ENVIRONMENTAL REPORT

2021/22

Scottish & Southern Electricity Networks

Powering our community

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) are performing against our RIIO-ED1 environmental commitments in 2021/22 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.

2021/22 represented a continued positive trajectory in many of our environmental and wider sustainability considerations, including a step change in our approach to managing our business carbon footprint (BCF); We're proud to lead by example by being the first Distribution Network Operator to have our 1.5°C science-based greenhouse gas emissions reduction targets accredited by the Science Based Targets Initiative (SBTi). Additionally, as our BCF is mostly comprised of electrical losses, through transporting electricity across our network, we have followed international best practice by classifying our distribution losses as a Scope 2 emission. The new strategy on SF_6 emissions, introduced in 2019, continues to deliver with reducing emissions year on year. This year SHEPD saw the lowest level of SF_6 emissions for any year in RIIO-ED1.

Additionally, we saw a significant increase in the uptake of LCTs such as Heat pumps and Electric Vehicles being installed on our networks compared to 2020/21.

Looking towards the final year of RIIO-ED1 and the beginning of the next price control, RIIO-ED2 (commencing in April 2023), we are looking to address emerging challenges and increase our focus in this space by seeking to electrify our vehicle fleet, move to more sustainable and low carbon generation options on the Scottish Islands, continue to actively manage and reduce our electrical losses, and continue to engage with our consumers and most vulnerable customers.

1.1. Visual Amenity

Overhead lines, especially those at higher voltage running through areas of outstanding natural beauty (AONB) are considered unsightly by many. We committed to underground up to 90km of overhead line in designated areas in response to stakeholders' requests. 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 31.17 km of overhead lines to date during RIIO-ED1 with an additional 25.91 km of undergrounding projects planned by the end of the price control period. The details of the projects we have planned, and their completion dates 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 over the RIIO-ED1 period.

In 2021/22 we removed a total of 16.42 km of fluid filled cable across both our networks. This equates to a total of 14.8 km of fluid filled cables removed in RIIO-ED1 to date in SHEPD and 37.2 km in SEPD. Whilst we have achieved our RIIO-ED1 target, we will continue with our strategy of cable tagging and replacement throughout the rest of the price control period. More detail can be found in Section 6.

1.3. Business Carbon Footprint

In 2021/22, our business carbon footprint (BCF) across both SHEPD and SEPD licence areas reduced by around 11,690 tCO_2-e compared to 2020/21.

Despite reductions across several emissions sources including building energy usage, SF_6 emissions and island generation, our BCF has risen beyond the RIIO-ED1 emissions reduction trajectory (to achieve a 15% reduction from our 2012/13 baseline) during 2021/22. This is predominantly due to higher-than-normal consumption of diesel generation throughout the first few months of 2021/22, utilised to maintain security of supply to our licence areas during outages caused by four subsea cable faults and additional storm activity seen in winter. More detail can be found in Section 7.

1.4. Sulphur Hexafluoride (SF_6) Emissions

Sulphur Hexafluoride 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 22,800 kg of carbon dioxide.

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. The revised SF_6 strategy and associated interventions have led positive reductions in SF_6 leakage and are focusing efforts to continue to reduce SF_6 emissions during the remainder of RIIO-ED1 and beyond. More information can be found in Section 7.

1.5. Losses

Electrical losses are the difference between the electricity pumped into the network, from the transmission system or directly from generators, and the electricity that leaves our network going to consumers due to the assets used to transfer the electricity, electricity theft or calculation anomalies.

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 61 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.
- 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.

1.6. Innovation

Our innovation strategy has delivered over £80m of benefits to date in RIIO-ED1, whilst avoiding over 350,000 tonnes carbon dioxide emissions. Our RIIO-ED1 innovation focus areas have been updated to reflect our distribution Strategic Objectives as we move towards ED2. These include an emphasis on delivering a safe and resilient network, providing a valued service for customers, making a positive impact on society and accelerating progress towards Net Zero. We currently have around 20 innovation projects underway targeting these areas, as well as having innovative technologies such as our flexible solutions, thermal imaging cameras and forestry mulchers that have been delivered to BAU.

1.7. Distribution System Operator

An increase in low carbon distributed generation, electric vehicles, demand side response and energy storage are transforming our network, giving customers access to new products and services.

To accommodate the changes that will enable net-zero, SSEN is transitioning towards a Distribution System Operator (DSO) model. The transformation to DSO is one of the biggest challenges currently facing the industry. Our two flagship DSO projects, TRANSITION and LEO, are already providing 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.

This transition, along with the development of new technologies and smart meter data, will allow for greater network flexibility to pave the way towards a smarter and more sustainable network.

2. WHO WE ARE

Scottish and Southern Electricity Networks (SSEN) is the trading name of the two Distribution and one Transmission businesses that form part of the FTSE-100 energy company, SSE.

This report focuses on the two Distribution businesses, Scottish Hydro Electric Power Distribution plc (SHEPD), that operates to the north of the central belt of Scotland, and Southern Electric Power Distribution plc (SEPD) that operates in central southern England, as shown on the map below.

We have a duty to efficiently supply electricity to our customers but to also maintain and protect the environment we operate in whilst doing so.

Therefore, we continually seek to:

- Deliberate environmental planning during the design and construction phases of projects
- Reduce the amount of overhead line in designated areas e.g., areas of outstanding natural beauty (AONB) and sites of special scientific interest (SSSI)
- Reduce our business carbon footprint
- Reduce the amount of oil leakage caused by our assets
- Reduce SF_6 emissions from our assets
- Keep distribution losses as low as reasonably practicable
- Continuously innovate to reduce our environmental impact

Over **3.8 million** homes and businesses served by our networks

Over **3,700** employees across the country

More than **770,000** customers on our Priority Services Register

+127,000km of overhead lines and underground cables

+44k substations

100+ subsea cables powering island communities


Home
Emergency
Are you ready
Scottish & Southern
Electricity Networks

2.1. Introduction

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 2021/22 linked in the appendix of this report, unless otherwise stated.

VISUAL AMENITY

- Underground up to 90 km of OHL in AONB, National Parks & 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

MANAGING OUR ENVIRONMENTAL IMPACT

4. INTRODUCTION

We are committed to managing our environmental impact and to 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.

This section details the various activities we are 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, especially those at higher voltage running through areas of outstanding natural beauty (AONB) are considered unsightly by many. We recognise that overhead lines (OHL) can have an adverse impact on visual amenity especially in sensitive environments such as AONB, Natural Scenic Areas (NSA) and National Parks. 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 and so this is an important issue for us.

Therefore, to improve visual amenity, we committed to undergrounding up to 90km of overhead line in designated scenic areas in Great Britain across both of our distribution networks. Visual amenity projects are initiated by expressed interest from our stakeholders, enabling us to ensure areas targeted are best value for the consumer. To date we have completed undergrounding of 31.17 km of OHL in total across SHEPD and SEPD at a cost of £4.9m. In addition to this we have a further 25.91 km OHL undergrounding projects in progress which are aimed to be completed by the end of RIIO-ED1.

5.2. Undergrounding Schemes during RIIO-ED1

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

Visual amenity projects are driven by stakeholder requests, using a nomination scheme. Stakeholders have indicated that undergrounding of existing overhead lines was "important" or "very important" from a visual amenity perspective and supported SSEN's 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) overhead lines 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.

Details of the schemes are provided in Table 2 and 3, overleaf.

Table 2. Historic Visual Amenity Schemes Completed Across SHEPD

Scheme	OHL km Removed	Completion Date
Loch Lomond and the Trossachs National Park	1.92	17/18
Loch Tummel National Scenic Area	0.27	18/19
Cairngorms National Park	2.33	18/19
Cairngorms National Park (Glen Muick)	0.95	20/21
Cairngorms National Park (Glen Tromie)	7.96	20/21
Loch Lomond and the Trossachs National Park (Strathyre)	2.31	20/21

Table 3. Historic Visual Amenity Schemes Completed Across SEPD

Scheme	Designated Area	OHL km Planned	Progress
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

As presented in Tables 2 and 3, we have completed 20 visual amenity schemes in our SEPD and SHEPD licence areas during RIIO-ED1 to date, which totals 31.17 km of overhead lines removed.

Table 4. Visual Amenity Schemes in Progress Across SHEPD

Scheme	Designated Area	OHL km Planned	Progress	Planned Completion Date
PH002259 – Kingussie	Cairngorms National Park	7	Refinement	2022/23
PH003091 – Auchtertyre House, Crianlarich	Loch Lomond and the Trossachs	0.5	Refinement	2022/23
PH003357 – Colintraive	Kyles of Bute	0.245	Execution	2022/23

Table 5. Visual Amenity Schemes in Progress Across SEPD

Scheme	Designated Area	OHL km Planned	Progress	Planned Completion Date
PS002791 – Monkton Chilgrove	South Downs National Pack	1.01	Execution	2021/22
PS003427 – Winterbourne Near Newbury	North Wessex Downs AONB	1.6	Execution	2022/23
PS003301 – Vineyard Hole	South Downs National Park	1.4	Execution	2021/22
PS004269 – Church Road	South Downs National Park	0.92	Refinement	2022/23
PS006723 – Sherborne	Cotswolds AONB	1.31	Refinement	2023/24
PS003052 – South Burley	New Forest National Park	6.6	Execution	2022/23
PS004474 – North Cerney	Cotswold AONB	0.33	Refinement	2022/23
PS004473 – Kingwood Common	Chilterns AONB	0.87	Refinement	2023/24
PS006796 – Godlingston Hill	Dorset AONB	3.68	Execution	2022/23
PS006795 – Valley of Stones Nature Reserve	Dorset AONB	3.3	Execution	2022/23
PS004391 – Cheselbourne Village	Dorset AONB	1.81	Execution	2022/23

As presented in Tables 4 and 5, there are 12 visual amenity schemes in progress across our SEPD and SHEPD licence areas which are scheduled for completion by the end of RIIO-ED1. Once these 12 schemes are complete, we will have undergrounded a further 28.40 km of OHL, bringing the forecast total to 59.55 km by the end of RIIO-ED1.

Throughout the remainder of RIIO-ED1, we will continue to engage with our stakeholders to ensure that ongoing and forthcoming projects achieve the best outcomes for the local landscape, biodiversity, and communities.

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

6. OIL LEAKAGE

6.1. Summary

We have a responsibility to have adequate regard for the environment in both the SHEPD and SEPD communities in which 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 (FFC) 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 to ensure that there are no adverse environmental impacts.

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 fault detection fluid. 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.

