electricity north west

Bringing energy to your door

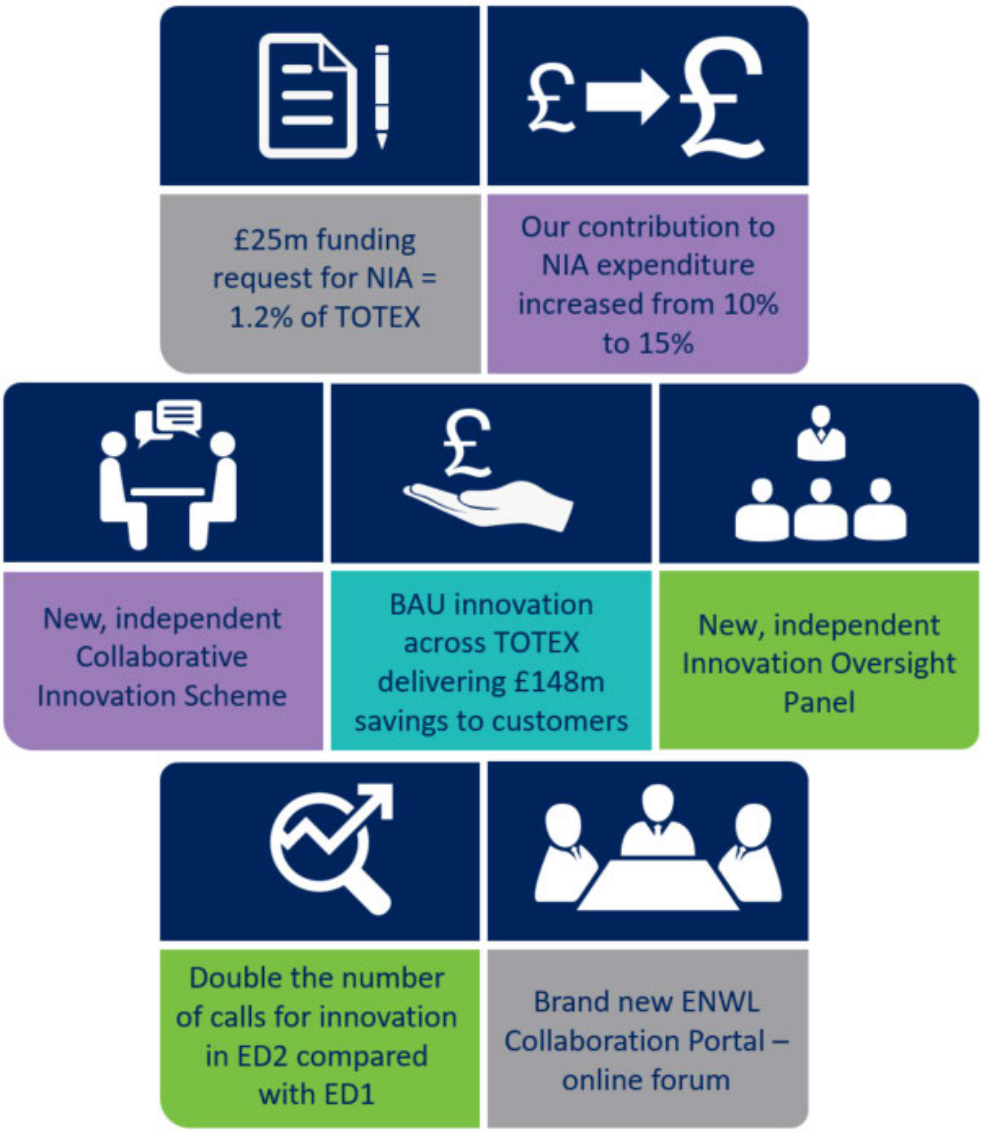
Annex 24: Innovation delivery plan

December 2021

Contents

1 Guide to Innovation Annex

Highlights of our RIIO-ED2 innovation plan



- **£25 million funding request for NIA across five years during RIIO-ED2, representing a £2 million per annum increase on current allowance, equating to 1.2% of TOTEX in RIIO-ED2 (1.1% in RIIO-ED1).**
- **Deployment of sizable BAU innovation across the TOTEX programme delivering £148 million in quantifiable savings to customers during RIIO-ED2 in addition to significant improvement in safety, customer service and resilience.**
- **A 5% increase in our contribution to NIA project expenditure from 10% to 15%**
- **Establish a brand-new, independent, Innovation Oversight Panel comprised of a range of key stakeholders to challenge and inform our ongoing and future innovation plans and projects.**

- **Introduce a brand-new, independently-run, Collaborative Innovation Scheme specifically for third parties, with a minimum of £2.5 million over RIIO-ED2 alongside our regular calls for innovation.**
- **Double the number of calls for innovation to facilitate a greater number of third-party generated projects aligned with our delivery of innovation commitments.**
- **Set up a brand-new Electricity North West Collaboration Portal, which will be an active online forum for establishing new and exciting innovation 'connections' and opportunities between innovation stakeholders across our region.**

Guide to this annex

In RIIO-ED2, we have categorised innovation into three areas:

Embedded innovation – this is proven innovation which is considered the default solution to a problem.

Business-as-usual innovation – both short-term, lower risk innovation funded by our base revenue allowance and our rollout of proven innovation.

Ofgem innovation stimulus – this is innovation funded by our customers under funding mechanisms NIA, NIC and SIF, as agreed by Ofgem, which demonstrate long-term value for customers with a focus on energy system transition and consumers in vulnerable situations.

This annex details Electricity North West's planned innovation programme for RIIO-ED2. It has been developed in line with our Innovation Strategy[1] and to support the wider strategic objectives set out in section 2 of the business plan.

In this annex, we will set out our proposed investment in innovation during RIIO-ED2, including a breakdown of how and where the investments will be made, identify the customer benefits we expect to accrue as a result of innovation, and detail our approach to both Ofgem-funded and Business as Usual (BAU) innovation for RIIO-ED2.

We have divided this annex into sections, each addressing the key features of innovation at Electricity North West considered relevant to answering Ofgem's specific requirement for RIIO-ED2 as set out in their RIIO-ED2 business plan guidance, as well as our plans over that period.

Section 2 evidences our **strategic focus on innovation**. We explain our view that innovation is a key enabler to meeting our broader objectives and facilitating outperformance, highlight Electricity North West's purpose and principles, and discuss our innovation lifecycle, demonstrating an embedded culture of innovation which aims to deliver valuable outcomes for our customers.

Section 3 illustrates our track record. So far during RIIO-ED1, we have approved projects across both NIC and NIA with a combined value of £47.8 million, which will deliver **£148 million in customer benefits to the end of RIIO-ED2**. We share the outcomes of innovation projects in our extensive portfolio, highlighting our now-embedded innovation and commitment to taking projects through to BAU, and recap our industry awards and recognition.

Section 4 draws out key features of our **new Innovation Strategy**, highlighting the industry-wide challenges we face, opportunities we have identified, and themes we have used to shape our RIIO-ED2 innovation plan.

[1] https://www.enwl.co.uk/go-net-zero/innovation/our-innovation-strategy/

Section 5 explains the importance of **stakeholder engagement** as we look to understand and respond to the needs of our customers and wider stakeholders. Here, we highlight the key stakeholder engagement activities that have given us confidence that our RIIO-ED2 innovation plan is aligned with the expectations of our stakeholders and customer representatives.

Section 6 provides a detailed explanation of how we plan to deliver our innovation activities in RIIO-ED2. We confirm our innovation commitments, including establishing our brand-new **Innovation Oversight Panel**, recap our innovation themes, and explain the potential for non-technical innovation, signposting where this exists across our business. We describe the types of funding available for innovation, confirming our plans for innovation funded via our total expenditure (TOTEX) and making a commitment to **increase our compulsory contribution from 10% to 15%.** We provide an overview of our proposed RIIO-ED2 innovations and the customer value we expect these to derive. We **propose to invest £25 million on Network Innovation Allowance** (NIA) projects in RIIO-ED2, which together with a **£21.5 million investment across NIC and SIF**, will contribute towards £163 million benefits in RIIO-ED2 and a further £200 million in RIIO-ED3. We explain how we will consider the impact of our innovation activities on consumers in vulnerable situations and detail our plans for third-party collaboration, including use of our novel **Collaborative Innovation Scheme** and the new **Collaboration Portal on our website**. We describe how we will manage project delivery and reporting, and confirm our **framework for rollout of proven innovation into BAU**. Finally, we present our detailed plan for innovation activities during RIIO-ED2.

We have included two appendices to this document: Appendix A, which details a portfolio of the projects we have undertaken during RIIO-ED1; and Appendix B, which contains the Terms of Reference for our Innovation Oversight Panel.

All financial figures provided in this document are presented in current prices.

2 A strong strategic focus and culture of innovation throughout Electricity North West

This section demonstrates our strategic focus on innovation within Electricity North West and how we consider innovation to be a key enabler**, as per 4.35 in the RIIO-ED2 business plan guidance**.

We have a strong focus on innovation across our business, starting at the very top with our CEO and the Executive Leadership Team and continuing throughout, including across our workforce. Our track record on innovation is industry-leading, as evidenced by our CLASS project, which is delivering significant savings for customers, and Smart Street[2], where we are one of only two distribution licensees to be granted funding from the Ofgem Innovation Rollout Mechanism (IRM).

So far in RIIO-ED1, we have used our end-to-end project management process for the successful delivery of all our projects. In the last five years, we have invested over £37 million and have successfully transitioned many of our projects into BAU. Transformational projects such as CLASS, Smart Street and Oil Regeneration have delivered millions of pounds of benefits for customers already. We will continue to invest and build on these successes as we look forward to RIIO-ED2.

It is important for us to understand and respond to the needs of our customers and wider energy stakeholders. Working together is at the core of our company purpose – engaging with our stakeholders on innovation, collaborating, sharing learning, listening and acting on what we hear is

[2] https://www.enwl.co.uk/go-net-zero/innovation/key-projects/smart-street/

vital to our success. We know that we can only be successful when we deliver outcomes that are valued by the communities we serve.

Innovation is core to our business at Electricity North West, and we consider it to be a key enabler helping us to meet our broader objectives and to address the challenges facing the electricity industry. It extends across all areas of our business and facilitates our delivery of many of our other key strategies, thus forming an integral part of our overarching business plan.

Much of the outperformance delivered during RIIO-ED1 has been achieved through application of proven innovation. Whether this be C2C[3], which has allowed us to connect more generation to the network without need for reinforcement; CLASS[4], which manages electricity demand by controlling voltage, allowing us to provide balancing services to National Grid ESO; asset optimisation[5], which has enabled us to approach our asset replacement with a keen eye on best value for money; or transformer oil regeneration[6], which has enabled us to extend the life of transformers without increasing the risk of them becoming unreliable.

We operate an employee suggestion scheme where employees are actively encouraged to submit ideas for innovation that might lead to savings for customers both now and in the future. An example of this is the "LV bypass", an innovation that was led by our Operations business working with our Policy and Standards team to introduce a solution that allowed a temporary repair to be quickly and safely established above ground on Low Voltage (LV) cables to significantly reduce the customers' time off-supply during a fault. Please see Section 3.3 on our embedded innovation for more information.

We work hard to ensure that our innovation is a success and is transitioned to BAU, delivering benefits to our customers. Where this isn't possible, we embrace the need for transparency and believe that capturing and sharing the learning is key. Across the whole industry, valuable lessons emerge from less successful projects, and it is therefore important that Distribution Network Operators (DNOs) continue to share the good and the bad of their innovation projects.

When it comes to transferring innovation into BAU, we believe in adopting a dynamic approach; one-size-fits-all does not work for projects of this nature. As such, we often need to move very quickly through the innovation cycle – from concept, to trial, to BAU – to ensure that we take full advantage of all opportunities that come our way. On other occasions, solutions are ready to transition to BAU at the opportune times, for example, depending on the increase in customers' use of new LCTs.

We hold regular "Innovation Steering Group" days, during which we invite all members of the innovation team and those who work closely with them to look at the innovation pipeline and horizon, producing ideas for possible future innovation projects. We also use these days as an opportunity to present the Innovation Strategy, alongside insights from the executive team, and to share our learning from past and current projects.

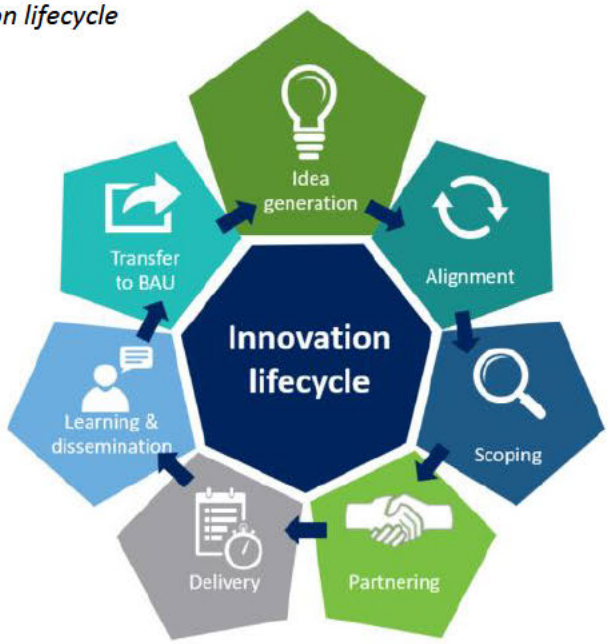
In recent years we reviewed our purpose and principles to develop and embed a culture of innovation at Electricity North West. We are switched on, attuned and responsive to the needs of our customers, colleagues and the world around us. We are adaptable, always looking for better

[3] https://www.enwl.co.uk/go-net-zero/innovation/key-projects/c2c/
[4] https://www.enwl.co.uk/go-net-zero/innovation/key-projects/class/
[5] https://www.enwl.co.uk/go-net-zero/innovation/smaller-projects/network-innovation-allowance/enwl005---asset-risk-optimisation/
[6] https://www.enwl.co.uk/go-net-zero/innovation/smaller-projects/network-innovation-allowance/enwl014---optimising-oil-regeneration-for-transformers/

ways to get things done, facing challenges head-on, embracing change and innovating to improve things for the future. We take pride in all we do and strive to do our very best, because we know it makes a difference to the lives of our customers.

Figure 2.1: Our purpose and principles

Figure 2.2: Our innovation lifecycle



Innovation as a business process features prominently in our strategy and taking innovation into BAU is a key consideration in our decision to undertake a project. After all, it's only when the innovation has been adopted across our business (i.e. embedded and considered the default

solution) that our customers realise the benefits. To ensure a consistent approach and, crucially, a smooth and successful transition to BAU, all innovation projects follow our innovation lifecycle.

- Ideas can come from a variety of sources, including diverse stakeholders such as academia, customers, partners, our supply chain and our people, and are assessed against our strategy and business plan.
- Ideas will not be taken forward unless the value for customers is clear and there are appropriate linkages to at least one of our innovation themes.
- All ideas go through our Engineering and Technical director, and are given a final stamp of approval by our board.
- Ideas are then turned into projects, which describe the aims, objectives and expected outcomes. Once partners are identified, together we will discuss the project scope to understand the value and cost.
- During project delivery, we rely on our proven project management skills to ensure projects are delivered on time and to cost. We also engage with the wider business to ensure that the scope includes all elements required to support the transfer to BAU.

3 Looking back to RIIO-ED1

This section describes our RIIO-ED1 innovation activities and how we have learned from them to better inform the development of our innovation plans for RIIO-ED2.

3.1 Our Track Record

This section demonstrates our track record for delivering innovative solutions during RIIO-ED1, providing benefits for our customers.

At Electricity North West, we are proud of our ability to use innovation to respond to the evolving needs of our customers, and of the contributions we have made to promote learning across our industry and beyond. As a single licence holder, we are the smallest DNO. Yet despite this, we continue to deliver innovation outcomes that bely that fact and are considered to be among the most successful DNOs in the area of innovation. We therefore consider ourselves to be punching above our weight in the area of innovation.

We believe our track record speaks for itself. To date during RIIO-ED1, we have successfully invested all of our allocated NIA funding which, combined with our investment on NIC over the same period, has delivered **£46 million in benefits so far in RIIO-ED1**, with expected benefits of **£148 million by the end of RIIO-ED2**. We aim to build upon our success and supplement this with proven innovation developed by the other DNOs.

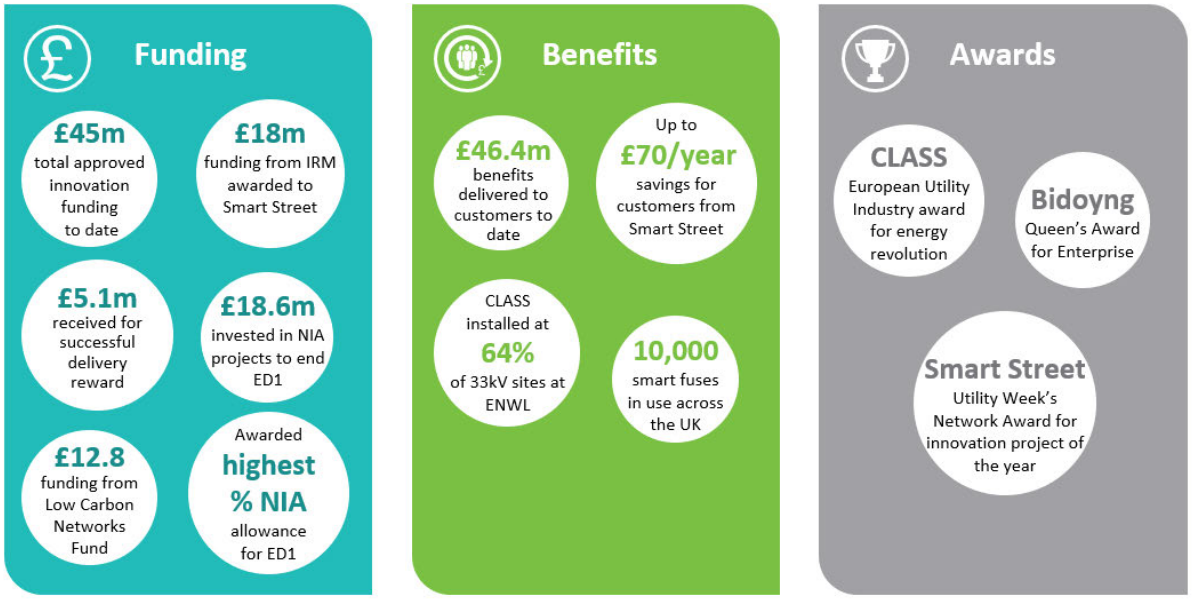
All of our innovation projects have delivered benefits to customers either directly through deferment of reinforcement, cheaper connections, improved fault response, energy consumption reduction or indirectly through improved forecasting and optimised investment planning.

As a single DNO and owing to the mechanism used in RIIO-ED1 to allocate funding between the DNOs, we had considerably less NIA in cash terms to invest than other DNOs and therefore it's been necessary for us to be much more circumspect in the types of projects we have pursued. We use our limited funding wisely by making use of incremental innovation, building learning through a series of

related projects the incrementally deliver benefits to customers. One example of this is QUEST[7], which builds on the learning gained from CLASS and Smart Street. While Smart Street uses learning from one First Tier Low Carbon Network Fund (LCNF) project and two Innovation Funding Incentive (IFI) projects; yet another is our multiple smaller NIA-funded projects on forecasting, which enabled us to build up learning to inform our Distributed Future Electricity Scenarios[8] (DFES). There are further examples of this in our RIIO-ED1 portfolio. This method of leveraging the innovation pipeline works incredibly well, we will seek to continue to employ it where possible in RIIO-ED2 and beyond.

Our track record of delivering innovation has resulted in significant benefits for our customers. By building upon the delivery framework and governance that provided these successes, we will continue this trend into RIIO-ED2 and beyond.

Figure 3.1: Our track record



Our success in RIIO-ED1 gives us great confidence in our ability to deliver a more ambitious innovation programme in RIIO-ED2. We have demonstrated that we can deliver and roll out real solutions which have the potential to be a game changer within the industry and deliver real benefits to Great Britain (GB) customers – we aim to build on this success during RIIO-ED2.

3.2 Our RIIO-ED1 Portfolio

This section summarises the innovation activities undertaken during RIIO-ED1 and provides evidence supporting our readiness for a more ambitious programme in RIIO-ED2.

Up to the end of March 2021, **we have invested 99% of our NIA allowance**, spending £18.6 million on innovation projects (as reported in RRP).

Up to March 2020, we had spent the highest percentage of NIA allowance across all DNOs, Figure 3.2 shows how this compares with the average percentage invested across the other DNOs.

[7] https://www.enwl.co.uk/go-net-zero/innovation/key-projects/quest/
[8] https://www.enwl.co.uk/get-connected/network-information/dfes/

Owing to Ofgem's approach to NIA funding allocation in RIIO-ED1, as we are a single-licence DNO, we received less cash funding than the other DNO groups. Despite this, we are delivering an impressive portfolio of projects, including both NIA and Network Innovation Competition (NIC) projects, summarised in Figure 3.3. For more detail on these projects please refer to Appendix A of this document and the innovation section of our website[9].

Figure 3.2 - Our NIA spending as a percentage of allowance compared with average spending across other DNOs

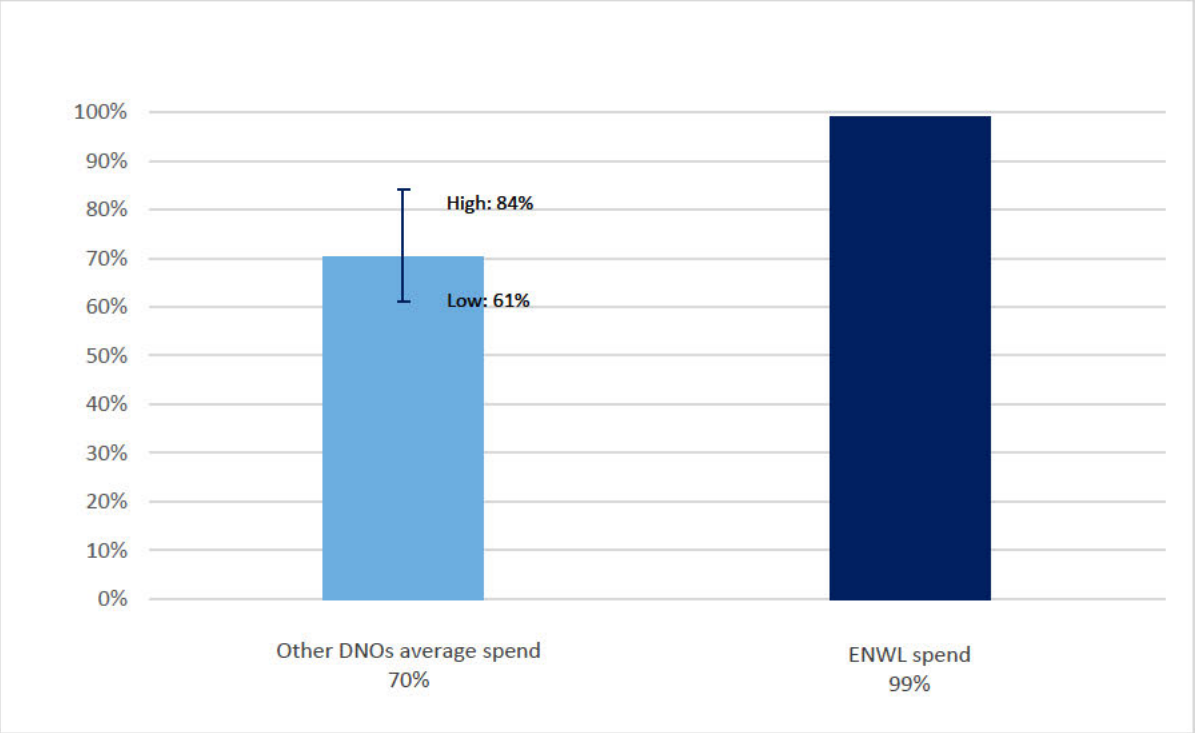


Figure 3.3 contains information on several of our key RIIO-ED1 projects, how they were funded, including the amount, together with a brief description on the outcomes obtained.

Figure 3.3: Our RIIO-ED1 portfolio

Project Name	Funding	Investment	Outcome
Demand Scenarios	NIA	£317,916	Produced a "Real Options Model" which we use to assess whether it is cost efficient to use a traditional or a smart solution to deliver network capacity.
Distribution Asset Thermal Modelling	NIA	£249,823	The outputs of this project were used in our NIC project, Celsius, to assist with the development of variable ratings.
Review of ENA Engineering Recommendation P2/6	NIA	£30,889	The findings from this work were taken forward by the Distribution Code Review Panel to implement.

