SSEN DISTRIBUTION RIIO-ED2

INNOVATION

RIIO- ED2 Business Plan Annex 14.1

Scottish & Southern Electricity Networks

Contents

EXECUTIVE SUMMARY

Our Innovation Strategy is fundamental to the successful delivery of our RIIO-ED2 outcomes. We believe in innovation; it is part of our DNA and underpins our desire to deliver efficiently and at lowest cost. The need for innovation has never been greater, our strategy sets out how innovation has a crucial role to play in facilitating net zero, delivering benefits for customers and ensuring a Just Transition.

In our submission, we have set out four Strategic Outcomes for RIIO-ED2, innovation has a fundamental role in the delivery of these by:

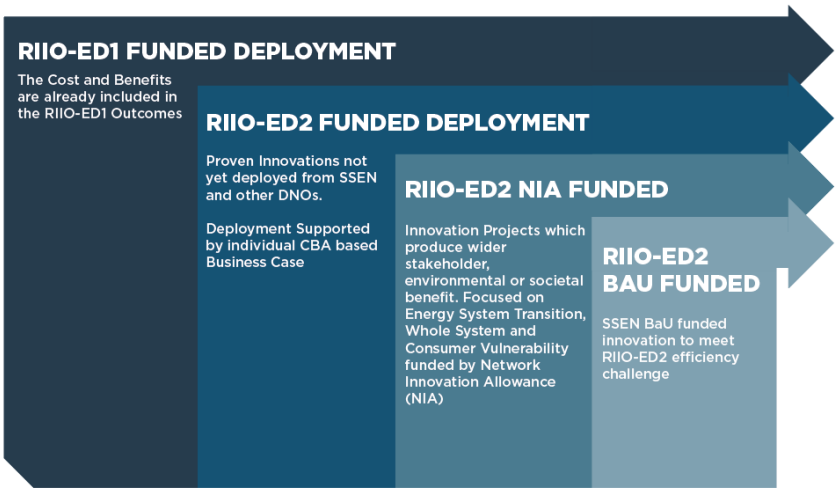
- Exploring new ways to engage with and support the aspirations and needs of our customers, including customers in vulnerable situations, underrepresented communities, and the wider stakeholder population to provide - **A trusted and valued service for our customers and communities.**
- Developing and testing new technologies to improve our asset management, increase our operational efficiency and enhance the reliability of our network to deliver - **A safe and resilient network for our customers and communities.**
- Enabling the integration of Low Carbon Technologies (LCTs) and Flexibility onto the network to facilitate the energy system transition. We are innovating to increase the viability of whole system solutions and leveraging value from the sharing of data as we seek to **Accelerate progress to net zero.**
- Developing new options for protecting customers in vulnerable situations or who are living in fuel poverty as we move toward net zero by reducing our carbon emissions and delivering improvements in our environmental and safety performance to **- To make a positive impact on society.**

Our Innovation Strategy will support the delivery of these Strategic Outcomes by:

- Building upon our successful Innovation performance in RIIO-ED1;
- Deploying proven innovation across all key areas of our Business Plan to bring benefits for our customers and stakeholders; and
- Creating and delivering of a portfolio of new innovation projects co-created with our stakeholders.

In RIIO - ED2, we will enhance our already strong innovation culture. We will focus on maintaining a healthy and open environment for co-creative innovation alongside a strong drive for deployment.

Combined, this will bring benefits for customers, through the realisation of new efficiencies, enhanced reliability, the acceleration of net zero and a fair and just transition, enabling the delivery of our four Strategic outcomes.



Delivering Benefits in RIIO-ED2 from Innovation

BUILDING ON RIIO-ED1 SUCCESSFUL OUTCOMES

During RIIO-ED1, we have delivered a diverse and successful programme of industry leading innovation activities, this has included ground-breaking projects like Local Energy Oxfordshire (LEO)[1] which is one of the most ambitious, wide-ranging, innovative, and holistic smart grid trials ever conducted in the UK.

Innovation has been at the forefront of our performance in RIIO-ED1. We have rolled out successful innovations such as LV Automation and Constraint Managed Zones (CMZs) across our network. So far, these deployments have delivered over £80m of benefits in RIIO-ED1, and we anticipate that this will increase to over £89m by the end of RIIO-ED1.

We are forecasting £19m of benefits to customers in RIIO-ED2 from our RIIO-ED1 innovation investments, predominantly through reliability improvements (LV automation and live line tree felling) and reduced inspection costs through LiDAR deployment. These innovation deployments are described in more detail in Section 5.1 and Appendix B, It should be noted that the costs and benefits of these deployments have already been included in the unit rates we have used to build our Business Plan.

Importantly, many of these deployments have facilitated additional benefits for the communities involved. For example, our Orkney Active Network Management (ANM) project has enabled over 22MW of new renewable to be connected, the majority of which is locally owned, which has brought substantial economic benefits for the community.

Alongside this, we have demonstrated our ability to innovate effectively with over £16.0m of Network Innovation Allowance (NIA) funding being invested in innovation to date. Our NIA programme includes over 55 projects, covering a broad range of topics including safety, net zero, sustainability and connections. The programme has been delivered in conjunction with our stakeholders, we have worked with over 130 individual organisations across over 80 individual collaborations.

We are also delivering two of the most innovative Network Innovation Competition (NIC) projects in TRANSITION and Resilience as a Service (RaaS). We have shared the knowledge and learning with other

[1] https://project-leo.co.uk/about/the-leo-project/

Distribution Network Operators (DNOs) and the wider industry to allow them to learn from our experience. Further details on our RIIO-ED1 Performance are included in Section 2.

INNOVATION DEPLOYMENT IN RIIO-ED2 – BRING BENEFITS TO CUSTOMERS

During RIIO-ED2 we will continue to embed more innovative solutions into our Business as Usual (BaU) operations. In preparing our RIIO -ED2 Business Plan, we have undertaken a systematic review of our existing innovation portfolio and those of all other network licensees to identify opportunities for deployment which will bring benefits for our customers. We are proposing to invest over £120m on the deployment of proven innovations, which will leverage long term benefits for customers, consumers, and the environment of over £177m and avoiding over 125,000 tonnes of CO2.

Our proposed deployment covers the full breath of our plan and will see the use of new monitoring equipment to facilitate the mass uptake of LCTs, new sensor equipment on our subsea cables to improve the security of supply for our island customers and innovative transformer stop/start technology to reduce losses. We also propose to deploy new voltage management technology, developed in ENWLs Smart Street project, which will produce environmental benefits and significant energy bill reductions for the consumers involved.

INNOVATION DEPLOYMENT COSTS (£K)		
RESILIENCE	Enhanced Lightning Protection	[redacted]
ASSET MANAGEMENT	On Load Tap Change Transformers	[redacted]
SUSTAINABILITY	Additional Hybrid Generators	[redacted]
SUSTAINABILITY	Transformers Auto Stop Start	[redacted]
RESILIENCE	Sub Sense	[redacted]
NET ZERO	LV Monitoring	[redacted]
NET ZERO	DSO Readiness / Flexibility –	[redacted]
	Total Cost	**£120,585**

BENEFITS (£K)	
Deferred Capex	**£36,400**
Efficiency Improvements / Connections	**£1,019**
Reliability Improvements	**£1,043**
Customer Bill reduction	**£119,020**
Losses Reduction	**£5,608**
Carbon Benefits	**£14,222**
Total Benefit	**£177,312**

Full information on these projects can be found in the relevant Chapters and annexes of our Business Plan, along with the accompanying Investment Decision Packs (EJPs & associated Cost Benefit Analyses), the cost for the deployments have been incorporated within the BPDTs for each relevant deployment. These are summarised in Section 5.2.

OUR RIIO-ED2 INNOVATION PROGRAMME

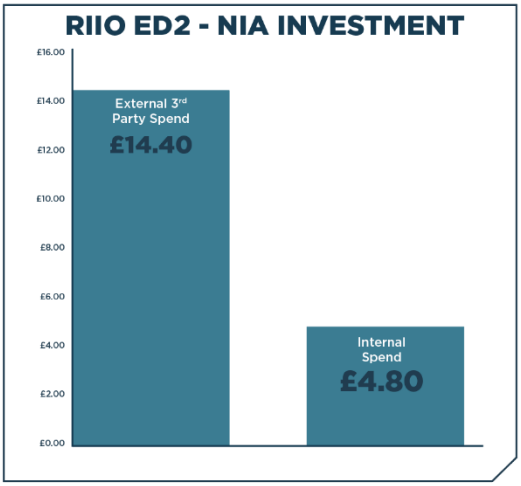
The need for innovation has never been greater to allow us to prepare for future challenges and at the same time deliver benefits for customers and stakeholders. We have increased the ambition of our RIIO-ED2 innovation programme and will use a combination of funding approaches to develop a portfolio of new innovation projects to meet the needs of our customers, stakeholders and the business.

RIIO-ED2 NETWORK INNOVATION ALLOWANCE

In RIIO-ED2, we are seeking a NIA allowance of £17.5m over the five-year period, plus our own 10% contribution to create a total fund of £19.25m. This will allow us to maintain the momentum and pace of our RIIO-ED1 progress and at least £14.5m of this will be allocated to third parties.

Our NIA projects will continue to be highly collaborative, and will be co-created with our stakeholders and will focus on the following areas:

- **Delivering Net Zero and the Energy System Transition** – including electrification of transport, low carbon heat, distributed generation, energy storage and energy efficiency
- **Consumer Vulnerability –** we will create solutions for consumers in vulnerable situations and support for communities and vulnerable consumers to ensure a just transition to net zero
- **Whole System -** With the increasing interaction between sectors beyond electricity such as gas and transport as we move to net zero, there will be a need for further Whole System Innovation



Further details on our NIA proposals can be found in Section 5.3 and Section 7.

RIIO-ED2 BUSINESS AS USUAL FUNDED INNOVATION

To meet our strategic outcomes, we will continue to invest in innovation to drive efficiency across the business. In RIIO-ED2, we will deliver £10m of BaU funded innovation activities, which is not part of our Totex ask, and from which we expect to deliver at least £10m of efficiency benefits . This innovation investment will support our delivery of ongoing efficiencies throughout RIIO-ED2 (our stretch target of 0.7% per annum, as set out in our **Costs and Efficiency Chapter 15**), as well as supporting the step change in performance required to deliver the increase in volumes for RIIO-ED2 at the lowest possible cost and to develop the new capabilities required to deliver our Business Plan. It is likely that the work will focus on areas such as:

- Driving efficiency improvements in our operations to reduce costs.
- Improving network resilience and supply restoration performance to avoid disruption for our customers.
- Developing a better understanding our assets and their condition to improve network reliability and to inform our investment decisions.

For this area of our innovation programme, we have not sought specific allowances within our RIIO - ED2 plan. Instead, it will be funded at our risk with the prospect of a return through existing regulatory incentive mechanisms should the programme prove effective. Similarly, we have not sought any specific allowances for subsequent deployment of these innovations, each will be driven by a specific business case with the “traditional” option being used as a counterfactual.

OUR INNOVATION THEMES AND PRINCIPLES

Our Innovation Strategy covers a broad range of themes, which have been supported by our stakeholders and are summarised below, full details are included in Section 6.

Irrespective of how innovation projects are funded we will follow the same set of Innovation Principles to ensure its successful development and delivery. These principles have been shaped by our experience in RIIO-ED1 and the feedback we have received from stakeholders.

- **Collaborative and Open** – collaborating and cocreating with stakeholder, our peers and the supply chain. Central to this will be our relationship with the Energy Innovation Centre and other similar organisations.
- **Agile** – adapting fast through learning by doing.
- **Relevant** – connected to what our stakeholder and business need.
- **Data Driven** – securely using data and analytics to support our findings.
- **Innovation Culture** – further developing our culture to ensure that we achieve optimum value from our innovation work.

DELIVERING OUR RIIO ED2 INNOVATION PROGRAMME

We have set out our proactive approach to the successful delivery of our programme in Section 8, this describes our project development and delivery process. This includes the crucial role partners such as the Energy Innovation Centre (EIC) and the Power Networks Demonstration Centre (PNDC) have in the successful delivery of our programme.

Transparently demonstrating the value from our innovation activities is vital to ensure that stakeholders are clear on the benefits that are being delivered. Throughout RIIO-ED1 we have been actively tracking and reporting on both quantitative and qualitative benefits, we have included proposals on how we will develop this further in RIIO-ED2.

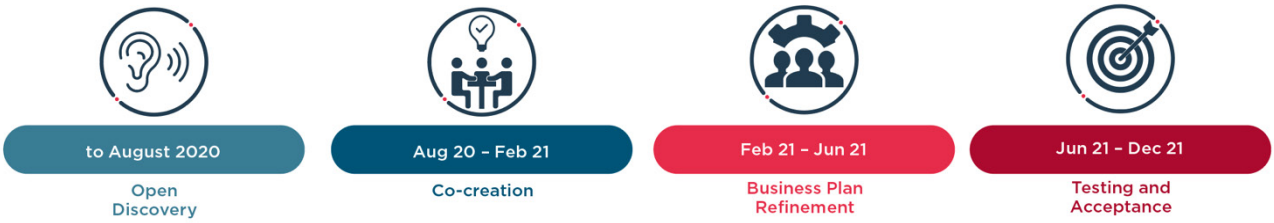
CHANGES SINCE DRAFT SUBMISSION

Following publication of our Draft Strategy, we received clear feedback from our stakeholders on how our Innovation programme can be used to support our Sustainability ambitions and to improve Business Carbon Footprint. Sustainability has always been part of our innovation portfolio, in particular, the need to innovate to help identify alternate options for the operation of our Embedded Diesel Generation fleet in the Scottish islands. Therefore, we have identified an additional Theme within our Innovation Strategy on Island Decarbonisation – see Section 6 for further details.

In response to stakeholder feedback, we have also provided further details in our proposed innovation deployments and the benefits that they will bring, along with enhanced transparency on how our innovation programme will be funded.

Similarly, stakeholders also wanted to have a more transparent understanding of the benefits which arise for our innovation activities; therefore, we have committed to publish an Annual Innovation Benefits Report – see Section 8 for further details.

1. ENHANCED ENGAGEMENT



Our Innovation strategy has been informed by our Enhanced Engagement programme, full details of which are set out in Annex A 3.1. Our draft plan was underpinned by three phases of stakeholder and customer engagement (illustrated in the diagram above). The details of this engagement and insights are set out in Appendix A to this Annex and provide a clear line of sight between what stakeholders told us and our Innovation strategy and outputs.

1.1 FINAL INNOVATION STRATEGY TESTING AND ACCEPTANCE

We have refined our final Innovation strategy and outputs based on Phase 4 of our Enhanced Engagement, which involved direct testing of the strategy, outputs and costs with 130 stakeholders through four events. The table below sets out the clear line of sight of the changes between our draft and final Innovation strategy and outputs based on this engagement.

1.2 ENHANCED ENGAGEMENT TRIANGULATION AND CHANGES BETWEEN DRAFT AND FINAL PLAN

The table below summarises the clear line of sight between stakeholder and consumer insights and our Innovation strategy and outputs. For our **draft Innovation strategy** and outputs, based on phases 1 to 3 of our enhanced engagement program, we demonstrated how engagement insights had informed our outputs using these keys:

Findings converge to support proposals.

Findings generate new insights that lead to further refinement of proposal.

The proposed approach diverges from the findings.

To demonstrate the line of sight between the scope of **change between draft and final**, based on testing our draft proposals with stakeholders and consumers, we use theses keys:

Strategy/Output	Phases 1-3 Enhanced Engagement	Phase 4 Outputs and Cost Testing	Acceptability
REFINED **Innovation strategy and project plan**	**Stakeholders said** Innovation activity should focus on helping to deliver net zero. **Our response** We have constructed our NIA funding proposal in response to this feedback. Our proposed portfolio is larger and more focused on net zero as a result.	**Stakeholders said** Developing innovation projects that empower people and communities was a priority. Innovation was deemed to play a key role in the progress to net zero and future-proofing the network. Collaboration is essential for success. **Our response** Collaboration is heavily integrated in our plan; we are a member of the EIC, which has a membership of over 8,000 innovators. We also collaborate with other industry partners via the ENA and PNDC. We have supply chain partners and an innovation partnership	Not tested

Strategy/Output	Phases 1-3 Enhanced Engagement	Phase 4 Outputs and Cost Testing	Acceptability
		with UKPN. We have a strategic EV and heat partnership with SPEN and the Scottish Government.	
NEW **Output:** Publish an annual Innovation Deployment Customer Report to improve the transparency of the benefits of our innovation programme	**Stakeholders said** Consumers engaged by Citizens Advice Scotland place less value on innovation investment. **Our response** We recognise that all stakeholders should have a voice and we will consult further with customers on the value of innovation funding and the associated customer benefits.	**Stakeholders said** Stakeholders called for better communication and understanding of the benefit accrued from the deployment of innovation. Collaboration with a range of stakeholders was listed as a key facilitator for good innovation, especially learning from others. **Our response** We will increase the transparency of our innovation programme by publishing an annual report divided for each workstream (net zero, vulnerability, environmental etc). We will include our future focus areas to co-create and test these with stakeholders.	73%

Strategy/Output	Phases 1-3 Enhanced Engagement	Phase 4 Outputs and Cost Testing	Acceptability
ENHANCED Integration of innovation into projects designed to decarbonise Scottish Islands to facilitate net zero objectives	-	**Stakeholders said** We should use innovation on Scottish islands to cut costs and improve maintenance efficiency – stakeholders noted the huge potential for improvement both through learning lessons from elsewhere and applying innovation. **Our response** This innovation strategy has been enhanced by including specific Scottish Islands decarbonisation initiatives as part of the plan to reduce the environmental impact of diesel back-up generation.	Not tested

2. OVERVIEW

2.1 OUR STRATEGIC OUTCOMES

Our four Strategic Outcomes are:

- To Accelerate progress to net zero.
- To provide a Safe, Resilient & Responsive Network.
- To deliver a Trusted and Valued Service for Customers and Communities.
- To deliver Measurable, Social, Environmental and Safety Benefits.

Our Innovation Strategy is closely aligned with these strategic outcomes, it will help ensure their delivery by identifying and resolving new challenges, identifying opportunities to add additional value and then providing deployable innovation solutions.

In RIIO-ED2, we will use a combination of funding to deploy of innovative solutions and create a new programme of innovation projects, to deliver value to customers from.

Realising Enduring Benefits from RIIO- ED1 Innovation Deployments - Innovation has been at the forefront of our performance in RIIO-ED1. We have rolled out successful innovations such as LV Automation and CMZs across our network. We have also shared the knowledge and learning with other DNOs. These innovations are described in Section 5.1 and Appendix B, they will continue to deliver benefits in RIIO-ED2. The forecast innovation benefits between now and the end of RIIO-ED1 have been incorporated into our unit rates for the start of RIIO-ED2.

RIIO - ED2 Funded Innovation Roll Out - During RIIO-ED2 we will continue to embed innovation solutions into our BaU operations, as well as bringing forward new deployments from both our own and other DNOs' portfolios. We are proposing to invest over £120m on the deployment of proven innovations throughout RIIO-ED2. This investment will deliver in excess of £177m of benefits for consumers in the long term, along with a carbon saving of over 125,000 tonnes. A full justification for each project can be found in the relevant Chapters and annexes.

RIIO- ED2 Network Innovation Allowance – We are seeking £17.5m of NIA funding, matched with an additional 10% contribution from ourselves (to give a total NIA fund of £19.25m), to deliver a high-quality portfolio of projects which facilitate the energy system transition and deliver value for vulnerable customers. The portfolio will be co-created with stakeholders and at least £14.0m of this will be spent with third parties. We will use this funding for projects where the benefits are more likely to accrue to wider stakeholders, deliver environmental improvements or produce broader societal benefits.

RIIO - ED2 BaU Efficiency Funded Innovation – To meet our strategic outcomes and efficiency targets we need to continue to invest in innovation across the business. In RIIO-ED2 we will deliver a BaU funded programme of up to £10m, to focus on increasing network resilience, enhancing network reliability, improving our asset management processes and reducing the overall cost of our operations. This s not part of our overall Totex funding request and we expect that this will deliver at least £10m of efficiency benefits by the end of RIIO-ED2.

2.2 EMBEDDING INNOVATION WITHIN OUR PLAN

Innovation has played a key role in shaping many aspects of our RIIO-ED2 plans beyond the deployment of new innovative solutions. The knowledge and learning we have developed from our RIIO-ED1 innovation programme have been used to inform the creation of our plan, including;

- **Delivering Net Zero and the Energy System Transition** – our work on the electrification of transport, low carbon heat, distributed generation, energy storage and energy efficiency has helped shape our ***Connections Strategy (Annex 10.2)*** and in particular the range of flexible connections we now offer. Our innovation programme in RIIO- ED1 has also been fundamental in developing our use of flexibility as an alternative to traditional solutions and has informed both our ***Load related Plan build & strategy (Annex 10.1)*** and the investments we require to help us transform to a Distribution System Operator in our ***DSO Strategy (Annex 11.1)***. These are areas which will need increased innovation investment, to meet new challenges that emerge as we head toward net zero, which identified as a key Innovation theme by stakeholders.

- **Consumer Vulnerability –** we will create solutions to reduce any detrimental impacts on vulnerable customers from our day-to-day works, look to increase resilience for consumers in vulnerable situations and support for communities and vulnerable consumers to ensure a just transition. The outputs from our RIIO-ED1 Innovation portfolio including projects such as Equal EV, which have helped inform our ***Consumer Vulnerability Strategy (Annex 4.2)***.

- **Whole System -** with the increasing interdependencies between sectors such as electricity, gas and transport we need to develop a new "Whole System" approach. Through collaboration this approach provides an opportunity to meet the needs of our consumers and stakeholders by delivering innovative projects that result in "an overall enhancement in quantifiable consumer benefits and/or societal outcomes". Examples of Whole System activities include working with local authorities to support the creation of local energy strategies and plans, building a shared transmission/distribution connection for the Shetland Islands and working with other utilities to take a consumer-centric approach to supporting vulnerable customers. As part of our innovation strategy, we will identify Whole System options that can support the priority areas. More information on our Whole System strategy is set out in our ***Whole Systems (Chapter 12).***

- **Enhanced Customer Service** - Consumer Vulnerability will play a significant part in our innovation activities in RIIO-ED2, informing our approach to how we will play a part in delivering a Just Transition. For further information see our Customer Service and ***Consumer Vulnerability Strategy (Annex 4.2)***. The new data gathered from LV monitoring will be fundamental to allowing us to service customers connection requests as they transition to electric vehicles and heat pumps, our earlier innovation works has shaped the proposals in our ***Connections Strategy (Annex 10.2).***

- **Improved Asset Management** – developing new techniques to gather asset data, creating new interventions to better understand our assets as well as new options for refurbishment and replacement.
  Innovative solutions such as the use of Light Detecting Aerial Radar (LiDAR), have fundamentally

changed our approach to managing assets, we will look to unlock further opportunities during RIIO-ED2 to support delivery of our plans to ***Maintain a Resilient Network (Chapter 07).***

- **Data and Digitisation** – making more of our data available and accessible. Our ***Digital Investment Plan***[2] **(Annex 5.1)** sets out how SSEN plan to become a fully digitalised business. Our RIIO- ED1 Innovation activities have been critical in shaping the Digital Strategy, with learning from projects such as NERDA and LEO. We will ensure that our RIIO-ED2 innovation plans address future needs and enable the scaling up of our core digital capabilities.

