Design Follow-Up Exercise (HNDFUE) recommend a 5x increase in onshore power transfer capability. Our proposed UHV DC spine could deliver up to 10GW per circuit over a much greater distance than the equivalent 400kV AC circuits. We are working across BAU innovation and innovation stimulus funding on this concept. We will be further developing our existing NIA work, for example by focusing on detailed compact UHV tower designs and locations for deployment. Our appraisal indicates UHV would need to be substantially delivered by 2035 to materialise the greatest benefits to meet bulk power transfer capabilities required for future renewable generation connections and demand growth.

Ultra grid benefits:

Potential of up to 40% reduction in route length, resulting in less transmission lines.

Billions of pounds in capital investment savings which will reduce cost impact on consumers compared to traditional 400kV AC reinforcements. This is due to higher transmission capacity of UHV DC over longer distances.

Reduced impact on communities and the environment due to fewer grid reinforcement projects.

The phased and extendable design would offer the capability to manage uncertainty in future generation and demand growth and location, to ensure value to present and future consumers.

5.4.2 Accelerate customer connection plans

Outcomes:

- Find new ways of connecting the growing number of customers to our network
- Maintain system operability and stability as the energy system decarbonises
- Facilitate system access as the energy system decarbonises

In today's rapidly evolving energy landscape, accelerating customer connections in electricity transmission is critical to driving innovation and enabling a more sustainable future. As demand for clean energy grows and technologies such as electric vehicles and smart grids become integral to everyday life, efficient and timely access to the power grid is essential. However, this acceleration faces challenges, including infrastructure limitations, large connection queues, regulatory complexities, and the need for enhanced grid resilience. Innovation technologies that accelerate the connections queue are essential for decarbonisation and particularly Clean Power 2030. We outline example projects or problem statements identified for RIIO-T3 within this focus area as follows:

Dynamic System Rating:

Integrate different types of Grid Enhancing Technologies such as Dynamic Line Rating, weather rating systems and power flow controllers under one platform to enable 'real' dynamic system rating and provide congestion relief on the network. This project has the potential to enable a £98m constraint cost saving over 10 years on the B6 boundary where this project is initially focusing. The benefit will increase with further T3 rollout.

Dynamic Line Rating – drone installation:

One of the challenges for installation of existing DLR sensors on our towers is that outages are required for many of the providers. We will explore the innovative approach of using drones to install DLR sensors on our towers or conductors whilst they are live. This removes the need for costly, and disruptive outages and accelerates deployment of DLR.

Data centres:

We need to reevaluate the impact that data centre connections have on network infrastructure. Examples of key areas of research that we intend to undertake and will help us to better manage the connection of data centres are: incentivising data centres to explore load shifting strategies, correct siting of data centres, ramping up data centres to allow them to launch at a fraction of full energy capacity.

5.4.3 Enhance sustainability plans

Outcomes:

- Eliminate emissions across our operations, construction activities and from our supply chain
- Ensure our infrastructure benefits communities and the environment

Building a sustainable electricity transmission network is crucial to supporting the global transition towards cleaner, greener energy sources. The unprecedented scale of growth in transmission construction means we also need to look at new and innovative methods for ensuring we build the future network in a sustainable way and operate the existing and future network sustainably.

More detail is provided within Annex A01: Environmental Action Plan around our performance and vision for a sustainable network, including references to innovation which is playing a core role in achieving this vision. Key sustainability innovation focus areas are net zero construction and reducing our operating emissions i.e. SF_6 leaks and alternatives. For example, concrete accounts

for 8% of global CO_2 emissions and as a concrete user, we are a direct contributor to emissions. Approximately 250-500 kilo tonnes of concrete were used in RIIO-T1 construction, which equates to approximately 150-300 kilo tonnes of CO_2 emissions. Another focus area is vulnerable consumers and ensuring our work provides community benefit. Our Community Benefit Framework EJP[5] provides more detail around our business-as-usual plans and commitments to support vulnerable consumers. Our innovation team will continue to work closely with internal teams and external stakeholders to support and drive vulnerable consumer innovations into business-as-usual operations. Example projects or problem statements identified for RIIO-T3 within this focus area are:

Graphene enhanced concrete:

Scale graphene enhanced concrete to deployment ready for construction projects. This novel concrete is 30% lighter, cures in 1 day, and has higher crack resistance compared to conventional concrete. It uses recycled plastics and requires no water. If applied to 24 UK substations, it could reduce concrete volume and CO_2 emissions by 25%. It will enable us to accelerate build times and customer connections.

Graphene for sealing SF_6 leaks:

We plan to explore new approaches and technologies for sealing SF_6 leaks of different sizes to the ones we have already developed BAU innovation solutions for. One such technology is graphene tape and spray which may prove promising for sealing certain SF_6 leaks.

Vulnerable consumer future needs:

Exploring the use of AI and machine learning to predict vulnerable consumer needs, which could automate and speed up our ability to support vulnerable consumers across networks and help signpost appropriate interventions offered by our partners.

5.4.4 Improve Resilience Plans

Outcomes:

- Maintain the reliability of our asset base efficiently and economically
- Improve our resilience against a changing external threat landscape, including from natural climate events and cyber events

Improving the resilience of the electricity transmission network is essential to ensuring a reliable and secure energy supply in the face of growing challenges. With the increasing frequency of extreme weather events, cyber threats, and fluctuating energy demand, a robust transmission system is crucial to minimising disruptions and maintaining grid stability.

Enhancing resilience involves upgrading infrastructure, deploying advanced technologies, and improving response strategies to swiftly recover from outages. By strengthening the network's ability to withstand and adapt to unforeseen events, we can safeguard the continuity of energy supply and support a more reliable and sustainable energy future.

Example projects or problem statements identified for RIIO-T3 within this focus area are set out below.

[5] NGET_Atypical_EJP_Community Benefit Framework

5.4.5 Strategic Innovation Fund

We have 8 active SIF projects across various stages and spanning a range of topics from network resilience to SF_6 to HVDC networks. Of which, we are leading on four and the other four we are partnering on. In RIIO-T3 we will continue to fully engage with SIF alongside a flexible funding allowance to deliver on our innovation ambition. We are using both mechanisms in a joined-up approach, one example of this being our superconductor projects. We developed clear goals and a roadmap for our superconductor programme working across industry with suppliers, academia, networks, UKRI etc. We identified we needed to clarify the market, use cases, benefits, and routes to BAU. This has led to us undertaking parallel superconductor projects, one funded by NIA focusing on R&D around the market, use cases and cost benefit and the other funded by SIF Alpha focusing on the required changes and updates to standards for superconductor projects. We then intend to pool these project outputs together for a SIF Beta submission, which will focus on technical demonstration and pilot testing for the identified use cases and a route to BAU clearly in place. We will continue to plan and execute in a joined-up approach like our superconductor programme as we move into RIIO-T3.

Cyber informed engineering:

Examine engineering consequences that a sophisticated cyber attacker could achieve and drive innovative engineering changes that provide mitigations to limit or eliminate those consequences. Making changes upfront driven by this project in the design of large infrastructure could significantly reduce the consequence of a cyber-attack and the lifetime cost of implementing security controls.

Cyber security – Gen AI:

Cybercriminals are actively exploiting the power of GenAI to improve the efficiency and efficacy of attacks and create malicious tools. We plan to assess these risks in more detail, understand the implications for us and assess and develop our internal capabilities and controls with novel solutions.

Grid forming technologies:

To accommodate future high penetration of renewables and manage the risks of declining system inertia and strength, many grid forming plants with grid forming capability will be required to ensure the security of power systems. We intend to bolster and build on existing work to date, to ensure we have models and systems in place to maintain network resilience using grid forming technologies.

6. RIIO-T3 funding request

6.1 RIIO-T3 flexible funding allowance (NIA) budget request

We are requesting £150m of NIA funding for RIIO-T3, which would be made of a 10% contribution from us (£15m) leaving a requested £135m funded through the NIA mechanism. In addition to our NIA funding request, we intend to continue funding innovation via shareholder investments and Totex at a minimum of £46m per annum in RIIO-T3.

Table 2: Proposed NIA budget and annual spend profile for RIIO-T3

Year	2026	2027	2028	2029	2030	Total
NIA (£m)	25	25	35	35	30	150

To determine our requested amount, we have considered our RIIO-T3 funding needs from 4 different perspectives:

1 Building a plan from the bottom up with a pipeline of projects identified
2 Innovation spend against Totex allowance
3 Stakeholder influence
4 Our internal capability

6.1.1 Building a plan from the bottom up

We have identified a list of projects which we have high confidence we would look to undertake within RIIO-T3. A summary table is provided below showing the total forecasted costs per innovation strategy area for these projects. In Appendix 8.3 we include a summary of each proposed project and forecasted costs. These pre-identified projects total £81m, and consist of a mixture of brand-new innovations, or follow on from existing projects that will scale the solution towards deployment. Many of the new projects are also aligned to the updated Energy Innovation Needs Assessment (EINA) due to be published soon which is a collaboration between Innovate UK, Ofgem, Carbon Trust and networks which has identified high priority focus areas for achieving net zero.

Table 3: Forecasted RIIO-T3 spend for already identified NIA projects

Focus area	Total forecast spend for identified projects (£m)
Build the future network	[redacted]
Accelerate customer connections	[redacted]
Enhance sustainability	[redacted]
Improve resilience	[redacted]
Total	**81**

As well as the identified projects, we anticipate generating new ideas and innovations which are currently unidentified or unknown, particularly as the innovation landscape can change quickly and promising new technologies can enter at any time. To ensure we have capability to work on currently unknown innovations, we are requesting a further £69m for this purpose. Additionally, our high expected benefits ratio of 52:1 indicates there are many opportunities for successful innovation. In RIIO-T2, we are on track to spend and deliver £68.2m worth of NIA funded innovation projects, and this consists of project ideas that have all been generated during the RIIO-T2 price control period. This gives us confidence that we have capability to generate £69m worth of new innovation ideas for RIIO-T3.