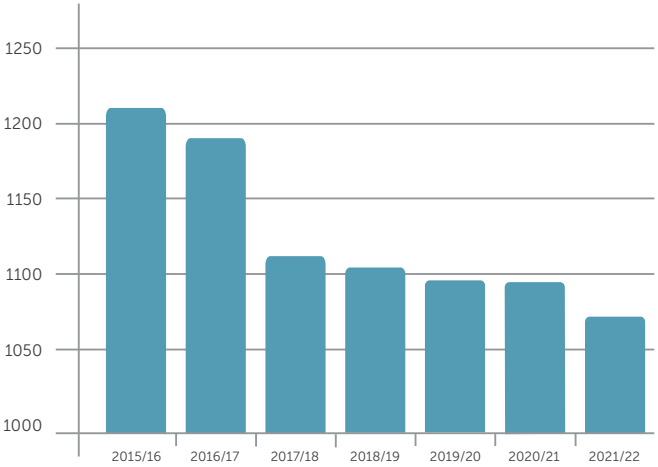
6.2. Oil Leakage Performance During RIIO-ED1

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.

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, above, shows that the total km of FFC on our network has decreased over the RIIO-ED1 period.

Figure 1: Total km of fluid filled cable (SSEN)

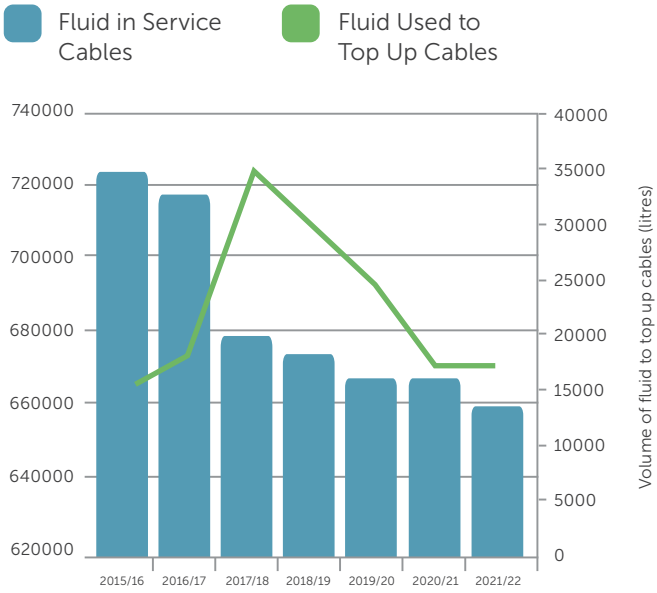


The significant drop in FFC between 2016/17 and 2017/18 was mainly due to data cleansing. The subsequent drop of 16km between 2017/18 and 2021/22 is due to removal of FFC and a small amount of (0.67km) data cleansing.

In 2021/22, there was a decrease of fluid used to top up cables across both licence areas of around 2%.

The total amount of oil contained in FFC in service has dropped over RIIO-ED1. The fluid used to top up FFC is now on a consistent downward trend, as shown in Figure 2, below.

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



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

The total amount of oil contained in FFC in service has dropped over RIIO-ED1. The fluid used to top up FFC is now on a consistent downward trend, as shown in Figure 2.

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 for the remainder of RIIO-ED1.

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 as part of the Worksheet E2 – Environmental Reporting requirement, linked in the appendix.

Over the RIIO-ED1 period SEPD has spent £4.76m on 136 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.

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 Business Carbon Footprint (BCF) 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.

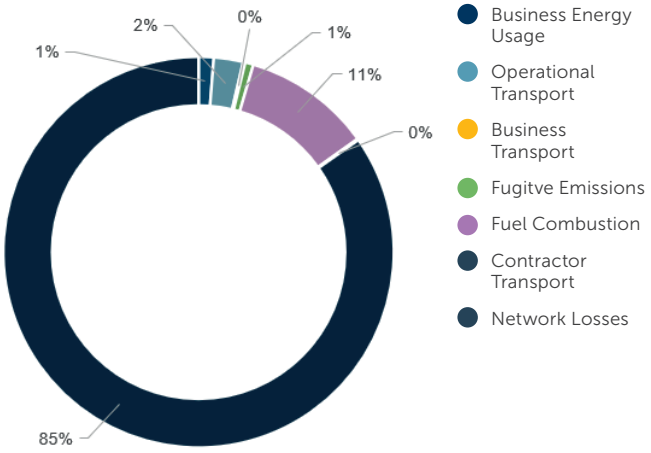
This section provides a transparent account of the impact that our business activities have on the environment and our progress against our emissions reduction target for RIIO-ED1. It details the total greenhouse gas (GHG) emissions produced in both SHEPD and SEPD licence areas from our base year, 2012/13, to the 2021/22 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.

In 2021/22, the combined total GHG emissions for both SEPD and SHEPD were estimated at 520,887 tCO_2-e, including distribution losses – a a 35,803 tCO_2-e reduction reduction over the previous reporting period 2020/21.

Despite reductions across several emissions sources including building energy usage, SF_6 emissions and island generation, our BCF has risen beyond the RIIO-ED1 emissions reduction trajectory. Our RIIO-ED1 commitment was to reduce our Business Carbon Footprint (excluding Losses) by 15% during the RIIO-ED1 period relative to 2012/13.

Missing our emissions reduction trajectory this reporting period was predominantly due to higher-than-normal consumption of diesel generation throughout the first few months of 2021/22, utilised to maintain security of supply to our licence areas during outages caused by four subsea cable faults and additional storm activity seen in winter.

Figure 3. 2021/22 Greenhouse Gas Emissions by Emissions Source



For further details of our Business Carbon Footprint, please see worksheet E3 – BCF linked to the Appendix of this report.

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 Greenhouse Gas (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 Environment, Food & Rural Affairs (DEFRA) for annual reporting to Ofgem.

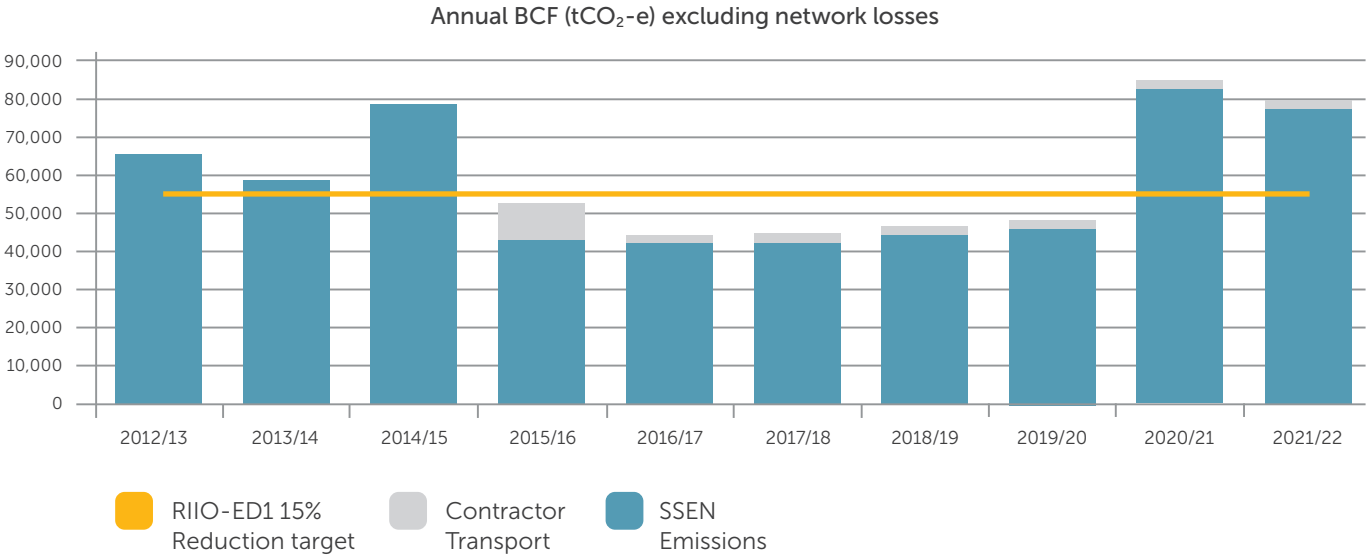
7.1.3. Business Carbon Footprint Calculations and Results

In 2021/22, SSEN's combined total Greenhouse Gas (GHG) emissions for both SEPD and SHEPD licence areas were estimated at 520,887 tCO_2-e, including distribution losses – a 35,803 tCO_2-e (or 7%) reduction over the previous reporting period 2020/21.

Whilst we missed our emissions trajectory during 2021/22 due to higher-than-normal consumption of diesel generation throughout the first few months of the reporting year, utilised to maintain security of supply to our licence areas during outages, the biggest decreases in emissions between the 2021/22 and 2020/21 reporting years was seen in Fuel Combustion. This is largely due to a reduction in embedded generation station diesel consumption following resolution of the 4 subsea cable faults experienced over 2020/21 and 2021/22 financial years midway through the 2021/22 period.

A comparison of our SHEPD and SEPD total operational emissions for the 2020/21 and 2021/22 financial years, by GHG emissions category and scope, are shown in Figure 4, below.

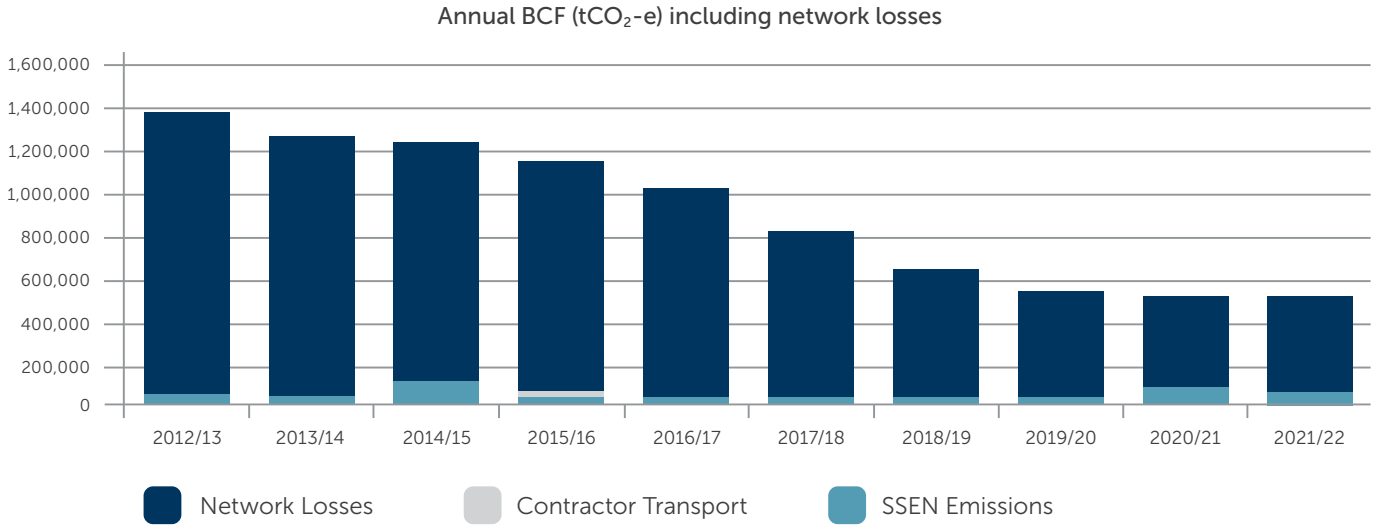
Figure 4: SHEPD and SEPD Historical GHG Emissions (tCO_2-e) by Emissions Source (Excluding Losses)



As shown in Figure 4, above, our BCF (excluding losses) has increased by 22% from 2012/13. For the RIIO-ED1 period, we have consistently been below the reduction target until 2020/21. This was due to four major subsea cable faults experienced in SHEPD, that led to a significant increase in our emissions from generation compared to 2019/20, due to us having to run diesel generators for extended periods. Fixed Generation in SHEPD accounted for around 38,960 tCO_2-e in 2021/22 compared with 18,970 tCO_2-e in 2019/20.

