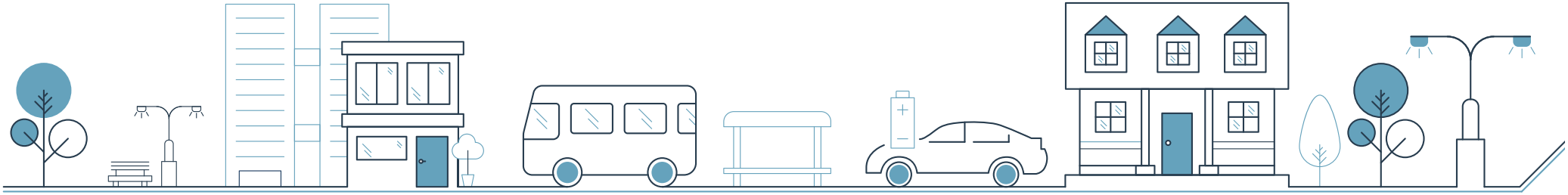
SSEN Distribution

ENVIRONMENT REPORT

2022/23 - Final Year of RIIO-ED1

Scottish & Southern Electricity Networks

CONTENTS



INTRODUCTION

1. EXECUTIVE SUMMARY

This report aims to inform our stakeholders on how we (Scottish Hydro Electric Power Distribution plc, SHEPD, and Southern Electric Power Distribution plc, SEPD) have performed against our RIIO-ED1 environmental commitments in 2022/23 and provides details of wider sustainability work that we have undertaken in this period. Additionally, this report provides an overview of our latest innovation projects that are paving the way towards a more sustainable grid - crucial to facilitating the energy system transition - and are continuing to drive efficiency, improve customer service, and enhance the customer experience.

2022/23 represented a continued positive trajectory in many of our environmental and wider sustainability considerations, including an increased focus on managing and reducing our business carbon footprint (BCF); We are delighted to have achieved our RIIO-ED1 absolute reduction target to reduce greenhouse gas (GHG) emissions by 15%, attaining a 30% reduction in 2022/23 compared to base year levels. We continue to be proud to lead by example, having been the first Distribution Network Operator (DNO) to have our 1.5°C science based GHG emissions reduction targets accredited by the Science Based Targets Initiative (SBTi).

We had a successful year across many elements of our BCF profile. We continue to make good progress with further electrification of our vehicle fleet and increasing the use of fossil-fuel alternatives in our operations.

However, our Sulfur hexafluoride (SF_6) emitted increased in 2022/23, compared to 2021/22, due to poor leak performance partly a result of unfavourable weather patterns. Our new strategy for SF_6 emissions ensures a focus on reducing SF_6 emitted as we enter RIIO-ED2 through improved monitoring and analysis as well as targeted investment to replace assets where repair is not viable and exploring innovative solutions.

Positively, emissions associated with embedded generation on the Scottish Islands, utilised to ensure security of supply for our island communities, reduced significantly in 2022/23 compared to previous reporting periods in RIIO-ED1.

As well as this, our use of innovative solutions, such as Live Line Harvesters and flexibility schemes, contributed to a reduction of over 413,000 tonnes of carbon dioxide equivalent (tCO^2-e) over the RIIO-ED1 period.

We are also proud to have achieved a 45% reduction in fluid filled cable (FFC) leakage in 2022/23, compared to base year levels, exceeding the 15% reduction commitment for the RIIO-ED1 period.

Additionally, emissions arising from network losses (which represents the majority of our Scope 2 emissions) reduced by around 13% in 2022/23 compared to 2021/22. During the 2022/23 period, there was reduced load thought to be due to the cost-of-living crisis which saw consumers trying to reduce their electricity consumption. The reduction in emissions was also due to an increase in renewable generation connected to the grid and the progression of our losses strategy.

We are proud that RIIO-ED1 has closed with some extremely positive outcomes, and we will continue to push on during RIIO-ED2 to improve the sustainability of our operations further by addressing emerging challenges and increasing our focus in this space overall.

Through our Environmental Action Plan, and existing business-as-usual practices (BAU), we have strategies in place to reduce our use of, and holdings of, polluting gas and oils, and are actively working to reduce our emissions in line with our science-based targets including network losses. Following Final Determinations, we were awarded baseline funding to invest in Nature-based Solutions for carbon removal through native ecosystems and were also awarded a Consumer Value Proposition for seagrass planting in our local communities.

We will also work to investigate flexibility and low carbon generation options on the Scottish Islands and continue to engage with our consumers, including those most vulnerable, as well as continue to invest into innovation projects with a focus on increasing the uptake and speed of roll out of Low Carbon Technologies. Our RIIO-ED2 Environmental Action Plan, our investment into innovative solutions, and our recent achievement of ISO 14001 Environmental Management accreditation, will propel continuous improvement in our environmental and sustainability ambitions forward into RIIO-ED2 and beyond.

For more information, see our RIIO-ED2 Environmental Action Plan and Sustainability Strategy. ***Sustainability - SSEN***

Shirley Robertson
SSEN's Head of Strategic Planning and Sustainability

1.1. VISUAL AMENITY

Overhead lines, especially those at higher voltage running through Areas of Outstanding Natural Beauty (AONB) and National Scenic Areas (NSAs) are considered unsightly by many. We committed to underground up to 90 km of overhead line in designated areas in response to the request of stakeholders during RIIO-ED1. Utilising the nomination scheme, we targeted our funding at AONB and National Parks on our High Voltage network. Across both of our licence areas, we have removed 52.2 km of overhead lines to date during RIIO-ED1.

Further details of the projects undertaken are in Section 5.

1.2. OIL LEAKAGE FROM FLUID FILLED CABLES

Oil leakage from fluid filled cables (legacy assets of electricity transmission and distribution networks) is known to cause negative environmental impacts. As a result, we made a commitment to replace a total of 76 km of fluid filled cables in both of our licence areas to achieve at least a 15% reduction in oil leakage over the RIIO-ED1 period. In 2022/23 we removed an additional 14.35 km of fluid filled cable across both our networks and we also achieved a leakage reduction rate of 45% compared to base year levels, thus exceeding the RIIO-ED1 leakage reduction commitment.

More detail on our oil leakage management can be found in Section 6.

1.3. BUSINESS CARBON FOOTPRINT

We are delighted to have achieved our RIIO-ED1 absolute reduction target to reduce GHG emissions by 15%, delivering a 30% reduction in 2022/23 compared to base year levels. In 2022/23, our BCF (excluding network losses) across both SHEPD and SEPD licence areas reduced by 34,215 tCO^2-e compared to 2021/22.

The positive reduction in our emissions is due to several factors including utilisation of fossil fuel alternatives such as electric vehicles, and hybrid mobile generators, and an increase in energy efficiency measures throughout our buildings.

Despite our unique obligation to operate embedded generation power stations to maintain security of supply to a number of Scottish Islands, supplied by a single distribution subsea cable, GHG emissions associated with this activity were significantly reduced compared to previous reporting periods. In 2022/23, SHEPD's fuel combustion emissions reduced by 83% compared to 2021/22 due to a reduction in storm activity and faults experienced across our SHEPD licence area, reducing the need for use of back up embedded generation.

Our planning standards rely on diesel generation to maintain security of supply for our customers on the Scottish Islands, should a fault occur on a subsea cable supplying that island, or during a storm. Therefore, during RIIO-ED2, we have proposed more environmentally friendly solutions to continue to reduce the reliance on diesel power stations, including the deployment of innovative technological solutions, the utilisation of fossil fuel alternatives, and strengthening our North of Scotland resilience by exploring local solutions and flexibility services.

More detail on our BCF emissions profile and reduction efforts can be found in Section 7.

1.4. SULPHUR HEXAFLUORIDE (SF_6) EMISSIONS

Sulphur Hexafluoride (SF_6) is an extremely effective electrical insulator that is used in our circuit breakers, switchgear, and other electrical equipment. It has significant advantages over alternative materials. It is non-flammable - a critical safety requirement in the high-voltage applications – and, because of its excellent insulating properties, it takes up less volume than alternatives such as oil. However, it is also a very potent greenhouse gas, one kilogram of SF_6 is equivalent to approximately 23,500 kg of carbon dioxide .

In 2022/23, our SF_6 emitted increased compared to 2021/22 due to poor leak performance partly a result of unfavourable weather patterns. Our ambitious Environmental Action Plan, part of our RIIO-ED2 Business Plan, details our approach to reducing SF_6 emitted as we enter RIIO-ED2 and beyond. We have also improved monitoring and analysis methods to track the poorest performing assets and we have begun targeting investment to replace these where repair of the asset is not viable. Unfortunately, limited market availability of SF_6 alternatives has also restricted opportunities to reduce our SF_6 bank, however, we continue to work collaboratively with other Transmission Operators and Distribution Network Operators via the Energy Networks Association to identify and approve alternatives as they come onto the market.

More information on our SF_6 management can be found in Section 7.

1.5. DISTRIBUTION LOSSES

Electrical losses are the difference between the amount of electricity entering into the network, from the transmission system or directly from generators into the distribution network, and the amount of electricity leaving the network to our customers. Losses arise primarily as a function of electricity travelling through our network but can also arise from calculation anomalies or electricity theft.

We have obligations to ensure distribution losses are as low as practicably possible; to date during RIIO-ED1, we have achieved a saving of circa 77 GWh by delivering interventions identified in our losses strategy. This includes implementing the following measures:

- Installing energy efficient transformers that deliver enhanced losses performance, including replacing inefficient pre-1960 transformers;
- Adjusting the minimum sizing of cables and transformers to reduce losses;
- Upgrading network voltages in specific areas of our network to reduce losses; and
- Switching off underutilised plant during periods of low loading.

We have also achieved significant savings from initiatives to reduce non-technical losses, by continuing to refine our processes and better understand and use the data available to us in this area.

More information on our losses strategy and its outputs can be found in Section 7.

1.6. INNOVATION

Over RIIO-ED1, our innovation strategy has delivered over £67m of benefits, whilst avoiding over 413,160 tonnes of carbon dioxide emissions.

Following Our RIIO-ED2 business plan submission in 2021, our innovation focus areas have been updated to reflect the new four Strategic Objectives for the business we identified as part of this submission. Our efforts to invest in innovation during RIIO-ED1 has played 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 innovation projects co-created with our stakeholders.

Over the course of RIIO-ED1, we have completed 63 innovation projects targeting these areas and have over 20 projects underway that will run into RIIO-ED2 and beyond. Additionally, we have already embedded several innovative solutions into business as usual such as our flexible solutions, thermal imaging cameras and forestry mulchers.

Looking ahead, 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 and 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.

1.7. DISTRIBUTION SYSTEM OPERATOR

The local distribution networks are key to unlocking the benefits of the low-carbon transition. Creating opportunities for consumers to generate and sell electricity and provide network flexibility services is crucial to cost effectively delivering Net Zero at pace. Electricity networks will need to be capable of delivering at least twice the amount of energy by 2035 to meet the government net zero plan.

Our vision for DSO is to make the best use of our electricity networks, data and emerging technology to facilitate the decarbonisation of transport and heat at maximum pace, and at minimal cost to consumers.

Our two flagship DSO projects, TRANSITION and LEO, have already provided insights into the scope of this transition, whilst the learning and outcomes from our various Network Innovation Allowance projects, including TraDER and MERLIN, will further inform the industry as it progresses toward DSO.

In addition, Whole Systems Growth Scenario Modelling Phase 2 (WSGSM2 aka RESOP) is assisting Local Authorities (LAs) place LCTs and create Local Area Energy Plans (LAEPs), and the learning from our Near Real-Time Data Access (NeRDA) is helping us to understand a variety of stakeholder needs for network data.

We are also promoting use of flexibility through our Constraint Managed Zones (CMZs) and Active Network Management (ANMs) which use flexibility services to offer security of supply during times of peak demand, planned maintenance or fault conditions and allow generators to connect to constrained networks through releasing flexible generation capacity.

More information on these projects can be found in Section 10.

2. WHO WE ARE

We are the electricity Distribution Network Operator (DNO) responsible for delivering power to 3.9 million homes and businesses across central southern England and the north of Scotland. We serve some of the most diverse and unique geographies across the UK, and keep customers and communities connected whilst developing the flexible electricity network vital to achieving net zero.

Our network serves some of the UK's most remote communities and also some of the most densely populated. Our two networks cover the greatest land mass of any of the UK's DNOs, covering 72 local authority areas and 75,000km² of extremely diverse terrain.

OUR DISTRIBUTION NETWORK AT A GLANCE

Over **3.9million** homes and businesses

More than **889,790** customers on our Priority Services Register

Over **128,000km** of overhead lines and underground cables

Over **460km** of subsea cables powering our island communities

Over **4,100** employees across the country

Figures as of October 2023

3. PURPOSE OF THIS REPORT

The purpose of this Environment and Innovation Report is to provide stakeholders with a transparent and public account of our commitment to addressing environmental matters in RIIO-ED1. This includes, but is not limited to, our role in the low carbon transition. It is intended to provide a holistic overview and clear rationale for our actions and details of actual benefits to customers. It also provides an important update on our continuing progress to meet our environmental targets and demonstrates how stakeholders shape this going forward e.g., through continued engagement on our strategies and focus areas, as well as their role in specific environmental and innovation initiatives such as our visual amenity projects.

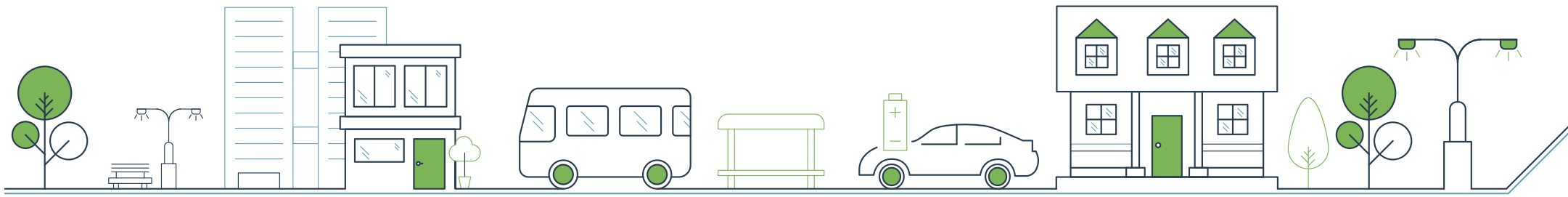
Note that costs in this report are reported in the nominal year pricing, according to the Environment and Innovation Regulatory Reporting Packs 2022/23 (linked in the appendix of this report), unless otherwise stated.

Our RIIO-ED1 environmental commitments are summarised in Table 1.

RIIO-ED1 ENVIRONMENTAL COMMITMENTS

Visual Amenity	• Underground up to 90 km of Overhead Lines (OHL) in Areas of Outstanding Natural Beauty (AONB), National Parks and National Scenic Areas (NSA)
Fluid Filled Cables	• Replace 76km of fluid filled cable and tag our worst performing circuits • Reduce oil leakage by 15% relative to 2012/13 levels
Business Carbon Footprint	• Reduce our business carbon footprint (excluding losses) by 15% relative to 2012/13 levels • Reduce the average mileage of SSEN cars by 10% • Reduce rate of leakage of SF_6 by 15% relative to 2012/13 levels
Electrical Losses	• Continue replacing current equipment with lower loss equipment • Continue to assess, and where appropriate, implement technologies designed to reduce losses • Better understand the energy use of our customers and work with customers to reduce their overall energy use • Use new sources of data to create better models that allow us to analyse and track losses, and target loss reduction • Work with Electricity Supply Licensees to detect and prevent fraudulent energy use (theft)
Security of Supply	• We will continue to operate standby generating stations to provide security of supply to remote Scottish islands

Table 1. RIIO-ED1 Environmental Commitments



MANAGING OUR ENVIRONMENTAL IMPACT

4. INTRODUCTION

We are committed to managing our environmental impact and causing no further damage to the communities in which we operate. We have dedicated workstreams to address this whilst we operate as Distribution Network Operator (DNO).

This section details the various activities we have been engaging in to meet our RIIO-ED1 environmental commitments and covers the following environmental considerations:

- **Visual Amenity** - The act of undergrounding overhead lines in designated areas including AONB, Natural Scenic Areas and National Parks. Projects to remove overhead lines are initiated by our stakeholders to ensure areas are targeted to provide the best value for the consumer and return the locations to a more natural state.
- **Oil Leakage** - Many of our assets contain oil which is essential for insulation and providing electrical safety. However, oil leakage from these assets can cause environmental harm. As a result, we are tactically reducing oil leakage by replacing specific high-risk assets to minimise and mitigate environmental harm.
- **Business Carbon Footprint** - We are committed to reducing our business carbon footprint by reducing emissions associated with diesel consumption, energy usage in our buildings and by keeping electrical losses as low as reasonably practicable. We are also committed to minimising the amount of SF_6 that leaks from our assets, amongst other emissions reduction efforts.
- **Additional Environmental Activities** - We engage in a host of environmental activities across our licence areas. The implementation of flood protection defenses, contaminated land clean-up efforts and further innovations providing environmental benefits, as well as community fund raising and improving employee awareness, are just some of the projects we are involved in to help maintain and protect our local environment.

5. VISUAL AMENITY

5.1. SUMMARY

- Overhead lines (OHL), especially those at higher voltage running through Areas of Outstanding Natural Beauty (AONB), National Scenic Areas (NSAs) and National Parks are considered unsightly by many. We recognise that OHL can have an adverse impact on visual amenity, especially in these sensitive environments. This adverse impact could affect individual wellbeing and local economies if, for example, the primary local industry is tourism. The communities we serve are key stakeholders for our business, so this is an important issue for us.
- Therefore, to improve visual amenity, we committed to undergrounding up to 90km of OHL in designated scenic areas across both of our distribution networks during RIIO-ED1. Visual amenity projects are initiated by expressed interest from our stakeholders, enabling us to ensure areas targeted are best value for the consumer. During RIIO-ED1, we have completed undergrounding of 52.22 km of OHL in total across SHEPD and SEPD at a cost of £6.36m. This has resulted in achieving 58% of the RIIO-ED1 commitment. The shortfall is due to the nomination scheme being completely stakeholder driven; Whilst we did conduct community engagement sessions during RIIO-ED1, these did not generate the required volume of requests.
- For RIIO-ED2, we are ramping up stakeholder engagement through targeted, local engagement sessions to ensure that all of our stakeholders are aware of the options to underground local network where applicable.

5.2. UNDERGROUNDING SCHEMES DURING RIIO-ED1

Both SHEPD and SEPD were provided specific funding by Ofgem for undergrounding of OHL in protected landscapes in RIIO-ED1. Funding is applicable for distribution voltages up to 132 kV and is specifically targeted at AONB, NSAs and National Parks.

Visual amenity projects are driven by stakeholder requests, using a nomination scheme. Stakeholders have indicated that undergrounding of existing OHL was "important" or "very important" from a visual amenity perspective and supported our stakeholder led approach to address concerns in these areas.

Our stakeholders indicated that we should include factors that they considered important to them, such as the historic environment and that these were considered integral to the scheme selection process. This is achieved by using a Visual Amenity Impact scoring model, developed in agreement with the AONB and National Park officials within our licence areas. Schemes are nominated by these stakeholders, and then considered and prioritised to ensure consistency in assessment across all SEPD and SHEPD licence areas and delivery of maximum value for money.

The focus has primarily been on High Voltage (HV) and Extra High Voltage (EHV) OHL that have a high visual impact on the landscape and have a dominant impact for many viewers. We have therefore, targeted our efforts on the worst affected areas identified using the scoring mechanism. Schemes are co-ordinated with other network investment and maintenance works where practicable, to minimise disruption for stakeholders and reduce delivery costs, i.e., reducing costs for consumers. Details of the schemes are provided in Table 2 and 3.

Unfortunately, during RIIO-ED1, the stakeholder engagement that we carried out failed to generate the required volume of requests needed to meet the target for the price control. However, we have committed to increasing our engagement in this space. In 2022/23 we held reinvigorated workshops with communities in our licence areas showcasing how to make an application as well as what makes a good application. Following these events, we have seen a higher number of applications via our website and therefore we have a higher number of projects in the planning and refinement stage. During RIIO-ED2, we will continue to ramp up engagement through targeted, local engagement sessions to ensure that ongoing and forthcoming projects achieve the best outcomes for the local landscape, biodiversity, and communities.