Following Ofgem's SSMD decision, as we move into RIIO-T3, SIF Discovery phase is being removed, and instead NIA funding will be used in place of SIF Discovery. To date in RIIO-T2 we have spent nearly £1m on SIF Discovery. As a result of this, we anticipate greater NIA spend to fund what would've been SIF Discovery, so that we can build a pipeline of projects that will feed into SIF Alpha and SIF Beta in RIIO-T3.

6.1.2 Innovation spend against Totex allowance

We have compared our RIIO-T1, RIIO-T2 and RIIO-T3 NIA requests as a percentage of Totex allowance (including baseline and unmodelled expenditure across Electricity Transmission and Strategic Infrastructure).

- RIIO-T1 final determination for NIA funding equated to 1% of our RIIO-T1 Totex allowance
- RIIO-T2 final determination for NIA funding equated to 0.45% of RIIO-T2 Totex allowance
- RIIO-T3 request for NIA funding is 0.45% of proposed RIIO-T3 Totex allowance

Our RIIO-T3 request is therefore in-line with RIIO-T2.

Evidence shows that developed countries invest between 2% and 3.5% of GDP in innovation, and so our 0.45% request is not excessive[6]. Through consultation and engagement, we believe £150m strikes the right balance between our innovation ambition, but also deliverability, ensuring we focus on the right innovations to deliver value, as well as accounting for innovation which will be funded elsewhere across the business through shareholder investments and Totex funding.

6.1.3 Stakeholder influence

When we polled stakeholders at our Innovation Stakeholder events, 93% of them said we should spend more than we have in RIIO-T2 (see Appendix 8.4). Stakeholders, including the Electricity Independent Stakeholder Group (ISG) consisting of external cross sector leaders, thought that £150m was not enough and that we should request more. This was because of the imperative to achieve net zero targets with pace and because stakeholders thought we should continue to ramp up capability at our current trajectory to deliver more benefit for consumers.

We saw that "build the future network" consistently came out as the highest priority focus area across all polling we did and therefore intend to spend the largest quantity of innovation funding here. Sustainable and resilient network consistently came out as the next highest priorities, followed by accelerating customer connections.

Table 4: Proposed RIIO-T3 spend breakdown by innovation focus area

Focus area	Build the future network	Accelerate customer connections	Enhance sustainability	Improve resilience	Total
NIA (£m)	55	25	35	35	150

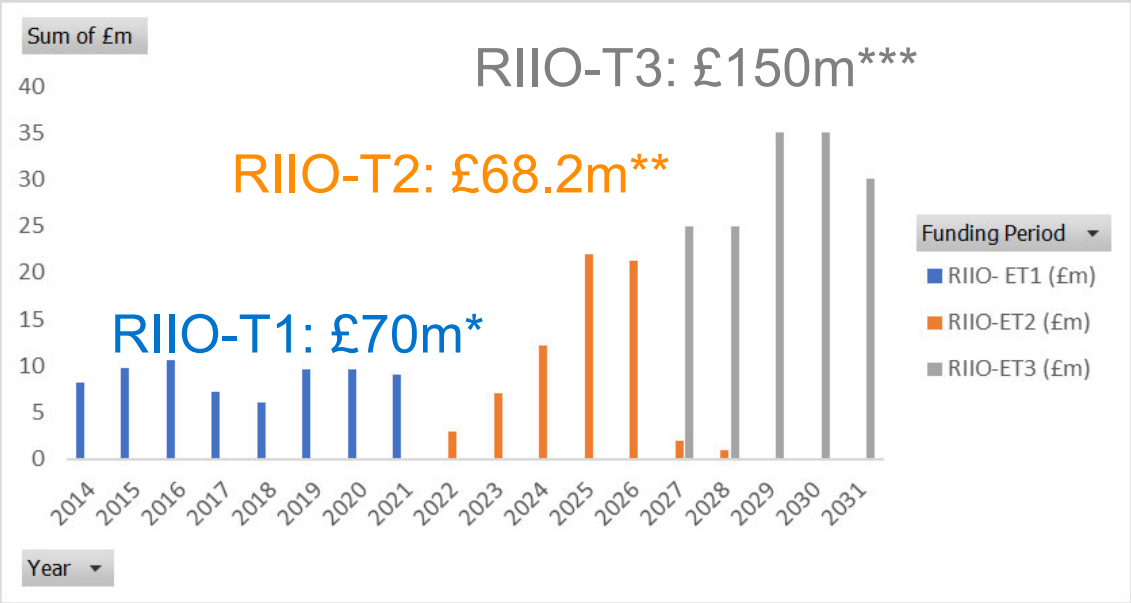
6.1.4 Our internal capability

Figure 11 below shows our RIIO-T1 and RIIO-T2 expenditure profile to date for NIA, along with forecasted spend for the remainder of RIIO-T2 and into RIIO-T3.

---

[6] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=R%26D_expenditure#:~:text=While%20R%26D%20expenditure%20in%20the,in%20Switzerland%20(2021%20data) and https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/ukgrossdomesticexpenditureonresearchanddevelopment/2022#:~:text=Based%20on%20our%20latest%20available,included%20in%20the%202019%20release

Figure 11: NIA actual / forecasted spend for RIIO-T1, RIIO-T2 and RIIO-T3. Figures are in 23/24 price base.



*T1 spend was across an 8-year price control, therefore less average spend than RIIO-T2 per annum
**T2 spend includes actuals to date and forecast for remainder of price control. Also includes £3m of carryover NIA funding (CNIA) for year 1 and 2 of RIIO-T3
***Proposed RIIO-T3 NIA budget

NIA spend has ramped up during the RIIO-T2 price control as we set up frameworks and contracts, and fully resourced our innovation team. All frameworks and a fully resourced innovation team were in place from mid-2023, where we demonstrate an increase in spend and associated pace of delivery. We are confident we will spend the remainder of the RIIO-T2 forecast and demonstrate our capability to deliver innovation rollout and benefit at pace, and we are confident we can continue this momentum into RIIO-T3. We are on track to spend £21.9m in FY24-25 and £21.3m in FY25-26 for example, which demonstrates our ability to deliver at this increased pace.

As we are already demonstrating capability to deliver £22m of NIA innovations per annum, any reduction below this run rate would be a decrease in innovation capability and benefit output. A spend of £22m per annum in RIIO-T3 would result in a minimum RIIO-T3 NIA budget of £110m.

We are one of the core enablers for the net zero transition within the UK, and our ambition to deliver a clean, fair and affordable energy system requires large scale investment, infrastructure build and customer connections on a pace and scale not seen before, whilst ensuring the network is sustainable and resilient. We have demonstrated in this plan the proven and tangible benefits that rollout of innovation can bring. To deliver the pace and scale of change required, our business is clear that innovation will play a core part in this. Innovation is a core objective (A4) in our business plan for RIIO-T3, and as such, our funding request reflects the level of ambition we have to further innovation, support Clean Power 2030 and accelerate Net Zero 2050.

6.2 Why Totex funding is not suitable for innovation stimulus projects

Using an innovation stimulus fund rather than Totex to fund innovation can offer several advantages, particularly in reducing risks associated with low TRL innovation for example. Below we highlight the reasons why we are continuing to request stimulus funded innovation in RIIO-T3 alongside planned BAU / Totex funded innovation. Below are some key reasons for continuing to request NIA funding:

6.2.1 Targeted Investment for High-Risk Projects

Focus on innovation: Innovation stimulus funding supports both low TRL and high-risk, high-reward projects. It allows us to pursue innovative ideas that might not fit within the constraints of a traditional Totex budget, or that might be too risky to test as part of a capital project for example.

Risk mitigation: By providing dedicated funding, it helps mitigate the financial, operational, and risk to consumers associated with experimental or early-stage projects that have uncertain outcomes.

6.2.2 Encourages experimentation

Flexibility: Innovation stimulus funds, particularly NIA funding is flexible by its nature and allows us to experiment and pivot at pace.

Failure tolerance: Innovation stimulus funds are more tolerant of failure, recognising that not all innovation will lead to immediate success, which encourages a culture of experimentation and learning. In the context of our large capital schemes such as the ASTI framework, we have penalties for late delivery and therefore experimenting with technologies or processes that might delay projects poses a risk to our business. Innovation stimulus funds allow us to test and scale innovations before deploying them on the network or in capital schemes.

6.2.3 Attracts external partnerships

Collaboration incentives: Innovation stimulus funds can be used to attract and support partners, such as startups, research institutions, or other companies, by providing them with the resources needed to co-develop innovative solutions.

Shared risk: By pooling resources through an innovation fund, we can share the risks of innovation with external partners, making it more feasible to undertake ambitious projects.

6.2.4 Encourages strategic innovation

Aligned with strategic goals: Innovation stimulus funding is aligned specifically with strategic goals, including the NIA governance criteria, SIF challenges and our Innovation Strategy, ensuring that innovative efforts are closely tied to long-term net zero targets.

Focus on long-term value: It encourages investments that may not yield immediate financial returns but have the potential to generate significant long-term value. Some innovations may not have mechanisms for cost recovery and therefore without stimulus funding there may be no method by which a given project makes commercial sense for us, even though it delivers consumer benefit.

6.2.5 Incentivises innovation across the organisation

Cultural impact: A dedicated innovation fund signals to employees that we and our regulator values creativity and is committed to supporting new ideas, fostering a culture of innovation.

Competitions and crowdsourcing: Following internal innovation competitions, the fund can be used to develop and deliver employee-driven projects that meet the criteria, further embedding innovation into our company culture.

6.2.6 Regulatory and Policy Alignment

Government and policy support: Innovation stimulus funds align business activities with broader economic or social policy goals, such as those driven by the NIA and SIF governance criteria / challenges.

Compliance with innovation mandates: We have regulatory mandates to produce efficiencies in our operations, and as evidenced in our Annex A14: Cost Assessment and Benchmarking Approach Section 3, innovation plays a core role in achieving efficiencies for the UK consumer.

By using an innovation stimulus fund, we can strategically manage and mitigate risks associated with innovation, create a supportive environment for new ideas, and accelerate net zero.