- **Environmental Sustainability** – Reducing the environmental impact of operations and delivery our sustainability objectives is critical. Our RIIO-ED1 innovation portfolio, delivered considerable environmental benefits including reduced use of fossil fuels and new measures to reduce network losses. These have helped shape our ***Sustainability Strategy (Annex 13.2)*** and *associated* ***Environmental Action Plan (Annex 13.1).*** We will build on this in RIIO-ED2 and innovate to reduce the impact of our operations and help deliver our sustainability objectives**.**

2.3 RIIO- ED1 INNOVATION DELIVERY AND BENEFITS

We have delivered a successful innovation programme in RIIO-ED1, key highlights include:

- *Cocreation and Engagement*, with over 130 individual collaborations across over 80 innovation projects, including
    - 19 Small and Medium Enterprises and innovators
    - 40 collaborative engagements with other DNOs
    - 31 working relationships with government bodies, not for profit organisations and academia
    - 6 collaborations with fuel poverty and carbon action groups
    - 35 partnerships with technology providers, OEMs, transport companies and energy suppliers
- *External Funding* - Over £4.5m of external funding competitively secured to leverage our existing innovation funds. This has allowed is to broaden the scope of our innovation projects and deliver additional benefits.
- *Efficiency benefits* of £23.8m realised to date and an expected £32.0m by the end of RIIO-ED1, which have been embedded into our unit rates for the start of RIIO-ED2.
- *Deferred capex* benefits of £56.9m delivered by the end of RIIO-ED1.
- *Avoided Customer Interruptions (CI)and Customer Minutes Lost (CML)* of 390,000 CI and 56,700,000 CML to date in RIIO-ED1 as a result of the innovations we have deployed.

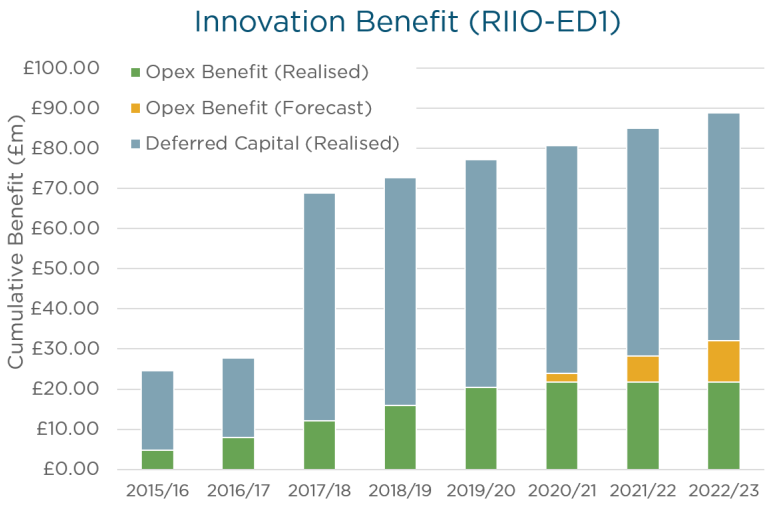
All of these deployed projects will deliver benefits well into and in many cases beyond the end of RIIO-ED2.

[2] https://www.ssen.co.uk/DigitalStrategy/

We have estimated additional saving from our existing deployments of £19.8m by the end of RIIO-ED2. The cost and benefits from these deployments have already been incorporated in the relevant sections of the business plan.

Benefit delivered from DPCR5 and RIIO-ED1 completed innovation projects	Value projected to end of RIIO-ED1 (8 years)	Value projected to end of RIIO-ED2 (5 years)
Efficiency Benefit	£32.0m	£19.8m
Deferred Capex	£56.9m	£0

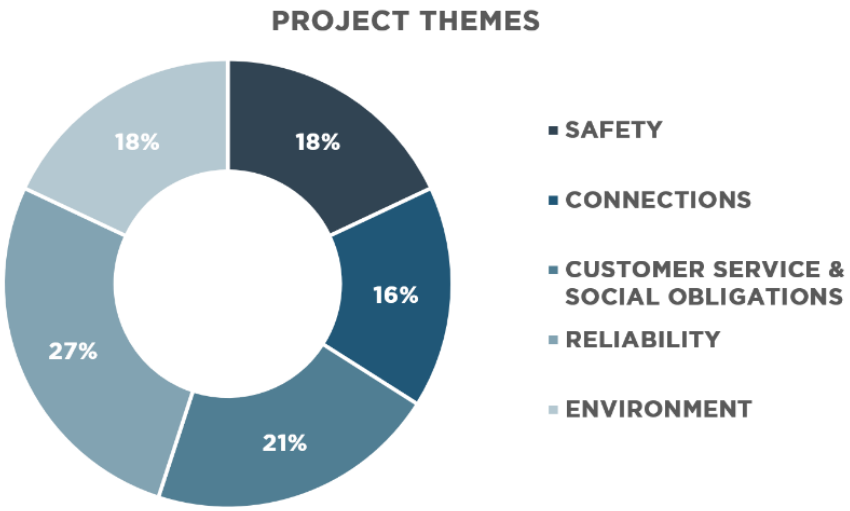
The chart below provides an overview, of our RIIO-ED1 performance.



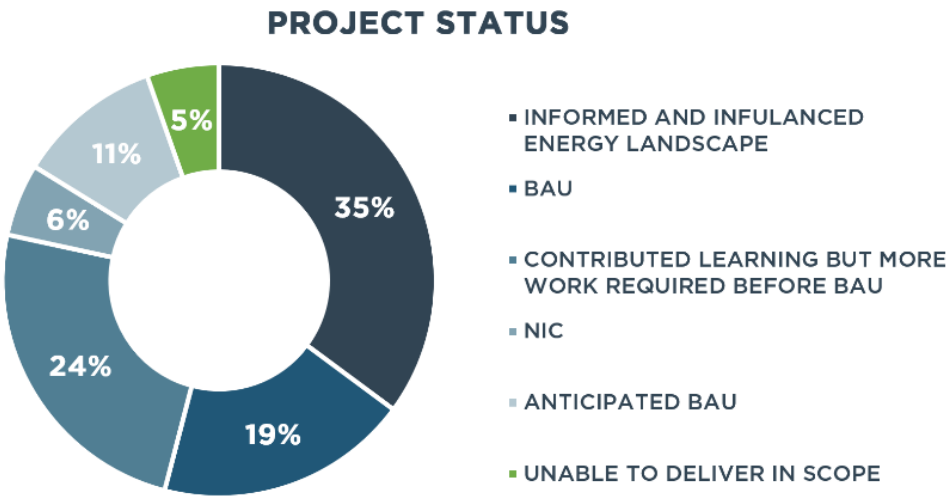
Full details of the Innovative solutions we have deployed in RIIO-ED1 are included in Appendix B.

2.4 OUR RIIO-ED1 NIA PORTFOLIO

The NIA has been a crucial funding stream in RIIO-ED1, allowing us to take projects from initial concept right through to business-as-usual. Our RIIO-ED1 NIA portfolio (to the end of 2020/21) spans 55 innovation projects, 32 of which have been completed and vast majority of which have involved collaboration with other networks, stakeholders or the supply chain. During RIIO-ED1 to date, we have invested over £16m in an NIA portfolio. The themes covered by our NIA portfolio are as shown below.



The outcomes from many of these projects have already been deployed within the business and are delivering benefits. There are a number which are anticipated to enter BaU in the near future, whilst others have developed new learning to inform our thinking on emerging issues such as net zero . These are summarised below.



Further details on our NIA portfolio can be found here - **https://www.ssen.co.uk/Innovation/**

2.5 OUR RIIO - ED1 NIC PROJECTS

Additionally, we have actively participated in the annual NIC and have successfully led some of the most technically challenging and ambitious projects. The NIC provides an opportunity to engage with a wider range of partners to deliver ambitious high value projects. Our two current NIC projects are:

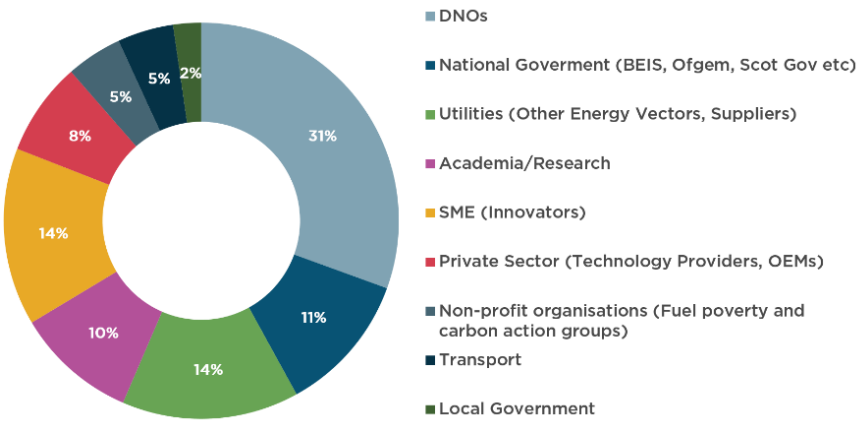
> ***TRANSITION - TRANSITION will design, develop, demonstrate and assess the common tools, data and system architecture required to implement the transition to a DSO. The project was awarded £12.8m in 2018 and is being delivered in conjunction with CGI, Atkins and Origami Energy. https://ssen-transition.com/dso/tef/***

Resilience as a Service - The Resilience as a Service (RaaS) project, SSEN with partners Costain and E.ON, seeks to develop an innovative solution to improve energy security in rural and remote areas. The £9.5m project aims to combine battery storage with local energy resources to provide low carbon, cost effective network resilience in response to faults. https://project-raas.co.uk/

Going forward, we plan to participate in the remaining NIC competitions in RIIO-ED1 and will look to fully engage with the Strategic Innovation Fund (SIF) in RIIO-ED2.

2.6 OUR RIIO-ED1 ENGAGEMENT

Our RIIO-ED1 innovation programme has been highly collaborative, not only with the stakeholders who participate in our innovation projects but also with the innovation community in its broadest sense. During RIIO-ED1 we worked with over 130 individual organisations across over 80 individual collaborations in our 55 projects.



2.7 INNOVATION FUNDING PERFORMANCE IN RIIO-ED1

To date, the maximum available funding for NIA was approximately £26.4m, of which we have forecast to spent around £16.1m to the end on the 2020/21 financial year. This is a conscious application of our innovation proposal assessment process in conjunction with our capacity to deliver quality outputs.

Providing value for customers is absolutely fundamental to our use of NIA funding, and as such we believe that is it is essential that funding is used effectively rather than maximising the available spend. Delivering value for customers from our NIA allowance will remain central to our RIIO-ED2 Innovation proposals.

However, it must be emphasised that we have a strong tradition of funding innovation from within the business, to date in RIIO-ED1 we have invested over £150m in:

- **IT Programme** - our IT upgrade programme has deployed our new asset management systems, GIS systems and enabled more mobile working for our field staff.
- **Active Solutions Deployment** – deploying the systems to let us operate our growing portfolio of ANM and CMZ schemes. This includes the introduction of a Dynamic Procurement System which has we have contracted approximately 470MW of flexibility services for the management of network constraints and fault support.

- **Innovation Deployments** – we have invested in the BaU deployment of CMZs to reduce and manage network constraints, Low Voltage Automation to reduce the impact of supply interruptions on our customers, and hybrid generators which are a more sustainable alternative to conventional diesel sets.

The key point of any innovation project is to realise benefits for customers, as stated previously we have reported over £80m in benefits for customers so far in RIIO-ED1.

The transition to net zero will require innovation across the entire energy supply chain, throughout RIIO-ED1, supported by our Corporate Partnership Funding Team, we have identified opportunities to link up and participate in wider energy industry innovation projects. This has not only allowed us to leverage additional value from our NIA and NIC funding, but also allowed us to engage with a much wider range of partners to explore issues beyond the traditional boundaries of the distribution network. This has resulted in the delivery of more rounded learning and enhanced value for consumers. During RIIO-ED1 we successfully secured over £4.5m from a range of funding sources including Innovate UK and BEIS for projects such as **LEO**[3] and **MERLIN** (Modelling the Economic Reactions Linking Individual Networks)[4].

2.8 DEVELOPING NEW KNOWLEDGE AND ACCELERATING OUR LEARNING

Our innovation portfolio has been essential to developing our knowledge of the future challenges, risks and opportunities that face the industry as we move to net zero. This has allowed SSEN to prepare for a wide range of potential future scenarios. Our approach of cocreation and collaboration has allowed us to better understand future problems and develop our thinking as the energy system becomes more complex. As an example, the diagram below, demonstrates how our innovation work has helped shape our DSO Strategy[5].

[3] https://project-leo.co.uk/
[4] https://project-merlin.co.uk/
[5] https://www.ssen.co.uk/SmarterElectricity/

Our innovation programme has also supported the development of our strategies for electric vehicles https://www.ssen.co.uk/WorkArea/DownloadAsset.aspx?id=19141 and heat (https://www.ssen.co.uk/WorkArea/DownloadAsset.aspx?id=20483) . It is vital that we continue to work with stakeholders to develop the knowledge of an ever-changing energy landscape that we will need to prepare for RIIO-ED3 and beyond.

Developing and sharing new learning will continue to be a crucial part of our innovation activities throughout RIIO-ED2.

2.9 LESSONS LEARNED FROM RIIO-ED1

As part of the formulation of our RIIO-ED2 strategy, we have critically reviewed our RIIO-ED1 experience, identifying areas of strength, and recognising elements that would benefit from improvement. These key lessons have helped us to develop a set of Innovation Principles to guide how we will deliver our portfolio in RIIO-ED2 and helped us to identify the key Innovation themes that will shape our portfolio.

The key lessons are centred around:

2.9.1 COLLABORATION AND CO-CREATION

Collaboration and co-creation have been one of the most effective elements of our RIIO - ED1 approach. We deliberately set out to promote collaboration and cocreation to ensure that we “walked the talk” in the delivery of our projects. One of the key lessons, was that the appetite for collaborative working is significant and growing both amongst licensees and across the wider stakeholder community.

In RIIO-ED1 we focussed on problems we needed to solve and on ensuring that we collaborated with the relevant stakeholders to deliver these projects. RIIO-ED1 has taught us that there is a reciprocal demand for collaboration from communities and local authorities across our network and to learn by doing and progress their own innovation projects. We recognise that there are times where we have struggled to service this demand from a resource and funding perspective.

This is partly because we cannot justify duplicating trial projects, looking at similar problems in different geographic areas across our license areas, whilst complying with the NIA and NIC Governance obligations. As a result, we are faced with the difficult situation of choosing which community or initiative to support. This situation has been exacerbated by increasing drive for decarbonisation as authorities across our network declare climate emergencies and as enabling funding becomes directly available to communities. Additionally, UK, European and regional governments have made significant research funds (over £1bn) available for low carbon projects in the next few years to support the Green Recovery, this will further increase the number of opportunities for third parties to create innovative projects.

Collaboration and cocreation are a key part of our proposed Whole System approach for RIIO-ED2, reflecting the lessons we have learnt. In the future, we will need to continuously engage with local communities and authorities, alongside organisations in the energy, transport, telecoms, water sectors. For RIIO-ED2 we have set out a plan for strengthening how we collaborate and partner with stakeholders to cocreate, test and deploy innovative solutions in our own right but also to cocreate and jointly deliver innovation projects with other organisations through a Whole System approach. One element of this plan acknowledges the issue of managing demand for collaboration from stakeholders. We have proposed an "Embedded Whole System Support Services for Local Authorities" Consumer Value Proposition (CVP) which is described in our ***Whole Systems Strategy (Annex 12.1)*** to allow us to meet the volume of demand for deep collaborative support across our network.

Collaboration goes beyond participation within individual projects, we have supported ongoing industry collaborative initiatives such as the *Energy Innovation Centre (EIC)* [6]and the *Power Networks Demonstration Centre (PNDC).*[7] These initiatives are focused on removing friction from the process of innovation and accelerating testing and validation of the operation and benefits of individual innovative solutions. This produces benefits for the innovator, the DNO and ultimately the Consumer. Previous analysis has shown that this can reduce overall cost of innovation over 40% - for further details see Appendix C. This has been a highly effective approach from our stakeholders' perspective as evidenced at our stakeholder engagement events [EO56] and [E088], and we intend to build on this approach in RIIO-ED2 introducing a greater emphasis on whole system solutions

We have engaged directly with colleagues at all levels within our business to better understand their needs and involve them directly in development of innovative solutions. This joined up approach results in more effective deployment and an earlier realisation of benefits. This approach has seen the development of projects like Smart Hammer, and we will continue to ensure that end users are actively involved in the scoping, design and delivery of our innovation projects going forward to ensure the outputs remain relevant and delivers benefits.

[6] https://www.ukeic.com/
[7] https://pndc.co.uk/

In addition, in 2019 we joined the Scottish Government, Transport Scotland and SP Energy Networks (SPEN) in a £7.5m strategic partnership to coordinate EV Infrastructure development in Scotland[8]. The funding has and will continue to see SSEN and SPEN trial projects to widen access to electric vehicle charging networks and provide the electricity infrastructure needed to support it.

We have sought to collaborate with stakeholders in projects that help this alignment projects such as LEO, Transition, Trader and E-Tourism. The LEO project stands out as one where we have deliberately brought together two different funding streams (PFER programme and NIC funding). An approach which has helped to encourage convergence in key approach as the UK tries to find the pathway to net zero .

We will build on this approach in RIIO-ED2, where collaboration and cocreation will be one of our key Innovation Principles.

2.9.2 AGILITY

In RIIO-ED1, our innovation deployments brought benefits to our stakeholders and customers. Of particular note, Flexible Connections alone have saved customers in up to 90 years of connection waiting time. Other innovations such as) have brought efficiencies and data quality improvements to our business, LIDAR is a good example of "fast following" where we recognised the value demonstrated in the innovation projects of other networks operators around the world and committed to rapid deployment.

Our proposed innovative programme in RIIO-ED2 will build upon the good practices we have evolved during RIIO-ED1 by:

- At the early stages of the innovation project confirming that a successful technical delivery will result in a solution which has a clear route to deployment that will be commercially viable for SSEN, our customers and the supplier of the solutions.
- Accelerating the progress of trial projects which are producing positive outcomes, and quickly ceasing projects which are not progressing as initially expected as we "learn by doing". Thereby, avoiding the innovation portfolio becoming congested with potentially unproductive innovations. This will allow us to focus on progressing successful projects to BAU to bring benefits for our customers.
- Continuously scanning the innovation landscape and fast following the successful innovations from other DNOs and relevant sectors.

Clearly the benefits of this approach will be applied to all our innovation activities across RIIO-ED2 and will be embodied as one of our Innovation Principles.

[8] https://www.sse.com/news-and-views/2019/08/charging-ahead-with-evs/

2.9.3 RELEVANT

During RIIO-ED1 we have been able to demonstrate the relevance of our innovation activity through the alignment with the challenges presented by RIIO-ED2. Emerging themes that were considered marginal in their relevance in some quarters were included in our portfolio and are now proving valuable. A good example of this was our Aberdeen Hydrogen Project which emerged prior to new Whole System licence requirements, and where we worked with stakeholders to trial a number of technical issues relating to hydrogen buses and to consider the impact of decarbonising transport on our network.

Looking back at our programme, a key reason for being able to keep our portfolio relevant has been input from the full range of stakeholders from academia to community groups, policy makers, innovators, and our own colleagues.

2.9.4 DATA DRIVEN

Throughout RIIO-ED1, the capture, analysis and utilisation of network data has formed an ever-increasing part of our innovation portfolio. This has included projects such as Network Grid Reporter, which for the first time enabled the digitalisation of the customer fault engagement process, which combined with the collection and analysis of high-resolution network data from our deployment of the LV automation equipment has the potential to improve our fault location activities.[9]

We have made significant investment during RIIO-ED1 in our Digital and IT systems. This investment in our core infrastructure has enabled SSEN to adopt new tools for gathering network data. This includes the deployment of handheld data gathering tools used by our inspection teams, as well as committing to the use of LiDAR to revolutionise our approach to overhead line inspection and tree cutting activities.

Clearly this ability to efficiently capture, new high-quality data offers up significant new opportunities to innovate, even more so when this data is leveraged against external data sets. Our stakeholders have made It clear that they feel that transparency and open sharing of data are necessary to break down barriers to ensure the delivery of a successful innovation programme.

We intend to increase our Data Driven innovation activity in RIIO-ED2, this is described in more detail in our ***Digital Investment Plan (Annex 5.1)*** and expressed in our Business Plan as the key principle of "Data Driven".

2.9.5 INNOVATION CULTURE

During RIIO-ED1 we have seen considerable benefits from innovation however, our analysis has shown that we could achieve even more by further nurturing a culture of innovation at all levels in our business.

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[9] https://www.ssen.co.uk/Powertrack/

This has influenced our Business Plan, in which we will continue to foster an environment in our business not only for testing innovative concepts but also for the full and thorough deployment of these in a manner that allows the full potential of any specific innovation to be realised.

In our Business Plan we have expressed this in the Key Principle of “Innovation Culture”.

3. THE CHALLENGE – NEED FOR INNOVATION AND STRATEGIC OUTCOMES

3.1 THE CHALLENGE

As a DNO, we are responsible for maintaining a secure, reliable, and cost-effective electricity network for nearly 3.8 million customers. Going forward we need to maintain that same level of service, reliability and resilience whilst simultaneously facilitating the transition to a decarbonised future. We strongly support the transition to net zero carbon emissions and will play an active role in delivering the UK and Scottish Governments’ respective 2050 and 2045 targets.

This transition will see ever increasing volumes of LCTs, distributed generation and energy storage connected across the SSEN networks. This will significantly impact power flows with new patterns of supply and demand, with new interdependencies being created with other sectors including gas networks and transport. New retail products and services are beginning to emerge driven by the uptake in LCTs and the increasing availability of energy system information will also place new demands upon the network. At the same time customers will become ever more dependent on a secure and reliable source of electricity as the country continues to decarbonise.

The next 30 years will see unprecedented change in the ways that electricity is used, and our role is clear – to ensure both heat and transport can be decarbonised at the scale and pace our stakeholders demand across all the communities we serve. This change must be delivered efficiently and effectively. At the same time, we need to continue our focus on driving efficiency, improving customer service, enhancing the customer experience, and optimising asset performance.

Successful innovation will be essential to deliver the transition successfully, maintain levels of reliability and manage costs for customers. Similarly, we are clear that it is in everyone’s interests that fairness needs to be firmly embedded into net zero transition plans; companies like SSEN will play a key role in ensuring this happens.

3.2 THE NEED FOR INNOVATION – DEFINITION OF INNOVATION

Innovation has always played an important role in SSEN and the need to innovate becomes increasingly imperative if we are to achieve our RIIO-ED2 Strategic Outcomes. Specifically, we aim to use innovation to:

"Support and enable the efficient delivery of new capabilities to meet consumer needs and deliver value."