[9] https://www.enwl.co.uk/go-net-zero/innovation

Project Name	Funding	Investment	Outcome
Combined Online Transformer Monitoring	NIA	£232,773	Currently a live project which is further validating the benefits of oil regeneration.
Asset Risk Optimisation	NIA	£105,250	The outputs of this project were used to optimise our investment programme.
Sentinel	NIA	£5,729,032	Currently a live project which has developed sensors we will be deploying in BAU to detect low hanging conductors.
Reliable, Low Cost, Earth fault detection for overhead lines	NIA	£171,742	The sensors developed in this project are now deployed in BAU to improve fault response.
ATLAS	NIA	£369,055	This project further improved our forecasting capabilities and the outputs are used in the construction of our DFES.
Cable Health Assessment – Low Voltage	NIA	£2,933,234	Currently a live project, one of the outputs from the research is a new low voltage monitoring unit, which we are deploying in BAU. The monitoring unit will be further developed to bring in the facility to enable the deployment of Celsius.
Value of Lost Load (VoLL) to Customers	NIA	£662,545	Further research in this area was conducted in the VoLL 2 project.
Enhanced Voltage Control	NIA	£190,848	This project delivered new policies for the setting of voltage control at sites with significant generation. These policies are now part of BAU and used for new connections.
Investigation of Switchgear Ratings	NIA	£286,274	This project developed a new "fault withstand" performance envelope for a range of more commonly used distribution switchgear. This is used to apply new ratings to existing assets and allows us to tailor our load related programme.
Detection of Islands	NIA	£119,040	We have not seen issues to warrant an implementation at this stage.
Optimising oil regeneration for transformers	NIA	£1,155,345	Currently a live project which is a follow on from Combined Online Monitoring investigating the benefits of performing oil regeneration earlier in the transformer lifecycle.
Tap Changer Monitoring	NIA	£1,955,592	Currently a live project to develop techniques to monitor tap changers to allow asset management decisions.

Project Name	Funding	Investment	Outcome
Future Network Modelling Functions	NIA	£76,517	This project produced an assessment of the expected future requirements for system modelling to inform strategic decision making. This is used to help construct our Distribution System Operation (DSO) and data strategies.[10]
Futurebay Heat Recovery	NIA	£987,336	This solution will not be taken forward as the benefits case is not sufficient.
Customer Avatar	NIA	£886,109	Currently a live project to understand customer needs by specific group to inform what technologies are required in the future to deliver effective customer service.
Interface	NIA	£792,347	Currently a live project investigating new communications interfaces for distribution substations. The learning from this will allow us to integrate the Celsius and Cable Health Assessment – Low Voltage projects to form a BAU solution.
Machine Learning and Artificial Intelligence	NIA	£757,537	Currently a live project investigating whether modern techniques can be used to interrogate existing data to gain further insight and benefit.
VoLL 2	NIA	£319,963	The outputs are being reviewed and assessed for possible implementation.
Reflect	NIA	£74,000	Currently a live project producing tools and methodologies for improved forecasting of Electric Vehicle (EV) charging.
Intelligent Network Meshing Switch	NIA	£1,435,656	Currently a live project developing a link box switch to be used in areas where existing devices will not work.
C2C	Tier 2	£211 904	C2C contracts are now a standard offering for new connections.
CLASS	Tier 2	£1,500,370	CLASS has been rolled out to 85% of primary substations on our network.
Smart Street	Tier 2	£7,316,735	Smart Street is currently being deployed at 180 substations during RIIO-ED1 with plans to roll out to a further 1000 substations during RIIO-ED2.
Respond	Tier 2	£4,660,000	We will target the deployment of Respond techniques in response to specific fault level constraints when they arise.
Celsius	NIC	£4,901,000	The Celsius techniques will be combined with the Cable Health Assessment – Low Voltage solution via the Interface project to form a BAU solution.

[10] Please see our DSO Strategy, DSO Transition Plan (Annex 17) and our Data Strategy (Annex 18)

Project Name	Funding	Investment	Outcome
QUEST	NIC	£5,494,004	Currently a live project developing an overarching control system to co-ordinate and boost the benefits of existing voltage control techniques.
Low Cost Actuator	BAU	[redacted]	We will install 3,350 units will at over 1800 substations in RIIO-ED1.

3.3 Embedded innovation summary

This section details several innovative solutions developed previously as part of our innovation activities which we now consider "embedded" innovation. This evidences our successes in achieving the ultimate objective of transitioning a project into becoming the default solution.

At Electricity North West, we are proud to have undertaken innovation projects which have produced technology now considered the default solution to a problem, or "embedded" into operations both here and across the industry. Details of some of our embedded solutions are provided in Figure 3.4, below.

Figure 3.4: Embedded innovation

Bidoyng Smart Fuse

In the early 2000s there was significant debate within the industry regarding smart grids and the potential impact on electricity distribution networks. It was also recognised that LV networks would need greater reliability if the planned migration to electric heating and transport was to take place. At Electricity North West we recognised that radical new technology would be required to ensure that LV electricity distribution networks could deliver the required step change in performance.

In 2006, together with our technology partner Kelvatek, we initiated the IFI-funded Fuse Restorer project. The aim of the project was to develop a device capable of carrying two low voltage fuses in a standard size fuse carrier. The device was designed to automatically insert a secondary fuse into a circuit following a transient fault to restore supplies to our customers and send an alarm to a nominated contact. Kelvatek delivered the final device in November 2010 which subsequently became known as the "Bidoyng Smart Fuse".

The Smart Fuse project, funded under First Tier LCNF, was launched in December 2010. The purpose of this second project was to facilitate the deployment of smart fuses across a number of feeders to gather a range of network performance data and to improve customer service by reducing the time taken to respond to a fault. The ultimate aim was to move the smart fuse through design, development and deployment to BAU, and provide real data to further develop the original financial cost and benefit projections.

The Bidoyng Smart Fuse is now fully developed and installed across our LV network as a standard means of addressing faults, and considered BAU for Electricity North West. It is also commercially available and in use by several DNOs across GB.

Weezap

The Weezap is a controllable circuit breaker (CB) which allows us to make adjustments to our supply arrangement remotely and dynamically, in line with changing load and supply conditions seen on the network as a result of the increasing uptake of Low Carbon Technologies (LCTs). It protects the network, allowing us to open CBs in overload and fault conditions and providing automatic reclosing to facilitate quick supply recovery. It also collects information about fault activity and helps to support fault location.

Background work for the Weezap started in DPCR5 with an IFI project called Conservation Voltage Reduction, which looked at our approach to connecting High Voltage (HV) capacitors to HV circuits and understanding how to control them to vary the voltage profile of the circuit. Following this, a further IFI project called LV Vacuum Circuit Breaker resulted in the joint development, with Kelvatek, of the Weezap.

Next, we ran the Low Voltage Protection and Communications project in conjunction with Kelvatek, and funded by the First Tier LCNF, from September 2013 to March 2015. This project developed the Weezap's protection capabilities and improved communications functionality to allow us greater control of the LV network, enabling us to modify system protection remotely.

The Weezap was used in our Smart Street trials from 2014-2018, and made up part of a system which trialled innovative voltage control techniques on the network to enable our customers' appliances to perform more efficiently and make it easier to adopt LCTs on to the network.

The device is now integrated into our Network Management System (NMS) and used across GB by other DNOs.

Additionally, as of April 2020, the Weezap is being rolled out across our network as part of the transition of Smart Street from innovation to BAU, following an £18 million investment via Ofgem's IRM.

Sapient

Approximately half of LV faults are transient in nature, and supplies are restored by replacing the blown fuse without an associated repair. A significant number of LV transient faults will subsequently develop into permanent faults, often following a period of repeat fuse operations. LV faults and our response to them are known to be a major factor in customer satisfaction outcomes.

The use of LV reclosing technologies provides for enhanced fault detection capability, helping fault teams to speed up response and repair; however, analysis of the data is a specialist activity and there are only a small number of internal champions that are capable of using it. Sapient has established a support centre provision via a specialist third party, which enables the use of the fault location features on an industrial scale as the analysis is performed centrally, off-site by a combination of software and specialists who provide location information and specific fault management advice directly to Electricity North West. This data analysis works to improve fault response times and enable proactive repair.

Following its successful development via the IFI in March 2015, Sapient, which helps us to find and repair faults before customers are affected, was trialled at scale within Operations, gathering data from around 600 smart devices installed on the LV network. To support the adoption of Sapient, a capital investment project was approved which sanctioned the purchase of additional

hardware and allowed Electricity North West to contract Kelvatek to provide third party support and assistance.

During RIIO-ED2 we will continue our use of Sapient by adding new LV reclosing devices, such as those being deployed as part of the Smart Street roll out, to the platform thereby widening the areas of the network being supported.

LV Bypass

As distribution network operator, our priority is to provide an excellent service to our customers. A key element of this service is ensuring that supplies are restored as quickly as possible in the event of a network fault.

Our codes of practice specify that in order to restore supplies within the allocated timeframe, supply restoration shall take precedence over fault repair. Wherever possible, restoration switching shall be carried out to restore customers by reconfiguring the LV system. There will be some situations where the fault location is obvious, and permanent repair can be completed within the specified time. However, supply restoration by permanent repair shall only be the priority where the exact fault location has been pinpointed and supplies cannot be restored by other methods.

We operate an employee suggestion scheme where employees are actively encouraged to submit innovation ideas that might lead to savings for customers both now and in the future. The idea for LV Bypass came from our Operations team, who worked with our Policy and Standards team to introduce a solution that allows a temporary fault repair to be quickly and safely established above ground, on LV cables, to significantly reduce our customers' time off-supply during a fault.

LV Bypass uses the Over Ground Temporary Link Box (OGTLB) to bypass an LV fault before it becomes permanent. The fault is first pin-pointed using a sniffer, before two holes are excavated either side of the fault and the cables are opened up. Leads are then connected to the OGTLB and to the LV mains cables either side to bypass the fault, and fuses are inserted into the OGTLB before the cable is cut either side of the fault. The fault cable/joint is then replaced with a new cable and two straight joints and the leads and OGTLB are removed. Customers remain on supply throughout this process.

This innovative solution is now used across the business to restore supplies in the event of a fault, and is the preferred method of temporary supply restoration in most cases.

3.4 Value of RIIO-ED1 innovation activities

This section details the investment we have made during RIIO-ED1, presented against our innovation themes, and the benefits delivered for our customers.

During RIIO-ED1 we developed a strong portfolio of innovation projects centred around the challenges deemed most important to our customers and stakeholders.

We successfully registered 23 NIA projects and secured Ofgem funding for two NIC projects, demonstrating our commitment to champion network innovation and facilitate the transition to Net Zero.

We further bolstered our efforts by successfully transitioning multiple Second Tier LCNF projects into BAU, including our award-winning CLASS – now operating at 257 primary substations, and Smart Street – operating at 180 distribution substations.

For RIIO-ED1 we were allocated a total NIA budget of £25.3 million. NIC funding is allocated subject to our successful funding applications.

Up to the end of March 2021, as reported in RRP, we have spent:

- **£18.6 million** on NIA innovation projects – **99%** of our available NIA allowance
- **£18.4 million** on NIC innovation projects
- Overall – **£37 million**

Figure 3.5 includes all of our forecast investment to date in RIIO-ED1, against each of our innovation themes.

Figure 3.5: Approved investment for RIIO-ED1 to-date in our innovation themes

Theme	NIA	NIC / LCNF Tier 2	Total to-date
Consumer Vulnerability	£4.1m	£6.0m	**£10.1**
Net Zero and the Energy System Transition	£5.5m	£7.9m	**£13.4m**
Optimised Assets and Practices	£12m	£7.0m	**£19.1m**
Flexibility and Commercial Evolution	£1.4m	£3.1m	**£4.5m**
Whole Energy System	£0.7m	-	**£0.7m**
Totals	**£23.7m**	**£24.1m**	**£47.8**

The investments we have made in innovation projects to date have delivered **£46.4 million in benefits for our customers in RIIO-ED1, as reported in RRP.**

Our innovation projects have and continue to deliver benefits to customers either directly, through deferment of reinforcement, more affordable connections, improved fault response, and energy consumption reduction, or indirectly, through improved forecasting and optimised investment planning.

3.5 Our work with third parties

This section details our work with third parties in RIIO-ED1, and highlights our plans to extend our use of third parties in RIIO-ED2 and to collaborate with other network companies and disseminate learning, **as per 4.36 in the RIIO-ED2 business plan guidance.**

Our work with third parties is an essential component of innovation at Electricity North West and we consider it central to the successful delivery of our projects.

Third parties are actively involved in all our innovation projects, either as a partner or a supplier, and are selected for their expertise or via competitive tender.

As appropriate, informed by our Innovation Strategy, we have successfully established long-term, strategic relationships with third parties who provide the technology required to meet our customers' needs. We also hold regular bilateral meetings with third parties to discuss our overall innovation portfolio, our future programme and areas where they may be able to provide support, including partnership opportunities.

In addition, we have ensured that third parties can send us their innovative ideas and proposals in a variety of ways; we have received ideas directly to our mailbox or a member of the team or across our business, and in response to calls for innovation. Each idea is assessed to determine whether it meets our challenges, aligns with our themes, and delivers benefits to customers. We then inform the third party of our decision and, if not taken forward, provide details of our reasoning and feedback. If a third-party idea is taken forward, they will be made a partner and assist with the development of the project registration documentation.

So far, during RIIO-ED1:

- We engaged with **182 third parties**
- We have invested **£31.9 million** with these organisations
- This equates to **86%** of our total innovation investments

We have consistently spent less than the 25% maximum allowed for internal labour – for example, in FY19 we spent 15.1% on labour, and in FY20 we spent only 8.9%. We decide on the most appropriate means of delivering a project and select the most efficient and effective delivery method for the individual projects. In many instances, this requires our working with third parties on the development of new technology; in other instances, the innovation concerns a novel application of an existing technology, meaning that more work is required directly on our network, thereby necessitating an increase in the amount of innovation funding spent on internal labour.

This funding has facilitated our collaboration with a range of organisations outside of Electricity North West, for example, large multinational companies such as Schneider Electric, large United Kingdom (UK)-based companies such as United Utilities, Small to Medium Enterprises (SMEs) such as Impact Research and other specialist consultancies, as well as academia and trade associations. Figures 3.6 and 3.7 below show our third-party innovation spend by company size and type, respectively.

Figure 3.6: Third-party innovation - % spend by company size

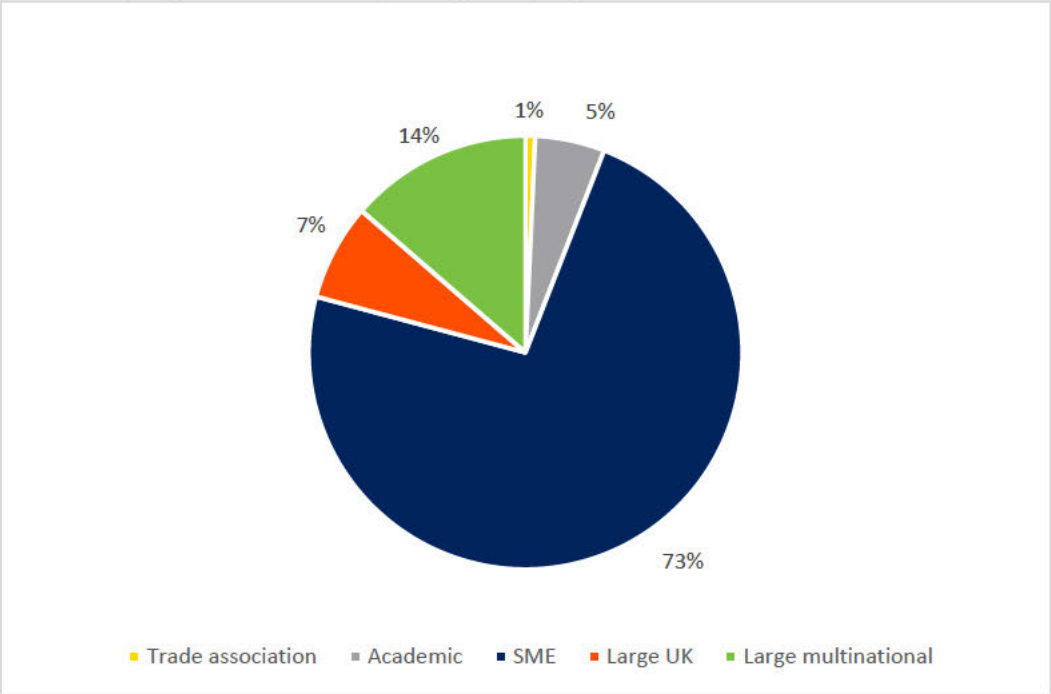
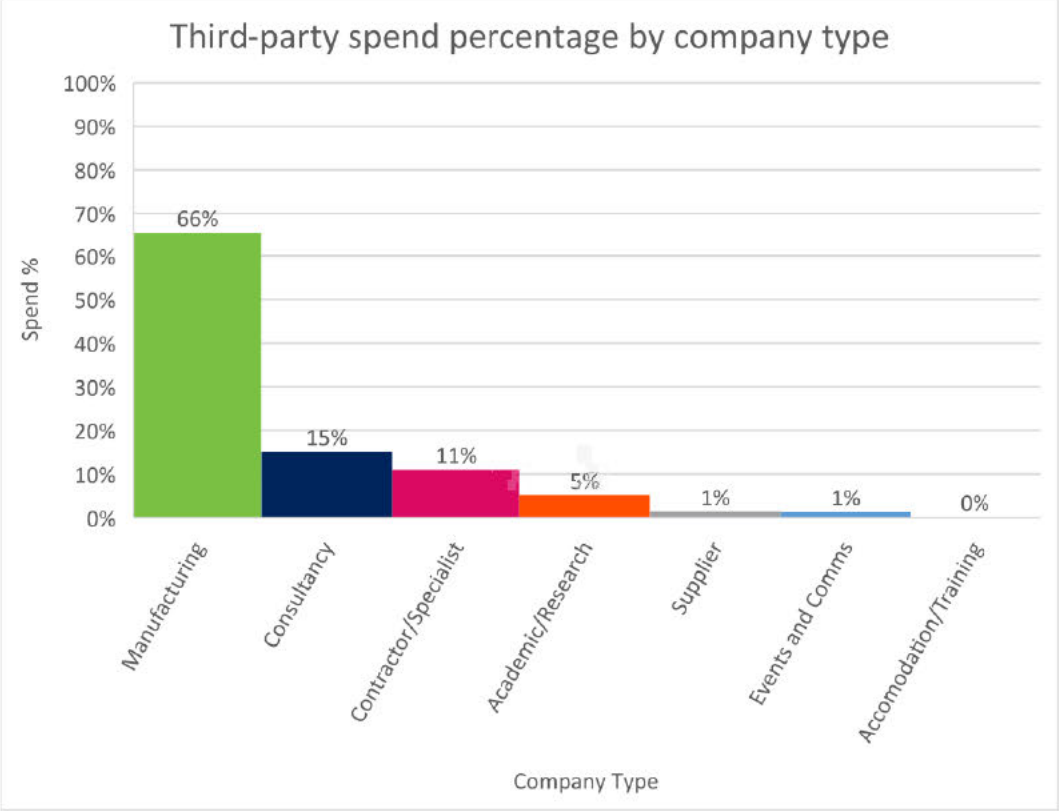


Figure 3.7: Third-party innovation - % spend by company type



In RIIO-ED2, we plan to increase third-party involvement in our innovation activities and ensure full consideration of third-party innovation ideas by committing to run regular calls for innovation and introducing our new Collaborative Innovation Scheme. The innovation calls are well-established, and

we aim to run these more frequently during RIIO-ED2. The Collaborative Innovation Scheme will be a defined route through which third parties can apply for innovation funding, with a view to launching a NIA project – this scheme will be run by an independent authority.

When the NIC comes to an end in 2022, Ofgem has proposed to discontinue ENA's annual Call for Ideas, instead placing a requirement on network companies to participate in generation of project ideas for the replacement funding mechanism, the Strategic Innovation Fund (SIF). Our Collaborative Innovation Scheme will therefore provide third parties with an extended opportunity to access innovation funding via the NIA alongside the SIF. For more information on our scheme, please refer to Section 6.9.1.

3.5.1 Industry collaboration

Throughout RIIO-ED1, we have been active members of the ENA Electricity Innovation Managers group and have contributed to the development of the Electricity Network Innovation Strategy and the Electricity Network Innovation Process including the new Innovation Benefits Reporting Framework for RIIO-ED2. We will continue this during RIIO-ED2.

It is through the Electricity Innovation Managers Group that we share project ideas with all network operators to ensure there is no duplication, promote collaboration between network licensees and share project learning to promote the roll out of innovative solutions.

ENA manage the Smarter Networks Portal (SNP) on behalf of the industry. The SNP holds information on all the innovation projects carried out by network licensees and allows third parties to submit ideas to the network licensees as well as providing a route for the network licensees to issue calls for innovation or project support. We have used the SNP to seek support with specific projects and we will be issuing details of our Collaborative Innovation Scheme via this route. Adjustments will be made to the SNP ahead of RIIO-ED2 and this will continue to play a key role in facilitating collaboration across the industry.

We are actively involved in ENA's annual National Call for Ideas, which seeks third-party innovation to take forward via the NIC. In 2018, we partnered with WPD on DC Share, an idea put forward by Ricardo, and have recently agreed to work with TNEI and Frazer Nash, alongside the other DNOs, on their idea, ATHENA, as a NIA project in 2021, with a view to submitting a NIC application in 2022.

Through our membership of the ENA Innovation Managers group and the ENA Collaborative Energy Portfolio (CEP), which has recently been re-tendered for a further 5 years, taking us well into RIIO-ED2, we have made the most of the opportunities to collaborate in a range of projects. Figure 3.8 gives an overview of those we have invested in during RIIO-ED1.

Figure 3.8: Collaborative projects

Project Name	Funding	Collaborators	Description
DC Share	NIC	WPD	This project is demonstrating a smart Direct Current (DC) network solution that facilitates rapid charging in constrained areas by using the available latent capacity across a number of substations through a DC network.

Project Name	Funding	Collaborators	Description
Smart Grid Forum WS7	NIA	NG ESO, SSE, UKPN, WPD	This project has undertaken detailed analysis into the operation of the GB power system as projected for 2030. Future needs of the distribution networks were identified with consideration of both traditional and smart solutions.
Improved statistical ratings for distribution overhead lines (WPD)	NIA	SPEN, SSE UKPN WPD,	This project will use the test rig facility to conductor and weather data to be analysed to validate and update overhead line ratings, update existing tools and methodologies, and produce a software tool that will enable GB DNOs to further optimise regional or line specific ratings.
REACT	NIA	NGESO, SSE, SPEN, UKPN, WPD	The project developed key learning relating to the interaction between active and reactive power demand while establishing an understanding of why reactive power is reducing across the country.
Project APPEAL	NIA	SSE, SPEN, UKPN	This project is investigating an alternative to creosote for preserving wood poles.
Management of plug in vehicle uptake on distribution networks	NIA	SSE, SPEN, UKPN, WPD	The objective of this project was to agree content to inform an Engineering Recommendation (or equivalent) with a number of influential stakeholders. The secondary objective will be to agree on the message and approach for communicating with the PIV buyer, the media and other key stakeholders.
Engineered Poles products	NIA	NPG, SPEN, SSE, UKPN, WPD	This project has produced new specification for Engineered Poles and is demonstrating whether they are fit for procurement activities.
Smart Grid Architecture Model (SGAM) Services	BAU	All ENA members	This project used the SGAM Process to provide a comprehensive representation of the future DSO and evaluate how the DSO might be operated under various market models.
Impact of LCTs on Electricity Networks	BAU	NPG, SPEN, SSE, UKPN, WPD	This project assessed the impact of LCTs on the UK's electricity Networks under various uptake scenarios and inform which solutions and approach will minimise the cost to customers while maintaining network resilience.