Figure 5, below, shows the contribution that our network losses make to our overall BCF in relation to our operational emissions and contractor emissions.

Figure 5: SHEPD and SEPD Historical GHG Emissions (tCO_2-e) by Emissions Source, Including Losses



Emissions associated with losses has dropped significantly since 2016/17. This was due to a significant downward change in the factor used to derive carbon impact in this emission category and a decrease in network demand. The conversion factor used was updated every year following the latest published figures by DEFRA. In addition to this, we adopt a more pro-active measures to reduce losses e.g., increasing minimum cable size and reducing energy theft as detailed in Section 7.3, Distribution 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

To reduce our business transport emissions, we committed to reducing the average mileage of SSEN cars by 10% during the RIIO-ED1 period compared to 2012/13.

In 2021/22 our average business miles travelled reduced significantly to 3,031 miles per vehicle. This equates to a 57.4% reduction from our 2012/13 base year of 7,118 miles per vehicle. This is largely following the COVID-19 pandemic which saw travel restrictions. We are continuing to conduct engagements virtually by utilising digital technologies like Microsoft Teams to reduce our mileage. As Figure 6, we are significantly below the set reduction target and anticipate we will continue to remain ahead of target for the remainder of RIIO-ED1.

Figure 6: Historic Annual Average Vehicle Mileage (SHEPD and SEPD)

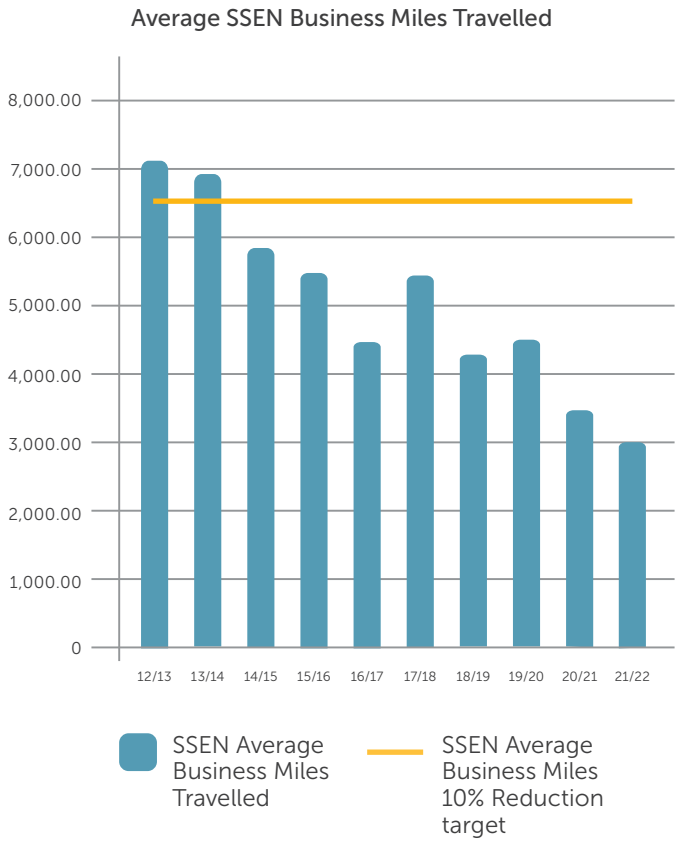
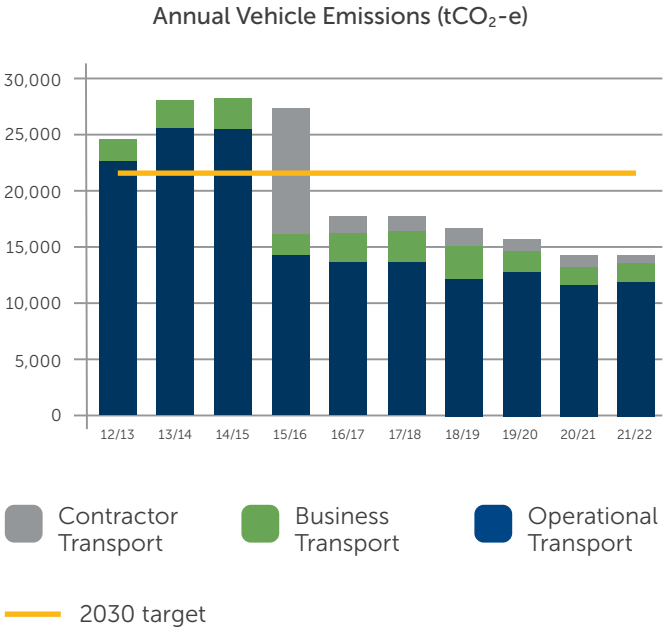


Figure 7, below, shows the emissions associated with our business transport and operational transport, which shows that we are moving in the right direction in terms of reducing our transport emissions.

Figure 7: Historic Annual Transport Emissions (SHEPD and SEPD)



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 2021/22 show a significant reduction relative to 2012/13. Operational transport emissions increased slightly in 2021/22 compared to the previous reporting year due to easing of COVID-19 restrictions.

As shown in Figure 7, our contractors' transport emissions in 2021/22 exhibit a downward trend from 2015/16. This is because there has been a 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.

7.1.5. Reducing our Energy Consumption

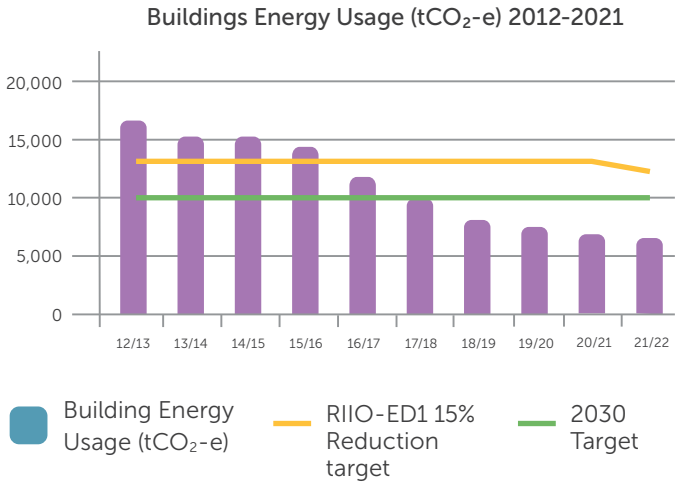
SSEN makes up one part of the wider SSE Group, which is comprised of several other businesses. Over the last six years, SSE Group's non-operational building carbon footprint has experienced a reduction in Greenhouse Gas (GHG) emissions. By sharing building space with other SSE businesses, we can reduce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

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

To report SSEN's portion of SSE Group's total energy consumption emissions, 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, overleaf. The figure shows that we have met our target to reduce energy usage emissions by 15% from a 2012/13 baseline by the second year of this price control and continue to reduce emissions in this category.

In 2021/22, electricity usage increased by around 27% whilst gas usage decreased by around 4% 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. The reduction in gas usage is largely due to efficiency improvements seen from boiler replacements at two of our sites.

Figure 8: Annual Building Energy Usage (SHEPD and SEPD)



For further details of our Business Carbon Footprint, please see worksheet E3 – BCF linked to the Appendix of this report.

SSE Group Target

SSE Group has an internal target of 5% Greenhouse Gas (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 is to be reported to align with their ambition of achieving a Net Zero non-operational buildings estate by 2035. Performance will be measured going forward against a revised annual reduction target of 7.19% against a 2020/21 baseline.

Performance of the existing target had exceeded expectations. 2021/22 performance for all SSE Group wide non-operational Buildings (Offices, Depots, Warehouses, Data Centres and Telecoms emissions) was 47.42% ahead of the target 5% reduction on a 2017/18 baseline.

The 2030 target to reduce emissions by 15% was deemed to be achieved. SSE's focus is to achieve Net Zero non-operational buildings by 2035.

One of the core reasons for the large reduction in building energy use seen over the reporting periods has been due to a move to 'Agile Working', which allows employees more flexibility in terms of working times and locations. We have also moved one of our major office hubs in Reading to a new and significantly more energy efficient building.

In 2020/21 the COVID-19 pandemic led to the majority of our office-based workforce move to work from home. This change, whilst vastly reducing the emissions related to employees' commutes, has not caused a significant reduction in our building's energy use. This is due to buildings remaining accessible to approved essential workers, and although power usage from IT and lighting did reduce, the safe operation of these buildings for essential workers required an increase in air exchanges and heating to mitigate temperature drops from these exchanges, which ultimately resulted in increased energy usage of heating, ventilation, and air conditioning systems.

We are continually looking to make our buildings more energy efficient to accelerate our position towards being a Net Zero business. Highlights of our energy efficiency investments throughout RIIO-ED1 are summarised in Table 6, below.

Table 6. SSE Group's Energy Efficiency Performance 2012/13 to 2021/22[1]

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	–

1 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.

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 22,800kg of carbon dioxide.

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 and are focusing efforts to continue to reduce SF_6 emissions during the remainder of RIIO-ED1 and beyond.

7.2.2. SF_6 Performance during RIIO-ED1

The total capacity of SF6 used in assets on our network during 2021-22 was 27,367kg across our two licence areas as presented in Table 7, below.