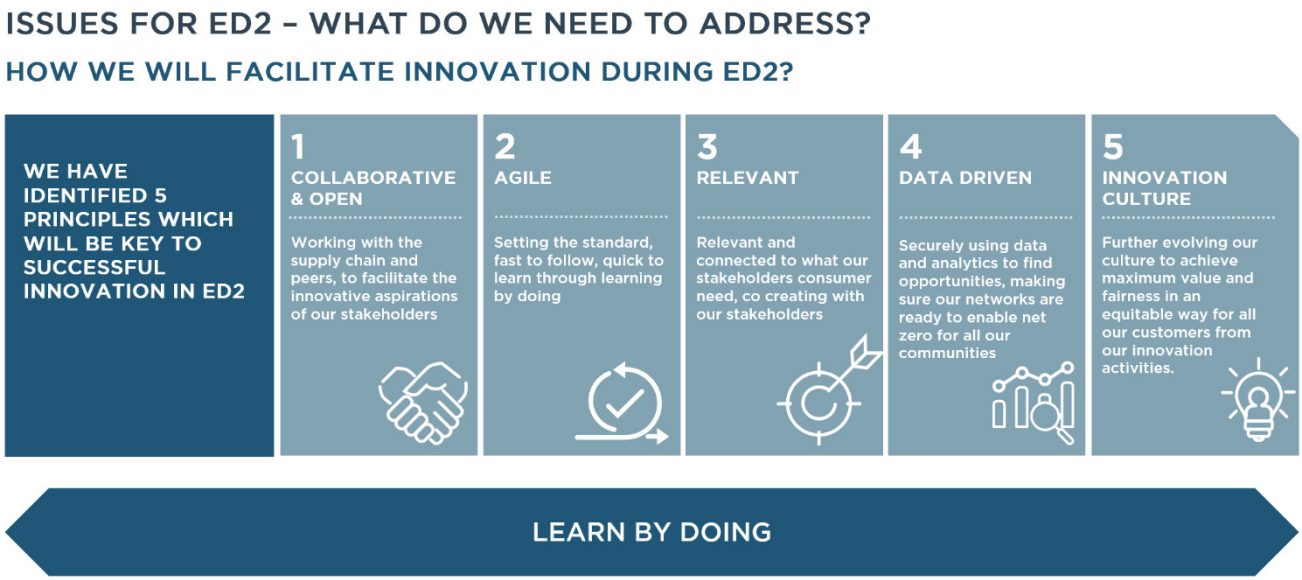
Our wide-ranging approach to innovation includes:

- Engaging with stakeholders to identify new challenges and cocreate opportunities for innovation to develop solutions across the whole system.
- Identifying opportunities to share best practice and 'fast follow' to deliver benefits for both customers and stakeholders.
- Trialing new tools, techniques, systems, and methods of work.
- Developing new knowledge and gathering evidence to shape future plans.
- Identifying and testing the functions to support the transition to DSO.
- Demonstrating new and emerging capabilities to de-risk and learn by doing.

We shared our definition of innovation and our overall approach at our stakeholder event (EO56) and received widespread support.

4. IMPLEMENTING OUR INNOVATION PRINCIPLES IN RIIO-ED2

Innovation by its very nature is uncertain and needs to be delivered in an adaptive and responsive manner to meet the challenges of a dynamic and ever-changing energy network. The needs of our stakeholders and consumers will also change with new opportunities, risks and threats emerging as we move toward net zero. Based on our successful RIIO-ED1 innovation experience, and the learning we gained from it, we have developed an approach based on five key principles, underpinned by a strong commitment to "learn by doing". This section describes how we will apply these Principles to the delivery of our portfolio in RIIO-ED2.



At our Stakeholder Engagements (EO56) and (EO88), our stakeholders widely accepted our five innovation principles, with over 83% supporting their use.

4.1 COLLABORATIVE & OPEN

Collaboration and openness are critical elements of our innovation approach, the rapid shift toward net zero, combined with the transition to DSO will give rise to a wide range of complex challenges. To resolve these issues will require an open-minded approach to allow input from beyond the traditional boundaries of the electricity network, entailing consideration of the needs and requirements of customers, other network licensees, suppliers, aggregators, flexibility providers innovators, academics, and the wider supply chain. We have a strong track record of involving a broad range of partners and collaborators in our innovation activities. We plan to build on this experience and strengthen our commitment to Collaboration and Openness by:

1. Committing to long term membership of the *Energy Innovation Centre (EIC* Home | Energy Innovation Centre (ukeic.com) *),* with a key focus of engaging and supporting the innovation community. Further details of our engagement with the EIC are shown in Appendix C. This approach received over 91% support from stakeholder at our (EO880) stakeholder event.

2. Creating a *Digital Innovation Hub* promoting data partnerships, open sharing of data was identified as being an important component of our innovation strategy by stakeholder at our (EO88) event. Further details can be found in our Digital Strategy.

3. Continuing to develop our existing relationships with academia such as Imperial College and University of Strathclyde, whilst maintaining support for the *Power Networks Demonstration Centre* **https://pndc.co.uk/**) see Appendix D as it moves to become a cross vector and whole energy system facility.

4. Actively seek to participate in ambitious and relevant multi-party demonstration projects as lead or partner, including future Strategic Innovation Fund Competitions or other Innovate UK or UKRI funded programmes.

5. Developing new innovation partnerships with other GB licensees to share best practise, improve efficiency and pace of innovation. We have already agreed to form an Innovation partnership with UKPN for the remainder of RIIO-ED1 and early part of RIIO-ED2 to leverage additional value from our innovation activities, initially this will focus on network reliability. The initial terms of reference, signed by senior management from both companies in included in Appendix E.

6. Continuing to identify opportunities to collaborate and partner with other licensees from a Whole Systems perspective including DNOs, Transmission Owners, and the GB System Operator, as well as engaging with other sectors such as gas, telecoms and water. We have set out the forums we will use to work with these stakeholders and identify these opportunities. We will embed consideration of Whole System solutions in our approach to assessing options for innovation projects.
   We will continue to work collaboratively with partner organisations to tackle shared Whole System challenges through innovative solutions.

7. Proposing the provision of an Embedded Whole System, Support Services for Local Authorities CVP which is described in our Whole System Strategy to increase our capacity to support third party led projects in our network area and increase the probability of Whole System Solutions success.

8. Maintaining an active role in the activities of the Energy Networks Association (ENA), Open Networks, and Open Data initiatives building on the work of the ENA *Data Working Group*[10].

9. Continuing to build and participate in devolved regional government led collaborations such as the *Scottish Governments EV and Heat Partnerships.*

4.2 AGILE

Successful innovation requires agility to be able to learn quickly, respond to change and refine activities to meet the needs of consumers and stakeholders. In practice this means being quick to recognise when an innovation has proven itself and can be deployed. Similarly, it is also about recognising when an innovation is not likely to deliver the anticipated benefits and focussing resource on those that are more likely to produce benefits. This can only be delivered with a strong focus on benefits realisation and having robust systems to measure the benefits of innovation.

We will deliver our innovation programme in an agile manner by:

1. Undertaking *robust and early exploration* of the potential of any new innovation opportunities, benchmarking with other innovations competing for the same benefits, the

[10] https://www.energynetworks.org/creating-tomorrows-networks/modernising-energy-networks-data

viability of the scale of deployment, undertaking a high-level Cost Benefit Analysis (CBA) and testing the viability of a route to deployment prior to committing to any innovation project.

2. Formalising the introduction of *value reviews* stage gates to our innovation projects to identify any early outcomes that can be deployed or if the project has been overtaken or proven unviable.

3. Actively considering new approaches to procurement to support innovation whilst ensuring we remain compliant with our legislative obligations. This will include providing early line of sight to BaU deployments to help ensure early realisation of benefits. Our ***Supply Chain Strategy (Annex 16.2)*** provides examples of BAU innovation delivered in ED1 and gives further details on our approach to procurement in RIIO-ED2.

4. Remaining open to approaches from innovators and suppliers and commit to providing feedback and support on rejected ideas to help vendors develop their solutions.
   Our updated innovation website will make it easier to "pitch" ideas, alternatively vendors can propose solutions via the EIC or the ENAs Smarter Network Portal[11].

4.3 RELEVANT

We will commit to ensuring that our innovation portfolio remains relevant and fully connected to our stakeholders and consumer's needs. Crucial to this is ensuring that the innovation portfolio is producing learning in a timely manner to ensure that it can be utilised to bring benefits to consumers. To help articulate this principle we have developed a series of Innovation themes, which we have shared with our stakeholders, who have confirmed that they see these as the key focus areas for our RIIO ED2 Innovation programme. The innovation themes are discussed in more detail in Section 6.

To help ensure our portfolio remains relevant we will:

- *Publish our innovation focus annually to share the areas in which we are innovating and to obtain feedback and guidance from our stakeholders including the identification of gaps and new opportunities.*
- *Work with the EIC to provide support and direction to innovators to help them develop solutions which are aligned with the SSEN portfolio.*
- *Utilise the tools developed in the "Smart & Fair Project"[12] to assess relevant innovations and ensure that our portfolio as a whole addresses the needs of all our consumers including people in fuel poverty, digitally excluded and people identified as likely to be left behind for other circumstantial reasons. This approach received strong support when we shared this at our (EO88) stakeholder engagement event.*
- *Feedback from our stakeholders, specifically at our (EO81) engagement event where Stakeholders expressed concern that customers in vulnerable situations and the elderly maybe disproportionally impacted by disruptive innovation. We will ensure that Consumer*

[11] https://www.smarternetworks.org/
[12] https://www.cse.org.uk/projects/view/1359

Vulnerability is a key part of our Portfolio in RIIO - ED2 – as set out in Section 6. In addition, we will undertake a Consumer Vulnerability Impact Assessment on each of our new RIIO-ED2 Innovation projects. This will help ensure that we can identify any potential issues in advance and identify mitigations if necessary.

- *We will continue to engage across a wide range of stakeholders, consumers, academic, the supply chain and other licensees to ensure that we identify opportunities, new challenges that need to be addressed and understand emerging requirements. In ED2, we will expand and strengthen our engagement activities in the Whole System and Consumer Vulnerability areas.*
- *We will ensure that our portfolio builds upon and addresses the industry wide challenges and strategic direction, maintaining alignment with the Electricity Networks Innovation Strategy[13] published by the ENA, actively supporting and participating in industry working groups such ENA Electricity Managers Innovation Forum and Open Network, as well as our wider partnership working with local, regional and national government.*

By following this approach well will develop a balanced portfolio of innovation projects which has been cocreated through engagement with stakeholders and remains relevant to their needs. This approach will result in SSEN delivering a portfolio of Innovation activities which reflects the mix of consumers we serve, the specific needs of the geographic areas that we cover both north and south, as well as balancing the needs of both current and future customers.

4.4 DATA DRIVEN

Data and digitalisation are addressed in our *Digital Investment Plan (Annex 5.1).* However, digitalisation itself will be a significant source of innovation and value in RIIO-ED2. Our stakeholders have highlighted three key points, which we will need to consider as we develop our RIIO-ED2 innovation portfolio:

- Access to data and understanding of the challenges faced are the catalyst of productive digital innovation.
- The probability of an economic route to deployment for digital innovation is improved by collaboration and alignment between DNOs.
- Many of the benefits of digitalisation are in the field of whole system solutions.

In response to these issues and further feedback from our Stakeholder Event (EO88), we will:

1. Establish a *Digital Innovation Hub* to actively promote the innovative use of data sets from SSEN and the wider data pool to drive value and benefits for stakeholders across the range of innovation themes.

[13] https://www.energynetworks.org/newsroom/electricity-and-gas-network-innovation-strategies

2. Work collaboratively with organisations such as with the Energy Innovation Centre (*EIC*), Power Network Demonstration Centre (*PNDC*) and the *ENA* to align the approach to data sharing and promote Digital Innovation across the full range of energy vectors.

3. *Invest in the Open Data systems* to remove barriers to network date. Further details are included in our ***Digital Investment Plan (Annex 5.1).***

4. *Invest in data gathering and monitoring* to provide a rich pool of Open Data, which can act as a resource for Digital innovators.

5. *Develop new Data Partnerships to provide opportunities for new partnerships to better define problems and develop data driven solutions.*

4.5 ENHANCING OUR INNOVATION CULTURE

A strong culture of innovation fundamentally requires three things. Firstly, the drive to innovate and improve even where that takes an individual or an organisation out of their comfort zone. Secondly, the time, space, and funding for effective innovation. Thirdly, the ability to turn viable innovation into deployments which ultimately deliver benefits.

To achieve this in RIIO-ED2 we will:

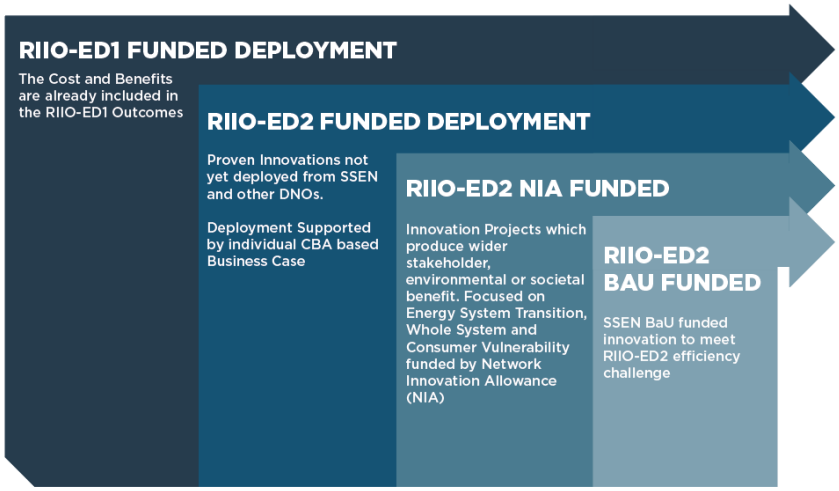
1. Create a platform for the exchange of ideas, thoughts, and opportunities within the business, with our peer organisation, other sectors and communities to promote innovation on a whole system basis. This will be achieved working with the EIC through their "*Innovation Links Programme*", through our internal "*Innovation Workshops*" and via our wider stakeholder engagement activities.
2. Build *innovation benefit realisation* into the objectives of key colleagues and provide training and support.
3. Ensure that all innovation projects are *sponsored at a "director"* or "Head of" level, to ensure alignment with our business objectives.
4. Ensure that innovation projects and have input from end users in our business and have input from subject matter experts acting as "*critical friends*".
5. Maintain *Benefit tracking* of all innovation for at least five years after deployment, following feedback from our stakeholders since our initial draft we have committed to publishing an Annual Innovation Benefits Report – see details in Section 8.3.
6. Put in place the governance process necessary to maintain a balanced innovation portfolio which delivers benefits for current customers as well as developing the learning the business needs for the future.
7. Maintain a focus on efficiency of our innovation engagement and create a frictionless experience for innovators through the extensive use of the *Energy Innovation Centre*, new partnerships, and ongoing supply chain engagement.

This approach has been developed from the stakeholder feedback at our innovation engagement event in December 2020 (EO56), and at the follow up event in early 2021 (EO88). We received strong support from stakeholder for these proposals and in particular the role of the EIC.

5. SCALING UP OUR INNOVATION ROLL OUT AMBITIONS IN RIIO-ED2

To achieve our strategic outcomes, we will need to continue to deploy innovative solutions and develop the new innovations needed to address future challenges, to achieve this we will:

- Maintain the progress with the innovations we have already deployed in RIIO-ED1.
- Identity additional innovations which bring wider stakeholder and environmental benefits and have developed individual investment proposals to support their deployment during RIIO-ED2.
- Deliver a high-quality NIA portfolio focussed on the energy system transition and consumer vulnerability. This programme will largely deliver wider stakeholder, environmental and societal benefits.
- Identify more opportunities for BaU funded investment to ensure we meet our RIIO-ED2 efficiency targets.



5.1 INNOVATION DEPLOYMENT - ENDURING BENEFITS FOR RIIO-ED1 DEPLOYMENTS

Innovation has been at the forefront of our performance in RIIO-ED1. We have delivered a successful programme of forward-thinking projects, developed an ecosystem with suppliers, technology providers and stakeholders to develop new ideas and test them. Most importantly, we have rolled out and deployed successful innovations across the network to improve reliability, increase efficiency and bring benefits to our customers. Alongside this we have developed and maintained a successful dialogue with other DNOs and licensees to share learning, and to allow us to more easily "fast follow" from their successful innovation deployments.

Our successfully, deployed innovations in RIIO-ED1 include:

Innovation	Description
Live Line Tree Felling	Innovative technique to avoid outages when felling trees adjacent to our HV overhead lines. We have deployed two live line tree harvesters during RIIO-ED1
LV Automation	The use of smart equipment to protect the LV network can reduce the likelihood and impact of supply interruption to our customers. SSEN introduced this technology by "fast following" an NIA project delivered by ENWL. We have deployed over 800 sets of LV automation equipment during RIIO-ED1.
Hybrid Generators	More efficient and lower carbon option for maintaining supplies to customers during an outage compared with traditional diesel equipment. We have deployed ten of these units to date and plan to expand this significantly in RIIO-ED2
Remotely Operated Forestry Mulchers	New tool to more efficiently clear vegetation around our overhead lines, especially in areas where access is challenging
LiDAR	Airborne radar scanning of our Overhead line network to reduce inspection costs and optimise maintenance activities. LiDAR technology was being tested by a number of other licensees including National Grid Gas Transmission as part of their innovation work, based on their initial progress SSEN proceeded to a BaU deployment to deliver an early realisation of benefits
Thermal Imaging Cameras for LV fault location	Thermal Imaging Cameras assist in the location of LV underground faults by detecting heat emitted from damaged cables. This helps to effectively pinpoint the fault, reducing the time that customers are off supply and the number of excavations required to allow repairs.
CMZs	CMZs offer security to constrained areas of the network via local generation, demand side response, energy storage and stand-by generators. CMZ schemes are generally temporary and deployed to cover periods of planned maintenance, fault conditions or increased demand. These can be used to defer expensive network reinforcements.

ANM	We have deployed several ANM schemes across our network, including those in Orkney and the Isle of Wight which have allowed large volumes of new renewable generation to connect more quickly to our network. ANM uses advanced technology to manage the generators access to the network, whilst maintaining system integrity.

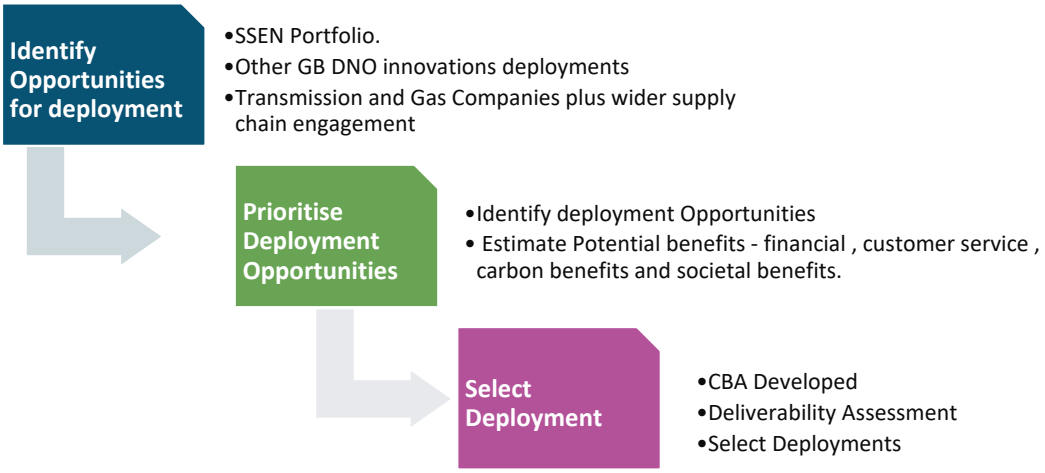
These deployments have either been initiated as a direct result of either a SSEN led innovation project such as Thermal Cameras or via SSEN fast following another DNOs project as is the case with LV automation. Additionally, the more complex deployments of ANM and CMZs draw on outputs from both our Innovation Portfolio and those of the other licensees. These have been directly developed from some of our early projects on Orkney and Shetland but have utilised the Flexible Power platform developed by WPD to procure the services we need**.**

These innovations will continue to deliver benefits throughout RIIO-ED2. The forecast innovation benefits between now and the end of RIIO-ED1 have been incorporated into our unit rates for the start of RIIO-ED2. Further details of each deployments are described in Appendix E.

5.2 RIIO-ED2 FUNDED INNOVATION ROLL OUT

We propose to expand and develop our innovation roll out in RIIO-ED2 by bringing through new solutions for deployment that will bring benefits for consumers, improve reliability, reduce carbon emissions, introduce more network flexibility and provide enhanced visibility of network loading to allow us to better facilitate the connection of large volumes of LCTs.

As part of our RIIO-ED2 preparations we have undertaken a systematic three stage assessment of the available innovations from our own portfolio and importantly from those of other electricity, transmission and gas licensees, to identify options for further deployment. The process is described below.



1. **Identify Opportunities for Deployment** – we have concluded a thorough review of the historic innovation portfolio of all the GB DNOs, as well as transmission and gas licensees to identify innovations which have the potential to deliver benefits.

Additionally, we have engaged with supply chain and vendors to identify further innovation opportunities. These extend across the majority of the RIIO-ED2 workstreams.

2. **Prioritise Deployment Opportunities** – working across our RIIO-ED2 Business Plan, we have developed CBAs and supporting information to allow innovations to be considered for deployment within our investment proposals. Benefits from these innovations include enhanced reliability, sustainability improvements, deferred reinforcement, improved customer service and external societal benefits.

3. **Select Deployment** using CBAs we have made value and deliverability-based decisions to include or exclude these from our plan. Deployments will be justified where they return a positive CBA or non-financial benefits including carbon reduction or wider consumer or societal benefits.

This ensured that we identified those innovations with the greatest potential to bring benefits if they are deployed during RIIO-ED2. The incremental costs for deployment of the innovative solution have been included within the relevant sections of the investment proposals contained in our business plan.

Each individual deployment has been supported by a specific Investment Decision Pack (including Engineering Justification Papers and Cost Benefit Analysis) which describes the rationale behind its selection, the costs and the resulting benefits. We have also considered alignment with our other planned work programme to ensure that these initiatives can be delivered.

These innovation investments will also help support the step change in performance required to deliver the increase in volumes for RIIO-ED2 at the lowest possible cost and allow us to develop the new capabilities required to deliver our outcomes. We propose to invest over £120m across RIIO-ED2, which will produce long term benefits for consumers of over £175mm, as well as avoiding over 125,000 tonnes of CO_2.