Project Name	Funding	Collaborators	Description
Wildlife protection	BAU	NPG, SPEN, SSEN, UKPN, WPD	This project will assess the susceptibility of overhead lines to ascertain those most a risk of wildlife contact and develop a risk assessment app to be used by DNOs.
Voltage Tolerance	BAU	NPG, SPEN, SSEN, WKPN, WPD	This project proposes to carry out a literature review of previous industry learning and carry out tests on historic wet and cold goods, such as washing machines and fridge-freezers, to understand the performance and operational impact at values towards and at -10% of the nominal LV system voltage.
G98/99 database consultancy support	BAU	NPG, SPEN, SSEN, UKPN, WPD	The objective of the review is to assess whether the information provided on the G98.99 database is suitable and sufficient to be able to demonstrate compliance with the technical and legal requirements of G98/99.
WS4 CBA – Whole systems CBA methodology	BAU	All ENA members	This project as part of Open Networks project delivered a whole system CBA methodology and model.
WS1A P7 – Baselining methodology	BAU	All ENA members	This project as part of Open Networks project explored if the adoption of a common baselining methodology can be employed when verifying distribution flexibility providers response to a flexibility event.

3.5.2 Customer engagement

Learning from our previous innovation projects has enabled us to develop and refine a broad range of traditional and innovative customer engagement techniques, which we will continue to use throughout RIIO-ED2. For example, as part of the Smart Street project we involved an engaged customer panel (ECP), a group of customers selected to represent an appropriate cross-section of customers in each of the project trial areas, at key points during the project. The ECP was recruited and educated on the project with the purpose of evaluating our proposed awareness materials to ensure they were pitched appropriately for all customers.

To facilitate vital customer engagement of this nature we employed third party Impact Research, a leading market research organisation with extensive experience in customer engagement activities in the utilities industry. We have also undertaken considerable work with Impact Research to effectively engage with customers in the VoLL1 & 2 projects, amongst others.

3.6 Showcasing some of our RIIO-ED1 projects

This section demonstrates the key details of three of our major RIIO-ED1 projects: CLASS, Smart Street and Sentinel.

See Appendix A of this document for details on our full portfolio of RIIO-ED1 projects.

Customer Load Active System Services (CLASS)	
Funding: Low Carbon Networks Fund, Tier 2	*Budget: £9 million*
Timescales: January 2013 – September 2015	*Website: www.enwl.co.uk/class*

Our award-winning CLASS project used innovative voltage control to reduce demand for electricity without customers noticing a difference to their service.

Cutting edge voltage controllers installed in our primary substations allowed us to manage electricity consumption at peak times by making tiny reductions in voltage which then reduced demand.

This ground-breaking approach can be used to help balance electricity supply and demand for the whole of GB and brings a number of other benefits:

- Makes it easier to adopt low carbon technologies onto the electricity network such as wind and solar power;
- Avoids or defers the need to expand our network of overhead lines, underground cables and substations; and,
- Reduces costs for all electricity customers.

CLASS is expected to save customers in the North West around £100 million over 25 years, and £300 million if deployed across GB.

Original project

The original CLASS trials were carried out in 2014. Working with National Grid ESO, we developed four sets of trials, using a range of equipment installed in our control room and at 60 primary substations serving 485,000 customers – around 17% of our network.

The substations were selected to ensure that the trial area was representative of our geographic area and our different types of customers.

A device called an autonomous substation controller (ASC) was installed at the 60 substations. This device linked to our control room management systems and the onsite automatic voltage control (AVC) relay. The AVC is a BAU device which monitors voltage and operates the transformer's on-load tap changers to maintain voltages within statutory limits.

The ASC is the onsite intelligence of the CLASS system which, once activated or enabled from the NMS dashboard via the remote terminal unit, makes decisions on what commands to send to the AVC and circuit breakers and makes adjustments to voltage levels as required.

We conducted four trials over a 12-month period which were developed to demonstrate how voltage management techniques can reduce demand. We collected and analysed data on voltage and power quality so that we could quantify the effects of the trial on the regional and national electricity networks.

The project demonstrated that the relationship between voltage and demand is more or less linear, meaning that a 1% reduction in voltage leads to a 1% reduction in power. This equates to a customer's kettle taking eight seconds longer to boil.

As part of the project over 1,300 customer surveys were carried out to understand if CLASS techniques had any adverse effects on customers' electricity supply.

The findings from these surveys and the technical trials proved conclusively that by using CLASS techniques we can use voltage control to reduce demand without affecting customers' perception of their electricity service.

Business as usual

Following a six-month extension to the original CLASS project which demonstrated how the technology could be deployed commercially, we have since rolled out CLASS techniques into our BAU processes.

Working with our project partner Fundamentals, we developed new, cutting-edge voltage controllers which have been installed at 260 primary substations across the region which serve nearly 2 million customers. These controllers receive instructions from the CLASS dashboard developed as part of our NMS by our project partner, Schneider Electric.

As well as allowing us to reduce peak demand on our own network, links between our control room systems and National Grid ESO allow for the provision of balancing services to maintain electricity supplies for millions of customers across GB.

Balancing services are a range of energy and capacity products used by National Grid ESO in response to a sudden drop in generation. Using CLASS as a balancing service helps reduce the need for additional expensive sources of power such as coal-fired power stations.

There are two products that we offer to National Grid ESO using CLASS technology:

Secondary frequency response: CLASS activates when frequency drops below a certain level, by automatically reducing voltage via tap changers at some of our primary substations. Response is provided within 30 seconds and the service must be maintained for 30 minutes.

Fast reserve: for this service we can make up to 75MW available to National Grid ESO in response to a sudden dip in generation. When it's needed, control engineers in the national control centre can hit the button to operate the tap changers in our primary substations. The signal is transferred electronically through our NMS to a number of our sites. This causes our tap changers to reduce local voltage and therefore reduce electricity demand – all within a minute of National Grid ESO's control engineer activating the service. When National Grid ESO want to stop the service, a signal is sent in the same way and the local voltage returns to normal. Each activation is typically around 15 minutes in duration and the service can be called upon a number of times per day.

Providing balancing services in this way CLASS can help keep the entire national electricity grid stable and secure, all without our customers noticing a difference to their service. This is a ground-breaking innovation and we are the only network operator who can currently offer this capability.

Smart Street

Funding: Low Carbon Networks Fund, Tier 2	*Budget: £11.5 million*
Timescales: January 2014 – April 2018	*Website: www.enwl.co.uk/smartstreet*

By combining innovative technology with existing assets, Smart Street makes networks and customers' appliances perform more efficiently and makes it easier to adopt low carbon technologies onto the electricity network.

As we become more reliant on electricity as our main source of power, our customers will use more low carbon technologies such as Electric Vehicles (EVs), heat pumps (HPs) and solar panels.

These technologies tend to occur in clusters which has a dramatic effect on the electricity network. While EVs and HPs could cause voltage to fall below statutory limits, new generation from solar panels exporting electricity to the network will have the opposite effect. If voltage levels fall outside statutory limits, the way our customers' appliances perform will be affected.

Smart Street combines the concepts of interconnection of networks, developed within our C2C Project, and voltage control, developed within CLASS.

Using on-load tap changing transformers and new controllable switching devices, called the Weezap and Lynx, integrated into our NMS, Smart Street stabilises voltage and avoids it falling outside of statutory limits.

We can then reduce the supply voltage to our customers to an optimum level so that our networks and our customers' appliances work more efficiently, a technique known as conservation voltage reduction.

Controlling voltage on our low voltage network brings a number of benefits to customers. It can reduce electricity bills by up to £70 a year, reduce carbon emissions and will provide more flexible solutions to help us connect low carbon technologies to the network, all without impacting power quality.

Original project

The original Smart Street project involved a series of trials to test the technology on six primary substations and 38 related distribution substations, serving around 67,000 customers.

During the technology build we installed 498 Weezaps and 126 Lynx devices. We also installed 49 end-point monitors, 84 low voltage capacitors, six high voltage capacitors and five on-load tap changing transformers. All of this equipment was integrated into our NMS and was controlled by Siemens Spectrum 5 from our control centre.

The primary substations involved in the Smart Street trial were Egremont, Wigton, Hindley Green, Green Street, Wigan, Denton East and Longsight.

The new equipment was installed and the system configured between late 2014 and late 2015, with live trials beginning in January 2016. The trials took place over a two-year period using a two-week-on/two-week-off test regime. This enabled us to compare one year's worth of Smart Street data with normal network operation, so we could calculate the overall benefits of Smart Street and understand any impact on the 67,000 customers served by the trial circuits.

Understanding whether customers were affected by the trials was crucial to the viability of the Smart Street solution. Engaged customer panels were held during the trials to see if customers observed any changes in their electricity supply. All the customers who took part in our panels confirmed that they had not noticed any changes.

The trial results showed that the capacitors did not provide any additional benefit over that provided by the other technologies; therefore, these devices are not being installed as part of the Smart Street rollout.

Innovation rollout mechanism

In October 2019 Smart Street was awarded £18 million from Ofgem's IRM. The IRM provides funding to implement proven innovations like Smart Street which will provide long-term value for money to customers and deliver environmental benefits.

In 2020 we began a three-year programme to install Smart Street technology at 180 distribution substations, targeting areas with a high uptake of low carbon technologies, particularly where these overlap areas of fuel poverty. This will bring benefits for up to 45,000 customers, reducing electricity consumption by 5-8% per year and saving up to £60 a year off customers' electricity bills.

In the longer term this rollout will save a massive 143,860 tonnes of carbon between now and 2050, the same as removing 2,570 cars from our roads every year.

Smart Street demonstrates a step change in the co-ordination and operation of electricity networks in GB and is the first demonstration of a fully centralised low voltage network management and automation system.

Sentinel	
Funding: Network Innovation Allowance	*Budget: £4 million*
Timescales: September 2015 – December 2022	*Website: www.enwl.co.uk/sentinel*

The project will trial new sensors on our overhead lines which will enable us to detect and repair broken or damaged equipment more quickly.

The protection system on our HV overhead lines is designed to detect faults and where possible remove that danger by opening a circuit breaker. Most faults on the HV system generate sufficient levels of fault current to cause protection systems to trigger which then removes the faulty part of the system from the network in a very short time, in most cases within a second.

Some faults, however, referred to as "high impedance" faults, may not create enough fault current and can therefore go undetected. Typically, these faults include a broken overhead line conductor which could be low-hanging or in direct contact with the ground. As well as impacting our customers' electricity supply, these faults can become a safety hazard for the public and out own people if they are not detected and repaired.

Faults on overhead lines can also be difficult to find and we rely on engineers patrolling large areas on foot to locate damaged equipment. This means some of our customers will be without power until the fault can be located and repaired. This is particularly true in storm conditions. Storms mainly affect the rural areas of our network which are predominantly made up of long lengths of overhead line and which may be impeded by overgrown trees.

It is these types of faults which are the main focus of the Sentinel project.

The project is trialling two different techniques for fault location – impedance-based and voltage gradient. We have developed new advanced fault sensing technology and installed sensors at 110 locations on our HV overhead line network to detect high impedance faults, typically those associated with broken conductors. Following the success of this trial, we will install a further 850 improved devices within RIIO-ED1.

The two techniques are being trialled on a variety of network types e.g. radial, meshed, resistance earthed, compensation earthing or solidly earthed and a number of different line lengths, including some with sections of underground cable. This will allow us to understand the performance of the techniques and which technique suits which network type.

The fault sensing technologies are integrated into a central dashboard at our control centre which displays the results from all of the selected sites.

The system is capable of detecting all types of HV network faults, including transient faults, and providing a fault location within 500m of the actual fault position.

By developing novel fault location sensors which enable earlier detection and response to broken or damaged conductors, this project will improve quality of supply for customers who experience weather-related outages and provide a higher level of safety for the public and livestock.

In addition, Sentinel will provide a number of other benefits:

- Improve the safety of repair teams
- Detect and locate transient faults
- Avoid the need to patrol the network in extreme weather conditions
- Reduce repair time
- Reduce the time customers are off supply
- Enable the detection of multiple faults following a storm.

The results of the Sentinel trials can be used to inform specifications and engineering policy for the application of HV distance-to-fault systems on distribution networks for the whole of GB.

3.7 Awards and recognition

This section highlights the awards and recognition our innovation activities have received during RIIO-ED1.

We have an impressive track record, which includes official recognition from a number of sources for multiple projects.

Smart Street

- Awarded £18 million funding by Ofgem for rollout of Smart Street via the Innovation Rollout Mechanism in 2019
- Won Network Award for Smart Street – Innovation Project of the Year – Electricity, 2019.
- The Network Awards recognise individuals and organisations who demonstrate exceptional performance in the energy networks space. We were awarded Innovation Project of the Year for Smart Street at the Network Awards in 2019, despite tough competition from National Grid, UKPN, WPD and Northern Powergrid.
- Featured in several publications, including the Guardian, Energy Live News, Smarter Networks and Current News.

"a new carbon-cutting frontier for the UK as it moves towards its 2050 target..."

- *The Guardian*, 2019

"Royal recognition for power cut kit..."

- *Network*, 2018

Bidoyng

- Won Queen's Award for Enterprise in 2018.

  The Queen's Awards recognise outstanding achievement by UK businesses in innovation and celebrate the success of a great product or service. They are a prestigious way to recognise a contribution to enterprise in the UK.
- Technology rolled out across Electricity North West and nationwide.
- Featured in Network Magazine, Lancashire Evening Post and Cumbria Crack in 2018.

CLASS

- Won European Utility Industry Award for Energy Revolution – CLASS – 2016.

  These prestigious awards recognise and celebrate projects that have shown outstanding commitment and accomplishments towards a sustainable energy sector.
- Ofgem permitted us to roll CLASS out into BAU.
- Featured in Smart Energy International, Inframation, Energy Live News and others.

"leading the way in developing smart solutions to meet the UK's future energy challenges..."

- Smart Energy International, 2016

We also received a number of Ofgem rewards:

- **£1.75 million First Tier Reward**

  The First Tier reward was used by Ofgem to imitate the benefits of commercial innovation by rewarding DNOs for successful innovation. The maximum award that could be gained by any one DNO would not exceed £2.5m.
- **£3.4 million in SDRs** for CLASS, C2C, Smart Street, Respond and Celsius

  The Successful Delivery Reward (SDR) is a financial reward for network companies that deliver projects efficiently. DNOs will make a compulsory contribution of 10% of the total project funding approved at the start of the project, and can apply to have this funding repaid if they meet the necessary criteria.

  We met this criteria for a number of projects and received a total of £3.4 million out of a potential £3.8 million.

In 2022, we will be submitting two of our projects – Smart Street and CLASS – into the second application window of the Second Tier Reward.

4 Innovation strategy

Our Innovation Strategy is proactively shared with stakeholders, regularly updated and published on our website. This section provides a brief insight into the contents of the current strategy and how we have used it to inform our strategic approach to our innovation plan, **as per 4.36 in the RIIO-ED2 business plan guidance.**

We have constructed our Innovation Strategy[11] and the associated business plan around the themes and principles as set out by ENA in the Electricity Network Innovation Strategy[12] and the three core challenges (energy system transition, asset management and vulnerability) facing distribution network operators. This approach ensures all our innovation activities build upon industry-wide challenges and strategic direction, that our stakeholders have visibility of the areas on which we are focused, and that we target our innovation resources appropriately across the full range of current

[11] https://www.enwl.co.uk/go-net-zero/innovation/our-innovation-strategy/
[12] https://www.energynetworks.org/publications

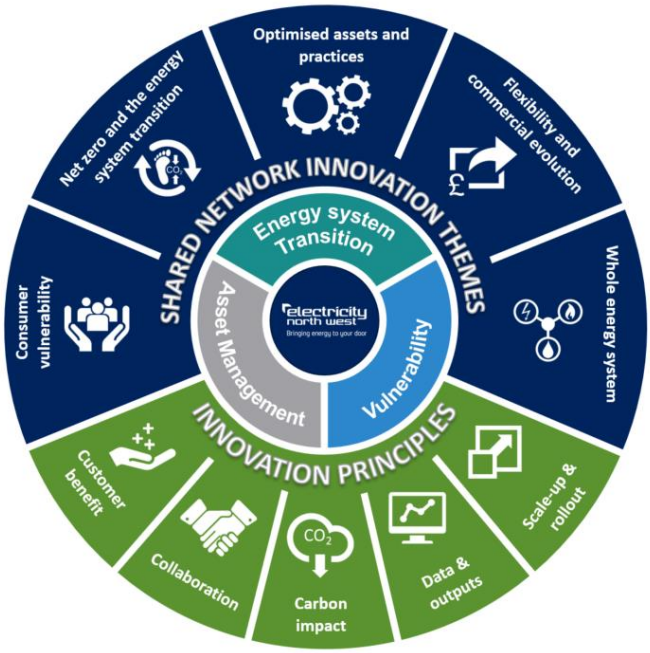
and future challenges. All of our NIA-funded RIIO-ED2 innovation projects will address one or more of the themes set out in the strategy.

The shared network innovation themes are the five areas of focus for all eligible innovation projects. Identified with the help of industry stakeholders through active engagement, they provide shared strategic direction across the whole of industry, a means of categorising and tracking investment in innovation, and help for innovators and others to understand how they can collaborate with us by setting out clearly and consistently the purpose of the innovation. Each of our RIIO-ED2 innovation projects will cover one or more of these themes, and we have endeavoured to construct a balanced portfolio of projects across all areas; though we have not been constrained by this as an objective.

Each of our innovation projects seeks to explore a range of technological and commercial issues, and trial solutions to one or more of the problems associated with each of the three key challenges.

Finally, to further ensure our RIIO-ED2 innovation projects are aligned with the needs of stakeholders, and that deliverables are communicated in a manner consistent with our industry peers, our five innovation principles are the pillars underpinning all projects.

Figure 4.1: Innovation Strategy at a glance



4.1 Innovation challenges

This section describes the industry-wide challenge areas on which we will focus our innovation plan during RIIO-ED2.

Successfully delivering against our RIIO objectives presents several challenges right across the organisation, and it is in these areas that we aim to focus our RIIO-ED2 innovation efforts. The innovation challenges can be split into three broad areas:

i. Energy system transition

The energy system transition will result in a network originally designed for passive energy flows increasingly operating in a much more active way with power flowing in both directions. This change, along with the predicted increase in customers' demand for electricity from the adoption of

LCTs, requires us to rethink the way we operate the network, the technologies we use and how we interact with those customers. We expect RIIO-ED2 to be a crucial period for this transition.

Our Net Zero[13], DSO[14], and Digitalisation[15] strategies are key enablers to help meet the challenges of the energy system transition by incorporating techniques such as demand response, intermittent generation, storage, interconnection and consumer choice.

- *Net Zero* – As our national and regional targets drive the decarbonisation of heat and transport, more customers will change from passive consumers to active "prosumers", who can generate, store or sell electricity. Others will rely on the network more than ever before to heat their homes and charge their EVs.
- *DSO* – Delivering DSO functions is a key enabler to making Net Zero affordable. These functions are at the heart of a more active regional electricity network, fit for the changing ways customers produce and consume energy.
- *Digitalisation* – Our Digitalisation Strategy states: "In order to manage the increasingly uncertain energy flows on the network, it is essential that key network parameters such as voltage and power flow magnitude and direction at critical points in the network are measured in real-time. Consequently, key enablers for the energy system transition include many additional network energy and voltage measurement points, advanced communications technology and enhanced automatic control capabilities."

The individual strategies set out our key activities to help meet the energy system transition targets and how innovation can facilitate these. These key activities are reflected in our RIIO-ED2 innovation plan.

ii. Asset management

A key responsibility of a DNO is to operate and maintain apparatus, and optimising the use of our existing assets has been central to our Innovation Strategy for several years and we will continue to innovate in this key area during RIIO-ED2.

Asset Management can be looked at from two perspectives:

- *Safe & efficient network* –Most of the electricity industry assets were installed in the 1950s and 1960s and many are approaching their designed end of life. To avoid large peaks in asset replacement programmes, which are both unaffordable and impossible to deliver effectively, we need to investigate alternative ways of managing this ageing asset base, particularly as they are increasingly being asked to perform new functions owing to changes in the needs of our customers.
- *Reliability & resilience* – The energy system transition will result in customers becoming more reliant on the electricity network for heat and transport, increasing the importance of a reliable and resilient network.

Delivering the higher reliability levels and safe and efficient performance from the ageing asset base will require innovation in active network management, energy management, active automation systems, fault detection and repair technologies, and asset condition assessments.

[13] https://www.enwl.co.uk/go-net-zero/our-plans-to-go-net-zero/leading-the-north-west-to-net-zero/
[14] https://www.enwl.co.uk/go-net-zero/our-plans-to-go-net-zero/dso/
[15] https://www.enwl.co.uk/go-net-zero/our-plans-to-go-net-zero/dso/

iii Vulnerability

Vulnerability from the perspective of a consumer of electricity is defined as one who is significantly less able than a typical consumer to protect or represent their own interests and/or significantly more likely to experience detriment, or for that detriment to be more substantial.

The energy system transition of the electricity network could, without action, lead to those consumers in more vulnerable situations being left behind or otherwise disadvantaged if they are unable to access the new technologies and innovative services available, and therefore to take advantage of lower tariffs or improved reliability.

Throughout RIIO-ED2, we need to ensure that the most vulnerable in our region are not disadvantaged or excluded from the benefits of the developments we and others make in the energy sector.

4.2 Innovation opportunities

This section describes the opportunities that we will maximise during delivery of our innovation plan for RIIO-ED2.

Our innovation work is driven by the challenges we face and is key to unlocking the opportunities made available to us through the availability of elements such as new technologies and new emerging markets. Our approach is to maximise the potential that these new opportunities bring, to address our challenges and help us to improve our performance and efficiency.

4.2.1 New technology

New technology has the ability to transform what we do. We are excited by the opportunities provided by new technology and the potential benefits to our customers.

The supply chain plays a central role in meeting the future needs of our customers, and innovation is core to this. In RIIO-ED2, we will continue to work with SMEs to help and encourage them to develop new technologies which will, in turn, help us meet the challenges facing our industry.

Technology and innovation are only valuable to our business if they help us improve our services or reduce costs for customers. To ensure we meet the expectations of our customers, during RIIO-ED2 we will continue to investigate new technologies on the market and how they might be utilised to help us meet our challenges; we will also continue to work with SMEs and survey the market for new entrants.

We will continue to signal our requirements and expectations for innovation to the market for goods and services, utilising such things as our Innovation Strategy, our RIIO-ED2 innovation plan, and our calls for innovation and Collaborative Innovation Scheme.

4.2.2 New markets

Offering customers choice is a cornerstone of our Innovation Strategy and, during RIIO-ED2, we will continue to explore the opportunities provided by new and emerging markets.

Our strategy is to consider the widest application of our innovation by adopting a holistic “whole system” approach, which focuses on the impact on our network and how the innovation can be deployed to maximise benefit to customers. This could be through entering an existing market to provide services at lower cost or working with other industry participants to define new products and services for which markets can be developed.

4.3 Our innovation themes

This section describes the themes that we will use to ensure we deliver an appropriately balanced portfolio of projects during RIIO-ED2 to meet our innovation plan, building upon industry-wide strategic direction, **as per 4.36 in the RIIO-ED2 business plan guidance**.

To ensure our innovation activities are focused on the areas identified as most important by our stakeholders, we have adopted the five innovation themes outlined in ENA's national strategy. These themes provide shared strategic direction, a means of categorising and tracking investment, and help innovators understand how they can collaborate with us.

Each of our projects will tackle one or more of these themes and our plan for innovation in RIIO-ED2, outlined in Section 6, will be presented against these themes in line with the RIIO-ED2 business plan guidance.

4.3.1 Consumer vulnerability

This theme seeks to address how we can support the needs of consumers in vulnerable situations today and in the future. We need to ensure that everyone can experience the benefits of the energy system transition, and any adverse effect of change is minimised.

4.3.2 Net Zero and the energy system transition

This theme looks at methods to facilitate and accelerate the UK's transition to Net Zero greenhouse gas emissions before 2050. As the UK continues to transition to Net Zero, the ways in which different customers use electricity and electrical networks will need to keep pace, resulting in significant changes in our network. We will manage the uncertainty associated with those changes through our innovation projects.

4.3.3 Optimised assets and practices

This theme looks to develop and implement industry-leading techniques for optimising assets and practices for energy networks.

4.3.4 Flexibility and commercial evolution

This theme will develop and test innovative solutions to increase the flexibility, transparency and efficiency of the energy system, enabling information to be more open and networks to be more responsive to change.

4.3.5 Whole energy system

This theme seeks to enable joined up and efficient approaches across multiple aspects of the energy system around planning, forecasting, design, construction, operation, maintenance and data.

5 Stakeholder engagement

This section describes our stakeholder engagement activities during RIIO-ED1 and highlights what we have done to ensure that our RIIO-ED2 plans will meet stakeholder expectations.