7. How we will deliver our innovation plans

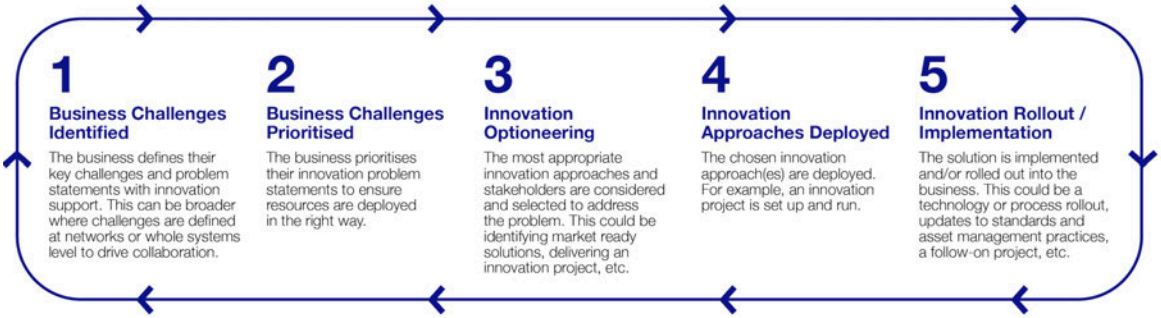
7.1 Our current innovation capability and how we will build on this

To deliver the successful portfolio of innovation projects and rollout we have had within RIIO-T2, we have a range of processes, governance and ecosystems in place such as:

- Energy Networks Innovation Process (ENIP)
- Framework agreements
- Innovation partnerships and collaborative projects
- Innovation benefit ratio
- Cost benefit analysis
- Innovation Strategy Group (ISG)
- Smarter Networks Portal
- Calls for Innovation and ENA Basecamp
- Dissemination events
- Deeside Centre for Innovation
- Rollout processes

Our RIIO-T3 plan for innovation builds on a well-established set of practices that will enable us to execute our innovation strategy. Our refreshed innovation strategy sets out our approach to how we will innovate below. We provide further detail on some of these processes and how we'll build future capability in the sections below.

Figure 12: How we will innovate for RIIO-T3



7.2 Collaboration and third-party involvement

Collaboration is key to reaching a decarbonised future and delivering a fair transition for all. To ensure we deliver value for money for the consumer, avoid duplication, and work as a collective to deliver innovation, we have further increased our stakeholder engagement during RIIO-T2. All the work we do with our stakeholders is to the intent of driving towards net zero and consumer benefit. Our 'whole systems strategy' commits that we will 'develop a collaborative approach to network and infrastructure solutions'. We have several existing initiatives and plans in place to continue to collaborate both internally, and with third parties on our innovation.

We have established a network of more than 120 utilities called NextGrid Alliance that share ideas, solve problems and work together on some of the sector's most pressing challenges. Throughout the year, members come together to share knowledge and innovative technologies through a mix of working groups, showcases and engagements. From our reporting we are seeing that NextGrid Alliance membership is encouraging startup partnerships with the industry. Collaboration between NextGrid Alliance members with startups has increased from 23% in 2021 to 90% in 2024.

We collaborate across all UK network companies, the ENA and EIC to co-develop, co-fund, and co-deliver innovation projects. Through the ENA, we work collaboratively with networks on additional activities including the ENA Network Innovation Strategy, ENA Basecamp, and Energy Innovation Summit. All our SIF projects and 35% of our NIA projects are undertaken in partnership with other networks – meaning that other networks directly partner on the project and sit on the project team. All our NIA and SIF project proposals are shared with other networks via established processes to ensure early visibility of proposed innovation projects and when they are starting.

We are also a member of the Energy Innovation Centre (EIC) who support us in cross sector collaboration, SME engagement, rollout, and dissemination. We also have direct access to insights and feedback from Small and Medium Enterprises (SMEs) and suppliers who work with the EIC. This direct link and feedback have allowed us to adapt our approach to working with SMEs and has enabled us to undertake projects with SMEs to deliver innovation. As of March 2024, 56% of our NIA project partners consist of SMEs. Here is a summary of our NIA project partners by category which can also be found on our 2024 Innovation Measurement Framework (IMF).

Table 5: RIIO-T2 NIA project partners split

Organisation Type	Academia	GB Networks	Private sector (small)	Private sector (medium)	Private sector (large)	Public sector	Not for profit
Number of Partners	11	6	22	14	8	1	2

100% of our innovation projects see us working with third party suppliers, with many of our projects involving multiple suppliers. This collaboration across the sector and supply chain is critical in finding and delivering the best innovation outcomes for the benefit of the consumer.

Creating a culture of innovation is an absolute necessity to unlock the potential for growth and success. During RIIO-T2, we actively supported the UK Research and Innovation (UKRI) led Culture of Innovation work, which was a cross-network project delivered by PA Consulting. Both the delivery and outputs of this involved cross network collaboration. This work helped shape our Innovation Culture programme which will develop strategies to embed our innovation culture principles throughout the organisation, nurturing creativity, encouraging collaboration, and embracing risk-taking to drive innovation forward.

In RIIO-T3 we will continue to leverage different methods to undertake innovation calls with suppliers such as EIC, Leading Edge Only, I3P etc with each of these giving access to a wide market of suppliers to solve industry challenges. In addition, these suppliers offer much wider collaboration benefits, for example, through I3P we have been collaborating with the Environment Agency and are in the process of fast following an innovation they have been testing which is a greener alternative to steel rebars for use in construction.

We will refresh our RIIO-T2 academic framework agreement in RIIO-T3, adding more universities, and providing specific focus topics, to build on our relationship with academia and provide a mechanism to rapidly deploy R&D projects in this space. We will implement new frameworks, such as a consultancy innovation framework that will allow us to rapidly start projects with this supplier type as well.

We will continue to work collaboratively with industry bodies such as ENA, EIC and research organisations such as EPRI and CIGRE to work collaboratively on the industry's biggest challenges.

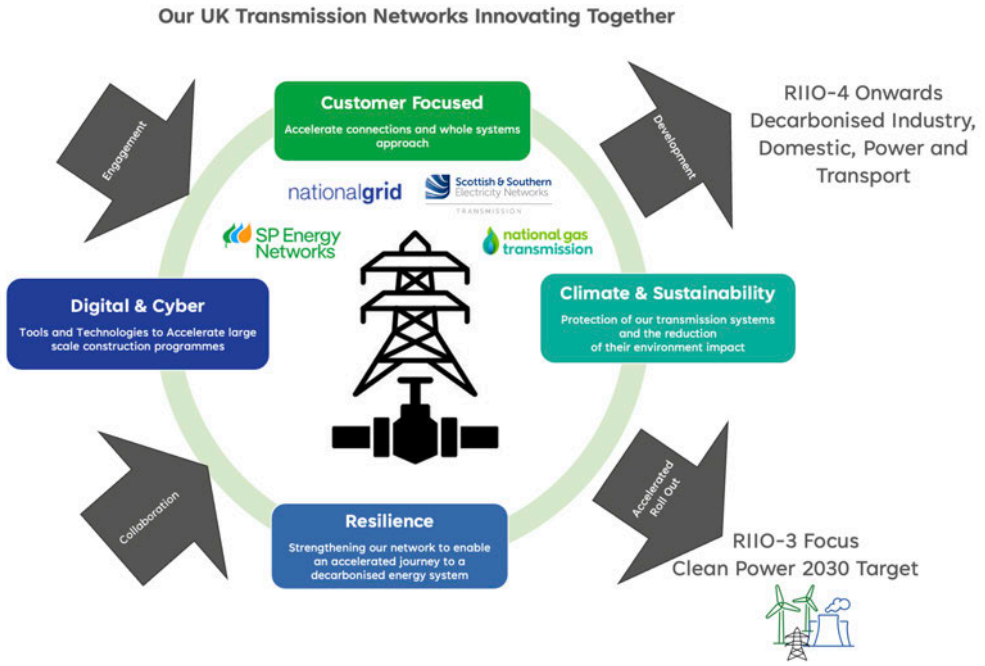
It is also recognised that to innovate effectively, meeting net zero objectives and delivering a whole systems approach, as an industry we need to develop an effective innovation ecosystem. We see innovation ecosystems as a new framework to deliver better cross industry collaboration with the initial steps being:

1 Within sector: To confirm roles and responsibilities for an ecosystem within sector, this will include electricity and gas networks, EIC, ENA, Ofgem, UKRI, Energy Systems Catapult etc.
2 Beyond sector: To include water, telecoms, supply chain and wider partnerships. This will build upon the work already undertaken in RIIO-T2, facilitated through our partnership with the EIC.

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

We have already worked with the EIC, SSEN-T, SPEN and National Gas Transmission to define common industry challenges that we face where innovation can provide solutions, and to jointly collaborate on development of our RIIO-T3 plans. We are providing a commitment to work together throughout the remainder of RIIO-T2 and in RIIO-T3 on innovating in these challenge areas. These areas of mutual interest for collaboration are illustrated in the below diagram:

Figure 13: Our vision for collaboration opportunities across electricity and gas transmission



We are also looking to broaden our collaboration within RIIO-T3 by looking outside of the UK. Because National Grid has both UK and US businesses, we are already starting to collaborate with the US to identify opportunities where we can fast follow on innovation. The EIC have also supported us by undertaking international technology scanning for certain technology areas such as Dynamic Line Rating and Power Flow Control devices where we think there might be opportunity to leverage innovation from other organisations across the world.