Further information on each deployment is contained in Appendix F and are summarised on the following page:

Strategic Outcome	Innovation	Description	Potential Deployment Year	ED2 Totex Deployment Indicative	ED2 Indicative Benefit	Link to Investment Decision Pack or Engineering Justification Paper (EJP)
Accelerate progress towards to net zero world.	LV Feeder Monitoring	LV network visibility will be crucial to facilitate the connection of the LCTs required to achieve net zero, we propose to deploy, During RIIO-ED2 we propose to deploy around 19,500 sets of monitors	2023- 2028	[redacted]	These monitors will be used to provide the improved visibility of the low voltage network which will facilitate the connection of large volumes of LCTs . This will primarily benefit customer by better informing the timing and location of our Load related investments,	Network Visibility Strategy and LV Monitoring EJP
Deliver a safe, resilient and responsive network.	On Load Tap Changer for secondary substations (ENWL)	This technology has been successfully deployed by ENWL in the Smart Street Project. The equipment dynamically manages voltage to the optimum level bringing benefits for the customers connected to the network.	2023/24	[redacted]	By dynamically managing and optimising the LV output from secondary substation, will reduce the energy consumption for customers connected to that network, thus reducing their energy costs. This has been estimated as a 45-year reduction of at [redacted] in the energy bills of the consumers connected to this equipment There will also be a reduction in network losses. These have been estimated at [redacted] with a corresponding carbon saving of 123,000 tonnes of CO2.	EJP for 6.6/11kV Transformers 308/SSEPD/NLR/HV_TRANSF
Deliver a safe, resilient and responsive network	Enhanced Lightning Protection	Updated approach to lightning protection on the network, which sees the use of new data analytics to identify areas at risk combined with the use of new lighting protection equipment	2023- 2028	[redacted]	Better informed location of lightning protection and the utilisation of improved lightning protection equipment will avoid unplanned outages and plant damage because of lightning strikes. This will reduce or avoid customer disruption, reduce repair time, and potentially avoid the cost of equipment replacement. Over the twelve-year life of the new equipment this has been estimated at around [redacted]	Network Reliability Annexe
Positive Impact on Society	Transformer Auto Stop Start (TASS)	Technology that can automatically switch off a transformer in a Primary Substation at times of low demand to reduce network losses.	2023/24	[redacted]	The technology reduces network losses, which ultimately are the cost of which are borne by customers. The reduction in losses will result in a customer benefit of approximately [redacted] over the life of the equipment. With a corresponding saving of 595 tonnes of CO2	TASS Roll Out 5/SSEPD/ENV/LOSSES
Positive Impact on Society	Additional Hybrid generators	Additional deployments to replace existing diesel units with lower carbon more efficient alternatives.	2023/24	[redacted]	These are lower carbon more efficient alternatives to traditional diesel fuelled versions. This will produce an efficiency benefit of [redacted] over the 10-year life of the equipment and a carbon reduction of 1,406 tonnes.	EJP for Hybrid generators - 10/SSEPD/ENV/GENERATION
Accelerate progress towards to net zero world.	Flexibility Deployment	Deployment of flexibility at scale to avoid network reinforcement and other benefits.	2023/24	[redacted]	The benefits from the ANM enabled connection activity will enable higher volumes of LCTS to connect to the network . It has been estimated in DSO paper that a more flexible network will result in between [redacted] of benefits for consumers	DSO Workforce Capability IDP
Deliver a safe, resilient and responsive network	SUBsense Deployment	This uses an acoustic sensing system to monitor the health of our subsea cables. Real time monitoring gives a greater understanding of the conditions of the cable which allows proactive management, thus mitigating associated lost or	2023- 2028	[redacted]	Improved reliability of subsea cable circuits and avoided cost of unplanned repairs. We are proposing to retrofit the Subsense system on up to ten of our existing subsea cable circuits as well and including it in all new installations going forward. It is envisaged that the improved ability to intervene at an early stage to affect a repair will avoid the catastrophic failure of the cable. It has been estimated that avoiding a single subsea cable replacement could avoid up to [redacted] of capex being required.	A11 – North of Scotland Strategy

		interrupted supplies due to disruptive failure			

5.3 RIIO-ED2 INNOVATION – NIA FACILITATING NET ZERO AND SUPPORTING VULNERABLE CONSUMERS

We will look to use our NIA allowance to deliver a high-quality portfolio of new innovation projects which explore opportunities and deliver value added change for vulnerable customers, facilitate net zero and address whole system issues. In RIIO-ED2, we are seeking an NIA allowance of £17.5m over the five-year period, plus our own 10% contribution to create a total fund of £19.25m for NIA. This will allow us to maintain the momentum and pace of our RIIO-ED1 progress and at least £14.5m of this will be allocated to third parties.

Our NIA portfolio will be co-created with our partners and stakeholders. Key focus areas, identified by Ofgem for RIIO-ED2 NIA activity include:

- **Whole System** – developing data driven, transparent and cross sector solutions.
- **Whole System** – improving competition and enabling new markets.
- **net zero** – facilitating energy storage and enabling low carbon generation to connect.
- **net zero** – mass electric vehicle adoption and wider decarbonisation of transport and heat.
- **net zero** – creating robust evidence-based solutions to achieve net zero.
- **net zero & Consumer Vulnerability**– achieving a just and fair transition.
- **Consumer Vulnerability** – improving understanding and developing new services and solutions for customers in vulnerable situations.
- **Consumer Vulnerability** – changing nature of vulnerability as we move to net zero.

Our NIA allowance will be focussed on projects which are more likely to deliver wider stakeholder, environmental or societal benefits rather than network benefits directly to ourselves. We will also use NIA for projects where associated benefits will either accrue in the longer term beyond the end of price control period, or accrue to external parties other than SSEN, or are high risk or where the potential returns are very uncertain.

These projects will help to inform and facilitate the UK's transition to net zero, largely producing benefits for external stakeholders and involve significant cocreation with partners. The level of risk and uncertainty of each of these projects make them inappropriate for direct funding by us, and without the support of NIA would be unlikely to proceed.

For more details on our proposals for NIA Funding are set out in section 8.

5.4 RIIO ED2 INNOVATION – CONTRIBUTING TO EFFICIENCY

Innovation will have a key role in supporting our delivery of ongoing efficiencies throughout RIIO-ED2 including our stretch target of 0.7% per annum, (as set out in our **Costs & Efficiency Chapter 15**). It will also be needed to support the step change in performance required to deliver the increase in volumes for RIIO-ED2 at the lowest possible cost and to develop the new capabilities required to for the successful delivery of our RIIO-ED2 Business Plan.

Overall our efficiency targets will be achieved by a combination of the benefits we expect to realise from our planned IT investments, our ongoing continuous improvement activities, our supply chain engagement strategy and by embedding established innovative solutions into BAU (as described in section 5.2) .

However, to meet our efficiency target and deliver our Strategic Outcomes, we will need to invest in further innovation. We plan to establish a BaU funded innovation programme focussed on identifying, testing and deploying solutions which will deliver value and improve the efficiency of our operations.

In RIIO-ED2 we will deliver £10m of BaU funded innovation activities, which is not part of our Totex ask, and from which we expect to deliver at least £10m of efficiency benefits. With the subsequent deployments being funded from Totex and BAU efficiency savings justified on a case-by-case basis to a level that provides an appropriate return within the RIIO-ED2.

The role of innovation alongside our other proposed cost efficiency measures will be continually reviewed during the next price control to ensure that the Business delivers its overall objectives,

To develop this BAU funded portfolio successfully we will:

- Identify internal Business and Stakeholder priorities and target these selected areas.
- Specifically focus on efficiency target areas.
- Focus on innovations that have a robust and material benefit case and clear route to deployment within RIIO-ED2.
- Utilise agile processes to accelerate successful deployments.

For clarity, we have not sought specific allowances within our plan for our BaU Innovation programme. Instead it will be funded at our risk, based on achieving a suitable a return through existing regulatory incentive mechanisms if the programme should prove effective. Similarly, we have not sought any specific allowances for the subsequent deployment of these innovations beyond the allowance that would have funded the “traditional” method for delivering the associated outputs. Instead, the funding on the traditional method will be re-allocated to the deployment of the new innovative alternative.

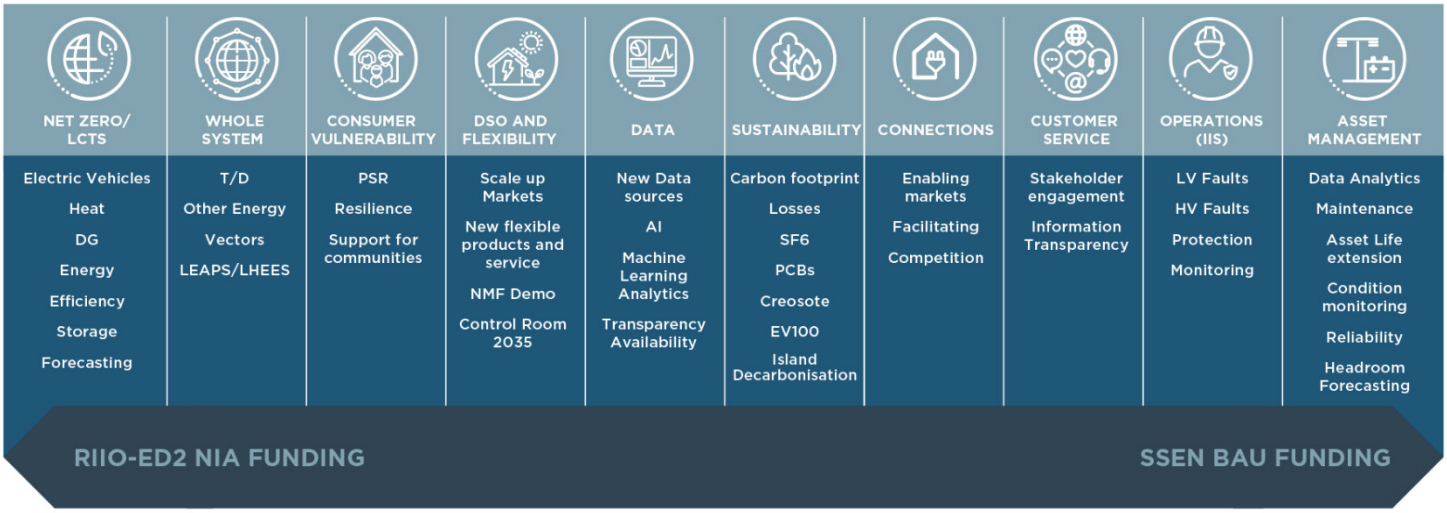
Whilst, opportunities will arise across our business activities, here are the areas which we currently believe offer the best potential for delivering benefits, these include:

	Topic	Description	Benefit Description
Deliver a safe, resilient and responsive network.	**Network Resilience**	LV Fault Location HV Fault Location Innovative Spur Protection Network Automation	Reduced CML Reduced CI Process Efficiency Improved Customer Service
Deliver a safe, resilient and responsive network.	**Asset Management**	Fault Anticipation Asset Inspection Lightning Protection Asset Health Data Equipment replacement	Reduced CI / CML Improved Customer Service Improved Data Quality Process Efficiency
Deliver a safe, resilient and responsive network	**Inspection**	Extend LiDAR OHL Data Collection AI / Machine Learning	Improved Data Quality Process Efficiency
Provide a valued and trusted service	**Flexibility**	New Flexibility Products Constraint Managed Zones Flexible Connection options	Deferred Investment Optionality Process Efficiency
Provide a valued and trusted service	**Data / Digital**	Data Analytics Customer Service Work Programming Self Service Connection Improvement	Improved Data Quality Process Efficiency Customer Service

This £10m programme of BaU will focus on rapid discovery, evaluation and transition to deployment. As a result, this will focus on higher Technology Readiness Level (TRL) solutions and those closest to being ready for deployment.

Throughout RIIO-ED2, we will work closely with the supply chain nationally and internationally, EIC, PNDC and other partners to identify potential options for deployment. We will drive implementation and business deployment to realise these benefits within the price control period in order to establish a return from our investment before these benefits are time expired through them being "baked in" to the RIIO-ED3 settlement.

6. INNOVATION THEMES, FOCUS AREAS AND OPPORTUNITIES IN RIIO-ED2



We have consulted with stakeholders, including those who have helped to create our existing portfolio and those who attended our two dedicated innovation events (E056) and (EO880), to identify a broad spectrum of themes for our RIIO-ED2 Innovation activities. This will help us develop our portfolio in a structured fashion, to ensure we deliver a portfolio which reflects the needs of our customers both current and future and our wider stakeholder community.

These themes supported by the five principles described earlier will allow us to anticipate and respond to emerging challenges from within the business, from our stakeholders, the innovation community and with the supply chain. These themes are aligned with the wider Industry Network Innovation Strategy published by the ENA. https://www.energynetworks.org/newsroom/electricity-and-gas-network-innovation-strategies.

Our high-level innovation themes are as set out below, and are described in more detail in Appendix F.

Focus Area	*Innovation Outcome*
Net zero & low carbon technologies	*The energy systems transition will create significant change within our industry, with technology development, evidence gathering, and policy change essential steps on the decarbonisation journey, beyond the timescales of RIIO-ED2. As the move to net zero gathers pace the need for innovation in this area is anticipated to grow significantly, our stakeholders have told us at our (EO56) event that* ***"net-zero and low carbon technologies was considered the most important of the ten categories of the themes"*** *Therefore, we intend to make net zero and LCTs a significant part of our innovation portfolio in RIIO ED2. Our innovation portfolio will undertake targeted research, development and demonstration projects that will support our role as a key enabler of net zero. This will include the electrification of transport and heat, distributed generation (DG), the role of energy storage and other LCTs, ensuring that we consider whole system solutions to the barriers being addressed by our innovation portfolio .*

Focus Area	Innovation Outcome
Whole systems	*Innovation in this focus area will involve engaging with local communities and authorities as well as other organisations in the energy and transport, telecoms, and water sector to look at options for developing whole systems solutions. For example, the decarbonisation of heat, with a range of alternative solutions (hydrogen, energy storage, electric heat pumps and district heating),requires cross sector collaboration and Whole System thinking to optimise costs and investment while meeting environmental commitments. This will include work to inform the development of Local Area Energy Plans (LEAPS) and Local Heat and Energy Efficiency Strategies (LHEES) This is an area which will have a significant part to play in the net zero transition and the need for innovation work in this area is anticipated to grow in RIIO-ED2.*
Consumer Vulnerability	*This focus area will remove or reduce the impact of 'everyday operations' on customers in vulnerable situations including those on our Priority Services Register (PSR). Through research, development, and demonstration, we will create opportunities for the creation and deployment of appropriate solutions. This will also look at how consumer vulnerability will evolve and change as we head toward net zero. The scale of the change required to get to net zero has the potential to impact on consumers in vulnerable situations, therefore, we intend to use our innovation activities to help ensure a Just Transition and will use the learning from the 'Smart and Fair' project to help shape our portfolio.*
DSO and Flexibility	*This focus area will build upon the learning from our innovation projects in RIIO-ED1 and will look to innovate to inform the wide scale application of flexibility, testing and evaluating new flexible solutions for new and emerging network issues, neutral market facilitation (NMF), as well as enabling flexibility markets and facilitating more competition in this area. The focus area will help inform the developing role of the DSO. Given the anticipated role of flexibility as we move to net zero, again we feel there is a growing need for innovation in this area. Creating a more flexible network will facilitate the connection of a much wider range of LCTs and associated network services*
Data and Digitalisation	*This focus area will include projects which can maximise the value from our data, investigate new options for making our data more readily available for our stakeholders and the use of latest data analytics and machine learning techniques. Our stakeholders at event (EO88) identified that open sharing of data is key to breaking down the barriers to successful innovation.*
Sustainability	*This focus area will look to reduce the impact of 'everyday operations' on the environment and reduce our business carbon footprint. This will include looking at techniques for better managing network losses and reducing the use of environmentally harmful insulating materials such as SF6. We will also look at how we can use lower carbon options for mobile generation, and the use of electric vehicles and tools for our own operations.* *Stakeholder engagement since the submission of our draft plan, has been clear that they see the decarbonisation of SSEN activities on our remote islands as being a key area in need of innovation, with the replacement of embedded diesel generators with low carbon alternatives being especially important. Therefore, we have included this with our list of Innovation Themes*
Connections	*We will build on the progress we have made in RIIO-ED1 by developing further options for deploying 'smart' solutions as an alternative to traditional connection options. This will also include evaluating new connection options which may be required to enable the large-scale adoption of LCTs.*
Customer Service	*We will use innovation to improve our existing customer service options, especially for consumers in vulnerable situations, including those who are medically dependent upon their electrical supply. We will also consider new ways to interact with our consumers in the event of a fault or an outage.*

Focus Area	Innovation Outcome
	Potentially this could also include the role of energy efficiency and local energy systems in achieving net zero.
Operations and Efficiency	*This focus area will look at how we improve the efficiency of our operations to reduce costs and improve the resilience of the network. We will look at options for being able to anticipate faults and resolve issues before they cause any disruption to our customers, we will also look at methods of reducing the impact of any interruptions to our customers.*
Asset Management	*This area will look at how we can improve the inspection and maintenance of our assets. We will look at new ways of gathering network data, inspecting our assets to assess condition, understanding how we can better manage and utilise the asset management data that we already must better manage our investment decision making.*

Our innovation portfolio will cover all the themes identified above, the priorities and phasing of our programme will be shaped by the needs of the business and the requirements of our stakeholders and will be kept under review as we progress through RIIO-ED2.

As identified in the previous chapter we anticipate that our NIA Funding will be focussed on the Net Zero, Whole System and Consumer Vulnerability themes. We would expect that innovations in the Operations, Efficiency and Asset Management themes will largely be funded by ourselves to achieve our efficiency targets.

We recognise that there are other technology areas such – artificial intelligence, machine learning, the Internet of Things, enhanced automation, etc. – that have huge potential, but haven't been widely deployed in the electricity networks environment. As such, we see these as areas where innovation funding can be utilised to help develop successful proof of concepts for wider adoption by the industry. There are likely to be options for us to participate in externally funded innovation schemes to leverage our existing innovation funds. Our existing partnerships with academia, the EICs membership of 8,000 plus innovators and other industry partners will ensure we are well placed to be successful in these competitions.

In addition, we will continue to innovate in areas such as talent, skills development and commercial models which don't necessarily require new technology or equipment. As an example, we are beginning to explore innovative commercial models to with suppliers and the wider innovation community, for further details see our ***Supply Chain Strategy Annex 16.2.***

7. INNOVATION FUNDING – NEED FOR NIA SUPPORT TO BENEFIT STAKEHOLDERS.

For RIIO-ED2 we will look to build upon our previous success and leverage funding from across four key funding sources. This will allow for a balanced portfolio of innovation activities to be created which deliver business benefits, facilitate the transition to net zero, help progress whole system solutions and support consumers in vulnerable situations.

We recognise that a commitment to innovation is fundamental to a sustainable business and that innovation can deliver value for our customers. Therefore, we propose a balanced and fair approach to funding innovation in RIIO-ED2, which appropriately shares the costs to reflect the risks and benefits from its successful delivery.

This will allow us to maintain our key role in facilitating the net zero transition, supporting our customers and stakeholders' ambitions, whilst continuing to focus on delivering efficiency within the business.

Network Innovation Allowance (NIA)	*SSEN will use NIA funding to explore opportunities and deliver value added change for vulnerable customers, facilitate net zero whilst addressing whole system issues.*
Strategic Innovation Fund (SIF)	*Innovation to address specific challenges identified by Ofgem's Net Zero Advisory Board. We will actively seek to cocreate projects with interested stakeholders in response to the innovation challenges issued by the SIF programme.*
3rd party funding	*SSEN will actively seek to get involved in innovation activities funded via wider government funding mechanisms (Innovate UK etc). This will allow SSEN to develop further projects looking at whole system and emerging challenges associated with achieving net zero. See Appendix H – Third Party Innovation Funding – DNO Involvement*
Business as Usual (BaU) funded innovation	*To deliver immediate benefits to improve the day-to-day delivery of our network operations, SSEN will invest in up to £10m in innovation initiatives to ensure that we meet our RIIO-ED2 objectives. This is described in Section 5.4.*

7.1 NEED FOR NIA FUNDING

The challenges associated with the net zero are wide ranging and we welcome Ofgem's decision to retain the NIA funding for RIIO-ED2 to let us continue to work with stakeholders to cocreate the knowledge and learning that we need to help the country achieve its carbon reduction targets. We have a track-record of successfully implementing projects that started at the demonstration stage, which then evolved through to larger scale initiatives, e.g., those funded through the NIC supporting our principle of learning by doing.

For RIIO-ED2 we intend to continue along this path – utilising NIA to support the development of ideas through to benefit-realising concepts, both in terms of financial return, and by driving benefits related to safety, customer satisfaction, the environment to the benefit of our stakeholders. We

intend to focus our NIA portfolio on issues related to the energy system transition including net zero and whole systems. Similarly, we will look to develop a portfolio of NIA projects which support customers in vulnerable situations and to ensure a just transition to a low carbon future.

Based on our experience, the growing demands of net zero and associated consumer vulnerability challenges we believe that an enhanced level of innovation activity will be required during RIIO-ED2. This is a view which has been supported by our stakeholder engagement activities, (EO88) which clearly identified achieving net zero, as being a priority.

Our NIA portfolio will be cocreated with stakeholders and in most cases, the benefits from the projects will accrue to stakeholders rather than ourselves. Similarly, benefits may not materialise until the longer term, or are exploring technologies which are still at an early stage and whose potential to deliver benefits are yet unproven. The level of risk involved in these projects, the uncertainty involved in their outcomes and the fact that benefits are not necessarily realised by ourselves, makes it inappropriate for them to be funded from our Totex allowances. We believe that NIA is the most appropriate mechanism for the delivery of these projects.

7.2 NIA FUNDING REQUEST AND THEMES

In RIIO-ED2, we are seeking an NIA allowance of £17.5m over the five-year period, plus our own 10% contribution to create a total fund of £19.25m for NIA. This will allow us to maintain the momentum and pace of our RIIO - ED1 progress and at least £14.5m of this will be allocated to third parties.

Area	NIA Funding Request £m (for RIIO-ED2 period)	Match / Collaborative Funding minimum £m	Total Investment £m
Energy System Transition incl. Whole System	14	1.4	15.4
Consumer Vulnerability	3.5	0.35	3.85
Total Funding	17.5	1.75	19.25

In RIIO-ED1 to the end of financial year 20/21, the maximum available funding for NIA was approximately £26.4m, of which we have forecast to spend around £16.1m. Given the urgency and importance our stakeholders place on achieving net zero and the increasing need to support vulnerable customers, we believe that our request for RIIO-ED2 will allow us to grow our innovation activities in these key areas:

- **net zero / whole system** – developing data driven and transparent solutions. Including cross vector solutions involving Transmission licensees, Gas Distribution Networks (GDNs), as well as local, regional and national governments and potentially other sectors. Whole system planning combines electricity, gas, transport, head and a wider range of Government, regulated networks and community stakeholders to provide a better understanding of infrastructure delivery.
- **net zero / whole system** – enabling competition and facilitating new markets for flexibility and whole system solutions.

- **net zero / whole system** – decarbonising heat, the role of energy efficiency, demonstration of new low carbon heating technologies, development of new business models to achieve decarbonisation of heat, developing learning to inform the policy changes required to achieve decarbonisation of heat.
- **net zero** – Mass electric Vehicle adoption and wider decarbonisation of transport including commercial vehicles, and public transport
- **net zero** – developing new knowledge to enable the creation of robust evidence-based solutions to facilitate the net zero transition. This could include topics such as energy storage and new forms low carbon generation
- **net zero & consumer vulnerability**– achieving a Just and Fair transition. The potential unfairness that could occur in a low carbon energy system as the UK transitions to net zero; the impacts it could have on vulnerable customers; the risk of negative social impacts on the net zero transition; and methods to ensure inclusivity so that no one's left behind.
- **consumer vulnerability** – improving understanding and developing new services and solutions for customers in vulnerable situations. Understanding what the future landscape could look like and how this will impact our customers, stakeholders and wider society has enabled us to create a plan that can respond flexibly to the changing needs and requirements of our customers now and in the future.
- **consumer vulnerability** – changing nature of vulnerability as we move to net zero, as consumers become more reliant on electricity for heat and transport a secure supply of electricity will become more important to them. Similarly, we need to respond to the changing needs of our consumers driven by wider demographic and societal change including challenges from an ageing population. We will horizon scan and use up to date social demographic and network data to redefine what vulnerability really means in our future networks during ED2 and beyond. We innovate to develop solutions which ensure our innovations are fair, just, and beneficial for all.
- **Consumer Vulnerability** - During RIIO-ED1 we have championed the principal of actively finding ways in which the transition to net zero can benefit people in vulnerable situations, as opposed to just not to leaving them behind. Our innovations will continue to actively seek ways of helping people out of fuel poverty and find ways that smarter networks can provide practical options to lift people out of poverty, away from vulnerable situations and help hard to reach communities to flourish.
- **Consumer Vulnerability -** We will continue to ensure our information is available in accessible formats and that our communication is inclusive, whether that be digital or offline.

In line with our previously identified principles, especially Collaborative and Open, Relevant and Agile we will look to cocreate our RIIO-ED2 NIA portfolio with our stakeholders. At this stage we have identified the high-level themes for NIA, which are set out above but do not feel that it would be appropriate to scope individual projects at this stage. We plan to build on our RIIO-ED1 innovations portfolio and will engage with stakeholders closer to the start of RIIO-ED2 to begin to cocreate projects which are relevant and beneficial.

Part of this cocreation process will involve the development of a benefit case for the project, using the most up to date information available. We will deliver our NIA portfolio, following the approach detailed in Section 8 below.