An important driver in preparing our innovation plan is to understand and respond to the needs of our customers and wider energy stakeholders. Working together is at the core of our company purpose; engaging with our stakeholders to inform innovation, collaborating, sharing learning, listening to and acting on what we hear is vital to our success. We know that we can only be

successful when we deliver outcomes that are valued by the communities we serve, and we therefore consider stakeholder engagement central to the successful delivery of our projects.

We follow best practice when engaging with stakeholders to ensure that we consult the right stakeholders, in the right way, at the right time, on the right issues. Further information about our stakeholder engagement methodology is detailed in our RIIO-ED2 business plan.

We continuously rely on engagement with our stakeholders to inform our innovation activities and have numerous examples of the types of engagement we have carried out during RIIO-ED1, some listed in Figure 5.1 below. We will continue our tried and tested engagement methods through RIIO-ED2 to ensure that we are meeting the needs and expectations of our customers and wider energy stakeholders.

Figure 5.1: Our engagement activities

Activity	Description	Feedback
Engagement Hub on website	A platform on our website for stakeholders to access draft documents and provide views and feedback on our open consultations via online surveys. We used this for our draft Innovation Strategy.	Some feedback received - focus on themes we are planning to address and confirmed online engagement is preferred method of engagement.
Virtual Innovation Strategy event	Presentation introducing our draft Innovation Strategy. Several specific feedback questions asked to the audience, opportunities for open Q&A at several points throughout presentation.	Good - majority of attendees completed survey questions, confirming our thinking, and we received a high level of engagement through questions and general comments during the presentation.
Online survey embedded into new Innovation Strategy	Specific questions asked about our themes and what participants would like us to focus on going forward, questions about how best to engage in future and an opportunity to leave general comments.	Feedback pending – only recently published.
Electricity North West's Call for Innovation	Call for innovation placed via our website and the ENA portal, publicised to our stakeholder mailing list and via our social media channels. Our call invites stakeholders to submit their innovation ideas for our defined key innovation areas.	Strong response to the call itself and several specific queries from stakeholders in advance, 50 ideas submitted in total for 2021.

Activity	Description	Feedback
National Strategy Engagement	ENA actively engaged with industry stakeholders to identify innovation themes, also adopted by Ofgem in their plans for RIIO-ED2, which provide shared strategic direction across the whole industry, a means of categorising and tracking investment in innovation, and to help innovators and others to understand how they can collaborate with us by setting out clearly and consistently the purpose of the innovation.	Themes agreed and ranked in order of priority by industry stakeholders. 1. Net Zero and the Energy System Transition 2. Optimised Assets & Practices 3. Whole Energy System 4. Consumer Vulnerability 5. Flexibility and Commercial Evolution

Much of our recent stakeholder engagement has focussed on our new Innovation Strategy, which details our innovation themes, challenges and principles – for more information see Section 4 of this document – and feeds into our innovation plan for RIIO-ED2.

This engagement has provided feedback which we can use to shape our stakeholder engagement methodology going forward. For example, we have learned that stakeholders are very comfortable using online media and virtual conferencing to engage and submit their feedback and innovation ideas. We will therefore continue to expand our use of this method of engagement during RIIO-ED2, including general dissemination of project outcomes, consultation on changes to our Innovation Strategy, and our calls for innovation and Collaborative Innovation Scheme.

Importantly, this engagement has given us confidence that our RIIO-ED2 innovation plan is aligned with the expectations of stakeholders and customer representatives. For example, our engagement with ENA on the National Innovation Strategy, which was challenged by stakeholders and incorporates much of their feedback, heavily influenced our new Innovation Strategy. Feedback received during our virtual Innovation Strategy event confirmed the appropriateness of our decision to use ENA's model for our own strategy.

Our strategy was also given the blessing of Electricity North West's Customer Engagement Group (CEG), who emphasised the importance of work with third parties and engaging with a wide audience. Our internal Regulatory Steering Group (RSG), which is chaired by the CEO, and our Executive Leadership Team (ELT) have challenged and approved our new strategy which forms the basis of our RIIO-ED2 plan.

In addition to the above, we will continue to take advantage of our links with Kansai Electric Power, one of our shareholders, to explore project idea options. Already we have identified several opportunities for trialling on our network innovation proven by Kansai that could have the potential to bring value to our customers during RIIO-ED2. This is a unique form of stakeholder engagement which will help us to utilise innovation from across the globe and is something that we will take advantage of going forward.

6 Innovation delivery in RIIO-ED2

This section includes a summary of all our innovation investment, including NIA, NIC/SIF and BAU throughout RIIO-ED2. It further describes our approach to innovation for RIIO-ED2 and includes our proposed innovation plan, **as per sections 4.33-4.39 of the RIIO-ED2 business plan guidance for innovation.**

Whilst we take pride in our track record in innovating to provide benefits for customers, we will not be resting on our laurels. What we plan to do during RIIO-ED2 is our primary focus here and, crucially, how we will build on our successes to continue delivering for our customers.

Figure 6.1: Summary of our RIIO-ED2 innovation investment

Funding Route	Investment (£m)	
NIA	25.0	Total Ofgem Stimulus: 46.5
NIC	21.5	
BAU	138.1	

6.1 Our innovation plan and the wider business plan

This section details the link between our innovation plan and the wider RIIO-ED2 business plan.

Our wider business plan details seven priority areas on which stakeholders have asked us to focus, and innovation will be a key enabler in addressing these:

- Meeting customers' needs;
- Supporting electricity users in vulnerable circumstances;
- Delivering a reliable network;
- Building a resilient network;
- Keeping our communities safe;
- Leading the North West to Net Zero; and,
- Our direct environmental impact.

Our plans for delivering against our innovation themes (Section 6.3) and our detailed innovation plan (Section 6.16) for RIIO-ED2 have been constructed with these priority areas in mind. For example:

- We have a specific theme addressing consumer vulnerability and we have committed to assessing the impact of all innovation projects on our customers.
- Our optimised assets and practices theme will look to improve the reliability and resilience of our network.
- We have detailed research areas aimed at improving the safety of our operations for both employees and members of the public.
- We have highlighted a number of areas where innovation could provide a solution to facilitate the transition to Net Zero.
- The environmental impact of our network is considered across a number of our themes and, in particular, the carbon impact will be assessed for every innovative solution we deliver.

Our innovation projects are designed to produce solutions that provide benefits to our customers through either a reduction in bills or an improvement in service.

6.2 Our innovation commitments

This section outlines our innovation commitments as set out in our Innovation Strategy and contains information on how we will meet them in our RIIO-ED2 innovation plan.

Our innovation commitments are detailed in our Innovation Strategy. These commitments represent our innovation promise to our customers and stakeholders. Figure 6.2 provides further details on these commitments, including what we will do during RIIO-ED2 to ensure that we meet them.

Figure 6.2 Our innovation commitments

Commitment	What this will look like in RIIO-ED2
We will keep our strategy under regular review, ensuring that it reflects our priorities and those of our stakeholders	Our strategy includes a survey which stakeholders can use to provide feedback. We will continue to review any feedback annually along with recommendations from the Innovation Oversight Panel (new for RIIO-ED2) to make any relevant changes to the strategy and, where appropriate, our associated plan. When the strategy and plan are updated we will hold stakeholder events to communicate the changes.
We will ensure that we deliver projects that tackle the challenges of energy system transition and vulnerability	We will introduce this into our existing processes prior to RIIO-ED2 such that it is fully embedded ready for the start of the new price control. By completing a customer impact assessment and carbon impact assessment we will be able to prioritise project proposals and take forward those that provide a positive impact on vulnerability or carbon. Using these assessments, we will adapt our innovation plan accordingly.
We will routinely hold a 'call for innovation' and encourage innovators to submit their ideas for consideration	A call for innovation is a useful tool to encourage third parties to engage with innovation. We have carried out several calls, with our 2021 call[16] resulting in 50 submitted proposals. We aim to further build on this practice in RIIO-ED2 to open innovation to more third parties. In RIIO-ED2 we will introduce a **Collaborative Innovation Scheme** (see Section 6.9).
We will ensure collaboration is at the forefront of all innovation, keeping stakeholders up-to-date and sharing all learning	All our projects involve collaboration with third parties and, where appropriate, with other network operators. We will continue to grow both areas of collaboration during RIIO-ED2 and we will launch a new **Collaboration Portal** to share learning, publish upcoming events, highlight opportunities and more. All learning from our projects are published on our website and we will continue this practice in RIIO-ED2. We will make all data available to interested stakeholders.

[16] https://www.enwl.co.uk/go-net-zero/innovation/our-innovation-strategy/call-for-innovation-2021/

Commitment	What this will look like in RIIO-ED2
We will establish an innovation oversight panel to routinely review and challenge our innovation programme	This will be brand new for RIIO-ED2. The panel will be made up of key stakeholders, including academia, suppliers, partners, manufacturers and local representatives, to provide oversight and challenge of our innovation programme. This will involve routine review and assessment of our innovation plan, review of proposed project scope ahead of registration, annual review and assessment of ongoing and completed projects, and support and guidance on the SIF. The oversight panel will also assess and recommend projects to be funded by through the Collaborative Innovation Scheme. The proposed Terms of Reference of this Panel can be found in Appendix B.
We will publish an annual innovation update report to provide visibility of how we are meeting our commitments	In RIIO-ED2, our annual innovation report[17] will be greatly expanded to include, amongst other things, our progress against our commitments. This report will be submitted to ENA Smarter Networks Portal and published on our website via our new Collaboration Portal, together with an online dissemination event.

6.3 Innovation themes in RIIO-ED2

We presented our innovation themes in Section 4.3 as part of the insight into our strategy. This section explains how we will deliver against these themes in RIIO-ED2, including our consideration of innovative whole system approaches, **as per 4.36 in the RIIO-ED2 business plan guidance.**

As set out within our Innovation Strategy we have developed **five innovation themes** under which to pursue new and exciting innovation projects. This allows us to ensure we focus on the challenges that are most important to our customers and secure the most substantial benefits and savings through RIIO-ED2.

***Consumer Vulnerability* - supporting the needs of our consumers in vulnerable situations today and in the future.**

In RIIO-ED2, we will ensure consumers in vulnerable situations everywhere are able to share fully in the benefits of all our innovation. Starting in RIIO-ED1 such that it is fully embedded in RIIO-ED2, we will carry out a customer impact assessment (Section 6.8) for every innovation project to ensure that innovation benefits are available to all customers and, most importantly, that consumers in vulnerable situations are not adversely affected. We will discuss these assessments with our Innovation Oversight Panel and publish them on our website as part of our project registration.

We will partner with relevant organisations to enable us to develop innovation projects to specifically address the needs of consumers in vulnerable situations. We will collaborate with other

[17] https://www.enwl.co.uk/go-net-zero/innovation/smaller-projects/network-innovation-allowance/#!?page=1

DNOs to ensure that the innovations are replicable and can provide benefits to consumers in vulnerable situations across GB.

Net Zero and the energy system transition **– investigating methods to facilitate and accelerate the UK's transition to Net Zero greenhouse gas emissions before 2050.**

As the UK continues to transition to Net Zero, the ways in which different customers use electricity and electrical networks will need to keep pace, resulting in significant changes in our network. Continuing from RIIO-ED1, we will proactively manage the uncertainty associated with those changes through our innovation projects.

We will carry out a carbon impact assessment for every innovation project, which we will discuss with our Innovation Oversight Panel and publish on our website as part of our project registration, and will only take on those which contribute to our Net Zero target.

Optimised assets and practices **- developing and implementing industry-leading techniques for optimising assets and practices for energy networks.**

Conscious of the ever-changing technology landscape we operate within, we will routinely evaluate our asset management and operating practices to ensure that we are working as efficiently and reliably as possible with the latest technology, whilst improving safety and our impact on the environment. We will maximise the use of our existing assets by combining innovative ideas with new technology, for example, by avoiding reinforcement through use of flexible services.

As detailed in our innovation plan (Section 6.16), we will identify innovation projects that seek to address one or more of these objectives and work with relevant partners to design and trial the new technologies or processes and, most importantly, move these into BAU so they can deliver value to customers.

Flexibility and commercial evolution **- developing and testing innovative solutions to increase the flexibility, transparency and efficiency of the energy system, enabling information to be more open and networks to be more responsive to change.**

Building on our success with C2C and CLASS, we will continue to spearhead meaningful change in this area. As flexibility markets continue to develop it is essential that we ensure these markets are used to help address the Net Zero challenge, are open and transparent, are accessible to our customers, and can identify and remove any barriers to flexibility.

We will do several projects in this area during RIIO-ED2.

Whole energy system **- enabling joined up and efficient approaches across multiple aspects of the energy system around planning, forecasting, design, construction, operation, maintenance and data.**

To ensure that we play our part in the energy system transition throughout RIIO-ED2, we will further develop our understanding of how our activities impact on and interact with the wider energy system, including Gas and Telecommunications. It is clear to us that in RIIO-ED2 and beyond, good opportunities lie in the development of whole system solutions for the energy transition, and we have introduced this concept into our innovation plan in RIIO-ED2.

We intend to build on our existing relationships with Cadent and the Gas Innovation Governance Group via ENA and our active membership on the Collaborative Energy Portfolio to seek collaboration opportunities which will ensure the best value for customers when transitioning to Net Zero. This will include new processes for standardisation and whole system co-ordination to ensure we deliver the best value for our customers.

6.4 Ofgem innovation vision and our plan

This section explains how our plan aligns with Ofgem's innovation vision.

Our approach to innovation is in line with the principles contained in Ofgem's Innovation Vision 2021-25[18]; innovation should create value for the whole system, should be customer focussed, and should be widely disseminated.

Ofgem's Innovation Vision details four key themes for innovators; Low Carbon Infrastructure, Full Chain Flexibility, Future of Retail and Data & Digitalisation. We have strategies in place which already look to address these themes, such as our Leading the North West to Net Zero[19], Electric Vehicle[20], DSO[21] and Data & Digitalisation[22] strategies[23]. Our Innovation Strategy[24] and innovation plan in Section 6.16 detail our plans to innovate in areas that will help to address these key themes and facilitate the transition to Net Zero.

6.5 Types of innovation

This section highlights our recognition that not all innovation is technical innovation.

Innovation runs through the core of every area of our business, as evidenced by the range of initiatives developed during RIIO-ED1, along with learning shared from other companies which we have actively adopted to benefit our customers, as detailed below and in Section 6.14.

All our innovation projects are aligned with our Innovation Strategy – to maximise the use of our existing network and combine new technology and creative thinking to provide real solutions to real problems. We have demonstrated the capability for world-leading technical innovation and the practical application of the technology to deliver customer benefits.

Due to its focus on Ofgem's NIA, this document is necessarily biased toward solutions that benefit the network. However, innovation is not just technical in nature, and in RIIO-ED2 we will continue to use innovative techniques to continually improve all aspects of our business. Key examples of how we've done this in RIIO-ED1 include the integration of the STORM telephony platform and customer call back processes – innovations that have helped us achieve the biggest improvements in customer satisfaction of any DNO.

[18] https://www.ofgem.gov.uk/system/files/docs/2021/05/innovation_vision_2021-2025_final_24may2021.pdf

[19] https://www.enwl.co.uk/globalassets/go-net-zero/net-zero/documents/leading-the-north-west-to-net-zero.pdf

[20] https://www.enwl.co.uk/globalassets/go-net-zero/net-zero/ev-strategy/electric-vehicle-strategy-2021.pdf

[21] https://www.enwl.co.uk/globalassets/go-net-zero/dso/dso-consultation-documents/dso-strategy-2021.pdf

[22] https://www.enwl.co.uk/globalassets/go-net-zero/dso/dso-consultation-documents/grid-digitalisation--data-strategy-2021.pdf

[23] Please also see our RIIO-ED2 Data Strategy (Annex 21) and DSO Transition Plan (Annex 2)

[24] https://www.enwl.co.uk/globalassets/innovation/innovation-strategy/innovation-strategy-downloads/innovation-strategy-2021.pdf

6.6 Innovation funding in RIIO-ED2

This section describes the different methods of funding and how we decide which funding route to use, including our TOTEX allowance, **as per 4.33 and 4.34 in the RIIO-ED2 business plan guidance.**

In RIIO-ED2, we have categorised innovation into three areas:

- *Embedded innovation* – this is proven innovation which is considered the default solution to a problem.
- *Business-as-usual innovation* – this is short-term, lower risk innovation which is funded by our base revenue allowance and our rollout of proven innovation during the RIIO-ED2 period.
- *Ofgem innovation stimulus* – this is innovation funded by our customers under a mechanism agreed by Ofgem, which demonstrates long-term value for customers with a focus on energy system transition and consumers in vulnerable situations.

When deciding on the most appropriate funding route for innovation ideas we will assess the Technology Readiness Level (TRL), using the scale in Figure 6.3 at the start and end of the project, as well as the anticipated benefits and when they will accrue.

Figure 6.3: TRL scale

TRL Level	Definition
1	Pure research that is theoretical or experimental work undertaken to acquire new scientific or technical knowledge for its own sake rather than directed towards an application.
2-3	Applied research driven by a desire to broaden scientific and technical knowledge for application on the network, related to an identified Problem. It typically includes investigating the underlying foundation of phenomena and observable facts.
4-6	Development activities with a more commercial application including technology validation and or demonstration in a working environment.
7-8	Full scale demonstration in a working environment to test and improve technologies so they are ready for commercial deployment.
9	Application of technology in its final form, i.e. the technology has been proven.

If the innovation is at the lower end of the TRL scale, as demonstrated in Figure 6.4, we will test it against the NIA eligibility criteria shown in Figure 6.5. All NIA projects in RIIO-ED2 will meet this eligibility criteria irrespective of its primary innovation theme.

For projects that deliver benefits in the short term and are higher on the TRL scale we will look to fund these via BAU funding, taking advantage of the TOTEX Incentive Mechanism (TIM). We have already identified several BAU Innovation projects and these are summarised in Section 6.7.1.

Figure 6.4: TRL levels related to funding

Figure 6.5: RIIO-ED2 NIA project eligibility criteria

Ofgem Criteria	How do we ensure the project meets criteria in RIIO-ED2
A project must have the potential to facilitate the energy system transition and/or benefit consumers in vulnerable situations.	We will use our carbon impact assessment and consumer vulnerability impact assessment – suitably validated, including through discussion with the Innovation Oversight Panel – to ensure that projects have a positive effect on this area and to quantify the carbon savings.
A project must have the potential to deliver a net benefit to consumers	Using the agreed Ofgem approach, we will carry out a detailed Cost Benefit Analysis (CBA) for each innovation project to quantify the net benefit to customers.
A project must involve Research, Development or Demonstration	We will carry out a TRL assessment of the proposed solution to understand the position at the start of the project and where we expect the solution to be at the end of the project. Our choice of project partner will also determine where the project sits, i.e. an academic institution will be used to perform research.
A project must develop new learning	We will assess the relevance of the project to our innovation challenge areas. We will also perform a thorough check for duplication by reviewing past projects through the SNP and engagement with ENA Innovation Managers group. In addition, we will engage with the Innovation Oversight Panel to ensure we're taking advantage of international innovation.
A project must be innovative	
A project must not lead to unnecessary duplication	

6.7 Innovation plan

This section sets out all of our proposed innovations for RIIO- ED2. It provides a high-level snapshot and covers innovation we propose to fund via the innovation stimulus and BAU, **as per 4.34, 4.36 and 4.38 in the RIIO-ED2 business plan guidance.** Section 6.16 presents the detailed plan which includes information on areas in which we intend to innovate.

As per the Ofgem RIIO-ED2 business plan guidance, we have presented our plan thematically, but have taken the opportunity to include a more detailed breakdown of our plan in Section 6.16. Although we are assigning the investment to one of our five innovation themes, i.e. "Primary Theme", we recognise that many projects will address more than one theme, therefore the benefits will necessarily flow across multiple themes.

Where we intend to use the Ofgem stimulus, we have labelled that activity as being either NIA, NIC or SIF. Innovation activity that is not funded via Ofgem innovation stimulus funding is labelled as BAU innovation.

6.7.1 BAU innovation

This section sets out our BAU innovation activities during RIIO-ED2, **as per 4.37 in the RIIO-ED2 business plan guidance.**

BAU innovation is both short-term, lower risk innovation funded by our base revenue allowance and our rollout of proven innovation. The table in Figure 6.6 presents a high-level view of our proposed BAU innovation activities in RIIO-ED2. We have categorised these activities according to the RIIO-ED2 innovation themes, allowing for easier comparison with our activity funded through Ofgem stimulus. Across the total capital programme, we will undertake a range of BAU innovation. The table identifies the larger-scale, currently known innovations from work carried out during RIIO-ED1 and the amount to be invested in delivering that innovation during RIIO-ED2.

Section 6.16 provides details of the areas we have identified for further BAU investment during RIIO-ED2, laid out against our innovation themes.

Figure 6.6: High level view of RIIO-ED2 BAU innovation investment

Primary Theme	Areas for innovation	Amount to be invested (£m)
Consumer Vulnerability	Provision of a fund to address how we can remove barriers that prevent the uptake of low carbon technologies.	1.25
Net Zero and the Energy System Transition	Deploy the innovative advanced monitoring solution, PreSense, to provide information on the use and available capacity of the LV distribution network.	20.6
	Deploy the innovative solution, Smart Street, to reduce customers energy consumption and bills.	78
Optimised Assets and Practices	Deploy the innovative actuator, Reflex, to provide automation at reduced cost.	2

Primary Theme	Areas for innovation	Amount to be invested (£m)
	Deploy innovative overhead line fault passage indicators to improve fault response and thereby reduce fault costs.	0.25
	Deploy the innovative solution, Sentinel, to improve detection of low hanging conductors.	36.0
	Deploy the use of enhanced switchgear ratings to allow a targeted investment programme.	-
Flexibility and Commercial Evolution	Deploy the use of flexibility and innovation to facilitate the transition to DSO.	-

In addition to the above, we will carry out additional BAU innovation across many areas, although the precise nature of this isn't known. One example of this would be our adopting any novel solutions made available to us by our supply chain and other strategic partners. Our use of these new solutions would provide efficiencies in addition to those associated with our known rollout of innovation prove during RIIO-ED1.

6.7.2 NIC / SIF innovation

This section sets out the high-level view of our RIIO-ED2 innovation activities related to NIC / SIF funding.

In RIIO-ED2, Ofgem will replace the NIC with a new SIF. However, we have and expect to further take advantage of the NIC during RIIO-ED1. So, in addition to our accessing innovation funding from the new SIF, we will be performing innovation activities delivering NIC projects that necessarily continue into the RIIO-ED2 period.

The table in Figure 6.7 presents a high-level view of the areas we are currently investigating and propose to investigate during RIIO-ED2 as part of NIC / SIF innovation. Section 6.15.2 gives further detail on how we plan to move from NIC to SIF in RIIO-ED2.

Figure 6.7: High level view of NIC / SIF innovation activities during RIIO-ED2

Funding Route	Project Title	Description	Amount (£m) in RIIO-ED2
NIC	QUEST	An approved project of £10m to build an overarching system which operates a holistic voltage control methodology to co-ordinate existing and future voltage management techniques.	3.5
NIC	Smarter Heat	A potential £6m project to examine the combination of network-side variable capacity with demand-side flexibility to exploit thermal latency and allow use of a "connect and manage" approach to HPs.	4

Funding Route	Project Title	Description	Amount (£m) in RIIO-ED2
NIC	Bi-Trader	A potential £6m project to investigate options for introducing "bilateral trading" into the functioning of a Distributed Energy Resource stack adding value to the flexibility space and boosting the value for all participants.	4
SIF	The amount to be invested in SIF will be dependent on the number and types of challenges issued during RIIO-ED2. We intend to consider all the challenges issued and, where appropriate, submit project ideas to deliver solutions to meet the challenges. We are committed to engaging fully in the SIF and working with Ofgem and its stakeholders to make it a success. In our detailed plan, in Section 6.16, we have highlighted areas against our themes that we expect will benefit from investment through SIF during RIIO-ED2. We will be working with Ofgem on shaping the future innovation challenges and sharing our understanding of the future challenges. We assume that as a minimum we will invest £2 million each year throughout RIIO-ED2.		10

Our total forecast investment across NIC/SIF during RIIO-ED2 is £21.5 million.

6.7.3 NIA Innovation and Funding Required

This section sets out the high-level view of our RIIO-ED2 NIA innovation activities and funding requirements, **as per 4.38 in the RIIO-ED2 business plan guidance.**

We will undertake a range of innovation activities across each of the five themes as set out in our Innovation Strategy. In total, **we will invest £25 million over the five years of RIIO-ED2.**

Figure 6.7 provides a high-level view of our proposed RIIO-ED2 investment in the NIA programme. Section 6.16 provides further detail on specific areas of investigation against each of the themes.