As presented in Tables 2 and 3, we have completed 26 visual amenity schemes in our SEPD and SHEPD licence areas during RIIO-ED1, which totals 52.22 km of OHL removed.

Designated Area	OHL km Removed	Completion Date
Loch Lomond and the Trossachs National Park	1.92	2017/18
Loch Tummel National Scenic Area	0.27	2018/19
Cairngorms National Park	2.33	2018/19
Cairngorms National Park (Glen Muick)	0.95	2020/21
Cairngorms National Park (Glen Tromie)	7.96	2020/21
Loch Lomond and the Trossachs National Park (Strathyre)	2.31	2020/21
Cairngorm National Park	3.92	2022/23
Kyles of Bute National Scenic Area	0.18	2022/23

Table 2: Historic Visual Amenity Schemes Completed Across SHEPD

Scheme	Designated Area	OHL km Removed	Completion Date
Hungerford	North Wessex Downs AONB	1.4	2015/16
North Lodge to Sunwood Farm, Buriton, Petersfield	South Downs National Park	0.8	2015/16
Thursley Common	Surrey Hills AONB	0.3	2015/16
Tichborne, Alresford	Southdowns National Park	3.53	2016/17
Turville Village	Chilterns AONB	2.5	2016/17
Woodyates PMT	Cranbourne Chase	1.38	2019/20
Bignor Park	South Downs National Park	0.82	2019/20
Itchen Abbs	South Downs National Park	0.2	2019/20
Rivar Hill, Shalbourne	North Wessex Downs AONB	0.39	2020/21
Plush	Dorset AONB	0.19	2020/21
Franklin Farm	South downs National Park	1.21	2021/22
Worth Matravers	Dorset AONB	0.11	2021/22
Clayhanger	Dorset AONB	2.45	2021/22
Turville Village phase 2	Chilterns AONB	0.16	2021/22
South Burley	New Forest National Park	7.43	2022/23
Godlingston Hill	Dorset AONB	3.68	2022/23
Valley of Stones Nature Reserve	Dorset AONB	3.95	2022/23
Cheselbourne Village	Dorset AONB	1.88	2022/23

Table 3: Historic Visual Amenity Schemes Completed Across SEPD

Tables 4 and 5, detail visual amenity schemes in progress across both of our licence areas.

Scheme	Designated Area	OHL km removed	Progress	Planned Completion Date
Kingussie	Cairngorms National Park	7	Refinement	2024/25
Auchtertyre House, Crianlarich	Loch Lomond and the Trossachs	0.5	Refinement	2023/24

Table 4: Visual Amenity Schemes in Progress Across SHEPD

As presented in Tables 4 and 5, there are 14 visual amenity schemes in progress across our SEPD and SHEPD licence areas scheduled for completion during RIIO-ED2, undergrounding a further 24.64 km of OHL.

For further details on Visual Amenity, please see worksheet E1 – Visual Amenity linked to the Appendix of this report.

Scheme	Designated Area	OHL km Planned	Progress	Planned Completion Date
Monkton Chilgrove	South Downs National Pack	1.01	Execution	2023/24
Winterbourne Near Newbury	North Wessex Downs AONB	1.6	Execution	2023/24
Vineyard Hole	South Downs National Park	1.4	Execution	2023/24
Church Road	South Downs National Park	0.92	Refinement	2024/25
Sherborne	Cotswolds AONB	1.31	Refinement	2023/24
North Cerney	Cotswold AONB	0.33	Refinement	2023/24
Kingwood Common	Chilterns AONB	0.87	Refinement	2023/24
Teffont	Cranbourne Chase	1.3	Refinement	2024/25
Treyford	South Downs National Pack	1.1	Refinement	2024/25
Northend Common	Chilterns AONB	1.4	Refinement	2024/25
Eastbury	North Wessex Downs AONB	5	Refinement	2024/25
Church Road, Steep	South Downs National Pack	0.9	Refinement	2024/25

Table 5: Visual Amenity Schemes in Progress Across SEPD

6. OIL LEAKAGE

6.1. SUMMARY

We are committed to reducing our environmental impact in the areas we operate. An important element of this is to ensure that any oil contained in our assets does not cause damage to the surrounding area.

Oil is widely used as an insulating material or cooling medium across a wide variety of electrical equipment including fluid-filled cables and some types of electrical switchgear and transformers. We have robust processes in place to maintain and operate these assets such that we ensure that any potential leakage is minimised. If there are any incidents, then we are committed to a fast response and to addressing and resolving any issues thus ensuring that there are no adverse environmental impacts seen as a result.

A focus of our oil leak monitoring is oil within fluid-filled cables (FFC). FFC can leak due to age, wear, or third-party damage. If untreated, a leak will not only cause potential environmental damage but may result in equipment failure and disruption for our customers.

To mitigate the environmental impact and any associated supply disruption, we employ a pro-active leak location process known as tagging. This process allows the circuit to remain in service while the leak is being located by dosing the cable system with a chemical marker that can be detected by equipment above ground. This method of detection can detect multiple leaks on the circuit at each operation. Once identified, repairs and any necessary remedial works will be carried out using a risk-based approach. This process is built into the routine maintenance process of our FFC assets.

In addition to our pro-active oil leakage strategy, we have a comprehensive range of specialist equipment to ensure that we can provide a robust response to any oil leakage event. We have also established service agreements with specialist contractors for support in the event of an incident.

6.2. OIL LEAKAGE PERFORMANCE DURING RIIO-ED1

In our RIIO-ED1 business plan, we made a commitment to achieve a 15% reduction in oil leakage from fluid-filled cables FFC, relative to 2012/13 levels, and to replace 21 kilometres of fluid-filled cable in SHEPD and 55km in SEPD, totalling 76km across both our networks. We also committed to tag our 25 worst performing circuits on an annual basis.

We are proud to have achieved a 45% reduction in oil leakage in 2022/23 compared to 2012/13 levels, thus achieving, and exceeding, our RIIO-ED1 target. We have also successfully continued with our tagging and replacement programmes.

During 2019/20 SSEN implemented a new strategy for FFC to improve the focus on our RIIO-ED1 commitments. This has involved several internal changes including establishing an internal working group to address FFC leakage, updating and consolidating procedures and policies related to FFC, and introducing a more pro-active approach using analytics to better target FFC leakage prevention.

Figure 1 shows that the total km of FFC on our network has decreased over the RIIO-ED1 period, from 1,207 km in 2015/16 to 1,060 km in 2022/23. The reduction in total km of FFC on our network was due to 66.41km of FFC removed with the remainder due to data cleansing.

Additionally, the total amount of oil contained in FFC in service has dropped over RIIO-ED1. In 2022/23, there was a significant decrease of fluid used to top up cables across both licence areas of around 31%. The fluid used to top up FFC has been on a consistent downward trend over RIIO-ED1, as shown in Figure 2.

For further details on Oil Leakage, please see worksheet E2 – Environmental Reporting linked to the Appendix of this report.

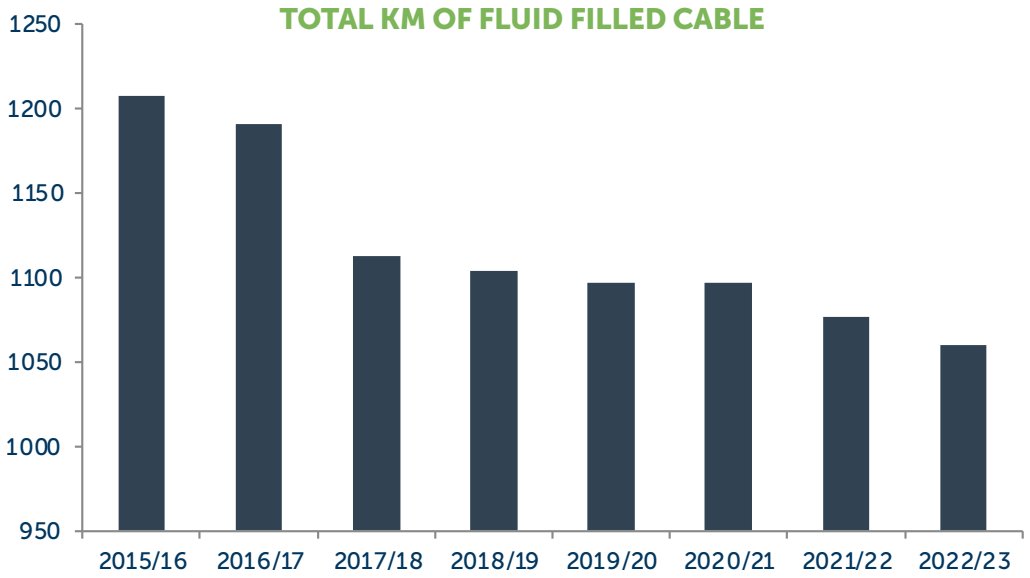


Figure 1: Change in total length of fluid filled cable over the RIIO-ED1 period (SHEPD and SEPD)

6.3. FLUID-FILLED CABLE INDUSTRY ENGAGEMENT

We continue to engage with other industry stakeholders to share best practices to reduce oil leakage. This involvement includes meetings with other Distribution Network Operators to share best practice learnings and ongoing innovative projects. We hold regular meetings with the Environment Agency and Scottish Environmental Protection Agency to review performance. We will continue this work into RIIO-ED2.

6.4. OIL MITIGATION SCHEMES

We report the number of oil mitigation schemes affecting cables and substation plant, such as transformers and circuit breakers, and the costs associated with these to Ofgem on an annual basis.

Over the RIIO-ED1 period SEPD has spent £5.24m on 139 oil mitigation schemes, while SHEPD has spent £0.1m on 13 schemes.

For further details on Oil Leakage, please see worksheet E2 – Environmental Reporting linked to the Appendix of this report.

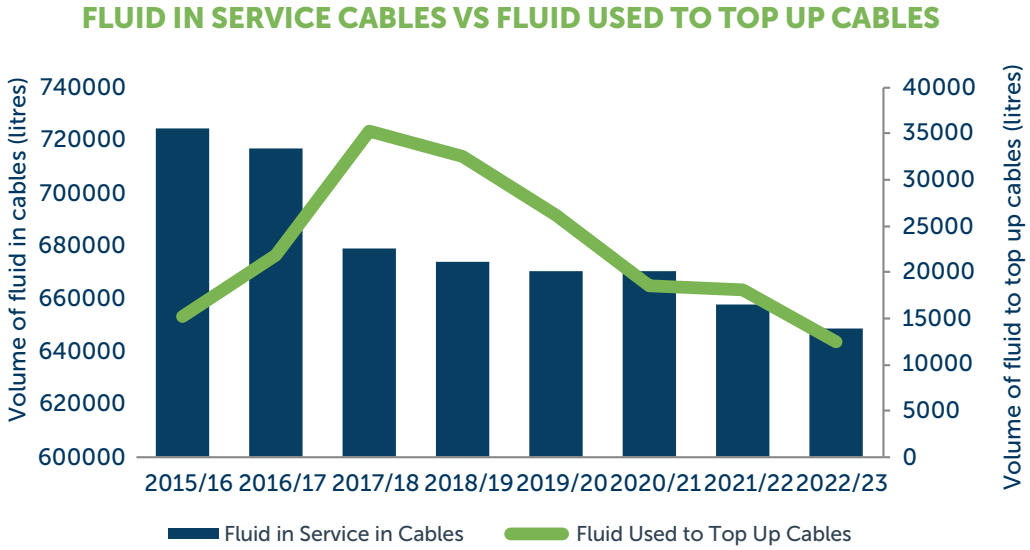


Figure 2: Oil in service cables vs fluid used to top up cables over the RIIO-ED1 period

7. CARBON AND CLIMATE CHANGE

7.1. BUSINESS CARBON FOOTPRINT

7.1.1. SUMMARY

SSEN operates over a wide geographical area across central Southern England and the North of Scotland and employs thousands of people to maintain and operate the network. We are committed to reducing our BCF by reducing our GHG emissions across the board, including those associated with diesel consumption, energy usage in our buildings and network losses. We are also committed to minimising the amount of SF_6 that leaks from our assets.

This section provides a transparent account of the impact that our business activities have on the environment and our progress against our emissions reduction target for RIIO-ED1. It details the total GHG emissions produced in both SHEPD and SEPD licence areas from our base year, 2012/13, to the 2022/23 reporting year. Our BCF is published as part of our company reporting obligations and reported annually to Ofgem as part of our distribution licence requirements.

We are delighted to end RIIO-ED1 on a positive note having achieved our RIIO-ED1 absolute reduction target to reduce GHG emissions by 15%, attaining a 30% reduction in 2022/23 compared to base year levels. In 2022/23, our BCF (excluding network losses) across both SHEPD and SEPD licence areas were estimated at 45,292 tCO^2-e, reduced by 34,215 tCO^2-e compared to 2021/22.

2022/23 was a successful year across many outputs including reducing emissions across our BCF profile. We continue to make good progress with further electrification of our vehicle fleet and increasing the use of fossil-fuel alternatives in our operations (for e.g., hybrid generators, battery powered vegetation management tools, and diesel alternatives).

In 2022/23, the combined total GHG emissions including network losses were estimated at 435,739 tCO^2-e, equating to a 92,66 tCO^2-e reduction over the previous reporting period 2021/22.

Figure 3, shows our total GHG emissions by source for the 2022/23 reporting period.

For further details of our business carbon footprint, please see worksheet E3 – BCF linked to the Appendix of this report.

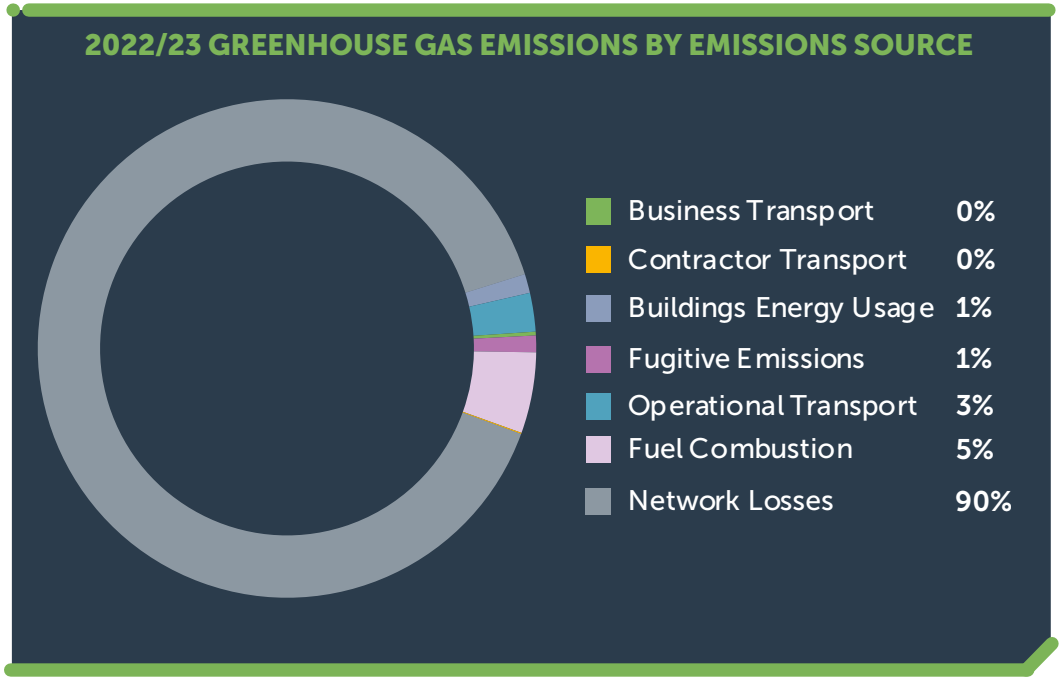


Figure 3: 2022/23 Greenhouse Gas Emissions by Emissions Source

7.1.2. METHODOLOGY

In the following sections, we document our energy usage from offices and substations, distribution losses, transport emissions (both operational and business), fuel combustion, and fugitive emissions from SF_6. The reported data for some emissions sources also takes account of several of our larger contractor emissions as required in Ofgem's Environment & Innovation Regulatory Reporting Pack.

We collate the data from across our business using the methodology described within international GHG emissions accounting standards, the GHG Protocol and ISO14064-1. We convert our data to equivalent tonnes of carbon dioxide (tCO^2-e) using conversion factors as provided by the Department for Business, Energy, and Industrial Strategy (BEIS) for annual reporting to Ofgem.

7.1.3. BUSINESS CARBON FOOTPRINT CALCULATIONS AND RESULTS

In 2022/23, our combined total GHG emissions across the SHEPD and SEPD licence areas (including network losses) were estimated at 435,739 tCO^2-e, equating to a 92,66 tCO^2-e (18%) reduction over the previous reporting period 2021/22.

The positive reduction in our emissions is due to several factors including utilisation of fossil fuel alternatives such as electric vehicles, and hybrid mobile generators, and an increase in energy efficiency measures throughout our buildings.

Despite our unique obligation to operate embedded generation power stations to maintain security of supply to several Scottish Islands, supplied by a single distribution subsea cable, GHG emissions associated with this activity were significantly reduced compared to previous reporting periods. In 2022/23, SHEPD's fuel combustion emissions reduced by 83% compared to 2021/22 due to a reduction in storm activity and faults experienced across our SHEPD licence area, reducing the need for use of back up embedded generation.

Our planning standards rely on diesel generation to maintain security of supply for our customers on the Scottish Islands, should a fault occur on a subsea cable supplying that island, or during a storm. Therefore, during RIIO-ED2, we have proposed more environmentally friendly solutions to continue to reduce the reliance on diesel power stations, including the deployment of innovative technological solutions, the utilisation of fossil fuel alternatives, and strengthening our North of Scotland resilience by exploring local solutions and flexibility services.

Our total operational emissions for the RIIO-ED1 period, against our absolute reduction target, is shown in Figure 4.

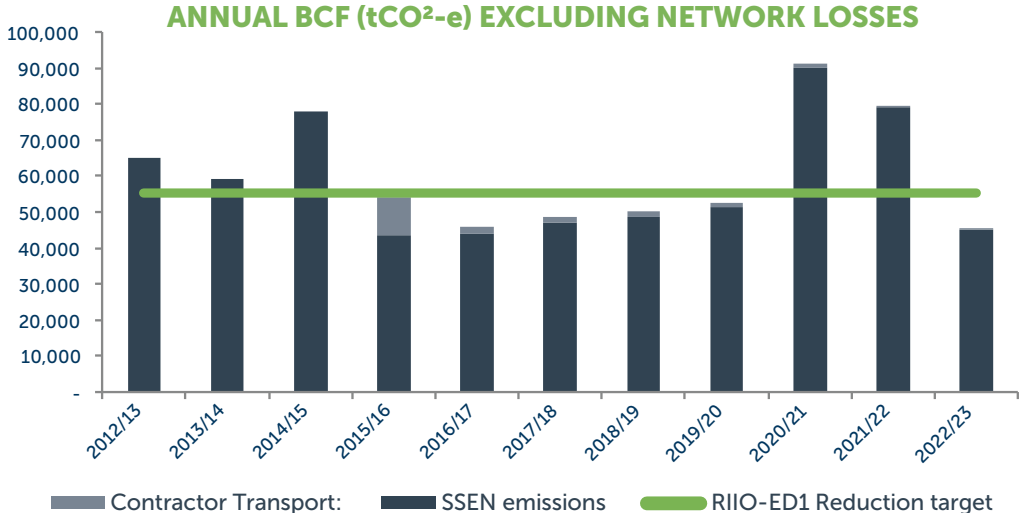


Figure 4: SHEPD and SEPD Historical GHG Emissions (tCO^2-e) by Emissions Source (Excluding Losses)

As shown in Figure 4, our BCF (excluding losses) has decreased by 30% from 2012/13, highlighting the positive action undertaken in our operations to reduce our environmental impact whilst ensuring security of supply to our 3.9m customers throughout our SHEPD and SEPD licence areas.

Figure 5, shows the contribution that our network losses make to our overall BCF in relation to our operational emissions and contractor emissions across both SHEPD and SEPD licence areas over the RIIO-ED1 period. As shown, network losses make up the largest proportion of our total BCF.

In 2022/23, network losses across both licence areas made up 90% of our total GHG emissions. Therefore, we continually strive to keep network losses to as low as practicably possible.