Whilst, the above Table above shows our NIA Funding Request being split between the two topics, we believe that there are strong synergies between the two issues. Therefore, we envisage that many of the NIA projects we will undertake in RIIO-ED2 will consider both Consumer Vulnerability and the Energy System Transition.

We are seeking this allowance, across the RIIO-ED2 price control period, this will allow for a more flexible approach to project initiation and delivery. This flexibility will help ensure we can maintain our agile principle, allowing more opportunities for third party involvement and cocreation.

Additionally, this ability to manage the phasing of the NIA funding over a wider time frame increases the opportunity to leverage these funds in with other sources of innovation funding such as Innovate UK or Horizon 2020. We would intend to contribute at least 10% toward the cost of all NIA projects.

7.3 DRIVING VALUE AND BENEFITS FROM OUR RIIO-ED2 NIA ACTIVITIES

We will look to use our NIA allowance to deliver a high-quality portfolio of innovation projects which explore opportunities and deliver value added change for vulnerable customers and facilitate net zero whilst addressing whole system issues. We anticipate that the benefits and value from these projects will accrue to a wide range of stakeholders across the energy landscape, as well as environmental and societal benefits. The benefits from our NIA activities could include:

- *Projects where the benefits are more likely to accrue to the wider stakeholder group–* in many cases the primary beneficiaries from our innovation projects have been other stakeholders – for example, our Assisting Communities to Connect to Electric Sustainable Sources (ACCESS) project developed a new flexible connections option to benefit renewable generators and communities in areas which have network constraints.

- *Deliver environmental benefits* – our earlier projects have delivered outcomes which have delivered an environmental benefit. For example, our Low Energy Automated Network (LEAN) project, delivered a new approach to managing network losses, which benefits consumers and the environment.

- *Deliver societal benefits -* our NIA and NIC projects have delivered outcomes which provide a societal benefit. For example, our E Tourism project is looking at the impact of high volumes of tourist driven EVs in remote locations and to identify new options for local stakeholders to become involved in providing solutions.

- *Deliver benefits in the longer term beyond the end of the price control period –* our Future Control Room Project is looking at the high-level architecture requirements for network control centres as we move toward net zero.

- *Provide benefit to external parties other than SSEN* – in some cases we have delivered projects in direct response to approaches from communities, innovators, or stakeholders. For example, our TraDER project was specifically developed in response to an approach from an Innovator who was working with a local community to develop a system for trading network access rights in constrained areas.

As can be seen, in many cases the outcomes from the projects will deliver tangible benefits for stakeholders rather than ourselves, similarly, benefits that may not materialise until the longer term, or are exploring technologies which are still at an early stage and whose potential to deliver benefits are yet unproven. The level of risk involved in these projects, the uncertainty involved in their outcomes and the fact that benefits are not necessarily realised by ourselves, makes it inappropriate for them to be funded from our Totex allowances. We believe that NIA is the most appropriate mechanism for the delivery of these projects.

7.4 NEED FOR NIA TO SUPPORT NET ZERO

The transition to net zero has been identified as the highest priority area by our stakeholders, developing a smarter more flexible electricity network will be critical if the country is to meet its objectives. The benefits from a smarter system include the effect of lower levels of peak electricity demand, reduced cost of investing in and operating low-carbon generation and avoidance of reinforcement of local distribution networks. There have been a range of studies which show the potential benefits from a smarter system, these include:

Publication	Benefits
"Value of Flexibility in a Decarbonised Grid and System Externalities of Low-Carbon Generation Technologies" Report for the Committee on Climate Change Imperial College London October 2015	More than **£3bn/Year** for 100g/kWh scenario, **c£8bn/ year by 2030** for a 50g/kWh scenario, from a flexible energy system
"An Analysis of Electricity System Flexibility for GB" Carbon Trust with Imperial College London, November 2016	**£17-40bn over the period to 2050** from a flexible energy system that support electrification of transport
"Smart Power" National Infrastructure Commission published its report Smart Power, May 2016	A smart system, built principally around interconnection, storage, and Demand Side Response (DSR) could deliver **£8bn of savings per year by 2030**
"Early Insights into System Impacts of Smart Local Energy Systems (SLES)" EnergyREV, Aunedi, M., Green, T, C., June 2020	**£1.2bn/ year to £2.8bn/ year total cost saving by 2030** (assuming 10% and 50% SLES penetration respectively and emissions limit of 100g CO2/kWh in 2030) **£2.9bn/ year - £8.7bn/ year total cost saving by 2040** (assuming 10% and 50% SLES penetration respectively and emissions limit of 100g CO2/kWh in 2040)

Increased flexibility, derived from Distributed Energy Resource (DER), ancillary services and peer to peer trading of constraints, capacity and energy, as well as the development of the markets that facilitate their application are key drivers of reduced total system costs. These are areas which need significant further innovation to develop these still nascent markets. Our NIA portfolio will be largely focussed on helping GB realise it low carbon ambitions, and accelerating progress towards net zero.

7.5 LEVERAGING NIA FUNDS

The issues associated with the transition to net zero are complex and wide ranging. The electricity distribution network is at the heart of this, and we need to ensure that our innovation activities are aligned with the those of the wider industry, and in particular other energy related UK Government innovation programmes. Engaging in these wider innovation programmes allows SSEN to leverage added value from our NIA allowance and allows us to participate in a much broader and far-reaching projects. SSEN has a strong track record in identifying and securing these funds, leading the industry with projects such as LEO, MERLIN and TraDER, we intend to build on this in RIIO-ED2.

At this point in time, we are not seeking a re-opener, but we will monitor and reassess the situation as we progress through RIIO-ED2. This will allow us to respond to emerging issues or stakeholder demands. Our Innovation team along with our Partnership Funding Team will look to identify potential opportunities, engage, and share details with potential partners and cocreate projects together.

Participation in these projects offer the opportunity to bring wider benefits over and above those which can be realised from the confines of the regulatory funding streams. Crucial to this will be our ongoing participation in the Strategic Innovation Fund, which will give an opportunity for us to further build upon our portfolio of successful NIC projects.

The partnership working enabled through these initiatives (and the potential for additional funding they create) provides opportunities to develop whole systems solutions which consider interactions within the electricity sector (for example between distribution and transmission), as well as broader interactions between our sector and others, such as gas, water utilities and transport. When deciding how best to allocate NIA funding over RIIO-ED2, we will work closely with partner organisations to consider whether innovation investments are best delivered by SSEN individually (with the support and advice of our partners), or whether a multi-organisational delivery approach is more appropriate.

8. DELIVERING OUR INNOVATION PORTFOLIO

The return from investment in innovation is by no means guaranteed, a robust approach to its management is required to ensure its successful delivery, but yet must be flexible enough to adapt as new knowledge and challenges emerge. Our proactive approach to the creation and delivery of our innovation portfolio is a key part of our plan.

During RIIO-ED1 (and earlier), we have been listening to our stakeholders and measuring our outcomes to allow us to tune our approach and deliver even greater returns for our customers and stakeholders. Having consulted extensively with our stakeholders at events (EO56 and EO88) key issues emerged, which stakeholders identified as being crucial to how we can effectively deliver our ambitions in the next price control, addressing these issues has been fundamental in shaping our Innovation Principles described earlier. The issues identified included:

- *Transparency* – making our requirements and needs more visible and easier to understand and being more transparent on the benefits resulting from our innovation work.
- *Cocreation* – recognising that innovation requires a collaborative approach to deliver effective solutions to the complex challenges that the industry faces.
- *Improved Engagement*- to make SSEN more accessible for suppliers to pitch new ideas and innovations, as well as helping the supply chain better understand the challenges and problems being faced by the business.
- *Support* – provide support to help them ensure solutions meet our needs and to provide "line of sight" and a route to market for technology and innovation providers.
- *Procurement* –our willingness to be flexible and consider alternate options.
- *Data* – stakeholders specifically identified a need for better sharing of data, to help better define opportunities and develop more tailored solutions.

In this section of the strategy, we have set out how we plan to deliver our Innovation Strategy and ensure that we meet the needs of our stakeholders.

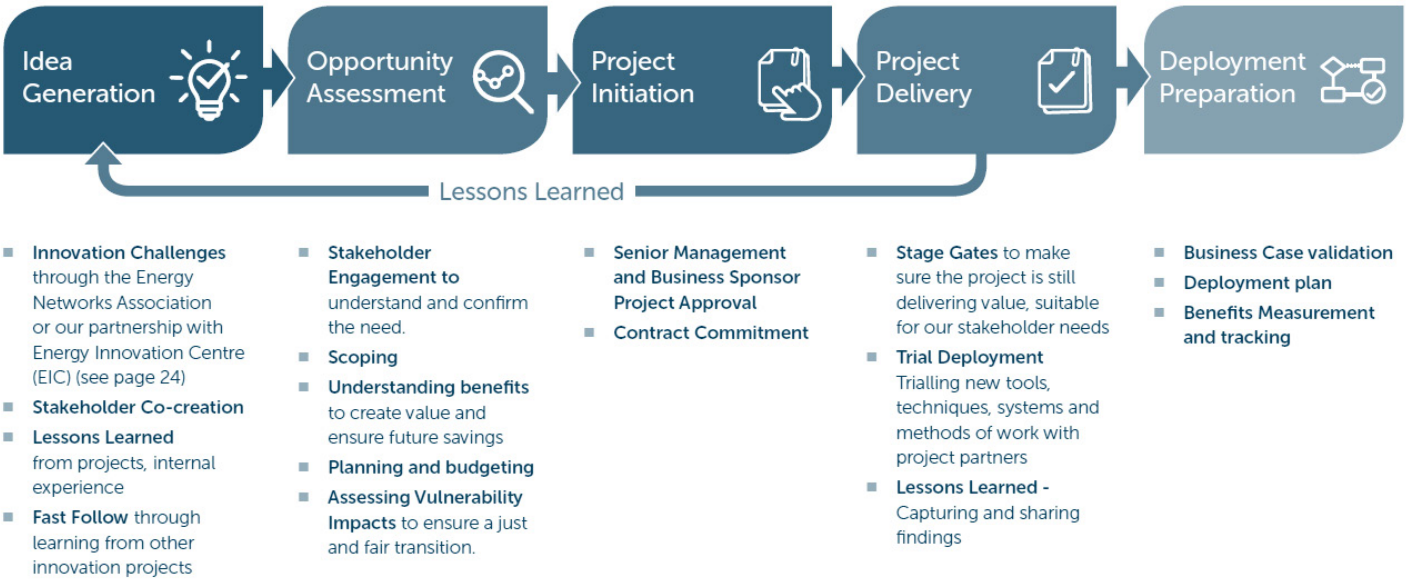
8.1 MANAGING INNOVATION PROJECTS EFFECTIVELY

We look to innovate to understand how to improve our business and in doing so, deliver benefits to our customers and stakeholders. This means that we need to manage our innovation projects so that they are focussed on the benefits they deliver. We have implemented a process which allows us to assess the potential for delivered benefits at each stage of the innovation cycle – from initial idea through to implementation.

This will allow us to maximise the benefits for our consumers.

Getting the right ideas into our Business

We do not have a monopoly on good ideas – the best ideas come from cross fertilising different experiences, capabilities, and interests. We have an open approach to encouraging stakeholders and third parties to submit innovation ideas. This can be done via our innovation website, at any of our planned dissemination events, via the ENA Smarter Network Portal or via the Energy Innovation Centre. With partners we will issue "Innovation Calls" to seek out innovative solution to specific business challenges. Alongside this we will publish our Annual Innovation Priorities (which will be informed by our ongoing engagement activities) to help ensure that innovators and suppliers are aware of our needs. Our, collaborative approach to innovation in RIIO-ED1 has allowed us to develop a broad-based innovation 'eco system' including communities, stakeholders, academia, and the supply chain which we will look to build on in ED2.



All projects will be under constant review to ensure that it is still relevant, likely to deliver benefits and meeting the needs of the business. This will give the opportunity to amend and refine the project scope or even cancel the project, to avoid wasted time and effort.

Stage	Detail
Idea	Innovation ideas come from a broad range of sources. For an idea to progress to the next stage it must meet a pre-determined threshold as well as an identified project lead and senior sponsor. We have an open approach to idea generation – these will come from internal sources, external stakeholders, supply chains, communities, and academia. We will also issues Calls for Innovation to seek our solutions for specific challenges, additionally, we will also publish our Annual Innovation Priorities to raise awareness of our future needs.
Opportunity Assessment	This is a new stage in our innovation process, specifically included to ensure that we understand how the idea will deliver benefits. This will include initial scoping, identify opportunities to cocreate or involve stakeholders, understand most appropriate means to fund the projects and determine an initial CBA. This also includes an initial assessment on how the innovation could impact on our business. We will also undertake an assessment of how the potential project may impact on Vulnerable Consumers. This also provides a clear point to provide feedback to Innovators and External Providers.

Approval and Initiation	The purpose of this stage is to ensure that every innovation project that has achieved approval to proceed, is set up to succeed and increase the probability of seamless roll out into the business. As well as highlighting key risks, we also assess at this early stage what would be required for a successful roll-out at the end of the innovation project.
Delivery	Delivery of the innovation project, validation of assumptions to refine and develop the business case. The project will be subject to regular Stage Gate reviews, focussed on the CBA to ensure that the project remains on track to deliver the anticipated benefits. This gives the opportunity to refine the scope or cancel the project, as well as providing valuable lessons learned to shape future innovation projects.
Deployment Preparation	The key output from the innovation is to prepare for deployment, deliver a validated business case, understand the change management required training requirements all understood to ensure a smooth transition to BaU. This will include dissemination where appropriate and include requirements for tracking benefits from the innovation. Alongside our Annual Innovation Priorities we will also publish an Annual Innovation Benefit Update.

Innovation proposals will only progress beyond the ideas stage subject to rigorous assessment and confirmation that it can meet our business case requirements and be aligned with our key innovation principles, and to ensure we do the right thing as a business. When assessing an innovation, we will consider

- **Benefit mapping** – to ensure that the outputs are incremental to earlier work and avoid unnecessary duplication.
- **Delivery of benefits** - Cost Benefit Analysis will be used to ensure that the project delivers successful outcomes for customers, this will include an assessment of environmental or societal benefits. Our approach will include assessing how the project is best delivered, including whether we are best placed to deliver the project individually or whether a whole system approach (potentially involving multiple network firms collaborating on a solution) is most suitable. Where relevant and proportionate, we may use the industry standard approach to assessing whole system options developed by the ENA. The process will also consider wider customer benefits, environmental, safety and societal benefits.
- **Consumer Vulnerability Impact Assessment** – we will undertake an assessment of the project to identify any potential impacts on consumers in vulnerable situations, and if required put in place appropriate mitigations.
- **Deliverability** – to ensure that the project can be successfully resourced, the necessary consents can be secured, or any regulatory barriers overcome. We will also ensure that all the stakeholders have the resources and capacity to deliver the project.
- **Technical compatibility with our network and topography** – ensuring that any trial deployment can be successfully delivered.
- **Eligibility** – if the project is being proposed for NIA, then we will undertake an assessment to ensure that it meets the Eligibility Criteria.

Additionally, when developing NIA projects, we will ensure that they follow the good practise guidance which is set out in the Energy Networks Innovation Process (ENIP). This document is being developed by the ENA and will be used by all network licensees to ensure that NIA projects are delivered in a consistent, high-quality manner across the industry.

8.2 EIC ENGAGEMENT – KEY INNOVATION DELIVERY PARTNER

The Energy Innovation Centre[14] will be crucial to help SSEN deliver its innovation activities in RIIO-ED2. Our stakeholder engagement activities identified the need for greater transparency from DNOs, support for innovators and enhanced engagement opportunities. The EIC are well placed to provide an efficient and effective link between SSEN and the wider innovation community, with a key objective of "removing friction" from the innovation process.

The EIC is it not for profit Partnership, we were a founding partner when it was set up some 13 years ago. The Partnership now includes UK Power Networks, SPEN, Northern Power Grid, National Grid Electricity Transmission, Northern Gas Networks and Cadent. In addition, the partnership is increasing its associate partners which include Network Rail, Highways England and various water companies. The primary purpose of the EIC is to attract and accelerate innovation from a global innovation community to efficiently meet the challenges and needs of utility businesses in a cost-effective manner.

In its 13 years of operation, the EIC has developed a dedicated and focused team of experts that have a deep understanding of the needs of innovators and utility businesses. The Partnership has created a single route for innovators large and small to access the industry. Through the cocreation of standardised processes and legal contracts, we now have direct access to an evolving global innovation community of over 8,000 innovators and more recently to an academic community of over 150 academic institutes. Of these 8,000 innovators, over 15% are located out with the UK, hence, this brings a real opportunity to understand international best practise to the improve our innovation activities and accelerating the potential to deliver benefits.

For the sector, working through the Partnership avoids duplication of resource, effort and cost. Working in collaboration represents a significant cost saving for each partner company. By way of example, the EIC team will review and manage over 350 independent proposals received from innovators who wish to present these to the industry each year. 119 of those specifically targeted SSEN, of which 48 of those proposals were developed and shared with us. This triage process is undertaken once for all Partners, saving time and money for network businesses and the innovators. For those innovator companies who have a potential viable solution, the EIC provides education and supports them throughout the process. The EIC also works with network businesses to continually improve and accelerate innovation through to BaU.

It has developed cultural transition and human behavioural change programmes that, running alongside technological innovation, will make SSEN a truly innovative organisation.

[14] https://www.ukeic.com/

The EIC, on our behalf work tirelessly to gain insight and understanding from the innovator stakeholder community. Through surveys and a focussed Innovator Impact Panel, we learn first-hand the challenges innovators face in working with large utilities. These insights are then translated into action plans that result in changes to how we and other EIC Partners operate to improve the experience of innovators. Changes that ultimately deliver greater value and benefits to all our stakeholders, especially the energy consumers. The EIC is a core part of how we collaborate with other energy networks as part of taking a whole system approach. An Innovator and Industry Charter was created and signed last year by all member CEOs who agreed that their businesses would work together address key barriers to the deployment of innovation experienced by innovators.

As a founding Partner to the EIC, we have seen the Partnership deliver tangible change across the sector. The consistency of operation across the Partners has seen an increased number of new market entrants to our sector. A key signature activity of the EIC is its “calls” process. The EIC has learned to translate the needs of our business into the language of its global innovator community. In the last 12 months the calls process has achieved a success rate over 90% for DNO Partners delivering potential solutions to all our business challenges.

During that same period, each call has attracted approximately 30% of new innovators to the industry. This ensures the innovator community continues to evolve and expand to meet the changing needs of our business. The challenges ahead for our sector are great and we need to access as much expertise as we can to meet those challenges. With the continued growth of our innovator community, our continued focus on partnership working and by reducing barriers to deployment we will be able to achieve more and better for less.

Over the past five years, over around a quarter of our NIA innovation portfolio has been delivered through the EIC, the default position is to open all innovation calls and opportunities for collaboration. The EIC team ensure that all Partners have visibility of all activity. Collaboration across EIC Partners is significantly higher than those companies outside of the Partnership. SSEN, alongside its Partners has leveraged approximately £4.3m additional funding for innovation through EIC collaboration over the past five years. This approach provides us with an opportunity to align our innovation portfolios on an ongoing basis to remove duplication and maximise shared learning across businesses.

The EIC platform and its resources and expertise provide, across the supply chain, an efficient and proven method of efficiently and cost effectively accelerating innovation to BAU. Partnership also helps de-risk the innovation process. All of which the result of the highly co creative way in which the centre has evolved. In an industry first collaborative survey to the innovation community, 87% of respondents supported network businesses continuing to work through organisations like the EIC as they recognised the value it delivers across the supply chain. Additionally, positive feedback was received in relation to the support and education delivered through the EIC from our stakeholders via our webinars undertaken in preparation for our RIIO2 business plan.

Further details on our engagement with the EIC and value it brings is included at Appendix C

8.3 POWER NETWORK DEMONSTRATION CENTRE

Academia offers the potential to improve the quality and rigour of our innovation activities, especially as we become ever more focussed on Whole System solutions. Central to our academic engagement in RIIO-ED2 will be our ongoing commitment to the PNDC. The PNDC, part of the University of Strathclyde, is a unique facility built around a physical test and demonstration environment, consisting of 11kV to low voltage distribution network at scale, and including associated electrical and simulation capabilities. The centre currently brings together academics, industrial organisations, and technologists to define and execute **pre-commercial research, development, test and demonstration projects with the aim of shaping and optimising smart energy networks of the future.** PNDC was established by founding partners SSEN, SPEN, and the University of Strathclyde and has been fully operational since 2014.

The key benefit of the PNDC is the ability to install new equipment on a demonstration network and then operate that equipment across a wide range of operating scenarios within a compressed timescale. This has been shown to significantly reduce the time required for trials when compared to a typical field trial, in some cases this has been shown to be up to five years. Additionally, the PNDC has the ability to create simulated network faults and other anomalies to provide a much broader evidence base which significantly reduces the risks associated with any future deployment and providing investment grade outcomes to inform future decision making. The PNDC provides further opportunities for cocreation and further leveraging funding from across their wider portfolio of activities.

The PNDC will continue to play a key role in our RIIO-ED2 NIA and Totex funded programme. A more detailed paper laying out the benefits of our membership of the PNCD can be found in Appendix D.

8.4 REPORTING ON THE IMPACTS OF OUR INNOVATION

In RIIO-ED1 we have been implementing solutions into BaU following the successful completion of innovation projects. The demonstration that innovation investment is delivering value for money is crucial, and throughout RIIO-ED1 we have been actively tracking and reporting on both quantitative and qualitative benefits in the E6 tables in the Regulatory Reporting Pack, as well as the associated Environment and Innovation Report, following completion of projects and subsequent adoption of the final solution. We have also developed an internal reporting system to complement the annual E6 Table RRP returns, which enables clarity of the financial and societal benefits that have been delivered from innovation. These reports are cascaded across the business at periodic intervals to enable trend analysis and share successes with stakeholders.

Monitoring and reporting of benefits is an essential activity and we work to support the business to ensure consistent application, benefits reports offer a visible and comparable analysis to ensure that the forecasted benefits are realised and increase the likelihood of return on investment.

We will continue to track and report on benefits in RIIO-ED2, and in recent years we have worked with the EIC, GDNs and other DNOs to develop a collaborative, industry-wide framework to report on the outputs and outcomes of innovation. This Innovation Measurement Framework, facilitated by

the ENA and described in the Energy Networks Innovation Process, is currently concluded by the ENA Innovation Manager group. This will act as a balanced scorecard, capturing key outcome measures from innovation in a concise and consistent method across networks.

As stated previously, in response to stakeholder feedback, we will publish an Annual Innovation Benefit Update, to share the outcomes of our projects, and how the benefits are being realised.