Table 7. Installed SF_6 capacity per Licencee (2021/22)

Licencee	Installed Capacity (kg)	SF_6 Leakage (kg)	Percentage of Bank
SHEPD	5,007.7	0.78	0.02%
SEPD	22,133.9	155.48	0.70%
TOTAL	**27,141.6**	**156.26**	**0.58%**

Emissions of SF_6 are 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.

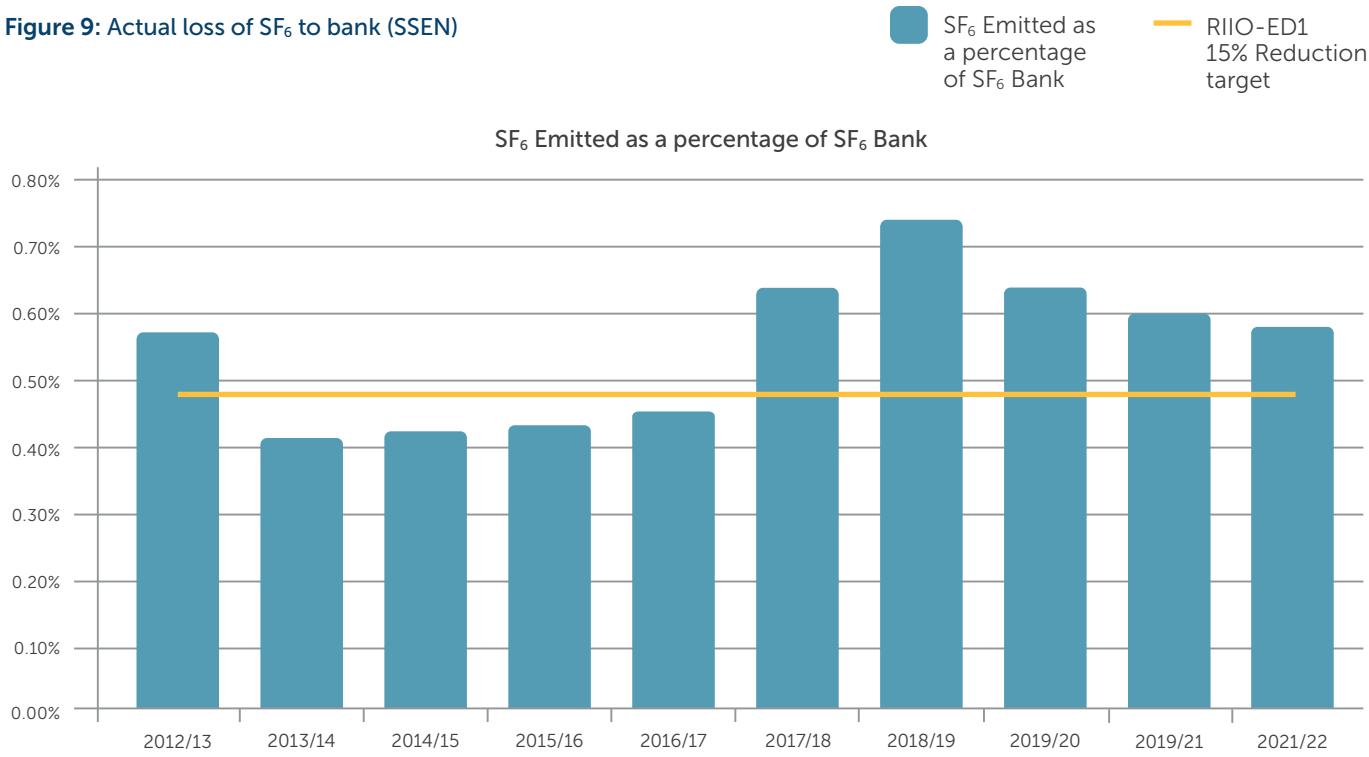
During 2021/22 we continued to progress our strategy to minimise SF_6 leakage from switchgear. This has involved a number of internal changes, including establishing a working group to address SF_6 leakage, utilising a more pro-active approach to the SF_6 switchgear repairs process and changes to internal 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 ED2.

During the reporting period we continued to investigate the deployment of SF_6 free equipment which included optioneering on two 132Kv projects. 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 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 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 participate 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.

The revised SF_6 strategy and associated interventions have led to a reduction in SF_6 leakage in 2021/22 compared to 2020/21 levels. Whilst this is not yet meeting our RIIO-ED1 target of a 15% reduction in SF_6 leakage (from a 2012/13 base year), we expect the progress made from this increased focus to continue to reduce SF_6 emissions in future years.

Figure 9: Actual loss of SF_6 to bank (SSEN)



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 figures, their impact and what we are doing to keep them as low as reasonably practicable.

Distribution losses are an unavoidable consequence of transferring energy across the electricity network, where they have a significant financial and environmental impact. Losses can either be technical (electricity can turn to heat as it is transported) or non-technical (for instance, due to theft or measurement errors).

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 & Grid transformers that meet the EU Eco Directive, 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.

Full details of our Losses Strategy can be found at: www.ssen.co.uk/lossesstrategy.

7.3.3. Losses Volume

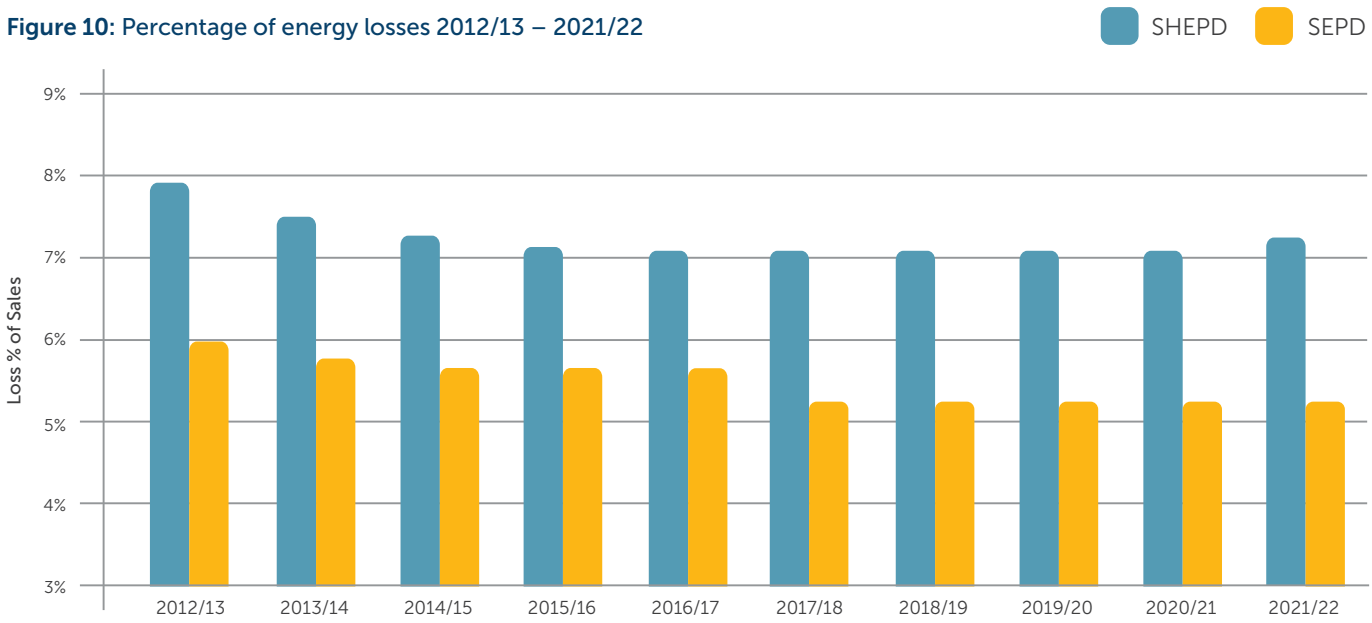
The total amount of distribution electrical losses in 2021/22 was around 2,078.7 GWh as shown in Table 8, below. The distribution losses are calculated by subtracting the number of energy units known to be delivered to customers from the number of units that originally entered our network from the transmission system or directly from generators.

Table 8. Total Losses in the SSEN Distribution Network

Year 2021/22	Total Distribution Losses MWh	Equivalent tCO_2-e
SHEPD	487,223	103,452
SEPD	1,591,525,309	337,929

Figure 10, overleaf, shows the percentage of losses in the network in relation to total electricity distributed.

Figure 10: Percentage of energy losses 2012/13 – 2021/22



From the graph above, there appears to have been a significant reduction in SEPD losses in 2018. However, this is due to advanced calculation methods which led to more accurate losses recording.

7.3.4. Losses Strategy in Action

To help ensure we meet our commitment to reduce losses and ensure they are as low as practicably possible, we have been implementing a number of targeted measures outlined in our Losses Strategy as outlined below.

1. Energy Efficient Transformers

We have been installing plant and equipment that delivers enhanced losses performance and meet the EU Transformer Eco Directive Tier 2. This includes replacing inefficient pre-1960 secondary transformers with modern equivalents that perform at much lower losses levels. These interventions have delivered over 41,000 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 16,700 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 2,902 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 a number of transformers in a primary substation 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 are being considered in our RIIO-ED2 business plans.

5. Non-Technical Losses

Our Network Protection team continues to focus on reducing non-technical losses by addressing MPAN (Metering Point Administration Numbers) discrepancies. In 2021/22 the team investigated 6543 discrepancies. This work has delivered significant non-technical losses savings to date over ED1.

7.3.5. Losses Reporting Progress

The tables 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., above. During RIIO-ED1 to date, an estimated £75.8m has been spent on losses reduction activities in SEPD and £59.2m in SHEPD.

A summary of losses costs and benefits in both of our license areas can be found in the tables, below.