Figure 5 shows that emissions associated with losses has dropped significantly over the RIIO-ED1 period. This was a result of our work to reduce network losses, a significant downward change in the factor used to derive carbon impact in this emission category (due to an increase in the proportion of renewables in the generation mix) and a decrease in network demand following the cost-of-living crisis experienced throughout the UK. The conversion factor used was updated every year following the latest published figures by BEIS (formally DEFRA). Through our Losses Strategy, we adopt more pro-active measures to reduce network losses e.g., increasing minimum cable size and reducing energy theft. More detail of our work in this space can be found in Section 7.3.

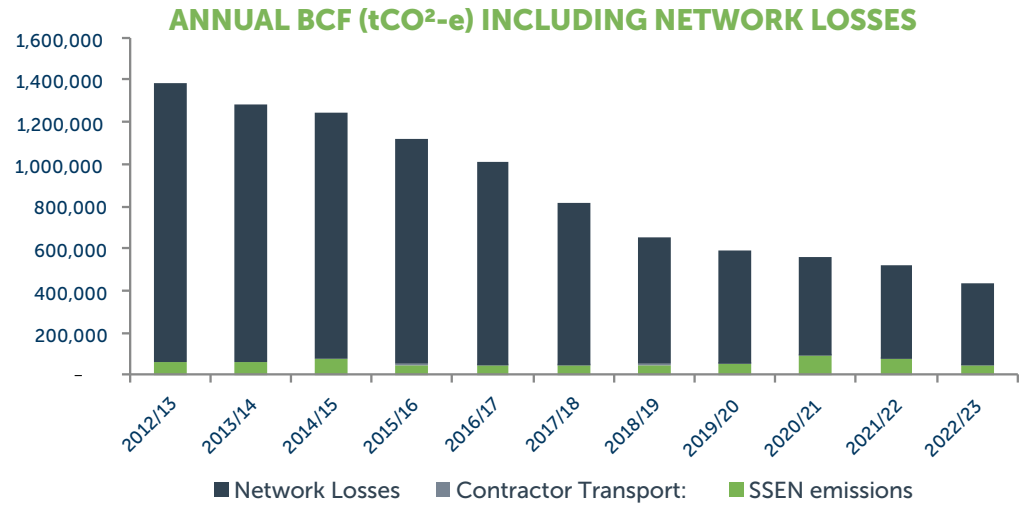


Figure 5: SHEPD and SEPD Historical GHG Emissions (tCO^2-e) by Emissions Source, Including Losses

For further details of our business carbon footprint, please see worksheet E3 – BCF linked to the Appendix of this report.

7.1.4. REDUCING OUR BUSINESS TRANSPORT MILEAGE

We have successfully met our RIIO-ED1 business plan commitment to reduce the average mileage of our cars by 10% compared to 2012/13 levels.

In 2022/23 our average business miles travelled reduced significantly to 2,613 miles per vehicle. This equates to a 63.3% reduction from our 2012/13 base year of 7,118 miles per vehicle. This is largely due to utilising flexible working arrangements following the COVID-19 pandemic and conducting engagements virtually by utilising digital technologies like Microsoft Teams. Figure 6, outlines our progress against this target throughout RIIO-ED1.

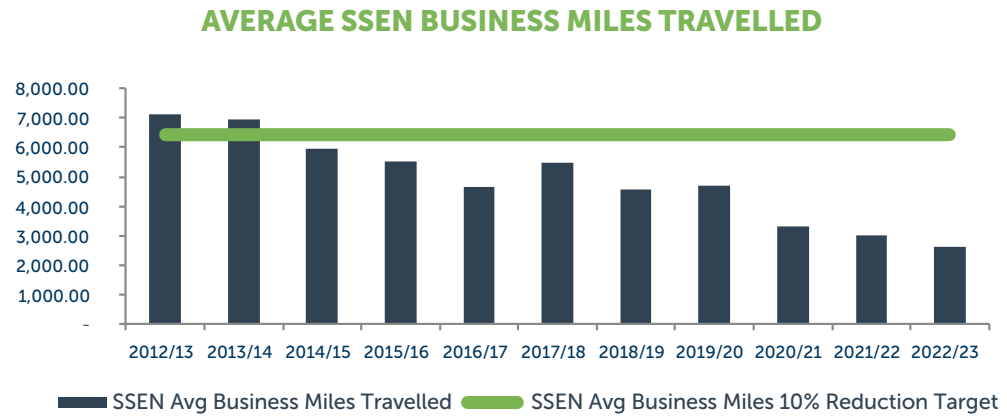


Figure 6: Annual Average Vehicle Mileage Over the RIIO-ED1 Period (SHEPD and SEPD)

Figure 7, shows the emissions associated with our total transport emissions (business and operational), which shows a significant reduction over the RIIO-ED1 period.

Our commitment to reduce the average mileage of our business cars was intended to reduce our annual transport emissions. Both our average business car mileage and overall transport in 2022/23 show a significant reduction relative to 2012/13.

In 2022/23, the number of flights undertaken equated to 0.3 per employee which means we have successfully met our RIIO-ED1 business plan commitment to undertake no more than 0.5 business flights per employee per year.

As shown in Figure 7, our contractors' transport emissions in 2022/23 have exhibited a downward trend from 2015/16. This is because there had been a decision to shift away from using 'external' contractors in 2016/17, with several core areas being brought into the Networks business. It should be noted that contractor emissions were recorded as part of operational transport prior to 2015/16. After this point they were recorded separately as shown in Figure 7.

For further details of our business carbon footprint, please see worksheet E3 – BCF linked to the Appendix of this report.

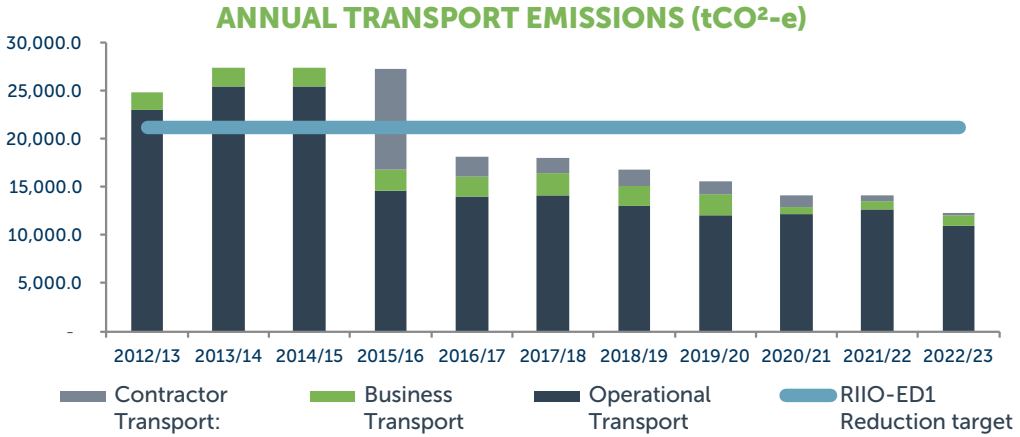


Figure 7: Annual Transport Emissions Over the RIIO-ED1 Period (SHEPD and SEPD)

7.1.5. REDUCING OUR ENERGY CONSUMPTION

SSEN makes up one part of the wider SSE Group, which is comprised of several other businesses. Over the last six years, SSE Group's non-operational building carbon footprint has experienced a reduction in GHG emissions. By sharing building space with other SSE businesses, we can reduce costs as well as energy consumption.

To date, investments in a range of energy efficiency projects have been successful in returning financial and GHG emissions savings. They have also enhanced SSE's reputation in meeting our commitment to minimising environmental impact. Further details of this can be seen in Table 6.

To report our portion of SSE Group's total energy consumption emissions across SHEPD and SEPD, we adopted a recharge model which is based on number of employees per SSE business. The total building energy usage for SSEN is shown in Figure 8. The figure shows that we have met our target to reduce energy usage emissions by 15% from a 2012/13 baseline and have continued to reduce building energy emissions throughout RIIO-ED1.

In 2022/23, electricity usage increased by around 27% whilst gas usage increased by around 25% compared to the previous reporting year. The increase in electricity usage is a combination of improved data capture, acquisitions, and overall increased occupancy due to business growth and easing of Covid-19 restrictions.

SSE GROUP TARGET

SSE Group has an internal target of 5% GHG emissions reduction per three-year period (up until 2030) based on 2017/18 baseline. However, from the 1st of April 2022, a new SSE Group GHG emissions reduction target was reported to align with their ambition of achieving a Net Zero non-operational buildings estate by 2035.

Performance is measured going forward against a revised annual reduction target of 7.19% against a 2021/22 baseline. SSE Group reports that its non-operational estate Net Zero target was 5% over target in 2022/23.

2022/23 saw electricity and gas usage increase across SSE Group's non-operational estate owing to increased occupancy of offices and depots post Covid-19 pandemic. However, electricity and gas emissions conversion factors were lower than previous years, largely due to an increase of renewables in the generation mix, and this resulted in the slight drop in total GHG emissions as reported below.

Latest data confirms that 99.54% of electricity supplied to SSE Group's offices and depots is sourced from renewable generation. Electricity supplied to all Facilities Management sites comes from renewable sources.

We are continually looking to make our buildings more energy efficient to accelerate and strengthen our Net Zero position as a business.

Highlights of our energy efficiency investments throughout RIIO-ED1 are summarised in Table 6.

During 2022/23, investments included £250,000 in energy efficient LED lighting at a range of sites including Waterloo Street, Poole Depot and training facilities at Thatcham, the installation of a new car park lighting controls system at SSE Perth HQ campus and the installation of a new solar Photo Voltaic (PV) system at Perth Training Centre.

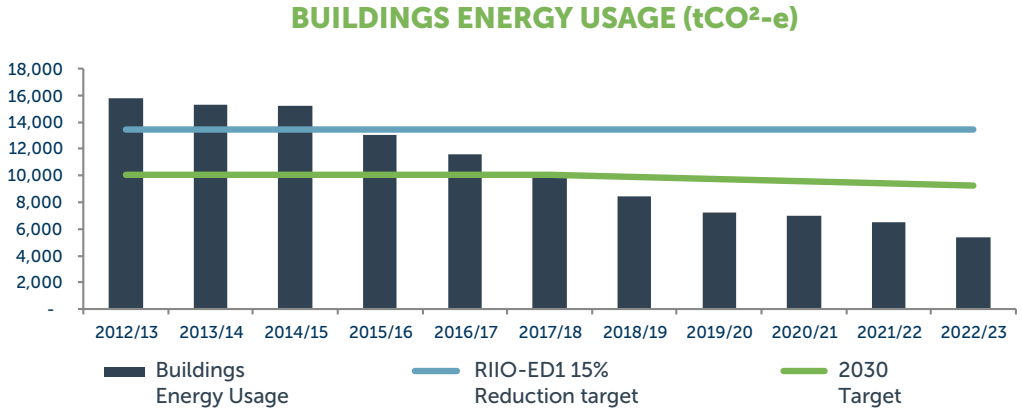


Figure 8: Annual Building Energy Usage Over the RIIO-ED1 Period (SHEPD and SEPD)

For further details of our business carbon footprint, please see worksheet E3 – BCF linked to the Appendix of this report.

Year	Energy Efficiency Investment (per annum)	Reported Annual Carbon Reductions	Energy Saving (Annually recurring)
2012/13	£1,170,000	12,469	£39,740
2013/14	£2,399,000	7,819	£164,492
2014/15	£2,360,000	35,020	£632,540
2015/16	£3,083,000	6,170	£1,134,412
2016/17	£1,568,000	2,203	£229,786
2017/18	£2,237,910	2,314	£107,733
2018/19	£429,244	3,765	£207,228
2019/20	£450,000	5,268	£2,457,580
2020/21	£150,000	2,074	£717,189
2021/22	£150,000	3,066	-
2022/23	£250,000	165	-
Totals	**£14,247,154**	**80,333**	**£5,375,739**

Table 6: SSE Group's Energy Efficiency Performance 2012/13 to 2022/23 [2]

For further details of our business carbon footprint, please see worksheet E3 – BCF linked to the Appendix of this report.

[2] Previous reports have included energy savings for SSE Group, monitored by the Property Services Team, however, an increased focus on reducing GHG emissions has led to a shift in data monitoring and availability. Therefore, this data is not available for 2021/22 and 2022/23.

7.2. SULPHUR HEXAFLUORIDE (SF_6) EMISSIONS

7.2.1. SUMMARY

SF_6 is an extremely effective electrical insulator that is used in our circuit breakers, switchgear and other electrical equipment. It has significant advantages over alternative materials. It is non-flammable, a critical safety requirement in the high-voltage applications and because of its excellent insulating properties it takes up less volume than alternatives such as oil. However, it is also a very potent greenhouse gas; one kg of SF_6 is equivalent to approximately 23,500kg of carbon dioxide equivalent.

Therefore, we are committed to minimising the amount of SF_6 that leaks from our assets and continue to work with our supply chain to investigate alternatives on the market.

We have established a working group to address SF_6 leakage, are utilising a more pro-active approach to the SF_6 switchgear repairs process and are implementing changes to internal systems to better target leaking SF_6 assets for replacement or intervention. Our revised SF_6 strategy and associated interventions have led positive reductions in SF_6 leakage in RIIO-ED1 and are focusing efforts to continue to reduce SF_6 emissions through to RIIO-ED2.

[3] DESNZ Greenhouse Gas Reporting: Conversion Factors 2023 Greenhouse gas reporting: conversion factors 2023 - GOV.UK (www.gov.uk)

7.2.2. SF_6 PERFORMANCE DURING RIIO-ED1

The total capacity of SF_6 used in assets on our network during 2022/23 was 27,367kg across our two licence areas as presented in Table 7.

The volume of SF_6 emitted, or leaked, is calculated by combining the volume of SF_6 used in routine maintenance and the volume used during fault repair.

During routine substation inspections, all SF_6 switchgear, plant and equipment are inspected, and all gauges checked to ensure that SF_6 pressure is in the normal operating range. Low SF_6 gas levels are reported to the Network Management Centre, which will ensure prompt attention.

We take any leakage of SF_6 extremely seriously and have detailed policies and procedures in place to manage our relevant assets. We monitor plant leakage rates on a monthly basis to quickly identify plant items that are becoming problematic and decide on an appropriate course of action for intervention to halt any leakage. Topping up of SF_6 network assets is done in accordance with the BS EN 60376 standard. The quantity of SF_6 topped up is recorded in our asset management system upon the completion of the top-up work.

During 2022/23 we continued to progress our strategy to minimise SF_6 leakage from switchgear. This has involved several internal changes, including establishing a working group to address SF_6 leakage, utilising a more pro-active approach to the SF_6 switchgear repairs process and changes to internal systems to better target leaking SF_6 assets for replacement or intervention. We are also currently undertaking two innovation projects involving utilising a paint with the potential to reduce the time taken to detect leaks and deployment of a flange guard to stop leakage following detection. These projects will continue throughout RIIO-ED2.

Recent examples of optioneering include our projects for 132kV GIS at Iver and Thatcham which are both currently investigating the deployment of SF_6 -free equipment. We are also in the process of transitioning our primary plant catalogue to introduce where possible SF_6-free versions of previously approved SF_6 circuit breakers. We plan to adopt an alternative first approach to all SF_6 replacements in RIIO-ED2 price control, whereby investment decisions will have to justify why an alternative to SF_6 is not suitable for any particular project. Project teams will have to demonstrate the business case for SF_6 in every case put forward. We are actively engaging with numerous suppliers to discuss and technically review their alternative gas offerings at lower 11kV and 33kV voltages and will continue this approach as we move into the RIIO-ED2 price control. Several non-disclosure agreements have been signed with a variety of switchgear suppliers to share their own developments in HV switchgear at voltage levels across the Distribution arena, in both primary and secondary equipment. We are actively engaging with our framework partners and encouraging new suppliers to discuss possibilities for trialling their alternative-gas offerings on our network with the aim to accelerate the adoption of SF_6-free equipment and understand some of the potential challenges of managing a multiple gas asset-base.

Externally, SSEN is taking an active role in addressing the issue of SF_6 across the industry and currently participates in the Energy Networks Association SF_6 Task Force group. The working group was established to input to the EU consultation on Fluorinated Gases Regulations and has a focus on exploring SF_6 alternatives and reducing SF_6 leakage in order to reduce emissions.

Licensee	Installed Capacity (kg)	SF_6 Leakage (kg)	Percentage of Bank
SHEPD	5,069.99	3.85	0.08%
SEPD	22,297.16	202.71	0.91%
TOTAL	27,367.15	206.56	0.75%

Table 7: Installed SF_6 capacity per Licensee (2022/23)

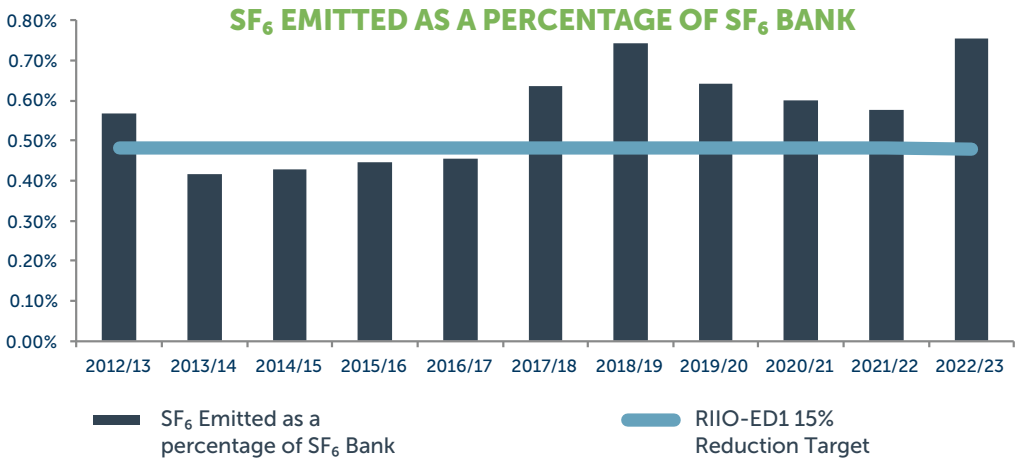


Figure 9: SF_6 Emitted as a Percentage of Bank during RIIO-ED1 (SHEPD and SEPD)

Unfortunately, in 2022/23 we missed our RIIO-ED1 target of a 15% reduction in SF_6 leakage (from a 2012/13 base year), largely due to poor leak performance in part as a result of extreme weather conditions. As part of our efforts to improve our performance in this area we have set up a monthly working group focused on raising the profile of leakage investigations and repairs with a view of driving performance to assist with the delivery of our RIIO-ED2 SF_6 reduction targets. Additionally, SF_6 leakage performance is tracked on a monthly basis as part of our sustainability key performance indicators which are reviewed by senior managers to ensure appropriate action is undertaken to minimise the impact of our assets.

For further details on business carbon footprint, please see worksheets E2 – Environmental Reporting and E3 – BCF linked to the Appendix of this report.

7.3. DISTRIBUTION LOSSES

7.3.1. SUMMARY

This section details electrical losses performance, their impact and what we are doing to keep them as low as reasonably practicable.

Electrical losses are an unavoidable consequence of transferring energy across the electricity network, where they have a significant financial and environmental impact. Electrical losses are the difference between the amount of electricity entering into the network, from the transmission system or directly from generators, and the amount of electricity leaving the network to our customers. Losses arise as a function of electricity travelling through our network, from calculation anomalies or electricity theft.

7.3.2. LOSSES STRATEGY

Our Distribution Losses Strategy identifies our approach to ensuring that losses on our network are kept as low as reasonably practicable. Key measures identified include:

- Installing Primary and Grid transformers that meet the European Union's Ecodesign Directive (Directive 2009/125/EC), including replacing historical higher loss transformers on our network.
- Increasing the minimum size of new secondary transformers.
- Increasing the minimum cable size for both LV and HV to the next size up where practical to do so.
- Upgrading network voltages in specific areas of our network.
- Switching off underutilised plant during periods of low loading.
- Continuing to develop new methods of managing Non-Technical Losses (calculation anomalies and electricity theft)

Year 2022/23	Total Distribution Losses MWh	Equivalent tCO^2-e
SHEPD	487,369	94,247
SEPD	1,531,700	296,200

Table 8: Total Losses in the SSEN Distribution Network

Full details of our Losses Strategy can be found at: ssenfuture.co.uk/EnvironmentalActionPlan.

7.3.3. LOSSES VOLUME

The total amount of distribution electrical losses in 2022/23 was around 2,000 GWh as shown in Table 8. The distribution losses volume is derived from an industry standard model utilising both percentage of sales and purchases of electricity from the grid.