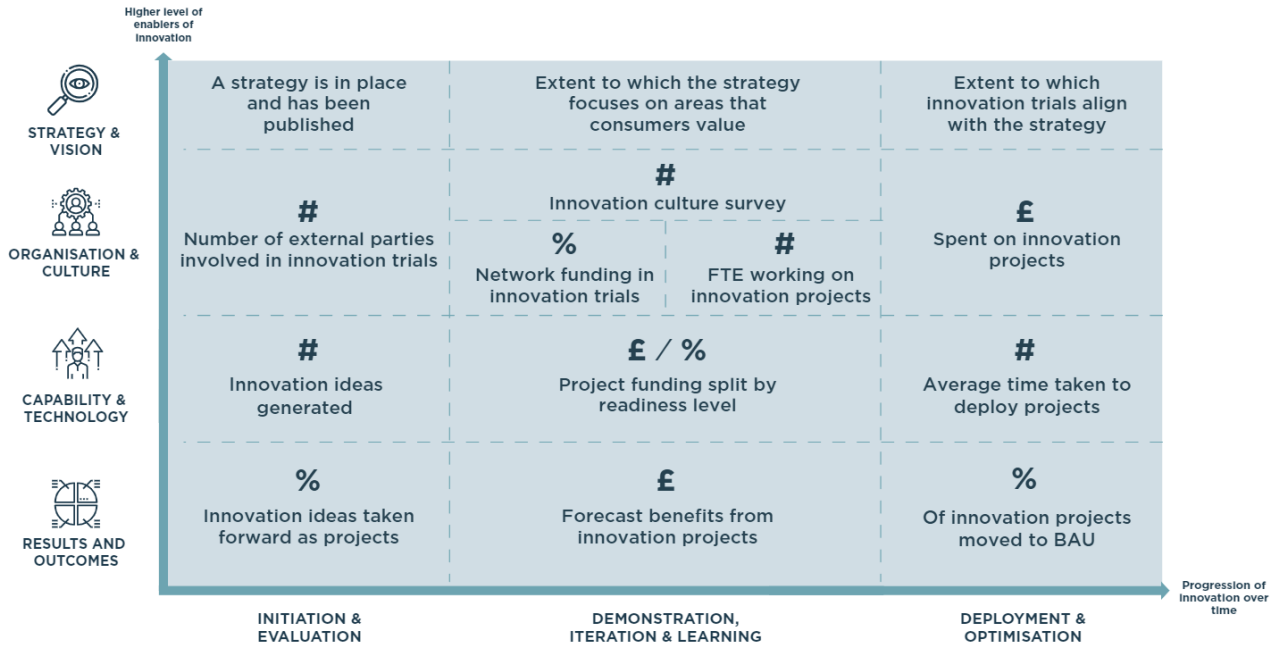


Figure 8 – ED2 Innovation Measurement Framework

8.5 SHARING KNOWLEDGE AND ASSESSING IMPACT

Our stakeholders have identified transparency (E088) as a key element to the delivery of a successful innovation strategy, therefore, we will deliver a comprehensive suite of dissemination activities across the ED2 period. This will include a range of physical and virtual events organised by SSEN as well as wider industry events such as the Energy Networks Innovation Conference. In addition, we have upgraded our innovation website, where full details of our innovation activities are available, along with a comprehensive documentation on project outcomes.

To deliver our ongoing engagement activities and commitment to cocreation, it is crucial that we continue to share the outputs from our projects, with other licensees, suppliers, local, regional, and national government and our wider stakeholder community.

In ED1, we delivered a comprehensive programme of dissemination event and activities, which covered the full spectrum of our activities. In the, last two years we have engaged with over 2000 stakeholders across nearly 30 separate events to share the outputs from our projects. These events ranged from a specific Solent Achieving Value from Efficiency (**SAVE**) project event at the House of Parliament, to local events in the community as well as a range of webinars and conferences. In addition, in our innovation website contains full details of all our projects as well as a comprehensive library of supporting literature - **https://ssen-innovation.co.uk/**

Appendix A ENHANCED ENGAGEMENT

- Overview: **We will continue our innovation programme, expanding and refining as the opportunities to employ these solutions increases with the growth of low carbon technologies on our network**
- Total cost: **£17.5m NIA funding**
- Contribution to annual customer bills: **N/A**

RIIO-1 CONTEXT

During ED1, innovation investment totalled £16.1m. This was derived from NIA funding and has delivered up to £80.7m of benefits for our customers and our business. We forecast this will increase to over £89m by the end of ED1. We anticipate that the ongoing utilisation of these deployed innovations will produce a further £19m of benefits from their continued use in ED2.

ENGAGEMENT SYNTHESIS

Stakeholder engagement	
Engagement details	**Insights derived**
Domestic customers We deliberated on innovation with customers via a Citizens' Jury to understand their views on the value that it can deliver for customers	• Participants saw benefit to SSEN's innovation plans: they understood the benefits that could be delivered by spending on innovation such as long-term improvements to the environment, reliability & affordability [E149] • Participants suggested that issues such as the climate crisis are best tackled in partnership and this could contribute to reduced cost for UK consumers. [E149] • Efficiency savings would be shared with consumers. [E149] • Make employment impacts from innovation transparent. [E149]
Vulnerable customer representatives Citizens Advice provided their views on all DNOs draft Business Plans via a published report, and we engaged them directly via a bilateral about our Draft Plan Innovation strategy and outputs	• CA asked whether there are cheaper/better options than RaaS (Resilience as a service) which could be revisited for ED2. [E159] • DNOs should show how they have identified and are implementing innovation from other companies and sectors. [E176]
Supply chain, partners, local community groups	• Stakeholders widely accepted our five innovation principles [E056].

We engaged stakeholders via online Innovation Workshops (which included Sli.do polls) in the north and south to co-create our innovation principles, themes and priorities for ED2	• Short interruptions should be considered as they may become an increasing issue for ED2 given the future needs of the network. [E056] • 'Net-zero/low carbon technologies' was considered the most important of the ten categories of the themes, with 'connections' and 'customer service' being seen as the least important. [E056] • Consider timescales as a potential barrier e.g., renewable developers can't wait years for enabling innovations to be approved. [E056] • Aim for carbon negative, with engagement on community energy, energy storage to support connection issues, and new smart microgrids for new zero carbon developments. [E056]

DNOs, technology providers, and SMEs
We engaged stakeholders via an online Innovation Workshops (which included Sli.do polls) to co-create our innovation principles, themes and priorities for ED2
	• 83% stakeholders supported our updated key principles. [E088]
	• To ensure the innovation process for digitalisation recognises customers in vulnerable situations, stakeholders suggested:
	  ○ Models providing insights on real-time data and linkage to health service databases
	  ○ Ensure inclusion by a 'Smart and Fair?' assessment. [E088]
	• 91% of participants agreed with the EIC proposals to help combat the barriers innovators face including:
	  ○ Increased co-ordination with other industry organisations to ensure appropriate signposting is available
	  ○ Active promotion of relevant funding opportunities
	  ○ Continue the drive to accelerate the pace of innovation and decision making
	  ○ Earlier commercialisation and support/ Increased visibility of BAU transfer process
	  ○ Open sharing of data / Improve quality and timely feedback / Improved visibility of technology or innovation roadmaps. [E088]
	• To ensure our innovation process for digitalisation recognise customers in vulnerable situations:
	  ○ Include check lists for each consultation/design/test etc and engage with vulnerable customer organisations
	  ○ Analytics/data science models providing insights on real-time data
	  ○ Linkage to health service databases. [E088]
	• To provide more value to stakeholders:[E088]:
	  ○ Make available data on where there is unconstrained access for generation;

	○ Provide standard security protocols to enable inter-connectivity of data sources; ○ open-source tools providing data on low-voltage networks to aid distributed energy generation and storage assets, LV network optimisation/operation and partnerships; creation of heat maps on capacity, demand and other resources; ○ provide access to our modelling environment and network test facilities; ○ guided customer journeys
Distributed generation customers, local authorities We engaged with stakeholders via an online workshop to gather their feedback on our proposed measures and strategies to support Scotland's remote islands and improve resilience there, with a particular focus on investment in subsea cables and innovation approaches	**Innovation – Island flexibility and resilience** • RaaS should play a major role in ED2 as there is a lot to learn from previous work on community-owned off-grid networks and there would be many opportunities because of increased use of battery storage. [E097] • CMZs would benefit from more strategic planning and closer collaboration with local communities. They do provide opportunities to facilitate operations for private generators. [E097] **Innovation – Island reliability** • Establishing real time monitoring across the network to facilitate net zero objectives, currently the approach is impromptu and inconsistent across the network. [E097] • Proactively offer spare capacity in our cables for projects with a community need and dove-tail into more national policies for rolling out fibre cables in rural areas. [E097].
Citizens Advice Scotland Research undertaken to gain consumer awareness of and satisfaction with Scotland's gas and electricity distribution network investment	• Consumers participating in this research gave low priority to investment in innovation and they struggled to envisage how a 'smart, flexible, and responsive' network will be achieved without significant disturbance to daily life. This indicates the scale of challenge energy networks face in affecting the energy transformation. [E081] • Younger consumers were more inclined to allocate priority to innovation than those in older age groups (and significantly so for electricity distribution) – more aware of the need for change in response to the climate emergency and may well be more receptive to the adoption of new technologies providing services such as flexibility and energy storage. [E081]

EVIDENCE STATISTICS

ED2 ENGAGEMENT EVENTS	INSIGHTS	STAKEHOLDERS ENGAGED
12	47	1,791

STAKEHOLDER SEGMENTS ENGAGED

CONSUMERS	Domestic customers	Customers in vulnerable situations	Transient customers	Next generation bill payers	SMEs	Major energy users	
CUSTOMERS	Distributed generation customers	Builders and developers	Community energy schemes	Landowners/ farmers			
POLICY MAKERS AND INFLUENCERS	Government	Research bodies, policy forums and think tanks	Media	Consumer groups	Regulators		
COMMUNITIES AND LOCAL DECISION MAKERS	Local authorities	Charities	Academic institutions	Housing associations			
	Vulnerable customer representatives	LEPs	Emergency response	Healthcare	Community interest bodies		
WIDER INDUSTRY AND VALUE CHAIN	DNOs	Transmission	GDNs	Water	Telecoms	IDNOs	
	ICPs	Consultants	Energy suppliers	EV charging	Other supply chain	Storage and renewable providers/ installers	Transport and highways agencies
PARTNERS AND ENABLERS	Current and future employees	Contractors	Service partners	Shareholders	Investors	Business advisers	Trade unions

EVIDENCE ASSESSMENT

ENGAGEMENT SCORING KEY

The engagement score assigns a weight to each source accounting for the robustness of the engagement event and the relevance of the feedback to the topic.

Overall Score	Description
1-1.66	Limited evidence of good event planning, methodology or data collection. Feedback provided is high level with tangential relevance to the topic.
1.67-2.33	Good evidence of engagement planning and discussion of data collection methods, but limited depth of feedback and range of opinions. Feedback not necessarily fully aligned to the topic and only provides a limited insight and thus moderately useful.
2.34-3	Well conducted, trustworthy event with highly relevant feedback. Specific, clear and relevant information with clear link to the topic discussed and high value added.

Phase	Date	Event ID	Event name	Key stakeholder groups	Number of stakeholders engaged	Engagement score
Phase 4: Testing and Acceptability	Sep-21	E176	Citizens Advice report on DNO Draft ED2 Business Plans	Consumer groups	1	2.0
	Aug-21	E159	Customer Service and Consumer Vulnerability Bilateral and Survey on Draft Outputs	Consumer groups, Local Authorities, Research Bodies, Vulnerable Customer representatives, Charities, Water and Energy Suppliers	21	2.0
	Jul-21	E149	Citizens' Jury	Domestic Customers	34	3.0
	Jul-21	E172	Customer Service and Consumer Vulnerability Internal Engagement	Current and future employees	74	1.5

Phase 3: Business Plan Refinement	Apr-21	E148	Corporate Affairs Bilats	Government, Consumer groups and Charity	6	1.3
Phase 2: Co-creation	Dec-20	E021	Connections engagement - ED2 focus groups - Distributed Generation	Distributed generation customers	6	1.3
	Dec-20	E056	RIIO-ED2 Innovation Event - North and South	Other supply chain, domestic customers	63	2.5
	Feb-21	E088	ED2 Innovation workshop	Other supply chain, SMEs, DNOs	25	2.5
	Feb-21	E097	Remote Island Communities workshop - Inner and Outer Hebrides	Distributed generation customers, local authorities, charities	20	2.5
	Sep-20	E081	Citizens Advice Scotland survey on Consumer Insights on the Future of the Gas and Electricity Distribution Networks in Scotland	Domestic customers	1,507	2.0
Phase 1: Open Discovery	Mar-20	E015	SSEN Distribution ED2 Online Workshop - Northern Scotland	Wider industry and value chain, Consultants, ICPs	27	2.0
BAU Insights	Apr-18	E002	Annual Report from the Stakeholder Advisory Panel	Business Advisors, Current and future employees	7	1.8

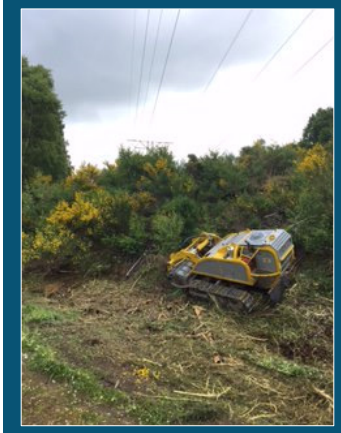
MEASUREMENT OF SUCCESS

The table below sets out the benefits that the innovation strategy and output will deliver to customers.

Metric/Output	Northern Target	Southern Target	Comparison to RIIO-1	Cost in Baseline Plan	Consumer Benefit
Deliver a portfolio of projects with value for money calculated for each individual project	Positive benefits case for each project	Positive benefits case for each project	NIA funding of £16.1m and benefits of £89.0m (end ED1)	£17.5m (NIA funding)	Reduced costs
Publish an annual Innovation Deployment Customer Report to improve the transparency of the benefits of our innovation programme	Report published	Report published	New output	Incremental	Improved transparency of benefits. Innovation programme reflects customer priorities.

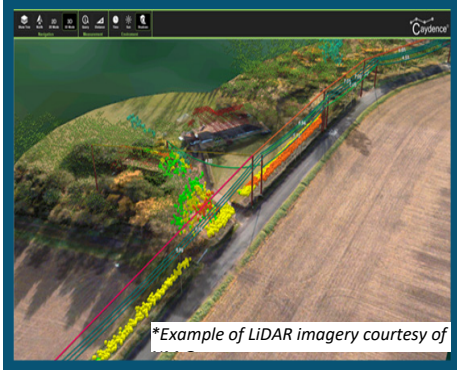
Appendix B BENEFITS FROM DEPLOYED INNOVATIONS IN ED1

Name of Innovation	Live Line Tree Felling
Area of Business Plan	Tree Cutting
Strategic Theme(s)	Deliver a safe, resilient and responsive network
Year of Delivery (ED1)	2015/16
	The Live Line Tree Harvester is a machine which allows felling of trees within falling distance of overhead lines without the need for a planned outage. This avoids CI and CML costs associated with the outage and the need for temporary generation. It is also safer and faster than traditional manual felling techniques. SSEN deployed two Live Line Tree Harvester into BaU at the start of RIIo-ED1 following an Innovation Funding Incentive (IFI) project which concluded in 2014. For more information see: https://www.smarternetworks.org/project/2007_08

Name of Innovation	Remotely Operated Forestry Mulcher
Area of Business Plan	Tree Cutting
Strategic Theme(s)	Deliver a safe, resilient and responsive network
Year of Delivery (ED1)	2016/17
	The Forestry Mulcher is a remotely operated machine which can clear vegetation from around overhead lines. The machines are more effective than clearing the equivalent location by hand with chainsaws and chippers and can tackle hard to reach areas such as 45-degree banks. As the mulchers are operated remotely, they also offer a safer option for removing vegetation around overhead lines. SSEN deployed two Forestry Mulchers into BaU in 2016/17 as part of an NIA project. These units have since been replaced in 2020/21 with newer models which are lighter, more powerful and use less fuel. For more information see: https://www.smarternetworks.org/project/nia_ssepd_0018

Name of Innovation	LV Automation
Area of Business Plan	Reliability
Strategic Theme(s)	Deliver a safe, resilient and responsive network
Year of Delivery (ED1)	2015/16
	LV Automation uses a smart fuse and fault location technology which can automatically replace LV fuses when one has blown, meaning customers only experience a temporary loss of supply. This means that SSEN do not incur any CI or CML costs as power can be restored within the three minutes. In addition to auto fuse replacement, the suppliers of the technology, also provide a fault location service, whereby they can locate the position of transient faults on a cable before the damage turns into a full-blown fault. This allows us to schedule preventative repairs avoiding fault conditions. SSEN deployed the technology straight into BAU in 2015/16 as a fast follower from an IFI project completed by ENW. For more information see: https://www.smarternetworks.org/project/enwt1001

Name of Innovation	Thermal Imaging Cameras
Area of Business Plan	Reliability
Strategic Theme(s)	Deliver a safe, resilient and responsive network
Year of Delivery (ED1)	2017/18
	Thermal Imaging Cameras were introduced to the business in 2017/18 following the success of our original NIA project. The cameras assist in the location of LV underground faults by detecting heat emitted from damaged cables. This helps to effectively pinpoint the fault, reducing the time that customers are off supply and the number of excavations required to restore supply. For more information see: https://www.smarternetworks.org/project/nia_ssepd_0021

Name of Innovation	LiDAR
Area of Business Plan	Asset Data
Strategic Theme(s)	Deliver a safe, resilient and responsive network
Year of Delivery (ED1)	2016/17
 *Example of LiDAR imagery courtesy of	SSEN invested in state of the art Light Detecting Aerial Radar (LiDAR) technology following an NIA project by National Grid. The technology offers airborne laser scanning techniques which use aircraft to produce 3D surveys of the network. This data can then be used to inform tree cutting and maintenance works by determining power lines and assets at risk of tree or vegetation interference. The aerial laser scanning system is much faster than foot-patrolled line inspections and allows inaccessible areas to be monitored more effectively. SSEN have mapped overhead assets in both our North and South regions. For more information see: https://www.smarternetworks.org/project/nia_nggt0116

Name of Innovation	Hybrid Generators
Area of Business Plan	Customer Service
Strategic Theme(s)	Accelerate progress towards a net zero world
Year of Delivery (ED1)	2019/20
	Hybrid generators are temporary mobile generators that combine a diesel generator and battery storage system. This setup is more effective than using a diesel generator alone as the battery storage system allows the hybrid generators to run at optimum loading levels, reducing fuel consumption and carbon emissions. There is also significant noise reduction and improved air quality for customers. SSEN currently have [redacted] 26kVA hybrid generators which were procured following learnings of our IFI project. For more information see: https://www.smarternetworks.org/project/2011_14

Name of Innovation	Active Network Management and Constraint Managed Zones
Area of Business Plan	Load Related
Strategic Theme(s)	Accelerate progress towards a net zero world
Year of Delivery (ED1)	2015/16

SSEN have deployed a variety of flexible solutions over ED1 to reduce constraints on the network. These include:

- ANM– this applies to areas where there are several complex constraints affecting a number of customers over a period of time. The ANM solution monitors limits on the network in real time, providing the maximum amount of capacity available to generation without overloading the network. ANM has been deployed in the Western Isles, Isle of Wight and Orkney to allow generators to connect ahead of network reinforcement.

- CMZs – these are small scale operations that offer security to constrained areas of the network via local generation, demand side response, energy storage and stand-by generators. CMZ schemes are generally temporary and deployed to cover periods of planned maintenance, fault conditions or increased demand. The schemes mean the use of diesel generators or network reinforcements can be minimised, saving operational costs and reducing carbon emissions. SSEN currently have two active CMZ schemes in the Western Isles and Isle of Islay.

For more information see: https://www.ssen.co.uk/FlexibleConnections/

Appendix C ENERGY INNOVATION CENTRE

EIC Together we innovate | May 2021

EIC

Together we innovate

EIC Partnership Unique Proposition & Benefits

Cadent Your Gas Network

Northern Gas Networks

NORTHERN POWERGRID

nationalgrid Electricity Transmission

Scottish & Southern Electricity Networks

UK Power Networks Delivering your electricity

SP ENERGY NETWORKS

1

EIC Together we innovate

May 2021

Executive Summary

The EIC Partnership

1. Not for Profit & Established for 13 years
2. A single low cost, low risk, agile and proven gateway for innovators
3. Access to an EIC managed global Innovation community (see EIC Innovation Community Detail)
4. Innovator support, motivation & education programme
5. Access to open multi-sector collaborative innovation
6. The resources and expertise to facilitate collaboration across multiple sectors
7. Partner-approved and established end-to-end innovation support and validation
8. A trusted & established sector voice that promotes innovator interests to key stakeholders

Primary Benefits

For Partners and Energy Customers

1. **Internal Cost Savings** (see 1 below)
2. **Project Financial Benefits** (see 2 below)
3. **Funding Leveraging** (see 3 below)
4. **Whole system & multi sector collaboration**
5. **Collective Innovator engagement & support** (As requested by Innovators)
6. **Reduced transaction cost** to engage with Innovators
7. **Increased Transparency** (EIC led initial development of Innovation Measurement Framework to access NIA)

For Third Party & Innovators

1. **Single, funded gateway** to access the industry
2. **Bespoke education, coaching and support to innovators**
3. **Accelerated and increased innovation** through continual engagement with innovators
4. **Increased rate of success** in innovation through established networks, insight and expertise
5. **Reduced transaction cost to access industry** experts through sector wide coordination
6. **Ability to influence and affect change** in Network behaviours and culture.
7. **Providing innovators with a collective voice**

Partners and Energy Customer Benefits in Numbers

1	Up to 50%	Internal cost Savings on innovation activity
2	£50m+	Project financial benefits expected in the next 7 years (Based on benefits calculated by Partners)
3	£4.3m	Average funding leveraged per Partner over the past 5 years
4	57%	Ideas reviewed but not presented, saving time for both Innovators and Partners (Average across all Partners in 2020/21)

Additional benefits

Innovators Insight	Higher quality of interaction for Innovators	Contribution to cultural development
Faster Pace of Collaboration	Shared Industry Service	External Perspective

2

Evidence of Partners Benefits Numbers

Partners Benefit 1 (Internal Cost Savings)

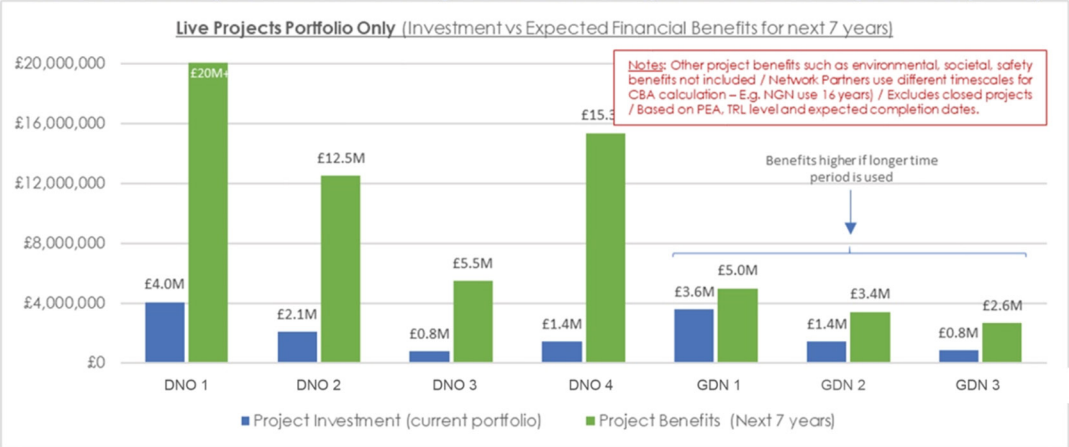
1. Analysis undertaken by Gas EIC Partner
   - The analysis focussed on SME engagement through Innovation Calls, projects development, legal framework & projects delivery support.
   - Gas EIC Partner calculated that the average unit cost for the above end-to-end process via the EIC is £11k.
   - Gas EIC Partner calculated that the cost to undertake the same activities using internal resources (i.e. Engineering, legal & co-ordination resources) would be £20k.
   - **This analysis demonstrated that the EIC is 45% cheaper**.