Table 9. Summary of SEPD Losses Costs and Benefits from Activities in 2021/22 and RIIO-ED1 to date

SEPD Programme/ Project Title	2021/22 Regulatory Reporting Year			RIIO-ED1
	Distribution Losses Justified Costs	Reduced Losses	Reduced Emissions Associated with Losses	Cumulative Reduced Losses to Data
	£k (21/22 prices)	MWh	tCO_2-e	MWh
Technical Losses Projects				
LV Cable Asset Replacement	6.80	172	37	573
LV Cable General Reinforcement	0.00	31	7	155
LV Cable Other	113.21	1341	285	4713
HV Cable Asset Replacement	3.39	155	33	406
HV Cable General Reinforcement	0.08	116	25	443
HV Cable Other	59.53	1076	229	3527
6.6kV to 11kV Upgrade	0.00	532	113	2902
33kV Transformer Replacements	2164.20	2230	474	7380
66kV Transformer Replacements	0.00	98	21	476
132kV Transformer Replacements	450.88	2061	438	7779
Pre-1960 Transformer Replacements	0.00	295	62	1112
Non-Technical Losses Projects				
DUOS recovery SEPD – non domestic Other	N/A	101445	21540	362945
DUOS recovery SEPD – non domestic Other	N/A	38393	8152	170160

Table 10. Summary of Amount of SEPD Losses Activities in Regulatory Reporting Year and Estimate for the Following Regulatory Year

SEPD Programme/ Project Title	Description of Unit	Volumes in Regulatory Reporting Year	Forecast Volumes for Following Regulatory Year
Technical Losses Projects			
LV Cable Asset Replacement	km	1.22	TBC
LV Cable General Reinforcement	km	0.0	TBC
LV Cable Other	km	20.33	TBC
HV Cable Asset Replacement	km	1.15	TBC
HV Cable General Reinforcement	km	0.03	TBC
HV Cable Other	km	20.19	TBC
6.6kV to 11kV Upgrade	km	0.0	TBC
33kV Transformer Replacements	#	24	TBC
66kV Transformer Replacements	#	0	TBC
132kV Transformer Replacements	#	5	TBC
Pre-1960 Transformer Replacements	#	18	TBC
Non-Technical Losses Projects			
DUOS recovery SEPD – domestic Other	#	5090	TBC
DUOS recovery SEPD – nondomestic Other	#	88	TBC

Table 11. Summary of SHEPD Losses Costs and Benefits from Activities in RIIO-ED1

SHEPD Programme/ Project Title	2021/22 Regulatory Reporting Year			RIIO-ED1
	Distribution Losses Justified Costs	Reduced Losses	Reduced Emissions Associated with Losses	Cumulative Reduced Losses to Data
	£k (21/22 prices)	MWh	tCO_2-e	MWh
Technical Losses Projects				
LV Cable Asset Replacement	4.22	56	12	189
LV Cable General Reinforcement	0.46	5	1	22
LV Cable Other	90.24	1380	293	4171
HV Cable Asset Replacement	6.93	95	20	232
HV Cable General Reinforcement	0.25	21	5	77
HV Cable Other	17.09	613	130	2218
33kV Transformers	541.05	4461	947	21468
Pre-1960 Transformers	180.35	2575	334	3116
Non-Technical Losses Projects				
DUOS recovery SEPD – non domestic Other	N/A	41709	8856	157684
DUOS recovery SEPD – non domestic Other	N/A	15780	3351	73497

Table 12. Summary of Amount of SHEPD Losses Activities in Regulatory Reporting Year and Estimate for the Following Regulatory Year

SHEPD Programme/ Project Title	Description of Unit	Volumes in Regulatory Reporting Year	Forecast Volumes for Following Regulatory Year
Technical Losses Projects			
LV Cable Asset Replacement	km	0.76	TBC
LV Cable General Reinforcement	km	0.08	TBC
LV Cable Other	km	16.20	TBC
HV Cable Asset Replacement	km	2.35	TBC
HV Cable General Reinforcement	km	0.08	TBC
HV Cable Other	km	5.79	TBC
33kV Transformers	#	6.00	TBC
Pre-1960 Transformers	#	2.00	TBC
Non-Technical Losses Projects			
DUOS recovery SEPD – domestic Other	#	1268.00	TBC
DUOS recovery SEPD – nondomestic Other	#	97.00	TBC

8. OTHER ENVIRONMENT-RELATED ACTIVITIES

8.1. Innovation

8.1.1. 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 below.

8.1.2. 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.

Start/end date: July 2019 – September 2022

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

8.1.2. Supporting The Uptake of Low-Carbon Technologies (LCTs) continued

Decarbonising Utility Transport (NIA_SSEN_0057): The aim of the project is to report on the extent to which utilities are on the decarbonisation journey of their vehicle fleets. Key outputs include reporting on the present-day composition of utility fleet vehicles (mixture of electricity and gas network operators). Understanding the challenges, needs, global logistic trends and options for on-road and off-road vehicles. The project will also create a roadmap, including a gap analysis and assessment of intervention options to support utility fleet decarbonisation between now and 2050.

This project will be collecting vehicle fleet data from a range of gas and electricity utility companies. The aim is to create a fleet decarbonisation Road Map for all utilities to benchmark their own progress against and use to inform strategy. The Road Map will also identify hard to decarbonise vehicles such as unique tree cutters, heavy machinery, etc. As there will be a large number of utilities participating the outputs of the Road Map Report can help focus innovation in areas of concern and to also promote investment in these areas by companies looking to benefit from assisting with the Net Zero transition. Energy Systems Catapult will be using their whole system model to perform this study on behalf of Utilities.

Start/end date: February 2022 – November 2022

For more information see:
https://smarter.energynetworks.org/projects/nia_ssen_0057/

8.1.3. Reducing Greenhouse Gas Emissions

Western Isles Inertia (NIA_SSEN_0056): This project aims to install measurement technology in the Western Isles to monitor power quality and inertia during extended network outages known as island mode. Data gathered from the project will be used to validate the existing network operating models used during island mode. In island mode, distributed generation (DG) is curtailed to 10% of network load with diesel generation supplying the bulk of electricity and network inertia. The learning from the project will inform future studies which may allow an increase in DG, which in turn will reduce the reliance on diesel generation reducing overall costs and Greenhouse Gas emissions.

Start/end date: May 2021 – March 2022

For more information see:
https://smarter.energynetworks.org/projects/nia_ssen_0056/

8.1.4. 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. Up to March 2021, 150 surge arresters have been installed in our Southern Network and another 300 are installed in our Northern Network. 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 – March 2023

For more information see:
https://smarter.energynetworks.org/projects/nia_ssen_0035/

Flood Mitigation: SSEN has invested £15.52 to date in RIIO-ED1 on investigation works and flood mitigation measures in SEPD, with £0.90m also invested in SHEPD over the same period.

In 2021/22, SSEN completed projects in SEPD to elevate substations, switchgear and associated equipment above the risk of potential flood damage. This included completion of a £4.5m programme on Osney Island in Oxfordshire, a £2.3m programme at Melksham Town, and a £2.9m project in Drakes Way, Wiltshire. The works completed will protect over 35,000 people from potential outages associated with flooding whilst also ensuring power supplies and infrastructure are fit for the future.

Following recommendations put forward by ADAS, the UK's largest independent provider of agricultural and environmental consultancy, consideration was also taken to keep the site at the Drakes Way project as green as possible. A grass mix was planted instead of using stone or shingle in order to enhance biodiversity and slow water runoff, reducing pressure on the water drainage infrastructure thereby reducing risks of flooding.

We are continuing a focus on flood mitigation and prevention throughout our last year of RIIO-ED1 and have ensured continued focus for RIIO-ED2 by continuing with our programme of flood mitigation implementation, providing support to our operational teams by providing relevant training and providing support to our communities via our Resilient Communities Fund.

More information can be found on the SSEN website:
https://www.ssen.co.uk/news-views/2022/ssens-20000-award-helps-to-protect-oxfordshire-retirement-complex-from-flooding

https://www.ssen.co.uk/news-views/2021/2021-ssen-completes-4.7-million-osney-island-flood-alleviation-project

8.1.5. Reducing Our Use of Creosote

Environmentally Acceptable Wood Pole Pre-treatment Alternatives to Creosote (APPEAL) (NIA_SPEN0008): SSEN are collaborating with SPEN 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 overhead line (OHL) supports (millions 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:
https://smarter.energynetworks.org/projects/nia_spen0008

8.1.6. Reducing Excavations

Open Circuit Detector NIA SSEN 0052 : 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 faults 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.

Start/end date: December 2020 – September 2022

More details can be found here:
https://smarter.energynetworks.org/projects/nia_ssen_0052

8.1.7. Employee Environmental Awareness

At SSEN 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 2021/22 include:

- **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.
- **Climate Academy** – During 2021/22 we hosted a Climate Academy in partnership with the Supply Chain Sustainability School. The academy involved a series of five online learning sessions introduced by our senior leaders with sessions being made available to all colleagues. The sessions were well attended and shared insight on safeguarding, protecting, and enhancing the environment, with an emphasis on education and awareness of climate change. Added to this was a strong focus on social inclusion, and creating a more fair, just, and inclusive society at local, national and international levels.
- **Pledge to Power Change** – At SSE Group level we encouraged all staff to make climate pledges to power change to tackle our personal impact on the environment, these range from pledging to taking shorter showers and ditching disposable cups to donating old clothes and switching your car to EV. SSEN Distribution have made 1276 pledges and have saved:
  - 20,072.33 kg of CO_2 equivalent to 34 flights from London to New York;
  - 73,787.87 kg of Waste equivalent to 74 bin lorries;
  - 1,506,912.33 kg of Water equivalent to 6.4 million cups of tea.
- SSE has been enabling its workforce to adopt green transport measures by offering a low-emissions car scheme.
- SSEN have two groups on the social networking platform 'Yammer', which allows colleagues to keep updated with new environmental awareness information about the networks sector.

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

8.1.8. Waste, Landfill, Recycling

As part of the wider SSE Group, SSEN follows 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 2021/22, SSEN recorded 2,403 tonnes of waste of which 64% was recycled and 87% 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. SSEN are continuing to improve waste practices for the duration of RIIO-ED1, ahead of RIIO-ED2 commencing in 2023.

Further details of SSEN's future waste ambitions can be found by accessing our Sustainability Strategy: https://www.ssen.co.uk/about-ssen/sustainability/

8.1.9. Contaminated Land Clean Up

In 2021/22, there were 26 incidents of land contamination in the SEPD licence area costing £220k in remedial work. There was 1 incident in the SHEPD licence area costing £52k in remedial work.

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

8.1.10. Noise Pollution

16 reportable noise complaints were made in 2021/22, of which 10 were reported in SEPD and 6 in SHEPD. These included complaints relating to substation noise or noise from transformers. £53.1k was spent on reducing noise pollution.

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

8.1.11. 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. SSEN has a legal duty to conserve and enhance biodiversity, and to mitigate any adverse effects that our projects may have on flora or fauna of special interest.

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 ecologist, and other specialists, to ensure that our infrastructure projects are designed sympathetically and with the aim of avoiding or reducing biodiversity impact.

To inform our projects, we undertake ecological assessments including surveys for protected species such as crested newt (GCN), dormouse, 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.

Many of our infrastructure projects require environmental licences, permits or consents before they can start. During 2021/22, we secured multiple consents that ensured our projects are delivered in accordance with relevant environmental legislation. These included protected species licences (bats, GCN, badgers), Environmental Permits (e.g., for watercourse crossings), hedgerow removal consents and permission to work in Sites of Special Scientific Interest (SSSI).