Figure 11, shows the volume of distribution network losses in each reporting period over RIIO-ED1. Network losses reduced by around 13% in 2022/23 compared to 2021/22. During the 2022/23 period, there was reduced load thought to be due to the cost-of-living crisis which saw consumers trying to reduce their electricity consumption. The reduction in emissions was also due to an increase in renewable generation connected to the grid and the progression of our losses strategy.

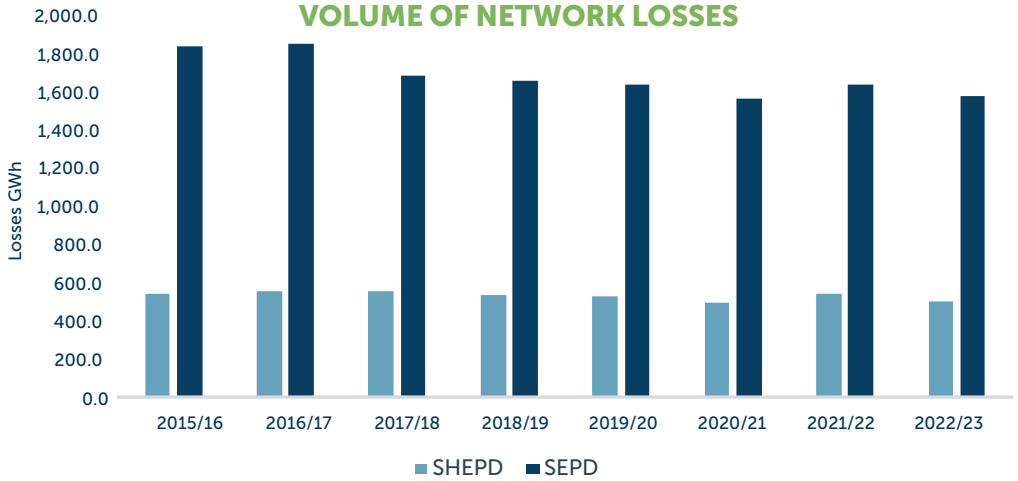


Figure 10: Volume of Losses across SSEN Distribution Network during RIIO-ED1

7.3.4. LOSSES STRATEGY IN ACTION

To help ensure we meet our commitment to reduce losses and ensure they are as low as reasonably practicable, we have been implementing a number of targeted measures outlined in our Losses Strategy throughout RIIO-ED1. These initiatives are summarised below.

1. Energy Efficient Transformers

We have been installing plant and equipment that delivers enhanced losses performance and meets the EU Transformer Eco-design Directive Tier 2 specification. This includes replacing inefficient pre-1960 secondary transformers with modern equivalents that perform at much lower losses levels. These interventions have delivered over 49,700 MWh losses savings to date in RIIO-ED1.

2. Minimum Sizing of Cables and Transformers

In general terms, increasing the diameter of conductors lowers losses. Therefore, we have put in place measures to increase the minimum size and rating of new cables and transformers. These upgrades are made as part of our asset replacement scheme once the original asset has reached the end of its life, as well as for new connections. Losses savings of over 22,900 MWh have been achieved to date in RIIO-ED1 following cable and transformer upsizing.

3. Upgrading Network Voltages

As losses are proportional to the square of the current, and current is directly proportional to the voltage, increasing network voltages can reduce losses for the same power transfer. As part of our network capacity increase and standardisation, we have been upgrading legacy 6.6kV networks to 11kV in our SEPD region. This has resulted in over 3,900 MWh losses savings to date in RIIO-ED1.

4. Switching off Underutilised Plant

As of June 2018, we have been trialling the use of Transformer Auto Stop Start (TASS) technology to switch off one of the transformers at a twin or triple transformer site at times of low demand to avoid the fixed iron losses associated with that transformer. The business case assessment demonstrates that TASS offers a financially viable, as well as technically feasible option for reducing losses at individual substations. Over 100 MWh losses savings were achieved across the two substations during the trial period. Further applications of this technology will be delivered during RIIO-ED2.

5. Non-Technical Losses

Our Network Protection team continues to focus on reducing non-technical losses by addressing Metering Point Administration Numbers (MPAN) discrepancies. In 2022/23 the team successfully resolved 4,621 cases of theft from our network. This work has delivered significant non-technical losses savings to date over RIIO-ED1.

7.3.5. LOSSES REPORTING PROGRESS

Tables 9, 10, 11 and 12 below, show a snapshot of our losses reduction activities throughout RIIO-ED1. These benefits have been achieved through our programme of installing lower loss equipment as well as reducing energy theft as described in Section 7.3.4. During RIIO-ED1, an estimated £91.9m has been spent on losses reduction activities in SEPD and £64.1m in SHEPD. Our work to focus on reducing actual losses has a dual benefit of reducing the carbon impact of distributing electricity across our network and minimising the cost to our consumers, crucial to ensuring a just transition to net zero and alleviating the current cost-of-living crisis.

A summary of losses costs and benefits in both of our licence areas can be found in the Tables 9, 10, 11 and 12.

TABLE KEY

Distribution Losses Justified Costs	DLJC
Reduced Losses	RL
Reduced Emissions Associated with Losses	REAL
Cumulative Reduced Losses	CRL

SEPD PROGRAMME/PROJECT TITLE Regulatory Reporting Year 2022/23	DLJC	RL	REAL	CRL
Technical Losses Projects	£k (22/23 prices)	MWh	tCO^2-e	MWh
LV Cable Asset Replacement	0.00	185	36	757
LV Cable General Reinforcement	0.00	32	6	187
LV Cable Other	159.72	1,680	325	6,393
HV Cable Asset Replacement	6.76	197	38	603
HV Cable General Reinforcement	0.00	129	25	572
HV Cable Other	84.09	1,520	294	5,047
6.6kV to 11kV Upgrade	0.00	1,066	206	3,968
33kV Transformer Replacements	991.93	2,804	542	10,184
66kV Transformer Replacements	161.50	115	22	590
132kV Transformer Replacements	1408.21	2,481	480	10,260
Pre-1960 Transformer Replacements	0.00	470	91	1,582
Non-Technical Losses Projects				
DUOS recovery SEPD - domestic Other	N/A	119,711	23,150	482,655
DUOS recovery SEPD – non-domestic Other	N/A	39,558	7,650	209,718

Table 9: Summary of SEPD Losses Costs and Benefits from Activities in 2022/23 and over RIIO-ED1

SEPD PROGRAMME/PROJECT TITLE	Description of Unit	Volumes in Regulatory Reporting Year
Technical Losses Projects		
LV Cable Asset Replacement	km	0.56
LV Cable General Reinforcement	km	0.25
LV Cable Other	km	28.67
HV Cable Asset Replacement	km	2.29
HV Cable General Reinforcement	km	0.01
HV Cable Other	km	28.52
6.6kV to 11kV Upgrade	km	0.00
33kV Transformer Replacements	#	11
66kV Transformer Replacements	#	1
132kV Transformer Replacements	#	5
Pre-1960 Transformer Replacements	#	19
Non-Technical Losses Projects		
DUOS recovery SEPD domestic Other	#	971
DUOS recovery SEPD non-domestic Other	#	103

Table 10: Summary of Amount of SEPD Losses Activities in 2022/23

SHEPD PROGRAMME/PROJECT TITLE Regulatory Reporting Year 2022/23	DLJC	RL	REAL	CRL
Technical Losses Projects	£k (22/23 prices)	MWh	tCO^2-e	MWh
LV Cable Asset Replacement	8.95	72	14	260
LV Cable General Reinforcement	0.27	6	1	28
LV Cable Other	90.67	1605	310	5776
HV Cable Asset Replacement	6.35	123	24	355
HV Cable General Reinforcement	0.43	22	4	99
HV Cable Other	15.03	681	132	2899
33kV Transformers	721.40	4690	907	26158
Pre-1960 Transformers	450.88	252	49	1012
Non-Technical Losses Projects				
DUOS recovery SHEPD domestic Other	N/A	46,558	9003	204,242
DUOS recovery SHEPD non-domestic Other	N/A	17,091	3305	90,588

Table 11: Summary of SHEPD Losses Costs and Benefits from Activities in 2022/23 and over RIIO-ED1

SHEPD PROGRAMME/PROJECT TITLE	Description of Unit	Volumes in Regulatory Reporting Year
Technical Losses Projects		
LV Cable Asset Replacement	km	1.61
LV Cable General Reinforcement	km	0.05
LV Cable Other	km	16.28
HV Cable Asset Replacement	km	2.15
HV Cable General Reinforcement	km	0.15
HV Cable Other	km	5.10
33kV Transformers	#	8.00
Pre-1960 Transformers	#	5.00
Non-Technical Losses Projects		
DUOS recovery SHEPD domestic Other	#	524.00
DUOS recovery SHEPD non-domestic Other	#	89.00

Table 12: Summary of Amount of SHEPD Losses Activities in 2022-23

For further details on losses, please see worksheet E4 – Losses Snapshot linked to the Appendix of this report.

TABLE KEY

Distribution Losses Justified Costs	DLJC
Reduced Losses	RL
Reduced Emissions Associated with Losses	REAL
Cumulative Reduced Losses	CRL

8. OTHER ENVIRONMENT-RELATED ACTIVITIES

8.1. ENVIRONMENT-RELATED ACTIVITIES

8.1.1. SUMMARY

We are committed to managing our environmental impact and causing no further damage to the communities in which we operate. 2022/23 saw an improvement across many categories, including our achievement of ISO 14001 certification which underpins our commitment to protecting and enhancing the environment in which we operate.

In March 2023, an independent third-party certification body led a comprehensive 15-day Environmental Management System audit across our operations. This resulted in the successful achievement of ISO 14001 certification, the widely recognised international standard for Environmental Management Systems. Through our certification process we demonstrated that we have robust processes in place for ensuring regulatory compliance, appropriately managing and monitoring our environmental impact, and continually improving environmental performance. Achieving ISO 14001 certification is a significant achievement for the business and will propel our environmental and sustainability ambitions forward into RIIO-ED2 and beyond.

The sections below outline other environmental-related activities undertaken in the 2022/23 period to drive environmental stewardship.

8.1.2. EMPLOYEE ENVIRONMENTAL AWARENESS

We take pride in creating a culture fit for the future that encourages our staff to lead by example and think about the impact their actions have on the environment at work and at home. Highlights from 2022/23 include:

- **Internal Environmental Awareness Training** - During 2022/23 it became mandatory for all new starters in Distribution to complete the SSE Group internal environmental awareness training online learning module highlighting the Group's environmental strategy to managing environmental risks and opportunities. In addition, a Distribution specific environmental awareness Safety Awareness Toolbox Talk is briefed to all operational teams.
- **Internal Communications** - During 2022/23, we focused on improving the internal sustainability literacy of our staff and put together targeted communications across several channels to enable this. We developed toolbox talks, lunch and learn type sessions, Safety, Health and Environment (SHE) bulletins and regularly input into company newsletters and encourage the sharing of sustainability knowledge in dedicated Yammer groups. We also raised the profile of sustainability related KPIs by including them in internal reporting mechanisms up to a director level.
- **Supply Chain Sustainability School Membership** - Our membership allows us to offer our staff, and our supply chain, the opportunity to upskill themselves by accessing a free learning environment with thousands of learning resources and CPD-accredited content with focus on 17 key sustainability topics. At time of compilation, 1,521 individual users from 117 of our key suppliers had accessed 16,770 resources, amounting to 2,080 CPD hours.
- **SSE Group-wide Benefits** - SSE plc has been enabling its workforce to adopt green transport measures by offering a low-emissions car scheme, cycle schemes, and EV home-charging loans and discounts.

For more information see SSE's Sustainability Report: sse.com/sustainability

Figure 11: ISO 14001 Principals of an Environmental Management System

8.1.3. WASTE, LANDFILL AND RECYCLING

As part of the wider SSE Group, we follow the waste hierarchy to reduce, reuse and recycle waste. Recycling facilities are provided at key office locations and operational sites to reduce the amount of consumable waste sent to landfill.

In 2022/23, we recorded 2,907 tonnes of waste of which 69% was recycled and 94% was diverted from landfill. A large proportion of our recycling tonnage is achieved through adopting circular economy principles by recycling redundant equipment, particularly waste metal.

We are working with our waste contractors to continually improve our waste management performance, which features in our internal and external sustainability reporting and is monitored via our ISO 14001 certified Environmental Management System. Additionally, as part of our Sustainable Supplier Code, we are also working closely with suppliers to ensure we look to reduce the amount of waste that is generated in our operations and are supporting them to reach our aim of 60% of our supply chain (by spend) with a waste strategy in place by 2025.

CASE STUDY – SEGREGATING EXCAVATED MATERIALS

During excavation work, materials are dug up, removed, and then backfilled after the work has been completed. Previously, when removing material from the excavations, bituminous material and soil were not separated and all of the excavated material was sent off-site for disposal.

Our teams on the ground in our SEPD region decided to segregate the excavated materials on site, which allowed around 80% of the materials to be directly reused for backfilling which significantly reduced the associated waste. The remaining concrete, bituminous material, and other recyclables can then be sent to specialist local facilities for reprocessing and reused in other projects such as footpath construction.

Reusing the excavated materials avoids around 3,000 tonnes of excavated materials going to landfill sites as well as £180,000 by avoiding purchasing new material annually, as we complete thousands of similar jobs in the region in a given year. This is also lessening the impact on the wider environment given new material would likely be sourced from quarries around the country.

This is just one initiative we are undertaking to reduce waste generated in our operations.

Further details of our future waste ambitions can be found in our Sustainability Strategy: ssen.co.uk/sustainability

8.1.4. BIODIVERSITY

Our distribution network runs through some of the country's most biodiverse environments which support a wide variety of habitats, flora, and fauna. Sometimes our work has potential to harm sensitive biodiversity or sites, including those that are legally protected. We have a legal duty to conserve and enhance biodiversity, and to mitigate any adverse effects that our projects may have on priority habitats and species.

We assess our projects to identify potential ecological impacts that might arise, and to ensure that adverse effects to sensitive species and habitats are avoided or reduced. Our engineering design teams work closely with our in-house, and supply chain, ecological specialists to ensure that our infrastructure projects are designed sympathetically and with the aim of avoiding and minimising biodiversity impact as well as compensating for any residual impacts.

To inform our projects, we undertake ecological assessments including surveys for protected species such as great crested newt, otter, badger, water vole and bats. We liaise and work closely with Natural England, NatureScot, the Environment Agency, and the Scottish Environmental Protection Agency, and other environmental stakeholders.

PROJECT SPECIFIC BIODIVERSITY WORKS

The Fort Widley 132kV Cable project involves the installation of 2.1km of new underground cable near Portsmouth, Hampshire. The purpose of this project is to replace two existing 132kV fluid-filled cable circuits that are at the end of their operational life. A new cable is required to safeguard the security of the electricity supply for approximately 74,700 customers in Fareham (including homes, businesses, and community resources).

The route of the replacement cable is entirely cross-country with the final connection point being to an existing electricity tower that is located within Portsdown Site of Special Scientific Interest (SSSI). This is a legally protected site of national importance due to the chalk grassland and invertebrate assemblages that it supports. Because the tower is located within the SSSI, works within the designated site are unavoidable with approximately 150m of cable needing to be laid within the site.

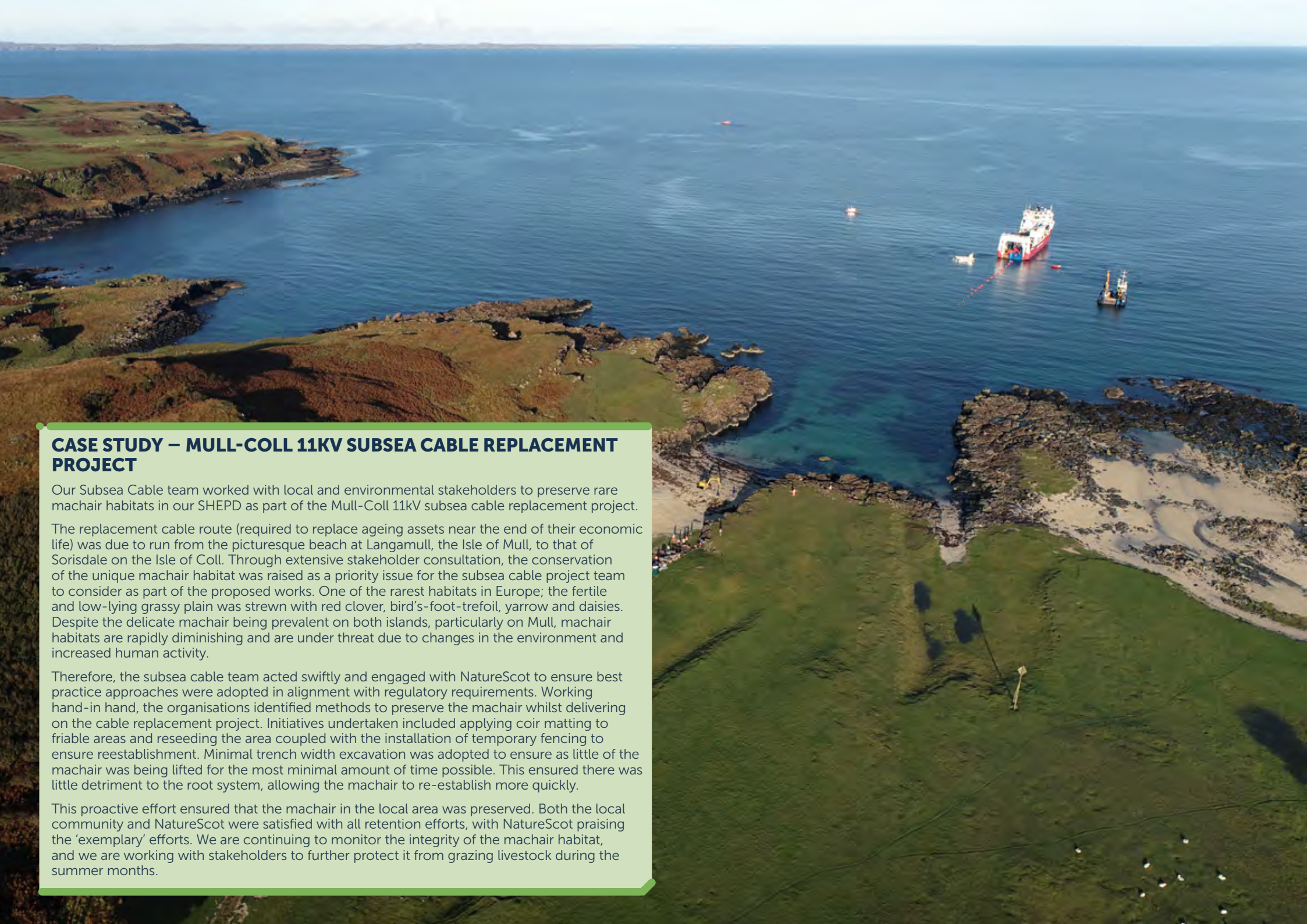
A feasibility and optioneering study were undertaken to identify various possible cable routes and construction methodologies, aiming to design a scheme that would minimise ecological impact whilst also addressing the various engineering and construction challenges presented by the project. The feasibility study was informed by several environmental assessments, including botanical, great crested newt, hedgerow, reptile, as well as archaeological surveys. Natural England and the landowner, Portsmouth City Council (PCC), were consulted throughout the feasibility and optioneering stages of the project, with their advice being integral to the selection of the final design.

The feasibility study determined a cable route that avoided or reduced impacts to sensitive ecological features along the full length of the cable route, including hedgerows, chalk grassland and trees. The route was also designed to avoid potential features of high archaeological value, as identified by the archaeological assessment.

To reduce impacts to Portsdown SSSI, it was elected to adopt a horizontal directional drilling technique. This means that impacts to areas of high-quality chalk grassland are avoided with construction works within the SSSI being confined to areas of lower quality grassland and scrub adjacent to the tower.

Having demonstrated that our works could be undertaken to a high environmental standard and with minimal risk, we obtained SSSI assent from Natural England and secured the agreement of the landowner, PCC. An Environmental Permit was also secured from the Environment Agency for a watercourse crossing.