Figure 6.8: High-level view of NIA innovation spend as per our Business Plan Data Tables

Primary Theme	Proposed Innovation Investment (£m)					Total (£m)
	FY24	FY25	FY26	FY27	FY28	
Consumer Vulnerability[25]	1.20	1.20	1.20	1.20	1.20	6.00
Net Zero and the Energy System Transition	2.00	2.00	2.00	2.00	2.00	10.00
Optimised Assets and Practices	0.75	0.75	0.75	0.75	0.75	3.75

[25] This represents our initial estimate. However, as further innovations are developed throughout industry during RIIO-ED2 we will seek to increase this where appropriate.

Primary Theme	Proposed Innovation Investment (£m)					Total (£m)
	FY24	FY25	FY26	FY27	FY28	
Flexibility and Commercial Evolution	0.65	0.65	0.65	0.65	0.65	3.25
Whole Energy System	0.40	0.40	0.40	0.40	0.40	2.00
Total	**5.00**	**5.00**	**5.00**	**5.00**	**5.00**	**25.00**

We propose to increase our NIA investment from the £3 million per year awarded for RIIO-ED1 to £5 million per year in RIIO-ED2. This increase is necessary to allow us to deliver our ambitious plan. We have a solid track record on delivery of innovation projects and we believe our plans for RIIO-ED2 are credible, deliverable, have a high chance of success for moving into BAU, aligned to stakeholder expectations, and represent good value for money for customers and stakeholders as illustrated in Section 6.7.5.

Due to the increase in TOTEX in RIIO-ED2 compared to RIIO-ED1, the NIA increase from £3m to £5m represents an increase of 0.1% overall, i.e. 1.1% of TOTEX in RIIO-ED1 compared to 1.2% of TOTEX in RIIO-ED2.

6.7.4 Why innovation can't be funded from TOTEX allowance

This section answers the Ofgem **business plan guidance question in 4.38** on why innovation cannot be funded from our TOTEX allowance.

As demonstrated in Section 6.6, we assess the most appropriate funding route based on the TRL of the innovation project. TOTEX, and more specifically the Totex Incentive mechanism (TIM), is suitable for use on innovation projects which have a higher TRL, i.e. a lower risk of failure, and are thereby capable of delivering value for customers during RIIO-ED2. In many instances, BAU-funded innovation projects will be those where we are seeking a novel application of an existing technology where that application has potential to offer an efficiency over existing solutions, or where the innovation provides benefits to customers that might not have been possible without use of the innovation. Our RIIO-ED2 innovation plan includes for significant BAU innovation, much more than that we propose to fund through NIA.

Of course, opportunities for use of innovation to provide benefits to customers in RIIO-ED2 will continue beyond the point at which we submit our RIIO-ED2 plans. Given this, we will continue to explore innovations and make use of the TIM throughout the RIIO-ED2 period.

We expect the transition to Net Zero will result in significant changes to the electricity system and the way it operates in future. The innovations required to meet this change are, in many instances, untested and unproven, and present significant uncertainties as to their integration with our BAU operations. Additionally, in all instances, the business case for these innovations has not been proven.

In such circumstances, BAU innovation is not a suitable funding route. We will therefore use the NIA to fund innovation trials to test and prove solutions, which are aligned to the expectations of our stakeholders, to ensure they deliver benefits for customers. These are set out in detail in Section 6.16.

6.7.5 Value of innovation

This section presents the proposed benefits we will deliver during RIIO-ED2 as a result of our innovation activities, **as per 4.38 in the RIIO-ED2 business plan guidance.**

During RIIO-ED2, our innovation activities will include our application of proven innovation (BAU innovation), our activities across our portfolio of innovation projects (NIA), our continued delivery of in-flight NIC projects, and any additional projects awarded us via the new SIF.

This section details the proposed benefits associated with our activities in these areas in RIIO-ED2. Figures 6.9 and 6.10 illustrate the benefits from innovation investments over time. This plan necessarily focusses on RIIO-ED2, during which the majority of benefits will be associated with our rolling out, in RIIO-ED2, of innovation investment made during RIIO-ED1. For completeness, we have estimated the future benefits associated with our rolling out innovation during RIIO-ED3.

*Figure 6.9: Our investment and forecast customer benefits for RIIO-ED1, **RIIO-ED2** and RIIO-ED3*

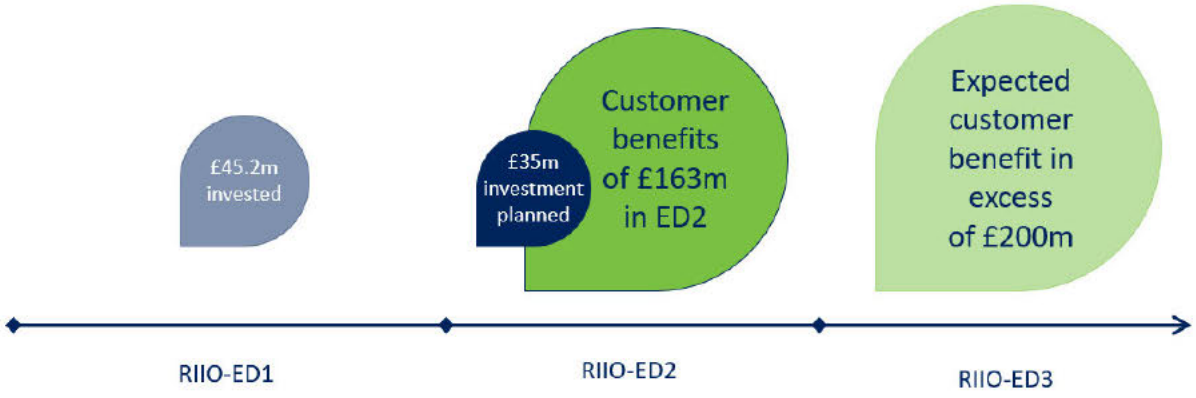


Figure 6.10: Our forecast customer benefits for RIIO-ED2 and RIIO-ED3

	RIIO-ED2	RIIO-ED3
BAU Innovation benefits	£148m	Embedded
NIA, NIC, SIF benefits	£15m	£200m
Total	£163m	£200m

Figure 6.11 provides a summary of our key innovation projects which will be ready for deployment during RIIO-ED2, i.e. BAU innovation associated with our rolling out of proven innovation, and the benefits we expect these to bring for our customers during this period. This does not include benefits that will accrue from ongoing RIIO-ED2 NIA and NIC / SIF projects.

Figure 6.11: RIIO-ED2 BAU innovation benefits (not including RIIO-ED2 NIA, NIC, SIF)

Project	Original funding	Description	Projected Benefits (£m) RIIO-ED2[26]	Comments
CLASS	Second Tier	CLASS is a low-cost solution which uses voltage control to manage electricity consumption at peak times.	£11.8m	Innovation benefit comes after the asset based solution because it manages peak demand rather than capacity on the network
Respond	Second Tier	Respond has delivered a revolutionary approach to managing fault current by using network data to predict fault level in near real-time with the aim of releasing capacity and voltage headroom for adoption of LCTs.	£3.9m	Innovation benefit comes in advance of the asset solution because it establishes accurate fault levels
QUEST	NIC	Will build an overarching system which operates a holistic voltage control methodology to co-ordinate existing and future voltage management techniques.	£13.5m	Innovation benefit comes in advance of the asset solution because it optimises voltage which is assumed in our modelling.
C2C	Second Tier	Combines proven technology with innovative commercial contracts to lower demand for electricity by offering our existing customers to reduce their demand following a fault in exchange for payments.	£3.5m	Innovation benefit comes in advance of asset solutions because our modelling is based on non-firm connections.

[26] These benefits are calculated assuming that charging methodologies used during RIIO-ED2 are the same as those used for RIIO-ED1. We recognise that work is ongoing regarding changes to charging and access (https://www.ofgem.gov.uk/electricity/transmission-networks/charging/reform-network-access-and-forward-looking-charges), which may impact the benefits calculations in future.

Project	Original funding	Description	Projected Benefits (£m) RIIO-ED2[26]	Comments
Celsius	NIC	The first solution of its kind in Great Britain, using a co-ordinated approach to manage the temperature of electrical assets in distribution substations to alleviate thermal constraints that may be inhibiting the connection of low carbon technologies.	£3.5m	Innovation benefit comes in advance of the asset solution because it is using latent capacity which is the basis of our modelling.
Enhanced Voltage Control	NIA	A method of maintaining voltages within statutory limits, particularly for sites with large amounts of generation connected. This allows for faster connection of generation and enables us to offer voltage managed connection contracts.	£13.4m	Innovation benefit comes in advance of asset solutions because it is addressing voltage constraints and is already factored into in our planning assumptions.
Investigation of Switchgear Ratings	NIA	Developed a new "fault withstand" performance envelope for a range of more commonly used distribution switchgear. This is used to apply new ratings to existing assets and allows us to tailor our load related programme.	£5.2m	Innovation benefit comes after the asset-based solution as this increases the switchgear ratings we use in our modelling.
Smart Street	Second Tier	Smart Street uses advanced real time optimisation software to simultaneously manage HV and LV network assets to respond to customers' changing demands allowing management of voltage and thermal constraints.	£31.9m	Calculated based on RIIO-ED2 CBA analysis for 1,000 sites.

Project	Original funding	Description	Projected Benefits (£m) RIIO-ED2[26]	Comments
Demand Scenarios	NIA	Developed and implemented a revised methodology for producing annual peak demand scenarios for each of the substations in our region, the first network operator to deliver this type of long-term scenario tool for network planning.	-	Improves load forecasting per substation by generating peak loading scenarios to inform strategic planning of the distribution network. Generating benefits by deferring reinforcement.
Asset Risk Optimisation	NIA	Improves our investment planning by enhancing our knowledge of the issues around optimising programmes of work and investigating the impact of investment decisions on different asset types.	£2.5m	Calculated based on our application of the risk optimisation methodology to our RIIO-ED2 business plan.
Combined online Transformer Monitoring	NIA	Will validate the results of our previous successful oil regeneration work which extends the life of high voltage transformers.	£27.5m	Calculated based on deferring replacement of 43 primary and 7 grid transformers.
Cable health Assessment	NIA	The research carried out as part of this project led to the development of a new low-cost LV monitor, PreSense, which we are installing across our network.	£26m	Calculated based on the rollout of over 8,000 PreSense LV monitoring units to our distribution substations providing capacity and avoiding the need for reinforcement.
Interface	NIA	Investigating the feasibility of connecting multiple communications devices, required because of the increased use of low carbon technologies, into the same communications interface.	£5m	Calculate based on assumption of rollout to 1500 substations.

Project	Original funding	Description	Projected Benefits (£m) RIIO-ED2[26]	Comments
Sentinel	NIA	Trialling new sensors on our overhead lines which will enable us to detect and repair broken or damaged equipment more quickly.	Qualitative benefits associated with high voltage OHL public safety improvements.	Will enable earlier response to broken or damaged conductors to improve quality of supply and safety for the public and livestock, amongst other benefits as described below.
Improved statistical ratings for distribution overhead lines (WPD)	NIA	Will use the test rig facility for conductor and weather data to be analysed to validate and update overhead line ratings, update existing tools and methodologies, and produce a software tool that will enable GB DNOs to further optimise regional or line specific ratings.	No projected benefits included owing to uncertainty as to the precise timing of this being delivered.	Can defer reinforcement for up to 5 years while also enabling savings from the avoidance of dynamic line rating schemes where loads are uncertain or embedded generation needs to be managed.
Collaborative Energy Portfolio (CEP) Composite Poles (UKPN)	NIA	Produced new specification for Engineered Poles and the second phase of this project will demonstrate whether they are fit for procurement.	No projected benefits included owing to uncertainty as to the precise timing of this being delivered.	Engineered Poles are expected to last four times as long compared to water-based, preserved wooden poles and two times as long compared to creosote-based, preserved wooden poles which mean the installation costs (more than 50% of the replacement costs) will be reduced over its lifetime.
Total			**£147.75million**	n/a

Our innovation projects seek to explore a range of technological and commercial issues facing our customers and are guided by the innovation themes set out in Section 6.3.

Customers are always at the heart of these innovation themes. Whilst we have developed a "Consumer Vulnerability" theme, within all our innovation projects we maintain a focus on how each

innovation can benefit our consumers in vulnerable situations quickly and effectively, given the urgency to support these customers as much as possible.

These themes provide a means of categorising and tracking investment while helping innovators and others to understand how they can collaborate with us by setting out clearly and consistently the purpose of the innovation. Each of our innovation projects will cover one or more of these themes, and we will endeavour to maintain a balanced portfolio of projects across all areas.

Figure 6.12 shows the benefits our existing innovation portfolio will bring within each innovation theme during RIIO-ED2. We will continue to target these areas with new innovation projects that can build upon the great success we have already seen within these core themes. By focusing our projects around these strategic themes, we can deliver additional benefits to customers over the RIIO-ED2 period.

Figure 6.12: Forecast benefits expected during RIIO-ED2 by theme

Theme	Projected benefits (RIIO-ED2)
Consumer Vulnerability	£23.21m
Net Zero and the Energy System Transition	£57.64m
Optimised Assets and Practices	£53.72m
Flexibility and Commercial Evolution	£13.19m
Whole Energy System*	-
Total	**£147.75m**

*Our demand scenarios NIA project could deliver a 20% reduction in load-related expenditure costs relative to traditional methods with further savings in ED2 and beyond as demand levels increase

6.7.5.1 RIIO-ED2 innovation deployment

The investments we have made in innovation projects to date have delivered **£46.4 million in benefits for our customers in RIIO-ED1, as reported in RRP.** We intend to build upon this success by continuing the rollout of our proven innovation projects in RIIO-ED2.

This section describes the expected customer benefits from continued rollout of our innovation projects in RIIO-ED2.

Network Innovation Competition Projects

We expect our NIC projects to provide approximately **£42.5 million in savings** for our customers during RIIO-ED2.

The NIC and LCNF projects undertaken during RIIO-ED1 will accelerate the transition to Net Zero whilst securing huge savings for our customers, in particular for those in vulnerable situations. They will also act as key enablers of our development to DSO, by providing the functionalities and capabilities required and allowing us to operate a flexible distribution network.

The NIC innovation projects below, detailed in Section 3.6 and Appendix A, are expected to bring a total of **£42.5 million** in savings for our customers during RIIO-ED2. This demonstrates the importance of continued innovation during RIIO-ED2, as the need to decarbonise our energy system in an affordable manner grows.

CLASS could create further benefits for customers in the North West during **RIIO-ED2**. Further deployment of CLASS will build upon the success of the project's transition into BAU, offering balancing services for National Grid and helping to maintain electricity supplies for millions of customers across GB, avoiding the need for additional expensive sources of power.

Further deployment of **Respond** benefits all electricity customers in the long-term by helping to avoid or defer traditional, expensive, and disruptive reinforcement solutions. This minimises costs for customers, reduces carbon emissions, and allows the connection of LCTs much more quickly.

The continued deployment of **Smart Street** presents an alternative to conventional reinforcement for voltage and thermal constraints, enabling faster connection of LCTs, keeping costs down for customers, and helping to reduce carbon emissions and aid the Net Zero transition.

Deployment of **Celsius** in RIIO-ED2 has the potential to accelerate decarbonisation by releasing capacity through the application of thermal monitoring and retrofit cooling technologies to mitigate the thermal limitations of the manufacturer's ratings.

Capacity to Customers (C2C) proved that our industrial and commercial customers are willing to sign up to demand-side response contracts.

Deployment of **QUEST** in RIIO-ED2 has the potential to create further benefits for customers through further optimisation of voltage profiles.

Network Innovation Allowance Projects

We expect deployment of our NIA projects to provide **benefits of approximately £68.1 million** for our customers.

The NIA has been an invaluable facilitator of innovation during RIIO-ED1. It has allowed us to deliver cutting-edge innovation projects across the TRL spectrum that have the potential to benefit our customers in the short, medium and long-term.

To the end of March 2021, the NIA has allowed us to **invest £18.6 million** into a portfolio of innovation projects, detailed in Section 3.6 and Appendix A. Not only have our NIA projects directly led to benefits and savings for our customers, but they have also allowed us to de-risk much larger and more expensive NIC projects by proving the foundations of these solutions before investing more of our customers' money.

During RIIO-ED2, we expect the deployment of our NIA projects into BAU to provide approximately **£68.1 million in benefits for our customers**, outlined below.

We believe we can further enhance these benefits with access to a larger NIA funding pot, as our existing portfolio of projects, developed from our current innovation budget, has proven an excellent investment for our customers. We intend to accelerate our efforts based on the success of our RIIO-ED1 track record.

Demand Scenarios could deliver a 20% reduction in load-related expenditure costs relative to traditional methods, with further savings in RIIO-ED2 and beyond as demand levels increase. We will continue to leverage the project benefits in RIIO-ED2 as part of our commitment to devise more efficient investment plans and commercial solutions to capacity problems.

Sentinel improves the quality of supply for customers who experience weather-related outages and safety for the public and livestock. Further deployment of Sentinel could provide a number of other benefits in RIIO-ED2, including improving the safety of repair teams, detecting and locating transient faults, avoiding the need to patrol the network in extreme weather conditions, reducing repair time, reducing the time customers are off-supply, and also enabling the detection of multiple faults following a storm.

Building on the successful deployment of **Asset Risk Optimisation** in RIIO-ED1, we expect its implementation in RIIO-ED2 to provide further improvements in our investment programme.

Deployment of **Enhanced Voltage Control** allows for conventional reinforcement at primary substations to be deferred by retro-fitting existing primary transformers. Further deployment in RIIO-ED2 can provide further benefits, such as cheaper connection contracts, to facilitate uptake of renewable generation to meet the Carbon Plan.

We anticipate deferral of replacement of 43 primary transformers and seven grid transformers by 10 years, as a result of **Combined Online Transformer Monitoring**.

The LV monitor developed from the **Cable Health Assessment** research can provide insight into the spare capacity available within the existing network, and how best to manage it, allowing us to make informed decisions regarding new connections and the reinforcement work.

Investigation of Switchgear Ratings allows us to defer the replacement of HV network assets as we can now tailor replacement decisions based on the actual fault level and capability of the equipment.

Interface has the potential to unlock benefits through reduction in communications and data costs as well as providing better access to network data.

The outcomes of our **Improved Statistical Ratings** project are paramount to improving our rating methodology, allowing planned network reinforcement to be deferred for five years, with the potential to generate savings from the avoidance of dynamic line rating schemes where loads are uncertain or embedded generation needs to be managed.

Through our membership and active involvement with the **Collaborative Energy Portfolio (CEP)**, we have investigated and produced a specification for engineered poles, the second phase of which will determine whether they are fit for procurement, to ensure economic continuation of overhead lines.

6.7.5.2 BAU Innovation Deployment

We developed a strong portfolio of innovation projects over the last price control period and we are confident that we can provide more benefits to our customers through the continued deployment of our extensive innovation portfolio in the next price control period.

Our track record shows that we are successful when transitioning our projects to BAU and deploying innovations that help our customers, as evidenced by the Smart Street IRM project and our state-of-the-art CLASS voltage management system.

We are excited by the prospect of adding to our impressive innovation portfolio during RIIO-ED2 with an increased NIA. Not only do we strongly believe this will allow us to continue to deliver additional benefits for our customers, but we believe this is a critical enabler to facilitate the transition to Net Zero within our licence area.

6.7.6 NIA structure and risk

This section addresses the Ofgem RIIO-ED2 **business plan guidance questions in 4.38 and 4.39** on the structure and risk of the NIA programme and states our intentions on contribution.

6.7.6.1 Annual allowance or for duration of RIIO-ED2

We are seeking a Network Innovation Allowance of £25 million for the duration of RIIO-ED2, rather than an annual allowance. A RIIO-ED2 allowance offers more flexibility in the creation and management of projects, enabling us to deliver benefits to our customers more effectively. We will enhance our existing programme controls to ensure that we profile the expenditure appropriately throughout the 5-year period.

Additionally, depending on the nature of the project, for example, if it requires the installation of equipment on the live network, some projects may require more internal resource than others. Given this, we would propose that if the RIIO-ED1 cap of 25% on the cost of internal labour is maintained in RIIO-ED2, this should cover the duration of RIIO-ED2, rather than being applied annually. Doing this will provide much greater flexibility when deciding the most efficient resource for project delivery, thereby allowing us to deliver more value to customers.

6.7.6.2 Compulsory contribution towards RIIO-ED2 NIA

In RIIO-ED1 our contribution was 10%, equating to approximately £2.3 million over the 8-year period; however, to reflect the confidence we have in our proposed portfolio for RIIO-ED2, **we are committing to increasing our contribution in RIIO-ED2 to 15%,** which represents a contribution of £3.75 million for the 5-year period. We will endeavour to select projects that will deliver value to customers with a good proportion of the benefits being delivered within RIIO-ED2.

6.7.6.3 Mechanisms to support funding, such as re-openers to reassess

Given the extent of work we have put into developing our RIIO-ED2 innovation plan, including our stakeholder engagement, we are confident that it represents a well-formed and justified plan. As such, we are not proposing to use any other formal mechanisms, such as re-openers, to reassess our NIA funding.

Our track record for delivering innovation is evidenced in Section 3.1. Whilst we recognise that our plan for RIIO-ED2 represents an increase on a like-for-like basis, we feel confident that we can deliver it, that our plans are credible, deliverable, have a high chance of success for moving into BAU, are aligned to stakeholder expectations, and represent good value for money for customers and stakeholders.

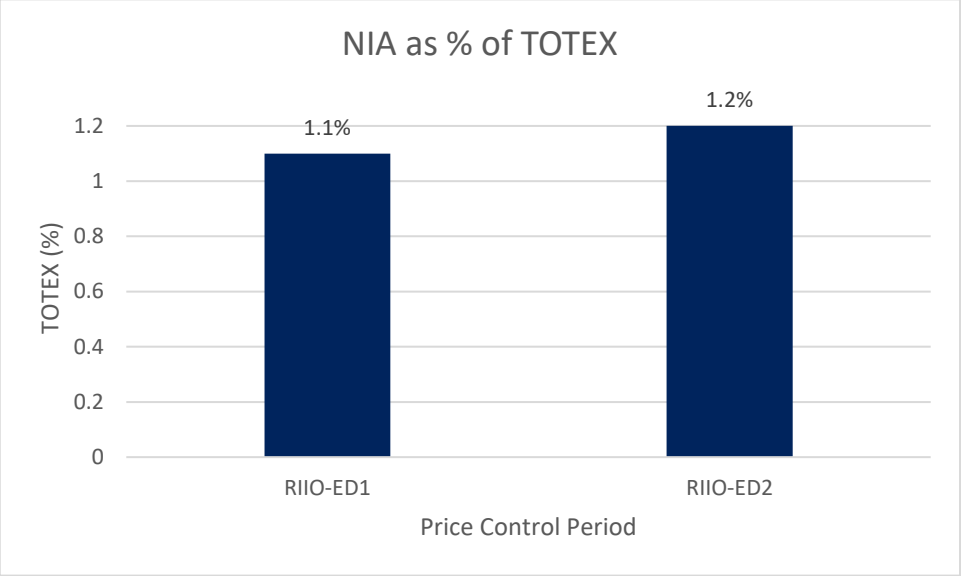
During RIIO-ED1, we continually reviewed our NIA allowance against our forecast spend and we have demonstrated that we can deliver projects to budget and spend all of our allowance to provide benefits for customers. We will continue this practice during RIIO-ED2 and, additionally, we will review our innovation plan against spending forecasts with our Innovation Oversight Panel.

6.7.6.4 How overall funding compares with NIA funding received in ED1

To enable us to deliver our ambitions for RIIO-ED2 and provide the benefits to our customers, the requested allowance for RIIO-ED2 is greater than the level of NIA funding received in RIIO-ED1. We believe that our track record of delivering benefits for our customers speaks for itself. We have produced innovation which has proven to deliver benefits throughout GB using the smallest monetary allowance and we believe that given a larger allowance we can expand on this to deliver even greater benefits. This increase is necessary to allow us to deliver an ambitious plan.

Due to the increase in TOTEX in RIIO-ED2 compared to RIIO-ED1, the NIA increase from £3m to £5m represents an increase of 0.1% overall, i.e. 1.1% of TOTEX in RIIO-ED1 compared to 1.2% of TOTEX in RIIO-ED2, as illustrated in Figure 6.13.