7.3 Dissemination and avoiding duplication

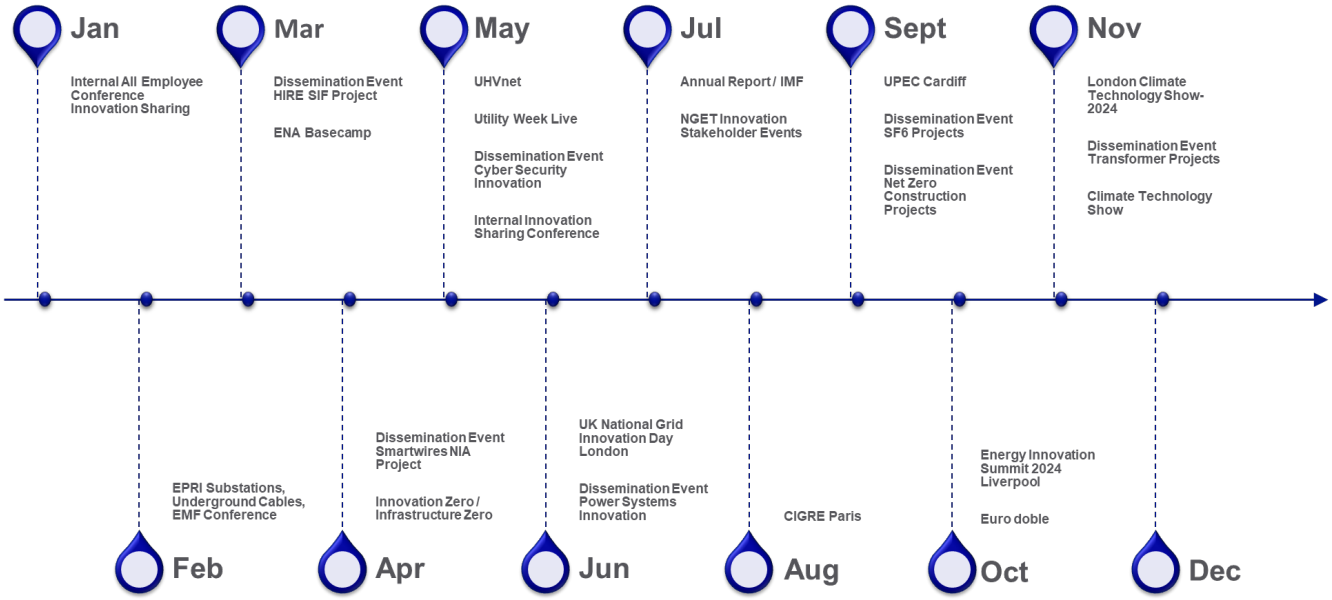
We have robust processes in place to avoid duplication of projects across network innovation. The Energy Networks Innovation Process (ENIP) provides clear guidance that is followed to remove duplication. We have the following steps in place, including a multi-step project review process involving UK energy networks:

- **Project Specification Template (PST) & Project Eligibility Assessment (PEA)** – Project summaries to enable network innovation teams to review for duplication and collaboration opportunities
- **Innovation Strategy Group (ISG)** – innovation managers across electricity transmission and distribution meet every month and present proposed projects
- **Smarter Networks Portal** – Our innovation teams screen the Smarter Networks Portal before starting any innovation project to check for previous or current projects that may duplicate with a proposal
- **Project collaboration** – We work with other networks at the inception stage of innovation projects to enable collaborative working. Many of our NIA projects include UK networks such transmission, distribution and gas as formal project partners, with many more of our projects involving UK networks as supporters / collaborators
- **EIC Partnership** – Working in Partnership avoids duplication of resource, effort and cost
- **ENA Basecamp** – Our yearly process whereby energy networks collaborate and share our key challenges with suppliers to seek the best solutions.

We are committed to removing and reducing duplication which is why we have committed to working on shared challenges with other networks (see above Section 7.2).

In 2024, we have continued to have an ambitious programme of events, which have included a range of internal and external dissemination, from large conferences to more focused innovation portfolio or project events. We demonstrate below our major innovation events that have either taken place or are planned for 2024. This is a cadence of dissemination which we intend to build on and improve as we move into RIIO-T3.

Figure 14: Our 2024 innovation dissemination programme highlights



We recently held a 2-day dissemination event in September 2024 to share progress on our SF_6 related innovation projects and an opportunity for the UK networks to hear the latest about other innovations regarding the reduction of SF_6 emissions. The event was hosted by one of our suppliers at Manchester University and featured 2 days of sharing outputs and progress of various projects relating to SF_6 leak sealing, SF_6 alternatives retrofill and SF_6 alternatives life-cycle analysis. The event was attended by ten UK transmission and distribution networks as well as manufacturers, academia and wider supply chain including both GE's and Siemens' Chief Technology Officers.

We also had presentations from RTE (France), SINTEF (Norway), GE Vernova (France), Hitachi Energy (Switzerland) and Siemens Energy (Germany) to share and learn what others are doing.

Our SF_6 leak sealing solution, developed through NIA innovation funding, has also been fast followed by another DNO earlier this year to again demonstrate the power of dissemination that we undertake as networks, and we aim to develop more examples of fast follow in RIIO-T3 as we continue to hold ambitious events such as these.

7.4 Our approach to rollout

Since RIIO-T1, we have delivered and implemented innovation projects across the business. As we have built our innovation capability, we have developed our Deeside Centre for Innovation for piloting and scaling innovation in a high voltage substation environment to accelerate innovation deployment, as well as developing processes and ways of working to ensure innovation rollout is taking place.

In RIIO-T2, our Deeside Centre for Innovation is already testing and scaling technologies such as transformer heat recovery for local community heating, low carbon construction materials, and technologies that will increase existing overhead line capacity. In RIIO-T3, we will fully utilise the facilities at Deeside to test and scale technologies in a high voltage environment, such as superconductors, before we implement them on the network. All networks will have the potential to

benefit from the use of this facility for testing and the learning generated at no cost to them. Networks will only pay for the running costs of a test, the same as our own internal innovation projects at this facility.

Throughout RIIO-T2, we have worked externally with other networks via the ENA and EIC to develop consistent innovation rollout processes, as well as developing our own improved processes to enable rollout. Examples of processes already in place to support innovation rollout are as follows:

Table 6: Existing innovation rollout processes

Approach	Description
Documented rollout procedures	Process maps and procedures are in place to enable rollout
Rollout plans	Every NIA and SIF project now has a rollout plan produced for sanctioning. This evaluates: route to deployment, testing and trials, training, standard and procedures, deployment strategy and deployment budget.
BAU Readiness Framework	A BAU checklist developed in collaboration with EIC and other networks. Reviewed regularly throughout the project lifecycle and provides prompts to review the following as examples: route to commercialisation, standards, rollout budget, legal and procurement requirements, benefits metrics and more.
CRM Portfolio Management Tool	Use to manage and track our NIA and SIF innovation portfolio. We use CRM to log all innovations which have gone into BAU, and log associated case studies aligned to a particular rollout.
Innovation Measurement Framework (IMF)	Used to track innovation rollout across networks. We utilise this tool to log the rollout of innovations which fit within the criteria of the IMF. We are also working with ENA and other networks on improvements for the IMF.
Ideas start from business challenges	We have worked hard to ensure that most of our NIA and SIF innovation projects begin with a clear business need or challenges. In RIIO-T3, we will ensure all ideas begin with business challenges. We will do this through improved processes such as innovation workshops with business areas or teams to identify and prioritise challenges.

We will continue to deploy innovation into our business-as-usual operations in RIIO-T3 and beyond, and we will do so using a range of mechanisms to fund this, including our own funding. For example, we have identified a selection of innovations that request additional RIIO-T3 Totex allowance for rollout. We have included these in Business Plan Data Table '9.10 Innovation' and summarised in Section 7.6 below. These are projects that we have high confidence will deploy into business as usual and projects which we have collected supporting information for. We also do not believe that fixed cost baseline funding for innovation deployment is the best option for consumers and we welcome the ongoing working groups between networks and regulator regarding an innovation rollout mechanism.

Projects currently in development and planned for RIIO-T3 rollout are listed in Appendix 8.2.

7.5 Our approach to defining and monitoring the benefits of innovation

For our NIA innovation programme, we measure the success and benefit of innovation at a portfolio level. Our industry standard benefits ratio of 4:1 is a target for us to manage risk across the innovation portfolio. For every £1 we spend on innovation we expect a minimum return on investment of £4. Our RIIO-T2 benefit ratio sits at 52:1 currently, demonstrating the expected benefit across the whole NIA portfolio. The risk of a project being unsuccessful is managed against the consumer benefits that innovation can bring.

Our current and future projects will continue to provide benefits to achieving the energy system transition and to support consumers in vulnerable situations. The most common project benefits which our NIA and SIF projects provide are as follows:

- Accelerating electricity decarbonisation and UK net zero
- Reducing costs for UK consumers through reduced constraint costs and efficiencies
- Providing a reliable and resilient energy supply
- Reducing the environmental impact of our operations and construction
- Wider socio-economic benefits

We are improving metrics and methods used for measuring innovation. We produce an annual National Grid innovation report, highlighting facts and figures for innovation across our businesses. We have introduced new metrics into this report to track the probability that innovations will be rolled out (such as reporting deployment readiness levels for all our innovation projects), and we are developing more metrics to measure project success and commercialisation opportunities.

We have launched an Innovation Management Platform, which will ultimately be used to track National Grid Group-wide innovation metrics including project and rollout benefits, and successes.

In RIIO-T3, we will also commit to developing bespoke metrics to measure the success of high TRL deployed innovation projects (proportionate to scale of investment and where practicable to track). We already do this for some innovation projects rolled out into BAU such as our SF_6 leak sealing solution. We plan to improve reporting by tracking the following metrics: solutions deployed on the network, speed of rollout, fast follow examples, cost of deployment, and bigger picture reporting to show how multiple deployed innovations are addressing key strategic themes i.e. carbon reduction and additional capacity.

Through the outputs of these pieces of work, we are confident that we can implement improvements to the way we measure innovation success for RIIO-T3. We envisage being able to measure the success of innovation from several rollout scenarios, which could be the rollout of a new technology, updating processes and ways of working, informing strategy and business planning, successfully scaling a technology and so on.