Cable installation at locations outside the SSSI commenced in 2022 with measures being implemented to protect and reduce impacts in alignment with the feasibility study. Drilling and other works within the SSSI are due to commence during Autumn of 2023 in accordance with the ecological mitigation strategy agreed with Natural England and PCC. This project also seeks to deliver a biodiversity net-gain by enhancing chalk grassland on land adjacent to the cable route.



CASE STUDY – MULL-COLL 11KV SUBSEA CABLE REPLACEMENT PROJECT

Our Subsea Cable team worked with local and environmental stakeholders to preserve rare machair habitats in our SHEPD as part of the Mull-Coll 11kV subsea cable replacement project.

The replacement cable route (required to replace ageing assets near the end of their economic life) was due to run from the picturesque beach at Langamull, the Isle of Mull, to that of Sorisdale on the Isle of Coll. Through extensive stakeholder consultation, the conservation of the unique machair habitat was raised as a priority issue for the subsea cable project team to consider as part of the proposed works. One of the rarest habitats in Europe; the fertile and low-lying grassy plain was strewn with red clover, bird's-foot-trefoil, yarrow and daisies. Despite the delicate machair being prevalent on both islands, particularly on Mull, machair habitats are rapidly diminishing and are under threat due to changes in the environment and increased human activity.

Therefore, the subsea cable team acted swiftly and engaged with NatureScot to ensure best practice approaches were adopted in alignment with regulatory requirements. Working hand-in hand, the organisations identified methods to preserve the machair whilst delivering on the cable replacement project. Initiatives undertaken included applying coir matting to friable areas and reseeding the area coupled with the installation of temporary fencing to ensure reestablishment. Minimal trench width excavation was adopted to ensure as little of the machair was being lifted for the most minimal amount of time possible. This ensured there was little detriment to the root system, allowing the machair to re-establish more quickly.

This proactive effort ensured that the machair in the local area was preserved. Both the local community and NatureScot were satisfied with all retention efforts, with NatureScot praising the 'exemplary' efforts. We are continuing to monitor the integrity of the machair habitat, and we are working with stakeholders to further protect it from grazing livestock during the summer months.

8.1.5. CLIMATE ADAPTATION (FLOOD MITIGATION)

Over the RIIO-ED1 period, we have invested £15.73m on investigation works and flood mitigation measures in SEPD and £0.90m invested in SHEPD.

In 2022/23, we installed flood doors at Rothes Primary substation in SHEPD and completed some scoping work in SEPD for larger projects which will be completed in RIIO-ED2.

As we enter RIIO-ED2, we are continuing a focus on climate adaptation through our Climate Resilience Strategy, submitted as part of our RIIO-ED2 Business Plan. Our adaptation plan focuses on several risks, identified through our involvement with the Electricity Networks Association Climate Change Resilience Working Group, including flood mitigation. Through this work, we have identified several adaptation actions we will undertake to ensure our resilience to the changing climate in our licence areas. Amongst other actions, we plan to carry out flood risk assessments at the sites identified in our register of at-risk substations which will inform appropriate mitigation measures for the site where necessary during RIIO-ED2.

We will also continue providing support to our operational teams by delivering relevant training and to our communities via our Powering Communities to Net Zero fund.

Read more about our Climate Resilience Strategy and our recently published Strategic Update and Progress Report here.

8.1.6. NOISE POLLUTION

In 2022/23, there was 1 noise pollution complaint received in the SHEPD licence area and 8 complaints received in the SEPD licence area. These included complaints relating to substation noise or noise from transformers. Over RIIO-ED1, there were a total of 80 complaints received across both licence areas, costing around £1.44m in remedial work.

We will continue to look to mitigate noise pollution from our operations as much as possible and to address any complaints in a timely manner throughout RIIO-ED2.

For further details on noise pollution, please see worksheet E2 – Environmental Reporting linked to the Appendix of this report.

8.1.7. CONTAMINATED LAND CLEAN UP

Contamination can result in harm to humans and animals with remediation removing the existing risk to the quality of groundwaters, such as rivers and streams. Therefore, we focus on resolving all incidents as quickly as possible to reduce associated impacts. In 2022/23, there were 0 incidents of land contamination in the SHEPD licence area and 20 incidents in the SEPD licence area (at a cost of £100k in remedial work). Over RIIO-ED1, there were a total of 122 incidents across both licence areas, costing around £1.48m in remedial work.

We will continue to look to mitigate contamination from our operations as much as possible and to address any incidents in a timely manner to reduce impact as much as possible throughout RIIO-ED2

For further details on contaminated land clean up, please see worksheet E2 – Environmental Reporting linked to the Appendix of this report.

8.1.8. COMMUNITY ENGAGEMENT

Over the past 8 years, during RIIO-ED1, the Resilient Communities Fund (RCF) has supported community groups and charities across our electricity distribution network areas in central southern England and the north of Scotland. In that time, the fund has demonstrated the value in helping communities to build resilience for emergency events and protect the welfare of vulnerable community members. As we see increased effects of climate change in our local licence areas, such as more frequent extreme weather and storm events, this support has proved to be increasingly useful for our communities.

Since 2015, the Resilient Communities Fund has awarded £4.7m to 680 not-for-profit community groups and charities. 2023/24 represents the final year of the Resilient Communities Fund as RIIO-ED1 comes to a close. Commencing in RIIO-ED2, the new 'Powering Communities to Net Zero' fund will be available to support low-carbon technology accessibility initiatives for those in vulnerable situations as well as community-led environmental and resilience schemes.

2022/23 FUND

During late 2021 and early 2022, several significant storms affected both regions of our network. The impact of these storms on our communities was significant and tested the resilience of many areas.

Recognising this impact, we decided to carry out a consultation at the start of 2022 to establish the priorities for the fund in 2022/23. The number and duration of outages throughout the winter of 2021-22 meant that many of those affected where in communities who had not experienced such emergencies before. Therefore, significant need to strengthen community resilience as a whole was identified.

The scale of the impact of Storms Arwen, Malik and Corrie in Scotland and Storm Eunice in England led to an increase in the amount of funding made available through the Resilient Communities Fund in 2022/23. This led to 110 groups across both areas being awarded funding more than £1.36m to support and build capacity in communities, particularly those impacted during the storms.

A large proportion of the Resilient Communities Fund was used by communities to purchase back-up generators and other equipment that was lacking during the storms. Communities were also able to learn from these emergency events and adapt their provision accordingly.

CASE STUDY – EASSIE, NEVAY AND KIRKINCH COMMUNITY ASSOCIATION

The Eassie, Nevay and Kirkinch Community Association were awarded £15,000 to purchase a permanent stand by generator for their community resilience centre in Angus as well as improve 'on the ground' communications in their community. These requirements were identified during recent storms when members of the community attended the resilience centre only for the power at the hub to fail. This back up system will ensure that the community will have enhanced resilience during any future emergencies.

CASE STUDY – YARNTON COMMUNITY EMERGENCY GROUP

The Yarnton Community Emergency Group, which includes parish councillors and supports a group of volunteers in the village called the Yarnton Flood Defence Group, applied to the RCF for just under £2,000 of funding that would buy them the equipment they needed to help them respond to residents' needs during flooding, and to potentially reduce the damage caused to waterlogged homes.

Run wholly by village volunteers who respond in emergency situations, the group have invested their RCF award in equipment including submersible pumps, long pump outlet and suction hoses, and shovels; all vital to enable them to carry out assistance confidently and safely to the community.

More information regarding the Resilient Communities Fund is available here:

ssen.co.uk/resiliencefund

8.2. INNOVATION PORTFOLIO WITH ENVIRONMENTAL DRIVERS

8.2.1. SUMMARY

Environmental benefits are the key driver of a number of projects in our innovation portfolio. Some examples of our innovation projects that deliver environmental benefits are detailed in the sections below.

8.2.2. SUPPORTING THE UPTAKE OF LOW-CARBON TECHNOLOGIES (LCTS)

E-TOURISM (NIA_SSEN_0038):

This project, in partnership with the Scottish Government and other key stakeholders, is exploring potential seasonal and geographical network challenges associated with EV charging points, which may arise from large volumes of EVs being driven by tourists. A desktop study was undertaken to understand the scale, location and impact on the electricity network of seasonal EV charging and particularly at locations where public transport was limited in the North of Scotland. The study investigated a number of use cases including a Ferry Port, Rural tourist attractions, a City Centre location and trunk roads.

A change request was submitted in May 2021 to expand the project to include our southern region. SSEN are working with an already formed consortium on the Isle of Wight. We are replicating the approach used in Scotland to understand the differences in available data between Scotland and England to develop a GB replicable methodology for realising seasonal charging impacts. Working with the Isle of Wight consortium has highlighted opportunities to complete the remaining objectives to test suitable local solutions to support the seasonal increase in network demand.

The project is now closed following dissemination which included EST and ESC presentations as well as embedding into Business As Usual EV Connections application process, which can be seen on SSEN's website (https://www.ssen.co.uk/our-services/new-supplies/ev-connections)

Start/end date: July 2019 – September 2022

For more information see: smarter.energynetworks.org/projects/nia_ssen_0038

WHOLE SYSTEM GROWTH SCENARIO MODELLING, PHASE 2 (NIA_SSEN_ 0043):

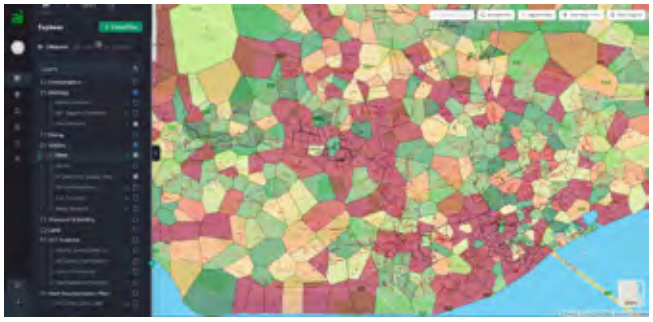
Also known as RESOP (Regional Energy System Optimisation Planning), this project follows on from NIA_SSEN_0030 Whole System Growth Scenario Modelling, which developed an initial model tool demonstrating network impacts and informed possible investment decisions over a two-decade time period.

This project delivers an enhance model tool to incorporate new governmental targets for economic and sustainable action plans and provides greater granularity by incorporating the 11kv network. It lets us understand the possible patterns of change associated with the Scottish Government 2045 climate change targets (Note: the UK target is 2050) in the distribution networks served by a single Grid Supply Point in an area of accelerated EV growth. Through use of this model, we can develop optimum solutions to meet whole system needs and validate and calibrate inputs for whole system planning with existing or planned requirements/expectations for the Local Authorities to avoid unnecessary extra work in producing local energy plans/strategies. We will also be able to develop a methodology and framework that allows the two-way transfer of knowledge and understanding between network operators and those that make investment decisions in the areas served by the network, to facilitate efficient whole system planning.

To date, we have contracted Advanced Infrastructure to provide the LAEP+ tool for both Dundee and Oxford City Councils to start trialling. This is a web GIS tool that allows Local Council Planners to place new energy projects. The tool shows where network constraints are present and therefore gives Local Council Planners an indication where energy projects may result in higher costs i.e. if area is highlighted green there is no constraint, if highlighted red then there is a constraint, or a constraint will be caused by the new connection and likely cause higher connection costs. The LAEP+ tool will also show SGN, the gas network operator in Dundee, data to provide Local Council Planners additional data layers when making investment decisions. Local Council projects can then be viewed by all parties to work collaboratively in suggesting new locations or investment options.

Start/end date: January 2020 – June 2023

For more information see: Whole System Growth Scenario Modelling Phase 2 | ENA Innovation Portal (energynetworks.org)



NET ZERO SERVICE TERMINATION (NIA_SSEN_0055):

The project will deliver a report capturing learnings on the suitability of service cables and cut-outs to accommodate the increased network loading as a result of the connection of EVs and heat pumps.

SSEN's demand growth forecasts (Distribution Future Energy Scenarios) for achieving Net Zero by 2050 suggest that around 70% of homes will require LCT connections. This equates to 2.8 million homes (of the current housing stock). Experience of connecting LCT to existing homes has shown that domestic loading assessments are required in 42.6% of cases and cut-out upgrades in 6% of cases. The outputs of this project, combined with SPEN's iDentify project, could avoid the need for individual loading assessments for new LCT connections. This could save up to £10.8m in loading assessment costs in SSEN's license area between 2021 and 2030.

Service terminations and service cable testing methodologies have been designed and agreed through a project team workshop. The design and approval of the service cable installations and test stations scenarios that have been recommended is complete. Project planning workshops identified the three-service cable installation test scenarios recommended within the service cable Installation Literature Survey and these have been discussed and implemented.

Construction of mock cut-out enclosures has been completed. This includes the construction and testing of the five-signal conditioning and precision rectifier units and their incorporation in the test rig. This has enabled a very low AC voltage drop to be measured across the cut-outs and logged whilst the rig is running. This allows the power dissipation to be calculated over time, giving a very valuable insight as to the heating effects of the individual cut-outs compared to the other components housed in the meter enclosure. These cut-out enclosures have been subject to solar radiance in the form of lamps to understand if solar radiance has an effect on the cut-out as the temperature will increase within the enclosure. The enclosures for looped services have been agreed and constructed, testing of these looped services is under way.

Start/End Date: August 2021 – August 2022
For more information see: Net Zero Service Termination Project | ENA Innovation Portal (energynetworks.org)

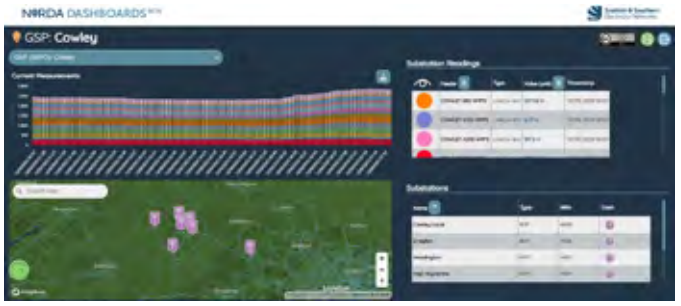
NEAR REAL-TIME DATA ACCESS, NERDA: (NIA SSEN 0050):

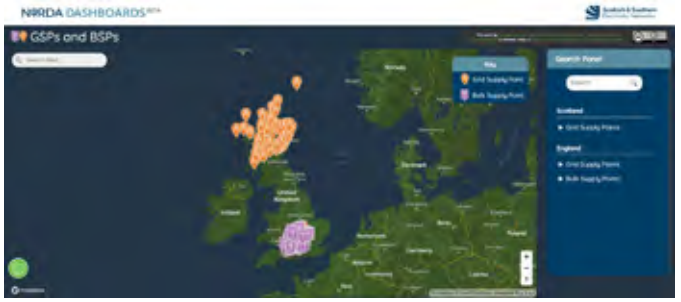
This is a small-scale demonstrator project which will make near real-time data available to stakeholders. This will be tested by engaging with stakeholders including those already involved in ongoing Local energy innovation projects.

The project will make near real-time data for the Oxfordshire area available to stakeholders and will assess its usefulness to them. This will be enabled through the implementation of a technology solution for near real-time DNO data within the SEPD licence area to enable its collation and presentation through an Application Protocol Interface (API). The project will assess the usability of the data through this API with stakeholder groups such as local community energy action initiatives Local Energy Oxford (LEO).

The NeRDA Application Protocol Interface (API) and dashboards are now live and have external users accessing real-time data about SSEN's network in the Oxfordshire area. Stakeholders in Oxfordshire have been fully engaged throughout the project and have participated in developing the business and technical requirements for the dashboard and API. This informed a greater emphasis on connectivity as well as real-time network data. The project has recently been extended to provide real-time data across our SHEPD and SEPD.

Start/End Date: November 2020 – March 2024
For more information see: Near Real-time Data Access (NeRDA) | ENA Innovation Portal (energynetworks.org)





8.2.3. REDUCING GREENHOUSE GAS EMISSIONS

LIVE LINE HARVESTING:

The innovation team have worked with SSEN's Vegetation Management teams within their SHEPD area, and Tiger Cut on developing a tree cutting and shearing machine suitable for work on live network. The technical solution was complemented by changes in processes and procedures, allowing SSEN to carry out 3rd party harvesting within the vicinity of power lines without the need for Planned Supply Interruptions (PSIs) and removing the need for Mobile Diesel Generation (MDG) to keep the network customers connected. Thanks to this technology, SSEN have avoided 8,993 tCO^2 since its first business-as-usual deployment in 2015-16.

HYBRID GENERATORS:

This is a temporary mobile generator that is a combination of a diesel generator and a battery storage system which can be used during planned and unplanned supply interruptions. The provision of the battery storage system allows to minimise use of diesel, thus reducing the amount of CO^2 released into the environment. SSEN have so far deployed 10 units across their SEPD area, saving 273 tCO^2 since their first trial operation in 2019.

CAGECAPTURE™ SF_6 PAINT DETECTION (NIA_SSEN_0059):

A net zero future promises reduced greenhouse gas emissions driven by a shift towards electrification. Electricity networks are expanding to connect wind and solar power to the grid and offer an infrastructure of Electric Vehicle (EV) charging points, but equipment containing (SF_6) as a dielectric medium presents the risk of significant greenhouse gas emissions in the event of a leak. However, as the network expands, so does the installed base of SF_6, which is expected to grow by 75% between 2019 and 2030. Network Operators are supporting switchgear manufacturers in the development of alternative dielectric materials to SF_6, but it will be several years before fully type tested products are available across the voltage range. Even when all new products are SF_6 - free, Network Operators will have to manage the installed SF_6 bank for the remainder of the life of the associated assets.

SF_6 is a man-made gas and highly effective insulator used in gas insulated switchgear (GIS). As one of the most potent greenhouse gases, current estimates suggest SF_6 is responsible for 0.8% of CO^2 equivalent modelled global warming, and more than 80% of the SF_6 produced is used by the electricity industry. While in principle SF_6 is contained within switchgear, leaks occur as assets age and are regularly exposed to the environment. Aging electrical equipment is a significant contributor to these emissions. In transmission and distribution networks, the leakage rate is estimated to be 1.29% and 0.40%, respectively .

Leak detection is challenging, and a reactive approach is used to locate leaks which often occur at flanges or connections points. The use of SF_6 'sniffers', and more recently SF_6 cameras, have improved leak detection but are not effective in all scenarios, e.g. if the gas is lost in short bursts as gaskets contract during cold evenings.

The project is initially a research project followed by a real-world trial to deliver a leak detection coating that can be applied to switchgear pipework and flanges to provide visual indication of leak points (either a fluorescence that can be seen with a UV torch or a change in colour visible to the naked eye). The application will provide an easy-to-deploy solution to accelerate leak detection and reduce total emissions. Further, early leak detection will prevent damage to assets caused by moisture entering the switchgear, hazards relating to SF_6 contamination and facilitate timely repair or replacement of assets.

We are currently assessing progress of this technology and reviewing next steps.

Start/end date: September 2022 – October 2024
For more information see: CageCapture™ SF_6 Paint Detection | ENA Innovation Portal (energynetworks.org)

[4] (Widger, P.; Haddad, A. "Evaluation of SF_6 Leakage from Gas Insulated Equipment on Electricity Networks in Great Britain", Energies 2018, 11, 2037)

8.2.4. CLIMATE CHANGE ADAPTATION

INFORMED LIGHTNING PROTECTION (NIA_SSEN_0035):

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. As our climate changes as a result of global warming, lightning events have the potential to become more frequent and severe. Avoiding the impact that unplanned lightning outages have on our customers is an important issue for SSEN, so we are trialling the use of surge arresters aimed at protecting circuits against lightning strikes. During RIIO-ED1, 150 surge arresters have been installed in SEPD and another 300 have been installed in SHEPD. Due to the initial performance success of these surge arresters protecting against lightning, there are plans to protect additional high-risk circuits during RIIO-ED2.

Start/end date: March 2019 – August 2023
More details can be found here: smarter.energynetworks.org/projects/nia_ssen_0035

8.2.5. REDUCING OUR USE OF CREOSOTE

ENVIRONMENTALLY ACCEPTABLE WOOD POLE PRE-TREATMENT ALTERNATIVES TO CREOSOTE (APPEAL) (NIA_SPEN0008):

SSEN are collaborating with SP Energy Networks on the APPEAL project which is trialling alternative preservatives to creosote for wood poles. Creosote is environmentally hazardous and is about to be fully banned in the UK. This ban will severely disrupt the supply of timber OHL supports (millions of poles in the UK). A small increase in the cost of an alternative preservative will have a major impact on the cost of maintaining the network. The chosen alternative must also be able to protect the poles at least as effectively as creosote to avoid premature failures of our OHL.