Figure 6.13: NIA as a % of TOTEX



6.8 Consumers in vulnerable situations

This section describes how we will consider the impacts of our innovation activities during RIIO-ED2 on consumers in vulnerable situations, **as per 4.36 in the RIIO-ED2 business plan guidance**, including the production of a customer impact assessment.

It is essential that we maintain our ability to support the needs of consumers in vulnerable situations today and in the future, and that all customers are able to share fully in the benefits of our innovation. We have therefore made consumer vulnerability one of our six innovation commitments in our newly published Innovation Strategy.

As part of this commitment, we will consider the impact of our innovation activities on consumers in vulnerable situations by carrying out a customer impact assessment for every innovation project we plan to undertake in RIIO-ED2. We will discuss these with our newly formed Innovation Oversight Panel, and publish the assessments on our website as part of our project registration document.

The customer impact assessment will allow us to understand what vulnerabilities exist and to identify what, if any, mitigating action is necessary to prevent any adverse technical or financial impact, as well as any impact on the mental wellbeing of our customers.

Although we will select projects that provide benefits to all of our customers, for the first time in RIIO-ED2 we will be innovating specifically to improve the situation for those in vulnerable situations. Therefore, where possible, we will select innovation projects which offset the impact of our activities on consumers in vulnerable situations. This could include technical mitigating actions or provision of other services for our customers.

As well as taking a steer from our Innovation Oversight Panel, we will partner with relevant organisations to facilitate wider learning and will construct proactive practices to meet the needs of consumers in vulnerable situations.

As outlined in our Electricity users in vulnerable circumstances[27] strategy we will introduce a new £250,000 annual fund designed to remove the barriers that prevent the uptake of low carbon technologies, such as EVs or solar panels. We are looking for new developments to trial and learn from, and if we find something we wish to develop further, we may consider doing this through a NIA-funded project. Customers will benefit from innovative solutions to ensure that everyone can benefit from a future energy system that is both smart and fair, and ensures that no customer gets left behind.

6.8.1 Customer impact assessment

We will continue to work with ENA and the DNO community to develop the approach and tools required to assess the impact of innovation on consumers in vulnerable situations. This is likely to be underpinned by the Consumer Classification Model developed by the Centre for Sustainable Energy as part of its Smart and Fair[28] research. However, we also intend to leverage learning from the extensive stakeholder and customer engagement undertaken during RIIO-ED1 and utilise existing embedded processes, such as the use of our social mapping tool and PSR register.

We have conducted detailed social mapping of our region, which provides a rich understanding of the location, characteristics and penetrations of consumers in vulnerable situations, at a local level. We continue to develop an increasingly granular view of vulnerability across our network by reaching out to local communities via trusted partners, and by way of the relationships we have developed through our advisory panels, Local Enterprise Partnerships, Local Authorities and other key stakeholders. All of this will be used to better inform our assessment of the impact of our innovation plan and its delivery on customers in vulnerable situations.

We will use our Social Return on Investment process to enhance the impact assessment. This will enable us to assess the overall social impact of an individual innovation project on its trial population. However, by focussing on the specific impacts and benefits for those in vulnerable situations, this data-driven methodology will provide a benchmark against which we can determine which projects are expected to benefit specific customer groups, and identify those that will be excluded or disproportionately impacted.

This approach will ensure the assessment reflects the full nature and the extent of vulnerabilities in the communities directly affected by each project.

6.9 Third-party collaboration in innovation activity

This section details our plans to increase third-party involvement in our RIIO-ED2 innovation activities and to collaborate with other interested bodies, **as per 4.36 in the RIIO-ED2 business plan guidance.**

As demonstrated in Section 3.5, we have had significant third-party involvement in our innovation in RIIO-ED1. This includes delivery of projects developed from third-party ideas, such as DC Share, an idea from Ricardo, and Sentinel, an idea from Kelvatek. We intend to build on this in RIIO-ED2 through our continued participation in ENA's National Call for Ideas and our commitment to continue with our own regular calls for innovation.

[27] Please see our Electricity Users in Vulnerability Circumstances strategy (Annex 8)

[28] https://www.cse.org.uk/downloads/reports-and-publications/policy/energy-justice/smart-and-fair-phase-1-report-september-2020.pdf

We receive innovation ideas and proposals from a variety of third parties, in a variety of ways; some directly to our mailbox or a member of the team, and others in response to a call for innovation. In RIIO-ED2, we aim to make this process easier by setting up a Collaboration Portal on our website alongside our strategy to encourage the submission of ideas.

Each idea received is assessed in terms of whether it meets our challenges, aligns with our themes, delivers benefits to customers and, if appropriate, meets the NIA eligibility criteria – detailed in Section 6.6. In RIIO-ED2, we intend to use our Innovation Oversight panel to provide independent consideration of which third-party ideas are taken forward.

Following this assessment, we will inform the third party of our decision and, if the idea will not be taken forward, the reason. If a third-party idea is taken forward as a project, that company will be made a Project Partner and will assist with the development of the project registration documentation.

We will continue to be active members of ENA Electricity Innovation Managers group and contribute to the updates of the Electricity Network Innovation Strategy and the Electricity Network Innovation Process[29]. As part of this forum we will assess all ideas submitted by third parties to the Innovation Collaboration Portal[30] and we will use the same portal to promote our calls for innovation.

We will continue to be actively involved in the annual National Call for Ideas, which seeks third-party ideas to be taken forward as innovation projects. Following review of submissions to the 2020 call, we conducted discussions with TNEI and Frazer Nash on their submission, ATHENA. As a result, we have registered this an NIA project to be completed during 2021/22, with a view to submitting a NIC project to the 2022 competition.

We have been successful in our search for innovation proven outside the UK. For example, the theory behind the Smart Street project came from the use of a technique implemented in the United States. To ensure that we continue to look beyond our shores and capitalise on innovations proven elsewhere, we will work with our Innovation Oversight Panel to conduct a regular exploration of innovations implemented worldwide. We will follow up on any interesting ideas and present our findings to the Innovation Oversight Panel and share the results on our Collaboration Portal.

6.9.1 Collaborative innovation scheme

Our proposed NIA spend during RIIO-ED2 represents an increase over that of RIIO-ED1. This reflects our increased ambition and confidence in our ability to deliver a strong portfolio of highly innovative projects, and to move these into BAU where they have been proven to add value to customers.

As a result of being awarded funding that is aligned with our proposals, as set out in Section 6.7.3, we will introduce a new "**Collaborative Innovation Scheme**", aimed specifically at third parties that wish to become key innovators.

We recognise the value that third parties can bring to innovation on distribution networks, and are aware that we do not have a monopoly on the good ideas. In our view, this plan is robust and well-tested; however, we want to allow opportunity for ideas that are not specifically aligned to our plan. We think it is right and in customers' interests to allocate a sum of money each year to fund NIA-compliant innovation projects that fall outside the scope of our plan, but which represent good value to customers. This will be in addition to our annual calls for innovation, which will be used to invite third parties help us to deliver our innovation plan.

[29] https://www.energynetworks.org/assets/images/Energy%20Networks%20Innovation%20Process-Final.pdf
[30] https://smarter.energynetworks.org/innovation-proposal

We will allocate a minimum of £500,000 each year to this scheme and will publish information on the defined route through which third parties can apply to us. This represents a notional 10% of our annual RIIO-ED2 innovation expenditure. We will keep this under review and increase or decrease as appropriate, subject to our assessment of benefits and uptake.

Whilst the majority of our NIA spend already goes to third parties, as detailed in Section 3.5, much of this interaction is initiated by us to deliver against our Innovation Strategy and wider business objectives. **The Collaborative Innovation Scheme will allow third parties direct access to the NIA for projects they wish to carry out** and which address specified innovation challenges covered by NIA.

As such, our role will be to communicate the challenge areas to third parties, including through our annual call for innovation, administer the scheme, and work with the third party to ensure that projects meet the relevant eligibility criteria and other conditions of funding.

Funding decisions will be made by our Innovation Oversight Panel. We will present all applications, possibly during defined windows throughout the year, alongside our assessment of whether those ideas meet the governance requirements set out by Ofgem for NIA projects and pass our eligibility assessment criteria. The Innovation Oversight Panel will then make a decision on where to invest this proportion of our allowance. Our eligibility criteria will include:

- Does the proposal address the challenge as set out in the call for innovation and support the transition of the energy system to Net Zero?
- Is the proposal innovative?
- Does the proposal have a defined scope?
- Does the proposal have defined outputs?
- Does the proposal represent value for money?
- Will the solution deliver customer benefits?

We believe that our Collaborative Innovation Scheme, in combination with our Innovation Oversight Panel, will be particularly valuable for third parties. Ofgem has proposed to discontinue the ENA's annual Call for Ideas to third parties for the NIC, instead placing a requirement on network companies to participate in generation of project ideas for the replacement funding mechanism, the SIF. Our Collaborative Innovation Scheme will therefore extend the opportunity for third parties to access innovation funding via the NIA.

6.10 How activities will be delivered

This section describes our processes for delivering innovation during RIIO-ED2, **as per 4.38 in the RIIO-ED2 business plan guidance**.

The process of developing our innovation ideas involves senior managers from across our business and ensures projects are targeted and linked to real problems that, when solved, will deliver value for customers and demonstrate a clear pathway to BAU.

Our innovation projects are subject to a rigorous assurance process to substantiate their predicted costs and benefits. This includes review through our internal audit before an external audit involving a relevant third-party review. We use the Regulatory Instructions and Guidance (RIGs) tables to report all benefits as a result of innovation. We also continually monitor and track our innovation spending against our planned project costs. In RIIO-ED2, we will complement our internal process with engagement with the Innovation Oversight Panel to obtain independent challenge and ideas on possible delivery routes.

We have recently worked with ENA to develop the new Electricity Network Innovation Process[31] for RIIO-ED2. This is an end-to-end process which will promote collaboration and sees the adoption of a new innovation benefits-tracking methodology for all DNOs, which will deliver a wide range of benefits to our customers and wider stakeholders. We are already building this methodology into our innovation process, ensuring that we are well-practised in advance of RIIO-ED2.

We keep up-to-date with all guidance to ensure that we can build it in to all innovation projects.

6.10.1 Approval of New Projects

In RIIO-ED2, new innovation projects will fall into three categories; BAU, NIA and SIF. We have different approval processes for each type of project.

6.10.1.1 BAU Approval Process

1. Check project supports our aims in the Innovation Strategy.
2. Produce paper detailing the project scope, method, budget and benefits.
3. Submit the project for discussion with the Innovation Oversight Panel.
4. Paper is submitted to the ELT for funding approval.
5. Produce Project Initiation Document (PID) for submission to our Network Investment Group.
6. Project approved by our Network Investment Group.
7. Project delivery commences.

6.10.1.2 NIA Approval Process

1. Check project supports our aims in the Innovation Strategy.
2. Check project meets eligibility criteria in the new NIA governance.
3. Produce paper detailing the project scope, method, budget and benefits.
4. Submit the project for discussion with the Innovation Oversight Panel.
5. Paper to be submitted to the Engineering & Technical Director and Chief Financial Officer for approval to submit as a NIA project.
6. Produce one-page notification document and submit to ENA Innovation Managers group to check for duplication and collaboration.
7. Produce Project Eligibility Assessment.
8. Register project on ENA Smarter Networks Portal.
9. Project delivery commences.

6.10.1.3 NIC / SIF Approval Process

1. Check project addresses Ofgem's challenges.
2. Produce paper detailing the project scope, method, budget and benefits.
3. Submit the project for discussion with the Innovation Oversight Panel.
4. Paper is submitted to the ELT for approval to submit application.

[31] https://www.energynetworks.org/assets/images/Energy%20Networks%20Innovation%20Process-Final.pdf

5. Produce application to SIF process.

6.10.2 Project Initiation and Procurement

Once a project has been approved the appropriate procurement processes will be followed to develop and sign contracts with Project Partners and suppliers. If appropriate, a competitive tender process will be completed in line with procurement processes.

At this stage of the process we will assess the most efficient delivery method for the project, i.e. using internal or external resource, to allow us to place all the necessary delivery contracts prior to the commencement of project delivery.

6.10.3 Project Delivery

We use a dedicated project management team who have significant experience in the delivery of complex innovation projects and programmes and are therefore able to employ best practice to maintain our high standards when guiding our projects from initiation to completion. In RIIO-ED1, this team delivered the rollout of the CLASS project to over 250 primary substations and led the project to install Smart Street at 180 distribution substations. This was all in addition to delivering the portfolio of NIA and NIC projects totalling over £35 million in RIIO-ED1. In RIIO-ED2, we will expand this team, as appropriate, to meet the extra challenge of delivering a £25 million NIA programme.

Our Engineering Standards team works closely with our Innovation team to help ensure that our innovations are embedded into BAU following project completion.

We adhere to the requirements outlined in Ofgem's project guidance and governance documents when undertaking Ofgem innovation stimulus projects.

All of our innovation projects comply with Ofgem's Data Best Practice guidance and we will create a publicly available data policy setting out how the data used and generated by projects will comply with Data Best Practice Guidance, including how data will be made available to stakeholders.

6.10.4 Workforce resilience

The innovation required to facilitate the transition to Net Zero is driving the agenda around skills and changing the mix of skills required to operate the network. As the new solutions are trialled and tested in the Innovation team, the requirement for different skills resides here first.

When delivering innovation projects we will use internal staff, where possible, to increase skill sets within the business. For example, we used contractors to deliver the BAU capital programme to free-up internal teams to install the Smart Street trial equipment, enabling them to learn the necessary skills.

Ensuring we have the correct skills is a crucial part of BAU transition and the Innovation team will facilitate the necessary briefing and training, in conjunction with our Training Academy, for all relevant staff within the business.

6.11 Innovation reporting

This section sets out how we propose to monitor and report benefits of all planned innovation activities during RIIO-ED2, how we plan to reduce costs in other areas, and how we will disseminate learning, **as per 4.36 in the RIIO-ED2 business plan guidance**.

We have recently worked with the ENA to develop the Energy Networks Innovation Process[32] (ENIP). This is an end-to-end industry-led process for reporting, collaboration, and dissemination of innovation projects and includes the Innovation Measurement Framework (IMF).

Although not strictly necessary, we have already started to use this process internally following its publication in April 2021, to ensure we have it fully embedded ready for the start of RIIO-ED2.

The IMF contains a benefit tracking methodology to report on a range of innovation outcomes, including collaboration and partnerships, the speed at which successful innovation is transitioned into BAU, and the benefits innovation has delivered for network customers. This is done in a transparent and consistent manner, using agreed benefits tables to populate a balanced scorecard – an example of this is available in Figure 6.14. To calculate the benefits, we will use either the RIIO-2 CBA model or the Whole System CBA developed by ENA depending on the project.

As demonstrated with our rollout of innovation in RIIO-ED1, we will continue to monitor the benefits of innovation and use this innovation where we can to reduce costs in other areas.

[32] https://www.energynetworks.org/assets/images/Energy%20Networks%20Innovation%20Process-Final.pdf

Figure 6.14: The balanced scorecard

Higher level enablers of innovation				
	Strategy & Vision (SV)	**1. A clear innovation strategy linked to what consumers and stakeholders value**		
		A strategy is in place – link to LNO strategy	Innovation projects are seeking to deliver benefits in areas which consumers/stakeholders value (optional)	The extent to which innovation trials align with the ENA strategy
	Organisation & Culture (OC)	Number of collaborators involved in innovation projects (including breakdown or partner types)	**2. A culture of innovation** • External survey • Internal survey (optional) • Average time taken to progress an idea through to trial • Number of FTEs working on innovation projects • % of network company funding in innovation projects • % of trials based on external ideas/suggestions	**3. A culture of adopting learning from others** • % of successful innovations from other companies implemented as BAU (fast follow)
	Capability & Technology (CT)	Number of innovative ideas	**4. Focus of TRLs** • Heat map illustrating where the % of projects and % of spend sit across TRLs	**5. Speed at which proven innovation is deployed** • Average time taken to deploy TRL 8 projects
	Results & Outcomes (RO)	Percentage of innovation ideas taken forward to projects	**6. Forecasting and tracking project benefits** • Level of RIIO-2 committed benefits • Tracked net benefits delivered • 5 of TRL6-8 projects which conclude with a positive CBA • Number of projects with negative CBA failed fast • % of TRL 2-6 projects which lead to another project	**7. % of projects moved into BAU** • % of completed TRL 8 projects moved into BAU
		Initiation & Evaluation (ideas – I)	**Demonstration, Iteration & Learning (trials – T)**	**Deployment & Optimisations (build – B)**
		Progression of innovation over time		

We will publish the balanced scorecard annually alongside a summary of our innovation portfolio, on both ENA Smarter Networks Portal and our website, to ensure that learning is shared in a timely manner.

We will also provide this information to ENA to be included with the ENA industry-wide Annual Innovation Report.

Additionally, we will continue to publish annual updates for all live innovation projects and formal closedown reports for completed projects, including an updated cost benefit analysis.

In addition to disseminating our learning at the Energy Networks Innovation Conference we will use our own events, industry conferences, and our attendance at the Innovation Managers group to ensure that learning is transferred across the industry.

6.12 Past projects and proven innovation

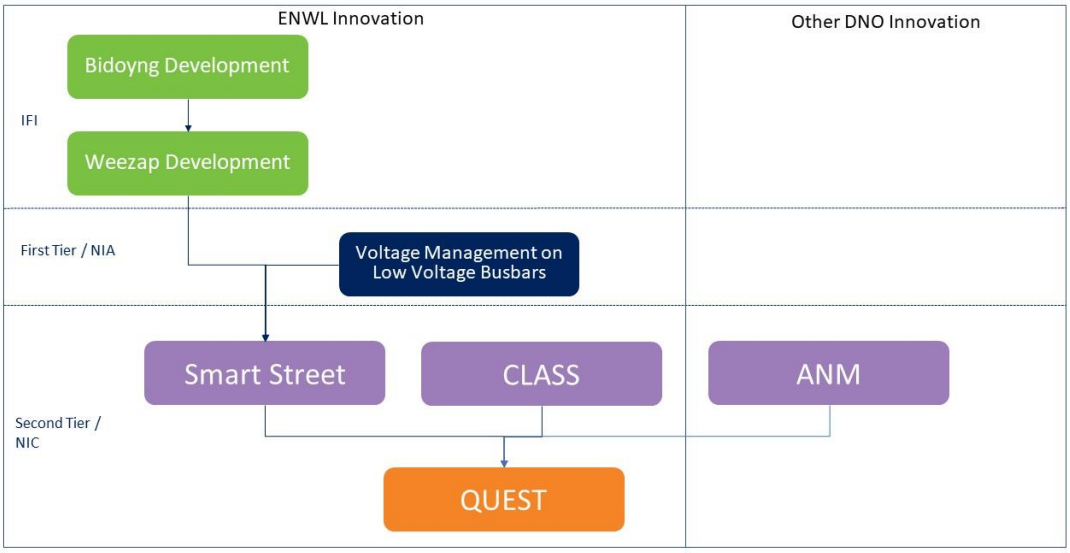
This section describes how we will continue to learn from past projects to deliver greater benefits during RIIO-ED2, **as per 4.36 in the RIIO-ED2 business plan guidance**, our steps to ensure that previously proven innovation is rolled out into BAU, and how the related benefits are reflected in our proposed expenditure, **as per 4.37**.

We have demonstrated the capability for world-leading technical innovation and the practical application of the technology to deliver customer benefits. In addition to the BAU application of CLASS, which is now delivering significant benefits to customers, and our NMS, we are now working on the rollout of Smart Street with its concomitant customer benefits.

We have maintained our use of innovation in process and technology to deliver network outputs, enhanced resilience and public safety improvements, at a lower cost. Examples of this are in our use of enhanced analytics to improve asset replacement decision-making, use of interconnectivity to provide enhanced resilience, installation of innovative smart fuses (Weezaps) on rising services and lateral mains to protect multi-occupancy buildings, and our innovative blast mitigation approach to link boxes.

Building on learning from previous projects is central to our innovation delivery and is evidenced by the transfer of learning from IFI projects to NIC projects as shown in Figure 6.15. This demonstrates that we have taken learning from IFI and First Tier projects as inputs to the Second Tier project, Smart Street. We have then built on the learning from this and other Second Tier projects in QUEST.

Figure 6.15: Innovation building on past projects



This method of building learning in stages reduces the risk of innovation failing, and in RIIO-ED2 we will continue to leverage learning from past projects to deliver more effective solutions that can bring further benefits to customers.

So far in RIIO-ED1, we have implemented a range of innovative solutions to make efficiencies against load-related allowances. In 2019/2020 we reported a cumulative saving of £10 million and forecast this value to increase to £17.7 million by the end of RIIO-ED1. These savings have been driven by the

innovative solutions of C2C, the LV Connect & Manage programme, the implementation of Demand Side Response and, in the remaining years of ED1, switchgear modifications which increase fault level capacity.

Innovative intervention strategies developed within RIIO-ED1 are now embedded in our unit costs for pricing the RIIO-ED2 business plan, and innovative techniques embedded in our business processes will be utilised in delivering the plan.

6.13 Innovation proven elsewhere

This section describes how we will learn from and, where appropriate, implement innovation proven elsewhere.

We continually scan the horizon for innovation projects undertaken by our industry colleagues and stakeholders to ensure that we do not miss an opportunity to include any suitable learning or industry developments into our BAU practices. This is built into our innovation process by way of our continuous involvement with ENA and other DNOs, as well as through our regular attendance at innovation and dissemination events.

Additionally, DNOs will share plans for rolling out proven innovation at the ENA Innovation Managers Group and ensure that innovative solutions are recorded on the ENA Implementation Log. This Implementation Log will allow us to understand what innovative solutions from other DNOs are ready for BAU rollout and we will then review them against our business drivers and challenges to ensure the solution is right for our customers.

We have already implemented best practice innovations developed by other DNOs, including the inclusion of the directional fault passage indicators and Fuse Savers, trialled by UKPN, which has improved our response to faults. The EV profiles developed by the UKPN My Electric Avenue project have been used as part of our demand forecasting. We have adopted ANM, which was trialled by a number of other DNOs first, and use techniques from WPD's FlexDGrid and UKPN's EDGE-FCLI in combination with our Respond to address fault level issues on our network. We have integrated the STORM telephony platform, first deployed in SP Energy Networks, and customer call back processes, which have helped us to achieve the biggest improvements in customer satisfaction of any DNO.

We are also the fifth DNO to join the Flexible Power Platform[33] developed by WPD, to enable a direct path for flexibility providers in the North West to participate in flexibility. This was a direct response to customer feedback calling for a simpler way to engage in the distribution flexibility services market, and greatly enhances our engagement with flexibility providers. We believe this platform will be instrumental in supporting the development of these new markets and will further reduce barriers to participation. This is key to our Net Zero carbon transition and will allow more stakeholders to realise the benefits that can be achieved through flexibility.

In our response to the Challenge Group questions sent on 25 February 2021 on the benefits of innovation, we included a list of best practice innovation we have adopted from other DNOs and implemented as BAU. These innovations have helped us to achieve the biggest improvements in customer satisfaction of any DNO: social data mapping, an outreach education programme for Key Stage 2 pupils, and top-up vouchers for customers in vulnerable situations.

In addition to the above, we will continue to take advantage of our links with Kansai Electric Power, one of our shareholders, to explore project idea options. Already we have identified several

[33] https://www.flexiblepower.co.uk/

opportunities for trialling on our network innovation proven by Kansai that could have the potential to bring value to our customers during RIIO-ED2. This will help us to utilise innovation from across the globe and is something that we will take advantage of going forward.

6.14 Framework for rolling out proven innovation into BAU

This section describes how we will ensure that proven innovation is rolled out into BAU during RIIO-ED2, **as per 4.37 and 4.38 in the RIIO-ED2 business plan guidance**.

Transitioning innovation into BAU is at the core of our innovation plan as its only then that the innovation can bring value to customers.

To ensure the transfer to BAU runs as smoothly as possible, we engage with the wider business as part of our innovation development process to fully understand and scope the requirements.

We also take advantage of the funding available to us, for example, through use of the IRM for Smart Street, to ensure that rollout can begin with appropriate speed to deliver the best value for money to our customers.

Successful transition of innovation into BAU requires a nuanced understanding of the unique challenge of normal business. A one-size-fits-all approach is not considered appropriate. Instead, we propose in RIIO-ED2 to continue to use our tailored approach to transitioning innovation proven within Electricity North West and elsewhere into BAU depending upon the size of the adoption challenge.