Early purple orchid in ancient woodland close to Coxmoor Wood – Wrecclesham 33kV Rutter Pole Replacement project.

Project Specific Biodiversity Works

The Thatcham to Ashford Hill 132kV Cable project, which commenced construction in April 2022, involves the installation of 5.5km of new underground cable near Thatcham, West Berkshire. The project is required to provide local economic growth and to improve network security. The cable route is entirely cross-country, passing through agricultural fields, hedgerows, ditches and watercourses. The River Kennet, which the cable route crosses twice using a Horizontal Directional Drilling technique, is a legally protected Site of Specific Scientific Interest (SSSI) – a nationally important chalk river with specialised flora and fauna.

The design and delivery of this project was informed by detailed environmental studies, including ecological, arboriculture, geological and hydraulic surveys and assessments. Having demonstrated that our works could be undertaken to a high environmental standard and with minimal risk, we obtained relevant consents and permits from Natural England, the Environment Agency and the Local Planning Authority. .

Protection and mitigation measures were implemented to safeguard the SSSI, watercourses, bat roosts, badger setts and breeding birds. This project also seeks to deliver a biodiversity net-gain by planting new hedgerows on land adjacent to the cable route.

8.1.12. Community Engagement

SSEN has implemented the Resilient Communities Fund which provides financial support for not-for-profit community groups and charities in our electricity distribution network areas in central southern England and the north of Scotland. The fund helps communities to build resilience for emergency events and protect the welfare of vulnerable community members.

The fund originally operated over a two-year period, awarding £1.25m in total to benefit communities in SHEPD and SEPD. In 2016/17, due to the success of the fund, the decision was taken to extend it until 2023 and, so far, it has supported 570 groups with £3.4m of funding.

After the repurposing of the fund the previous year to address the immediate impacts of the coronavirus pandemic, the 2021/22 fund refocused on its original priorities of building emergency resilience and supporting the vulnerable. The fund made awards to 30 groups across the north of Scotland and central southern England, totalling £474,599. Projects funded this year included support to build a mountain rescue team base in the Outer Hebrides allowing team members to train and store assets in central location; flood protection equipment for a number of communities with resilience plans; vehicles to support vulnerable residents in rural areas; support to allow better co-ordination of the voluntary sector in the management of emergency events; and the funding of

a role to support the vulnerable to access financial advice. The success of the fund is its ability to adapt to changing circumstances whilst addressing the core aims of resilience planning, and the support it gives is well received throughout communities.

More information regarding the Resilient Communities Fund is available here: https://www.ssen.co.uk/Resiliencefund/

Hebrides Mountain Rescue Team – received £38k in 2021 towards building new base for training and storage of assets in central location.

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

9. INTRODUCTION

This section provides an overview of SSEN's innovation activities 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[2] and the wider industry strategy[3]. We have also included information on the benefits realised from the various innovation deployments. Progress on Smart Meter deployment and how we anticipate benefits from them is also covered here.

9.1. Key challenges facing the industry

The energy system is facing a period of unprecedented change as we transition to meet the challenge of Net Zero, especially in decarbonising transport and heating, as well as our industrial use of energy. Meeting our objectives will see a huge increase in renewables and other low carbon electricity sources to meet demand from electric vehicles and new forms of decarbonised heat. 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. Key topic areas include:

IMPROVE NETWORK RELIABILITY

- Investigating technologies and methods of working to support network security.
- Avoiding and reducing the impact of supply interruptions.
- Improving safety performance for our colleagues.

DELIVER VALUE AND IMPROVE SERVICE FOR CUSTOMERS

- Maximising savings by implementing innovative solutions as Business as Usual (BaU).
- Adapting the services we offer to support our stakeholder needs.

FACILITATE NET ZERO TRANSITION

- Improving network access by reducing time and cost to connect low carbon technologies, low carbon generation and energy storage technologies.
- Supporting the use of flexibility and the transition to DSO.
- Enabling the uptake of electric vehicles and the electrification of heat.

DELIVER MEASURABLE SOCIAL ENVIRONMENTAL AND SAFETY BENEFITS

- Developing new options for protecting our most vulnerable customers.
- Reducing our carbon emissions and delivering improvements in environmental and safety performance.

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. This includes:

- **Innovation Development and Deployment:** So far in RIIO-ED1 we have engaged in over 50 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 £80m of benefits to date in RIIO-ED1, whilst avoiding over 350,000 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 BaU practises, with an expanding portfolio of products and services.[4] Our two flagship DSO projects TRANSITION and LEO[5] 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.

- **Decarbonisation of Transport and Heat:** a key requirement for Net Zero is the decarbonisation of transport and heat. Our Electric Vehicle strategy[6] 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:** The number of smart meters on our network continues to rise. At the end of 2021/2022 we had 1.93 million smart and advanced meters installed across our Scottish and Southern regions and were actively communicating with 1.42 million smart meters enrolled into the Data Communication Company (DCC) services enabling SSEN to collect valuable information. 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 2021/2022, 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 LCTs has increased across both of our licence areas in 2021/22 compared to 2020/21. This is due to an increase in EV fast charge points being installed in both regions, with a 34% increase in our SHEPD network and 84% increase in our SEPD network compared to 2020/21. SEPD also saw a 110% increase in Photo Voltaic (PV) installations in 2021/22 compared to 2020/21. Due to improvements in our data capturing system, Heat Pump installations have been captured for a second year running. There has been a 287% increase of heat pumps installed in SEPD and a 174% increase in SHEPD.

The total amount of distributed generation (DG) added to both our SEPD and SHEPD networks has increased in 2021/22 compared to 2020/21, with SEPD connecting 340.5MW (up 112%) and SHEPD 158.3MW (up 120%).

SSEN has worked hard in 2021/22 to promote the delivery of the UK's 2050 Net Zero (2045 in Scotland) ambition through engagement and support at all levels from UK and Scottish Governments, Ofgem, Local Authorities, ENA to trade bodies, third party stakeholders and individual organisations. Looking forward, supporting LCT uptake and achieving both Net Zero and a Green Recovery will remain a high priority for us.

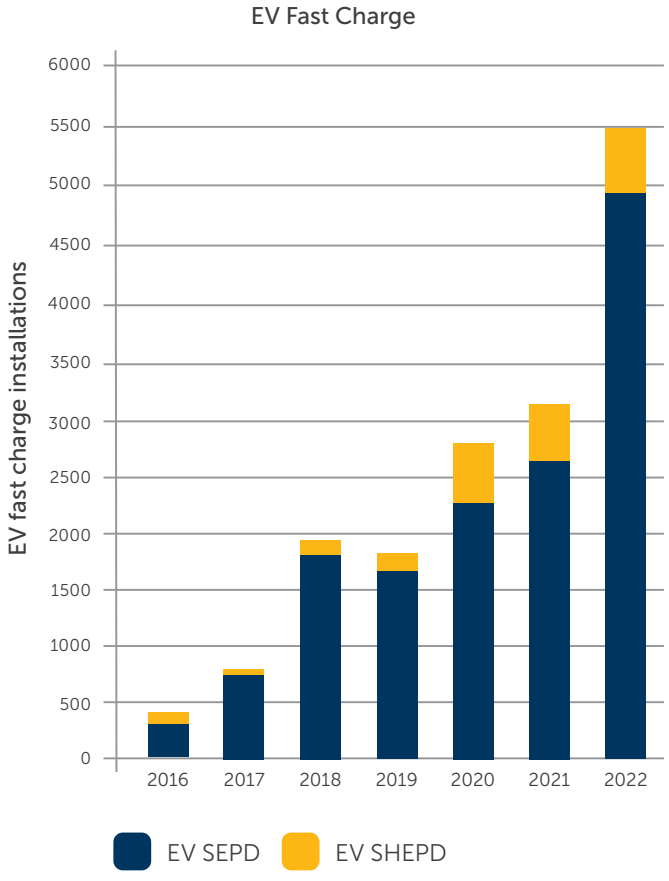
2. Innovation Strategy | SSEN Innovation (ssen-innovation.co.uk)
3. Innovation Strategy | ENA Innovation Portal (energynetworks.org)
4. Flexibility Services - SSEN
5. LEO | SSEN Transition (ssen-transition.com)
6. ssen-ev-strategy-september-2020.pdf

9.4. EV Charging Stations

Electric Vehicle (EV) uptake has increased in RIIO-ED1 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 2021/22, with a 84% increase in EV fast chargers on our SEPD network and an 34% increase in our SHEPD network in comparison to 2020/21.

As EVs become more popular and the 2030 UK ban on new petrol and diesel cars approaches, we expect the upward trend in charge point installations to continue as both residential and public chargers become more prevalent on the network. In response to this, SSEN is working to understand the potential impacts EVs have on different components of the network, including the installation of up to 1700 sets of monitoring equipment ahead of RIIO-ED2 in area which we have identified as having a high likelihood of electric vehicle uptake. This work is being undertaken as part the Ofgem Green Recovery programme.

Figure 11: Annual Uptake of EV Fast Chargers (SHEPD and SEPD)



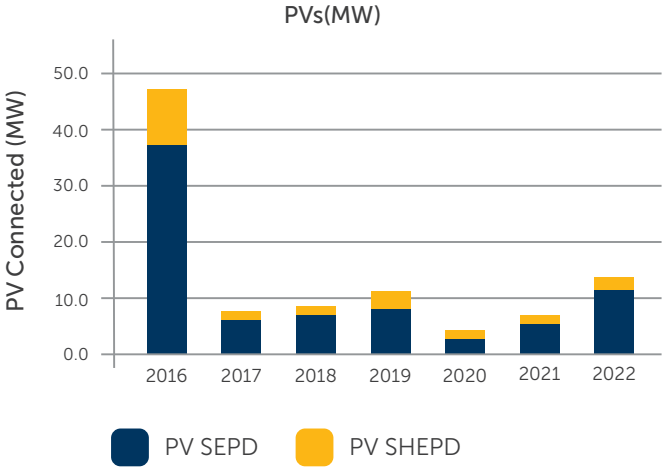
For further details on low carbon technologies, please see worksheet E7 – LCTs linked to the Appendix of this report.

9.5. Distributed Energy

9.5.1.Photovoltaic

The level of PV installations connecting to our network has remained relatively consistent over the past 6 years, with an average of 2000 new installations per year. There was an increase in size of installations in 2021/22 with our SEPD networking seeing a 110% increase and SHEPD seeing a 90% increase compared to 2020/21.