7.6 Totex innovation deployment funding

We will seek rollout funding to deploy the following innovation projects in RIIO-T3. These are in flight RIIO-T2 projects, and we do not have cost certainty or cost timing certainty for their deployment as they are not completed. We do have high confidence we will seek to roll them out and require funding support to do so. We provide indicative rollout costs below and will look to request rollout funding either at a later stage of the RIIO-T3 process, or through the pending innovation deployment reopener. We also intend to use the innovation deployment reopener for more projects not in this list – these additional projects have not been included as for example they have recently started. This information supports Business Plan Data Table 9.10 Innovation and addresses Business Plan Guidance Section 3.10.

Table 7: Innovation projects requesting additional Totex deployment funding for RIIO-T3

Project name	**Aerial inspection of OHLs from BVLOS**	**Funding request**	[redacted]
Project Description	This project focuses on the automation of data collection for OHL fittings and broadens the network application using drones Beyond Visual Line of Sight (BVLOS)		
Response to Ofgem questions	By providing high-quality asset condition data, the project aims to enable strategic maintenance work and create a more resilient network. Benefits include reduced operating costs, carbon emissions, unplanned outages, noise pollution, and livestock distress. In ten years, estimated savings could reach [redacted] in operating costs and 5,482 tCO_2 emissions reduction. Further justification for the [redacted] requested can be found in our OHL Aviation Investment EJP[7].		

[7] NGET_Atypical_EJP_T3 - OHL Aviation

Project name	TOTEM (Transmission Owner Tools for EMT Modelling) Extension	Funding request	[redacted]
Project Description	This project focuses on developing tools to enable electromagnetic transient (EMT) studies of the whole GB transmission system in simulation software.		
Response to Ofgem questions	The TOTEM model offers accurate simulation and analysis for power electronic-dominated networks ensuring stable power networks, reducing blackout risks and benefiting consumers. Rollout costs include training, software licenses and high-performance computers for future operation and maintenance, enabling large-scale EMT models and system analysis.		

Project name	Co-Simulation	Funding request	[redacted]
Project description	The project aims to develop an innovative integrated modelling method that enables a more flexible and efficient approach to dynamic studies.		
Response to Ofgem questions	This will also enable a flexible and efficient approach to sharing key dynamic network models with customers, facilitating their designs to compliance with Grid Code requirements. This will streamline the connection process for renewable and interconnector customers, ensuring more accurate studies for their connections. The proposed costs primarily cover training for deployment.		

Project name	Grid Forming Modelling and Stability	Funding request	[redacted]
Project description	This project focuses on developing the generic models for renewable generation plants in the network model for system studies.		
Response to Ofgem questions	There are currently no established generic models readily available for renewable generation plants with Grid Forming capability in dynamic studies. The project aims to develop robust generic models that accurately represent the dynamic characteristics of these plants in system studies for effective system planning. This will in turn, enhance the quality of the models for future network planning and reduce planning risks. The proposed costs primarily cover training required for the deployment of the developed model.		

Project name	Impedance Scan Methods	Funding request	[redacted]
Project description	This project will investigate a new impedance scan method, which provides a more accurate impedance representation to mitigate stability challenges associated with new power electronics and renewable connections.		
Response to Ofgem questions	Proposed costs are associated with training for deployment of the project and our engineers will adopt these new methods for future system assessments. The innovation costs enable early detection of stability impacts associated with power electronics devices. Training will be delivered to appropriate technical experts within the business who will continue to share knowledge and best practices.		

Project name	Optimum Wide Area Power Flow Control Solutions	Funding request	[redacted]
Project description	We will implement a planning tool to coordinate the dispatch of Modular Power Flow Control (MPFCs) devices to maximise network utilisation and reduce network constraints. This tool includes locating optimal deployment locations of additional MPFCs to realise additional capacity on a given network. The tool will also enable increased utilisation of network capacity by incorporating other technologies such as Dynamic Line Rating.		
Response to Ofgem questions	The implemented planning tool will optimise the operation of MPFCs, define optimal deployment locations for additional MPFCs and incorporate other technologies such as DLR, all of which will increase network capacity. The proposed costs are for integration of the tool in system planning software and the associated training for the tool.		

Project name	HVDC Assets Life Cycle Assessment (HVDC - LCA)	Funding request	[redacted]
Project description	The scale of future offshore development results in a need for better understanding around the carbon footprint of HVDC assets. This project will deploy a novel planning tool to reduce HVDC asset carbon emissions which will be used on the SeaLink project and future offshore link projects.		
Response to Ofgem questions	Proposed costs are associated with primarily with training for deployment of the tool. Carbon emission and sustainability benefits will be realised from each HVDC construction project this tool is used for.		

Appendix A – Additional RIIO-T2 track record and rollout examples

Additional examples of RIIO-T2 innovations that have been trialled or deployed categorised by how they were funded and aligned to Ofgem's consumer interest framework are below:

Shareholder funded investment track record – BAU innovation

Table 8: Shareholder funded investments that have been trialled or deployed within RIIO-T2

Project name	Summary	Benefits
Infrastructure fit for a low-cost transition to net zero		
Exodigo*	Ground penetrating technology that is the equivalent of an MRI, CT Scan and X ray for underground assets, giving information on material, depth, thickness and type.	For capital works where there are known to be many over lapping underground assets and where we need to de risk the project information to the contractor to ensure smooth delivery.
Sitetracker*	An easy to set up and use program / project, site, and work management tool for managing high volume works.	Can de-risk and speed up capital delivery processes and construction projects.
Secure and resilient supplies		
AI Dash	A technology that utilises data from satellites and AI to provide analysis and insights to utility companies	Used primarily for vegetation management and environmental assessments.
System efficiency and long-term value for money		
Fischer Block	Provides a no-outage power quality meter (SmartBlock) and corresponding frequency analysis tool (WaveIQ) that can correlate AC frequency distortions against specific asset failure modes.	Rollout of this technology will enable accurate non-intrusive power quality measurement to ensure full compliance with power quality monitoring standards requirements.

*Supports Clean Power 2030 target

Totex funded track record – BAU innovation

Table 9: Totex funded investments that have been trialled or deployed within RIIO-T2

Project name	Summary	Benefits
Infrastructure fit for a low-cost transition to net zero		
LPT2 green concrete pour	We have completed the world's largest ever pour of earth friendly concrete at LPT2. The 'greener' concrete uses a geopolymer binder system made by the chemical activation of industrial waste products instead of cement.	The use of 736m3 of climate friendly, cement-free concrete (enough to fill around two 25m swimming pools) at our Hurst substation site was needed to infill the base of the 55m deep tunnel shaft to its permanent level. The concrete reduces carbon by around 70%, saving an estimated 250kg of CO_2 per cubic metre poured.

Project name	Summary	Benefits
System efficiency and long-term value for money		
Asset management digital upgrades	We are implementing a new digital platform for asset management which will future proof our asset management for the net zero transition.	The new digital platform will provide innovative asset management techniques including a foundation for predictive analytics supporting when we need to make asset interventions, managing our assets at the right granularity, and making decisions based on a shared view of risk and total cost of ownership.

Innovation stimulus funded track record

Table 10: Innovation stimulus funded projects that have been trialled or deployed within RIIO-T2

Project name	Summary	Benefits
Infrastructure fit for a low-cost transition to net zero		
SF_6 Management and Alternative Gases (NIA_NGET0163)	Rejected one of the SF_6 alternative gases known as CF3I as a suitable gas for replacing SF_6.	Avoids future spend on an unfeasible technology.
Cable Alternative Cooling Technologies for Underground Systems (CACTUS) (NIA2_NGET0023)*	Has provided evidence that water-cooled cable systems can provide considerable advantage and potential for enhanced cable ratings.	Led to a follow-on project called TACTICS (NIA_NGET0076) which aims to enhance cable circuit ampacity by investigating the potential of thermosyphon systems for improved heat transfer.
Secure and resilient supplies		
NIPRAM (NIA2_NGET0038)	Delivered direct improvements to our System Restoration Strategy and Operational Switching Documents.	Future restoration plans will be subjected to a risk analysis developed by this project to identify the optimum asset selections in restoration routing. This is deployed across all Restoration Plans and included within Business Procedures associated with System Restoration Assurance.
SCISSORS (NIA2_NGET0032)	Developed a system that enables leak repairs on SF_6 -filled equipment to reduce emissions.	Reduced cost for defect repair activity, reduced impact on global warming from new SF_6 emissions and reduced volumes of SF_6 required for top ups and gas call outs for top-ups.
High quality of service from regulated firms		
MORE DLR system (NIA_NGET0046)*	We have developed a ratings system using NIA funding and working with the Met Office to provide weather-based ratings enhancements using algorithms.	Typically, up to 4% additional capacity provided with the MORE system.

Project name	Summary	Benefits
Vulnerable consumers	Completed a Digital Exclusion project, led by Cadent with other networks collaborating. This project aimed to review other industry best practice to identify the best methods for communication with vulnerable consumers in a digital world.	The outputs of this project have helped form a follow on RIIO-T2 project called Warmer Hubs, which is in partnership with multiple networks to develop warm spaces for vulnerable consumers in the UK.

*Supports Clean Power 2030 target

Appendix B – Additional innovations planned for RIIO-T3 rollout

Additional examples of innovation planned for RIIO-T3 rollout and aligned to Ofgem's consumer interest framework are below. These are additional to projects already highlighted for rollout in Section 5.3, Section 5.4 and Section 7.6.

Shareholder funded investments planned rollout – BAU innovation

Table 11: Shareholder funded investments planned for RIIO-T3 rollout

Project name	Summary	Benefits
Infrastructure fit for a low-cost transition to net zero		
Transcend*	Automation of substation designs	Increased speed and accuracy of early-stage substation designs. Reduced project development costs.
Viridi	Lithium-ion battery packs based on a proprietary module design that is both rugged and fail-safe, thanks to passive thermal management technology.	This solution helps replace construction site and standby type diesel generators with low carbon options, and mobile energy storage systems to improve sustainability of our construction.
Secure and resilient supplies		
Nodes and links*	AI technology to analyse large programmes i.e. capital programmes and produce reports and insights of the whole programme so actions can be taken.	Better management of project risks and reporting and reduce resource requirements on programme reporting.
System efficiency and long-term value for money		
Luminance	Brings AI to every touch point of the legal and contracting process. Currently deployed in one business unit, wider rollout planned for RIIO-T3.	Generate contracts faster and enables non legal teams to do this. AI augments negotiation, highlights areas of risk, streamlines process to reduce risk. Data analytics for all contracts i.e. termination dates for all contracts, how similar all contracts are, number of customers, risks within executed contracts, regulation changes etc.