There are 3 approaches to BAU transition:

1. **Simpler projects** which result in updates to policy and/or a business process before the innovation then becomes the default solution, e.g. new forecasting techniques, the new voltage control settings devised in the Enhanced Automatic Voltage Control NIA project. For this type of project, the Innovation team will update the policies and conduct briefing sessions for BAU staff to ensure the relevant areas of the business fully understand the changes and rationale behind them. These changes are often minor in nature and the transition to BAU is less onerous.
2. **Projects which have produced a device** which can be used as part of a larger business process, e.g. Earth Fault Indicator, PreSense. For this type of project, the Innovation team will provide the technical specification, installation and maintenance procedures, and any training to the relevant teams across the business. Where appropriate, support for Procurement will be provided to ensure that all lessons learnt are captured and incorporated in commercial contracts. These devices will then be deployed as part of the larger project, such as the load-related investment programme.
3. **Larger projects**, e.g. CLASS, Smart Street. For this type of project, we have dedicated delivery teams that are part of the Innovation team but with a dedicated project manager and support from the wider business. The dedicated teams will manage the rollout of the innovation across the network and the transition of solutions to BAU.

We also leverage synergies between projects to ensure we deliver a cost efficient BAU rollout. This can be demonstrated through our plans for the deployment of Celsius by using the outputs of the Cable Health Assessment – Low Voltage NIA along with the learning being developed in the Interface NIA.

BAU Deployment of Celsius

Celsius releases capacity on the LV network through the application of an enhanced thermal rating based on the local environment and loading. Measurement of three phase load, ambient temperature and transformer external temperature are required to calculate this rating using a Thermal Ratings Tool.

The ***Cable Health Assessment – Low Voltage*** project has developed a low-cost monitor (PreSense) to measure three phase loads. We are already deploying this monitor in RIIO-ED1 with plans for a further significant installation during RIIO-ED2.

The ***Interface*** project is developing learning on how to integrate disparate measurements within secondary substations and, where necessary, use local intelligence to provide information to the control room.

By using the techniques from Interface to integrate measurements from temperature sensors with the PreSense units and input this data to the Celsius Thermal Ratings Tool, we can produce the Celsius enhanced thermal rating. By integrating learning in this way, we can deliver greater benefits to customers.

We share all relevant learning from our innovation projects with our colleagues and ask for their feedback and ideas for future projects using internal channels such as our intranet, weekly e-newsletter and internal magazine

These approaches have performed well in RIIO-ED1, and we will continue to use them in RIIO-ED2 and beyond.

6.15 Our plans for moving from NIC to SIF

This section outlines our plans for moving from Ofgem's NIC funding mechanism to the replacement SIF, from 2023.

6.15.1 What is the SIF?

The Strategic Innovation Fund (SIF) is a funding mechanism that Ofgem will introduce for electricity distribution licensees from 2023, replacing the NIC. The SIF will make over £450 million available over the course of RIIO-ED2 for strategically important network innovation projects. The major differences between the NIC and the SIF are listed in Figure 6.16 below.

Figure 6.16: Differences between NIC and SIF funding mechanisms

NIC	SIF
Linear, bottom-up process, which is isolated from other funding bodies.	Focussed on energy system transition and aligned with Ofgem's Strategic Change Programmes; organised with other funding bodies; flexible and responsive.
Network companies bid with their own innovation ideas.	Ofgem, in partnership with UKRI, identifies and sets innovation challenges.
Project-based funding: projects funded based on set criteria.	Solution-based funding: focus on the best solution to defined problem.

NIC	SIF
Annual competition starting around April each year, funding decision issued around October.	Challenges can be issued by Ofgem at any time during the year, potential for issue of multiple challenges in a year.
Initial Screening Process (ISP) required.	ISP removed and replaced with detailed briefing and ongoing support prior to bid submission.
Long, in-depth screening by Expert Panel prior to funding decision.	Shorter funding evaluation; rigour shifted to discovery stage.
Winners left to proceed with project independently.	Ofgem, alongside UKRI, remains involved through stage-gating, governance and advisory.

Further to the last point in Figure 6.16, above, the SIF will comprise several phases. The Discovery phase identifies project feasibility and is designed to enhance understanding of the problem. Discovery is focussed on learning about users and their content, constraints affecting the problem or wider context, and opportunities for improvement. The Alpha phase will experiment with different solutions to the problem identified during Discovery, and will look at testing key assumptions, solving a whole-user problem, and using learning to decide whether to move projects on to the next phase. The final phase is the Beta phase, which will deploy the solution in a real-life environment, whilst continuing to make improvements, and will likely be the longest and largest phase of the project.

6.15.2 Our intended approach

The NIC has delivered significant benefits to our customers by allowing us to develop our CLASS and Smart Street projects, which are now BAU. In moving away from the NIC to the SIF, we will work with Ofgem and all other stakeholders to ensure the SIF builds upon the successes of the NIC and provides and more value for customers. We are committed to engaging fully in the opportunities presented by the SIF and ensuring that we are a key innovator with a broad range of innovation projects progressing through their various stages - including the critical 'Beta' phase, which is more closely aligned to the NIC.

The nature of the SIF, in particular its lack of any defined windows during which projects are submitted, and the need for us to monitor continuously to find out whether new challenges have been published, is expected to change the way we currently work. We are working closely with Ofgem as it continues to develop its proposals for SIF in RIIO-ED2, and we will need to consider how to organise our innovation resources during RIIO-ED2 to take full advantage of the opportunities afforded.

At this stage, we are not proposing any changes to our plan, including its delivery, as a direct consequence of the introduction of the SIF. However, we will keep this under review as the details of the SIF continue to be made available.

6.16 Our detailed innovation plan for RIIO-ED2

This section presents the detailed plan for our innovation activities during RIIO-ED2, showing our high-level areas of focus for NIA spending and the funding we believe will be necessary to deliver this, **as per 4.38 in the RIIO-ED2 business plan guidance**.

Figure 6.17 summarises wherewe propose to focus our innovation activities during RIIO-ED2, including examples of the types of project we will undertake for each theme. Figure 6.18 sets out in detail the areas in which we will invest, mapped against our innovation themes. We anticipate delivering one or more projects in each of these areas. Although we have mapped them against one theme, the benefits will deliver against a number of themes.

The plan is presented by:

- **Innovation Area** – the high-level aim of the innovation.
- **Innovation Driver** – why we need to innovate in this area.
- **Innovation Objective** – how we intend to innovate in this area.
- **Value / Benefits** – where we expect the benefits of the innovation to manifest.
- **Proposed funding route in RIIO-ED2** – how we intend to fund our activities in each area. This only indicates actual expenditure where activity is to be funded via NIA – for NIC/SIF/BAU we are signalling that there is work going on in these categories.

Figure 6.17: Summary of our innovation plan by theme with example projects

Theme	Innovation Area	Example Projects
Consumer vulnerability	Fuel poverty Impact of our operations Working with vulnerable communities	• Smart Street on rural networks • New methods to reduce requirements for excavations in public highways
Net Zero and the energy transition	Carbon Emissions Energy Efficiency / Maximise Capacity Low Carbon Technology Adoption Impact of SF_6	• Continue to explore opportunities for low loss infrastructure • Smart Street on rural networks • Domestic demand side response • Explore alternatives to SF_6 equipment
Optimised assets and practices	Safety Measures Network Resilience Network Reliability Asset Management	• Alternative methods for working at height • Continue to examine methods for proactively detecting developing faults • Improved models for risk-based assessment for LV asset replacement
Flexibility and commercial evolution	Domestic Flexibility Forecasting Data Access Connections Interface Arrangements	• Domestic demand side response • Continue to improve our forecasting capabilities • Explore innovative methods for data sharing • Maximise potential for API interface with real time systems
Whole energy systems	Assets Use Whole System planning	• Facilitate the use of hydrogen as an alternative to fossil fuel heating • Co-ordinate with other utilities on shared use of infrastructure

Figure 6.18: Detailed innovation plan

Theme	Innovation Area	Innovation Driver	Innovation Objective	Value / Benefits	Proposed funding route in RIIO-ED2		
					NIA	NIC/ SIF	BAU
Consumer vulnerability	<u>Fuel poverty / consumer vulnerability</u> Further explore opportunities in addressing fuel poverty through use of new technology to provide benefits to consumers in vulnerable situations.	Innovation projects, such as Smart Street, have shown the potential for technology to assist with challenges and provide opportunities for consumers in vulnerable situations. As networks evolve and new services become available to customers, it is important that all customers, especially the most vulnerable are not left behind as a consequence. We intend to specifically target these customers through innovation.	<u>Optimised distribution system operation</u> Through increased visibility and the ability to remotely control more of the distribution system together with enhanced capabilities in our NMS, we will examine opportunities and techniques for further optimisation of the network to provide benefits to customers.	Reduced costs to consumers in vulnerable situations.	£1.5m		✓

Theme	Innovation Area	Innovation Driver	Innovation Objective	Value / Benefits	Proposed funding route in RIIO-ED2		
					NIA	NIC/ SIF	BAU
	Impact of our operations Researching and trialling how new technology and innovation can reduce the environmental and societal impact of our operations.	Distribution system networks necessarily impact the environment and society more generally. The risks here are controlled through operational procedure and policy however, opportunity for reducing these risks and impacts needs to be examined.	Risk Management To explore the opportunities for new technologies to reduce the impact of networks on the environment and society. Advanced monitoring of insulating materials such as oil together with advanced asset management techniques to better control risks associated with networks.	Lower environmental risks	£3.0m		✓
	Working with vulnerable communities Explore working with organisations, such as charities, LAs and schools, in communities with high levels of consumers in vulnerable situations.	To date most community schemes have focussed on rural areas e.g. those that are off-gas. However, a significant number of our consumers in vulnerable situations are known to reside in inner cities or densely populated urban regions. There is a need to explore ways in which solutions typically targeted to rural communities can provide benefits when applied to these non-rural communities.	Stakeholder Engagement Engage with relevant organisations to understand the challenges they face and the opportunities available and trial various solutions.	Improved awareness and access to innovative solutions in communities with high levels of consumers in vulnerable situations	£1.5m	✓	✓

Theme	Innovation Area	Innovation Driver	Innovation Objective	Value / Benefits	Proposed funding route in RIIO-ED2		
					NIA	NIC/ SIF	BAU
Net Zero and the energy transition	Carbon Emissions Explore the role of innovation and new technology to help offset the carbon impact of our network.	The commitment to deliver net-zero is ambitious and network operators are significant contributors. By leveraging new innovation, we can reduce the impact we have and help achieve the ambition of Net Zero. Innovation and new technology is expected to provide significant opportunities to reduce carbon emissions associated with networks including offsetting the impact of losses.	Carbon Emission Management To trial use of new technology and innovation to reduce carbon emissions across our activities including at depots, in our mobile assets such as vans, generators, and in our offices. To explore new technologies to reduce the technical losses on our network.	Lower carbon footprint Reduced network losses	£2.5m		✓
	Energy Efficiency / Maximise Capacity Explore the use of new techniques and technologies to increase energy efficiency and maximise capacity.	Innovation projects, such as Smart Street, have shown the potential for technology to allow network operators to maximise the capacity on their network by increasing energy efficiency for our customers. We need to further increase our understanding of the opportunities provided by the application of new technology and innovation for the purposes of increasing efficiency.	Optimised distribution operations Examine further the extent to which voltage optimisation can provide value to customers, in particular those in more rural areas not fully covered by existing techniques.	Facilitate adoption of low carbon technologies by providing low cost capacity Reduced costs for all customers	£4.5m	✓	✓

Theme	Innovation Area	Innovation Driver	Innovation Objective	Value / Benefits	Proposed funding route in RIIO-ED2		
					NIA	NIC/ SIF	BAU
	Low Carbon Technology Adoption Researching and trialling how new technology and innovation can be used to facilitate and encourage the adoption of EVs and HPs	The government's ambition for Net Zero carbon will require significant uptake of low carbon technologies which will lead to significant increases in demand on the electricity network. We need to further examine low-cost alternatives to meeting the capacity needs associated with these new loads.	Capacity release Trial new approaches to the planning and operation of networks, including the possible use of these new demands as a source of flexibility.	Facilitate adoption of low carbon technologies Provide new services for customers Reduced costs for all customers	£2.0m	✓	✓
	Impact of SF_6 Explore the role of innovation and new technology in helping to reduce the carbon impact of SF_6 on our network.	SF_6 is used extensively on electricity networks as a form of insulation and arc suppression. It is a high-impact greenhouse gas and its leaking to the environment is harmful. There is a need to use innovation to explore new technologies to reduce the use of SF_6 and its impact on the environment.	Risk Management To explore new methods for alternative, low-impact, forms of electrical insulation to replace SF_6 and to examine reliable means for the early detection of any leakages.	Lower environmental risks	£1.0m		✓

Theme	Innovation Area	Innovation Driver	Innovation Objective	Value / Benefits	Proposed funding route in RIIO-ED2		
					NIA	NIC/ SIF	BAU
Optimised assets and practices	Safety Measures Explore how new technologies can provide improvement to safety measures for our operators and the general public.	We have a company philosophy of "No one goes home injured" and this applies to employees and members of the public equally. There are also statutory obligations regarding safety. Innovation can be used to investigate how technology can be used to find new ways of working to reduce the need for previously high-risk activities.	Risk Management To explore new technologies to mitigate the need for working at height and to improve the safety of our low voltage networks.	Improved safety	£0.75m		✓
	Network Resilience Further explore the use of new technologies to enhance automation across our operations to improve network resilience.	The transition to Net Zero will result in customers becoming more reliant on electricity for heat and transport meaning that any loss of supply will have more impact than before. Innovation can be used to exploit the opportunity provided by new technology to improve the resilience of our network and reduce impacts to our customers.	Resilience We will explore new technologies to further improve the resilience of our network including enhancing our use of automation to keep interruption times to a minimum.	Improved customer service	£1.5m	✓	✓

Theme	Innovation Area	Innovation Driver	Innovation Objective	Value / Benefits	Proposed funding route in RIIO-ED2		
					NIA	NIC/ SIF	BAU
	Network Reliability Further explore the use of new technologies to enhance automation across our operations to improve network reliability by avoiding faults.	The transition to Net Zero will result in customers becoming more reliant on electricity for heat and transport meaning that any loss of supply will have more impact than before. Innovation can be used to exploit the opportunities provided by new technology to improve the reliability of our network and reduce impacts to our customers.	Reliability We aim to develop techniques for proactively detecting developing faults thereby allowing interventions before failure, improving customer satisfaction.	Improved customer service	£1.5m		✓
	Asset Management Research the use of innovative techniques to increase the lifespan and improve the health of existing assets.	Electricity infrastructure was initially installed in the 1950s and 60s meaning that many are approaching their designed end of life. Additionally, they are increasingly being asked to perform new functions due to the changing needs of our customers. To avoid large peaks in asset replacement programmes, we need to investigate alternative ways of managing this ageing asset base.	Asset Management Examine new techniques for managing the health of assets, particularly low voltage assets which will be the first assets affected by the transition to Net Zero.	Improved investment plans	£1m		✓

Theme	Innovation Area	Innovation Driver	Innovation Objective	Value / Benefits	Proposed funding route in RIIO-ED2		
					NIA	NIC/ SIF	BAU
Flexibility and commercial evolution	Domestic Flexibility Explore opportunities to increase value associated with bringing domestic flexibility into the market.	The transition to Net Zero will result in increased demands on the electricity network and the majority of this new demand will be in the domestic sector. Solutions already exists for flexibility for larger customers connected at higher voltage levels, but the domestic sector remains largely untapped. Innovation can be used to investigate how network solutions and domestic flexibility can work together to resolve any potential conflicts that might arise and provide further benefits.	Adding Value We will explore opportunities to boosting the value proposition of flexibility for domestic customers to encourage participation.	Cheaper connections Savings on energy bills.	£1m	✓	

Theme	Innovation Area	Innovation Driver	Innovation Objective	Value / Benefits	Proposed funding route in RIIO-ED2		
					NIA	NIC/ SIF	BAU
	Forecasting Investigate new techniques to improve demand and generation forecasting.	Demand and generation forecasting is used to ensure that we are investing in the right area at the right time ahead of any increase in uptake of low carbon technologies. New innovative techniques can be used to refine our existing models to improve the accuracy of these forecasts and help target investment appropriately.	Accuracy in Forecasting We will look for new techniques which can be incorporated into our existing models to further improve the accuracy of future load forecasting.	Improved investment plans	£0.5m		✓
	Data Access Explore new techniques and technologies to further enhance access to our data.	Data is a crucial tool in the future management of electricity networks. Enhanced data will be required by third parties such as generators, other network companies, larger customer to assist with their operations. Innovation can be used to improve our understanding of the different methods for sharing data, e.g. formats, methods, tools and systems.	Data Provision We will look for innovative solutions for providing data to stakeholders using a method they are willing to accept to enable them to use it for their own manipulation.	Increased level of autonomy.	£1m	✓	✓

Theme	Innovation Area	Innovation Driver	Innovation Objective	Value / Benefits	Proposed funding route in RIIO-ED2		
					NIA	NIC/ SIF	BAU
	Connections Explore how new techniques and technology can be used to improve our connections processes.	Customers wishing to connect new demand or generation to our network will apply for a new connection. The new connection process has set maximum timescales and procedures. Innovation can be used to improve the customer experience and streamline elements of the process to reduce the time to connect.	Improve Customer Experience We will explore new techniques and technology to further enhance the customer experience during the connections process.	Improved customer service	£0.5m		✓
	Interface Arrangements Investigate new techniques to improve the interface arrangements with other network companies.	The transition to Net Zero will lead to more active networks which will require more data to allow the network to operate more effectively. This means that there is an increased need for real-time sharing of information and data between different network operators. New innovative techniques can be used to facilitate this real-time sharing of relevant information.	Data Sharing We will explore the new techniques and technology infrastructure required to allow real time sharing of data between network operators.	Improved customer service	£0.25m	✓	✓

Theme	Innovation Area	Innovation Driver	Innovation Objective	Value / Benefits	Proposed funding route in RIIO-ED2		
					NIA	NIC/ SIF	BAU
Whole energy systems	Assets Use Explore the synergies around the joint use of assets by different utilities.	Electricity and telecoms both use overhead infrastructure as part of their networks which, for operational reasons, means that in some locations there are two similar looking assets. For wooden poles this can also be an environmental issue as creosote is used to preserve the poles. To reduce the number of identical assets, innovation can explore new techniques to address the operational implications of putting telecoms equipment on electricity infrastructure or vice versa.	Environmental Management We will explore the joint use of overhead infrastructure by different utilities, e.g. electricity and telecoms to reduce the numbers of creosote poles in use.	Lower environmental risk. Improved customer service	£1m		✓

Theme	Innovation Area	Innovation Driver	Innovation Objective	Value / Benefits	Proposed funding route in RIIO-ED2		
					NIA	NIC/ SIF	BAU
	Whole System planning Promote whole system planning and decision making.	The transition to Net Zero is not just an electricity challenge and needs to be considered from the customer viewpoint. For instance, when decarbonising heat, it may be more beneficial for the customer to use a cleaner form of gas in existing infrastructure than retrofit a HP. Innovation can be used to take a holistic view of the problem and encourage sectors to come together and work collaboratively to address the challenges around Net Zero.	Customer Service We will investigate solutions to allow customers to transition to Net Zero in the most economical way. We will act as champion for Net Zero within our area and provide leadership and guidance for our customers.	Improve customer service Reduce energy bills	£1m	✓	✓

7 Appendix A – RIIO-ED1 Projects

This appendix contains our full portfolio of RIIO-ED1 innovation projects, including details of all Ofgem-funded projects, including LCNF, NIA and NIC projects, as well as our BAU projects.

Capacity to Customers (C_2C)	
Funding: Low Carbon Networks Fund, Tier 2	*Budget: £10 million*
Timescales: January 2012 – March 2015	*Website: www.enwl.co.uk/c2c*

The ground-breaking C_2C project combined proven technology with innovative commercial contracts to increase the amount of electricity that can be transmitted through the existing network.

C_2C works by reconfiguring our high voltage networks and working smarter to release 'spare' capacity. The networks are designed to keep some capacity for emergency use so that electricity can be re-routed in the event of a fault. Typically, the majority of customers are affected by a fault once every three years meaning that, for most of the time, only half of the total capacity of the network is used with half reserved for emergencies.

The networks are reconfigured by 'meshing' two adjacent circuits to form a closed ring and installing low cost, remote control devices at key locations on the trial circuits.

The spare capacity can then be released by asking customers to reduce their demand after a fault in exchange for payments or lower connection charges. Incentivising customers to change their demand behaviour in this way is known as 'demand side response' (DSR).

C_2C successfully proved that our industrial and commercial customers are willing to be flexible with their demand and sign up to a DSR contract. This helps us manage the network by releasing capacity when and where it's needed, and by reducing the amount of new infrastructure that would normally be needed to meet the growing demand for electricity. This helps lower customer bills and carbon emissions.

This approach has now been successfully integrated into our BAU processes. Since July 2016 all generators above 200kW applying for a new connection with us are offered this type of flexible contract.

Respond	
Funding: Low Carbon Networks Fund, Tier 2	*Budget: £5.5 million*
Timescales: January 2015 – October 2018	*Website: www.enwl.co.uk/respond*

The Respond project successfully demonstrated an intelligent approach to managing 'fault current', the instantaneous surge of energy which occurs when there is a fault on the network.

Intelligent software installed in our control room, known as the fault level assessment tool, interacts with our NMS, and uses network data to calculate the maximum potential fault current (or 'fault level') in near real time.

When fault level approaches or rises above network equipment ratings, the tool enables or disables one of three Respond mitigation techniques:

- *Adaptive protection:* re-sequences the operation of circuit breakers to reduce fault level

- *The I_S-limiter:* a current-limiting fuse which detects the rapid rise in current when a fault occurs and responds within 1/200th of a second to break the current
- *The fault current limiting service*: a commercial solution where large demand and generation customers can earn rewards by selling a fault current limiting response to their local network operator through a managed service agreement.

Respond will benefit all electricity customers by helping to avoid or defer traditional, expensive and disruptive reinforcement. This will help keep costs down, reduce carbon emissions and allow low carbon technologies to be connected to the network much more quickly.

Our policies and procedures have been updated so that Respond techniques can be used as part of our BAU processes.

Celsius	
Funding: Network Innovation Competition	*Budget: £5.5 million*
Timescales: January 2016 – March 2020	*Website: www.enwl.co.uk/celsius*

Our pioneering Celsius project successfully demonstrated how thermal monitoring and retrofit cooling technologies can release extra capacity.

As part of the project we trialled thermal monitoring at 520 substations across the North West and installed a range of retrofit cooling techniques at 100 of the trial sites.

Usually the amount of power we transmit through a transformer is limited by its manufacturer's rating which protects it from overheating. But thermal monitoring allows us to better understand the temperature of the transformer and release its full available capacity.

In addition, we trialled a range of retrofit cooling techniques, such as improved ventilation, heat extraction fans and alternative kinds of backfill material for underground cables, which help to cool down substations and maximise the use of our assets.

The project proved that capacity can be released simply by installing thermal monitoring, and the addition of the retrofit cooling techniques can release even more capacity. Both techniques reduce long-term costs for customers, avoid early asset replacement and prepare our network for renewable energy.

Celsius techniques have now been incorporated into our BAU processes which could save our customers £31 million over the next 30 years if rolled out across our network, and £399 million across Great Britain.

QUEST	
Funding: Network Innovation Competition	*Budget: £7.95 million*
Timescales: January 2021 – April 2025	*Website: www.enwl.co.uk/quest*

The QUEST project will create an overarching control system to co-ordinate our voltage management techniques and allow us to fully exploit their benefits.

Building upon learning and outputs from previous projects, QUEST will identify and trial novel methods to deliver a business-ready solution which will integrate and optimise the techniques in use across the whole distribution system.

Proven technology will be combined with innovative software in our NMS to co-ordinate a number of discrete techniques already deployed on our network such as CLASS and Smart Street, and future systems such as active network management.

As well as boosting the benefits of existing voltage management techniques, the new control system will:

- Ensure the network operates as efficiently as possible, optimising system voltage and minimising losses
- Facilitate the increased connection and use of low carbon technologies
- Maximise benefits to customers through energy consumption reduction
- Maintain security of supply as we move towards a Net Zero carbon economy.