2. Analysis undertaken by the EIC
   - The Analysis focussed on all key EIC activities and an assessment was made of the minimum level of resources that would be required by each Partner.
   - This analysis concluded that the minimum cost of replicating the EIC would be circa £280k per Partner (Market rate for salaries was assumed).
   - **This analysis demonstrated that the EIC is between 20% and 50% cheaper**.

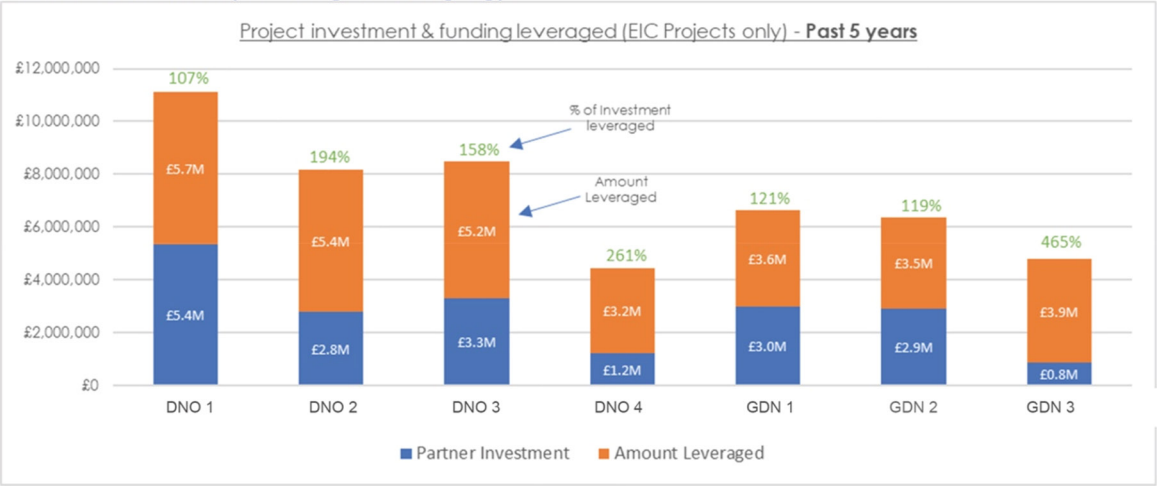
Counterfactual: Should the EIC Partnership cease to exist there would be a reduction in efficiency and effectiveness of innovation across the board due to:

- The absence of a single Gateway for SMEs.
- A lack of consistency across DNOs & GDNs leading to reduced quality of interaction for Innovators.
- Less efficient processes resulting in reduced collaboration & benefits (i.e. Funding leveraging, benefits from projects, etc.).
- Increased cost to Network partners and Innovators.

Partners Benefit 2 (EIC Facilitated Projects Benefits / April 2021 Live Projects Snapshot)

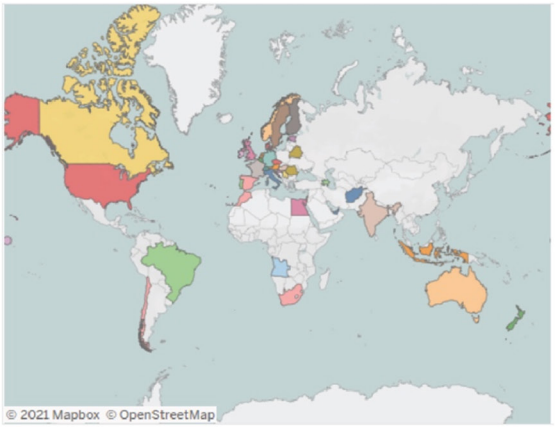


Partners Benefit 3 (Funding Leveraging)



EIC Innovation Community Detail

Innovation Community Geography



May 2021 Snapshot

- **8,000** Innovators
- **75%** Small & Medium-Sized Enterprises
- **15%** International Innovators
- **> 50%** Primarily operating outside Electricity sector
- **115** Relevant capabilities including IoT, Health and safety, Robotics, Artificial intelligence, Low Carbon Technologies, Data Management, Customer Service, Operational Improvements, Vulnerable Customer, New materials, etc.
- **Active development and engagement** to facilitate access and ensure current / future needs are met.

Appendix D PNDC MEMBERSHIP

General

The Power Networks Demonstration Centre (PNDC), part of the University of Strathclyde, is a unique facility built around a physical test and demonstration environment, consisting of 11kV to low voltage distribution network at scale, and including associated electrical and simulation capabilities. The centre currently brings together academics, industrial organisations and technologists to define and execute pre-commercial research, development, test and demonstration projects with the aim of shaping and optimising smart energy networks of the future. PNDC was established by founding partners SSEN, SPEN, and the University of Strathclyde and has been fully operational since 2014. The centre is currently broadening its capabilities and partner network to focus on the validation and acceleration of whole system solutions.

With its focus on accelerating innovation in the mid-to-late TRL, the centre delivers accelerated technology and system validation using its flexible real-world demonstration environment, coupled with a rich portfolio of research across all aspects of the energy system. This highly innovative activity is underpinned by collaboration with industrial partners and is supported by leading academic expertise from within the University of Strathclyde. The outputs of PNDC's innovation activity provide critical acceleration of technology solutions into BaU application.

Evolution into Whole Systems Innovation

There is broad recognition of the need to adopt whole systems approaches to support the delivery of net zero emissions targets. In this context, opportunities exist across our energy networks to develop innovation programmes that examine the societal, environmental, and economic impacts of energy pathways and choices, as well as the challenges surrounding technological progression in these areas. In particular, the decarbonisation of the heat and transport sectors will be critical to the UK realising its net zero target, with significantly increased electrification likely to play a key role in its delivery.

However, it is clear that there will be a need for new whole energy system solutions to ensure that system resilience and flexibility is maintained whilst delivering affordability and service reliability to all consumers, including people in vulnerable situations.

PNDC has recognised the need for an innovation environment that can support the development, de-risking and acceleration of new whole energy system technology solutions and services, and that can simulate and provide real-world validation of the wide range of critical functionalities that will be required for the future energy system. It has also recognised the need to deliver innovation activities across the

whole value chain from networks through to consumers. PNDC is therefore rapidly growing its facilities, capabilities and partnership network[15] in line with these requirements.

This evolution of PNDC provides benefits including the ability to identify critical network intervention points prior to network stress events being reached, the development and validation of future control scenarios, and the delivery of insights into the required levels of future system autonomy and insights that can inform network operator reinforcement infrastructure business cases. It also supports the maximisation of the economic benefits from available data.

Furthermore, to date PNDC has secured over £8m of capital funding from UK and Scottish Government to enhance PNDC capability to drive the whole systems agenda and support growth. This new infrastructure positions PNDC as a national whole systems industrialisation centre and will be accessible to all PNDC members. It creates a low carbon transport and propulsion systems hub, with around £1.5m specifically allocated for new EV integration infrastructure at PNDC. Additional funding of around £10m is currently being sought to expand the existing PNDC network facilities to support further heat and transport electrification activities, and to create new heat and hydrogen infrastructure to support activities aligned with our broader whole energy systems agenda.

The UK funding is part of their broader UK challenge investment of over £80m focussed on stimulating the UK power electronics, machines and drives supply chain to support a number of sectors, including energy. PNDC's role as host of Scotland's national innovation facility as part of this challenge will attract partners across government, industry and business to use our systems, manufacturing expertise, and facilities to develop innovative solutions that contribute to the realisation of the whole systems transition.

PNDC is growing its expertise in hydrogen systems through its involvement in the Hydrogen Accelerator Programme funded by Scottish Government, and in partnership with St Andrews University. This enables PNDC to inform SSEN of hydrogen system supply chain opportunities and provide informed insights into Hydrogen's role within the decarbonisation of the heat and transport sectors.

Delivering Value Through the PNDC Programme

PNDC's unique real-world demonstration platform and staff expertise deliver value through its collaborative research (core) programme, which has concluded over 200 innovation projects to date, delivered by PNDC and the other DNO members SPEN and UKPN. The value of this programme has totalled over £4.75M since 2014, and SSEN has benefitted from a 4:1 ratio of leveraged investment for this programme through PNDC membership.

The close collaborative nature of the PNDC research programme offers a unique collection of benefits, including:

Efficiency and sharing of benefits & risk – the shaping and subsequent implementation of the PNDC research portfolio in conjunction with SSEN, SPEN and UKPN ensures that PNDC's research activities are strongly aligned with common industry challenges (for example delivering the net zero transition and addressing consumer vulnerability) and address the key innovation objectives of a broad cross-section of the GB DNO landscape, thereby maximising research impact. The joint funding of PNDC's research

[15] For example, PNDC is partnering with the Energy Systems Catapult (through their Living Lab) to enable innovation activities that can interact in real-time with consumers

activities by the three DNOs delivers significant cost efficiency, enables the sharing of benefits & risk amongst the participating DNOs, and increases the likelihood of PNDC research outcomes progressing into business-as-usual; it also provides members with access to a broad and growing range of potential collaboration partners and technology suppliers.

A platform for the development and acceleration of whole energy system solutions - the centre started with a focus on electrical network innovation and continues to deliver valuable research and demonstration services in this area. Additionally, because of increasing external focus on the need for increased energy sector integration and the desire to further enhance the value of the centre, PNDC is expanding its capabilities to focus on the acceleration of integrated whole energy system solutions (incorporating electricity, heat, transport and hydrogen). This will specifically target key whole system innovation priorities of Ofgem and the ENA and will provide a platform to bring in new members from the gas sector, heat network sector and other multi vector whole system approaches. PNDC's whole energy system positioning is already underway and will be fully in place well in advance of the beginning of the ED2 period.

Accelerating & de-risking network-related innovation – the PNDC's unique combination of real-world network assets, communications and cyber security assets, modelling & simulation capabilities, and applied research capabilities enables the rapid development, de-risking and acceleration of new DNO-related technology and system innovations towards commercial reality. The knowledge and insight gained from these activities also feeds into the pipeline for future ideas and innovation opportunities for PNDC members, with the sharing of benefits and risk across members providing additional efficiency benefits.

An efficient route to leveraged external funding – over £5m of additional revenue funding and £8m of capital funding has been secured by PNDC over the last 3 years to support the PNDC's research activities. Section 2.4 provides additional details of this leveraged external funding and the potential new sources of external funding likely to materialise in the next 1-2 years. PNDC has also made a significant contribution in support of a number of successful NIA and NIC projects.

Enhancing skills, development & training – the staff and real-world network facilities at PNDC have been used to provide training for DNO staff in areas such as the installation and operation of new network technologies, thereby contributing to the development of energy sector skills and resources for the future. In addition, insights from PNDC projects have also contributed to the development of new installation and operating procedures for new technologies on DNO networks.

Providing a touchpoint to the wealth of expertise within the University of Strathclyde's academic community in support of research and project delivery, problem-solving, the generation of new ideas for research and innovation activities and attracting external funding.

In addition to the PNDC's core research programme, many projects have been delivered by PNDC where SSEN has either been the project lead or have collaborated with other DNOs. Examples of these projects are Future Control Room and Technical Enablers to Scale as a DSO.

Leveraging External Research & development Funding

PNDC's extensive network, which spans the wider energy supply chain, academia and industry, provides a platform for PNDC and members to leverage a wide range of funding mechanisms from national and international funding sources. By creating an environment in which small and medium-sized enterprises

(SMEs), industry partners and academia collaborate, this enables members to access funding to progress future facing concepts.

In total, over the last 3 years, PNDC has secured over *£3.6m revenue income* to support - and additional to - its core membership income.

Aligned Strategic Initiatives

In response to these evolving innovation needs, PNDC is currently implementing plans to grow its capabilities and develop its facilities into a "whole energy systems" innovation environment, including research activities in heat and transport, to complement its existing smart grid activities. In addition, PNDC is developing partnerships (such as with the Energy Systems Catapult) that extend its reach beyond technology and system innovation to include consumer interactions and business model trialling. **These developments position PNDC to a deliver unique set of whole system innovation services across the entire energy delivery value chain**.

A summary of how PNDC capabilities map onto Government and ENA innovation priority areas is provided in Figure 1. This demonstrates how the PNDC's facilities and capabilities are uniquely placed to support major whole energy system innovation projects in the mid TRL range over the ED2 price control period.

Figure 1 – PNDC alignment with ENA innovation priorities and Government priorities

Appendix E UKPN INNOVATION COLLABORATION

Company Sponsors

Collaborating Organisation	*Sponsor*	*Position*
UK Power Networks	[redacted]	Head of Customer Services & Innovation
SSEN	[redacted]	DSO Director / Head of Future Networks

Vision

At the date of this collaboration charter, UK Power Networks (UKPN) and Scottish & Southern Energy Networks (SSEN) intend to explore and deliver together Innovation Projects in the following focus areas:

- to share learning and best practise,
- to deliver a programme of innovation projects more efficiently,
- to innovate in Business as Usual (BAU) areas in RIIO-ED2,

which together result in the development and deployment of innovative solutions delivering customer benefits.

Initially the collaboration will focus on the improvement of network reliability (reduction of Customer Interruptions / Minutes Lost (CI/CMLs)) but may expand to include other areas in future.

Background

UKPN and SSEN have a long established but largely informal working relationship:

Shared Network Innovation Allowance (NIA) projects – there are five existing NIA projects where SSEN / UKPN are currently collaborating, with a value of over £4m

- Shared Network Innovation Competition (NIC) Projects – SSEN are amongst the partners in the Optimise Prime NIC project
- Shared Boundary – the shared boundary from Oxfordshire / Buckinghamshire down to the south coast results in many common operating challenges between the two organisations
- Shared Stakeholders – this shared boundary results in many shared stakeholders such as the Greater London Authority and Transport for London as well as local authorities along the boundary
- Shared Memberships – SSEN and UKPN are both very actively involved in industry initiatives including the Energy Innovation Centre (EIC) and the Power Network Demonstration Centre (PNDC). Both receive investment and provide opportunities for joint working

To date, most of the innovation activity has been funded from the NIA, but as we move toward RIIO-ED2 it will not be possible to use NIA funding for projects relating to CI/CML, operations or asset management. Ofgem's expectation is that these activities will be funded by DNOs. Without access to NIA support, the need for BAU funded innovation to be delivered efficiently and realise financial benefits becomes even stronger. By collaborating on projects there is an opportunity to share costs, share learning and leverage additional value from our investments in PNDC and EIC. This charter sets out the intent of UKPN and SSEN to collaborate on the objectives; it is not intended to create binding legal relations between the organisations.

Collaboration Objectives

The collaboration will have the following objectives:

1. To identify shared issues across both DNOs and share best practice to deliver measurable benefits to our customers – initially this will focus on network reliability improvement and CI/CML reduction.
2. To create a joint programme of Innovation projects during the remainder of RIIO-ED1 to continue through into RIIO-ED2. Initially funded by SSEN and UKPN from their respective NIA budgets, then from BAU innovation funding in RIIO-ED2 – the project lead and funding levels to be identified as appropriate.
3. To allow for a broad deployment of trial solutions, to develop a clear "line of sight" to BAU deployment and benefit realisation.
4. To leverage both parties' involvement with the EIC, using consistent and replicable commercial and collaborative agreements where possible, or other innovative procurement options

5. To support a collaborative, inclusive, environment that encourages the sharing of industry best practice and a collective understanding of the challenges of improving network reliability and how best to overcome them.

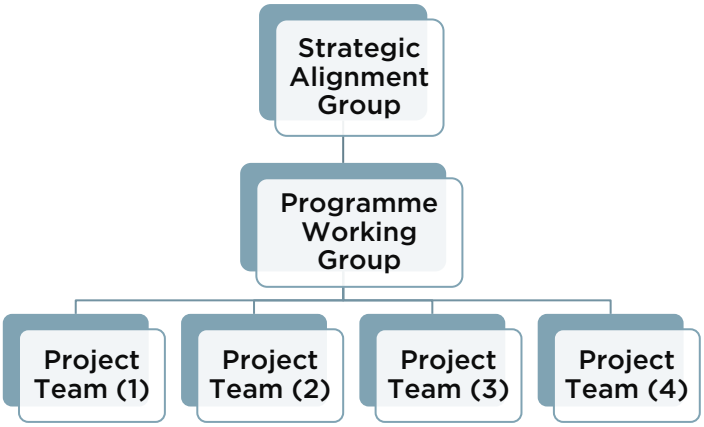
Success Criteria

The collaboration will be considered a success if the following criteria are met:

1. Undertaking at least four joint workshops (or 'Innovation Labs') to identify common problems and challenges over three years, these will be used to identify shared issues areas and potential projects.
2. Undertake four EIC-led 'Joint Innovation Calls' to resolve shared issues.
3. Jointly register two NIA projects (each DNO to lead one project) by the end of RIIO-ED1 and at least two BAU funded projects in RIIO-ED2 (each DNO to lead one project).
4. Deliver at least one investment ready deployment proposal to support BAU deployment of solutions from the joint work programme, with measurable benefits in performance.
5. Deliver joint dissemination and stakeholder engagement activities.

Governance

Governance of the collaboration to be provided by a three-level structure:



- **Strategic Alignment Group:** responsible for setting direction, agreeing joint investment/delivery priorities, ensuring appropriate staff and other resources are made available, and discussing and agreeing wider matters of strategic significance. Group of senior officers from the collaborating organisations.
- **Programme Working Group:** responsible for approving project execution plans, monitoring progress and risks across the collaboration portfolio, communications, establishing systems for sharing learning, and preparation of advice on delivering co-ordinated investment.
- **Project Teams**: responsible for the oversight of confirmed demonstration/pilot projects, including project specific quality assurance and best value, legal arrangements, procurement, risk management the progress monitoring.

This collaboration charter is not intended to, nor shall it be deemed to, establish any partnership or joint venture between UKPN and SSEN, nor make either party the agent of the other, nor authorise either party to make any commitments for or on behalf of the other party. Each party confirms it is acting on its own behalf and not for the benefit of any other person.

Appendix F RIIO ED2 INNOVATION DEPLOYMENTS

LV Network Monitoring

Name of Scheme	Low Voltage Network Monitoring
Area of Business Plan	Load
Strategic Theme(s)	Accelerate progress towards a net zero world
Reporting Table	CV11
ED2 TOTEX	[redacted]
Benefits	Better informed asset investment (Captured in Load related Plan build & Strategy to avoid double counting)
Planned Delivery Year	Throughout RIIO-ED2

With the onset of the DSO transition, rapid uptake of EVs and LCT, plus the need to utilise flexibility, DNOs will need visibility of demand and power flows on the Low Voltage (LV) network to inform decision making and ensure security of supply. Our New Thames Valley Vision innovation project and subsequent Low-Cost Substation Monitoring NIA project worked with manufacturers to produce and trial LV monitors which fulfilled functionality requirements whilst remaining low cost. The outcomes of the trial produced a unit at an 80% cost reduction which would be suitable for large scale cost-efficient LV network monitoring across GB.

To date over 700 monitors have been procured and 300 installed, with the majority planned for networks across SHEPD and SEPD that are estimated to be at risk of overload with EV uptake.

We plan a 'prioritised deployment' of LV monitors in RIIO-ED2, this will result in monitoring of all assets projected to be overloaded within RIIO-ED2, this will enable SSEN to

- Monitor of all assets projected to be using over 80% of their capacity within the RIIO - ED2 period.
- Allow proactive management of asset investment.
- Allow the ability to utilise flexibility on LV networks as a result of the new data flows giving enhanced visibility of network power flows.
- Dispatch restoration teams to LV faults more effectively and proactively thanks to the near real-time visibility from the monitoring equipment and the integrated alarm signals they produce in the event of a fault.

There will be a variety of benefits including efficiency savings, better informed connection decisions , CI/CML savings and improved investment management.

More information can be found in the LV Network Monitoring EJP.

On Load Tap Change Secondary Transformers

Name of Scheme	LV On-Load Tap Changer Secondary Transformers
Area of Business Plan	Non-Load Investment & Load Related Investment
Strategic Theme(s)	Deliver a safe, resilient and responsive network.
Reporting Table	CV7 Asset Replacement
ED2 TOTEX	[redacted]
Benefits	Consumer Bill savings for OLTC connected customers
Planned Delivery Year	Throughout RIIO-ED2

ENWL's Smart Street project trialled innovative LV On-Load Tap Changers (LV OLTC) to manage voltage levels on the LV network. The LV OLTC replace the conventional fixed tap changer built into 6.6kV/11kV Transformers (GM), allowing voltage to be regulated automatically in response to real time changes in demand and generation across the network. This setup allows DNOs to implement a technique known as Conservation Voltage Reduction (CVR) to reduce energy consumed by customers, reducing customer bills, CO_2 emissions and technical losses.

The LV OLTC can also add additional capacity to the network by alleviating voltage constraints caused by the adoption of LCTs such as photovoltaics and electric vehicles. This additional benefit will protect the network against future load growth and allow the distribution network to accommodate a higher penetration of low carbon technologies before wider and costly network reinforcement is required.

LV OLTC technology will be deployed as a fast follower in RIIO-ED2 as transformers are replaced based on their Health Score and Criticality. The deployment of LV OLTC technology will help to reduce customer bills, carbon emissions and support LCT uptake. In total we propose to install up to [redacted] of these units throughout RIIO-ED2.

More information can be found in the 6.6kV/11kV Transformers (Ground Mounted) engineering justification paper.

Transformer Auto Stop Start

Name of Scheme	Transformer Auto Stop Start (TASS) Technology
Area of Business Plan	Environmental Action plan
Strategic Theme(s)	Make a positive impact on society
Reporting Table	CV21 Losses & E4 Losses Snapshot
ED2 TOTEX	[redacted]
Benefits – 40 years	Reduction in Losses [redacted] , Carbon 595 tonnes CO2
Planned Delivery Year	Project to be delivered over the period of RIIO-ED2

In our LEAN project which concluded in 2019, we successfully demonstrated the use of the Transformer Auto Stop Start system (TASS). The LEAN project was funded via the Low Carbon Network Fund (LNCF) . The TASS technology reduces losses at 33/11kV primary substations by switching off one of a number of transformers at times of low demand to avoid the fixed iron losses associated with that transformer.

The technology has been successfully controlling automated switching on the SEPD network since June 2018, and over the course of the project (to December 2019) achieved losses savings of over 100 MWh from two primary substations.

TASS technology could be deployed across [redacted] sites in SHEPD and [redacted] sites in SEPD over the course of RIIO- ED2, helping us to operate more effectively, reduce technical losses and save up to 595.41 tonnes of CO_2 emissions over 30 years.

The primary drivers for this investment are:

- Sustainability - TASS reduces transformer losses in substations by switching out one of the transformers at times of low demand. On the trial sites transformer iron losses were reduced by around 25-30% (~3.5 MWh per month) at each trial site.
- Affordability - TASS control boxes are relatively inexpensive to install, the mid-range band for a unit being [redacted]
- Manageability - The aim of the TASS algorithm is to provide the intended automated transformer switching functionality in a safe, efficient and reliable manner. Additionally, the approach developed to identify suitable sites and implement TASS ensures that security of supply and quality of supply are not compromised.

More information can be found in the TASS engineering justification paper.

Hybrid Generators

Name of Scheme	Hybrid Generators
Area of Business Plan	Environmental Action plan
Strategic Theme(s)	Make a positive impact on society
Reporting Table	CV22 – Environmental Reporting
ED2 TOTEX	[redacted]
Benefits – ten years	Enhanced efficiency - [redacted] Carbon 1406 tonnes CO2
Planned Delivery Year	Project to be delivered over the period of RIIO-ED2

Hybrid generators have proven to be a successful innovation in RIIO-ED1 helping to improve operational efficiencies, minimise disruption to customers and support our drive for net zero through reduced carbon emissions. [redacted] 26kVA hybrid generators have been procured in RIIO-ED1 to replace ageing 30kVA diesel generators in our fleet.