*Supports Clean Power 2030 target

Totex funded planned rollout – BAU innovation

Table 12: Totex funded innovation planned for RIIO-T3 rollout

Project name	Summary	Benefits
Infrastructure fit for a low-cost transition to net zero		
SF_6 free substations	New substations to test innovative SF_6 free equipment and solutions.	The difference in CO_2 per kg is as follows: EconiQ (C4FN) global warming potential = 292 $kgCO_2e$ / SF_6 global warming potential = 25,000 $kgCO_2e$. Significantly reduced carbon emissions are realised from new SF_6 free substations.
Triton 2	Triton is used for long term modelling of power flows and network design for various future energy market scenarios.	Triton 1 reduced the time to process and resource our long term UK wide regional network model from 10 years down to 5 years. Triton 2 will reduce this further down to 3 years. It will enable annual and ad hoc regional network scenario modelling: helping business planning, provide early warnings etc to increase our agility to flexibly map and move boundaries. The solution allows whole system working with other networks to come up with optimal solutions for future needs.
Secure and resilient supplies		
Smartwires *	Equipment to reduce transmission network congestion and maximise the use of our existing network. Initially proved feasible and scaled through NIA funding. Deployments have begun in RIIO-T2, with wider rollout through Totex funding planned for RIIO-T3.	[redacted] is estimated to be saved over a seven-year period due to reduced constraint costs and avoided expenditure on new infrastructure build, with over 2GW of north-south power flow capacity being unlocked. As we rollout Smartwires technology further on the network in RIIO-T3, this benefit will increase.
High quality of service from regulated firms		
Intelligent outage planning tool*	Create a single intelligent outage planning tool that leverages AI and data to assist with faster and more effective outage planning decision making.	Create better quality outage plans and handle plan change more effectively. Removes unnecessary rigidity in the process to unlock the foresight and flexibility needed to continuously optimise.

*Support Clean Power 2030 target

Innovation stimulus funded planned rollout

Table 13: Innovation stimulus funded projects planned for RIIO-T3 rollout

Project name	Summary	Benefits	Linked to EJP / Plan
Infrastructure fit for a low-cost transition to net zero			
Compact substations	Reduce new substation footprint and associated carbon through a variety of techniques such as vertical busbar configurations.	Reduced capex cost and carbon footprint for new Air Insulated Substations (AIS). Reduced oil and SF_6 usage in substation equipment.	
AssetCool*	Conductor coating technology that could increase the capacity of existing conductors without reconductoring or new lines.	Potential for 15-20% capacity increase where applied. A cost saving in capex estimated at [redacted] vs BAU reconductoring. Reduction in outage durations.	
Intercompatible Cable Repair (iCARE and iCARE2)	New underground HV cable repair technique.	Saving of [redacted] in RIIO-T3, across an expected 15 400kV cable repairs. Installation takes 3 man-days versus weeks for conventional methods. The approach reduces scrap by [redacted], saving an additional [redacted] over 5 years, and lowers the need for skilled workers by employing a universal repair technique.	
Graphene enhanced concrete	A novel and green concrete technology.	Graphene-enhanced concrete is 30% lighter, cures in 1 day, and has higher crack resistance compared to conventional concrete. It uses recycled plastics and requires no water. If applied to 24 UK substations, it could reduce concrete volume and CO_2 emissions by 25%, saving [redacted] over 10 years.	NGET_Atypical_EJP_UIOLI Provision for Emerging Low Carbon Opportunities
EcoBuild 3D: Sustainable Automated Foundation Construction	Optimising infrastructure build by 3D printing low carbon concrete foundation structures.	Planned for trial and rollout on RIIO-T3 construction projects, as well as inclusion in our technical standards and tender requirements. Benefits vs existing foundations include up to: 50% reduction in time to build and waste produced, 40% reduction in CO_2 emissions, 20% reduction in cost.	NGET_Atypical_EJP_UIOLI Provision for Emerging Low Carbon Opportunities
Secure and resilient supplies			
High security protection and control	Innovate and develop efficient, deliverable, and secure protection and control systems capable of mitigating advanced cyber	Ofgem cyber compliance failure fines up to [redacted], and when NIS2 and Cyber Resilience Act come into effect, this could change to 'up to 2%' of global revenue. Through risk mitigation and reduced likelihood of cyber-attacks	RIIO-T3 NIS Cyber Resilience Business Plan (CRBP)

Project name	Summary	Benefits	Linked to EJP / Plan
	threats using secure by design practices.	enabled by this project, a benefit of [redacted] is assumed across a 10-year period.	
Fibre health monitoring	Enhanced optical sensing methods to detect and track the ageing process of fibre optic cables and associated fittings with the capability to forecast asset failures.	Avoidance of in-service failures and reduced constraint costs to consumers caused by failures. Extended lifetime of fibre optic assets from 40 years to 45 years. Delaying replacements and only replacing the assets that have got a high likelihood of failure will provide savings of [redacted] over the coming decade.	NGET_NN_Atypical EJP Satellite Phones Installation and Fibre Optic Monitoring using Coherent Optics
Visual Inspection & Condition Monitoring of OHL Tower Steelwork 2 & 3 (VICAP 2 & 3)	VICAP 1 delivered an AI tool that creates digital twins of our towers and identifies corrosion points and is already in BAU. VICAP 2 extends this to allow the AI to determine the corrosion rating and predict failures and VICAP 3 will extend this further by allowing the AI to analyse bar by bar inside the tower and fittings.	These advancements will enable us to adopt efficient new asset management practices and increase condition assessment throughput for an expanding overhead line network being built for Clean Power 2030 and net zero 2050. We anticipate annual savings between [redacted] with the rollout of VICAP 2 and 3, largely through efficiencies and this will result in a saving for consumers.	NGET_Atypical_EJP_T3 - OHL Aviation
High quality of service from regulated firms			
Benthic Life*	Understanding the impact of electromagnetic fields from HV subsea Interconnectors on marine life.	This will update our group-wide EMF policy and support improved consenting speed for future subsea cable projects in RIIO-T3.	
OpenMaps vulnerable consumer tool	A vulnerability visualisation tool has been developed in collaboration with other networks. We will deploy this into wider business processes.	This tool will improve allocation of resources for projects focussing on vulnerability, improve identification of and support offered to customers in vulnerable circumstances, and improve targeting for projects aiming to support community resilience.	

*Support Clean Power 2030 target

Appendix C – Planned RIIO-T3 innovation projects and forecast costs

[redacted]

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	1

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[redacted]

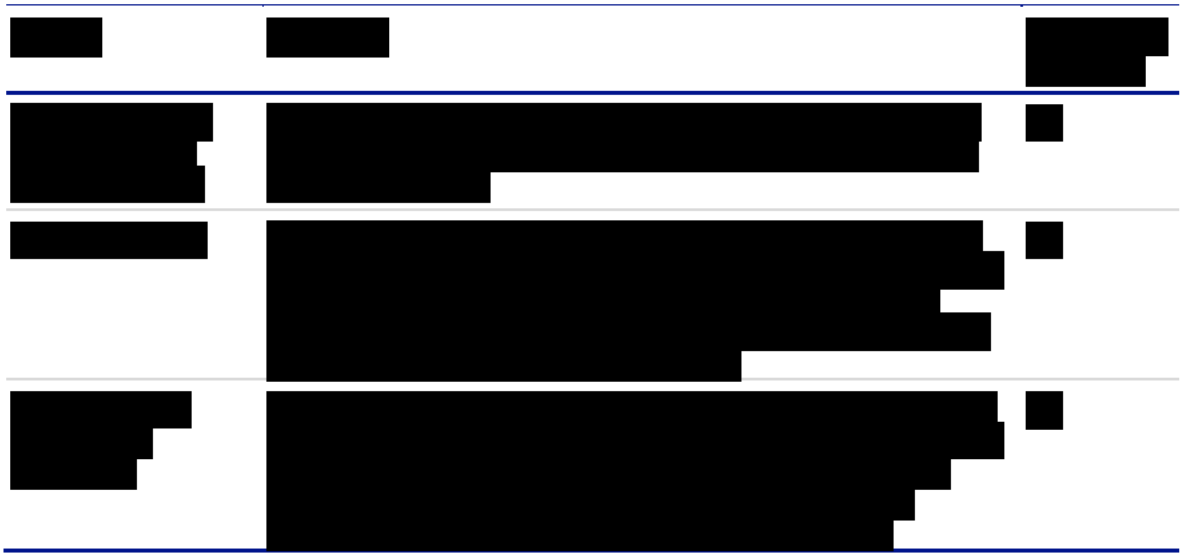
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	1

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]

[redacted]

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	3

[redacted]



Appendix D – Stakeholder engagement events that shaped our RIIO-T3 innovation strategy

Building on from our stakeholder engagement summary in Section 5.1, below we breakdown each engagement event, and what we learnt and how it influenced our innovation strategy and RIIO-T3 plans. In total we have undertaken seven listening phase activities and 4 optioneering phase activities, which have been across 11 events to collect stakeholder research for innovation.