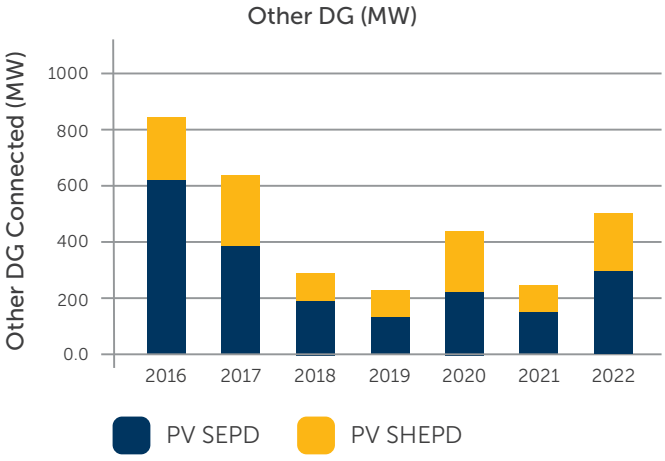
Figure 12: Annual Photovoltaic Connections (SHEPD and SEPD)



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 an increase in size of installations in 2021/22 with our SEPD networking seeing a 112% increase and SHEPD seeing a 120% increase compared to 2020/21.

Figure 13: Annual Distributed Energy Connections (SHEPD and SEPD) excluding PV



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

10. PROGRESS OF THE 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.

To the end of 2020/21 in RIIO-ED1 we have had 56 projects funded by the National Innovation Allowance (NIA) which is a total award of £19.7m, and two funded by the National Innovation Competition (NIC) totalling £20.6m (we have also been partners in a third NIC, Optimise Prime, with UKPN). On top of this we have implemented several innovations into BaU which have fast followed learnings from other DNOs.

A summary of our current innovation portfolio is as follows:

Table 13: Summary of 2021/22 Innovation Portfolio against SSEN Strategic Objectives

2021/22 Innovation Portfolio	STRATEGIC OBJECTIVES			
	Safe, resilient and responsive network	A valued and trusted service for customers and communities	Accelerate progress towards Net Zero	A positive impact on society
SubSense	x			
Informed Lightning Protection	x			
E-Tourism			x	
Technical Interfaces to Scale as a DSO			x	
Merlin				
Whole System Growth Scenario Modelling (Phase 2)		x		
Smart Hammer			x	
TraDER		x		
Skyline		x		
Equal EV				x
Near Real-Time Data Access (NeRDA)			x	
Synaps 2		x		
Low Voltage Feeder Cable Open Circuit Detection		x		
Future Control Room			x	
Alternative Jointing Techniques				x
Net Zero Termination			x	
Western Isles Inertia measurement		x		
Decarbonising Utility Transport		x		
Future Control Room	x			
Alternative Jointing Techniques	x			
Net Zero Termination		x	x	
Western Isles Inertia measurement	x	x		
Decarbonising Utility Transport	x		x	x

10.2. Highlights of 2021/22

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** – we have launched the second phase of the SYNAPS project in collaboration with UK Power Networks (UKPN). This technology can monitor LV Networks through Waveform Analysis, detecting pre-fault signals, initial results have been positive allowing a proactive response to a fault prior to fault conditions.
- **Smart Hammer** – we have been testing and refining the Smart Hammer with our operational teams, to assess its feasibility and reliability, these trials have proven to be successful including initial integration with our Asset management systems.
- **Equal EV** – working with disabled motoring organisations, SSEN along with the Energy System Catapult have identified gas in the offerings available to drivers with disabilities which could impact there ability to transition to electric vehicles.
- **LV Underground Fault Location Technologies (LVUFLT)** – we have completed trials testing the potential use of HV Fault finding acoustic equipment on the LV network. This solution has now been widely deployed across our SEPD licence area.
- **NeRDA** – The SSEN NeRDA project is a small-scale demonstration project which makes near real-time DNO network data available to stakeholders. The project will assess and understand the useability and benefits of this data. Ofgem have made it clear that Open Data is one if the key focus areas for driving decarbonisation and accelerating progress towards a Net Zero world.
- **SUBsense** – we are investigating the use of acoustic sensing systems to monitor the health of our submarine cables. This could reduce the need for costly divers or Remote Operated Vehicles (ROV's) to assess condition and improve reliability.

A more detailed breakdown of active NIA projects can be found in the 2022 Annual NIA Summary Report located here: **https://ssen-innovation.co.uk/wp-content/uploads/2022/07/SSEN-NIA-Distribution_2022.pdf**

10.3. Large Scale Innovation Projects

During 2021/22, we had 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: **www.project-raas.co.uk**

Funding Stream

Ofgem NIC, £10.2m project

Start/end date

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 North West 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) (**https://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 September 2023 and disseminated through a range of different communication channels to interested stakeholders.

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: **http://ssen-transition.com/library/**

For more information see: **www.ssen-transition.com**

Funding Stream

Ofgem NIC, £12.79m project

Start/end date

2018 – 2023

10.3.3. Project LEO

Key activities

Project LEO (Local Energy Oxfordshire) is one of the most ambitious, wide-ranging, innovative, and holistic smart grid trials conducted in the UK, and in its first two years significant progress has been 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 has been carrying 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 is being 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 are being supported through the development of accessible and easy-to-use IT systems. These provide clear information on opportunities for energy services, addressing constraint management and energy exchange between local energy users. These systems are 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 is co-creating locally relevant trials of different flexibility services. Project LEO is 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 are involving 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.

Expected outcomes

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

For more information see: **https://project-leo.co.uk**

Funding Stream

BEIS Industrial Strategy Fund, £37m project

Start/end date

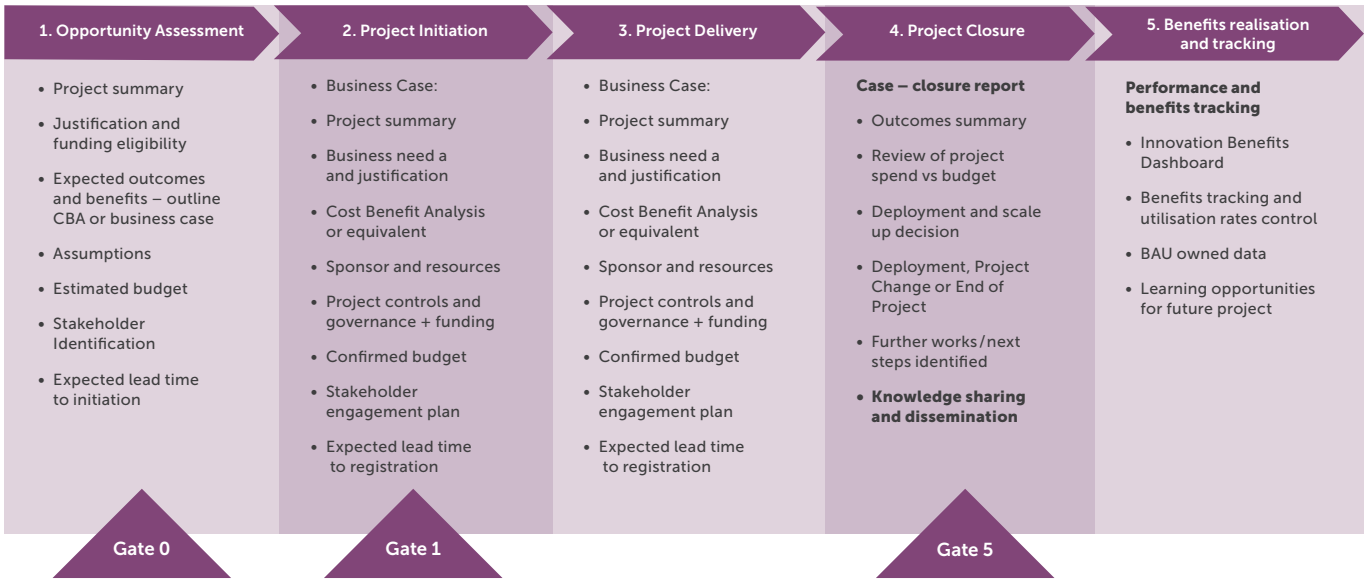
2019 – 2023

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 SSEN's 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 following stage-gate reviews:

Figure 14: Stage Gate Reviews for Innovation Projects



The process begins with anf 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 BaU rollout, success of the innovation is assessed and tracked to ensure benefits are being realised.

11.2. Innovation deployed in 2021/22

We have continued to embed and expand the innovations we have already deployed. Since the conclusion of the LV Underground Fault Location Technologies NIA project earlier in the year we have begun the preparation for its full roll out across our SEPD licence area in 2022/23, this has seen procurement of equipment, development of operational process and procedures as well as extensive staff training involving nearly 150 staff. This technology will help identify the location of low voltage faults, reducing time off supply for consumers and reducing the associated excavation works required for repairs.

11.3. 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.

Constraint Managed Zones (CMZ)

Constraint Managed Zones use flexible solutions to offer security of supply during times of peak demand, planned maintenance or fault conditions. The CMZ concept, which has been recognised in BaU for a number of 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.

Benefits

The flexible services avoided approximately 1,360 tCO_2-e in 2021/22 compared to using traditional diesel-based alternatives.

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. More information can be found here: **https://www.ssen.co.uk/FlexibleConnections/**

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.

Benefits

Significant reinforcement costs have been avoided and 366,290 tCO_2-e have been avoided for all ANM projects to date in RIIO-ED1.

Future Deployments

We continue to operate the ANM schemes on Orkney, Western Isles and Isle of Wight. During 2021/22 SSEN made further progress on the implementation of the South West Active Network (SWANs) scheme to address a number of transmission level constraints across the region, it is anticipated that the scheme will be operational later in 2022. For more details see section 3.3.3.1.

Innovation Strategic Objectives

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK

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.

Benefits

There has been an estimated £4.9m gross avoided costs, over 414,577 Customer Interruptions and 58,4271,20 Customer Minutes Lost avoided to date in RIIO-ED1.

Future Deployments

SSEN will continue to utilise and realise the benefits of LV Automation throughout the remainder of RIIO-ED1.

Innovation Strategic Objectives

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK

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

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 £7.8m gross avoided costs, 69,834 Customer Interruptions and 17,497,237 Customer Minutes Lost avoided to date in RIIO-ED1.

This project has also led to 7,626 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.

Innovation Strategic Objectives

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK

The original project was done as an IFI project.
More information can be found here:
http://www.smarternetworks.org/project/2007_08

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 BaU in 2018.

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.

Future Deployments

SSEN will continue to utilise the thermal imaging cameras and realise benefits throughout the remainder of RIIO-ED1. The use of thermal cameras for LV fault location will be further developed and enhanced as part of the wider roll out of LVUFLT technologies described earlier.