Start/end date: March 2016 – May 2025
More details can be found here: smarter.energynetworks.org/projects/nia_spen0008

8.2.6. REDUCING EXCAVATIONS

IMPROVING FAULT LOCATION IDENTIFICATION - OUR LV UNDERGROUND FAULT LOCATION TECHNOLOGIES (NIA_SSEN_0037):

Concluded in December 2020 and was then identified for roll out into BAU. Following a period of requirement specification, procurement and staff training the technology was deployed into the business early in 2022. This project helped to improve the accuracy of our fault location techniques for a number of LV fault types. This will reduce the carbon footprint associated with repairs by minimising the need for unnecessary, carbon intensive excavations as part of the fault location process. The deployment of the new equipment has been successful, and we are currently refining our approach to leverage maximum learning. Building on this success, we have developed the Open Circuit Detector project which will enable the more accurate location of LV Open Circuit faults. We continue to explore new options as part of our BAUactivities to improve our fault location capability and minimise disruption to customers. For example, we have recently introduced a highly sensitive fault gas detection tool which can help identify accurate fault locations without the need of excavations.

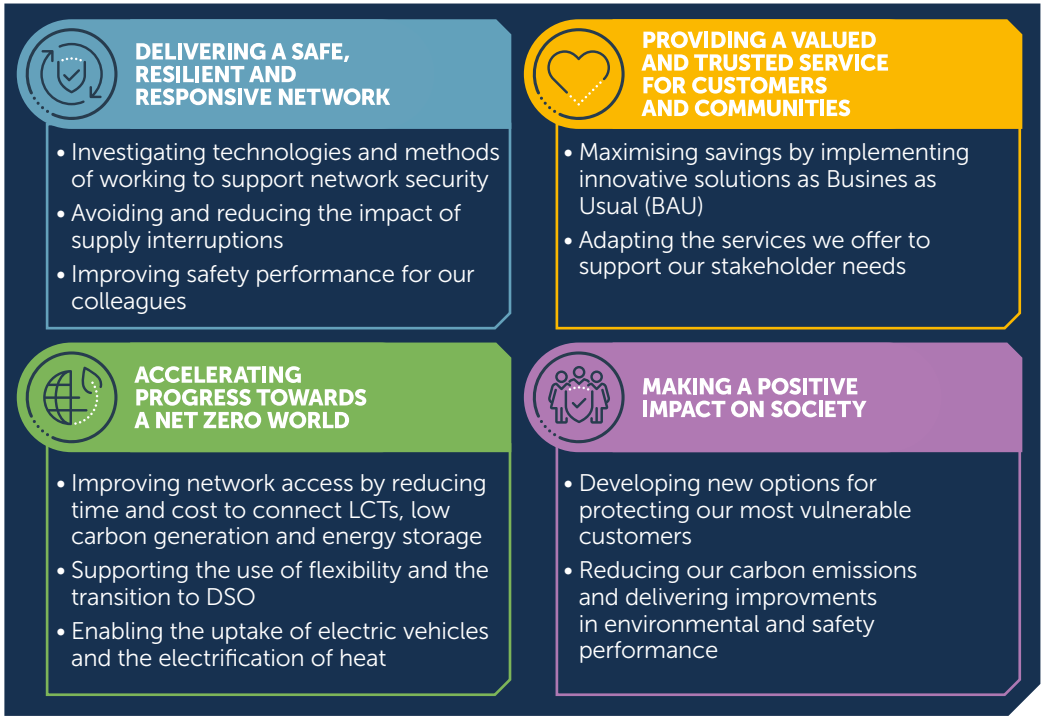
SMART GRIDS, INNOVATION AND OUR ROLE IN THE LOW CARBON TRANSITION

9. INTRODUCTION

This section provides an overview of our innovation activities across both SHEPD and SEPD licence areas that are associated with the transition to a low carbon network, whilst continuing to look at innovations that will improve efficiency and maintain network reliability to reduce costs and improve customer service. All the projects support both the SSEN Innovation Strategy and the wider industry strategy. We have also included information on the benefits realised from the various innovation deployments as well as progress on Smart Meter deployment and their anticipated benefits.

9.1. KEY CHALLENGES FACING THE INDUSTRY

The energy system is facing a period of unprecedented change as we transition to meet Net Zero. This is especially seen in the decarbonising of transport and heating, as well as the industrial use of energy. Meeting our objectives will see a huge increase in renewables and other low carbon generation sources to meet demand from electric vehicles and new forms of decarbonised heat. Additionally, a robust and reliable electrical network will be essential to facilitate this transition and delivering the network capacity required to achieve this will require significant investment either in the form of new flexibility services or traditional investment in assets. Providing this network, whilst maintaining network reliability, resilience, customer service and efficiency is the key challenge facing networks. Alongside this, innovation has a crucial role to play in reducing costs and improving efficiency to bring benefits and reduce costs for customers. Strategic areas of focus for RIIO-ED1 included:



9.2. OUR AREAS OF FOCUS

We are committed to creating a more flexible, cost effective and secure electricity network, which adapts and responds to our stakeholders' needs, whilst supporting the delivery of the country's Net Zero targets. Over RIIO-ED1, this included:

- **Innovation Development and Deployment:** So far in RIIO-ED1 we have engaged in over 60 innovation projects that will deliver a broad range of benefits for our customers. Projects have been aligned to distribution's four Strategic Objectives, outlined above, as we prepare for RIIO-ED2 and the transition to Net Zero. Our innovation portfolio has delivered over £67m of benefits to date in RIIO-ED1, whilst avoiding over 413,160 tonnes carbon dioxide emissions.
- **Flexibility Deployment and Distribution System Operator (DSO):** SSEN, along with other DNOs, is transitioning towards a Distribution System Operator model which will deliver significant benefits and transform the way we operate. The use of flexibility services and Constraint Managed Zones are becoming ever more integrated with our BAUpractises, with an expanding portfolio of products and services . Our two flagship DSO projects TRANSITION and LEO are continuing to provide insights to help remove barriers to smart technologies, assist in the evolution of a more flexible network as well as helping to facilitate new markets. In 2022/23 we procured 75.5MW of Flexibility Services to help defer, or avoid, reinforcement. The deferment of reinforcement is based on the Common Evaluation Methodology (CEM) which compares traditional reinforcement and flexibility requirements to decide the optimum strategy.
- **Decarbonisation of Transport and Heat:** a key requirement for Net Zero is the decarbonisation of transport and heat. Our Electric Vehicle strategy sets out our principles to support the uptake of 10 million EVs in the UK by 2030. In addition to this, we have a variety of innovation projects focused on the decarbonisation of both transport and heat, including the Skyline NIA project which launched in 2020/21 to provide visibility of the geographical emergence of EV charge points to support DNOs in coordinating the network reinforcements required to support the low carbon transition. Alongside this we are working with SPEN on the Enabling Renewable Heat (NIA-SPEN-0057) project to better understand how the combination of air source heat pumps combined with thermal storage can improve the overall experience for consumers.
- **Smart Meters:** Since becoming a Smart Energy Code (SEC) party and live Data Communications Company (DCC) user in December 2017, a dedicated smart meter operational team has been in place to manage the roll-out of smart meters and systems, ensuring compliance with the SEC and preparing and implementing systems and processes to realise benefits from the information and data that smart meters provide. Throughout 2022/23 SSEN completed a tender process to replace our obsolete smart meter IT systems, in particular our DCC Adapter, to ensure our systems are fit for the future and to maximise the collection of smart meter data and associated benefits as the volume of installations increase. It is anticipated that around 3.5 million smart meters will be connected by the end of the smart meter implementation programme rollout in 2025. Throughout 2022/2023, we have continued to further develop and implement our benefit realisation capabilities through the collection of smart meter data to benefit our customers and our network. We will help to facilitate the use of smart meter data within the business and continue to work with industry stakeholders to support the successful completion of the smart meter programme.

9.3. LOW CARBON TRANSITION

The total uptake of Low Carbon Technologies (LCT) has increased across both of our licence areas in 2022/23 compared to 2021/22. This is due to an increase in EV fast charge points being installed in both regions, with a 274% increase in our SHEPD network and 219% increase in our SEPD network compared to 2021/22. SEPD also saw a 323% increase and SHEPD saw a 239% increase in Photo Voltaic (PV) installations in 2022/23 compared to 2021/22.

Additionally, due to improvements in our data capturing system, heat pump installations have been captured for a third year running. In 2022/23 there has been a 41% increase of heat pumps installed in SEPD and a 6% decrease in SHEPD compared to 2021/22.

The total amount of distributed generation added to both our SEPD and SHEPD networks has decreased in 2022/23 compared to 2021/22. In 2022/23, SEPD connected 319MW and SHEPD connected 108MW representing a 6% and 32% reduction respectively from the previous reporting period. This reduction is largely due to a reduction in applications requested.

SSEN has worked hard in 2022/23 to promote the delivery of the UK's Net Zero ambitions through engagement and support at all levels from UK and Scottish Governments, Ofgem, Local Authorities, ENA trade bodies, third party stakeholders, and individual organisations. Looking forward to RIIO-ED2, supporting LCT uptake and achieving both Net Zero and a Green Recovery will remain a high priority for us.

Projects such as Transition, LEO, and Reheat have demonstrated the impact of LCT on our network. RESOP developed new tools to support Local Authorities develop their Local Area Energy Plans. We are leading the way in the use of flexible connections and deployed ANM in Orkney has enabled 95 flexible connections to connect to our system.

9.4. EV CHARGING STATIONS

Electric Vehicle (EV) uptake continues to increase in RIIO-ED2 as technological improvements to batteries improve vehicle range and prices become more attractive to consumers. A larger number of manufacturers are now offering fully electric and hybrid vehicles which has provided a better choice for consumers and competition within the marketplace. This has been reflected in the volume of charging points installed in 2022/23 with a 219% increase in EV fast chargers on our SEPD network and a 274% increase in our SHEPD network in comparison to 2021/22.

9.5. DISTRIBUTED ENERGY

9.5.1. PHOTOVOLTAIC

The level of photovoltaic (PV) installations connecting to our network has risen significantly with an increase of 323% in SEPD, and 239% in SHEPD compared to 2021/22.

9.5.2. OTHER DISTRIBUTED ENERGY

The volume of distributed generation (excluding PV) connected to our network has also remained relatively consistent over the past 5 years. There was a decrease in size of installations in 2022/23 with our SEPD networking seeing a 6% decrease and SHEPD seeing a 32% decrease compared to 2021/22.

For further details on low carbon technologies, please see worksheet E7 – LCTs linked to the Appendix of this report.

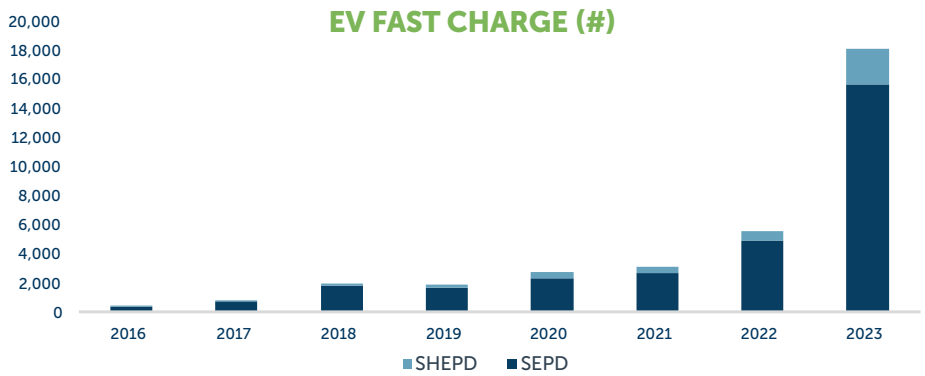


Figure 12: Annual Uptake of EV Fast Chargers (SHEPD and SEPD)

For further details on low carbon technologies, please see worksheet E7 – LCTs linked to the Appendix of this report.

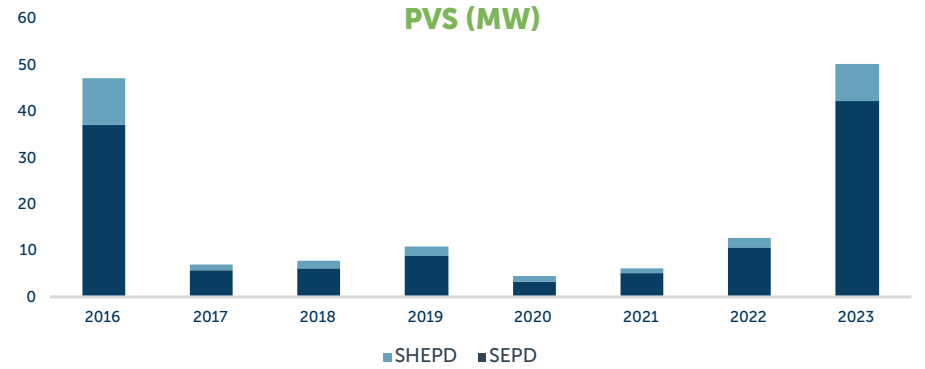


Figure 13: Annual Photovoltaic Connections (SHEPD and SEPD)

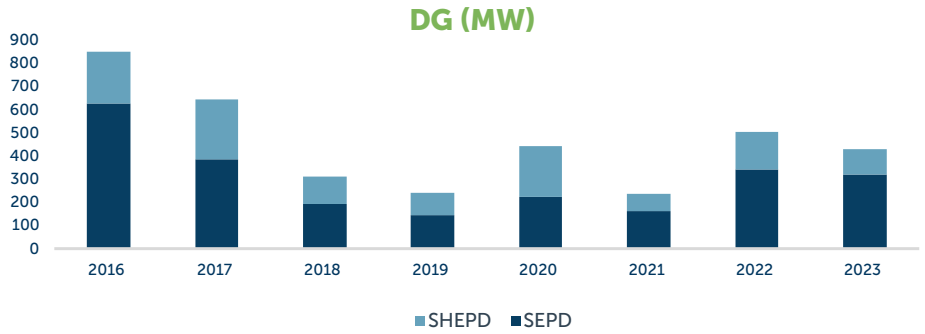


Figure 14: Annual Distributed Energy Connections (SHEPD and SEPD) excluding PV

10. PROGRESS OF OUR INNOVATION STRATEGY

10.1. INTRODUCTION

In 2020/21 SSEN refreshed its Strategic Objectives to prepare for RIIO-ED2, and as set out earlier we have updated our Innovation Strategy to reflect these objectives. Projects initiated to date have been specifically selected to ensure we have a balanced portfolio of innovations which target focus areas, whilst addressing stakeholder needs, priorities and delivering value.

Over RIIO-ED1, we have had 63 projects funded by the Network Innovation Allowance (NIA) which is a total award of £20.2m, and two funded by the Network Innovation Competition (NIC) totalling £21.1m. On top of this we have implemented several innovations into BAUwhich have fast followed learnings from other DNOs.

A summary of our current innovation portfolio is shown in Table 13.

OUR STRATEGIC OBJECTIVES

Our innovation projects have been linked to our 'purpose and vision' through four clear priorities directly linked to our strategic outcomes. These four priorities are detailed below.

2022/23 Innovation Portfolio	Strategic Objectives			
SubSense	●			
Informed Lightning Protection	●			
E-Tourism			●	
Whole System Growth Scenario Modelling (Phase 2)			●	
Smart Hammer		●		
TraDER		●		
Skyline			●	
Near Real-Time Data Access (NeRDA)			●	
Synaps 2		●		
Low Voltage Feeder Cable Open Circuit Detection		●		
Alternative Jointing Techniques	●		●	●
Net Zero Termination		●	●	
Decarbonising Utility Transport	●		●	●
CageCapture™ SF_6 Flange Guard	●		●	
CageCapture™ SF_6 Paint Detection	●		●	
CLEVER - Customer Led EV Registration				
HAYSYS - Phase Identification Unit	●			
Storm AI	●			
Transition				
VFES - Vulnerability Future Energy Scenarios		●	●	●
Street Score 2	●	●		●
HOMEflex - Household Or Microbusiness Energy Flexibility		●	●	●

Table 13: Summary of 2022/23 Innovation Portfolio against SSEN Strategic Objectives

10.2. HIGHLIGHTS OF 2022/23

This year we have completed several trials allowing us to progress our innovation strategy and also started a number of new projects. Highlights of these are as follows:

- **SYNAPS 2** – 13 sites have been installed with SYNAPS 2 sensors, and the calibration, installation and commissioning processes have been significantly improved. DNO personnel, Fundamentals' service personnel and third party (Freedom Group) personnel have been exposed to the technology. To date there have been 13 fault locations modelled. Out of the fault locations modelled 11 have been successfully excavated and validated as the cause of the fault. These have been validated at RINA or by DNO engineers.
- **Smart Hammer** – The Smart Hammer has been rolled out to operational staff across SEPD and SHEPD with 50 hammers in circulation. All staff using the smart hammer received training in its use and continue to receive ongoing support. For a period of three months, pole inspection staff used the smart hammer as their primary testing device. This generated over 3,000 smart hammer inspections in the smart hammer portal. This number of inspections gives the project a statistically significant data set in order to assess and improve the scoring algorithm. In additional to this, key feedback was captured from the pole inspection staff on the use and reliability of the smart hammer.
- **NeRDA** – The NeRDA Application Protocol Interface (API) and dashboards are now live and have external users accessing real-time data about SSEN's network in the Oxfordshire area. The dashboards and APIs were developed by Open Grid Systems (OGS) using their CIMphoney tool which means that all data being provided is CIM compliant. Stakeholders in Oxfordshire have been fully engaged throughout the project and have participated in developing the business and technical requirements for the dashboard and API. This informed a greater emphasis on connectivity.
- **Whole System Growth Scenario Modelling, Phase 2** - We have contracted Advanced Infrastructure to provide the LAEP+ tool for both Dundee and Oxford City Councils to start trialling. This is a web GIS tool that allows Local Council Planners to place new energy projects. The tool shows where network constraints are present and therefore gives Local Council Planners an indication where energy projects may result in higher costs i.e. if area is highlighted green there is no constraint, if highlighted red then there is a constraint, or a constraint will be caused by the new connection and likely cause higher connection costs. The LAEP+ tool will also show SGN, the gas network operator in Dundee, data to provide Local Council Planners additional data layers when making investment decisions. Local Council projects can then be viewed by all parties to work collaboratively in suggesting new locations or investment options.
- **HOMEflex** - The project is progressing as planned, the Centre for Sustainable Energy's research on customer attitudes was completed at the end of January 2023 and a research report was published. This has highlighted the main concerns for domestic consumers when participating in flexibility services and what could encourage them to participate in a future market. The content of the report has been very helpful in the drafting of the HOMEflex code and has been well accepted by industry in general.

A more detailed breakdown of active NIA projects can be found in the 2023 Annual NIA Summary Report located here: SSEN-NIA-Distribution_2023.pdf (ssen-innovation.co.uk)

10.3. LARGE SCALE INNOVATION PROJECTS

During 2022/23 we continued work on our three large-scale innovation projects in our distribution business. These focus on the transition to Distribution System Operator and creating a smarter, more flexible network which can support the low carbon transition.

10.3.1. RESILIENCE AS A SERVICE (RAAS) (SEEN007)

KEY ACTIVITIES

The RaaS innovation project (partnered with Costain and E.ON) seeks to develop a sustainable solution to improve network resilience, particularly in remote and isolated areas. The aim is to develop and trial a system which can swiftly and automatically restore power to customers in the event of an outage, using services provided by a third party owned Battery Energy Storage System, together with local Distributed Energy Resources.

This approach will provide cost effective, local network resilience, which will improve security of supply to customers, whilst reducing the use of carbon intensive, temporary diesel generation which is conventionally used to mitigate fault conditions.

EXPECTED OUTCOMES

As well as demonstrating the technical concept, the project will develop the commercial framework for RaaS, evaluating the financial case from a DNO perspective and assessing the investment case for RaaS service providers and options for revenue stacking in other flexibility services markets.

The first phase of the project focused on site selection, system design and evaluation of the business case. The project has now proceeded to the demonstration phase. The site chosen for deployment is at Drynoch primary substation on the Isle of Skye, following construction a series of trials will be delivered to validate the operation of the system.