Listening phase

- **Stakeholder priority outcomes research** – This research highlighted five design principles that work together to stress test and ensure we build robust plans:
    - Principle 1: Collapse the trilemma
    - Principle 2: Focus on core delivery
    - Principle 3: Plan for the future
    - Principle 4: Protect what is important
    - Principle 5: Remove barriers

  Our innovation strategy aligns with these key principles, like accelerating net zero to reduce consumer bills and improve energy security, addressing the energy trilemma. It focuses on core areas such as building the future network, speeding up customer connections, and ensuring resilience - all essential for planning for the future and delivery.
- **Pathway to net zero events** – In Autumn 2023, NGET hosted six stakeholder workshops across the UK, supported by local Distribution Network Operators and NESO to discuss pathways to net zero. These workshops gathered 5,000 unique responses, shaping our refreshed strategy and RIIO-T3 plan.
- **Consumer research** – Market research by Yonder Consulting involved 3,302 participants, revealing that 86% support innovation and investment in safety and efficiency. Strong backing for green energy was evident, with 73% of the public, 78% of businesses, and 91% of impacted stakeholders in favour. Reliability and affordability were top priorities, guiding our RIIO-T3 network innovations.
- **ENA Innovation Strategy Refresh** – We played a key role in shaping the updated 2024 ENA Innovation Strategy, using stakeholder feedback to inform our refreshed strategy and business plan. Insights from 150 respondents revealed support across various sectors: 26% technology companies, 26% networks, 17% consultancy, 6% academia, 5% government, 5% industry associations, and others. The final ENA Innovation Strategy themes and support levels are:
    - Flexibility and market evolution – 82% support
    - Net zero and energy system transition – 96% support
    - Optimised assets and practices – 79% support
    - Supporting consumers in vulnerable situations – 86% support
    - Whole energy system – 86% support

- **National Grid Group Innovation Strategy** – National Grid has developed its first group-wide innovation strategy, reflecting the aims and opportunities for enhancing innovation across NGET, NGED, National Grid Partners and the US. Internal research prioritised over 100 areas of interest into six key focus areas: flexible grid and energy system transition, DSO development, future customer needs, operational excellence, workforce of the future, and supply chain resilience, safety, and circularity. This engagement has shaped our refreshed NGET innovation strategy, ensuring alignment with the overall group ambitions.
- **Industry Peers Workshop** – In Spring 2024, we held an industry peers workshop to discuss our RIIO-T3 business plan and gather feedback on associated risks and opportunities. The event attracted 85 attendees from eight networks, including both electricity transmission and distribution. We engaged participants on our innovation strategy and polled them on priority focus areas, which ranked as follows:
    1. Accelerate new customer connections
    2. Maintain network resilience
    3. Whole energy systems
    4. Network capacity maximisation
    5. System access for all
    6. Reduce/remove SF_6
    7. Maintain an aging asset base
    8. New on/offshore network capacity
- **Internal Engagement** – Finally for our listening phase, we have undertaken a range of internal engagement on our innovation strategy over the last year, including workshops, leadership days, department away days. This has helped capture feedback on challenges and priorities for innovation from our business units.

Optioneering and testing phase

- **National Grid UK Innovation Day** – In June 2024, National Grid hosted its inaugural UK innovation day in London, bringing together global leaders to showcase innovations and foster collaboration in energy. The event received positive feedback, and we plan to make it an annual occurrence. We had 150 attendees including other utilities (24%), regulators and policy makers (29%), customers (12%), startups and our supply chain (35%) to build and deepen our relationships. We hosted interactive workshops to understand what challenges faced our stakeholders and how best to collaborate in developing innovative solutions. Key outcomes from the event include:
    - New connections made with startups and customers
    - Deeper relationships between National Grid, National Grid Partners, customers, government and industry bodies
    - New members joined the NextGrid Alliance
    - Agreements set up for greater collaboration between National Grid, National Grid Partners and key bodies including EPRI and UKRI.

  We tested a new startup technology, Ideaonomy, to gather attendee feedback on National Grid's innovation priorities. However, an error with the QR code and low engagement resulted in only a small sample size that was insufficient for our optioneering phase. Despite this, it highlights that not all stakeholder engagements proceed as planned.
- **Our innovation stakeholder events** – In June and July 2024, our innovation team hosted two webinars with over 1,000 invited and 87 final attendees to discuss our refreshed innovation strategy and the RIIO-T3 business plan, seeking feedback from a diverse range of stakeholders. Feedback was collected both quantitatively through polling, and qualitatively in breakout rooms. Results showed strong support for the four innovation focus areas:
    - Build the future network – 99%
    - Accelerate customer connections – 92%
    - Sustainable network – 100%
    - Resilient network – 98%

  When ranked in order of importance by 55 stakeholders, the priorities were:
    1. Build the future network
    2. Resilient network
    3. Sustainable network
    4. Accelerate customer connections

- **Regarding NIA innovation funding for RIIO-T3,** 93% of stakeholders suggested we should increase spending beyond the RIIO-T2 forecast of £68.2m. This engagement bolstered our confidence in our four focus areas and supported our request for increased RIIO-T3 flexible funding. Attendance representation was as follows:
    - Energy networks and supply chain – 26%
    - Academia/catapults – 15%
    - Manufacturers – 15%
    - Innovation experts and start-ups – 13%
    - Technology companies – 11%
    - Communications companies – 9%
    - Councils – 7%
    - Other infrastructure – 2%
    - Other Utilities – 1%.
- For more information about our innovation focused stakeholder events, refer to our Annex A07: Stakeholder Engagement and Decision Log.
- **Independent Stakeholder Group (ISG)** – In July 2024, we presented our proposed refreshed innovation strategy and RIIO-T3 business plan to the ISG, which provided broad support and recommended areas for improvement. The ISG noted significant progress in our innovation efforts over recent years, recognising the implementation of previous feedback. They offered constructive challenges, including:
    - Innovation culture: ISG expects innovation to be embedded in our business plan.
    - Increased ambition: There should be a focus on maximising community impact, particularly regarding vulnerable consumers and infrastructure acceptance.
    - Highlighting innovation journey: We should showcase our progress in innovation, collaborative work, and future ambitions.
    - Dissemination: Continued emphasis on sharing learning from innovation across networks is needed.
- ISG feedback has influenced various aspects of our strategy, including how we present our four focus areas and their outcomes.
- **Further internal engagement** – We have continued to undertake internal engagement throughout the testing and optioneering phase. Feedback has been positive, with each of our business units recognising the innovation strategy allows for innovation in their respective areas, and has the right 4 focus areas to address our key challenges.

What we learnt

Overall, feedback suggested our strategy covers the right four focus areas, that we should spend more on NIA innovation funding in RIIO-T3 versus RIIO-T2, and stakeholders provided views on ‘how’ we should innovate, including looking for global best practices.

There was a preference for potential added focus areas which included: future workforce; supply chain; offshore infrastructure; society and community innovation (i.e. to smooth the process of building new infrastructure) and local area energy plans.

We asked whether there were any best practices we are missing for the 'how' we will innovate section of our strategy. Participants suggested the following: (1) importance of skills and workforce availability to successfully implement new technologies at scale; (2) the use of AI and quantum computing for network innovation processes; (3) more methods for testing new asset innovations.

We adjusted our RIIO-T3 innovation strategy focus areas and approach using this feedback.

Focus areas: We have now added supply chain within our focus areas. We are keeping offshore infrastructure due to its unprompted importance to stakeholders. We re-worded our focus areas to better reflect that we are including society and community innovation i.e. to smooth the process of building new infrastructure.

Our strategy focus areas will not include future workforce as NIA funding criteria does not align to this; however, this area is receiving focus in a broader context across National Grid. Local area energy plans although important, we feel it is an area managed by NESO, that we will support. The use of AI and quantum computing for network innovation processes was too specific to include in our how we will innovate – AI is an enabler and a tool but not core to where we will focus innovation. And in terms of more methods for testing new asset innovations - we already have our

Deeside Centre for Innovation which is a key part of our strategy for testing new technology and Strategic Infrastructure are looking to also improve their capacity and ability to evaluate innovations.

Sharing phase

In 2025, we will go back out to the stakeholders we have spoken to over the last two years that have helped influence and shape our plan. We will provide them an overview of what we submitted in the plan and share how their feedback influenced our plan. We will also use this as a further opportunity for building whole system collaboration and partnerships to set ourselves up for RIIO-T3.

Appendix E – Our past, present and future innovation capabilities

To support Section 7 'How we will deliver our innovation plans' the below table provides further detail around our past, present and future innovation capability. Under the themes of innovation rollout, collaboration and culture, we have reflected on what has worked well and what we can improve as we move into RIIO-T3. The below table highlights where we have come from, where we are now and where our ambition lies for how we will innovate in these three areas.

Table 18: Our innovation journey across rollout, collaboration and culture

Timeline	Rollout	Collaboration	Culture
RIIO-T1 Baseline	We rolled out a selection of NIA / NIC innovation projects into small BAU trials such as Smartwires. Minimal rollout processes in place for innovation. Rollout mostly occurs within engaged teams.	Innovation Strategy first developed and implemented. Good collaboration with innovation project suppliers to deliver projects.	Innovation delivered through small team focusing on NIA and NIC projects. Ideas not always driven by business units. Wider business not aware or engaged with innovation.
Early RIIO-T2	We continue to rollout a selection of innovation projects such as SF_6 leak sealing and Synthetic Ester Transformers. We work with EIC and other networks to develop BAU Readiness Framework.	We set up our Academic Framework with 6 UK universities. The number of innovation suppliers and partners is growing including working with SMEs.	Our innovation team is increasing in size. More ideas are driven by business units. Annual innovation culture survey introduced. Other business units such as National Grid Partners delivering innovation benefits.
Present Day	Our innovation projects are starting to have rollout plans in place. We have examples of fast follow rollout across networks. Metrics being developed for measurement of innovation benefit, and some rolled out projects are tracking benefits. Business teams are planning for innovation rollout.	Our NIA and SIF projects include 66 collaborators. 56% of our suppliers (and the largest proportion) are SMEs. Our projects include whole system working. Innovation Strategy and plans are influenced by stakeholders.	Majority of projects are driven by business units. Some highly engaged teams within the business. UKRI Culture of Innovation work. Clear RIIO-T3 innovation ways of working vision established. Launch of National Grid Innovation Community of Practice and first National Grid Innovation Day.
Late RIIO-T2	Our innovation rollout guidance and processes are updated. Close working with business	Setting ourselves up for RIIO-T3, with partnerships being forged to solve	Multiple National Grid wide idea campaigns delivered with ideas now being progressed into projects.