Innovation Strategic Objectives

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK

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

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 £725k 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

TO DELIVER A SAFE, RESILIENT AND RESPONSIVE NETWORK

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

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 BaU in 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 BaU lead to SEPD procuring an additional 5 Hygen MX hybrid generators in November 2020.

Benefits

To date the machines have delivered £167k of avoided costs in the ED1 period and 71 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.

Innovation Strategic Objectives

ACCELERATE PROGRESS TOWARDS A NET ZERO WORLD

This project was originally completed as an IFI Project. More information can be found here:
https://www.smarternetworks.org/project/2011_14

11.4. Innovating Solutions for Connections

11.4.1. Flexible Connections

In some areas of our networks, the network is already at full capacity and 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 a number of alternative options available to customers who are willing to consider a more flexible connection offering which, depending on the circumstance, may allow connection ahead of the required reinforcement works.

In April 2021, as part of Access and Forward Looking Charges Significant Code Review (SCR), SSEN will look to offer, where applicable, curtailable connections to both generation and demand connections.

SSEN is proud to offer one of the widest suites of flexible connections in the industry, as well as offering flexibility in relation to payment options for connections. The flexible connection offers that we provide include:

Timed Connections
The timed export connection offers the customer the possibility of connecting to the network and exporting during certain periods of the day or week. This is an advantage in areas with low levels of generation diversity.

Intertrip
Legacy type of flexible connection, offering a simple 'on or off' but extremely efficient option for generation connections where network topography does not offer dual circuit capacity for connections in the event of circuit failure.

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 spring 2022 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 more timely should connecting customers wish to avoid reinforcement costs related to new connections, examples are available here: **https://www.ssen.co.uk**

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.

3rd Party ANM
There are two types of 3rd party ANM connections for the customer to consider - shared capacity and demand management. Both of which are installed and managed by the customer.

Contractual Flexibility
We consider flexibility in contractual terms in circumstances where a transitional solution may be available for a customer. Examples include situations where the local connection works can be completed early, but the full capacity is not available until reinforcement is complete. In this scenario, we can include special conditions within the Connection Agreement which can allow the customer to export some of their full capacity, dependent upon what the current network can accommodate.

Application Process
Our flexible connections process is available for generation connections above 50kW where there are thermal constraints leading to significant reinforcement works. In existing network areas where ANM schemes are already in place no other flexible option will be available. The main points of the process:

- You can now apply directly for a flexible connection;
- If you apply for a standard quotation and significant reinforcement works are triggered, we will provide two network studies (standard and flexible) and give you the option to change your connection type;
- This is available for all new generation connection applications

For more information, such as on how to apply, please visit **https://www.ssen.co.uk/connections/generationandstorage/flexibleconnections/**

11.4.2. 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.

SSEN has been at the forefront of implementing flexible services and currently has 14 live CMZ contracts in place and has recorded over 11GWh of utilisations through Flexible Service Providers since 2019. On top of this we have developed a heat map detailing constrained areas of our network which could be supported by flexible services.

Figure 15: Heat Map Detailing Constrained Areas of SSEN Network

We currently offer four types of flexible service:

- **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 based on a four-year, or 1 year rolling, contract term with the opportunity to extend by one year.
- **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 based on a one-year rolling contract limited to a maximum five-year term.
- **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 based on a one-year rolling contract limited to a maximum five-year term. SSEN will instruct services in close to real-time.

The key features of flexible services:

- Utilises a market approach to procure constraint management 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 **https://www.ssen.co.uk/our-services/flexible-solutions/flexibility-services/**. Should services be required, an assessment is undertaken to evaluate which flexible option could deliver the required capacity. 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 keep 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.

Prospective service providers should register and pre-qualify via the SSEN Dynamic Purchasing System (DPS). Located here: h**ttps://ssen.delta-esourcing.com**. The DPS allows service providers to pre-qualify for all future tenders. This helps to reduce SSEN's time to tender.

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:

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

https://www.ssen.co.uk/ConnectionsInformation/GenerationAndStorage/FlexibleConnections/CurrentCallsForFlexibility/

Owners can register on our Dynamic Purchasing System (DPS) to procure our CMZ services for the SSEN regions, details can be found in the links here:

https://www.ssen.co.uk/our-services/flexible-solutions/flexibility-services/

https://ssen.delta-esourcing.com/

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

11.4.3. 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 will provide.

Throughout 2021/2022 SSEN have continued to further develop and implement Information Technology (IT) systems and processes to maintain alignment with SEC releases and DCC changes. As the roll-out progresses SSEN continue to be heavily involved with industry forums and collaborative testing, including testing necessary for wider industry benefits and new meter firmware testing with the DCC. This has assisted in the early identification of any issues, alongside progression of these through to resolution. This has allowed SSEN 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.

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 not yet fully trustworthy and available in the volume required to give detailed information.

One area of benefit which SSEN have been able to continue to progress on, is the utilisation of "meter pings". SSEN has previously enabled the ability to check the supply status of a customer's smart meter from within SSEN's Customer Contact Centre. This allows for key information previously unavailable without smart meters to be utilised in day-to-day operations. This will continue to provide additional information and benefits as the roll out continues and more smart meters are installed in SSEN's licence areas.

Following the success of the integration of smart meter information into the Customer Contact Centre, we now look towards the future and implementation of mass data gathering from smart meters. SSEN have begun a re-procurement (Phase 2) of our DCC adapter to ensure the system and processes will be in place to regularly request information, receive the responses and store this data from each smart meter within our licence areas. This will then be used for analytics and benefit realisation within the smart meter operational team and the wider business.

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 will 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 will be connected to parties including DNOs via the DCC's communications and data infrastructure. These meters will 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 2021/22 is provided in Table 14 below.

Table 14. Volume of smart meters installed during 2021/22[7]

	SMETS1			SMETS2		
Licence Area	Installed in 2021/22	Total Installed	% Total Penetration (year-end)	Installed in 2021/22	Total Installed	% Total Penetration (year-end)
SHEPD	4,026	204,165	25.90%	59,812	123,898	15.72%
SEPD	10,266	853,626	27.29%	281,178	803,579	25.69%

The low total number of installed SMETS1 smart meters installed in 2021/22 is due to the continued priority of SMETS2 used at point of installation. It should be noted that due to the level of uncertainty associated with the connection, functionality, and accuracy of SMETS1 meters within the DCC systems. It is currently difficult to assess the impact that significant volumes of SMETS1 meter installations will have on our ability to deliver DNO smart meter related customer benefits.

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 2021/22 are detailed in worksheet E5 – Smart Metering, they are also summarised in Table 15 below.

Table 15. IT expenditure for Smart Meters during 2020/21

Licence Area	SM IT Costs (£k)	SM Communication Licence (DCC) Costs (£k)	Elective Communication (DCC) Costs (£k)
SHEPD	85	963	0
SEPD	339	3505	0

7. The total number of SMETS 1 meters does not consider any SMETS1 meters that were subsequently replaced with a SMETS 2 meter,

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 2020/21 are detailed in Table 3.3c below.

Table 16. Progress on delivery of benefits from Smart Metering throughout 2021/22

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. • Phase two of our data storage and analytics capability started. This will enable us to retrieve mass volumes of data. This will allow us to proactively invest in our network to avoid future interruptions. • 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 will allow us to respond more quickly to outages and reduce duration of interruptions. • Integrated our outage management system into our NDAG application so our Customer Contact Centres can receive and respond to 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 operational costs to fix faults	• Implemented our NDAG application to ensure that:
	  • We can check the energisation 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.
	• Implemented the integration of our outage management system into our NDAG application to:
	  • Enable the initiation of supply energisation status checks from relevant locations.
	  • 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.

Category of Benefit	Work Undertaken
Reduction in calls to faults and emergencies lines	• Implemented our NDAG 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 NDAG application so our Customer Contact Centres can receive and respond to power outage and power restore alerts from smart meters. • Continued engagement and collaborative testing with the DCC regarding the future operation of power outage and power restore alerts.
Better informed investment decisions for electricity network enforcement	• Implemented our NDAG application to enable access to relevant functionality in smart meters including meter configuration and access to appropriate data. • Developed and submitted our Data Privacy Plan to Ofgem for approval to enable access to consumption data, allowing better understanding of utilisation of our network. • Stage one of our data storage and analytics capability to maximise use of data made available by smart meters has been implemented. Stage two will look to 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 NDAG 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 NDAG application to: ▪ Enable users to request further information from smart meters regarding recorded voltage measurements. ▪ Enable 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	• Developing a means to influence suppliers regarding how customer load is controlled.

LOOKING FORWARD TO 2022/2023

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 power outage and restore alert performance and inconsistent behaviour in smart meters.
- Collaborate with the DCC, ENA and other Distribution Network Operators 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 Customer Minutes Lost meters and SMETS2.
- Continue working on phase 2, system implementation into next year, which will see the delivery of functionality for the mass data gathering from smart meters and data analytics.

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

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.

In 2021/22, 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 – and we are continuing to drive efficiency, improve customer service and enhance the customer experience.

2021/22 represented a continued positive trajectory in many of our environmental and wider sustainability considerations, including a step change in our approach to managing our Business Carbon Footprint; We're proud to lead by example by being the first Distribution Network Operator to have our 1.5°C science-based greenhouse gas emissions reduction targets accredited by the SBTi. The new strategy on SF_6 emissions, introduced in 2019, continues to deliver with reducing emissions year on year, and our Losses Strategy continues to successfully manage and reduce our electrical losses.

Additionally, we saw a significant increase in the uptake of LCTs such as Heat pumps and Electric Vehicles being installed on our networks compared to 2020/21.

The advancement reported for the seventh year of RIIO-ED1 provides a clear message to our stakeholders that we have an established programme to deliver environmental benefits and are aware of our responsibilities to our surroundings and our customers. We will continue to look to the future and pursue solutions that deliver enduring benefits during the remainder of RIIO-ED1 and beyond by expanding our work in this space through, for e.g., seeking to electrify our vehicle fleet, move to more sustainable and low carbon generation options on the Scottish Islands, continue to actively manage and reduce our electrical losses, and continue to engage with our consumers and most vulnerable customers.

CONTACT US

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

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APPENDIX

Additional Information	Location
Environment & Innovation Report 2020/21 **Environment and Innovation Regulatory Reporting Packs 2021/22 E1-E8 worksheets** Environment and Innovation 2021/22 E4 & E6 CBAs **Environment and Innovation Commentary 2021/22**	https://www.ssen.co.uk/about-ssen/library/environment-reports-document-library/?filterTerm=107#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 licencee'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 licencee 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 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.

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 licencee 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 licencee'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 & Southern Electricity Hydro. It is the acronym provided to our Scottish network.

SSES/SEPD
This stands for Scottish & 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.

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