For more information see: project-raas.co.uk

Funding Stream	**Start/end date**
Ofgem NIC £10.2m project	2020 – 2024

10.3.2. TRANSITION (SEEN005)

KEY ACTIVITIES

This transition toward the Distribution System Operator (DSO) model is especially significant as the proliferation of low-carbon technologies and solutions become more widespread, allowing households, businesses and communities to engage with the energy system. This includes customers, shifting from merely consuming energy, to producing, storing, balancing and selling energy back to the system. The objective of TRANSITION (partnered with Electricity Northwest Limited) is to explore the most effective system architecture, tools, platforms and market mechanisms needed to enable this change.

TRANSITION is currently in the midst of its three Flexibility Market Trial periods in Oxfordshire, which are due to end in Spring 2023. These will physically test the newly developed systems, platforms, and processes, as well as different market mechanisms and approaches, while maintaining market neutrality for all. Participation in the market trials will be from TRANSITION's project partner 'Local Energy Oxfordshire' (LEO) (**project-leo.co.uk**) as well as external organisations and businesses.

The trials will increase in their complexity and extent as we go through each of the three trial periods, with different flexibility service being delivered in each one. This includes both services provided to the DNO as well as Peer to Peer Import and Export Capacity Trading between customers.

EXPECTED OUTCOMES

TRANSITION is building on the outputs of the ENA Open Networks Project to design, develop, demonstrate and assess the common tools, data and system architecture required to implement proposed DSO models. Therefore, outcomes from the project will influence the development of these models and of zero-carbon smart local energy systems that optimise opportunities for distributed energy resources to provide flexibility to support the network.

The learning and outcomes for the trials will be reported on through a final report in Sept 2023 and disseminated through a range of different communication channels to interested stakeholders, which can be found here: Project LEO Final Report: A digest of key learnings - Project LEO (**project-leo.co.uk**).

The TRANSITION project produces an annual report to OFGEM outlining its achievements in the last reporting period and it's aims in the next period, which can be found **here**:

For more information see: ssen-transition.com

Funding Stream	**Start/end date**
Ofgem NIC £12.79m project	2018 – 2023

10.3.3. PROJECT LEO

KEY ACTIVITIES

Project LEO (Local Energy Oxfordshire) was one of the most ambitious, wide-ranging, innovative, and holistic smart grid trials conducted in the UK, and significant progress was made in informing the transition to an energy system that cost-effectively supports the UK's Net Zero ambitions.

PROJECT TRIALS ARE BASED AROUND THREE KEY THEMES:

- **Technology** – Project LEO carried out trials ranging from roof top solar and photovoltaic array to hydro stations on the river Thames and behind-the-meter battery capability at the Oxford Bus Company. Storage technology was explored through batteries and Vehicle to Grid technology, with demand side response being accessible, initially through the large building stock owned by the University of Oxford and Oxford Brookes, and the local councils. Over 80 low voltage monitors have been installed at key substations to support work on new forecasting systems. These technologies are helping inform decision making and identify potential constraints on the network.
- **Local Markets** – Local electricity markets were supported through the development of accessible and easy-to-use IT systems. These provided clear information on opportunities for energy services, addressing constraint management and energy exchange between local energy users. These systems were designed to make flexible energy markets accessible, fair, and more transparent.
- **Community** - the development of LEO's Smart and Fair Neighbourhood programme. Working with five different communities in Oxfordshire, LEO co-created locally relevant trials of different flexibility services. Project LEO was also concerned with ensuring fairness for all electricity market participants. As society progresses towards Net Zero and a more decentralised energy system, it is important that the benefits of the energy transition are shared equitably. These trials involved a range of energy assets including solar PV panels, wind turbines, electric vehicles, heat pumps as well as exploring the potential power of community led energy planning.

CONFIRMED OUTCOMES

Project LEO informed how DSOs can function in the future, showed how markets can be unlocked and supported, created new investment models for community engagement, and supported the development of a skilled community positioned to thrive and benefit from a smarter, responsive and flexible electricity network.

For more information see: project-leo.co.uk

Funding Stream	**Start/end date**
BEIS Industrial Strategy Fund £37m project	April 2019 Mar 2023

11. ROLL OUT OF SMART GRIDS AND INNOVATION INTO BUSINESS AS USUAL

11.1. CONVERTING INNOVATIONS INTO BUSINESS AS USUAL

To ensure a robust and efficient management of Innovation projects, SSEN apply a stage-gate approach to development, delivery, and benefits tracking. This process is managed and controlled by a dedicated PMO team, and runs alongside, and in compliance with our wider governance and assurance frameworks. This process is focussed on assessing innovation opportunities based on their potential benefits and adopting an agile approach to progress the best options to deployment. All Innovation projects are subject to the stage-gate reviews as outlined in Figure 15, below.

1 OPPORTUNITY ASSESSMENT

Project initiation document:

- Project summary
- Justification and funding eligibility
- Expected outcomes and benefits outline CBA or business case
- Assumptions
- Estimated budget
- Stakeholder Identification
- Funding stream identified
- Expected lead time to initiation

2 PROJECT INITIATION

Business case:

- Project summary
- Business need and justification
- Cost Benefit Analysis or equivalent
- Sponsor and resources agreed ISG informed
- Project controls and governance + funding
- Confirmed budget
- Stakeholder engagement plan if required
- Expected lead time to registration / start

3 PROJECT DELIVERY

Project management:

- Regular project reviews and pulse checks
- Regular Business Case validation
- Fast track/stop/amend decisions
- Change requests
- Project decisions and escalations
- Deployment/scale up potential review

4 PROJECT CLOSURE

Project management:

- Review against Business Case closure report
- Outcomes summary
- Review of project spend vs budget
- Deployment and scale up decision – Deployment CBA
- Deployment, Project Change or End of Project
- Further works / next steps identified
- Knowledge sharing and dissemination

5 BENEFITS REALISATION AND TRACKING

Deployment/BAU performance and benefits tracking:

- Innovation Benefits Dashboard
- Benefits tracking and utilisation rates control
- BAUowned data
- Learning opportunities for future project

Figure 15: Stage Gate Reviews for Innovation Projects

The process begins with an assessment of an idea's scope to ensure objectives align with our innovation focus areas and challenges. Successful ideas then undergo a robust Cost Benefit Analysis (CBA) process to ensure that the proposed initiatives have a positive business case. This will involve making a number of assumptions to predict the future benefits.

Following the Gate 1 Review, an idea is taken on to a project. This commences the trial period, where assumptions are tested to give better information on how the innovation will perform. This includes an ongoing assessment of the potential benefits. At the end of the innovation trial, the business case is thoroughly reviewed including a further robust CBA based on the learning gained through the innovation project. Only if this proves positive will we decide to implement it into BaU. In many cases, further trials may be necessary to provide the level of confidence required to consider a transition to BaU. Following BAUrollout, success of the innovation is assessed and tracked to ensure benefits are being realised.

11.2. INNOVATIONS THAT ARE NOW BUSINESS AS USUAL

We continue to support the following innovative solutions which have become business as usual over the RIIO-ED1 price control period.

For further details on Innovation, please see worksheets E6 – Innovative Solutions linked to the Appendix of this report.

11.2.1. CONSTRAINT MANAGED ZONES (CMZ)

Constraint Managed Zones uses flexibility services to offer security of supply during times of peak demand, planned maintenance or fault conditions. The CMZ concept, which has been recognised in BAUin recent years saw a new scheme commissioned in October 2020 to support the network following the subsea cable fault between the Isles of Skye and Harris. The contract sourced renewable generation from hydro generation plants on the island to offset diesel generation used to maintain customer's supply. This setup provided a more environmentally friendly means of supporting the network outage, reducing Greenhouse Gas emissions versus diesel generation alone. This scheme operated for over ten months to allow for repairs on the subsea cable.

In 2022/23 we procured 75.5MW of Flexibility Services to help defer, or avoid, reinforcement. The deferment of reinforcement is based on the Common Evaluation Methodology (CEM) which compares traditional reinforcement and flexibility requirements to decide the optimum strategy.

FUTURE DEPLOYMENTS

Following on from this success, SSEN has negotiated further CMZ contracts that have been agreed to provide network security when required. A heat map has also been developed highlighting constrained areas of our network which could benefit from CMZ services in the future. Opportunities are available on our website for Flexibility Service Providers to review and offer services. In addition, SSEN publish our looking back report detailing the outcome of our tenders and details regarding dispatch and operation of our services.

More information can be found here: ssen.co.uk/our-services/flexible-solutions/flexibility-services.

11.2.2. ACTIVE NETWORK MANAGEMENT (ANM) AND FLEXIBLE CONNECTIONS

ANM and flexible connections allow generators to connect to constrained networks through releasing flexible generation capacity. SSEN have implemented ANM in multiple locations across our network to help facilitate the connection of distributed generation.

FUTURE DEPLOYMENTS

We continue to operate the ANM schemes on Orkney, Western Isles and Isle of Wight. During 2022/23 SSEN made further progress on the implementation of the 'South West Active Network' (SWAN) scheme to address a number of transmission level constraints across the region, it is anticipated that the scheme will be operational later in early 2024. SSEN has delivered Minety GSP ANM within 2023 and is working with the ESO on defining ANM schemes to support the roll-out of Technical Limits.

11.2.3. LV AUTOMATION

LV Automation uses smart fuse and fault location technologies. Smart fuses are installed into substation LV feeder pillars where they automatically switch fuses when one has ruptured. This means customers only experience a brief loss of supply in cases where a fuse change is sufficient to restore power following a fault. The technology also provides a fault location service, which helps our field staff locate underground cable faults quicker than would otherwise be possible.

The technology was implemented straight into BAUfollowing learnings from Electricity North West Limited.

BENEFITS

There has been an estimated £6.82m gross avoided costs, over 441,801 Customer Interruptions and 62,572,970 Customer Minutes Lost avoided by the end of RIIO-ED1.

FUTURE DEPLOYMENTS

SSEN will continue to utilise and realise the benefits of LV Automation into RIIO-ED2.

The technology was implemented straight into BAUfollowing learnings from Electricity North West Limited.

11.2.4. LIVE LINE TREE HARVESTING

SHEPD have use of two Live Line Tree Harvesters. These machines can cut down trees adjacent to live overhead power lines and are far more efficient than hand felling, whilst reducing the risk of injury to tree cutters.

BENEFITS

There has been an estimated £11.5m gross avoided costs, 67,205 Customer Interruptions and 19,263,911 Customer Minutes Lost avoided to date in RIIO-ED1.

This project has also led to 8,993 tCO^2-e avoided due to the reduced requirement to run diesel generation.

FUTURE DEPLOYMENTS

The use of the live line tree harvesters in SHEPD will continue to realise benefits throughout the remainder of RIIO-ED1. In 2020/21 our contractor machine was off-hired due to the Coronavirus pandemic but is now returned to operation. Significant increase in recorded benefits for 22/23 attributed to removal for fuel exemption and requirement to fuel generators with white diesel.

INNOVATION STRATEGIC OBJECTIVES

The original project was done as an IFI project.

More information can be found here: smarternetworks.org/project/2007_08

11.2.5. THERMAL IMAGING OF UNDERGROUND CABLES (TOUCAN)

TOUCAN was an NIA project that investigated a technical method of using thermal imaging solutions as complementary tools in the context of locating underground cable faults in the power distribution network. Following the success of the NIA project, 201 thermal imaging cameras were procured as BAUin 2018.

This technology has now been included in the Low Voltage Underground Fault Location Technology toolkit.

BENEFITS

There has been an estimated £315k gross avoided costs, 3816 Customer Interruptions and 2,542,887 Customer Minutes Lost avoided to date in RIIO-ED1.

INNOVATION STRATEGIC OBJECTIVES

More information can be found here: http://www.smarternetworks.org/project/nia_ssepd_0021

11.2.6. REMOTELY OPERATED FORESTRY MULCHER

Forestry Mulcher was a NIA project that investigated the potential improvement of efficiency and safety by using remotely operated vehicles to carry out tasks associated with forestry mulching around overhead lines. SSEN procured two forestry mulchers in 2017 for our SHEPD licence area. In 2020 these were upgraded to newer models which are more reliable, lighter weight and more fuel efficient.

BENEFITS

Approximately £1.1m in cost reductions have been achieved since this technology was deployed as BaU.

FUTURE DEPLOYMENTS

The forestry mulchers will continue to be used in SHEPD throughout the remainder of ED1.

INNOVATION STRATEGIC OBJECTIVES

More information can be found here: smarternetworks.org/project/nia_ssepd_0018

11.2.7. HYBRID GENERATORS

In 2011 SSEN completed an IFI project trialing hybrid generators as alternatives to traditional diesel generation. The original hybrid generators had reliability issues, but following advancements in technology, 5 Hygen MX hybrid generators were procured as BAUin June 2019. Hybrid generators are a combination of a diesel generator and battery storage. The diesel generator charges the battery which can then be used to cover an outage. This setup is more efficient than using a diesel generator on its own, as the battery storage system allows the generator to operate at optimum loading levels. This means there is lower fuel consumption and thus lower Greenhouse Gas emissions when using hybrid generators, whilst significantly reducing noise and providing better air quality for the customer. The success of the hybrid generators in BAUlead to SEPD procuring an additional 5 Hygen MX hybrid generators in November 2020.

BENEFITS

To date the machines have delivered £314k of avoided costs in the ED1 period and 273 tCO^2-e has been avoided to date since acquiring the machines.

FUTURE DEPLOYMENTS

SSEN will continue to utilise the 10 hybrid generators throughout ED1 and are anticipating further deployments in ED2.

This project was originally completed as an IFI Project.

More information can be found here: smarternetworks.org/project/2011_14

The Cost Benefit Analysis models can be found in worksheet E6 – Innovative Solutions, please see worksheet linked to the Appendix of this report.

INNOVATION STRATEGIC OBJECTIVES

ACCELERATING PROGRESS TOWARDS A NET ZERO WORLD

11.3. INNOVATING SOLUTIONS FOR CONNECTIONS

11.3.1. CURTAILABLE CONNECTIONS

In some areas of our networks, the network is already at full capacity and, therefore, it is not possible to connect any further generation without upgrading the existing network. In these cases, customers would typically need to wait for the required reinforcement works, and pay associated contributions, to be completed before being able to connect to the network. However, there are several alternative options available to customers who are willing to consider a more flexible connection offering which, depending on the circumstance, may allow a viable connection ahead of the required reinforcement works.

In April 2023, as part of Access and Forward-Looking Charges Significant Code Review (SCR), SSEN will, where applicable, curtailable connections to eligible generation and demand connections.

A Curtailable Connection may be facilitated by using a Distributed Energy Resource Management System, sometimes referred to as Active Network Management (ANM).

ACTIVE NETWORK MANAGEMENT (ANM)

In areas where there are several, complex constraints affecting a number of customers over a long period of time, full ANM systems will be implemented. The ANM systems continually monitor all the limits on the network in real-time and allocate the maximum amount of capacity available to generation in that area.

In late 2023 SSEN will deliver the largest ANM system in the UK through the South West Active Network Management (SWAN) project, enabling new generation connections across 60% of its licence area which would not have been possible traditionally due to Transmission constraints. This system will run alongside 4 areas already ANM enabled, including the UK's first ANM system on Orkney which re-opened in 2020 for new connection applications.

SSEN has also undertaken significant development in its ANM systems within RIIO-ED1, as well as applying efficiencies within the connection processes and informing wider regulatory decisions on ANM implementation. As such ANM connections are now significantly lower in cost and far timelier should connecting customers wish to avoid reinforcement costs related to new connections.

SINGLE GENERATOR ACTIVE NETWORK MANAGEMENT (SGANM)

SGANM is similar to a full ANM scheme, except instead of managing multiple constraints and multiple generators it manages only one generator.

For more information and how to apply information, please visit Access SCR - SSEN

INNOVATION STRATEGIC OBJECTIVES

ACCELERATING PROGRESS TOWARDS A NET ZERO WORLD

11.3.2. FLEXIBLE SERVICES

Flexible Services are deployed in areas of existing SSEN network classed as Constraint Management Zones (CMZs). CMZs are geographic regions where network requirements, relating to network security, are met through the use of load variation techniques such as increasing generation or reducing demand. These services are provided to SSEN by a Flexible Service Provider according to contract agreements. On top of this we have developed a heat map detailing constrained areas of our network which could be supported by flexible services.

- **Sustain** – Sustain services will be sought by SSEN to manage networks that are close to capacity, meaning the network will not be able to meet power requirements during periods of highest demand. Pre-defined services can be procured in advance that can react by increasing generation / reducing demand at peak times to maintain customer supply during the outage. SSEN will procure these services on a 4 year overarching agreement with rolling 1 year tenders.
- **Secure** – In the same manner as Sustain activities, SSEN will procure ahead of time the required power injection/ demand response services from available distributed energy resource (DER) providers based on network conditions to manage pre-planned/post fault outages. This style of service will be appropriate for implementation across wide and locally specific areas, dependent on the maintenance scenarios affecting the network. SSEN will procure these services on a 4-year overarching agreement with call off agreements current at 1-year intervals but in future may happen for shorter periods.
- **Dynamic** – SSEN will seek to procure Dynamic services ahead of time from providers able to deliver an agreed change in output to avoid, or following, a network fault. For example, in N-1 scenarios, to avoid overloading of the second circuit due to another fault or to constrain loadings during restoration or repair scenarios.
- **Restore** – SSEN will procure Restore services ahead of time from providers able to either remain off supply, to reconnect with lower demand, regulate frequency and voltage or to generate into a network zone isolated from the main fault to support increased and faster load restoration within a specific network area. 'SSEN will procure these services on a 4-year overarching agreement with call off agreements current at 1-year intervals. SSEN will instruct services in close to real-time.

Figure 16: Heat Map Detailing Constrained Areas of SSEN Network

The key features of flexible services:

- Utilises a market approach to procure Flexibility Services.
- Technologically agnostic.
- Open to a full range of market participants.
- Replicable across a range of network scenarios.
- Compatible with flexible connections and other smart interventions.

SSEN has published a procurement statement and pricing methodology for placing new flexible services; this can be found on our website library: Flexibility Services Document Library - SSEN. Should services be required, an assessment is undertaken to evaluate which flexible option could deliver the required capacity. In the event of a flexible service being needed, an EU compliant tender is implemented to source suppliers or suitable resources.

SSEN keeps a record of all assessments and decisions at all stages and the results of all historic tenders are available in the links below.

HOW DO PEOPLE GET INVOLVED AND HOW CAN PROGRESS BE OBSERVED?

Suppliers can provide a service through different alternatives:

- Demand Side Response – this is via a customer or group of customers connected to the appropriate part of the SSEN network, who have the ability to reduce or increase their energy use at specific times in relation to network constraints.
- Distributed Generation – these are technologies connected to the SSEN network which have the ability to increase or reduce the amount of power exported in relation to network constraints.
- Energy Storage – this is via appropriate technologies connected to the SSEN network, which can store or export energy depending on network constraints.

Details on how prospective providers can find details on how to register to participate in Flexibility Services here:
ssen.co.uk/our-services/flexible-solutions/flexibility-services

SSEN releases new opportunities as they are identified, these can be found on the Flexible Power website, or on our own SSEN Flexibility Service Calls website:

flexiblepower.co.uk/locations/scottish-and-southern-electricity-networks/map-application-ssen

ssen.co.uk/ConnectionsInformation/GenerationAndStorage/FlexibleConnections/CurrentCallsForFlexibility

Should you have any questions or wish to discuss flexible services please contact the Flexible Solutions Team here:
Flexibilityprourement@sse.com

11.3.3. SMART METERS

Since becoming a Smart Energy Code (SEC) party and live Data Communications Company (DCC) user in December 2017, a dedicated smart meter operational team has been in place to manage the roll-out of smart meters and systems. Ensuring compliance with the SEC and preparing and implementing systems and processes to realise benefits from the information and data that smart meters provide.

Throughout 2022/23 SSEN completed a tender process to replace our obsolete smart meter IT systems, in particular our DCC Adapter, to ensure our systems are fit for the future and to maximise the collection of smart meter data and associated benefits as the volume of installations increase.

As the Governments smart meter programme has extended to 2025, SSEN continue to be heavily involved with industry forums and collaboration with industry parties. This has allowed us to understand, follow and implement the necessary changes to ensure smart meter data can be used within the business at the earliest opportunity. Through this collaboration, some issues highlighted include communication challenges, reliability of alerts and inconsistent behaviour between smart meter manufacturers. We continue to support and work with the DCC and impacted parties towards resolutions.