In RIIO-ED2 we plan to procure up to an additional [redacted] 26kVA hybrid units ([redacted] SHEPD and [redacted] SEPD), replacing our 30kVA diesel generators as they reach the end of their operational life. By the end of the price control we plan to have replaced all of our 30kVA diesel generators with hybrid options, saving 5,600 tonnes CO_2 emissions over 15 years.

The primary drivers for this investment are:

- CO_2 emissions could be significantly reduced through replacing the current fleet of [redacted] 30kVA diesel generators with hybrid generators that run off battery storage when charged.
- Hybrid generators would also contribute towards a reduction in air and noise pollution.
- The current diesel generators are reaching their end of life and the new hybrid generators would have lower running costs.

At present a hybrid solution is only available at 26kVA and therefore only the 30kVA diesel generators will be replaced. There are options available at 100kVA, but SSEN is in the process of testing these hybrids. It is expected that more alternatives will become available over the next few years and SSEN will continue to work with suppliers on alternatives and develop their options.

More information can be found in the Hybrid Generators engineering justification paper.

Flexibility Deployment

Name of Scheme	DSO Readiness and Flexibility
Area of Business Plan	Load-Related & Non-Load-Related Investment, Whole System, Connections, Data, DSO
Strategic Theme(s)	Accelerate progress towards a net zero world
ED2 TOTEX	[redacted]
Benefits	[redacted]
Planned Delivery Year	Over the period of RIIO-ED2

The UK's electricity system is changing. The increase in small-scale renewables and low-carbon technologies is creating opportunities for consumers to generate and sell electricity, store electricity using batteries, and even for electric vehicles (EVs) to feed energy into the electricity system. To ensure the benefits of this transition are realised, DNOs are developing the DSO functions that will facilitate these emerging markets.

In RIIO-ED2 SSEN will invest in building the DSO Workforce Capability required to deliver the DSO functions which will accommodate the UK's changing energy system. This will build on learnings from numerous DSO orientated innovation projects that SSEN has been delivering in RIIO-ED1, including our flagship innovation projects LEO and Transition.

The investment will deliver significant benefits in RIIO-ED2 by reinforcing our 'Flexibility First' commitment and mitigating the need for costly reinforcement of our networks. Building a coordinated, efficient and cost-effective DSO operating capability is key to facilitating the delivery of the UK's net zero ambitions and will provide strong value to consumers.

For more information see the DSO Workforce Capability engineering justification paper.

Name of Scheme	SUBsense
Area of Business Plan	Scottish Islands Strategy
Strategic Theme(s)	Deliver a safe, resilient and responsive network.
ED2 TOTEX	[redacted]
Benefits	Estimated avoided Capex investment [redacted]
Planned Delivery Year	Throughout RIIO-ED2

In addition to our inspection programme we are proposing to spend of up to [redacted] on installing SUBsense cable condition monitoring on [redacted] of our existing subsea cables during RIIO-ED2.

SUBsense is the project name for Distributed Acoustic Sensing (DAS) which can be installed on submarine cables with an embedded fibre optic bundle. SUBsense is an internationally tested real time monitoring system that is being trialled in our current NIA programme. SUBsense was identified as being a solution to assist with fault finding and extending the useable life of submarine cables.

The technology gives us information and alerts if we have excessive cable movement on the seabed which can lead to premature wear or environmental damage. SUBsense will also give us alerts should any third-party intervention such as anchor snags occur. To operate SUBsense an embedded fibre optic cable is required. It uses a single core from the fibre bundle which are typically present on all recently installed submarine cables. As a default we will install subsense technology on all proactive cable replacement works in RIIO-ED2.

Consumer's benefit will be realised if we can extend the useable life of submarine cables from the data and alerts provided by SUBsense. Currently, submarine cable condition is not able to be monitored in real time and is assessed by routine inspection by divers and Remotely Operated Vehicles. These inspections assess the external condition of the cable, of which only the top surface is visible, and can only routinely notify events such as third-party intervention. SUBsense will allow a proactive approach to submarine cable maintenance. For example, if a cable movement alert is issued preventative measures can be taken such as additional rock dumping to secure the cable prior to it failing. SUBsense can allow us to plan for a potential short-term failure should an anchor snag occur; and arrange for an enhanced inspection of the cable for damage in that location

For further Information please see our ***Scottish Islands Strategy – Annex 8.1***

Name of Scheme	Enhanced Lightning protection
Area of Business Plan	Reliability
Strategic Theme(s)	Deliver a safe, resilient and responsive network.
ED2 TOTEX	[redacted]
Benefits	[redacted]
Planned Delivery Year	2023-2028

Lightning strikes are known to cause a significant number of supply interruptions to our customers and damage to the network which is costly to resolve. In our Scottish Network, lightning strikes are the second highest cause of customer interruptions and minutes lost, whilst in our Southern Network it is the fifth highest cause.

Therefore, avoiding the impact that unplanned outages have on our customers is an important issue for SSEN. Our earlier NIA project NIA_SSEN_0035 Informed Lightning Protection developed new data analytics approach which improved the identification of a locations which are suitable for the installation of surge arresters aimed at protecting the circuits against lightning strikes. It also demonstrated the successful use of several new types of surge arrest equipment. Based on this successful project we are proposing the deployment of the new equipment on networks in both our northern and southern areas which have been identified as being at risk from lighting related damage.

Appendix G RIIO- ED2 INNOVATION THEMES

Focus Area	*Innovation Outcome*	*Innovation Opportunities*
Net Zero & Low Carbon Technologies	*The energy systems transition will create significant change within our industry, with technology development, evidence gathering, and policy change essential steps on the decarbonisation journey, beyond the timescales of RIIO-ED2. As the move to net zero gathers pace the need for innovation in this area is anticipated to grow significantly, our stakeholders have told us at our (EO56) event that* ***'net-zero and low carbon technologies was considered the most important of the ten categories of the themes'*** *Therefore, we intend to make net zero and LCT a significant part of our Innovation Portfolio in ED2. Our innovation portfolio will undertake targeted research, development and demonstration projects that will support our role as a key enabler of net zero. This will include the electrification of transport and heat, the role of energy storage and other LCTs, ensuring that we consider Whole System solutions to the barriers being addressed by our innovation portfolio.* .	• *Decarbonisation of transport including significant levels of electrification* • *An increase in energy efficiency* • *Changes in demand and customer behaviour* • *Impact of energy storage technologies* • *Connecting renewables* • *LCT forecasting* • *Network Visibility*
Whole Systems	*Innovation in this focus area will involve engaging with local communities and authorities as well as other organisations in the energy and transport, telecoms, and water sectors to look at options for developing whole systems solutions. For example, the decarbonisation of heat, with a range of alternative solutions (hydrogen, electric heat pumps and district heating) requires cross sector collaboration and Whole System thinking to optimise costs and investment while meeting environmental commitments. This is an area which will have a significant part to play in the net zero Transition and the need for innovation work in this area is anticipated to grow in RIIO_ED2.*	• *Transmission and Distribution Coordination* • *Local Energy Area Plans* • *Local Heat and Energy Efficiency Strategies* • *Cross Vector working* • *Local Authority Engagement*
Consumer Vulnerability	*This focus area will remove or reduce the impact of 'everyday operations' on customers in vulnerable situations. Through research, development, and demonstration, we will create opportunities for the creation and deployment of appropriate solutions . This will also look at how consumer vulnerability will evolve and change as we head toward net zero. The range of impacts from the net zero has the potential to impact on consumers in vulnerable situations, therefore, we intend to use our innovation activities to help ensure a Just Transition and will use the learning from the "Smart and Fair" project to help shape our portfolio.*	• *Priority Services Register* • *Support for Vulnerable Consumers* • *Fuel Poverty* • *Additional resilience requirements* • *Future vulnerability needs as we move to net zero*

DSO and Flexibility	*This focus area will build upon the learning from our innovation projects in RIIO- ED1 and will look to innovate to inform the wide scale application of flexibility, testing and evaluating new flexible solutions for new and emerging network issues, as well as enabling flexibility markets and facilitating more competition in this area. The focus area will help inform the developing role of the DSO. Given the anticipated role of flexibility as we move to net zero, again we feel there is a growing need for innovation in this area.*	• *New Markets* • *New Flexibility Products and Services* • *Market Facilitation* • *Scaling Up Flex* • *DSO Operation* • *Deployment*
Data and Digital	*This focus area will include projects which can maximise the value from our data, investigate new options for making our data more readily available for our stakeholders and the use of latest data analytics and machine learning techniques. Our stakeholders at event (EO88) identified that Open Sharing of Data is key to breaking down the barriers to successful innovation.*	• *New Data Sources* • *Machine Learning* • *Artificial Intelligence* • *Data Availability*
Sustainability	*This focus area will look to reduce the impact of 'everyday operations' on the environment and reduce our Business Carbon Footprint. This will include looking at techniques for better managing network losses and reducing the use of environmentally harmful insulating materials such as SF6. We will also look at how we can use lower carbon options for mobile generation, and the use of electric vehicles fand tools for our own operations*	• *Business Carbon Footprint* • *Losses* • *SF6* • *PCBs/ Creosote* • *Island Decarbonisation*
Connections	*We will build on the progress we have made in RIIO- ED1 by developing further options for deploying "smart " solutions as an alternative to traditional connection options. This will also include evaluating new connection options which may be required to enable the large-scale adoption of LCTs.*	• *Self Service* • *Automation* • *Information* • *Flexible Connection Options* • *LCT Headroom Forecasting*
Customer Service	*We will use innovation to improve our existing customer service options, especially for consumers in vulnerable situations, including those who are medically dependent upon their electrical supply. We will also consider new ways to interact with our consumers in the event of a fault or an outage. Potentially this could also include the impact of energy efficiency and local energy systems*	• *Improving Customer Interaction* • *Improving Customer Journey* • *Data Availability*
Operations and Efficiency	*This focus area will look at how we improve the efficiency of our operations to reduce costs and improve the resilience of the network. We will look at options for being able to anticipate faults and resolve issues before they cause any disruption to our customers, we will also look at methods of reducing the impact of any interruptions to our customers.*	• *HV Faults* • *LV Faults* • *Fault Anticipation* • *Network Monitoring* • *Automation*
Asset Management	*This area will look at how we can improve the inspection and maintenance of our assets. We will look at new ways of gathering network data, inspecting our assets to assess condition, understanding how we can better manage and utilise the asset management data that we already have.*	• *Data Analytics* • *Asset Life Extension* • *Condition Monitoring* • *Forecasting* • *Reliability* • *Improved investment*

Appendix H THIRD PARTY INNOVATION FUNDING

In December 2020, the UK government published its Energy White Paper and set out ambitious plans to transform the energy system, promoting high-skilled jobs and clean, resilient economic growth as the UK delivers net-zero emissions by 2050. Building on the Prime Minister's Ten Point Plan for a Green Industrial Revolution, the Energy White Paper set out specific steps the government will take over the next decade to cut emissions from industry, transport, and buildings. £12 billion of government investment was committed to delivering these plans, with potentially three times as much expected to come from the private sector. Also, in December 2020, the Scottish Government published its "Update to the Climate Change Plan 2018 – 2032: Securing a Green Recovery on a Path to Net Zero". The plan commits to hundreds of millions of investment and funding to meet the new targets of reducing emissions by 75% by 2030 (compared with 1990) and reaching net zero by 2045.

Innovation is key to developing the green technologies needed to deliver this energy transition, and therefore funding for innovation is critical. The recent government announcements included billions of innovation funding investment, and we anticipate that a large proportion of these innovation projects will require input, data or expertise from the DNOs in order to be successful. With the move to a whole system approach and a push towards more open sharing of energy data, the Distribution business is at the centre of the energy transition and could contribute to a wide spectrum of innovation projects.

The scale and the scope of innovation funding that could potentially be available for SSEN to leverage our already identified innovation investment requires our involvement is increasing. The new Government funding that could generate project opportunities in which we could participate over the RIIO-ED2 period includes:

- The Net Zero Innovation Portfolio (BEIS) - a £1 billion fund with the aim of accelerating the commercialisation of low-carbon technologies, systems and business models. The portfolio will focus on ten priority areas including: energy storage and flexibility; bioenergy; hydrogen; homes; industrial fuel switching; and disruptive technologies such as artificial intelligence for energy.
- Heat Network Transformation Programme (BEIS) - £122m for the roll out of district heating systems, including the switch to low or zero-carbon heat sources.
- Industrial Energy Transformation Fund (BEIS) - £289m to 2024 to help businesses in England, Wales and Northern Ireland with high energy use to cut their energy bills and carbon emissions through investing in energy efficiency and low-carbon technologies.
- Scottish Industrial Energy Transformation Fund (Scottish Government) – £62m for projects that support high energy use businesses to reduce energy costs and emissions through increased energy efficiency.
- Strategic Innovation Challenge Fund (Scottish Government) – to support strategic investment in R&D and innovation to reduce CO2 emissions, stimulate economic recovery and create jobs (value of funding is to be confirmed).
- Zero emission buses (Scottish Government) - £120 million for zero emission buses to accelerate the decarbonisation of Scotland's bus fleet.
- Charge points for electric vehicles (BEIS) - £1.3 billion committed to accelerating the rollout of charge points for electric vehicles in homes, streets and on motorways.

These funding opportunities are only a few examples from the wider funding landscape that we will be operating in during RIIO-ED2. An element of our future vision for whole system involves working with stakeholders to explore a range of different funding routes for initiatives.

Appendix I OFGEM'S MINIMUM REQUIREMENTS

The following Table provides details of the relevant minimum requirements and where we have described how we address these within this document.

Mapping of Ofgem Minimum Requirements

	Ofgem minium requirement	Where and how this is addressed in narrative
4.33	BAU innovation' is any innovation that is not dependent on, or funded via, ringfenced innovation stimulus funds. We expect companies to fund more BAU innovation in RIIOED2 using their totex allowance, as part of their BAU activities, rather than relying solely on innovation stimulus funds.	We are proposing to invest over £120m on the deployment of proven innovations, which will leverage long term benefits for customers, consumers, and the environment of over £177m and avoiding over 125,000 tonnes of CO_2. See section 5.2 for further details. In addition, we will continue to invest in innovation to drive efficiency across the business. In RIIO-ED2, we will deliver £10m of BaU funded innovation activities, which is not part of our Totex ask, and from which we expect to deliver at least £10m of efficiency benefits See Section 5.4 for further details.
4.34	There will not be a separate funding stream (on top of the totex allowance) for BAU innovation. Instead, this innovation should be incorporated into wider BAU activities throughout their plans. We would like DNOs to clearly identify/pull-out where they consider an activity to be BAU innovation. We are, however, not prescriptive as to how DNOs showcase this within their business plan (ie we are not prescribing that all innovation content is contained in a standalone Innovation Strategy).	N/A
4.35	As a minimum requirement under Stage 1 of the BPI, DNO Business Plans must evidence a strong strategic focus on innovation. This will include how companies are developing and embedding a culture of innovation throughout their business. Companies must evidence a commitment to innovation throughout their Business Plans. This is separate to the minimum requirements on ongoing efficiency detailed in paragraphs 5.44-5.46, plus we are not asking companies to set out all the specific innovation projects they plan to undertake with their totex allowance.	Innovaton is embedded throughout our Business Plan and has a fundemental role in the delivery of our four strategic outcomes as discussed in Section 2.1. In Section 4.5 we discuss how we are embedding and enhancing a culture of innovation within our Business Plan.
4.36	Instead we want to understand the high-level innovation activities (ie the areas and themes they seek to focus on) that companies are planning for RIIO-ED2, using their totex allowance, and the processes they have in place for identifying these ideas. Companies must include:	

	Ofgem minium requirement	Where and how this is addressed in narrative
(a)	a strategic approach to innovation activities, which builds upon industry-wide challenges and industry-wide strategic direction.	Based on our successful RIIO- ED1 innovation experience, and the learning we gained from it, we have developed an approach based on five key principles, underpinned by a strong commitment to "learn by doing". One of our key Innovation principles is "Relevant". This will help ensure that our portfolio is aligned with wider industry challenges and direction. See section 4.3 for further details.
(b)	how they will consider, and mitigate if necessary, the potential impacts of their innovation activities on consumers in vulnerable situations.	Consumer Vulnerability will be a key element of our Innovation activities in RIIO- ED2. We intend to utilise the tools developed in projects such as our earlier "Smart & Fair Project " to assess relevant innovations and ensure that our portfolio as a whole address the needs of our Consumers including those in vulnerable situations. In addition, we are committed to undertaking a consumer vulnerability impact assessment on each of our new RIIO- ED2 Innovation projects. Consumer Vulnerability has been identified as one of our Innovation Themes and we expect that consumer groups and other stakeholders to be involved in developing and cocreating our portfolio. See Section 4.3. Section 5.3 and Section 6 for further details.
(c)	consideration of innovative whole system approaches as potential solutions to problems.	Whole System is one of our identified Innovation themes and will form a part of our portfolio. This will be supported by our involvement in various partnerships and forums like the EIC , PNDC, Scottish Governments Strategic EV partnership as well as a continued commitment to co create solutions with stakeholders. See sections 3.2, 4.1, 4.3, 4.4, 5.3, 6, 7.1, 7.5, for further details.
(d)	how plans for RIIO-ED2 build on past projects completed by themselves and others, considering lessons learned from these past projects.	In developing our plan we have reviewed our RIIO - ED1 experience and identified lessons learned for RIIO - ED2. This is described in detail in Section 2.9. In addition, we also undertook a structured review of other licensee's innovation portfolios to identify potential deployment options, this process and the innovations we propose to deploy are set out in Section 5.2.

	Ofgem minium requirement	Where and how this is addressed in narrative
(e)	plans for third-party involvement in their innovation activities, demonstrating how they will increase third-party nvolvement in their innovation activities and ensure full consideration of third-party innovation ideas. They may, for example, include plans for independent consideration of which third-party innovation ideas to take forward.	SSEN have a strong record of involving third parties in our Innovation activities, in delivering our RIIO-ED1 we have engaged with over 130 individual organisations across 83 individual collaborations. Co creation and collaboration will continue to form part of our RIIO-ED2 Innovation approach. See sections 2.3, 4.1 , 7.5 for further details. In addtion we plan to publish our Annual Innovation Priorities (which will be informed by our ongoing engagement activities) to help ensure that stakeholder, innovators and the supply chain are aware of our needs. See Section 8.1 for further information.
(f)	plans to collaborate with other network companies and other interested bodies and to disseminate learning from innovation.	We have strong track record of collaboration with other network companies in NIC projects such as Optimise Prime, TRANSITION and NeSTS. Across our portfolio of NIA projects we have engaged with GDNs in projects such as RESOP, the System Operator in projects like 4D Heat and other DNOs in projects like Synaps, ReHeat and Distribution Fault Anticipation. We plan to strengthen and expand this in RIIO-ED2 and we intend to use collaboration to leverage further benefits from our PNDC and EIC engagements. We also propose to enter into an innovation partnership with UKPN. See Sections 4.1, 4.3 , 4.4, 4.5, 8.5 and Appendix E for further details.
(g)	a framework for rolling out proven RIIO-ED2 innovation into business during the course of the RIIO-ED2 price control.	Our Innovation life cycle from inception to deployment is set out in Section 8.1.
(h)	how they propose to monitor the benefits of planned RIIO-ED2 innovation and reduce costs in other areas during the course of RIIO-ED2 using this innovation.	We will monitor and report on the benefits of our innovation activities in line with the Industry wide mechanism being developed by the ENA. Further details can be found in Section 8.4.

	Ofgem minium requirement	Where and how this is addressed in narrative
4.37	The Business Plan must also as a minimum requirement describe the steps that the company is taking to ensure that previously proven innovation (ie innovation which was proven before the start of RIIO-ED2) is rolled out into BAU in the RIIO-ED2 Business Plan and how the related benefits are reflected in the company's proposed expenditure for RIIO-ED2. This will include innovation trials, in which the company has previously participated, as well as trials that have been led by other companies.	We have identified the benefits from our existing portfolio which will extend into RIIO-ED2, We have identified the benefits from our existing portfolio will extend into ED2, and we have also outlined the process which we undertook to identify further deployment opportunities. This is described in more detail in Section 2.3. We have also outlined our proposals for the roll out of proven innovations from both our own and other licensees portfolios – this is described in more detail in Section 5.2.
4.38	If companies believe that NIA funding is necessary for RIIO-ED2, their Business Plan must set out and justify the level of NIA funding requested. As part of this and in addition to the inclusion of the information detailed above in relation to innovation funded out of totex llowance, NIA funding requests must include:	
(a)	high-level areas of focus for NIA spending and, where known, details of individual planned NIA projects.	In consultation with our stakeholders we have identified the high level themes for our proposed RIIO-ED2 NIA programme. We will look to use our NIA allowance to deliver a high quality portfolio of innovation projects which explore opportunities and deliver value added change for consumers in vulnerable situations and facilitate Net Zero whilst addressing whole system issues. At this stage we have not identified individual projects but will look to develop these ahead of the start of the RIIO-ED2 period. Further details can be found in Section 5.3 and Section 7.0.
(b)	how activities will be delivered.	We have an established process for managing innovation projects which has delivered our highly successful RIIO-ED1 Innovation portfolio. We have reviewed our approach, considered any lessons learned and will incorporate these for RIIO-ED2 work. Further details are included in Sections 2.7 and Section 8.
(c)	how much NIA funding they believe is necessary for each of these areas of focus.	We have requested a total NIA allowance of £17.5m for the duration of the price review. Further details can be found in sections 5.3 and 7.2 for details.
(d)	the value/benefits they anticipate these activities may generate.	We anticipate that the benefits and value from these projects will accrue to a wide range of

	Ofgem minium requirement	Where and how this is addressed in narrative
		stakeholders across the energy landscape, as well as environmental and societal benefits. Further details can be found in Sections 7.3 and 7.4.
(e)	how the overall level of NIA funding compares with the level of NIA funding the DNO received in RIIO-ED1.	The maximum available funding to date for NIA was approximately £26.4m , of which we have forecast to spend £16.1m to the end on the 2020/21 financial year. Our RIIO-ED2 funding request is an 8.7% increase on our pro rata RIIO-ED1 NIA spend. Further details can be found in Section 7.2.
(f)	an explanation of why the innovation in question cannot be funded from the totex allowance.	In most cases the benefits from NIA projects will accrue to other stakeholders rather than SSEN, similarly, benefits may not materialise until the longer term, or are exploring technologies which are still at an early stage and whose potential to deliver benefits are as yet unproven. The level of risk involved in these projects, the uncertainty involved in their outcomes and the fact that benefits are not necessarily realised by SSEN, makes it inappropriate for them to be funded from our TOTEX allowances. Further details can be found in Section 7.3.
4.39	As part of any request for NIA funding, companies must also set out the desired structure of their proposed RIIO-ED2 NIA and how much risk they are willing to take on themselves against their NIA. For example:	
(a)	whether they seek an annual allowance or an allowance for the duration of RIIO-ED2.	We are seeking an allowance of £17.5m across the price control period. Further details can be found in Section 7.2.
(b)	the compulsory contribution they are willing to make towards their RIIO-ED2 NIA.	We are seeking our NIA allowance for the duration of the price control and are willing to make a 10% contribution toward the RIIO-ED2 NIA. See Section 7.2 for further details.
(c)	any other mechanisms they propose to support their NIA funding, such as reopeners to reassess the level of NIA funding needed during the course of RIIO-ED2.	During RIIO - ED1 SSEN successfully secured over £4.5 m from a range of external funding sources including Innovate UK and BEIS for projects such as LEO and MERLIN. SSEN will actively seek to get involved in Innovation activities funded via wider government funding mechanisms) to suppport the delivery of our NIA portfolio in RIIO-ED2. See Section 7.5for further details.