Demand Scenarios	
Funding: Network Innovation Allowance	*Budget: £0.5 million*
Timescales: April 2015 – April 2017	*Website: www.enwl.co.uk/demandscenarios*

As part of the Demand Scenarios project we developed and implemented a revised methodology for producing annual peak demand scenarios for each of the substations in our region, the first network operator to deliver this type of long-term scenario tool for network planning.

The way our customers use the electricity network is starting to fundamentally change. In recent years demand has gone down as our customers have become more energy efficient, but in the longer term will go up with increased use of electric cars and HPs. As well as the change in demand, more and more customers are connecting generation to our network such as solar panels, wind turbines and gas turbines.

This project developed a 'real options' cost benefit analysis tool known as ROCBA which helps us to better understand the scale of the impact of these changes and gives us more accurate ways of forecasting demand for each of our substations.

Our Demand Scenarios project focused on the long-term impact of domestic HPs and air conditioning on peak demand in summer and winter. This work is now used to inform National Grid, Ofgem and our Long-Term Development Statement.

This integrated approach to demand scenarios helps us devise more efficient investment plans and commercial solutions to capacity problems. Our approach is already contributing to a 20% reduction in load-related expenditure in RIIO-ED1 and will help us make more efficient decisions on £100 million of load-related expenditure in RIIO-ED2.

Distribution Asset Thermal Modelling	
Funding: Network Innovation Allowance	*Budget: £260,000*
Timescales: July 2015 – October 2016	*Website: www.enwl.co.uk/thermalmodelling*

This project delivered models which help us understand the impact of increased demand for electricity on the operating temperature and behaviour of distribution assets.

The increase in demand we expect to see as a result of the uptake of low carbon technologies will lead to an increase in the current flowing on the network. The greater the amount of current flowing, the greater the heat generated and the hotter an asset becomes. This will lead to thermal 'overload' at distribution substations.

The project produced two easy-to-use Excel-based models which provide greater understanding of the thermal behaviour and performance of distribution transformers and low voltage cables. The models help us to assess the capability of the assets to accept increased loads from low carbon technologies.

Two factors were considered when developing the models: thermal modelling and thermal failure modelling. Thermal modelling estimates the hot-spot temperature of individual distribution transformers and thermal failure modelling defines and quantifies the short-term failure probability.

The models can be used by network operators to maximise the lifetime of these assets by applying new understanding to network design, maintenance and asset management procedures.

The outputs from this project were also used as a fundamental building block to develop the 'thermal ratings tool' for our Celsius project (see above) which has redefined our transformer and cable ratings.

The outputs from this project were also used as a fundamental building block to develop the 'thermal ratings tool' for our Celsius project (see above) which has redefined our transformer and cable ratings.

Combined Online Transformer Monitoring	
Funding: Network Innovation Allowance	*Budget: £200,000*
Timescales: September 2014 – September 2022	*Website: www.enwl.co.uk/transformermonitoring*

This project will validate the results of our previous successful oil regeneration work which extends the life of high voltage transformers.

As the only network operator with a dedicated oil reprocessing plant in the UK, we already recycle 1.5 million litres of oil every year which is used to insulate and cool transformers. Our pioneering environmentally-friendly approach to regenerating oil extends the life of our power equipment and keeps costs down for customers across the region.

Funded under the IFI, the original project investigated transformer oil regeneration as an alternative transformer management option. The oil recycling process was improved as part of the project and is now used to extend the life of high voltage transformers.

The IFI project defined an oil regeneration window for transformers at the end or near the end of their design life which extends it by approximately ten years.

This project will monitor and record the results from using this approach for a significant time period to ensure the results are reliable and consistent.

Once sufficient data has been collected, it will be fed into data visualisation software which will allow consistent comparison of the data and for the project findings to be validated.

Asset Risk Optimisation	
Funding: Network Innovation Allowance	*Budget: £100,000*
Timescales: July 2015 – March 2017	*Website: www.enwl.co.uk/assetriskoptimisation*

The Asset Risk Optimisation project improved our investment planning by enhancing our knowledge of the issues around optimising programmes of work and investigating the impact of investment decisions on different asset types.

Network operators have used the condition-based risk management (CBRM) approach to asset management for a number of years. This approach allows for a detailed assessment of the relative condition of assets but does not integrate asset data into an overall risk assessment framework or allow planning for optimum investment to manage the asset risk.

The common network asset indices methodology (CNAIM) developed for RIIO-ED1 provides a standard approach for categorizing and quantifying risk across all asset types which opens up the possibility of inter-asset risk prioritisation.

The project was designed to understand the potential for the use of analytics and specifically optimisation tools which are used in other utility sectors, especially water and wastewater.

Using input generated from our existing data sources, the project carried out a trial optimisation of our current asset investment programmes for grid transformers, distribution high voltage switchgear, high voltage pole (supports) and underground link boxes.

This project demonstrated that risk optimisation tools can be applied in the electricity sector and developed a methodology to apply the techniques more widely. It has enabled us to understand the potential role of optimisation in driving efficient delivery in all areas of the business.

Reliable, Low Cost, Earth Fault Detection for Overhead Lines	
Funding: Network Innovation Allowance	*Budget: £350,000*
Timescales: October 2015 – October 2017	*Website: www.enwl.co.uk/earthfaultdetection*

This project developed and trialled fault passage indicator units for overhead line networks which allow us to detect faults in real time, speed up restoration times and improve service to customers.

Rural electricity distribution networks are largely comprised of long overhead lines which can represent an operational challenge to network operators owing to the higher-than-average incidence of faults, the large geographic regions they serve and the reduced availability of network automation.

Faults on overhead lines can be difficult to find and repair teams often need to patrol large areas on foot to locate them. This means some customers can be without power until the damage is located and repaired, particularly in storm conditions.

The aim of this project was to improve restoration times by providing a reliable, robust, low-cost solution to accurately identify the location of faults and improve the way we respond to faults on overhead lines.

Building on existing designs already deployed for underground cable fault detection, we extended this functionality to rural overhead lines. Working with project partner Nortech, we specified, developed, tested and demonstrated a low-cost clip-on-the-line sensor capable of detecting earth

faults and over-current safely. This 'fault passage indicator' (FPI), which is self-powered and harvests energy from the overhead line, can be deployed at volume and reliably communicates fault passage information to control engineers in real time.

Our project has successfully demonstrated that it is possible to detect over-current and earth faults using line-mounted sensors which can improve post-fault location by at least 20 minutes compared to traditional methods.

Architecture of Tools for Load Scenarios (ATLAS)	
Funding: Network Innovation Allowance	*Budget: £600,000*
Timescales: November 2015 – July 2018	*Website: www.enwl.co.uk/atlas*

Building on the work of our Demand Scenarios project, ATLAS developed methodologies, prototype tools and specifications to develop the types of detailed loading scenarios and comparisons to capacity which are needed by network operators to plan for future customer needs.

The Demand Scenarios project developed and implemented a revised methodology for producing annual peak demand scenarios for each of the substations in our region, for use in planning and reporting.

The project developed a 'real options' cost benefit analysis tool (ROCBA) which helps us to better understand the scale of the impact of future changes in demand and give us more accurate ways of forecasting demand for each of our substations.

The ATLAS project significantly extended the scenario analysis used in the Demand Scenarios project. It recognised that network planning decisions should consider not only peak demand forecasts but also scenario forecasts based on minimum demand, profile characteristics and reactive power flows during periods of peak and minimum demand.

ATLAS introduced new methodologies and tools to analyse historic demand at our grid and primary substations. Five alternative scenarios were developed for our network which can be used for demand forecasting. These scenarios are now used to inform our decisions about efficient development of the network for the long term, to ensure there is sufficient capacity to meet our customers' needs.

Cable Health Assessment – Low Voltage	
Funding: Network Innovation Allowance	*Budget: £2.75 million*
Timescales: November 2015 – August 2021	*Website: www.enwl.co.uk/cablehealth*

This project will develop the technology, data processing, support services, BAU operating model and condition-based risk management (CBRM) modelling required to give network operators the ability to assign health indices to low voltage cables and associated networks.

Low voltage cables represent a significant proportion of our asset base, yet there is little data available to allow the condition of a cable to be assessed. While the condition of many of our assets is assessed via our CBRM system, using data on age, environment and service, this type of data is not widely available for insulated low voltage cables. So, assessment of their condition requires

destructive testing and analysis of the cable's components which results in costly excavation of footways and roads and disruption to customers.

As an alternative to this intrusive destructive testing, this project will develop a device to collect measurements from in-service cables over a long time period and use this data to determine condition.

This device will provide results which accurately assess the condition of the cable and its movement over time in comparison to similar assets.

The project has already developed and agreed system software and fault detection/triggering algorithms concepts which will be refined as more data becomes available from field trials on low voltage networks.

The ability to determine the relative health of a cable in this way will provide network operators with improved measures of the cable's reliability under higher loading conditions and will permit targeted intervention. This assessment of a cable's condition will therefore replace the current process of 'fix on fail' and provide improved customer service.

Value of Lost Load to Customers	
Funding: Network Innovation Allowance	*Budget: £930,000*
Timescales: October 2015 – May 2020	*Website: www.enwl.co.uk/voll*

As part of the Value of Lost Load (VoLL) project we conducted an extensive piece of research which led to a better understanding of the unique impact of power cuts on a diverse range of customers.

Understanding the impact of power cuts on different groups of customers and VoLL is important as it is used by the electricity industry to determine investment strategies and network planning.

The research showed a huge difference in the way customers value their electricity supply. The under 30s are among the least affected by a power cut whereas the groups most affected include those in vulnerable situations, particularly those struggling with fuel poverty. Other highly impacted groups include young families and early adopters of low carbon technologies.

The research demonstrated that the value electricity consumers place on the security of their supply has increased significantly to an average of £17,500/MWh, since Ofgem set the single value for RIIO-ED1 at £16,000/MWh, reflecting customers' greater dependence on electricity and their evolving needs.

To move towards the practical implementation of a differentiated VoLL, further detailed analysis was required. VoLL 2 carried out two distinct pieces of research: a strategic piece of statistical analysis and industry consultation to explore the practicalities and regulatory implications for implementation of an alternative, segmented VoLL model; and empirical customer research to provide insight into the multiplier effect and socialisation of cost arising from a revised model.

The findings from the VoLL project directly guide our investment decisions on security of supply, restoration following an interruption or provision of temporary support during an interruption.

Enhanced Voltage Control	
Funding: Network Innovation Allowance	*Budget: £800,000*

Timescales: November 2015 – July 2019	*Website: www.enwl.co.uk/enhancedvoltagecontrol*

The Enhanced Voltage Control project successfully demonstrated a method of maintaining voltages within statutory limits, particularly for sites with large amounts of generation connected. This allows for faster connection of generation and enables us to offer voltage-managed connection contracts.

Government targets for reduction in CO_2 emissions and the use of renewable energy has led to a significant increase in large-scale generation connected to our 11kV and 33kV distribution networks. This increase in generation has resulted in difficulties controlling the voltages supplied to customers.

The project was divided into three workstreams:

- Part A further developed the technical solution to meet the required technical functionality for the rollout of our CLASS project
- Part B devised and applied new voltage settings to mitigate the impact of large-scale generation connected to our distribution networks
- Part C investigated the technical feasibility of offering new generators a 'voltage managed' connection to help solve the voltage issues caused by the increase in distributed generation.

Modelling and simulation work was carried out to assess the effect of significant generation on voltage control. This work developed new settings which were implemented at a trial site to understand the impact.

The project successfully developed settings which allow effective voltage control at a substation with significant generation connected. As a result, we have developed a new voltage control policy which provides guidance on the calculation of these settings and details of alternative connection methods which could be used to address the issue.

Optimising Oil Regeneration for Transformers	
Funding: Network Innovation Allowance	*Budget: £1.5 million*
Timescales: February 2016 – February 2022	*Website: www.enwl.co.uk/optimisingoilregen*

Building on our previous oil regeneration work, this project will identify the optimum window to carry out oil regeneration in the life cycle of a transformer.

Our original project which investigated transformer oil regeneration as an alternative transformer management option and improved the oil recycling process, defined an oil regeneration window for transformers at the end or near the end of their design life which extends it by approximately ten years.

Our Combined Online Transformer Monitoring project will monitor and record the results of this approach for a significant time period to ensure the results are reliable and consistent.

There is also a need for further research and development to explore the maximum life of a transformer and understand the optimum point that oil regeneration can be applied in the life cycle of the transformer to take full advantage of the technique and maximise the life of the transformer.

This project explores the best time to carry out oil regeneration. This will determine whether carrying out the process earlier, rather than at end-of-life, can reduce the rate of degradation of the oil and further extend the life of a transformer.

To achieve this, we are monitoring twin transformers at 13 sites at various stages of their lives. At each site, the oil is regenerated on only one of the transformers, so we can compare the oil condition and subsequent life extension over time.

The results will inform the optimum intervention strategy which we can then utilise in future asset investment plans.

Tap Changer Monitoring	
Funding: Network Innovation Allowance	*Budget: £1.5 million*
Timescales: December 2016 – February 2022	*Website: www.enwl.co.uk/tapchangermonitoring*

As there is currently no accurate online means to monitor the condition of tap changers, this project will develop and trial an accurate online tap changer condition monitoring system to identify when intervention is required for repair, maintenance or replacement of tap changers.

The project will develop, bring to pre-production and trial a condition monitoring system and explore other monitoring techniques. The system will accurately monitor tap changer performance and in turn determine appropriate intervention/triggers points.

Field trials will be carried out on a representative sample of our transformer population to identify the optimum point at which tap changer monitoring is required in the life cycle of a transformer.

To ensure a representative sample, we have selected a varying number of tap changer types with different manufacturing periods, designs and operating environments to be part of the trial. Tap changers of the same type/model will have monitoring installed at varying ages of their lifecycle to allow for comparison.

We have installed monitors at 40 sites to capture data to develop the algorithm for an anomaly warning system. We will carry out maintenance on any units which has anomalies identified to confirm the output of the algorithm.

The intervention and investigation trigger points identified via the new condition monitoring system will be fed into our future asset management strategies.

Interface	
Funding: Network Innovation Allowance	*Budget: £1 million*
Timescales: October 2018 - October 2021	*Website: www.enwl.co.uk/interface*

Interface will investigate the feasibility of connecting multiple communications devices, required because of the increased use of low carbon technologies, into the same communications interface, using varying protocols and communication mediums while maintaining data security.

Currently network operators have multiple remote terminal unit/communication interfaces installed in distribution substations to allow for the remote operation of switchgear as well as collecting analogue data such as voltage, current and temperature. In some cases, there may be four or five devices in a substation which all communicate independently with our central systems over the mobile network.

As we move towards a Net Zero carbon economy, increasing numbers of EVs and HPs will be connected to the low voltage network leading to a significant increase in demand.

As an alternative to reinforcement to meet the increase in demand, network operators could enter into contractual arrangements to manage these devices on behalf of customers. This means up to ten individual communication devices could be installed in a single substation.

This project will investigate and trial a variety of a communications mediums and protocols with a range of operator and customer equipment to understand the best solution and produce a functional specification for a single communications hub. The project will also develop control methodologies for managing third party devices such as EVs or HPs to assist in reducing network constraints.

The hub will transmit monitoring data and fault data to our NMS as well as operational commands to our own equipment and customers' devices.

Machine Learning and Artificial Intelligence	
Funding: Network Innovation Allowance	*Budget: £825,000*
Timescales: October 2018 - October 2021	*Website: www.enwl.co.uk/machinelearning*

This project will investigate whether modern techniques such as machine learning and artificial intelligence could assist with the interrogation of the large amounts of data generated from the growing number of intelligent devices installed on our network.

In recent years the installation of intelligent devices on the electricity network as part of innovation projects or BAU has resulted in the generation of large volumes of data.

This large dataset holds information relating to network operation and performance, asset health and the development of faults and abnormalities on the network. Analysis of this data is currently a time-consuming manual process so only clearly-defined, small pieces of analysis are carried out.

The data may hold hidden trends which cannot be manually investigated and may offer valuable insight into network operations which could influence our investment decisions as well as our response to events.

Finding an alternative way to interrogate this data could be crucial to the future management of distribution networks.

This project will investigate the application of machine learning and artificial intelligence to data which is already being collected by low voltage monitoring equipment and transformer monitoring equipment deployed on the network. The research will investigate whether machine learning can be used to identify hidden trends and make recommendations for network investment.

Reflect	
Funding: Network Innovation Allowance	*Budget: £192,500*
Timescales: March 2019 – March 2021	*Website: www.enwl.co.uk/reflect*

The Reflect project will produce prototype tools and methodologies that can be used by network operators to improve demand forecasting for EV charging.

The tools will model the uncertainties around EV charging on low voltage networks for slow charging (e.g. home and destination charging) compared to ultra-fast charging (e.g. at service stations).

The required network planning to facilitate EV charging depends not only on the future volumes of private and commercial EVs, but also on the location and capacity of the charging adopted. Although planned developments to electrify bus fleets and taxis provide some certainty on where ultra-fast chargers could be connected in the future, it is still uncertain where other ultra-fast chargers will appear and how much EV charging will take place via slow and fast charging.

Understanding these uncertainties at a regional level is critical for network operators as these uncertainties need to be framed and reflected in the forecasting scenarios that are used for the strategic planning of our networks.

The Reflect project will use EV charging profiles produced from other trials and analysis carried out by projects such as the NIA-funded 'Recharge the Future' (UKPN) and 'CarConnect' (WPD) projects.

The project will develop a complete prototype tool which will provide:

- A better assessment of the impact of EV charging on network capacity
- Enhanced scenario-based forecasting methodologies with probabilistic assessments to improve the modelling of uncertainties
- A framework for network operators to understand how regional characteristics such as traffic flows and access to off-street parking can affect demand forecasts and associated load-related reinforcements.

Intelligent Network Meshing Switch	
Funding: Network Innovation Allowance	*Budget: £1.87 million*
Timescales: April 2019 – April 2021	*Website: www.enwl.co.uk/meshingswitch*

This project will develop an alternative switching device to mesh low voltage (LV) networks, which will overcome the technical issues identified in previous projects, and which can be applied to the entire GB network.

Interconnecting LV networks is one of the ways we can reduce the voltage, thermal and harmonic problems created by the connection of low carbon technologies. Previous projects such as Smart Street proved that dynamic meshing offers considerable benefit and helps mitigate these issues.

During these projects we successfully trialled a number of different, proven, retro-fit devices installed in link boxes to remotely mesh the network when required.

However, these devices are only suitable for deployment on 80% of the low voltage network and some technical issues were identified such as condensation, communications, water ingress and heat dissipation.

As part of this project we are carrying out additional research to resolve these technical issues. The current link box meshing device will be improved so it can be deployed in all locations and environments on our network and across GB. The device will be trialled at a number of sites, selected to be representative of the full range of location types, and tested against all the issues identified.

Once the trials have been successfully completed, the new device will be deployed on our network as part of our Smart Street rollout.

Low Cost Actuator	
Funding: Business as usual	*Budget:* [redacted]
Timescales: March 2021 – March 2024	

This project will roll-out a low-cost solution to allow remote switching at thousands of our distribution substations which will reduce the amount of time our customers are off supply following a network fault.

By retrofitting actuators on our distribution switchgear, supplies to customers can be automatically switched within two minutes, without the need for an engineer to attend site and manually operate the switch.

Following a competitive tender process, Nortech were appointed to supply a new low-cost actuator known as the Reflex unit in March 2021.

Starting in October 2021 3,350 Reflex units will be installed at over 1800 of our substations, serving around 270,000 customers.

The new unit brings a number of benefits:

- Remote switching improves quality of supply for customers
- The Reflex device is a fully integrated compact unit which saves space and removes the need for a separate remote terminal unit
- The new unit is quicker and cheaper to install than other similar devices
- The low cost of the unit means it can be fitted at more sites
- Remote operation reduces travel time helps reduce carbon emissions.

8. Appendix B – Innovation Oversight Panel Terms of Reference

Electricity North West Limited

Innovation Oversight Panel

Terms of Reference (ToR)

1. Role of the Innovation Oversight Panel

The Electricity North West Limited ("ENWL") Innovation Oversight Panel ("IOP") is a committee made up of third-party representatives appointed by ENWL for the purposes as set out in these ToR. The primary purpose of the IOP is to provide independent challenge and steer on ENWL's ongoing innovation activities. ENWL will use the output from the IOP to better inform both the ongoing delivery of its innovation plan and the development of its forward innovation strategy and broader activities.

2. Aims & Objectives

The IOP has the following aims and objectives:

2.1 To act and operate independently of ENWL;

2.2 To provide appropriate challenge and steer on ENWL's innovation activities;

2.3 To feedback on ENWL's project ideas, processes and findings;

2.4 To discuss proposed amendments to ENWL's innovation strategy;

2.5 To ensure relevance of ENWL innovation activities in line with the wider industry;

2.6 To represent the diverse needs and viewpoints of ENWL's innovation stakeholders;

2.7 To assess requests for funding from third parties through the Collaborative Innovation Scheme and to make recommendations on which projects receive funding.

2.8 To keep ENWL up to date with innovation opportunities and developments outside of the ENWL organisation, including potential insights from elsewhere around the world.

2.9 In most instances, the IOP shall meet its objectives through making recommendations as appropriate to those responsible for the management of innovation at ENWL.

3. Functions

The IOP has the following functions:

3.1 To review and discuss, as appropriate, ENWL's innovation activities;

3.2 To review and discuss, as appropriate, innovation ideas and findings;

3.3 To review and discuss, as appropriate, reports and other information submitted by ENWL innovation representatives following project activities and agree and log further actions as appropriate;

3.4 To consider reports, guidance notes and other relevant information provided by Ofgem that may have potential to affect ENWL's innovation activities and strategy;

3.5 To facilitate the regular review as to the appropriateness and adequacy of ENWL's innovation strategy;

3.6 To provide a forum for discussion and, where necessary, suggestions for improvement to, innovation ideas and processes both at ENWL and more generally within industry;

3.7 To share information necessary to allow for full and effective participation in a consultation around current and future innovation activities.

3.8 To select projects to be funded through the Collaborative Innovation Scheme.

4. Authority

4.1 The IOP is authorised to make recommendations to colleagues with responsibility for making decisions in regard to ENWL's innovation activities.

4.2 The IOP shall have no executive powers with regard to its recommendations.

4.3 The IOP is authorised to obtain information required to fulfil its objectives as outlined in these terms of reference, and to facilitate effective discussions with nominated ENWL innovation representatives.

4.4 The IOP is **not** authorised to obtain information if:

- it would be against the interests of national security or against the law;
- it is about someone who has not given their permission for it to be given out;
- it would cause substantial injury to the organisation, or if supplied by someone else, to the business of that person; or
- the information has been obtained for the purpose of any legal proceedings.

4.5 The IOP will **not** review or discuss any issues that are subject to any commercial or legal restrictions.

5. Membership

5.1 The IOP shall comprise representatives from the following areas:

- Academia x1
- ENWL's key technology partners x2
- Customer Group x1
- Zero Carbon Group x1
- ENA x1
- ENWL ELT/CEO (as Chair)
- ENWL Head of Innovation (as Secretary)

5.2 The IOP Chairman will be a member of the Executive Leadership Team (ELT) or CEO. In the absence of the Chairman and/or an appointed deputy, the remaining members present shall elect one of themselves to chair any meeting.

5.3 The Head of Innovation or their nominee shall act as the secretary of the IOP.

5.4 Members of the IOP may ask a colleague to attend meetings in their place, or ask additional colleagues to attend, with the agreement of the Chairman or the appointed deputy.

5.5 External advisers may be invited to attend meetings of the IOP as appropriate.

5.6 Membership of the IOP shall be reviewed annually.

6. Quorum

6.1 The quorum necessary for the transaction of IOP business shall be three members to include at least one representative from the ENWL ELT (or their nominee).

7. Meetings

7.1 The committee shall meet at least two times each year. Meetings may be by exception as dictated by ENWL innovation activities, e.g. if ENWL intends to enter a project submission for funding by Ofgem as part of its Strategic Innovation Fund (SIF).

7.2 Unless otherwise agreed, notice of each meeting confirming the venue, time and date together with the agenda of items to be discussed, shall be forwarded to each member of the committee, and any other person required to attend, no later than 5 working days before the date of the meeting. Supporting papers shall be sent to committee members and to other attendees as appropriate, at the same time.

7.3 Members may place items on the agenda up to 5 working days before the date of the meeting.

7.4 The secretary shall record the names of those present and in attendance and the agreed actions of all meetings of the committee.

7.5 The agreed actions of committee meetings shall be circulated promptly to all members of the committee. As appropriate, reports of the IOP's feedback and recommendations will be published on the ENWL website.