Timeline	Rollout	Collaboration	Culture
	units to ensure plans for project handover and rollout are in place. Innovation projects adhere to BAU readiness framework.	common challenges across networks.	Launch of National Grid innovation reporting tool.
Early RIIO-T3	Innovation rollout across BAU and NIA/SIF is fully tracked via central reporting tool. Rollout benefits tracking is in place. Business units are clear on roles and responsibilities for handover of innovation projects to BAU. More examples of fast follow are occurring across networks.	Innovation frameworks refreshed and new frameworks introduced. First example of an innovation ecosystem is delivered (multiple sectors solving a common challenge). Number of partnerships increasing including a focus on whole system working.	All innovation ideas are driven by business units who are engaged with innovation. Business units are clear on roles and responsibilities for innovation. Innovation successes are widely shared and known across business and sector. Innovation culture driving improved rollout.
Future Vision	The wider business are accountable for rolling out innovation and proven innovations are rapidly scaling to achieve net zero. Innovation is implemented and adopted at pace within our network and other networks.	We will collaboratively work with our stakeholders to optimally plan, develop and operate the transmission network, protect vulnerable customers, and deliver whole system benefits while ensuring the delivery of the energy transition.	National Grid is proactive and committed to innovation and innovation occurs across the business. We unite around a shared innovation purpose that is driven from our leadership. We challenge ourselves to do things differently and innovation is embedded within our DNA.

As we transition into RIIO-T3, we acknowledge that we will need to further build our innovation capability to deliver at the pace and scale required for innovation to support the energy system transition. To deliver an innovation portfolio of the requested £150m NIA budget, and to ensure this portfolio translates into the expected benefits outlined throughout this document, we will explore and utilise the following approaches to develop and improve our innovation capability.

Table 19: How we will develop our innovation capability into RIIO-T3

Approach	Description
Leverage internal and external partnerships	Internal collaboration: We will work closely with other National Grid teams working on innovation, such as National Grid Partners to ensure we are optimising how we manage projects. Whole system working: We will ensure we are working with a whole systems approach, and build the scale of collaborative working to ensure we are being smart about solving cross sector challenges. Partnership collaboration: We will leverage our partnerships such as EIC, ENA, Leading Edge Only, I3P to help us solve challenges, and connect with more suppliers to deliver more innovation at pace. Innovation ecosystems: We will setup a mechanism to solve cross industry challenges.
Develop new ways of working	How we will innovate: We are improving the way we innovate to ensure our business is at the heart of the challenges we are solving. This approach ensures the innovation projects we are doing deliver maximum value by being driven by a clear need, supported by the business, and a pull to implement once ready.

Approach	Description
	Innovation deployment: We will bolster and develop improved processes for ensuring our successful innovation projects are rolled out onto the network to add value to consumers. Automation / agile frameworks: We will implement automation to handle routine tasks, allowing the team to focus more on identifying and delivering innovation. We will implement agile project management methodologies to increase flexibility and speed of delivery.
Improve innovation reporting	Deployment benefits tracking: We will develop new metrics for measuring the success of deployed innovation, such as number of deployments, cost to deploy, fast follow examples, benefits from deployment etc.
Increase team capability	Increased innovation team size: In order to achieve the ambition, we have for innovation as we move into RIIO-T3, it is likely our current team will need to expand. If we do need to expand, we will do so in a measured approach and review the team setup to ensure we have the right structure and roles to deliver innovation at pace and collaboratively. Professional development: We will invest in training and upskilling existing team members to improve their innovation capabilities, technical skills and strategic skills.
Foster a culture of innovation	Innovation programs: Establish internal programs that encourage and reward innovative ideas and solutions, like the crowdsourcing campaigns we are introducing from summer 2024 onwards.
Optimise processes	Prioritise projects: We will work with the business to ensure we focus on high-impact projects that align with strategic goals and offer significant benefit for achieving the energy system transition or for UK consumers. Improve processes: We will regularly review our innovation processes to ensure they still allow us to deliver the scale, pace and quality of innovation required. In particular and for example, we will review processes for innovation rollout and dissemination regularly.
Engage in continuous learning	Knowledge sharing: We will promote knowledge sharing and collaboration within the team, across the organisation, across the industry and within the UK. Industry conferences: We will continue to attend industry conferences and workshops to stay updated on the latest trends and technologies and share learning from our projects.

Appendix F – Innovation woven within our RIIO-T3 plan

We highlight below where innovation has been specifically referenced or included in other areas of the RIIO-T3 plan, across both Annexes and EJPs.

Table 20: References to innovation across the RIIO-T3 business plan submission

Business Plan Annex / EJP	Summary of innovation included
Annexes	
A08: ET Load Strategy	• Dynamic Line Rating (BAU and stimulus innovation) • TS Conductor (BAU innovation)
A10: Network Asset Management Strategy	• Novel asset management risk assessment approach (BAU innovation)
A14: Cost Assessment and Benchmarking Approach	• Outlines innovation examples that contribute towards ongoing efficiencies

Business Plan Annex / EJP	Summary of innovation included
A04: NIS-R Cyber Resilience Business Plan	• Cyber security – Gen AI and Cyber Risk Framework (proposed RIIO-T3 NIA projects) • Operational Technology data insights platform (BAU innovation) • Protection and control hardened compute trigger (BAU innovation)
A02: Climate Resilience Strategy	• Continued need for innovative solutions related to climate • Highlights RIIO-T2 NIA innovation projects such as WELLNESS, ICECREAM • Highlights RIIO-T2 BAU innovation projects such as Network Resilience Insights Hub
A05: Digitalisation Strategy and Action Plan	• Data Strategy (BAU innovation) • Product Line Director operating model (BAU innovation)
A01: Environmental Action Plan	• Low carbon concrete pour (BAU innovation) • Nature based dependencies innovation project (BAU innovation) • Marine projects innovation opportunities
A07: Engagement and Decision Log	• Showcases our Innovation Stakeholder Events from June / July 24 as an example of how we will meet Ofgem's consumer interest framework 'ensuring high quality of service from regulated firms'
EJPs	
NGET_Atypical_EJP_T3 Enhanced Rating Strategy	• Route to deployment for Dynamic Line Rating (BAU and stimulus innovation)
NGET_Atypical_EJP_UIOLI Provision for Emerging Low Carbon Opportunities	• Route to deployment for novel construction techniques and materials being developed and scaled via innovation stimulus funding (rollout will be BAU innovation funded)
NGET_NN_Atypical EJP Satellite Phones Installation and Fibre Optic Monitoring using Coherent Optics	• Route to deployment for Fibre Health Monitoring (scaled through NIA, rollout will be BAU innovation funded)
NGET_Atypical_EJP_T3 - OHL Aviation	• Route to deployment for BVLOS drone inspection of our OHL assets (scaled through NIA, rollout will be BAU innovation funded)
NGET_Atypical_EJP_Community Benefit Framework	• Sets out our BAU strategy and aspirations for delivering community benefits across all our activities. • Highlights intent to continue to leverage innovation funding and cross industry collaboration to support vulnerable consumers in novel ways.

We actively integrate innovation into the development process. Below is a summary of EJPs, grouped by intervention type, with the innovations under consideration for these projects.

Table 21: Innovations being considered across a range of substation, OHL and cable EJP

Intervention type	EJP description	Innovations being considered for EJPs
Substation – new projects	New substation construction	• CrystalClear - Lifecycle Analysis of SF_6 Alternative Technologies and Crystal Formation Impacts (NIA2_NGET0046) • Transformer Research Consortium – Phase 5: Future-proof Transformers in a Digital Twinning and Net-Zero World (NIA_SPEN0084) • Use of Innovative Materials and Construction Techniques in the Substation Environment to Accelerate Transition to Net Zero (NIA2_NGET0045) • Identification and quantification of C4F7N gas mixture arcing by-products and their implication for GIS operation (NIA2_NGET0028) • Compact Substation (NIA2_NGET0062) • EcoBuild 3D: Sustainable Substation Foundations (NIA2_NGET0070) • Secure Edge Platform (NIA2_NGET0014) • Centralised Protection and Control (NIA2_NGET0004)
Substation – rebuild / replacement projects	Rebuild or replacement of parts for existing substation based on asset health	• Use of Innovative Materials and Construction Techniques in the Substation Environment to Accelerate Transition to Net Zero (NIA2_NGET0045) • EcoBuild 3D: Sustainable Substation Foundations (NIA2_NGET0070) • EPRI Substations (P37) and Analytics (P34) 2021-2025 (NIA2_NGET0008) • Detailed Analysis of Transformer Ageing Mechanisms for Intelligent Estimation of Reliability - DATAMInER (NIA2_NGET0052) • Fibre Health Monitoring (NIA2_NGET0015)
Substation – voltage control and Super Grid transformer uprating projects	To facilitate additional connections and ensure a stable and secure network	• Insulating Dielectrics - Esters & Alternative Liquids (NIA2_NGET0024) • VITDTC (Voltage Interaction and Thermal Dynamics of Tertiary Connection) (NIA2_NGET0030) • Dynamic System Rating
OHL reconductoring projects	To increase capacity and reduce limitations	• AssetCool
Cable – decommissioning	Decommissioning of existing cable systems	• Cable Oil DEcontamination by BaCteria (CODEC) (NIA2_NGET0047)
Cable – uprating projects	To increase power flow and meet future demand	• Benthic Life: Understand the impact of Electromagnetic Fields from Interconnectors (BLUEFIN) (NIA2_NGET0057) • TunCab – Tunnel Power Cable Novel Earthing (NIA_NGET0061)
Cable – replacement projects	End of life cable system replacement	• Fibre Health Monitoring (NIA2_NGET0015)

National Grid plc
National Grid House,
Warwick Technology Park,
Gallows Hill, Warwick.
CV34 6DA United Kingdom
Registered in England and Wales
No. 4031152

nationalgrid.com

nationalgrid