The ongoing challenges in the GB Smart Meter Implementation Programme (SMIP) have had a knock-on impact on the delivery of a number of functionalities, benefits, and a slower roll-out of second-generation meters in both of SSEN's licence areas, particularly our SHEPD licence area. This has meant that the data, which we'll use to improve our network performance and provide a better service to our customers is only now, steadily increasing to the volumes needed to provide detailed information.

We have implemented into normal business functions a number of uses and benefits from smart meter data, such integrating near real time outage and restoration alerts, and ability to remotely "ping" a smart meter to check the supply status in the property into our Customer Contact Centres. This has enhanced the service and response we can provide our customers when dealing with power cuts or voltage issues.

We continue to trial and implement many use cases from smart meter data, and as the volumes, accuracy and reliability of data increases over time, we will continue to maximise the benefits for our customers.

In late 2023, our new DCC Adapter will start collecting smart meter consumption data at scale which will bring new and significant benefits for our network performance, visibility and service for our customers. We will incorporate consumption data into our business activities and with other data sets to help understand and predict demand on our network so we can better support connections such as Electric Vehicle and Heat Pumps.

It is anticipated that around 3.5 million smart meters will eventually be connected to our networks and whilst is it expected that DNOs will have the means to communicate and gather information from the majority of smart meters, we also believe that there will be a sizeable proportion of smart meters that we will not be able to fully communicate with or receive alerts from. Further information is provided in the following sections.

Meter Types and volumes of meters installed

Specifications for two versions of smart meters have been developed by the Smart Meter Implementation Programme (SMIP); these are defined as SMETS1 and SMETS2 meters.

- **SMETS1** meters provide a significant amount of smart functionality, however they do not provide the same level of functionality to DNOs as SMETS2 meters and will therefore affect the benefits SSEN expects to realise.
- **SMETS2** meters provide additional functionality from that defined in SMETS1; they are connected to parties including DNOs via the DCC's communications and data infrastructure. These meters enable SSEN to gain access to the full range of alerts and service requests as defined by the SMIP.

Information relating to the volumes of smart meters installed during 2022/23 is provided in Table 14 below.

Licence Area	SMETS1			SMETS2		
	Installed in 2022/23	Total Installed	% Total Penetration (year-end)	Installed in 2022/23	Total Installed	% Total Penetration (year-end)
SHEPD	1360	205,525	25.93%	54495	178,3993	22.51%
SEPD	4528	858,154	27.35%	244185	1,047,764	33.39%

Table 14 - Volume of smart meters installed during 2022/23

DEVELOPMENT OF INFORMATION TECHNOLOGY AND COMMUNICATIONS INFRASTRUCTURE

SSEN have developed systems to enable data from smart meters to be made available via connection to the DCC's infrastructure. In accordance with our business plan, we have connected our IT infrastructure to the DCC and developed our own systems to manage and monitor alerts sent by smart meters directly into our existing outage management system. Significant effort has gone into ensuring that the design of our systems and infrastructure remains compliant with the SEC which is a mandated requirement for all parties who interface with the DCC.

Our expenditure associated with the development of our IT and communications systems and payments made to the DCC during 2022/23 are detailed in worksheet E5 – Smart Metering, they are also summarised in Table 15 below.

Licence Area	SM IT Costs (£k)	SM Communication Licence (DCC) Costs (£k)	Elective Communication (DCC) Costs (£k)
SHEPD	165	1040	0
SEPD	662	3763	0

Table 15 – IT expenditure for Smart Meters during 2022/23

DELIVERING VALUE FROM SMART METERING DATA

In the design of our systems, we considered the need to have access to data that will enable us to use the information that smart meters provide to benefit both customers and the wider business. We split the benefits into a number of categories and provided an estimate of the potential benefit that could be delivered for both the RIIO-ED1 and RIIO-ED2 periods.

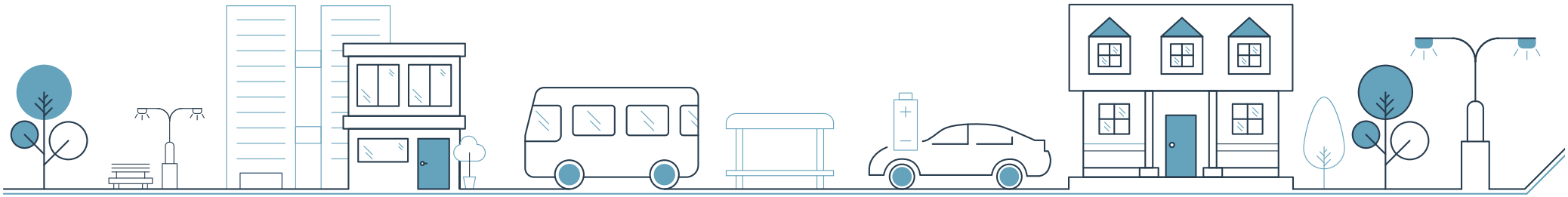
In the development of our smart metering business processes and systems, consideration has been made to ensure that maximum benefit can be delivered from how we use data from smart meters. Our efforts throughout 2022/23 are detailed in Table 16 below.

More details on Smart Metering can be found in worksheet E5 – Smart Metering linked to the Appendix of this report.

LOOKING FORWARD TO 2023/2024

In order to enable delivery of the smart meter related benefits we will continue to: Collaborate with the DCC, Communication Service Providers (CSP's) and Smart Energy Code Administrator and Secretariat (SECAS) on key issues impacting the availability, reliability and accuracy of smart meter data, so we can maximise its use and benefits.

- Collaborate with the DCC, ENA and other Distribution Network Operators (DNO's) to identify and resolve functionality and data quality issues with smart meter data through ongoing forums, collaborative testing and projects led by the DCC.
- Monitor and progress our detailed plan on benefit realisation and continue to gain learning from the data we receive from smart meters now and as the roll-out progresses.
- Support the ongoing work associated with the management and replacement of the Radio Teleswitch Service (RTS) as it retires and replaced with smart meters.
- Implement our new DCC Adapter and start the mass collection, analytics, open data sharing and benefit realisation of all smart meter data sets.
- Learn, refine and embed the use of smart meter data across our business and track the benefits this brings to our network performance and service we can provide our customers.
- Collaborate with other DNO's to develop a joint methodology for the collection, anonymisation and open data sharing of the smart meter consumption data, in line with the Data Best Practice guidance.



Category of benefit	Work undertaken
Avoided losses to network operators	Implemented alerts and messaging to and from smart meters to utilise benefits from earlier notification of supply interruptions and the ability to check the supply at a customer's premise. Our new DCC Adapter application will store the collected data and provide analytics capability. This will enable us to retrieve mass volumes of data to better understand the current and future demand on our network and to make informed investment decisions. Ongoing work which will enable the retrieval and storage of consumption data which will be aggregated and processed in accordance with our Data Privacy Plan which has been approved by Ofgem.
Reduction in Customer Minutes Lost	Implemented and integrated IT systems to ensure that power outage and power restore alerts are available for use in appropriate areas of the business. This allows us to respond more quickly to outages and reduce duration of interruptions, therefore reducing Customer Minutes Lost. Integrated our outage management system into our DCC Adapter so our Customer Contact Centres can receive and respond to power outage and power restore alerts from smart meters. Equipped our call centre agents and fault dispatch teams with the capability to remotely "ping" a smart meter to check the supply status, which ensure customers are restored a quickly and efficiently as possible.
Reduction in operational costs to fix faults	Implemented our DCC Adapter application to ensure that: • We can check the supply status of individual customers via their smart meter. • Power outage and power restore alerts are available for use in appropriate areas of the business. • This will allow more accurate identification of the location of faults, and direct the appropriate staff, this saves times and effort searching for fault locations. Implemented the integration of our outage management system into our DCC Adapter application to: • Enable the initiation of supply status checks from relevant locations. This enables us to quickly identify internal faults on the customer property, avoiding unnecessary site visits. • Receive power outage and power restore alerts from smart meters. • Continued engagement and collaborative testing with the DCC regarding the future operation of smart meters.
Reduction in calls to faults and emergencies lines	Implemented our DCC Adapter application to ensure that power outage and power restore alerts are available for use in appropriate areas of the business. Integrated our outage management system into our DCC Adapter application so our Customer Contact Centres can request, receive and respond to customers alongside power outage and power restore alerts from smart meters. We are able to proactivity identify power cuts and respond quickly, reducing the number of phone calls to our emergency lines.
Better informed investment decisions for electricity network enforcement	Implemented our DCC Adapter application to enable access to relevant functionality in smart meters including meter configuration and access to appropriate data. Developed our Data Privacy Plan, approved by Ofgem, to enable access to consumption data, allowing better understanding of utilisation of our network. Phase one of our data storage and analytics capability to maximise use of data made available by smart meters has been implemented. Phase two in late 2023 will deliver the full productionised capability to retrieve mass volumes of smart meter data as the penetration of smart meters increase.
Avoided cost of investigation of customer complaints about voltage quality of supply	Implemented our DCC Adapter application to ensure that voltage related alerts are available for use in appropriate areas of the business. Implemented integration of our outage management system into our DCC Adapter application to: • Enable users to request further information from smart meters regarding recorded voltage measurements. • Continued engagement with the DCC regarding the future operation, and accuracy of voltage data. At the present time inaccuracies mean the current voltage data cannot be relied upon.
Network capacity investment savings from electricity demand shift	Smart meter consumption data and other datasets will feed into our load model forecasting tool and will be made available on our open data portal so external stakeholders are able to determine where network loadings could facilitate flexibility products and services.

Table 16 – Progress on delivery of benefits from Smart Metering throughout 2022/23

CONCLUSION

We continuously review our environmental commitments to look for opportunities to reduce our impact on the environment and deliver the environmental expectations of our stakeholders effectively.

Throughout RIIO-ED1, we have made significant progress in many of our environmental and innovation initiatives with the view to pave the way towards a more sustainable grid - crucial to facilitating the energy system transition. We are continuing to drive efficiency, improve customer service and enhance the customer experience.

2022/23 represented a continued positive trajectory in many of our environmental and wider sustainability considerations, including an increased focus on managing and reducing our BCF; We are delighted to have achieved our RIIO-ED1 absolute reduction target to reduce GHG emissions by 15%, attaining a 30% reduction in 2022/23 compared to base year levels. We are also proud to lead by example, having been the first Distribution Network Operator (DNO) to have our 1.5°C science-based greenhouse gas emissions reduction targets accredited by the Science Based Targets Initiative (SBTi).

Additionally, we achieved several of our other RIIO-ED1 targets including business travel and fluid filled cable leakage. We also saw a significant reduction in network losses and a considerable increase in the uptake of LCTs such as Heat pumps and Electric Vehicles being installed on our networks compared to 2021/22.

The advancement reported for the eight, and final, year of RIIO-ED1 provides a clear message to our stakeholders that we have a successful established programme to deliver environmental benefits and that we are aware of our responsibilities to both the environment and our customers.

Whilst RIIO-ED1 has closed with some extremely positive outcomes, we are looking towards RIIO-ED2 and working to improve the sustainability of our operations further by addressing emerging challenges and increasing our focus in this space overall.

We have strategies in place to reduce our use of, and holdings of, polluting gas and oils, and are actively working to reduce our emissions in line with our science-based targets including network losses. Following Final Determinations, we were awarded baseline funding to invest in Nature-based Solutions for carbon removal through native ecosystems and were also awarded a Consumer Value Proposition for seagrass planting in our local communities.

We will also work to investigate flexibility and low carbon generation options on the Scottish Islands and continue to engage with our consumers, including those most vulnerable, as well as continue to invest into innovation projects with a focus on increasing the uptake and speed of roll out of Low Carbon Technologies. Our RIIO-ED2 Environmental Action Plan, our investment into innovative solutions, and our recent achievement of ISO 14001 Environmental Management accreditation, will propel continuous improvement in our environmental and sustainability ambitions forward into RIIO-ED2 and beyond.

APPENDIX

Additional Information

Environment and Innovation Regulatory Reporting Packs 2022/23 E1-E8 worksheets

Environment and Innovation 2022/23 E4 and E6 CBAs

Environment and Innovation Commentary 2022/23

More information can be found here:

ssen.co.uk/about-ssen/library/environment-reports-document-library/?filterTerm=211#docLib

GLOSSARY

Business Carbon Footprint (BCF)

A measure of the total Greenhouse Gas Emissions (in tonnes of carbon dioxide equivalent, tCO^2-e) resulting from operations on which the DNO has full authority to introduce and implement its operating policy, as well as contractors' emissions.

Common distribution charging methodology

Used to calculate charges to users who are connected to the LV and HV levels of the network.

Demand side response

Demand side response is a scheme where customers are incentivised financially to lower or shift their electricity use at peak times. This helps manage load and voltage profiles on the electricity network.

Designated area

Areas in which Visual Amenity Projects may be undertaken, according to the relevant definitions in CRC 3J (Allowed expenditure on Visual Amenity Projects).

Distributed Generation (DG)

Plant or equipment for the production of electricity that is directly connected to the Distribution Network.

Distribution losses

Units lost while being transported through the licensee's Distribution System, either as electricity turns to heat as it is transported through the network or non-technical losses, such as theft or measurement errors.

Distribution losses strategy

The DNO's strategy for designing, building, and operating its Distribution System in a manner that can reasonably be expected to ensure that Distribution Losses are as low as reasonably practicable.

Environment report

Standard Licence Condition 47 (Environment Reporting) sets out requirements for the licensee to publish an annual Environment Report about activities that it has undertaken in relation to environmental matters.

Fluid filled cables

Pressurised fluid-filled underground cables, high voltage cables in which the insulting medium is liquid oil as opposed to a solid insulator such as oil impregnated paper or PVC.

Fluid recovered

Fluid associated with pressurised fluid-filled underground cables that has leaked from a cable and is subsequently recovered and includes:

- Fluid captured in a container whilst jointing works are being undertaken.
- Spoil removed from site because it has become saturated with fluid during a cable leak.
- In order to avoid double counting, the volume of fluid used to top up a cable to prevent pressure reaching the Pressure emergency (PE) level prior to jointing or repair should be excluded.

Fluid used to top up cables

Fluid pumped into pressurised fluid-filled underground cables and includes fluid used to:

- Bring a circuit back up to the appropriate pressure from a lower pressure level.
- Sustain a circuit fluid pressure from reaching Pressure emergency level prior to jointing or repair of a leak.

Greenhouse Gas (GHG) emission

The release of greenhouse gases into the atmosphere, including carbon emissions. Within the BCF, greenhouse gas emissions, e.g., SF_6, are calculated as equivalent carbon dioxide emissions.

Innovative solution

Has been trialled by any DNO as part of an LCNF, NIC, NIA, or IFI innovation project during DPCR5 or RIIO-ED1.

Was considered a smart solution as part of the RIIO-ED1 smart solutions assessment.

Involves the application of technology, systems or processes not in widespread use at the beginning of RIIO-ED1 to provide long term direct benefits to distribution network customers through:

- Improving the utilisation or provision of network capacity for demand or generation (including demand side solutions),
- Improving the management of asset condition to reduce lifetime costs,
- Increasing the DNO's ability to manage network performance, safety or security, or
- Improving the level of service provided to network customers.

Direct benefits can include improvements in economic performance, environmental benefits, safety, quality of service, reliability, and/or resilience.

Innovation Funding Incentive (IFI)

This acronym stands for Innovation Funding Incentive. This was the funding mechanism that existed for small scale innovation projects pre RIIO-ED1. It has now been replaced with the Network Innovation Allowance (NIA).

Innovation strategy

A document published by the DNO that complies with the requirements set out in the Strategy Decision for RIIO-ED1. This requires the licensee to have in place and maintain an Innovation Strategy for demonstrating the role of innovation within the Electricity Distribution Group of which it is a part.

Low Carbon Technologies (LCTs)

LCTs is the collective term for technologies that are being introduced to the market with the aim of reducing carbon emissions through the more efficient use of energy, the storage of energy in a flexible way or a move from another energy vector such as oil to electricity. Examples include:

- heat pumps
- electric vehicles
- domestic batteries

Noise pollution

The activity of investigating reports of noise pollution, and consequential remedial works (if necessary). In this context, noise pollution is defined as levels of noise associated with the normal operational characteristics of electrical distribution assets that may be deemed to be a nuisance and subject to Part III of the Environmental Protection Act 1990 (EPA).

Non-technical losses

Electricity units lost for reasons such as theft and measurement inaccuracy.

Oil leakage

The discharging of insulating oil into the environment because of DNO's equipment and activities.

Network Innovation Allowance (NIA)

A set allowance per network licencee to fund smaller technical, commercial, or operational projects directly related to the licensee's network that have the potential to deliver financial benefits, and / or to fund the preparation of submissions to the Network Innovation Competition (NIC).

Regulatory Instructions and Guidance (RIGs)

The term RIGs refer to a collection of documents issued by Ofgem to the DNOs to enable them to complete the reporting requirements associated with the RIIO-ED1 price control arrangements. It includes excel reporting packs, instructions and guidance, commentaries, and the glossary.

RIIO-ED1 Business Plan

For SHEPD and SEPD, the document submitted to the Authority and published by the licencee in March 2014 in response to the document entitled "Assessment of RIIO-ED1 business plans and fast-tracking" published on 22 November 2013. This business plan covered the period 1st April 2015 to 31st March 2023.

RIIO-ED1 CBA tool

The CBA tool DNOs used when completing their RIIO-ED1 Business Plans.

SSEH/SHEPD

This stands for Scottish and Southern Electricity Hydro. It is the acronym provided to our Scottish network.

SSES/SEPD

This stands for Scottish and Southern Electricity South. It is the acronym provided to our Southern network.

SF_6

The chemical symbol for Sulphur hexafluoride, a gas that is used as both an insulating and arc extinction medium in electrical plant. The reporting requirement is in respect of fugitive BCF emissions attributed to SF_6 lost from electrical plant.

SF_6 bank

The total mass (in kg) of sulphur hexafluoride held by the DNO for both assets installed on the network and those held in inventory. Each DNO's SF_6 bank should be calculated according to the methods set out in ENA Engineering Recommendation S38.

SF_6 emitted

The total mass (in kg) of sulphur hexafluoride emitted during asset installation (only if gassed by the DNO), service life and decommissioning. Service life emissions include those due to leakage (measured through top-ups); those measured during service activity requiring gassing and degassing; and those due to equipment failure resulting in the loss of all gas contained by the asset. The SF_6 emitted value should account for gas recovered.

Each DNO's SF_6 emitted should be calculated according to the methods set out in ENA Engineering Recommendation S38. DNOs should not assume a percentage leakage rate to determine any element of SF_6 emitted and if a DNO does not have measured records of SF_6 emitted, this should be highlighted in the accompanying commentary.

Smart meter

An Energy Meter that can both send and receive information using an External Electronic Communications Network.

Tagging

Tagging is the process where the worst performing cables are targeted and injected with radioactive isotopes, which helps to identify leaks, monitor the cables and track their performance over time.

tCO^2-e

Carbon dioxide (CO^2) equivalent, measured in tonnes. This is a measure for describing how much global warming a given type and amount of greenhouse gas may cause, using the functionally equivalent amount or concentration of carbon dioxide (CO^2) as the reference.

Technical losses

Electricity units lost owing to the physical properties of the network. This also includes the way the network is configured and operated.

Visual amenity inside designated areas

Activity undertaken as part of a Visual Amenity Project funded under the Visual Amenity Allowance funding mechanism described in Special Licence Condition CRC 3J (Allowed expenditure on Visual Amenity Projects) of the electricity distribution licence which relates to overhead distribution assets located within a Designated Area.

Visual amenity outside designated areas

Activity undertaken as part of a Visual Amenity Project funded under the Visual Amenity Allowance funding mechanism described in CRC 3J (Allowed expenditure on Visual Amenity Projects) of the electricity distribution licence which relates to overhead distribution assets which form part of an overhead line which spans the boundary of a Designated Area and is located outside the boundaries of the DNO's Designated Area, for which up to 10% of the Visual Amenity Allowance funding mechanism described in CRC 3J (Allowed expenditure on Visual Amenity Projects) of the electricity distribution licence may be used.

CONTACT US

For any queries or to request further information, please contact us via:

Environment and sustainability queries
DistributionSustainabilityTeam@sse.com

Innovation queries
Fnp.pmo@sse.com

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